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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.

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COMPENDIUM OF METEOROLOGICAL SATELLITES AND INSTRUMENTATION

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PREFACE

The authors first began to compile the information presented in this Compendium in 1972. Because satellite meteorological technology has rapidly advanced, many changes have taken place during the last year. These changes are reflected in the written text in Section II and include events and happenings up to January 1973, such as the launchings of ITOS-D, Nimbus-E (renamed NOAA 2 and Nimbus 5, respectively, after launch), and Meteor 13, and the cancellation of ATS-G, etc. The automated portions of this document, Sections III and IV, and most of the tables were completed in July 1972 and are current as of that date unless otherwise indicated.

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

A-1	modified Sapwood ICBM with first generation upper stage
A-2	modified Sapwood ICBM with second generation upper stage
A-2-E	modified Sapwood ICBM with second generation upper stage plus escape stage
AC	alternating current
ACS	attitude control system
A/D	analog to digital
AFB	Air Force Base
AIM	Automated Internal Management (File)
alt	altitude
APL	Applied Physics Laboratory
APT	automatic picture transmission (system/subsystem)
A/R	acquisition/reference
ARDC	Air Research and Development Command
ARPA	Advanced Research Projects Agency
ATS	Applications Technology Satellite
AVCS	advanced vidicon camera system
AVHRR	advanced very high resolution radiometer
B-1	modified Sandal IRBM plus upper stage
BUV	backscatter ultraviolet (spectrometer)
cal	calorie
CAS	Cooperative Applications Satellite (more commonly referred to as EOLE)
CDA	command and data acquisition (station)
cm	centimeter
CNES	Centre National d'Etudes Spatiales
COSPAR	Committee on Space Research
CPKF	Cape Kennedy (also referred to as ETR, Eastern Test Range)
DATS	Despun Antenna Test Satellite (DOD)
DCP	data collection platform(s)
DCS	data collection and platform location system
DCS	data collection system (ERTS 1 and -B only)
deg	degree
DOD	Department of Defense
Dodge	Department of Defense Gravity Experiment (satellite)
DRID	direct readout image dissector
DRIR	direct readout infrared radiometer

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EOLE	French meteorological satellite (also referred to as EOLE 1)
ERB	earth radiation budget (experiment)
ERDC	Earth Resources Data Center
ERTS	Earth Resources Technology Satellite
ESMR	electrically scanning microwave radiometer
ESRO	European Space Research Organization
ESSA	Environmental Science Services Administration (presently NOAA)
ETR	Eastern Test Range (also referred to as CPKF, Cape Kennedy)
EVM	earth viewing (equipment) module
FOV	field of view
FPR	flat plate radiometer
FWS	filter wedge spectrometer
GARP	Global Atmospheric Research Program
GEMS	Geostationary European Meteorological Satellite (ESRO)
gHz	gigahertz
GISS	Goddard Institute for Space Studies
GOES	Geosynchronous Operational Environmental Satellite (also called SMS)
GSFC	Goddard Space Flight Center
GUGMS	Glavnoye Upravleniye Gidrometeorologicheskoi Sluzhby (Main Administration of the Soviet Hydrometeorological Service)
GVHRR	geosynchronous very high resolution radiometer
HDRSS	high data rate storage system
HRIR	high-resolution infrared radiometer
HRIRS	high-resolution infrared radiation sounder
Hz	hertz (cycles per second)
ICBM	intercontinental ballistic missile
ICSU	International Council of Scientific Unions
IDC	image dissector camera
IDCS	image dissector camera system
IDCSP	Initial Defense Communication Satellite Program (DOD)
IPA	Institute for Physics of the Atmosphere (SAS)
IRBM	intermediate range ballistic missile
IRIS	infrared interferometer spectrometer
IRLS	interrogation, recording, and location system
ITCZ	intertropical convergence zone
ITOS	Improved Tiros Operational Satellite
ITPR	infrared temperature profile radiometer
ITR	incremental tape recorder

kbs	kilobits/second
KFRG	Kourou, French Guiana
kHz	kilohertz
km	kilometers
KYAR	Kapustin Yar (USSR)
LES	Lincoln Experimental Satellite (DOD)
LRIR	limb radiance inversion radiometer
MASC	magnetic attitude-spin coil
Mc	megacycle
MHz	megahertz
MIT	Massachusetts Institute of Technology
MRIR	medium-resolution infrared radiometer
msec	millisecond
MSS	multispectral scanner
MSSCC	multicolor spin-scan cloudcover camera
MUSE	monitor of ultraviolet solar energy
mw	milliwatts
NAC	National Audiovisual Center
NADUC	Nimbus/ATS Data Utilization Center
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NCC	National Climatic Center (formerly NWRC)
NEMS	Nimbus-E microwave spectrometer
NESC	National Environmental Satellite Center (presently NESS)
NESS	National Environmental Satellite Service (formerly NESC)
NOAA	National Oceanographic and Atmospheric Administration (formerly ESSA)
NRL	Naval Research Laboratory
NSSDC	National Space Science Data Center
NWRC	National Weather Records Center (presently NCC)
OCC	OPLE Command Center
OI	other investigator
OMNI	low-resolution omnidirectional radiometer (on Explorer 7, thermal radiation experiment)
OPLE	Omega position and location experiment
PCM	pulse code modulation
PEOLE	Préliminaire EOLE
PEP	platform electronic packages

PI	principal investigator
PL	planned launch
PLSK	Plesetsk (USSR)
PM	project manager
PMR	pressure modulated radiometer
PMT	photomultiplier tube
PS	project scientist
QOMAC	quarter-orbit magnetic attitude control (system)
R&D	research and development
rad	radian
RAM	random access measurement (system)
RBV	return beam vidicon (camera)
rms	root mean square
rpm	revolutions per minute
rps	revolutions per second
RTG	radioisotope thermoelectric generator
RTTS	real-time transmission system
SAS	Soviet Academy of Sciences (also known as Akademiya Nauk SSSR)
SCAMS	scanning microwave spectrometer
SCEL	Signal Corps Engineering Laboratories
SCMR	surface composition mapping radiometer
SCR	selective chopper radiometer
sec	second
SECAM	Séquentiel Couleur a Mémoire
SEM	space environment monitor
SHC	Soviet Hydrometeorological Center (also known as Gidrometeorologicheskiy Tsentr, SSSR)
SHS	Soviet Hydrometeorological Service (also known as Gidrometeorologicheskaya Sluzhba, SSSR)
SIRS	satellite infrared spectrometer
SIRS	System for Information Retrieval and Storage
SMS	Synchronous Meteorological Satellite (also called GOES)
SNAP	systems for nuclear auxiliary power
SR	scanning radiometer
SSCC	spin-scan cloudcover camera
ster	steradian
TAC	Technology Application Center
T&DR	tracking and data relay
TEC	telemetry and command
THIR	temperature-humidity infrared radiometer

THORAD-AGE	Thor Augmented Delta Agena
Tiros	Television and Infrared Observation Satellite
TOS	Tiros Operational Satellite
TOVS	Tiros operational vertical sounder
TRF	Technical Reference File
TWERLE	tropical wind energy conversion and reference level experiment
TYUR	Tyuratam-Baikonur (USSR)
UHF	ultrahigh frequency
U.K.	United Kingdom
U.S. (US)	United States
U.S.S.R. (USSR)	Union of Soviet Socialist Republics
UV	ultraviolet
UW	University of Wisconsin
VHF	very high frequency
VHRR	very high resolution radiometer
VISSR	visible infrared spin-scan radiometer
VNBC	Vandenberg AFB (also referred to as WTR, Western Test Range)
VTPR	vertical temperature profile radiometer
w	watt
WAB	Walter A. Bohan Co.
WALI	Wallops Island
WBVTR	wide-band video tape recorder
WEFAX	weather facsimile
WMO	World Meteorological Organization
WSMR	White Sands Missile Range
WTR	Western Test Range (also referred to as VNBC, Vandenberg AFB)
WWW	World Weather Watch
yr	year

I. INTRODUCTION

This publication has evolved from work accomplished by the authors while assigned to the USAF Environmental Technical Applications Center, Space Data Section, located at the National Space Science Data Center (NSSDC), NASA-GSFC, Greenbelt, Maryland. This Compendium is intended to fulfill three purposes: (1) to serve as a historical summary of all meteorological-type satellites and instrumentation, (2) to act as a working document to be used by researchers to identify and locate meteorological satellite data that are presently available, and (3) to provide a guide for the types and sources of meteorological data that will be available in the future.

This Compendium contains pertinent information for 98 launched and planned satellites of the United States, the Union of Soviet Socialist Republics, France, and the United Kingdom, as well as their over 200 meteorological experiments or instruments. Table 1 provides a chronological list of and summary information for the spacecraft described in this document. Information for both operational and research satellites is included in this document, and the terms "experiment" and "instrument" are used interchangeably. It should also be noted that the definition of a meteorological satellite has been extended to include any unmanned earth-orbiting satellite equipped with a meteorological experiment or instrument that obtained data of meteorological value regardless of the satellite's primary mission.

Owing to a lack of information, nonscientific reconnaissance spacecraft orbited by the U.S. and U.S.S.R. have not been included, although any data obtained by these spacecraft could certainly have meteorological value. Furthermore, many useful weather photographs have been obtained during the manned space missions of the U.S. and the U.S.S.R. Information on meteorological experiments and data obtained from such flights will be omitted except to state that earth-directed photography from U.S. manned spacecraft is maintained at the Technology Application Center (TAC), University of New Mexico, Albuquerque, New Mexico 87106.

Following this Introduction are three major sections: an overview, by country, of the various series of meteorological satellite programs; brief descriptions of the satellites and their experiments; and an extensive bibliography. A glossary of acronyms and two indexes for cross-referencing purposes are also included. Various tables and figures presenting satellite operating times, data coverage, locations of launch sites, and descriptions of the launch vehicles used to orbit the meteorological satellites are found throughout the document. Also included is an appendix that contains a listing of various types of available meteorological satellite data and their locations.

TABLE 1. CHRONOLOGICAL LISTING OF IDENTIFIED METEOROLOGICAL SATELLITES (July 1972)

NSSDC SPACECRAFT ID	SPACECRAFT NAME[1]	MISSION	LAUNCH DATE	LAUNCH SITE AND COUNTRY	LAUNCH VEHICLE[1]	OPERATING STATUS[1,2]	DATE LAST USABLE DATA RECORDED
59-001A	Vanguard 2	R&D	02/17/59	Cape Kennedy, US	Vanguard	Inoperable	03/08/59
59-004A	Explorer 6	R&D	08/07/59	Cape Kennedy, US	Thor-Able	Inoperable	10/06/59
59-009A	Explorer 7	R&D	10/13/59	Cape Kennedy, US	JUNO 2	Inoperable	08/24/61
60-002B	Tiros 1	R&D	04/01/60	Cape Kennedy, US	Thor-Able	Inoperable	06/15/60
60-016A	Tiros 2	R&D	11/23/60	Cape Kennedy, US	Thor-Delta	Inoperable	09/27/61
61-017A	Tiros 3	R&D	07/12/61	Cape Kennedy, US	Thor-Delta	Inoperable	01/23/62
62-002A	Tiros 4	R&D	02/08/62	Cape Kennedy, US	Thor-Delta	Inoperable	06/30/62
62-025A	Tiros 5	R&D	06/19/62	Cape Kennedy, US	Delta	Inoperable	05/14/63
62-047A	Tiros 6	R&D	09/18/62	Cape Kennedy, US	Thor-Delta	Inoperable	10/21/63
63-010A	Cosmos 14	R&D	04/13/63	Kapustin Yar, USSR	B-1	Inoperable	08/29/63
63-024A	Tiros 7	R&D	06/19/63	Cape Kennedy, US	Delta	Inoperable	12/31/65
63-050A	Cosmos 23	R&D	12/13/63	Kapustin Yar, USSR	B-1	Inoperable	03/27/64
63-054A	Tiros 8	R&D	12/21/63	Cape Kennedy, US	Delta	Inoperable	08/31/65
64-052A	Nimbus 1	R&D	08/28/64	Vandenberg AFB, US	Thor-Agena	Inoperable	09/22/64
64-053A	Cosmos 44	R&D	08/28/64	Tyuratam-Baikonur, USSR	A-1	Inoperable	Unknown
64-055A	Cosmos 45	R&D	09/13/64	Tyuratam-Baikonur, USSR	A-2	Inoperable	09/18/64
65-004A	Tiros 9	R&D	01/22/65	Vandenberg AFB, US	Delta	Inoperable	07/26/65
65-014A	Cosmos 58	R&D	02/26/65	Tyuratam-Baikonur, USSR	A-1	Inoperable	Unknown
65-029A	Cosmos 65	R&D	04/17/65	Tyuratam-Baikonur, USSR	A-2	Inoperable	04/25/65
65-051A	Tiros 10	R&D	07/02/65	Cape Kennedy, US	Delta	Inoperable	07/31/66
65-083A	Cosmos 92	R&D	10/16/65	Tyuratam-Baikonur, USSR	A-2	Inoperable	10/24/65
65-106A	Cosmos 100	R&D	12/17/65	Tyuratam-Baikonur, USSR	A-1	Inoperable	Unknown
66-008A	ESSA 1	Operational	02/03/66	Cape Kennedy, US	Delta	Inoperable	10/06/66
66-016A	ESSA 2	Operational	02/28/66	Cape Kennedy, US	Delta	Inoperable	03/20/70
66-035A	Molniya 1C	Operational	04/25/66	Tyuratam-Baikonur, USSR	A-2-E	Inoperable	Unknown
66-038A	Cosmos 118	R&D	05/11/66	Tyuratam-Baikonur, USSR	A-1	Inoperable	Unknown
66-040A	Nimbus 2	R&D	05/15/66	Vandenberg AFB, US	Agena B	Inoperable	01/17/69
66-054A	Cosmos 121	R&D	06/17/66	Plesetsk, USSR	A-2	Inoperable	06/25/66
66-057A	Cosmos 122	R&D	06/25/66	Tyuratam-Baikonur, USSR	A-1	Inoperable	10/26/66
66-087A	ESSA 3	Operational	10/02/66	Vandenberg AFB, US	Delta	Inoperable	10/09/68
66-092A	Molniya 1D	Operational	10/20/66	Tyuratam-Baikonur, USSR	A-2-E	Inoperable	09/11/68
66-110A	ATS 1	Operational	12/07/66	Cape Kennedy, US	Atlas-Agena	Partial	
67-006A	ESSA 4	Operational	01/26/67	Vandenberg AFB, US	Delta	Inoperable	12/06/67
67-018A	Cosmos 144	R&D	02/28/67	Plesetsk, USSR	A-1	Inoperable	03/00/68
67-024A	Cosmos 149	R&D	03/21/67	Kapustin Yar, USSR	B-1	Inoperable	04/07/67
67-031A	ATS 2	R&D	04/06/67	Cape Kennedy, US	Atlas-Agena	Inoperable	09/00/68
67-036A	ESSA 5	Operational	04/20/67	Vandenberg AFB, US	Delta	Inoperable	10/08/69
67-039A	Cosmos 156	R&D	04/27/67	Plesetsk, USSR	A-1	Inoperable	08/26/67
67-052A	Molniya 1E	Operational	05/24/67	Tyuratam-Baikonur, USSR	A-2-E	Inoperable	09/26/71
67-066F	Dodge	R&D	07/01/67	Cape Kennedy, US	Titan 3C	Operational Off	01/00/71

TABLE 1. (continued)

NSSDC SPACECRAFT ID	SPACECRAFT NAME[1]	MISSION	LAUNCH DATE	LAUNCH SITE AND COUNTRY	LAUNCH VEHICLE	OPERATING STATUS[1,2]	DATE LAST USABLE DATA RECORDED
67-095A	Molniya 1F	Operational	10/03/67	Tyuratam-Baikonur, USSR	A-2-E	Inoperable	03/04/69
67-101A	Molniya 1G	Operational	10/22/67	Tyuratam-Baikonur, USSR	A-2-E	Inoperable	12/31/69
67-102A	Cosmos 184	R&D	10/24/67	Plesetsk, USSR	A-1	Inoperable	05/23/68
67-111A	ATS 3	R&D	11/05/67	Cape Kennedy, US	Atlas-Agena	Partial	
67-114A	ESSA 6	Operational	11/10/67	Cape Kennedy, US	Delta	Inoperable	11/04/69
68-019A	Cosmos 206	R&D	03/14/68	Plesetsk, USSR	A-1	Inoperable	05/06/68
68-035A	Molniya 1H	Operational	04/21/68	Tyuratam-Baikonur, USSR	A-2-E	Inoperable	08/00/69
68-041X	Nimbus-B	R&D	05/18/68	Vandenberg AFB, US	Agena	Inoperable	None
68-049A	Cosmos 226	R&D	06/12/68	Plesetsk, USSR	A-1	Inoperable	02/19/69
68-057A	Molniya 1J	Operational	07/05/68	Tyuratam-Baikonur, USSR	A-2-E	Inoperable	05/15/71
68-060A	Cosmos 232	R&D	07/16/68	Plesetsk, USSR	A-2	Inoperable	07/24/68
68-068A	ATS 4	R&D	08/10/68	Cape Kennedy, US	Atlas-Centaur	Inoperable	10/17/68
68-069A	ESSA 7	Operational	08/16/68	Vandenberg AFB, US	Delta	Inoperable	07/19/69
68-080A	Cosmos 243	R&D	09/23/68	Plesetsk, USSR	A-2	Inoperable	10/04/68
68-085A	Molniya 1K	Operational	10/05/68	Tyuratam-Baikonur, USSR	A-2-E	Inoperable	02/00/70
68-111A	Cosmos 258	R&D	12/10/68	Tyuratam-Baikonur, USSR	A-2	Inoperable	12/18/68
68-114A	ESSA 8	Operational	12/15/68	Vandenberg AFB, US	Delta	Normal	
69-016A	ESSA 9	Operational	02/26/69	Cape Kennedy, US	Delta	Normal	
69-029A	Meteor 1	Operational	03/26/69	Plesetsk, USSR	A-1	Inoperable	07/00/70
69-037A	Nimbus 3	R&D	04/14/69	Vandenberg AFB, US	THORAD-AGE	Inoperable	01/22/72
69-084A	Meteor 2	Operational	10/06/69	Plesetsk, USSR	A-1	Inoperable	07/00/70
70-005A	Cosmos 320	R&D	01/16/70	Kapustin Yar, USSR	B-1	Inoperable	02/10/70
70-008A	ITOS 1	Operational	01/23/70	Vandenberg AFB, US	Delta	Inoperable	06/18/71
70-019A	Meteor 3	Operational	03/17/70	Plesetsk, USSR	A-1	Inoperable	07/00/70
70-025A	Nimbus 4	R&D	04/08/70	Vandenberg AFB, US	THORAD-AGE	Partial	
70-037A	Meteor 4	R&D	04/28/70	Plesetsk, USSR	A-1	Inoperable	06/00/71
70-047A	Meteor 5	R&D	06/23/70	Plesetsk, USSR	A-1	Inoperable	04/00/72
70-085A	Meteor 6	R&D	10/15/70	Plesetsk, USSR	A-1	Inoperable	02/00/71
70-105A	Cosmos 384	R&D	12/10/70	Plesetsk, USSR	A-2	Inoperable	12/22/70
70-106A	NOAA 1	Operational	12/11/70	Vandenberg AFB, US	Delta	Inoperable	08/19/71
70-109A	PEOLE 1	R&D	12/24/70	Kourou, French Guiana	Diamant B	Normal	
71-003A	Meteor 7	Operational	01/20/71	Plesetsk, USSR	A-1	Inoperable	05/00/71
71-031A	Meteor 8	Operational	04/17/71	Plesetsk, USSR	A-1	Inoperable	07/00/72
71-059A	Meteor 9	Operational	07/16/71	Plesetsk, USSR	A-1	Inoperable	01/00/72
71-071A	EOLE 1	R&D	08/16/71	Wallops Island, US	Scout	Normal	
71-091X	ITOS-B	Operational	10/21/71	Vandenberg AFB, US	Delta	Inoperable	None
71-120A	Meteor 10	Operational	12/29/71	Plesetsk, USSR	A-1	Inoperable	06/00/72
72-022A	Meteor 11	Operational	03/30/72	Plesetsk, USSR	A-1	Normal	
72-049A	Meteor 12	Operational	06/30/72	Plesetsk, USSR	A-1	Normal	
72-058A	ERTS 1	Operational	07/23/72	Vandenberg AFB, US	Delta	Partial	
ITOS-D	ITOS-D	Operational	10/15/72	Vandenberg AFB, US	Delta	Planned	
NIMBS-E	Nimbus-E	R&D	12/12/72	Cape Kennedy, US	Delta	Planned	
ITOS-E	ITOS-E	Operational	06/73	Vandenberg AFB, US	Delta	Planned	

TABLE 1. (continued)

NSSDC SPACECRAFT ID	SPACECRAFT NAME[1]	MISSION	LAUNCH DATE	LAUNCH SITE AND COUNTRY	LAUNCH VEHICLE[1]	OPERATING STATUS[1,2]	DATE LAST USABLE DATA RECORDED
SMS-A	SMS-A	Operational	10/73	Cape Kennedy, US	Delta	Planned	
ERTS-B	ERTS-B	R&D	11/73	Vandenberg AFB, US	Delta	Planned	
SMS-B	SMS-B	Operational	02/74	Cape Kennedy, US	Delta	Planned	
ATS-F	ATS-F	R&D	04/74	Cape Kennedy, US	Titan 3C	Planned	
X-4	X-4	R&D	05/74	Vandenberg AFB, US	Scout	Planned	
ITOS-F	ITOS-F	Operational	06/74	Vandenberg AFB, US	Delta	Planned	
SMS-C	SMS-C	Operational	06/74	Cape Kennedy, US	Delta	Planned	
ITOS-G	ITOS-G	Operational	06/75	Vandenberg AFB, US	Delta	Planned	
ATS-G	ATS-G	R&D	07/75	Cape Kennedy, US	Titan 3C	Planned	
NIMBS-F	Nimbus-F	R&D	07/75	Vandenberg AFB, US	Delta	Planned	
TIROS-N	Tiros-N	Operational	08/76	Vandenberg AFB, US	Delta	Planned	
ITOS-H	ITOS-H	Operational	12/76	Vandenberg AFB, US	Delta	Planned	
ITOS-I	ITOS-I	Operational	06/78	Vandenberg AFB, US	Delta	Planned	
ITOS-J	ITOS-J	Operational	12/79	Vandenberg AFB, US	Delta	Planned	
ITOS-C	ITOS-C	Operational		Vandenberg AFB, US	Delta	Stored	

[1]See glossary for an explanation of acronyms and abbreviations.
[2]Status Codes:

- Normal - The spacecraft operating as designed. Usable data are being received from all experiments.
- Partial - The spacecraft is still being monitored, but not all systems or experiments are operating as expected.
- Inoperable - Spacecraft is no longer capable of producing usable data.
- Operational Off - Spacecraft and/or meteorological experiments are still capable of operation but have been either turned off or are not being used.
- Planned - The spacecraft has been approved and funded by the appropriate agency and assigned a tentative launch date.

The Overview of Meteorological Satellites and Satellite Programs, Section II, contains a general discussion of the various satellite series and provides a brief outline of the development and accomplishments of the different meteorological programs. Also included are the goals for meteorological satellite programs that are presently under study and those programs that will be implemented in the future.

Brief Descriptions of the Satellites and Instrumentation, Section III, is a computer printout of brief descriptions of all known active, inactive, and planned meteorological spacecraft and experiments. Spacecraft entries are arranged in subsections according to country and, if applicable, by satellite series. Individual satellites within a subsection are arranged by a five-character spacecraft identification number assigned by NSSDC for each spacecraft and based on international designations. For example, 66-040A is the NSSDC identification number for Nimbus 2. The first two digits are the year of the launch, and the remaining characters indicate the launch sequence number for that particular year. Brief descriptions of meteorological experiments on the various spacecraft are listed in order of their NSSDC-assigned identification numbers: the spacecraft identification number and an arbitrarily assigned two-digit addition (e.g., 66-040A-01 for the Nimbus 2 AVCS experiment). Brief descriptions of nonmeteorological experiments carried on meteorological satellites are not included in this Compendium.

The headings for each satellite brief description include such information as orbital parameters (for a given epoch date), launch date, and the names of project personnel. Headings for experiment entries indicate the principal investigator(s) and affiliation(s) and operational status of the experiment. The operational status is given as either (1) NORMAL, (2) PARTIAL, (3) INOPERABLE, or (4) UNKNOWN. These terms mean (1) the experiment is capable of returning data suitable for all scientific studies planned; (2) the experiment is capable of working, but not as well as the design required; (3) the experiment is no longer capable of producing any useful scientific data; and (4) the experiment's status is not known. Following each brief description is a series of numbers that provides a reference to the documents listed in the Bibliography, Section IV.

Some of the brief descriptions or entries are redundant since many of the satellites and experiments are quite similar, if not identical, in design and operation. Such duplication, however, is necessary because each entry in this section is a unique and independent element. With the exception of the reference numbers and illustrations, all information in this section was machine generated using the NSSDC Automated Internal Management (AIM) File, a computerized information storage and retrieval system.

The AIM File is one of several computerized information systems in use at NSSDC and provides an efficient tool for organizing, maintaining, and updating information relating to specific spacecraft and experiments. As part of the generalized NSSDC System for Information Retrieval and Storage (SIRS), the AIM File has the capability of a wide variety of search, retrieval, and output modes of information. Information compiled from AIM by SIRS can then be used to create tables and indexes, as has been done for this Compendium. For example, SIRS can select, sort, and list experiments according to the particular phenomenon measured (see Index to Phenomenon Measured), or it can provide a chronological listing of satellites that includes such items as the launch date, operating status, and the date last usable scientific data was recorded by the satellite, as was done to produce Table 1.

SIRS can also be used with other NSSDC information files. For example, Table 2 was generated by SIRS using information contained in the NSSDC Rocket File. (NSSDC does not collect rocket data per se but does maintain a file containing useful information on most scientific rocket launches and can direct an interested requester to the individual experimenter(s) involved.)

The Bibliography, Section IV, contains all the references cited under the brief descriptions in Section III. These references include published research results, news releases, magazine articles, and books. The bibliography was entirely machine generated using the NSSDC Technical Reference File (TRF). This file consists of space science documents physically maintained at NSSDC, the Goddard Space Flight Center Library, or various other libraries. NSSDC does not perform library functions with this file, but maintains it to aid the Data Acquisition and Analysis Branch at NSSDC. The bibliography is by no means complete; however, it is a representative sample of an extremely large number of articles that deal with all aspects of satellite meteorology. The emphasis in creating this bibliography has been to select articles that refer specifically to a satellite, its instruments, research results from its experiments, or its operational history. In general, theoretical papers have not been included.

As far as is known, this Compendium is the first comprehensive document devoted entirely to the meteorological satellite and instrument programs of the U.S., U.S.S.R., U.K., and France. Several excellent summary documents (Richter, H., "Instruments and Spacecraft, October 1957 - March 1966," NASA SP-3028, Washington, D.C., 1966; Rosenthal, A., and W. Corliss, Eds., "Encyclopedia of Satellites and Sounding Rockets, August 1959 to December 1969," NASA-GSFC, Greenbelt, Maryland; and Menzner, R., and J. Oberholtzer, "Space Applications Instrumentation Systems," NASA TMX-2066, Washington, D.C., May 1972)

TABLE 2. IDENTIFIED EARTH PHOTOGRAPHY FROM ROCKETS

ROCKET FLIGHTS NSSDC Rocket ID (RRRMM-DDSS)*	ROCKET TYPE	LAUNCH SITE+	SPONSORING AGENCY+
R4610-2401	V-2	WSMR	APL
R4612-0501	V-2	WSMR	NRL
R4702-2001	V-2	WSMR	ARDC
R4703-0701	V-2	WSMR	NRL
R4704-0101	V-2	WSMR	APL
R4704-0901	V-2	WSMR	APL
R4705-1501	V-2	WSMR	NRL
R4707-2901	V-2	WSMR	APL
R4712-0801	V-2	WSMR	ARDC
R4805-2701	V-2	WSMR	APL
R4807-2601	Aerobee	WSMR	APL
R4807-2602	V-2	WSMR	APL
R4808-0501	V-2	WSMR	NRL
R4901-2801	V-2	WSMR	NRL
R4902-1701	V-2	WSMR	APL
R4903-2204	V-2	WSMR	ARDC
R4905-0301	Viking 1	WSMR	NRL
R4906-1402	V-2	WSMR	ARDC
R4909-06	V-2	WSMR	NRL
R4912-0201	Aerobee	WSMR	ARDC
R5002-0901	Viking	WSMR	NRL
R5010-1201	Aerobee	WSMR	ARDC
R5011-2101	Viking	WSMR	NRL
R5102-0601	Aerobee	WSMR	APL
R5107-2501	Aerobee	WSMR	ARDC
R5205-2001	V-2	WSMR	SCEL
R5212-1501	Viking	WSMR	NRL
R5405-2401	Viking 11	WSMR	NRL
R5502-0401	Viking 12	WSMR	NRL
R6010-0521	Unknown	Ft. Churchill, Canada	GSFC
R6012-1901	Mercury Atlas	CPKF	NASA/MSC
R6105-0502	Mercury Atlas	CPKF	NASA/MSC

*RRR = R + year of launch, MM = month of launch, DD = day of launch, and SS = sequence number.
+See Glossary of Acronyms and Abbreviations.

as well as numerous general review articles previously have been published; however, most have been either very general or covered only one or two series of meteorological satellites.

The material presented in this document was compiled from documents by, and from personal interviews with, those directly involved with the various meteorological satellite programs. Frequently, source material pertaining to spacecraft included in this document was obtained from a wide variety of publications that were sometimes vague or conflicting. Some judgment was required to analyze and evaluate these sources in order to ensure technical consistency. Still, it is felt that the information appearing in this Compendium represents the most accurate and comprehensive unclassified collection of facts on meteorological satellites available at this time. Every effort was made to ensure the accuracy and completeness of all information presented in this Compendium; nevertheless, corrections to, and suggestions for improvements in, this document are solicited. The principal parts of this document were machine generated, and therefore, the Compendium can be easily updated. It is anticipated that, as more information is placed in the NSSDC information files, supplements to this document will be published.

II. AN OVERVIEW OF METEOROLOGICAL SATELLITES AND SATELLITE PROGRAMS

A. Background

The ability to obtain images of the earth from artificial earth satellites is the culmination of many years of various attempts by man to increase his perspective of the world in which he lives. The first high-level photography (beyond that of climbing high towers or mountains) was accomplished by a noted French photographer, Gaspard Felix Tournachon, who began photographic balloon ascents over Paris in 1858. The value of the increased visual coverage was quickly realized, and several countries used balloons for military reconnaissance during the remaining years of the 19th century.

The first few years of the 20th century saw balloons equipped with panoramic cameras ascending to heights of several thousand feet. Balloons were soon followed by rockets and airplanes that served as platforms for high-altitude photography. In 1905 a German, Alfred Maul, began firing solid-propellant rockets equipped with cameras, and by 1912 photographs were being obtained from heights of 0.79 km.

The outbreak of World War I and the rising popularity of the airplane as a reconnaissance platform, in addition to its use as a combat vehicle, caused the work with rockets to slow considerably. Balloons, however, continued to be used as reconnaissance platforms.

In the years following World War I, balloons were designed to attain ever greater heights. In 1935, Albert Stevens took the first photograph showing the curvature of the earth from the Explorer 2 balloon at an altitude of 22 km. The onset of World War II, however, brought high-altitude balloon flights to a virtual standstill.

During World War II, the German group working at Peenemünde applied the pioneering work of Konstantin Tsiolkovsky, Hermann Oberth, and Robert H. Goddard to produce the V-2 rocket. This event was to revolutionize the technology of high-altitude probes and, in the post-war years, greatly extend the heights from which photographs could be obtained.

The study of the atmosphere and its weather systems from high altitudes began in earnest after World War II. During the late 1940's and early 1950's many modified versions of captured German V-2 rockets equipped with cameras were launched from White Sands, New Mexico. In 1947 the first successful photographs of a large expanse of cloud cover were taken from a V-2 rocket at altitudes between 110 and 165 km. Many additional photographs were soon obtained from outside the atmosphere by V-2's, Viking rockets, Aerobee rockets, and various military ballistic missiles equipped with cameras (see Table 2).

Such flights demonstrated the feasibility and value of high-altitude photography for making synoptic observations of cloud systems and storms that would not have been detected by conventional ground-based observing networks. The desire for increased coverage on a more frequent and periodic basis established the need for a more permanent high-altitude monitoring platform -- the meteorological satellite.

Since the beginning of space flight in 1957, 84 of the successful 1300 identified unmanned spacecraft are known to have been weather satellites or to have carried meteorological instruments. At present (April 1973) the U.S.S.R. has launched 44 such spacecraft, the U.S. 38, and France 2 (see Table 3). The locations of the various launch sites used by these three countries are shown in Figure 1.

B. The Programs of the United States

1. Early Meteorological Satellites

The United States conducted its first experiments in satellite meteorology with Vanguard 2 (Figure 2) and Explorers 6 and 7, launched in 1959. Vanguard 2 was equipped with two photocells, and Explorer 6 was fitted with a primitive TV scanner. Both experiments were designed to carry out observations of the global cloud cover. These were the first attempts to obtain crude earth images from an artificial earth satellite. Explorer 7 (Figure 3) carried a thermal radiation experiment in the form of a low-resolution omnidirectional radiometer (OMNI) to measure incoming and reflected solar radiation and the thermal radiation emitted by the earth-atmosphere system in order to determine the gross heat budget of the earth. While these early remote sensing experiments were only partially successful, they provided scientists and spacecraft engineers with valuable experience and encouraged the further development of a meteorological satellite system.

An overview of data coverage from U.S. meteorological spacecraft is shown in Figure 4.

2. Tiros

By mid-1959, work previously begun by the Advanced Research Projects Agency (ARPA) of the Department of Defense on the development of a meteorological satellite was transferred to NASA. On April 1, 1960, Tiros 1, the first full-time meteorological satellite was launched by NASA. It and the nine Tiros spacecraft (Figure 5) that followed were equipped with a dual TV camera system consisting of a camera, vidicon tube, tape recorder, and transmitter. Pictures either could be stored on magnetic tape or transmitted directly to a command and data acquisition (CDA) station depending on whether the satellite was beyond

TABLE 3. METEOROLOGICAL SATELLITE LAUNCH TOTALS AS OF JULY 1972

Sponsoring Country	Launch Site	Coordinates Latitude	Coordinates Longitude	Number of Launches
France	Kourou, French Guiana	5°12'N	52°44'W	1
	Wallops Island, Virginia USA	37°50'N	75°29'W	1
United States	Cape Kennedy (ETR)	28°27'N	80°32'W	21
	Vandenberg Air Force Base (WTR)	34°38'N	120°32'W	15
Union of Soviet Socialist Republics	Kapustin Yar	48°31'N	45°48'E	4
	Plesetsk	62°42'N	40°21'E	21
	Tyuratam-Baikonur	45°38'N	63°16'E	17

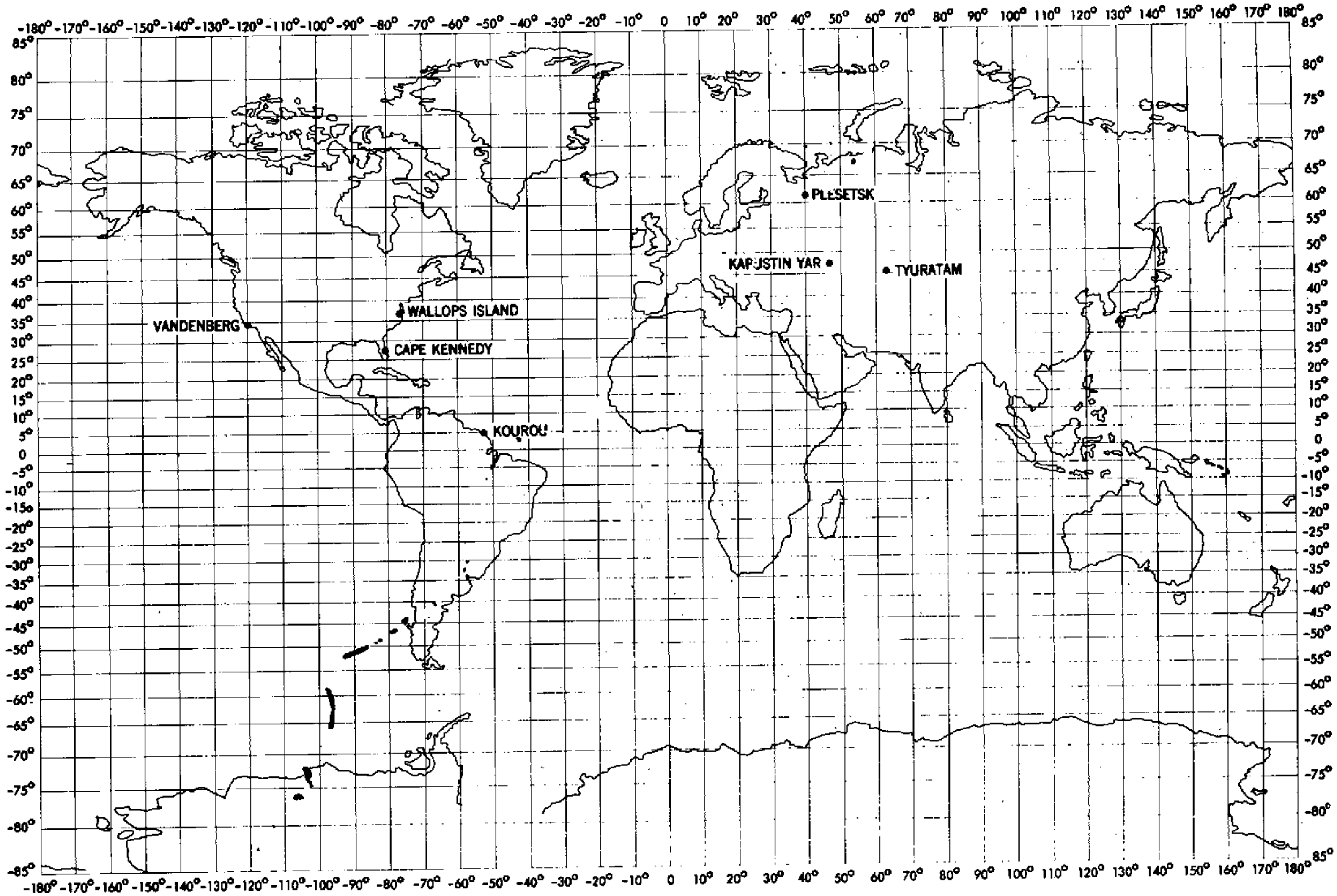
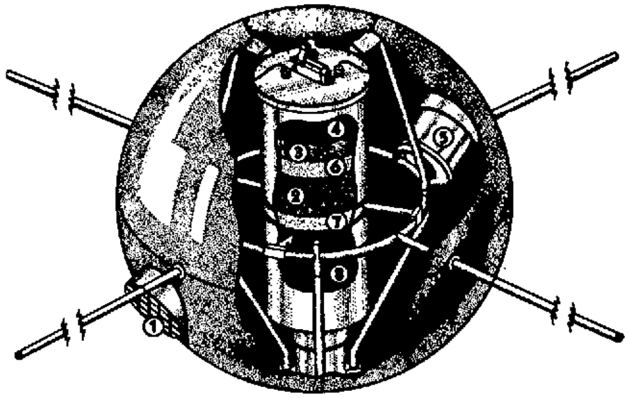


Figure 1. Launch Sites for Meteorological Satellites



(1) PHOTOCELL LIGHT SHIELDS, (2) RECORDER, (3) INTERROGATION RADIO RECEIVER, (4) METEOROLOGICAL DATA TRANSMITTER, (5) PHOTO-CELL, (6) DATA ELECTRONIC EQUIPMENT, (7) TRACKING TRANSMITTER, (8) MERCURY-CELL BATTERIES.

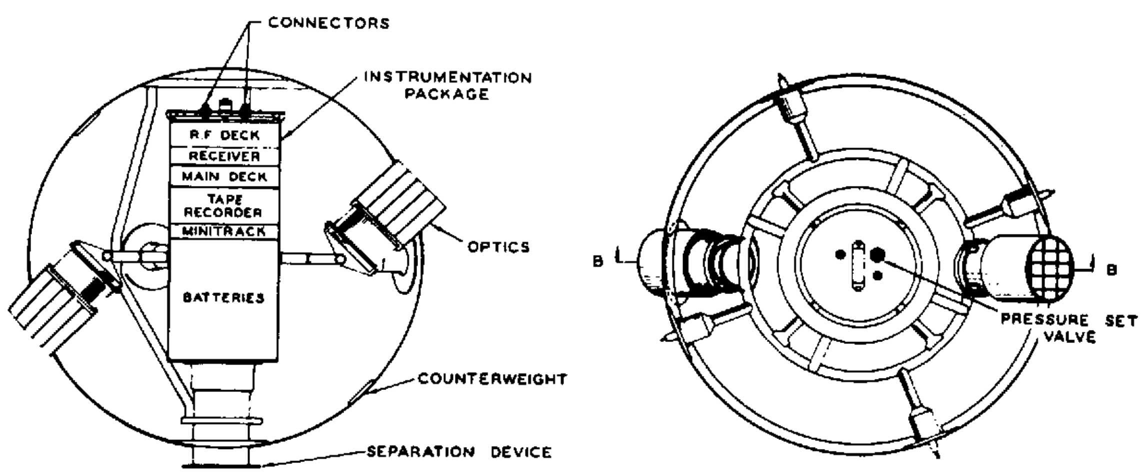


Figure 2. Vanguard 2 Configuration and Subsystem

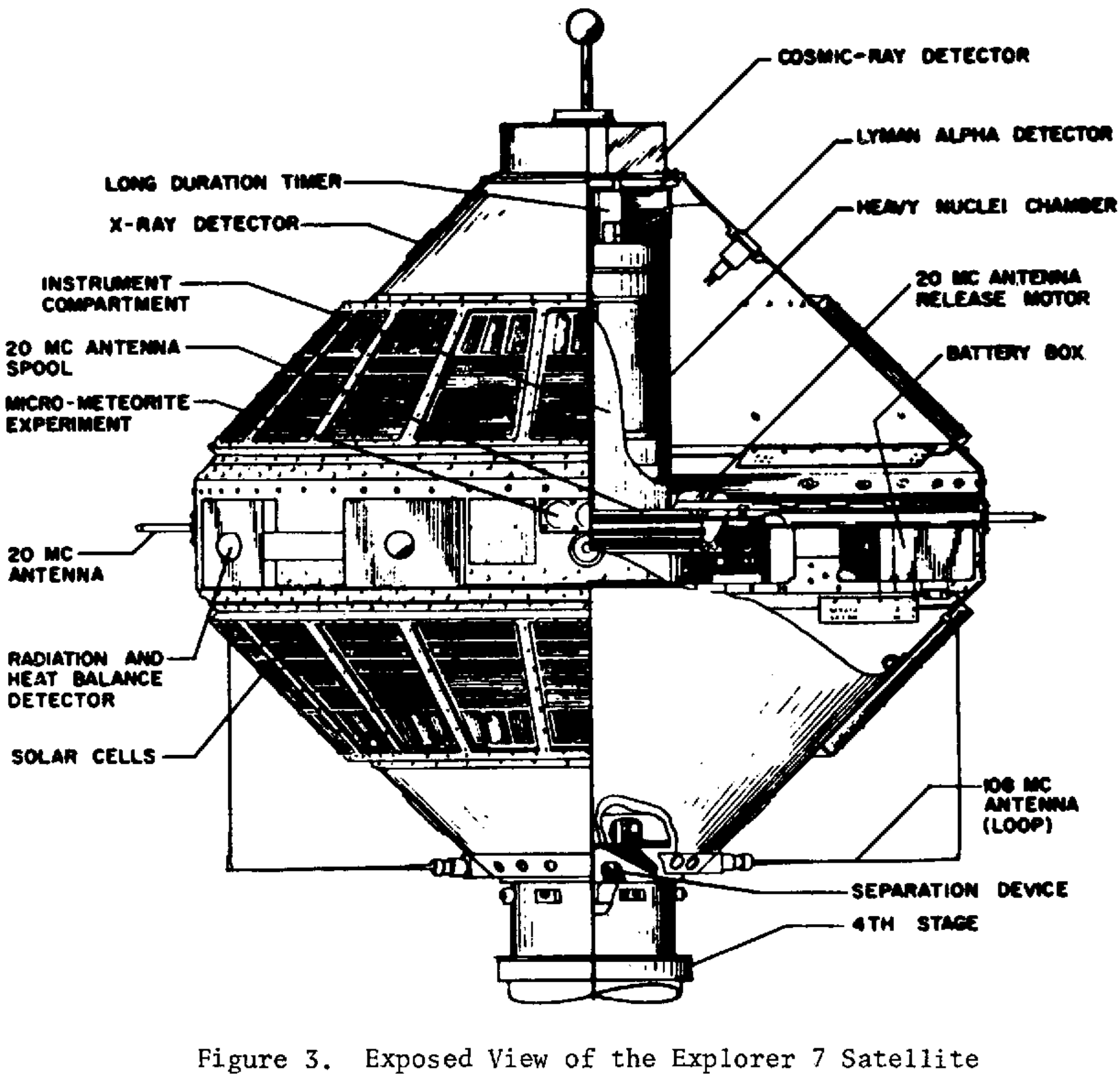
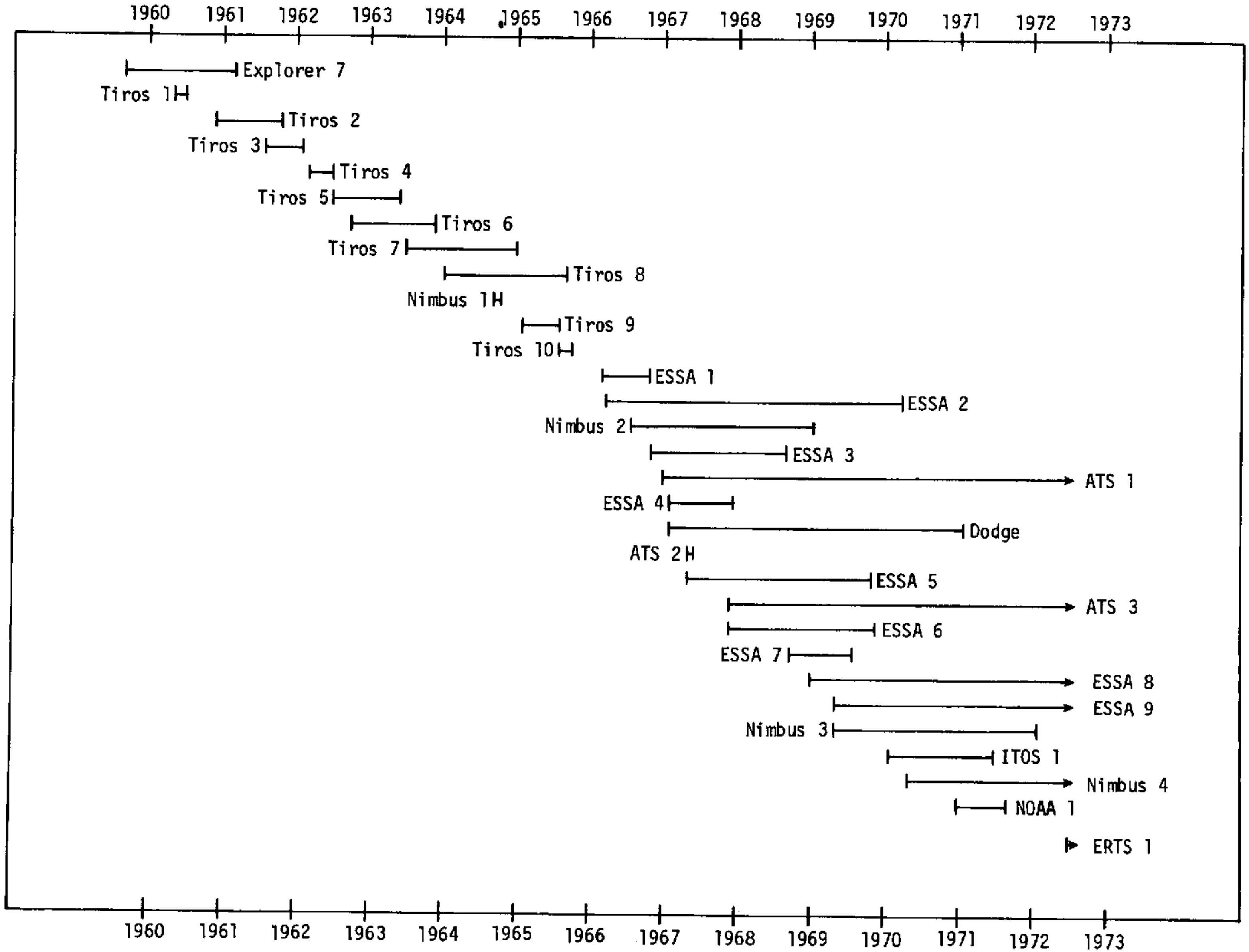


Figure 3. Exposed View of the Explorer 7 Satellite


1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973
Explorer 7
Tiros 1
Tiros 2
Tiros 3
Tiros 4
Tiros 5
Tiros 6
Tiros 7
Tiros 8
Nimbus 1
Tiros 9
Tiros 10
ESSA 1
ESSA 2
Nimbus 2
ESSA 3
ATS 1
ESSA 4
Dodge
ATS 2
ESSA 5
ATS 3
ESSA 6
ESSA 7
ESSA 8
ESSA 9
Nimbus 3
ITOS 1
Nimbus 4
NOAA 1
ERTS 1

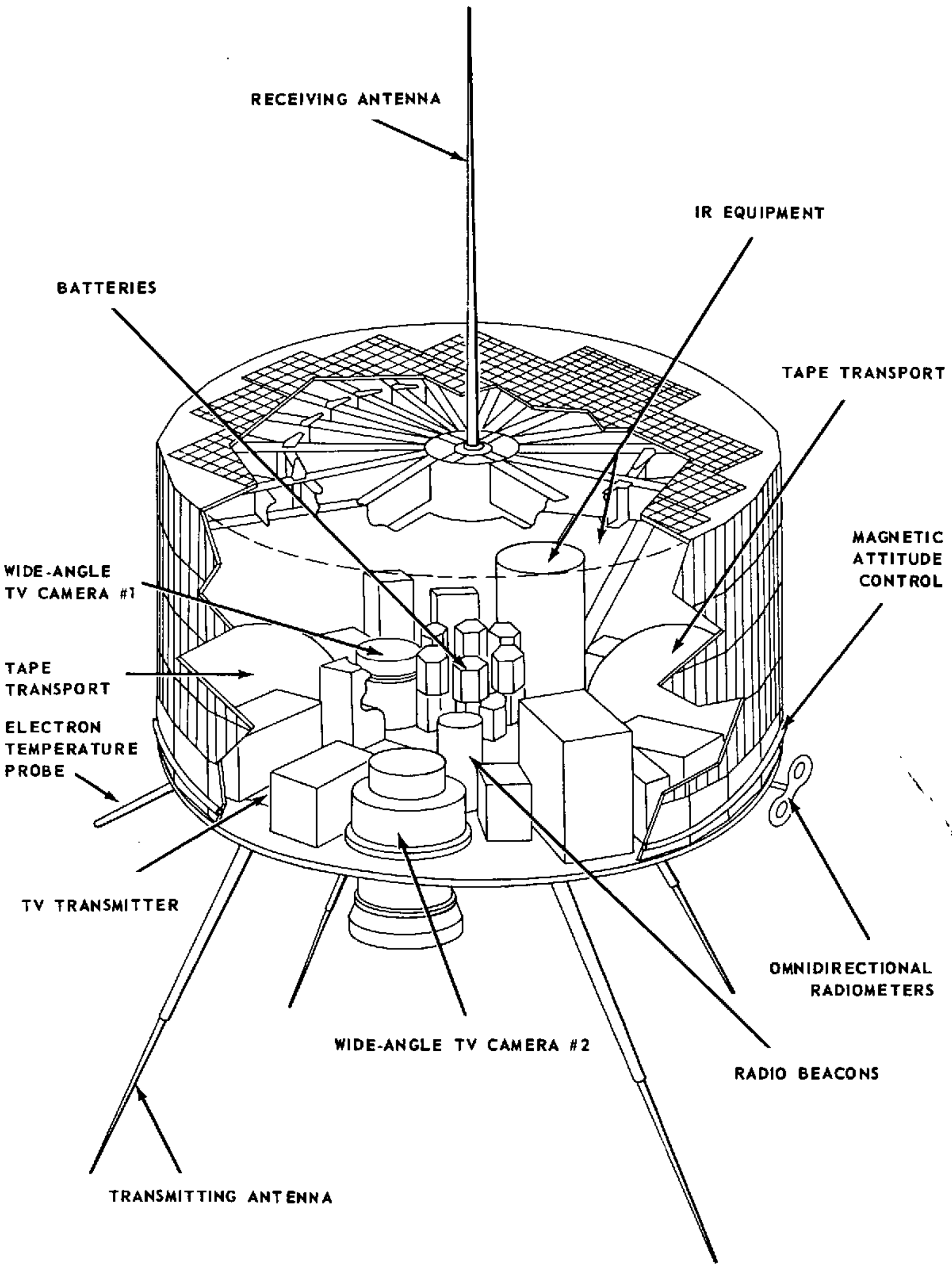


Figure 5. Standard Tiros Satellite Configuration (Axial Mode)

or within the communication range of a station. In addition, Tiros 2, 3, 4, and 7 each carried a five-channel scanning medium-resolution infrared radiometer for measuring emitted radiation from the earth and its atmosphere. Two other infrared sensors were also flown on Tiros spacecraft: a widefield radiometer (Tiros 3 and 4) and a low-resolution omnidirectional radiometer (Tiros 3, 4, and 7). These last two sensors provided low-resolution infrared data for radiation balance studies.

The first four Tiros satellites were launched into near-circular orbits with an orbit inclination of 48°, which provided TV coverage of the sunlit portion of the earth between 55°N and 55°S latitude. The orbit inclination on Tiros 5 through 8 was increased to provide TV coverage for the area between 65°N to 65°S latitude. The orbits of Tiros 9 and 10 were intended to be near-polar and sun-synchronous in order to extend the sensor coverage to the entire sunlit portion of the earth and also allow observations to be taken over local areas at approximately the same time each day. Tiros 10 achieved this desired orbit; however, owing to a failure in the guidance system, Tiros 9 obtained a nonsynchronous elliptical orbit.

Tiros 1 through 8 were spin stabilized, with both of their TV cameras mounted on the satellite base with their optical axes parallel to the spacecraft spin axis. Since the spin axis lay in the orbital plane, the cameras were directed earthward for only approximately one fourth of each orbit. To overcome this problem, Tiros 9 (Figure 6) and later operational meteorological satellites (to be described under TOS/ESSA) were placed in a cartwheel mode in which the spacecraft spin axis was normal to the orbital plane. The two TV cameras were relocated with their optical axes normal to the spacecraft spin axis so as to view the earth once during each satellite revolution. Thus, it was possible for the first time to monitor the daytime global cloud cover on a nearly continuous basis.

Tiros 8 was the first satellite to be equipped with automatic picture transmission (APT) capabilities. On the previous Tiros satellites, direct TV transmission was possible only when the satellite was in communication range with either of two ground stations (Wallops Island, Virginia, and the Western Test Range (WTR)). However, the APT system on Tiros 8 was capable of transmitting local, daytime cloudcover pictures directly to any properly equipped ground station in the global APT network.

The Tiros research and development (R&D) program, which began during April 1960 and ended with the deactivation of Tiros 10 in July 1966, demonstrated the vital role of satellites as meteorological tools for gathering data for research and operations. Tiros yielded information on global cloud cover, extended man's knowledge of the distribution and formation of various cloud systems, provided valuable data on global

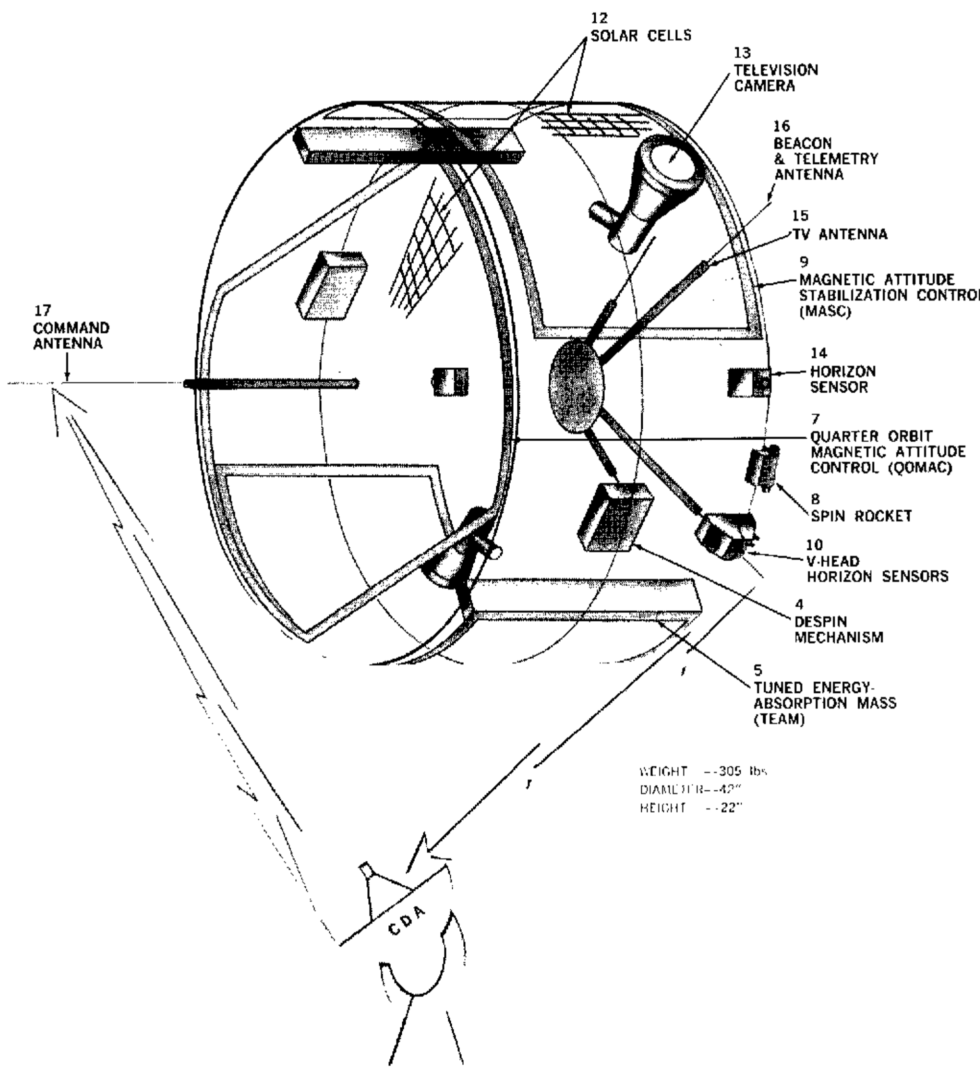


Figure 6. Tiros 9 Satellite (Wheel Mode)

heat balance and water vapor distribution, and supplied the meteorologist with near real-time photographs of weather systems influencing his local area, thereby permitting more accurate forecasts. Tiros satellites were also responsible for the detection of many hurricanes long before conventional meteorological observation networks could have done so, enabling the National Weather Service to issue timely storm advisories and warnings that saved countless lives.

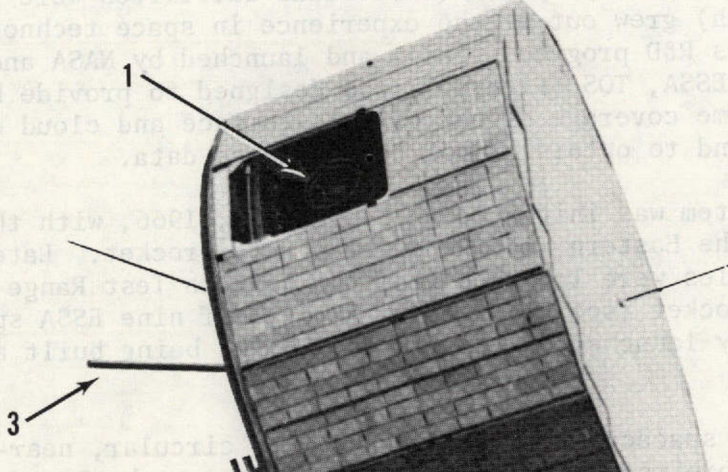
3. TOS/ESSA

The Tiros Operational Satellite, Environmental Science Services Administration (TOS/ESSA) system (individual satellites were designated ESSA after launch) grew out of the experience in space technology gained through the Tiros R&D program. Built and launched by NASA and operated and financed by ESSA, TOS (Figure 7) was designed to provide both local and global daytime coverage of the earth's surface and cloud cover on a daily basis, and to obtain global heat balance data.

The system was initiated on February 3, 1966, with the launch of ESSA 1 from the Eastern Test Range by a Delta rocket. Later spacecraft in the series were launched from the Western Test Range using an improved Delta rocket (see Figure 8). A total of nine ESSA spacecraft were successfully launched, with a tenth, TOS-H, being built and placed in storage.

All TOS spacecraft were launched into circular, near-polar, sun-synchronous orbits and spin stabilized in a cartwheel mode. Improved attitude configuration, higher orbits, and better camera resolution gave TOS spacecraft significantly improved photographic capabilities over the standard Tiros spacecraft. ESSA 2, 4, 6, and 8 were equipped with two identical 2.54-cm-diameter, 800-line, vidicon APT cameras to provide direct readout of daytime cloud cover over a specified location. ESSA 3, 5, 7, and 9 were fitted with two redundant 2.54-cm-diameter, 800-line, advanced vidicon camera system (AVCS) cameras and a dual tape recorder for photographing and storing global cloud-cover data for subsequent transmission to ground acquisition stations at Wallops Island, Virginia, and Fairbanks, Alaska. The cameras on ESSA 1 were identical to the vidicons used on Tiros satellites. All odd-numbered ESSA spacecraft after ESSA 1 also carried two low-resolution infrared flat plate radiometers (FPR's) that were mounted on the satellite baseplate and used to monitor the intensity of emitted and reflected radiation from the earth-atmosphere system on a global scale.

The TOS system consisted of two ESSA satellites operating in orbit simultaneously: one AVCS-equipped spacecraft and one APT-equipped spacecraft. The system provided full daytime global coverage of cloud systems on a daily basis. TOS spacecraft proved extremely reliable. The last APT-equipped spacecraft in the series, ESSA 8, is still



1. APT/AVCS CAMERA
2. COMMAND ANTENNA
3. BEACON & TELEMETRY ANTENNA (4)
4. SOLAR CELL PANELS

Figure 7. Standard TOS/ESSA Satellite Configuration

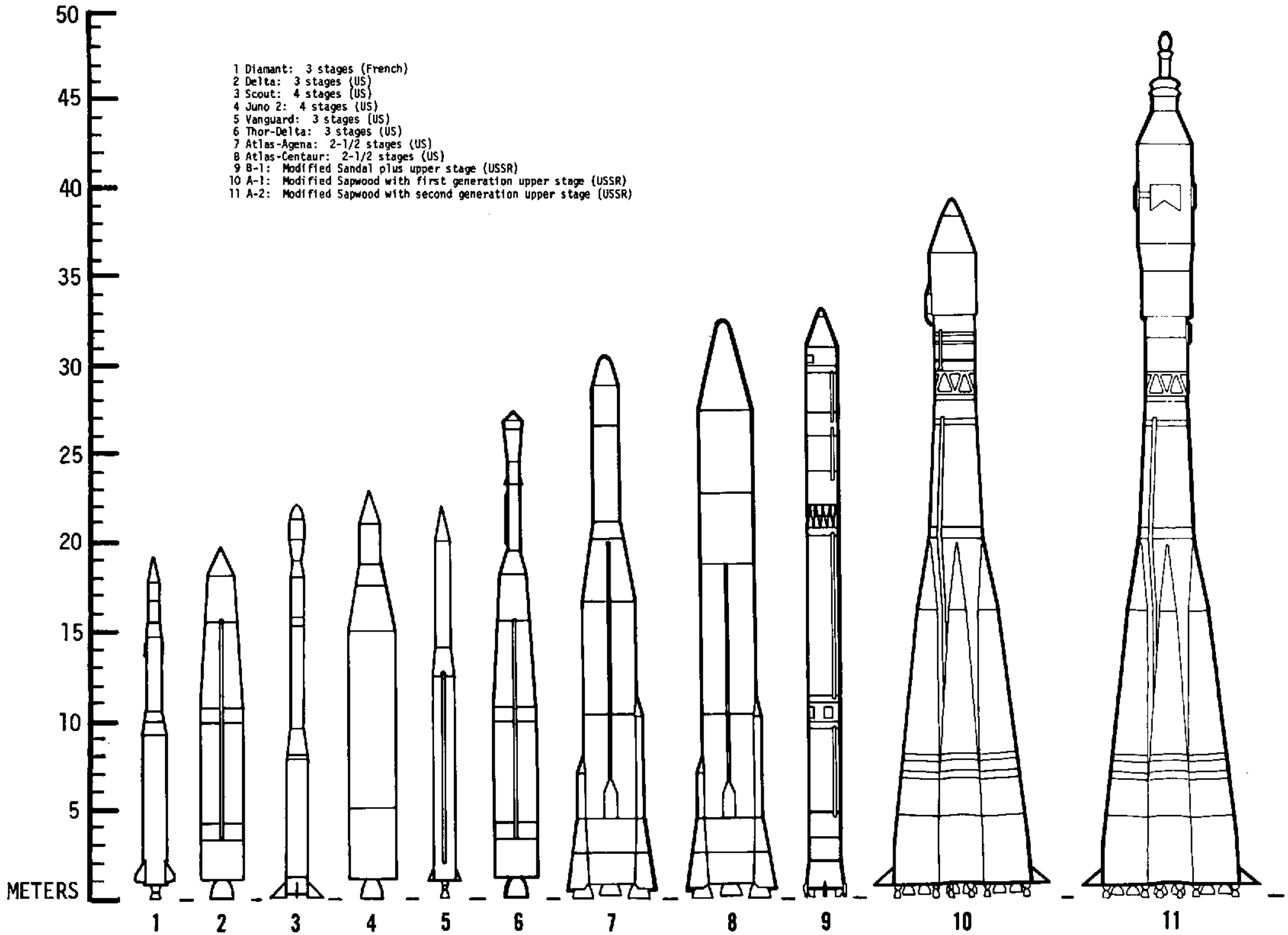


Figure 8. Common Launch Vehicles for Meteorological Satellites

functioning after more than 4 years in orbit. Over 140,000 useful meteorological photographs were received from the AVCS experiment on ESSA 9, the last spacecraft in the series, before it was placed in an operationally off mode in November 1972. The APT experiment also has been a great aid to operational meteorology at the local level; by 1971 nearly 600 stations throughout the world were capable of receiving real-time cloudcover photographs from APT-equipped TOS spacecraft.

4. ATS

The Applications Technology Satellite (ATS) series of NASA R&D spacecraft was designed to test new concepts in spacecraft design, stabilization, propulsion, and communication and to conduct a variety of technical application and scientific experiments, some of which were meteorologically oriented. Five ATS spacecraft have been launched, but only the first four vehicles carried meteorological experiments.

ATS 1 (Figure 9) was successfully placed in a geosynchronous orbit, 37,000 km above the earth's equator in December 1966. It could remain nearly stationary at any given point as it monitored the earth-atmosphere system. The spin-stabilized spacecraft was equipped with a spin-scan cloudcover camera (SSCC) that provided nearly continuous (every 20 minutes), near-full disk pictures of the earth's cloud cover from $\pm 55^{\circ}$ latitude from the western to eastern limb. The spacecraft also carried a weather facsimile (WEFAX) data relay experiment that retransmitted satellite and facsimile products, which were handled and prepared by NOAA, to APT ground stations.

The second satellite in the series, ATS 2, failed to achieve its planned 11,000-km circular orbit going instead into a highly elliptical (185-km perigee, 11,100-km apogee) orbit. The primary objective of ATS 2 was to test a gravity-gradient attitude control system designed to maintain the spacecraft's geometrical axis in a vertical position. However, it was also fitted with two AVCS cameras: one narrow-angle camera for viewing selected portions of the earth and a wide-angle camera capable of full disk coverage.

ATS 3 was nearly identical to ATS 1 and was also launched into a geosynchronous equatorial orbit. However, it was placed over the Atlantic Ocean, while ATS 1 was stationed over the Pacific Ocean. ATS 3 carried four meteorologically related experiments, a multicolor spin-scan cloudcover camera (MSSCC), an image dissector camera (IDC), a WEFAX experiment, and an Omega position and location experiment (OPLE) instrumentation. The MSSCC was identical to that flown on ATS 1 with the exception of having the added capability of color (red, blue, and green). The IDC used an electronic scan instead of a mechanical scan to produce black and white photographs of selected areas of cloud cover. It was the prototype for similar camera systems flown later on Nimbus 3 and 4.

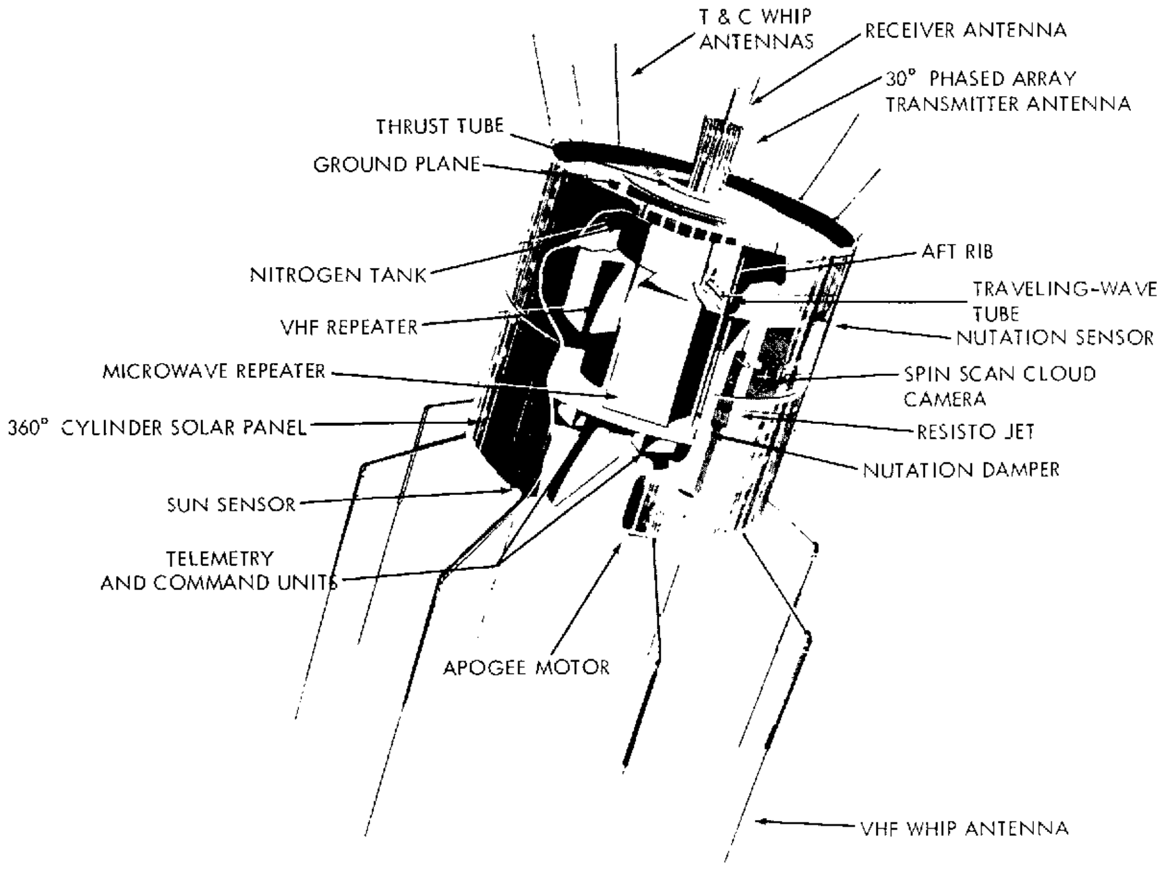


Figure 9. ATS 1 Satellite

OPLE was designed to demonstrate the feasibility of using the Navy's Omega navigation system in conjunction with a synchronous satellite to establish an operational global platform location and data collection system. It served as a forerunner to the more sophisticated platform data collection experiments flown on Nimbus 3 and 4.

ATS 4 (Figure 10) carried an image orthicon (day/night) camera designed to determine the feasibility of simultaneous day-night imaging of cloud systems in cases where the terminator divided the field of view (FOV). The spacecraft failed to achieve its planned geosynchronous orbit. The booster rocket remained attached to the spacecraft and, because of the resultant spacecraft tumbling and subsequent damage, no pictures or other data were obtained.

One additional spacecraft in the series, ATS-F (Figure 11) is presently planned. Resembling an open parasol, ATS-F will differ considerably in appearance from the earlier cylindrically shaped ATS spacecraft. The primary mission of ATS-F will be to serve as a high-gain, steerable, antenna structure. Secondary objectives for ATS-F will include carrying a geosynchronous very high resolution radiometer (GVHRR). The two-channel GVHRR will provide day and night cloudcover information for meteorological operations and for research.

A sixth satellite, ATS-G, was also planned. It was to carry two meteorological experiments: an atmospheric sounder and an imager. In early 1973, ATS-G was cancelled because of funding problems.

The ATS program has been highly successful. ATS 3 was the first satellite to provide near-full earth disk color photographs on an operational basis. Being able to monitor near-global weather patterns, ATS 1 and 3 have played a significant role in hurricane and typhoon surveillance. Cloud motions derived from successive ATS photographs have been used to supply estimates of the upper level wind velocity in areas of sparse data. ATS time-lapse movies (see Appendix A) have also been used to study general circulation patterns and the development and life cycle of tropical and extratropical storms and tornados. In addition, the WEFAX experiments on ATS 1 and 3 demonstrated the ability of a satellite to rapidly transmit processed data from a centralized meteorological facility to isolated remote stations.

5. Dodge

The Department of Defense Gravity Experiment (Dodge) satellite (Figure 12) was launched by the Department of Defense (DOD) primarily to study gravity-gradient stabilization techniques. Placed into a near-synchronous orbit on July 1, 1967, the satellite carried two vidicon cameras: one narrow angle (22° FOV) and one wide angle (60° FOV).

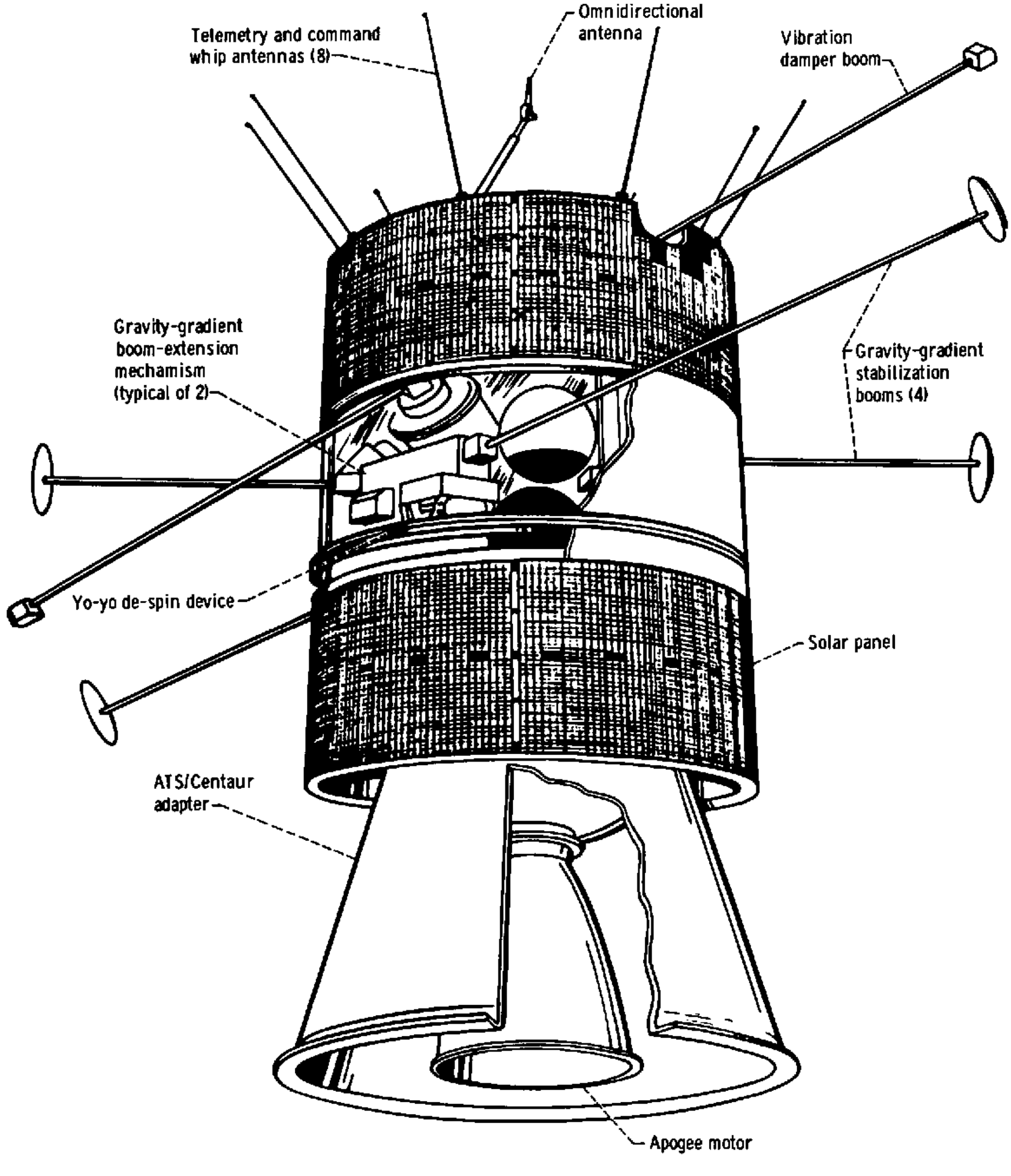


Figure 10. ATS 4 Satellite

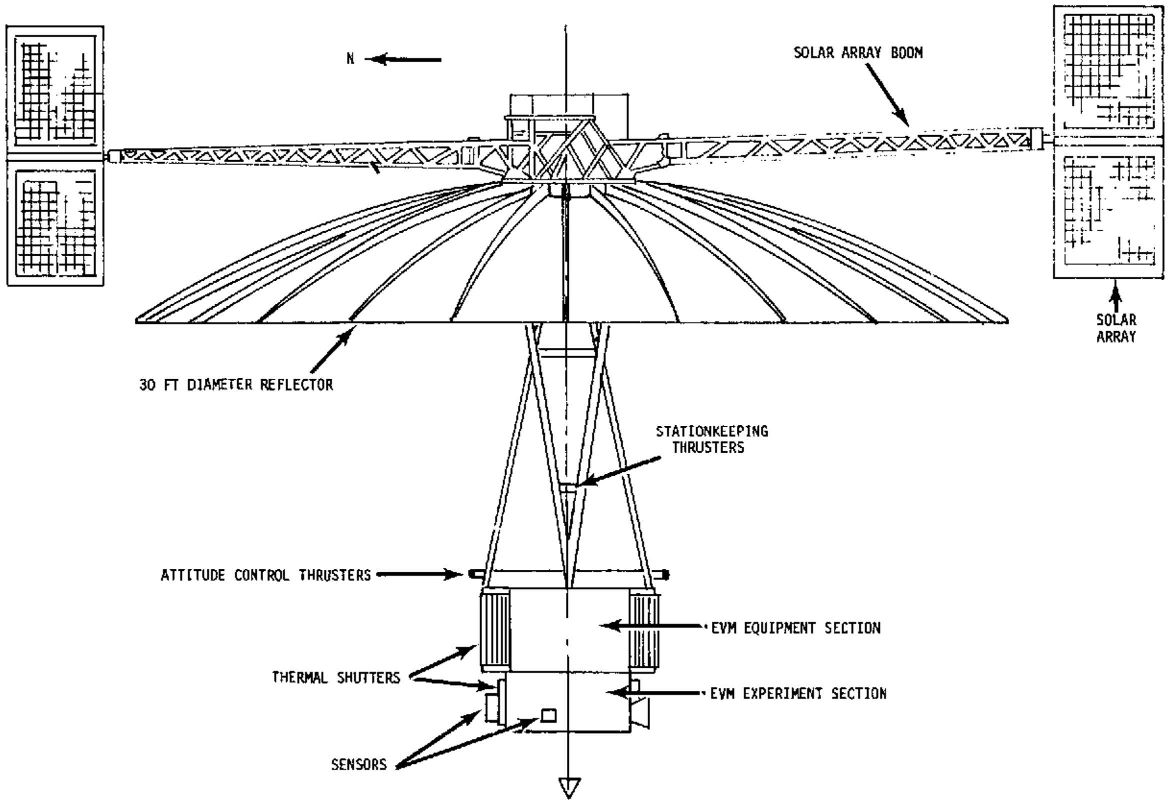


Figure 11. Basic ATS-F and -G Configuration

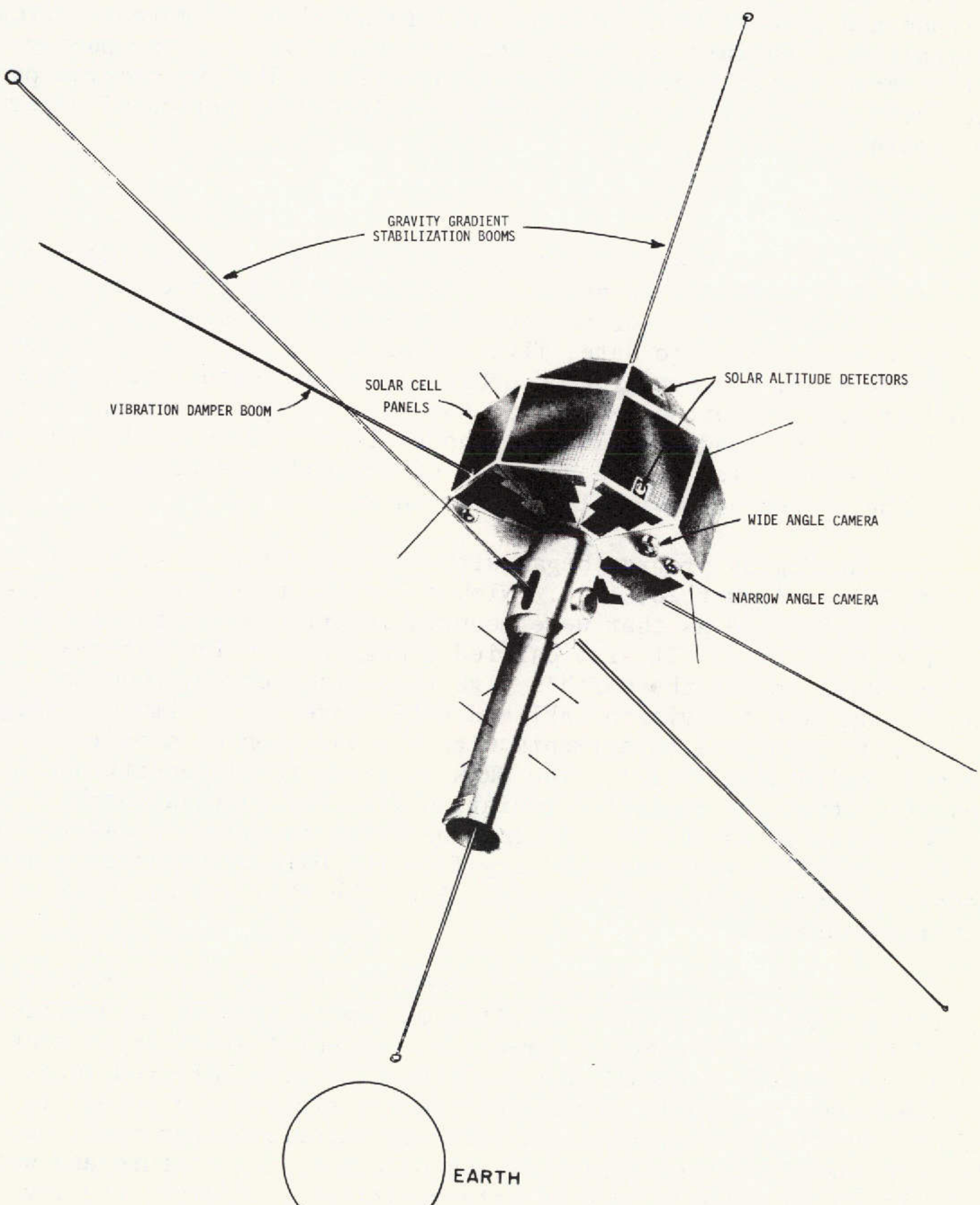


Figure 12. Dodge Satellite

The narrow-angle camera had a color capability. The cameras' main function was to assist ground personnel in maintaining proper spacecraft attitude and orientation, but the photographs also had meteorological implications. On July 25, 1967, Dodge took the first color photographs of the earth's disk ever made from a satellite. The two cameras produced over 25,000 pictures during the nearly 4-year period of experiment operation.

6. Nimbus

The Nimbus satellite is a second-generation meteorological R&D spacecraft designed to serve as a stabilized, earth-oriented platform for the testing of advanced systems for sensing and collecting meteorological data. To date, five Nimbus spacecraft have been launched into near-polar, sun-synchronous orbits. A sixth satellite, Nimbus-B, failed to attain orbit on May 18, 1968, when a booster guidance malfunction forced a payload destruct. Although later models tended to become progressively heavier by the addition of new and more advanced experiments, the spacecraft were all similar in design.

The Nimbus program began with the launching of Nimbus 1 (Figure 13) on August 28, 1964. Nimbus 1 was equipped with an APT camera and three AVCS cameras that were mounted in triad so as to have overlapping fields of view. It also carried a high-resolution infrared radiometer (HRIR) to map the earth's nighttime cloud cover, thus complementing the daytime television (APT and AVCS) coverage. Nimbus 2 (Figure 14) carried identical experiments with the addition of a medium-resolution infrared radiometer (MRIR). The MRIR measured the intensity and direction of emitted and reflected radiation from the earth-atmosphere system in five selected wavebands. Another addition on Nimbus 2 was the capability to provide real-time imagery from the HRIR by means of a direct readout infrared radiometer system. Both the HRIR and the MRIR were scanning radiometers.

The experiment payload of Nimbus 3 (Figure 15) represented a significant advance in the capability of remote sensors to provide data needed for numerical weather forecasts. Meteorological experiments on Nimbus 3 included: an MRIR and an HRIR to provide infrared imaging, an IDCS camera to supply daytime cloudcover pictures, a satellite infrared spectrometer (SIRS), an infrared interferometer spectrometer (IRIS) to determine vertical profiles of ozone, temperature and water vapor in the atmosphere, and an interrogation, recording, and location system (IRLS) to locate, interrogate, record, and retransmit meteorological and geophysical data from remote collection stations. By means of a real-time transmission system, direct daytime and nighttime cloudcover imagery was received by APT-equipped stations. Similar

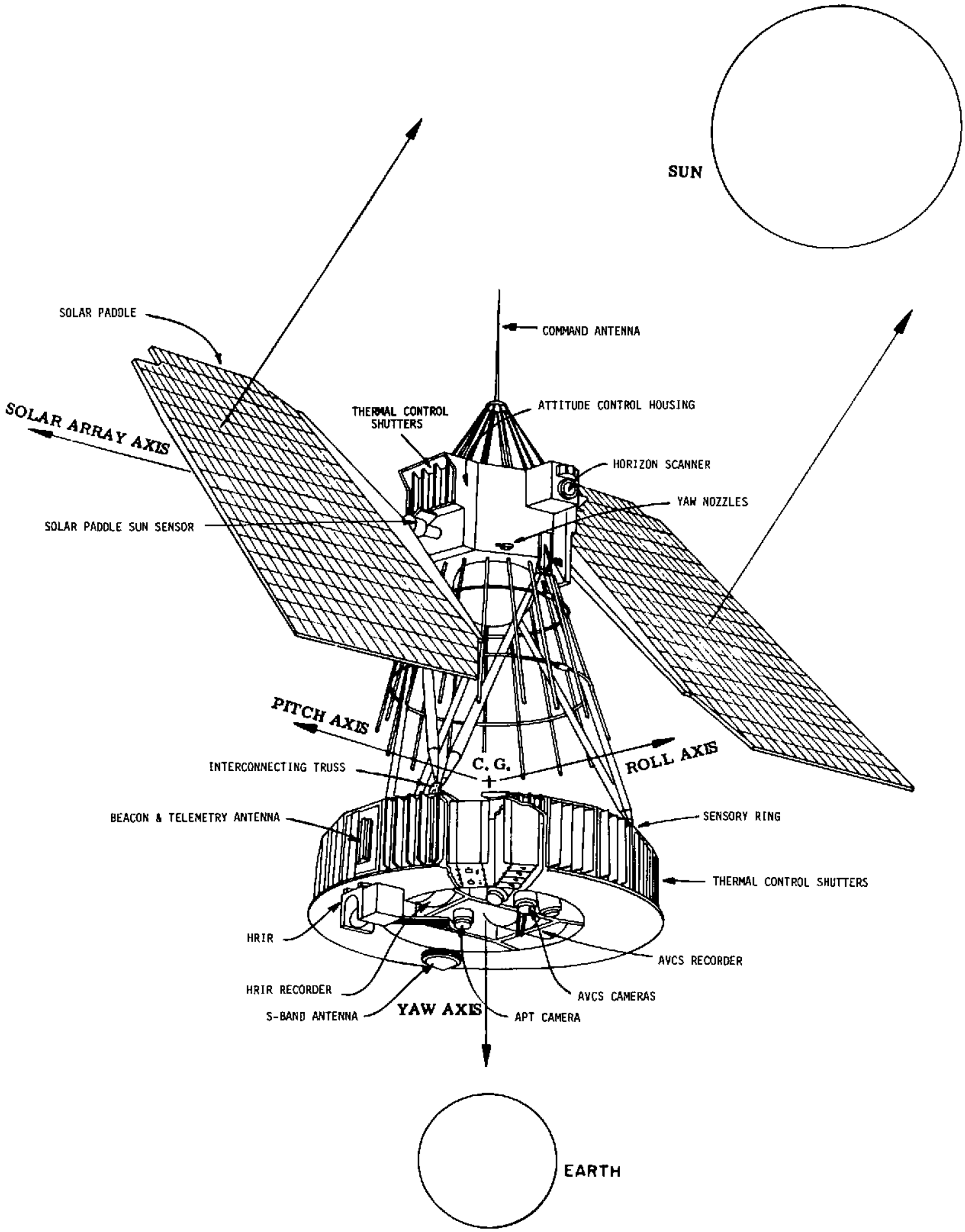


Figure 13. Nimbus 1 Satellite

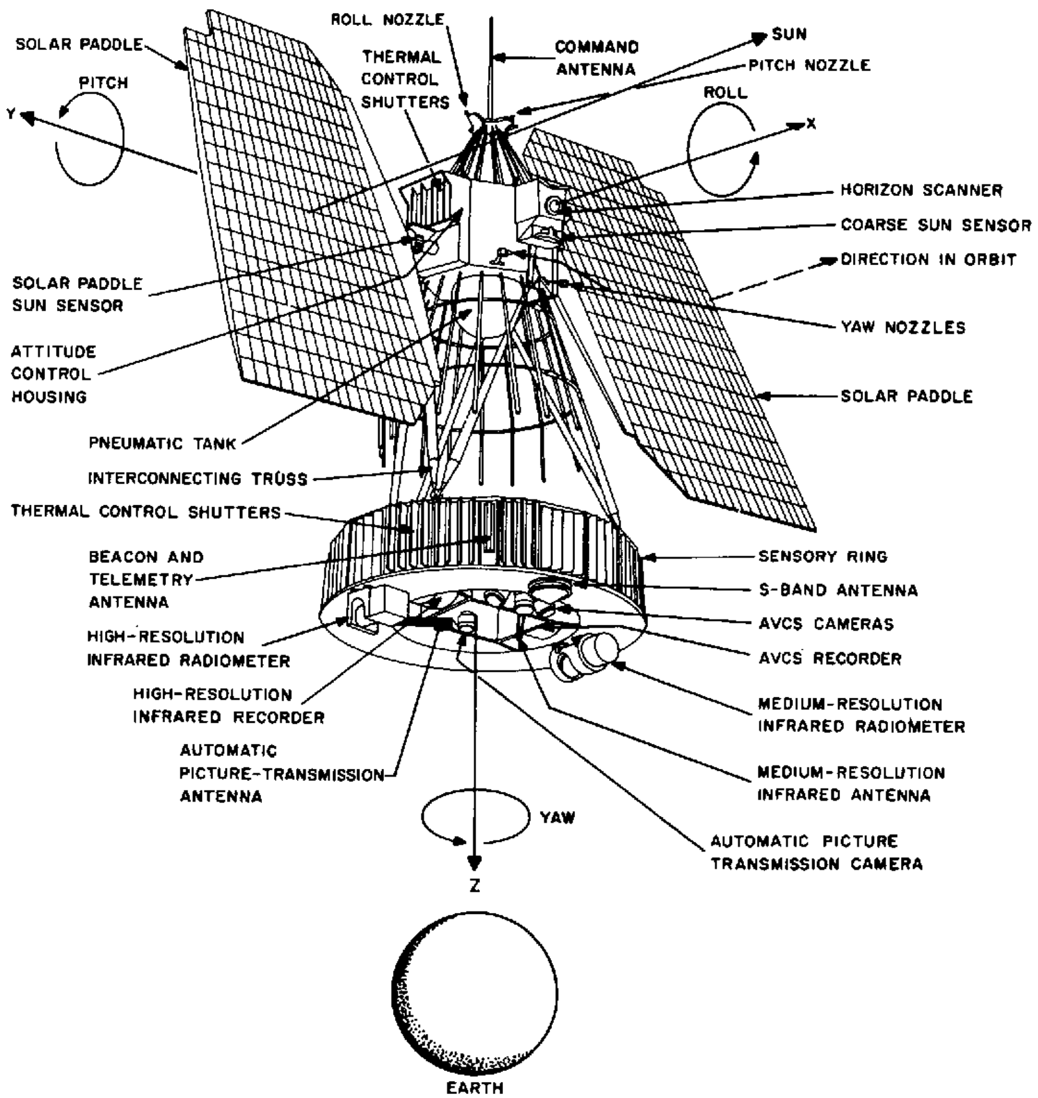


Figure 14. Nimbus 2 Satellite

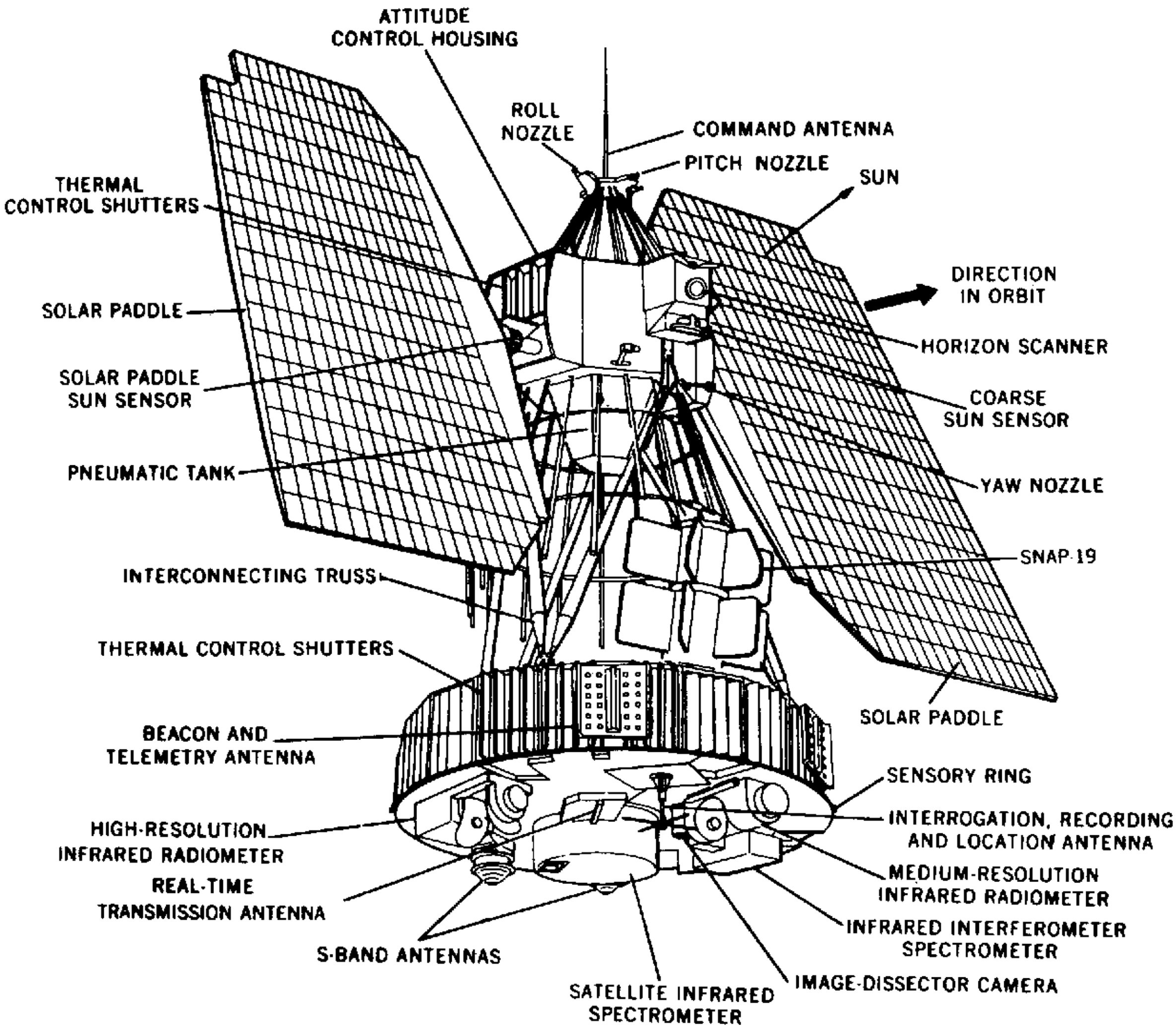


Figure 15. Nimbus 3 Satellite

experiments were flown on Nimbus 4 (Figure 16) with the following exception: the MRIR and the HRIR were replaced by a single two-channel temperature-humidity infrared radiometer (THIR). Two additional radiometric sensors were included: a filter wedge spectrometer (FWS) and selective chopper radiometer (SCR). These last two instruments were designed to indirectly determine the temperature and water vapor distribution in the upper atmosphere.

The most recent Nimbus to be launched was Nimbus 5 (Figure 17). Meteorological experiments on Nimbus 5 include a THIR, an SCR, and an infrared temperature profile radiometer (ITPR) that functions similarly to SIRS. The satellite was also fitted with two microwave sensors: an electrically scanning microwave radiometer (ESMR) and a Nimbus-E microwave spectrometer (NEMS) that provides global mapping of thermal radiation from the earth-atmosphere system and yields profiles of temperature and moisture even in the presence of various cloud conditions that presently hinder conventional infrared sensors.

Nimbus-F (Figure 18) is the final satellite of this series and will carry a complement of various infrared sensors: a pressure modulated radiometer (PMR), earth radiation budget (ERB), a high-resolution infrared radiation sounder (HRIRS), a limb radiance inversion radiometer (LRIR), and a THIR. These instruments will indirectly measure both the horizontal and vertical distribution of temperature and such atmospheric constituents as ozone and water vapor. Additional instrumentation consists of an ESMR and a scanning microwave spectrometer (SCAMS) (similar to NEMS), a tracking and data relay (T&DR) experiment to test the feasibility of a two-way real-time data relay system between Nimbus-F and ATS-F, and a tropical wind energy conversion and reference level experiment (TWERLE) to monitor and collect meteorological data from balloon-borne sensor packages.

The ITPR on Nimbus 5 and the HRIRS and TWERLE to be flown on Nimbus-F will provide the experience and knowledge necessary to develop advanced sensors and instrumentation needed for the Global Atmospheric Research Program (GARP) of the World Meteorological Organization (WMO), and the International Council of Scientific Unions (ICSU). This international global monitoring program will employ both polar-orbiting and geosynchronous weather satellites along with conventional air- and surface-based observational systems to obtain global weather data for use in short-range forecasting and for developing improved numerical models for more accurate long-range predictions.

Nimbus was the first satellite series capable of providing both daytime and nighttime global coverage of the earth's cloud cover on a daily basis. It was also the first U.S. satellite to routinely monitor the earth-atmosphere system using the microwave portion of the spectrum. However, the most outstanding accomplishment of the Nimbus

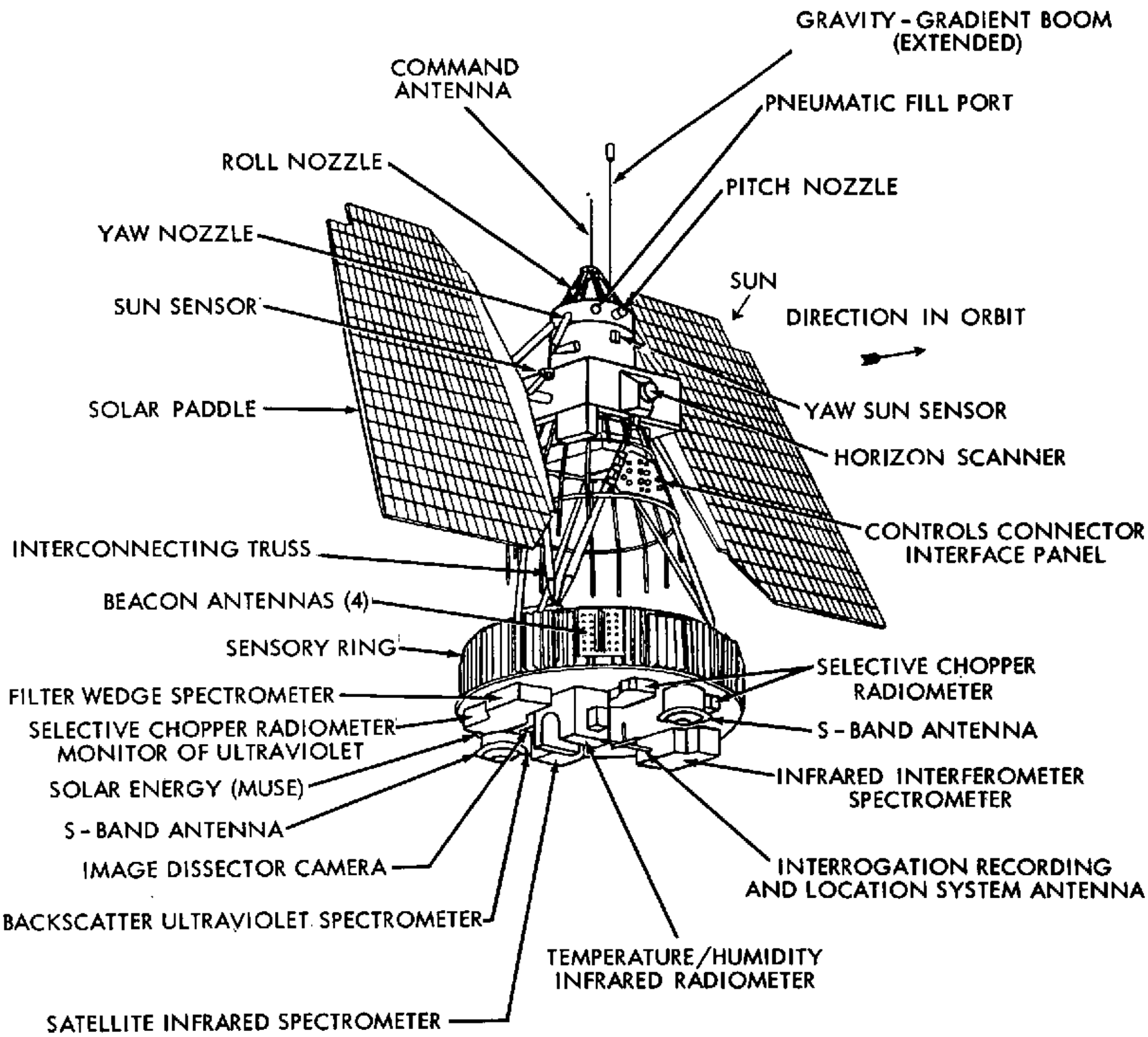


Figure 16. Nimbus 4 Satellite

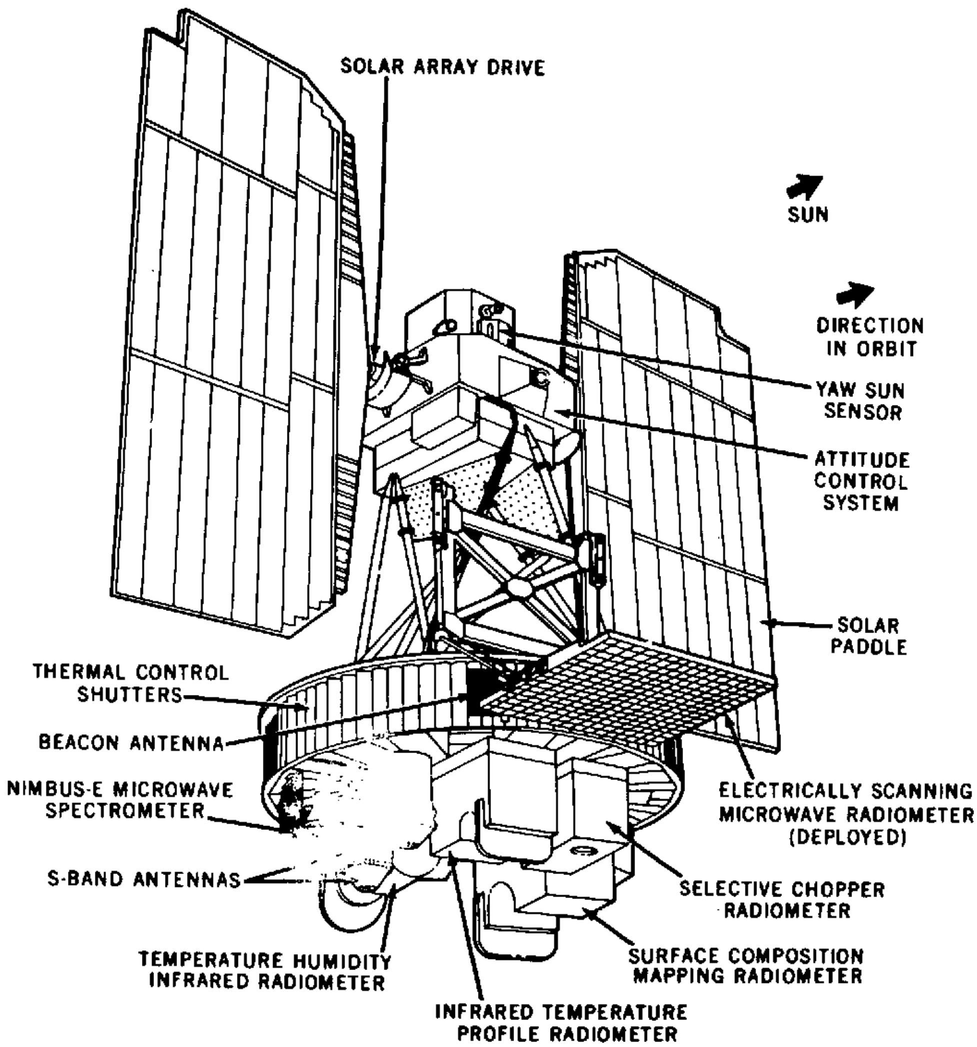


Figure 17. Nimbus 5 Satellite

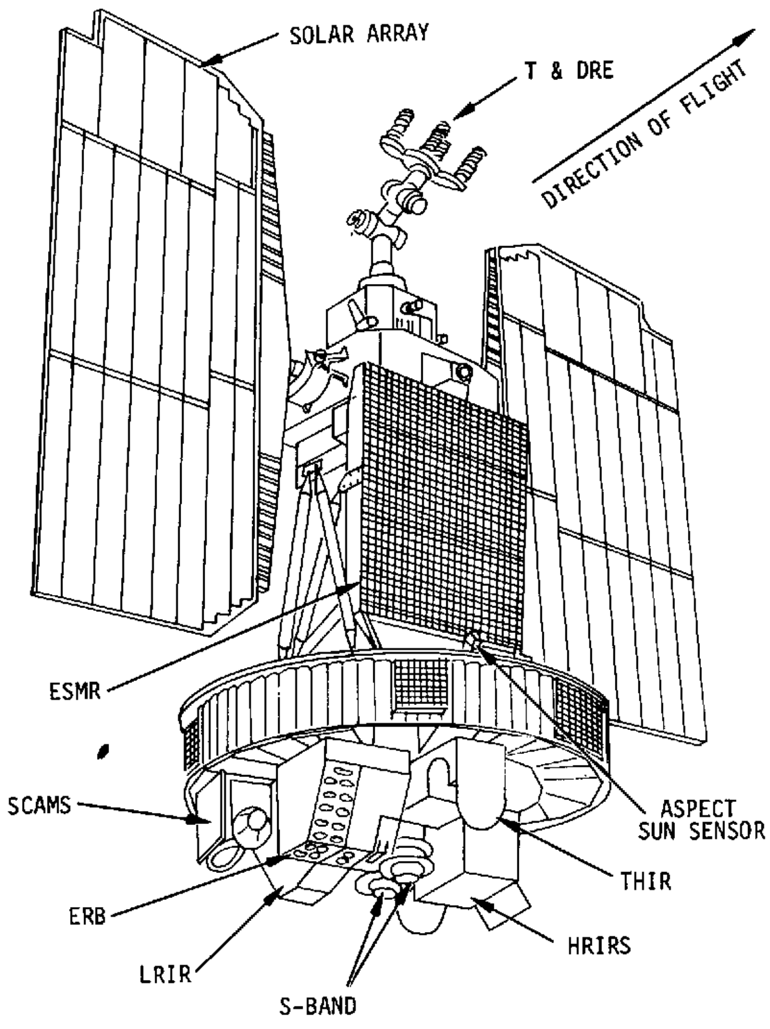


Figure 18. Nimbus-F Satellite

program to date has been the successful operation of SIRS. The instrument's capability to generate each day literally hundreds of vertical soundings of temperature and moisture from around the globe represents a major breakthrough toward overcoming the limitations to obtaining observational data that has historically hindered the progress of meteorology.

7. ERTS

The Earth Resources Technology Satellite (ERTS) (Figure 19) is a modified version of the Nimbus satellite. Although designed primarily to obtain information for earth resource studies, the spacecraft can also be used to conduct meteorological studies, i.e., monitoring environmental pollution, determining snow cover, and monitoring severe storms. Two spacecraft are presently planned for the series. The spacecraft will be instrumented with a multispectral scanner (MSS) and return beam vidicon (RBV) camera to provide high-resolution multispectral data on the earth's surface and a Data Collection System (DCS) to collect various data from ground-based platforms distributed over the globe. ERTS 1 was successfully launched from the WTR on July 23, 1972.

8. ITOS/NOAA

The Improved Tiros Operational Satellite (ITOS) (Figure 20) (designated NOAA 1, 2, etc., after being successfully launched) represents a new generation of operational meteorological satellites. As with the TOS system it replaces, the ITOS/NOAA series is comprised of satellites built and launched by NASA and operated and financed by NOAA.

The initial version, Tiros-M (ITOS 1 after launch), and the three spacecraft that followed, ITOS-A (NOAA 1 after launch), -B, and -C, were each fitted with dual APT and AVCS cameras, thereby eliminating the need for two spacecraft to operate simultaneously in orbit as in the case of the TOS system. Each spacecraft also carried scanning radiometers (SR's) and FPR systems, giving them both high- and low-resolution infrared imaging capability. The two-channel SR had both daytime and nighttime capability and could either read out data directly to a ground receiving station or store the information on magnetic tape for subsequent transmission, depending on whether the satellite was within or beyond communication range of the station.

Of the four spacecraft, only the first two in the series, ITOS 1 and NOAA 1, produced data. The third spacecraft, ITOS-B, failed during launch, and ITOS-C was placed in storage and was used as a backup satellite for ITOS-D. The ITOS represents a considerable improvement over the TOS system. The inclusion of an SR gives ITOS both daytime

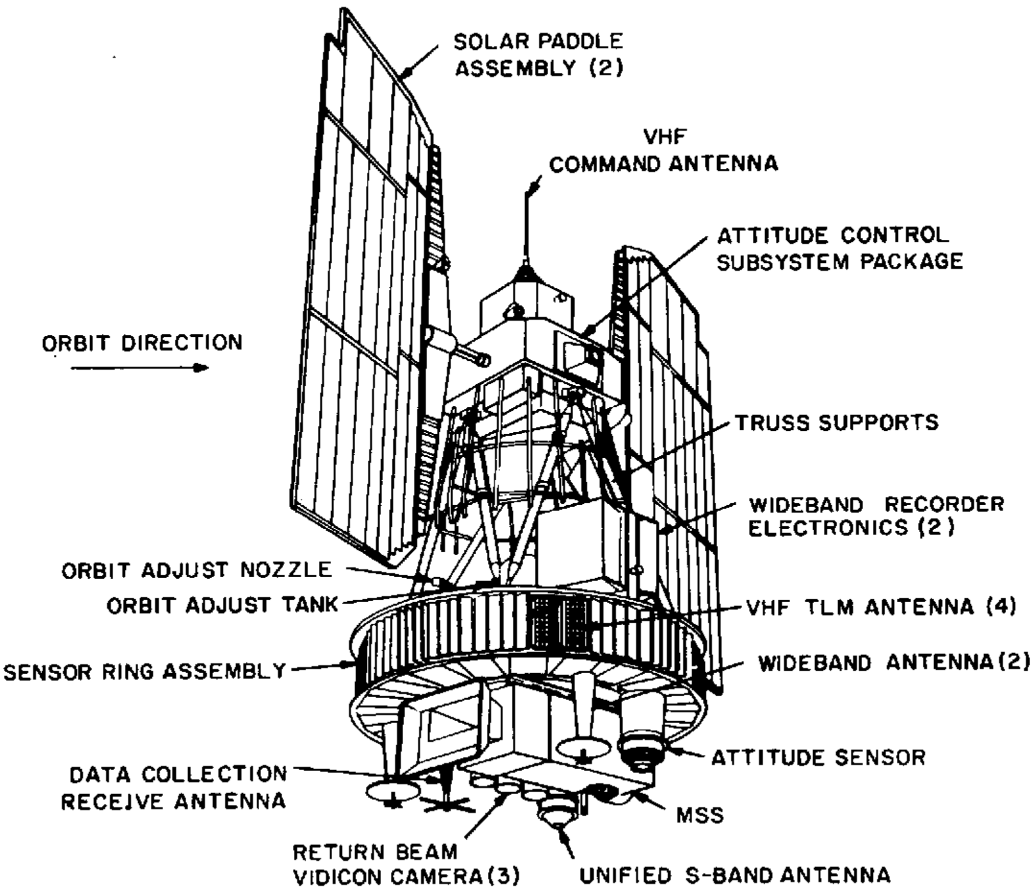
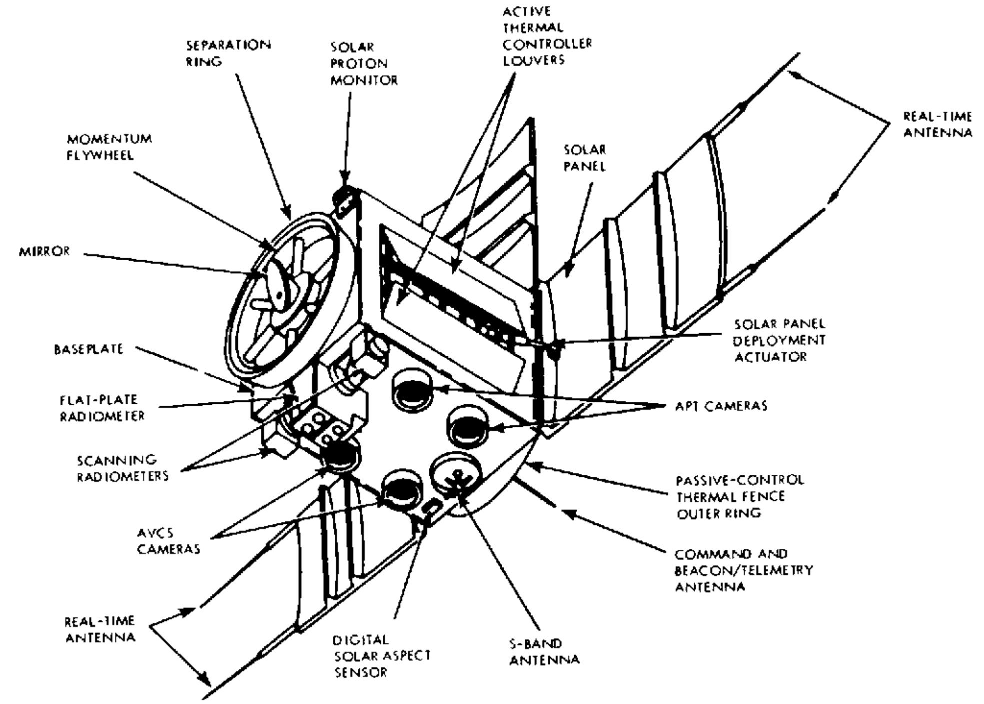
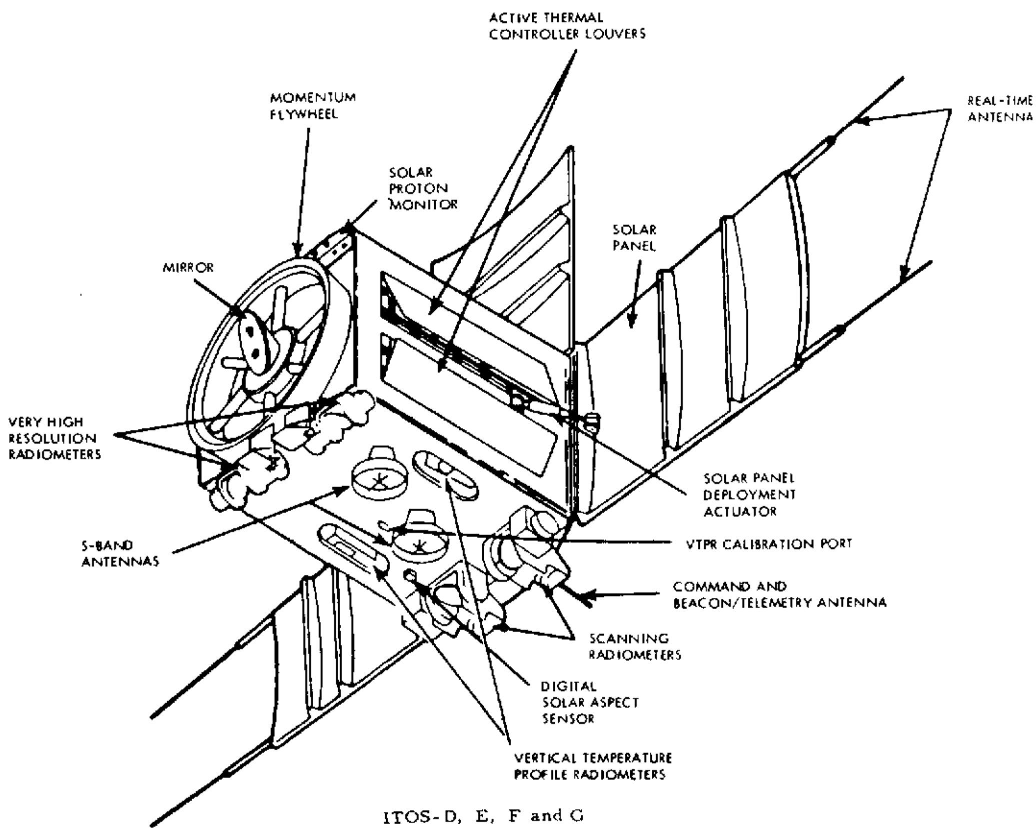


Figure 19. Basic ERTS 1 and ERTS-B Configuration



TIROS-M/ITOS-A, B and C



ITOS-D, E, F and G

Figure 20. Basic ITOS Satellite Configuration

and nighttime monitoring capabilities of the earth-atmosphere system. (TOS spacecraft are limited to observing only the sunlit portions of the globe. This additional capability doubles the amount of cloud-cover data available from each satellite.)

Four more spacecraft are included in the series: ITOS-D (now NOAA 2), launched in October 1972, and ITOS-E through -G. All the satellites carry a modified dual instrument payload that includes an SR, a very high resolution radiometer (VHRR), and a vertical temperature profile radiometer (VTPR). These improved spacecraft do not carry cameras but instead rely entirely on radiometers for earth-cloud imagery. The SR is identical to that flown previously. The two-channel VHRR operates similarly to the SR but with a much greater resolution. The VTPR is designed to take radiation measurements around the globe that permit the determination of vertical temperature profiles over selected points every 12 hours.

A second version of operational satellites is also under consideration for launch in the late 1970's: a prototype Tiros-N and three follow-on vehicles, ITOS-H, -I, and -J. Meteorological experiments planned for these spacecraft include an advanced very high resolution radiometer (AVHRR) for observing daytime and nighttime global cloud cover and a Tiros operational vertical sounder (TOVS) for obtaining atmospheric profiles of temperature, water vapor, and ozone. The spacecraft will also carry a Data Collection and Platform Location System Experiment. This experiment will locate and process various meteorological data received from free floating balloons and ocean buoys distributed around the globe and relay the data to central data acquisition stations. Tiros-N/ITOS-H, -I, -J, and their predecessors, ITOS-D through -G, are expected to constitute the U.S. contribution for near-polar orbiting, sun-synchronous satellites in GARP.

9. SMS/GOES

The Synchronous Meteorological Satellite (SMS) (Figure 21) is a NASA-developed, NOAA-operated spacecraft that will be positioned in a geosynchronous equatorial orbit. Currently, three spacecraft are planned for the series. The first two vehicles, designated SMS-A and -B by NASA, will serve as prototypes for the Geosynchronous Operational Environmental Satellite-A (GOES-A), also referred to as SMS-C, which will be used by NOAA in the national operational environment satellite system. The SMS/GOES series satellites are also expected to comprise the U.S. contribution to the geosynchronous spacecraft portion of GARP. The spin-stabilized spacecraft will be fitted with two meteorological experiments, a Meteorological Data Collection and Transmission System, and a visible/infrared spin-scan radiometer (VISSR). The VISSR will provide both visible and infrared observations of the earth-atmosphere system. The two-channel instrument will be able to take both full and

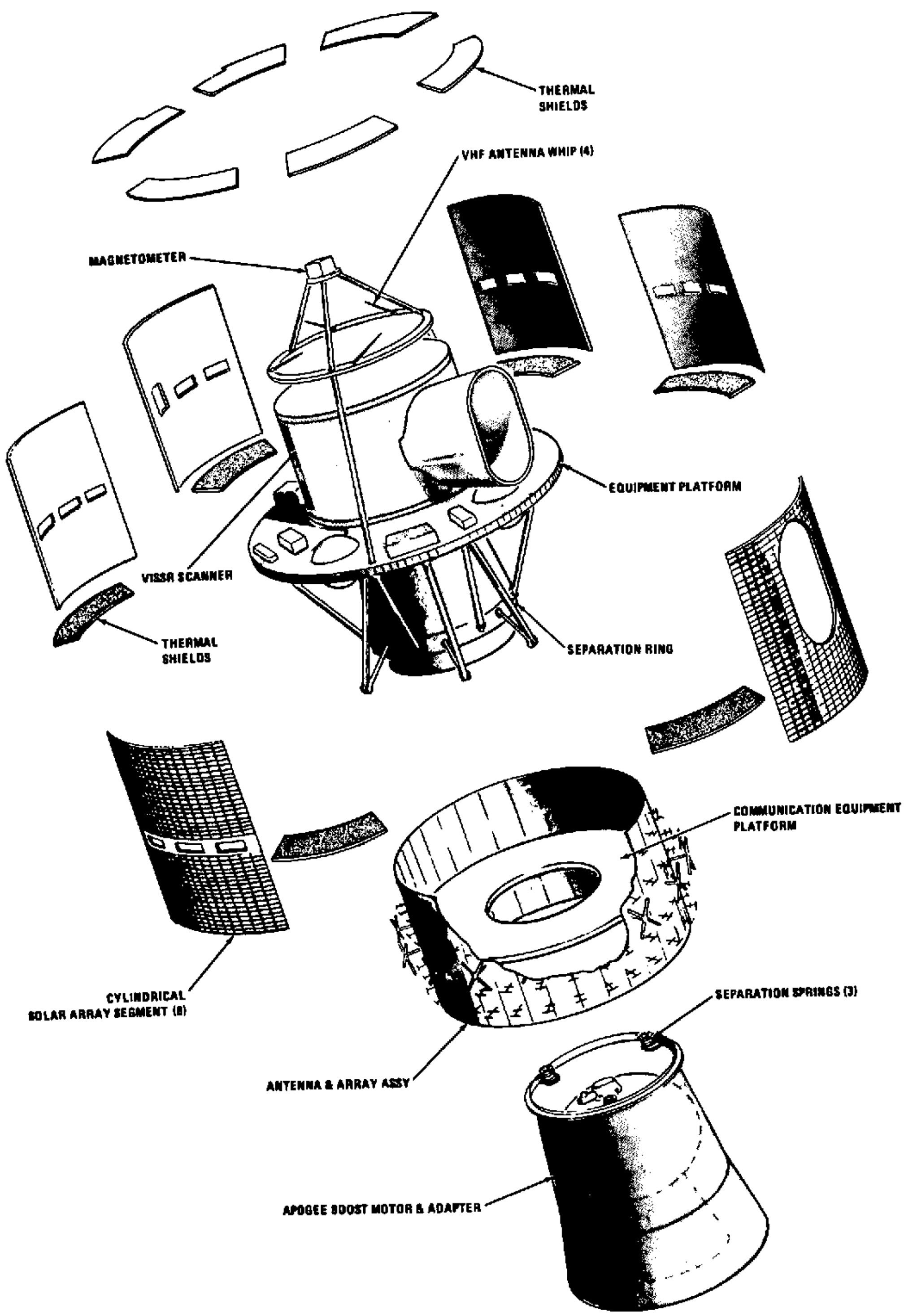


Figure 21. SMS/GOES Satellite

partial pictures of the earth's disk. The Meteorological Data Collection and Transmission System is an experimental communications and data handling system designed to receive and process meteorological and geophysical data collected from remote data collection platforms such as unattended ground stations and buoys.

The first satellite in the series is expected to be launched in October 1973.

C. The Programs of the Union of Soviet Socialist Republics

The Soviet meteorological satellite program, which began in 1963, had a late start compared to the U.S. effort. The early emphasis by the Soviets on manned flight and its biomedical aspects delayed a concerted effort in space research, including meteorological observations from satellites. This gap was narrowed on March 16, 1962, with the launch of Cosmos 1 and announcements by Premier Nikita Khrushchev at the Moscow Congressional Palace and by the Soviet Academy of Sciences of the initiation of a new, comprehensive program for space research by satellites -- the Cosmos program. The program was aimed at the investigation of basic problems in solar-terrestrial physics and geophysics and was to include the collection of general meteorological information.

An overview of data coverage from U.S.S.R. meteorological spacecraft is shown in Figure 22.

1. Cosmos

The first phase in the development of the Soviet meteorological satellite program consisted of the launches of two Cosmos spacecraft, Cosmos 14 and 23. Cosmos 14 was launched on April 13, 1963, from the Kapustin Yar launch site by a B-1 launch vehicle into an earth orbit with an apogee of 499 km and an inclination of 49°. The Cosmos 23 launch occurred 8 months later from Kapustin Yar with the spacecraft being placed in an orbit similar to that of Cosmos 14. These two spacecraft were essentially identical in design and mission. Most Cosmos satellites have the same basic configuration: a cylinder with hemispherical ends. The standardization of the spacecraft body allows a wide variety of missions to be flown on the same "bus" merely by changing the instrument package.

Cosmos 14 and 23 were orbited with the objectives of testing (1) orientation and stabilization systems, (2) the reliability of antenna design, (3) the solar batteries, (4) the efficiency of sun-earth reference sensors, (5) temperature monitoring and control equipment, (6) the operation of spacecraft servomechanisms, and (7) the effects of radiation on

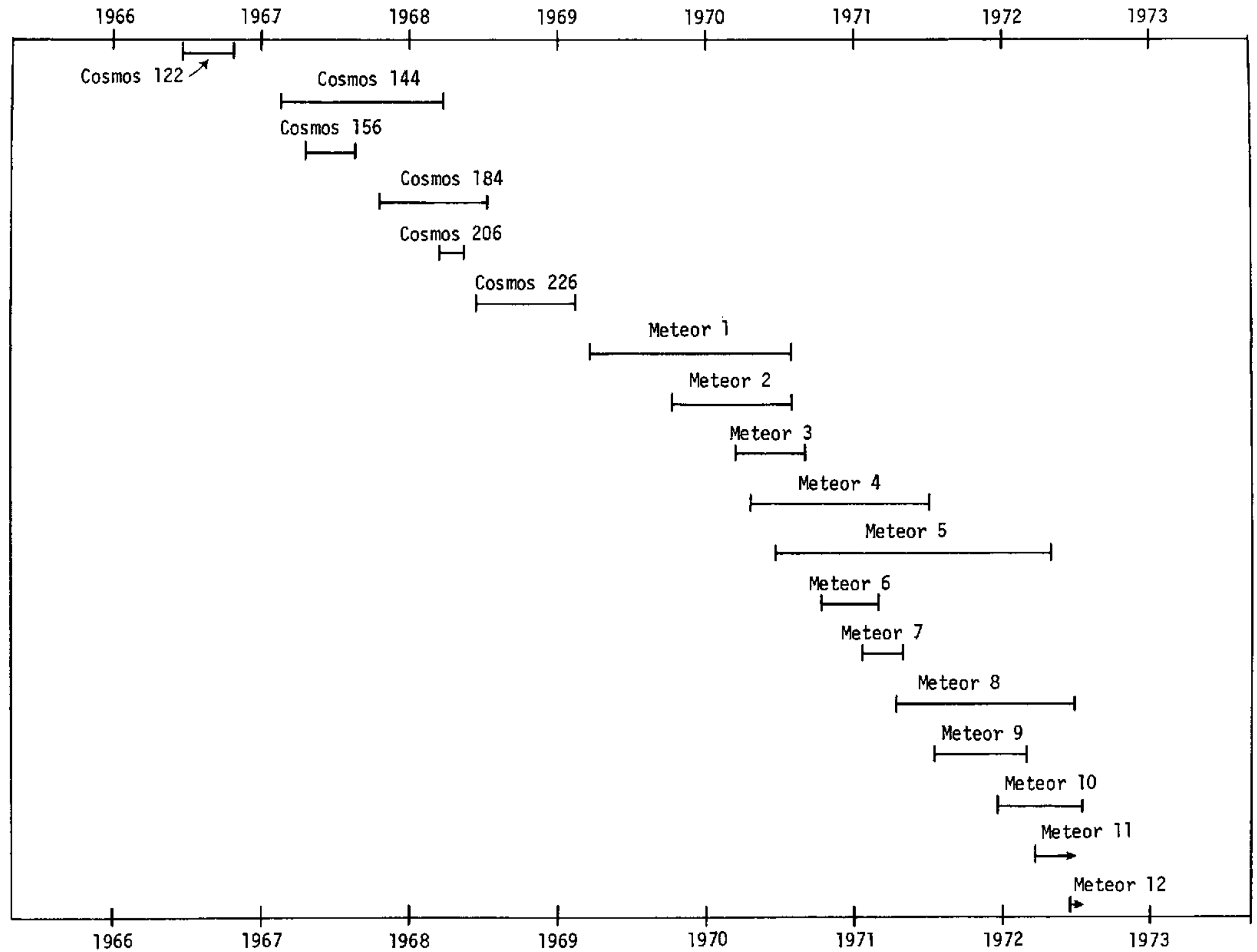


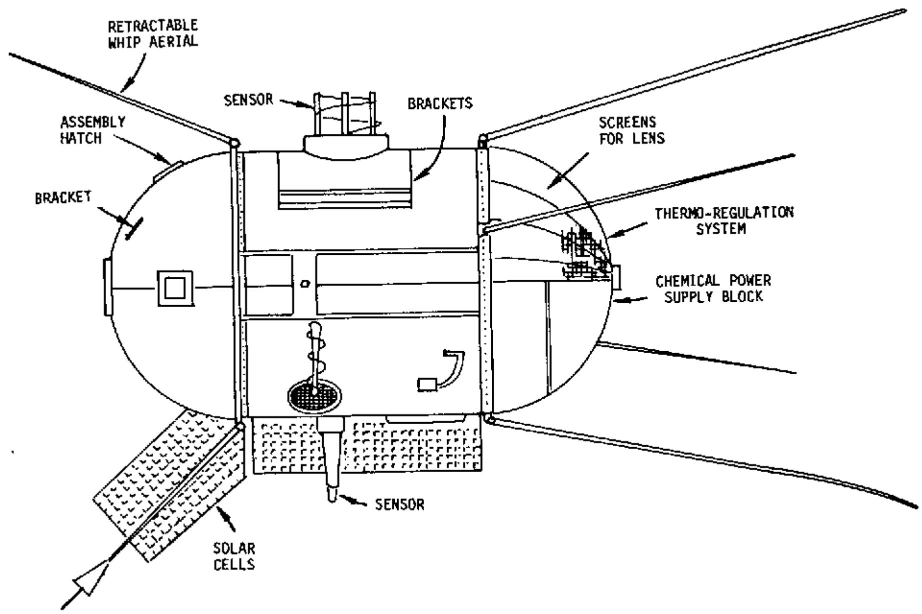
Figure 22. U.S.S.R. Meteorological Satellite Data Coverage as of July 1972

the various systems. The primary result of these flights was the successful validation of an electromechanical stabilization system, which has subsequently been used on the majority of Soviet meteorological satellites.

The second phase of development of the U.S.S.R. meteorological satellite program consisted of a series of five satellites, Cosmos 44, 58, 100, 118, and 122. All five spacecraft were launched from the Tyuratam site by A-1 launch vehicles into orbits with a 65° inclination and apogees ranging from 647 to 857 km. The launches were made over a 22-month period from August 28, 1964, to June 25, 1966. These satellites were precursors to the satellites in the experimental Cosmos Meteor system. The first four satellites of this phase carried prototype cloudcover cameras and radiometric sensors. In addition, a steerable antenna and two solar-array paddles were mounted on the sides of each satellite. No information has been released on the operation of these four Cosmos spacecraft.

The fifth satellite, Cosmos 122, was the first officially announced Soviet meteorological satellite. It was equipped with a dual vidicon camera system, an IR scanner, and an array of narrow-angle and wide-angle radiometers spanning the visible and IR bands. The purpose of the flight was to test the ability of the instrumentation to obtain daytime and nighttime images of cloud and snow cover and ice fields, as well as radiation budget measurements of the earth-atmosphere system. Among the first phenomena observed by Cosmos 122 were typhoons Alice, Cora, and Grace; it obtained images of these storms both on the dayside and nightside of the earth. The satellite operated for about 4 months and produced a large amount of useful data. These data were useful not only for scientific research but also for the day-to-day operation of the Soviet Hydrometeorological Service. Cosmos 122 was also the first Soviet weather satellite to transmit data via conventional communication circuits to the United States in accordance with a U.S.-U.S.S.R. bilateral agreement made in 1962.

Concurrent with these test flights were the launches of Cosmos 45, 65, and 92 (Figure 23), which were recoverable reconnaissance satellites also launched from Tyuratam but by the larger A-2 launch vehicle. They were placed into lower, more nearly circular orbits (apogee about 320 km) with inclinations of 65°. These spin-stabilized satellites were each equipped with a cloudcover photometer, a scanning IR radiometer, a UV spectrophotometer, and a night airglow colorimeter. These flights obtained much valuable information on the latitudinal and temporal variations of scattered, reflected, and emitted visible, UV, and IR radiation. The results of these studies were probably incorporated into the design of advanced meteorological satellite instruments. The satellites did not transmit their data but rather recorded them on a film loop in a miniaturized oscillograph that was carried on board and which was later recovered after reentry into the earth's atmosphere.



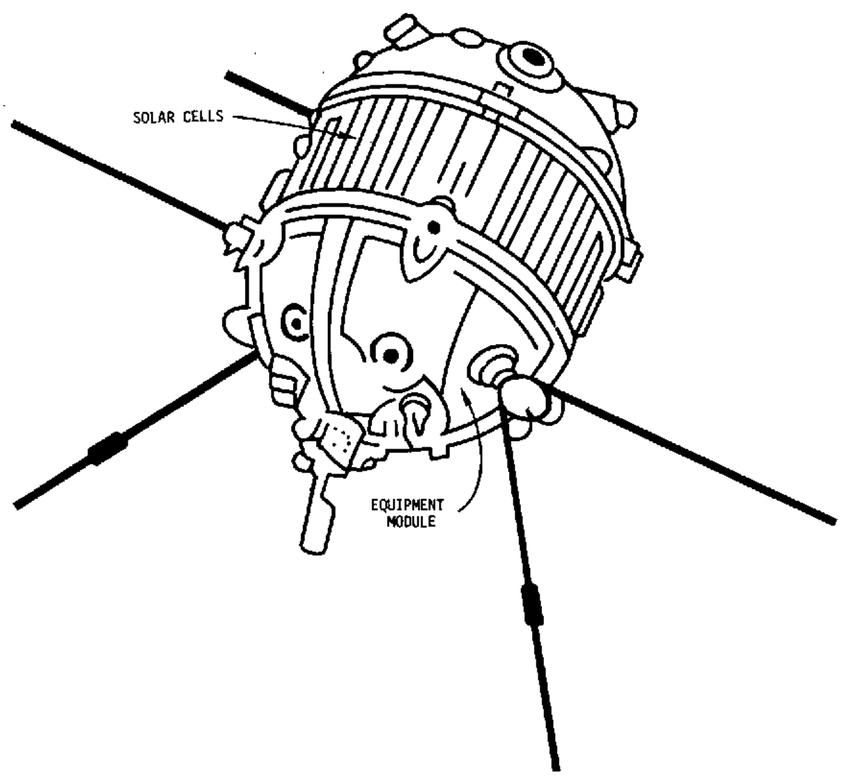


Figure 23. Possible Configurations of Recoverable Cosmos Satellites

A fourth recoverable reconnaissance satellite, Cosmos 121, was launched from the new, more northerly site, Plesetsk, on June 17, 1966, into a similar orbit. It was equipped with a cloudcover photometer similar to those carried on Cosmos 45, 65, and 92. Although it is likely that Cosmos 121 was equipped with other instruments similar to the IR and UV sensors carried on these spacecraft, no evidence is available to confirm this. The cloudcover experiment did, however, obtain information on the mesoscale variation of visible and near IR radiation scattered and reflected by the earth-atmosphere system.

The third phase of the Soviet meteorological satellite development program was initiated on February 28, 1967, with the launch of Cosmos 144, the second announced Soviet meteorological satellite. The successful tests of instruments and spacecraft systems by Cosmos 122 paved the way for the launch of Cosmos 144, which was a semi-operational meteorological satellite. The spacecraft was identical in configuration and payload to Cosmos 122, except that it had larger solar paddles and was equipped with a magnetometer. It was launched from Plesetsk into a near-polar (inclination of 81°), near-circular prograde orbit with an apogee of about 640 km. Greater orbital inclination (previous Cosmos weather satellites had a maximum inclination of 65°) allowed Cosmos 144 to obtain cloudcover images for 8 percent and radiation data from 20 percent of the earth's surface during a single orbit.

Cosmos 144 was joined in orbit by an identical satellite, Cosmos 156, on April 27, 1967. Together they comprised a major part of what was designated as the experimental Cosmos Meteor system. The system included the two Cosmos meteorological satellites, ground data acquisition stations, facilities for the control of the satellites and their onboard systems, and facilities for the processing and dissemination of meteorological information. The Cosmos Meteor system was intended for the regular collection of meteorological information for the operations of the Soviet Hydrometeorological Service and the scientific research groups associated with the Soviet Academy of Sciences, which had operational control of the meteorological satellite program.

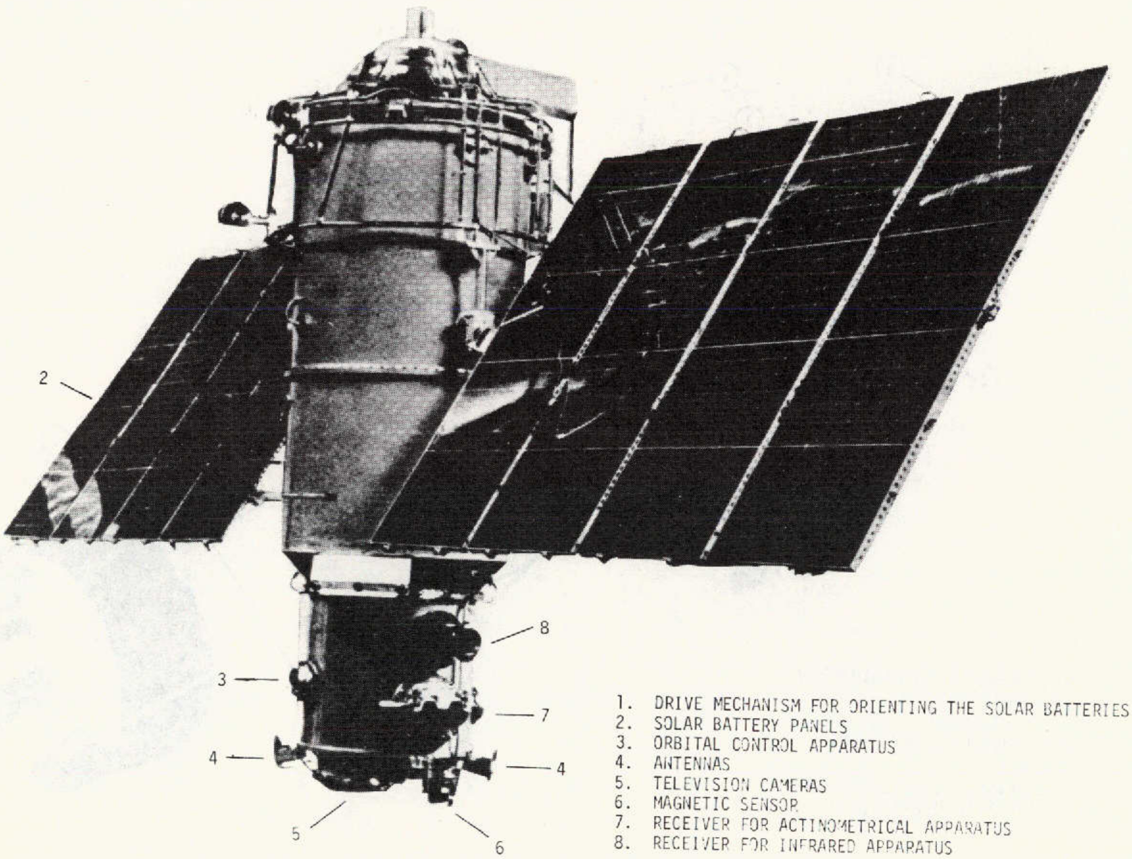
The orbits of Cosmos 144 and 156 were arranged in such a way that meteorological data were received from half the earth's surface in a 24-hour period. The requirement for two satellites operating in concert was caused by the relatively low orbits (apogee 600 to 700 km) that precluded continuous global coverage from one satellite such as that obtained by the higher orbiting ESSA satellites. Thus, by increasing the number of satellites and piecing together 10 or more smaller scale daytime photographs to form a large-scale cloud mosaic, the Cosmos Meteor system could approximate the same coverage as the TOS/ESSA weather satellite system.

Cosmos 184 was launched on October 24, 1967, as the third member of the Cosmos Meteor system. It was launched as a replacement for Cosmos 156, which apparently was experiencing some technical problems. Similarly, Cosmos 206 was launched on March 14, 1968, and replaced Cosmos 144 in the early part of 1968. Cosmos 206, however, appeared to have a short operational life and was replaced in mid-June 1968 by Cosmos 226.

All the Cosmos Meteor system satellites (Figure 24) had similar orbital parameters and identical equipment. Each satellite carried two vidicon cameras with slightly overlapping fields, one scanning IR camera, and actinometric instruments. These allowed each satellite to gather and record (or transmit directly if within range of a ground acquisition station) images in both the visible and IR portions of the spectrum and multiband radiation measurements (actinometry). All instruments were synchronized in order to provide a synoptic picture of the spatial distribution of clouds and radiation conditions in the earth-atmosphere system. The satellites were complex in design and operation and resembled the Nimbus satellites in concept more than the Tiros or ESSA satellites.

As the Cosmos Meteor system went into operation, parallel meteorological studies were being undertaken on six other Cosmos flights. Cosmos 149 and Cosmos 320 (Figure 25) were launched from Kapustin Yar on March 21, 1967, and January 16, 1970, respectively. These two spacecraft were orbiting optical stations that employed a unique aerodynamic stabilization system. Each was equipped with two multichannel scanning telephotometers, a narrow-angle IR radiometer, two wide-angle radiometers, and a cloudcover TV camera. Their main purpose was to obtain synchronized observations on the visible and IR radiation fields, cloudtop and surface temperatures, and cloud cover.

Cosmos 243 and Cosmos 384 were launched from Plesetsk on September 23, 1968, and December 10, 1970, respectively. They were similar to Cosmos 45, 65, and 92 in that they were part of the recoverable reconnaissance payload series, and they also carried a supplemental scientific payload. Meteorological sensors included a narrow-angle IR radiometer and a four-channel microwave radiometer to obtain synchronized measurements of the IR and radio thermal emissions from the earth, the clouds, and areas of precipitation. Cosmos 243 and 384 were the first two satellites to carry a microwave radiometer. Data on the water vapor content, cloud liquid water content, sea surface state, ice boundaries, and ocean surface temperatures were obtained from these experiments.



(Novosti from Sovfoto)

Figure 24. Cosmos 144 - Typical Cosmos Meteor System Satellite

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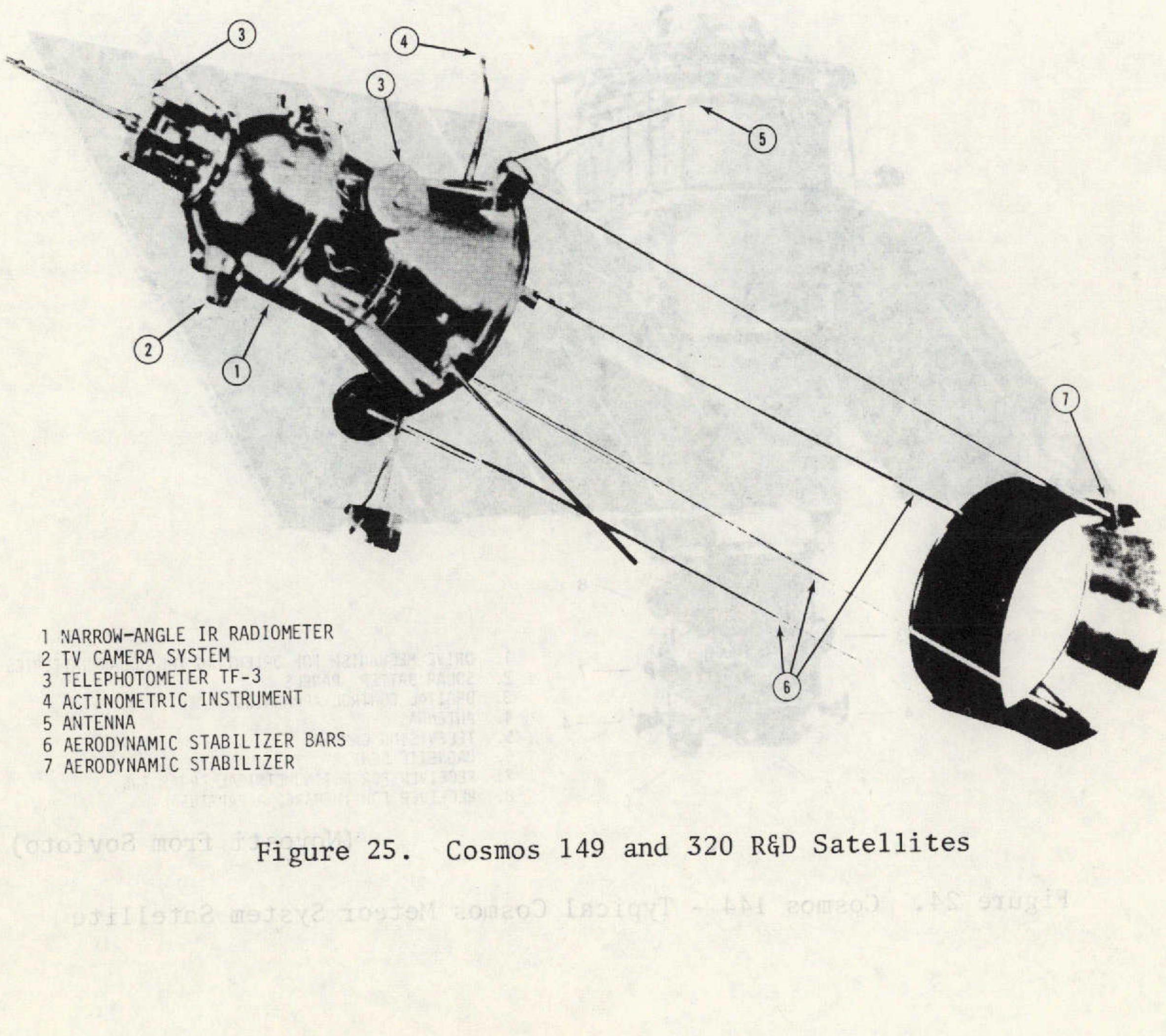


Figure 25. Cosmos 149 and 320 R&D Satellites

Cosmos 232 and 258 were similar in both configuration and orbital parameters to Cosmos 45, 65, and 92. Cosmos 232 was launched from the Plesetsk site on July 16, 1968, while Cosmos 258 was launched from the Tyuratam site on December 10, 1968. They both were members of the recoverable reconnaissance payload series that carried supplemental scientific instrument packages. Their payloads probably consisted of IR, UV, and visible sensors similar to those carried on Cosmos 45, 65, and 92.

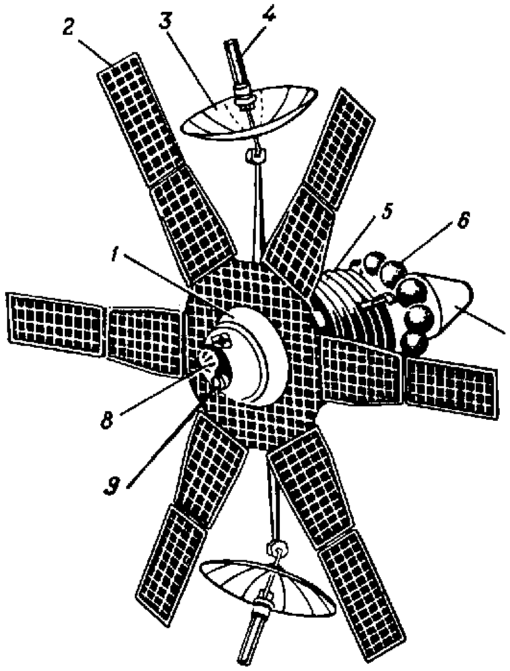
2. Molniya 1

The Molniya 1 series (Figure 26) was a first generation communications satellite series that was designed primarily to test and perfect a radio, telephone, and television communication relay system using earth satellites as active transponders and to test the system in operational use. The satellites were all launched from Tyuratam by A-2-E launch vehicles into highly elliptical orbits with apogees near 40,000 km and having 12-hour periods. Beginning in 1966, TV cameras were included on several of the Molniya 1 satellites in order to supplement the more detailed but smaller scale pictures obtained by the lower orbiting experimental Cosmos Meteor system satellites. These cameras were equipped with interchangeable lenses and various light filters. They were carried on the third through the tenth satellites of this series.

Taken at satellite apogee, the pictures provided nearly full earth disk coverage and gave Soviet meteorologists the opportunity to study large-scale cloud patterns over the Northern Hemisphere from a single photograph. With the initiation of the operational Meteor system satellites with their global cloudcover monitoring capabilities, the TV camera system was not included on later launches in the Molniya 1 series.

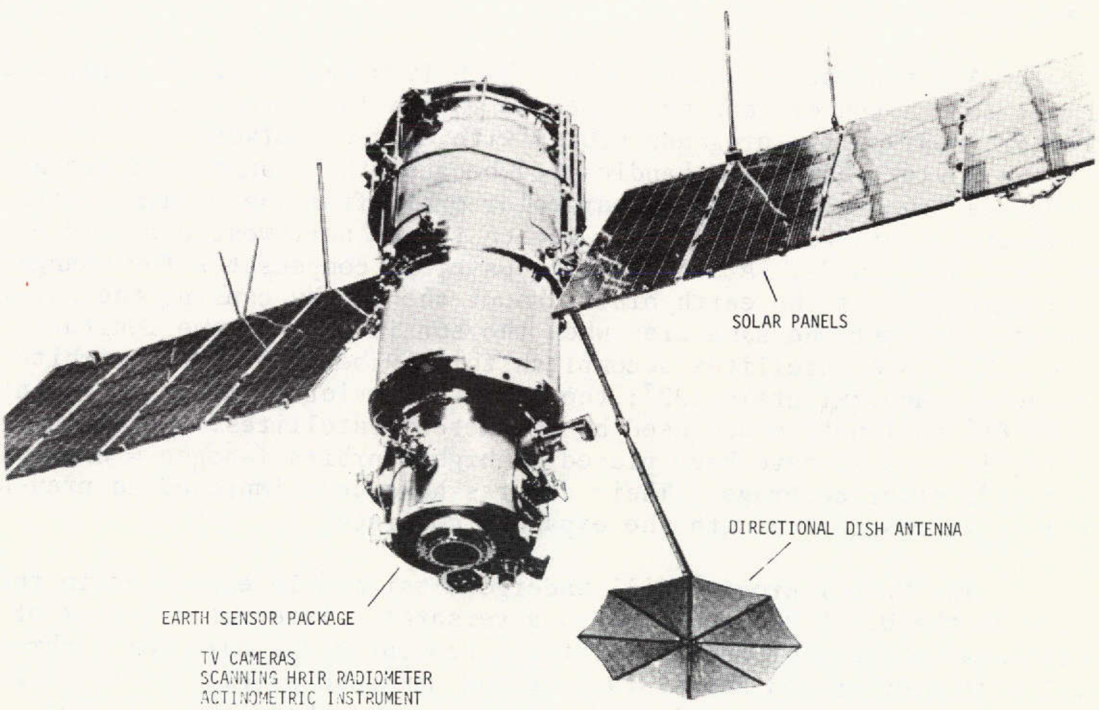
3. Meteor

The fourth phase of the Soviet meteorological satellite development program began in March 1969 and is comprised, to date, of 13 launches of fully operational meteorological satellites called Meteor (Figure 27). These satellites are under operational control of the Soviet Hydrometeorological Service. They are quite similar to the Cosmos Meteor system spacecraft both in configuration and instrumentation and provide day and night imaging and radiation sensing capabilities. Meteor 1 through Meteor 7 were each equipped with a dual vidicon camera system, HRIR scanner, and actinometric equipment, which were developed and tested on the Cosmos flights. Meteor 8 through Meteor 13 had an additional instrument: an atmospheric sounder for obtaining atmospheric temperature and water vapor profiles. All observations of the Meteor



1 INSTRUMENTATION CAPSULE
2 SOLAR CELL PANELS
3 HIGH-DIRECTIONAL ANTENNA
4 EARTH SENSOR
5 RADIATOR COOLER
6 FUEL CELLS & SMALL JET THRUSTERS
7 THRUSTER ASSEMBLY
8 SUN SENSOR
9 TV CAMERA

Figure 26. Molniya 1 Communications Satellite



(Novosti from Sovfoto)

Figure 27. Meteor 2 - Typical Meteor Satellite

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satellites are synchronized to provide a complete synoptic view of the earth-atmosphere system, and the acquired data can be either transmitted directly to one of the three ground acquisition stations (Moscow, Vladivostok, or Novosibirsk) if within communication range or recorded for later transmission if beyond communication range.

Meteor 10 through 13, in addition to the above experiments, were equipped with an APT camera system. The system is controlled by ground command and is operated only when the satellite is within communication range of APT receiving stations within the Soviet Union. Infrared imagery can also be transmitted in real time by using the APT capabilities.

All the Meteor launches have been from the Plesetsk site, and the A-1 launch vehicle has been used to launch the Meteors into near-circular, near-polar, prograde orbits with apogees between 630 and 710 km. The Soviets have been handicapped because they cannot achieve a retrograde (sun-synchronous), near-polar orbit from their launch site at Plesetsk; this would require a launch to the northwest directly over Greenland and Canada. A sun-synchronous orbit compensates for changes in illumination as the earth orbits about the sun by causing the satellite to pass over the same area when the sun is at the same zenith angle. The ESSA satellites accomplish this by being placed in orbits inclined at approximately 102°; the best the Soviets can do at present is the 81° inclination now used by the Meteor satellites. Meteor 5, 10, 11, 12, and 13 have been placed in higher orbits (apogee = 890 km) to provide wider coverage. Their cameras have been improved to prevent any loss in resolution with the expanded coverage.

The Meteor program will undergo considerable expansion in the future as the U.S.S.R. moves toward a versatile, integrated system of operational meteorological satellites. Present plans call for a three-level system of manned space stations and unmanned satellites to obtain observations of various scales of meteorological phenomena. In geosynchronous orbits at altitudes of approximately 36,000 km, will be satellites designed to carry out near-continuous observations of the atmosphere on a global scale. Situated well below these geosynchronous satellites at heights of 1000 to 1500 km will be the second level of meteorological satellites. These spacecraft, which will probably be very similar to the present Meteor satellites, will be placed in polar or near-polar orbits to observe medium-scale and small-scale processes in the atmosphere and to obtain numerical meteorological data required for weather forecasting on a global and a local scale. The third level of satellites will be the lowest level and will consist of long-term manned space stations. The cosmonauts on board these stations will make visual observations of the geosphere and meteorological phenomena. Observations will also be made of tides, landslides and avalanches, dust and sand storms, tsunamis, hurricanes, and earthquakes.

Future research in expanding the capabilities of remote atmospheric sensors will involve both individual satellites of the Meteor system and special experimental research satellites of the Cosmos series. These improved sensors will then be installed on the satellites comprising the three-tiered system described above.

D. The Program of France

The French meteorological satellite program was initiated on December 12, 1970, with the launch of PEOLE 1 (Figure 28). PEOLE 1 was launched into a near-equatorial orbit by the Centre National d'Etudes Spatiales (CNES) from the Centre Spatial Guyanais, Kourou, French Guiana. PEOLE 1 was an experimental spacecraft designed to determine the feasibility of acquiring and relaying telemetered data on altitude, pressure, temperature, moisture, and winds from instrumented earth-circling, constant level balloons.

The second French meteorological satellite, EOLE, was launched from Wallops Island, Virginia, by NASA in the late summer of 1971 under a NASA/CNES cooperative agreement. EOLE, a gravity-gradient spacecraft, is an operational version of the earlier PEOLE spacecraft. An additional mission objective is to prove the feasibility of using Doppler techniques during interrogation to determine both the range and range rate of each balloon and hence the upper level wind velocity. Over 500 balloons were launched from three sites in Argentina during 1.5 years of this GARP-oriented experiment.

E. The Program of the United Kingdom

The United Kingdom's meteorological satellite program is still in the developmental stage. Work is progressing on the development of a satellite that can participate in the World Weather Watch (WWW). The first U.K. meteorological satellite, X-4 (Figure 29), is scheduled to be launched by NASA in 1974 on a Scout Rocket from the United States Western Test Range. The spacecraft will be placed in a low-altitude (500 km), circular, sun-synchronous orbit. While this experimental satellite is intended primarily to test a triaxial attitude control system, it will also carry two meteorological experiments: a low-resolution earth albedo sensor and a high-resolution infrared sensor similar to the selective chopper radiometer used in the Nimbus program.

F. The Program of the European Space Research Organization

The European Space Research Organization (ESRO), a consortium of Western European countries, is developing meteorological spacecraft in order to participate in the GARP WWW observing network. Present plans call for ESRO to orbit one geosynchronous satellite in the mid- or late 1970's. This satellite will be quite similar in design and capability

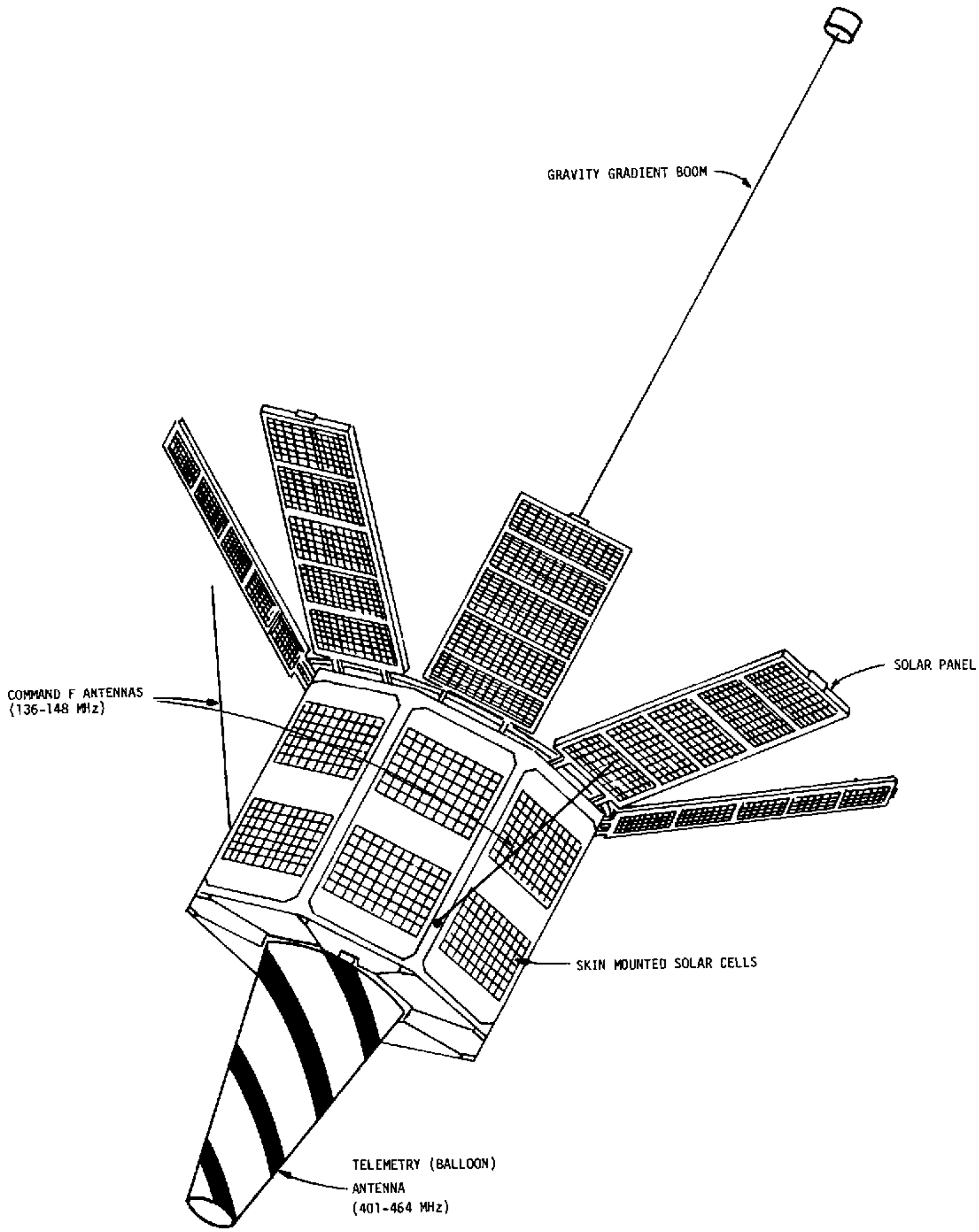


Figure 28. Basic EOLE and PEOLE Satellite Configuration

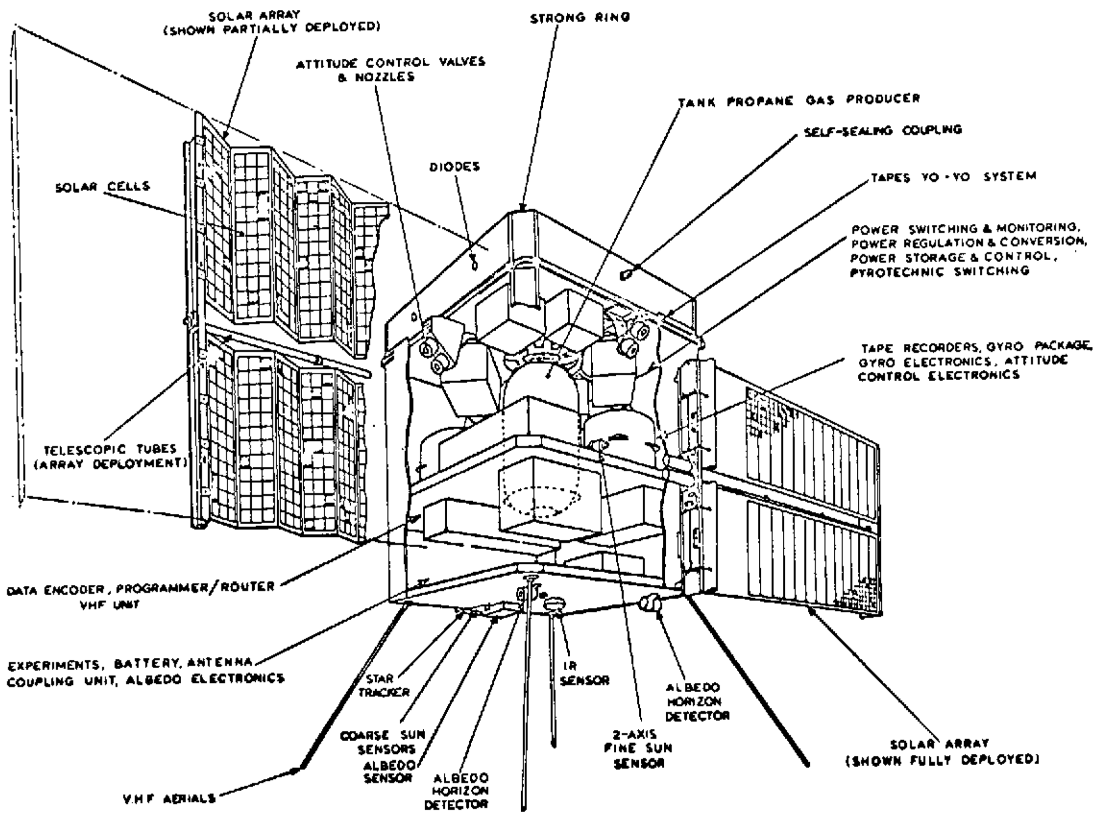


Figure 29. Exposed View of the British X-4 Experimental Meteorological Satellite

to the U.S. SMS/GOES satellite and will complete a five-satellite system of geostationary observation platforms (two U.S. SMS/GOES, one ESRO, one Japanese, and one Soviet) providing complete 24-hour global coverage. This system will be an integral part of the GARP observing network, particularly in the tropics.

The European satellite was originally a French project called Météosat. The 260-kg satellite, which was being developed by CNES, was to have been placed at about 10°E longitude in a 36,000-km geostationary orbit in 1975 by a NASA Thor-Delta launch vehicle. The instrumentation would have included IR (10.5 to 12.5 microns) and visible (0.5 to 0.7 micron) sensors to provide simultaneous images of the earth's disk with resolutions at nadir of 6 and 3 km, respectively, and an IRLS capability similar to that on Nimbus 3 and 4 and EOLE.

From its position in space, Météosat would have provided complete coverage of the continent of Africa, the southern part of continental Europe up to 50° to 60°N latitude, and the adjacent oceans. The project, however, encountered funding problems and was taken over by ESRO, which renamed it the Geostationary European Meteorological Satellite (GEMS). Details on the design of GEMS are not available at this time because formal funding by ESRO has not been made as yet; however, it is quite probable that the design will be similar to Météosat with the addition of a sounder to provide vertical temperature profiles.

G. The Program of Japan

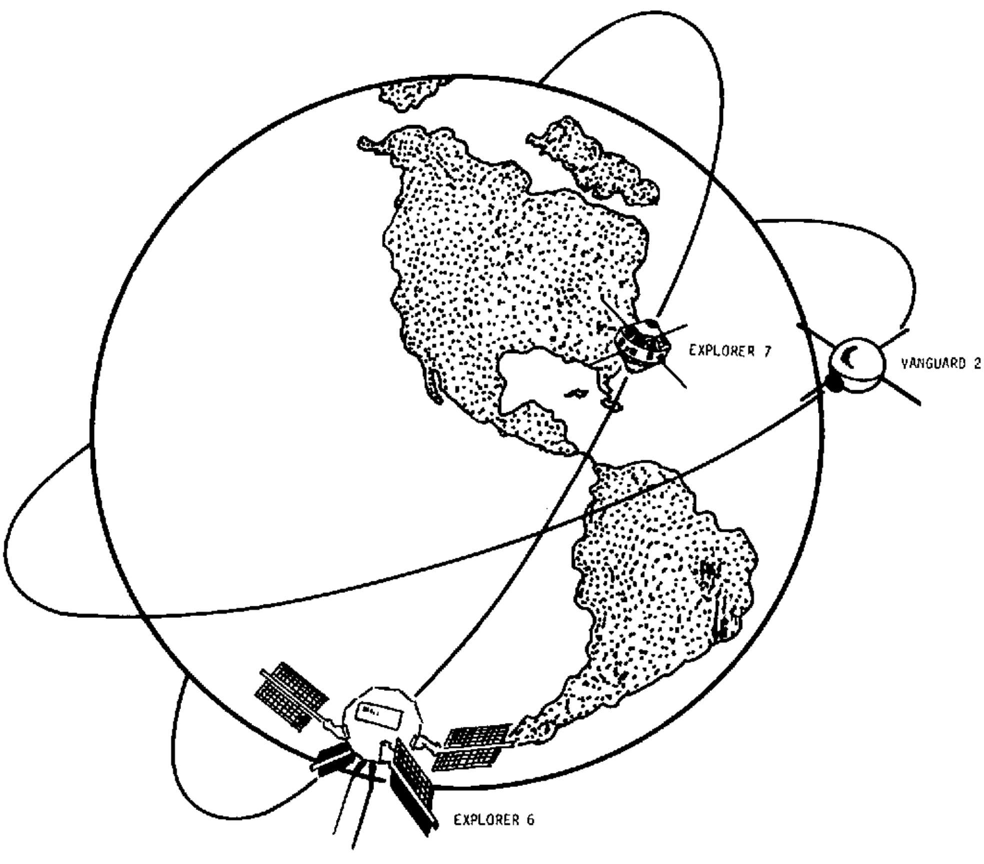
Japan is in the process of developing a geosynchronous satellite for participation in GARP. The spacecraft will be positioned over the Pacific Ocean and will provide near-continuous coverage of cloudcover conditions over East Asia and the Western Pacific.

The project has not yet been formally funded, and complete information on the satellite's name and design is not available.

III. BRIEF DESCRIPTIONS OF THE SATELLITES AND INSTRUMENTATION

Parts A, B, C, and D of this section are contained on the following pages. Machine-generated brief descriptions of the meteorological spacecraft and instrumentation developed in the United States comprise part A, which begins with Early Meteorological Satellites. Part B begins with the Cosmos Series and contains brief descriptions of the Soviet satellites and instrumentation. The descriptions in Part C refer to the French program, and the descriptions in Part D refer to the program of the United Kingdom. Reference numbers found after each description pertain to Section IV, the bibliography.

The Programs of the United States



EARLY METEOROLOGICAL SATELLITES

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A. THE PROGRAMS OF THE UNITED STATES

1. Early Meteorological Satellites

SPACECRAFT COMMON NAME- VANGUARD 2 NSSDC ID 59-001A
ALTERNATE NAMES- 1959 ALPHA 1

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 02/17/59
APOGEE- 3320.00 KM ALT
PERIGEE- 559.000 KM ALT
PERIOD- 125.6 MIN
INCLINATION- 32.88 DEG

OTHER INFORMATION
SPACECRAFT WT- 9.8 KG
LAUNCH DATE- 02/17/59
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 030859

SPACECRAFT PERSONNEL

PM - J.P.	HAGAN	NRL	WASHINGTON, D.C.
PS -	UNKNOWN	NRL	WASHINGTON, D.C.

SPACECRAFT BRIEF DESCRIPTION

VANGUARD 2 WAS AN EARTH-ORBITING SATELLITE DESIGNED TO MEASURE CLOUD-COVER DISTRIBUTION OVER THE DAYLIGHT PORTION OF ITS ORBIT. THE SPACECRAFT WAS A 9.8 KG MAGNESIUM SPHERE 50.8 CM IN DIAMETER. IT HAD AN ESTIMATED ORBIT LIFETIME OF 100 TO 250 YEARS. IT CONTAINED TWO OPTICAL TELESCOPES WITH TWO PHOTOCELLS. THE SPHERE WAS INTERNALLY GOLD-PLATED AND EXTERNALLY COVERED WITH AN ALUMINUM DEPOSIT COATED WITH SILICON OXIDE OF SUFFICIENT THICKNESS TO PROVIDE THERMAL CONTROL FOR THE INSTRUMENTATION. RADIO COMMUNICATION WAS PROVIDED BY A 1-W, 108.03-MHZ TELEMETRY TRANSMITTER AND A 10-MW, 108-MHZ BEACON TRANSMITTER THAT SENT A CONTINUOUS SIGNAL FOR TRACKING PURPOSES. A COMMAND RECEIVER WAS USED TO ACTIVATE A TAPE RECORDER THAT RELAYED TELESCOPE EXPERIMENT DATA OVER THE TELEMETRY TRANSMITTER. BOTH TRANSMITTERS FUNCTIONED NORMALLY FOR 19 DAYS. THE SATELLITE WAS SPIN STABILIZED AT 50 RPM, BUT TELEMETRY DATA WERE POOR BECAUSE OF AN UNSATISFACTORY SPIN AXIS. THE POWER SUPPLY FOR INSTRUMENTATION WAS PROVIDED BY MERCURY BATTERIES.

REFERENCES

241, 275, 466, 497, 572, 573, 574, AND 808.

EXPERIMENT NAME- OPTICAL SCANNER NSSDC ID 59-001A-01

EXPERIMENT PERSONNEL

PI - W.G.	STROUD	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 030859

EXPERIMENT BRIEF DESCRIPTION

TWO PHOTOCELLS, ONE AT THE FOCUS OF EACH OF TWO OPTICAL TELESCOPES, WERE USED AS PART OF A CLOUDCOVER EXPERIMENT. THE TELESCOPES WERE AIMED IN DIAMETRICALLY OPPOSITE DIRECTIONS AT AN ANGLE OF 45 DEG FROM THE SPIN AXIS OF THE SATELLITE. THE EXPERIMENT WAS DESIGNED TO OBTAIN CLOUDCOVER DATA BETWEEN THE EQUATOR AND 35 TO 45 DEG N LATITUDE. AS THE SATELLITE CIRCLED THE EARTH, THE PHOTOCELLS MEASURED THE VARYING INTENSITIES OF SUNLIGHT REFLECTED FROM CLOUDS (ABOUT 80 PERCENT), LAND MASSES (15 TO 20 PERCENT),

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AND SEA AREAS (5 PERCENT). THE SATELLITE SPIN AXIS CAUSED THE PHOTOCELLS TO SCAN THE EARTH IN SUCCESSIVE LINES. THE MEASURED REFLECTION INTENSITIES WERE STORED ON TAPE. SEPARATE SOLAR BATTERIES TURNED ON THE RECORDER ONLY WHEN THE EARTH BENEATH THE SATELLITE WAS IN SUNLIGHT. THIS PROVIDED 50 MIN OF DATA PER ORBIT. GROUND STATIONS INTERROGATED THE SATELLITE BY SIGNALING ITS COMMAND RECEIVER, WHICH CAUSED THE ENTIRE TAPE TO BE PLAYED BACK IN 60 SEC. THE TAPE WAS THEN ERASED AND REWOUND. EXPERIMENT EQUIPMENT FUNCTIONED NORMALLY, BUT DATA WERE POOR BECAUSE OF AN UNSATISFACTORY SATELLITE SPIN AXIS.

REFERENCES
241, 274, 275, 486, 497, 498, 572, 573, AND 824.

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SPACECRAFT COMMON NAME- EXPLORER 6 NSSDC ID 59-004A
ALTERNATE NAMES- ABLE 3, 1959 DELTA 1

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 12/19/59
- APOGEE- 41900.0 KM ALT
- PERIGEE- 237.000 KM ALT
- PERIOD- 754. MIN
- INCLINATION- 47.0 DEG

OTHER INFORMATION
- SPACECRAFT WT- 64. KG
- LAUNCH DATE- 08/07/59
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE
  - DATA RECORDED- 100659

SPACECRAFT PERSONNEL

PM - J.C.	LINDSEY	NASA-GSFC	GREENBELT, MD.
PS - C.P.	SONETT	NASA-ARC	MOFFETT FIELD, CALIF.

SPACECRAFT BRIEF DESCRIPTION

EXPLORER 6 WAS A SMALL, SPHEROIDAL SATELLITE DESIGNED TO STUDY TRAPPED RADIATION OF VARIOUS ENERGIES, GALACTIC COSMIC RAYS, GEOMAGNETISM, RADIO PROPAGATION IN THE UPPER ATMOSPHERE, AND THE FLUX OF MICROMETEORITES. IT ALSO TESTED A SCANNING DEVICE DESIGNED FOR PHOTOGRAPHING THE EARTH'S CLOUD COVER. THESE STUDIES WERE CARRIED OUT IN INTERPLANETARY SPACE AND WITHIN THE MAGNETOSPHERE. THE SATELLITE WAS LAUNCHED INTO A HIGHLY ELLIPTICAL ORBIT WITH AN INITIAL LOCAL TIME OF APOGEE OF 2100 HR. THE SATELLITE WAS SPIN STABILIZED AT 2.6 RPS, WITH THE DIRECTION OF THE SPIN AXIS HAVING A RIGHT ASCENSION OF 217 DEG AND A DECLINATION OF 23 DEG. FOUR SOLAR CELL PADDLES MOUNTED NEAR ITS EQUATOR RECHARGED THE STORAGE BATTERIES WHILE IN ORBIT. EACH EXPERIMENT EXCEPT THE TELEVISION SCANNER HAD TWO OUTPUTS, DIGITAL AND ANALOG. A UHF TRANSMITTER WAS USED FOR THE DIGITAL TELEMETRY AND THE TV SIGNAL. TWO VHF TRANSMITTERS WERE USED TO TRANSMIT THE ANALOG SIGNAL. THE VHF TRANSMITTERS WERE OPERATED CONTINUOUSLY. THE UHF TRANSMITTER WAS OPERATED FOR ONLY A FEW HOURS EACH DAY. ONLY THREE OF THE SOLAR CELL PADDLES FULLY ERECTED, AND THIS OCCURRED DURING SPIN UP RATHER THAN PRIOR TO SPIN UP AS PLANNED. CONSEQUENTLY, INITIAL OPERATION OF THE PAYLOAD POWER SUPPLY WAS 63 PERCENT NOMINAL, AND THIS DECREASED WITH TIME. THE DECREASED POWER CAUSED A LOWER SIGNAL TO NOISE RATIO AFFECTING MOST OF THE DATA, ESPECIALLY NEAR APOGEE. ONE VHF TRANSMITTER FAILED ON SEPTEMBER 11, 1959, AND THE LAST CONTACT WITH THE PAYLOAD WAS MADE ON OCTOBER 6, 1959, AT WHICH TIME THE SOLAR CELL CHARGING CURRENT HAD FALLEN BELOW THAT REQUIRED TO MAINTAIN THE SATELLITE EQUIPMENT. A TOTAL OF 827 HR OF ANALOG AND 23 HR OF DIGITAL DATA WAS OBTAINED.

REFERENCES

78, 80, 200, 203, 214, 215, 360, 474, AND 662.

EXPERIMENT NAME- TV OPTICAL SCANNER NSSDC ID 59-004A-05

EXPERIMENT PERSONNEL
PI - K. BAKER U OF UTAH SALT LAKE CITY, UTAH

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 082559

EXPERIMENT BRIEF DESCRIPTION

THE TV OPTICAL SCANNER FLOWN ON EXPLORER 6 WAS AN IMPROVED VERSION OF THE TV SYSTEM FIRST EMPLOYED ON PIONEER 2. THE EXPERIMENT CONSISTED OF AN OPTICAL UNIT CONTAINING A CONCAVE SPHERICAL MIRROR AND PHOTOTRANSISTOR, A VIDEO AMPLIFIER, TIMING AND LOGIC CIRCUITS, AND TELEMETRY. THE EXPERIMENT WAS DESIGNED TO TEST THE FEASIBILITY OF USING SUCH INSTRUMENTATION TO OBTAIN LOW-RESOLUTION DAYLIGHT CLOUDCOVER PHOTOGRAPHS. THE EXPLORER 6 SCANNER ALSO SERVED AS A FORERUNNER TO THE TV CAMERA SYSTEMS CARRIED ON LATER, MORE ADVANCED SATELLITES. THE SCANNER'S OPTICAL AXIS WAS DIRECTED 45 DEG AWAY FROM THE SPACECRAFT SPIN AXIS, WHICH WAS PARALLEL TO THE ORBITAL PLANE. THE VEHICLE'S SPIN FURNISHED THE LINE SCANNING, AND THE SPACECRAFT'S FORWARD MOTION ALONG ITS TRAJECTORY PROVIDED THE FRAME SCANNING. DURING A SCAN (ONE SPACECRAFT REVOLUTION), A SINGLE SCAN SPOT (ELEMENT) ON EARTH WAS VIEWED AND TRANSMITTED BACK TO EARTH. DURING THE NEXT SPACECRAFT REVOLUTION, AN ADJACENT SPOT WAS SCANNED. THIS PROCEDURE WAS REPEATED UNTIL A LINE OF 64 SUCH SPOTS WAS FORMED. THEN THE PROCESS WAS REPEATED TO FORM AN ADJACENT LINE OF ELEMENTS, AND SO ON, UNTIL A FRAME, OR PICTURE, WAS OBTAINED. THE SYSTEM COULD PRODUCE USEFUL PHOTOGRAPHS ONLY WHEN THE SPACECRAFT'S VELOCITY AND ORBITAL POSITION WERE SUCH THAT SUCCESSIVE LINES OVERLAPPED. (AT APOGEE FOR EXAMPLE, THE TV LINES WERE SEPARATED BY A DISTANCE ABOUT EQUAL TO THEIR LENGTH, AND HENCE NO MEANINGFUL PICTURE COULD BE OBTAINED.) DATA OBTAINED FROM THIS EXPERIMENT ARE LIMITED AND OF EXTREMELY POOR QUALITY. PROPER SPACECRAFT ORIENTATION WAS NEVER ACHIEVED, RESULTING IN A CONSIDERABLE AMOUNT OF BLANK SPACE BETWEEN SUCCESSIVE SCAN LINES. THE SCANNER'S LOGIC CIRCUITS ALSO FAILED TO OPERATE NORMALLY (ONLY EVERY FOURTH SCAN SPOT COULD BE SUCCESSFULLY REPRODUCED), FURTHER REDUCING THE RESOLUTION. THE LAST USEFUL DATA WERE OBTAINED ON AUGUST 25, 1959.

REFERENCES

78, 214, AND 215.

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SPACECRAFT COMMON NAME- EXPLORER 7 NSSDC ID 59-009A
ALTERNATE NAMES- 1959 IOTA 1, S 1A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC

OTHER INFORMATION
SPACECRAFT WT- 41.50 KG

EPOCH DATE- 10/16/59
APOGEE- 592.000 KM ALT
PERIGEE- 571.000 KM ALT
PERIOD- 101.4 MIN
INCLINATION- 50.3 DEG

LAUNCH DATE- 10/13/59
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 082461

SPACECRAFT PERSONNEL

PM - H.E. LAGOW NASA-GSFC GREENBELT, MD.
PS - UNKNOWN UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

EXPLORER 7 WAS DESIGNED TO MEASURE SOLAR X-RAY AND LYMAN-ALPHA FLUX, TRAPPED ENERGETIC PARTICLES, AND HEAVY PRIMARY COSMIC RAYS (Z GREATER THAN 5). ADDITIONAL OBJECTIVES INCLUDED COLLECTING DATA ON MICROMETEOROID PENETRATION AND MOLECULAR SPUTTERING AND STUDYING THE EARTH-ATMOSPHERE HEAT BALANCE. THE SPIN-STABILIZED SATELLITE'S EXTERNAL STRUCTURE CONSISTED OF TWO TRUNCATED CONICAL FIBERGLASS SHELLS JOINED BY A CYLINDRICAL ALUMINUM CENTER SECTION. THE SPACECRAFT WAS 75 CM WIDE AT ITS EQUATOR AND ABOUT 75 CM HIGH. MOUNTED ON BOTH THE UPPER AND LOWER SHELLS WERE APPROXIMATELY 3000 SOLAR CELLS. THE SPACECRAFT WAS ALSO POWERED BY 15 NICKEL-CADMIUM BATTERIES THAT WERE POSITIONED ON ITS EQUATOR NEAR THE OUTER SKIN AS AN AID IN MAINTAINING A PROPER SPIN RATE. TWO CROSSED DIPOLE (1 W, 20 MHZ) TELEMETRY ANTENNAS PROJECTED OUTWARD FROM THE CENTER SECTION, AND A 108-MHZ CLOVERLEAF ANTENNA USED FOR TRACKING WAS MOUNTED ON THE BOTTOM OF THE LOWER SHELL. LOCATED AROUND THE PERIPHERY OF THE CENTER SECTION WERE FIVE BOLOMETERS FOR THERMAL RADIATION MEASUREMENTS AND THREE CDS MICROMETEOROID DETECTOR CELLS. A CYLINDRICAL ION CHAMBER (LIF WINDOW) AND A BE X-RAY CHAMBER WERE LOCATED ON OPPOSITE SIDES OF THE UPPER CONE, AND A COSMIC-RAY GEIGER COUNTER WAS LOCATED ON THE VERY TOP. A PRIMARY COSMIC-RAY IONIZATION CHAMBER WAS LOCATED WITHIN THE CENTER PORTION OF THE UPPER CONE. USEFUL REAL-TIME DATA WERE TRANSMITTED FROM LAUNCH UNTIL FEBRUARY 1961 AND INTERMITTENTLY UNTIL AUGUST 24, 1961.

REFERENCES

79, 81, 82, 121, 241, 359, 380, 522, 529, 572, 574, AND 644.

EXPERIMENT NAME- THERMAL RADIATION NSSDC ID 59-009A-01

EXPERIMENT PERSONNEL

PI - V.E. SUOMI U OF WISCONSIN MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 022861

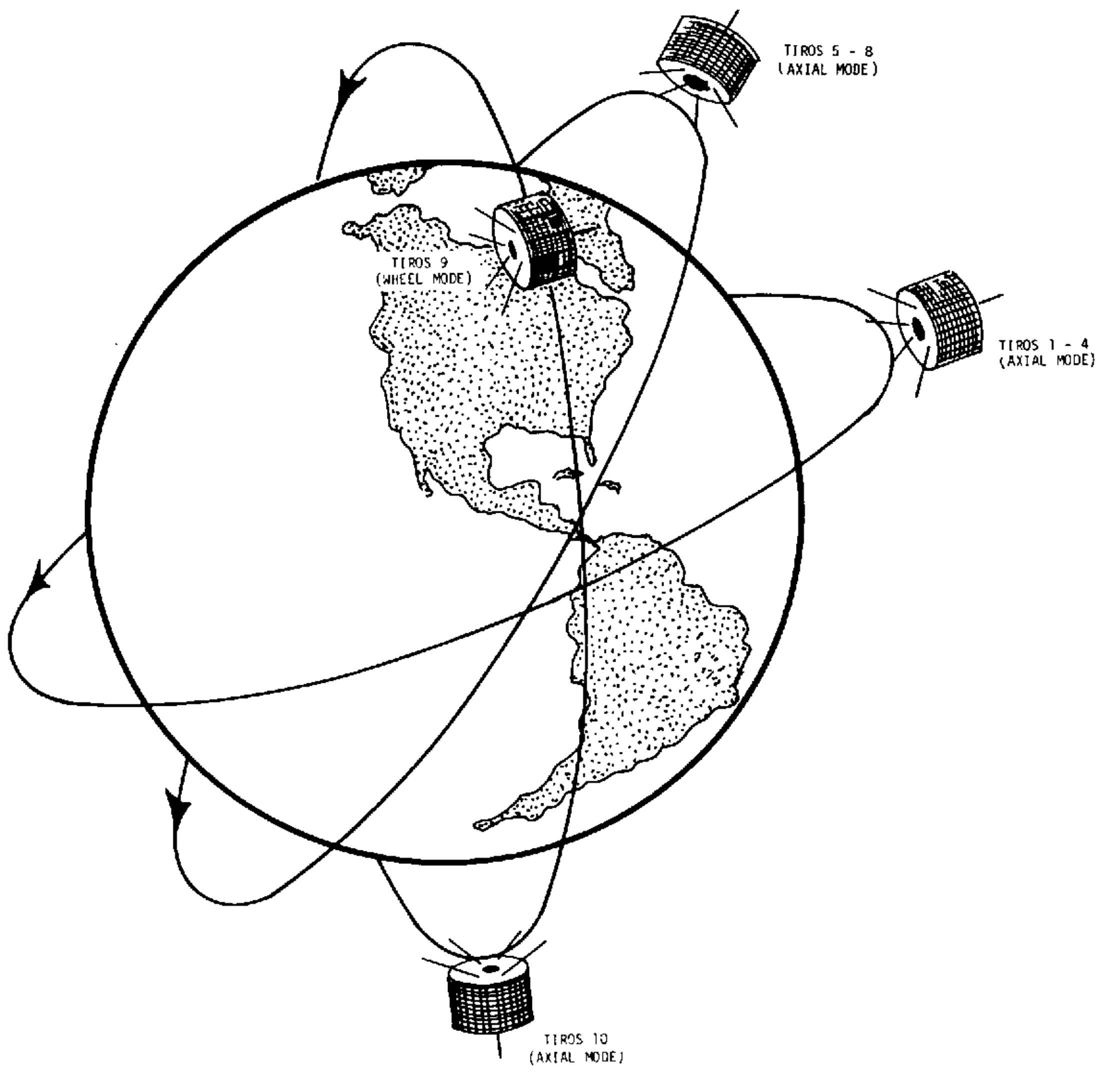
EXPERIMENT BRIEF DESCRIPTION

THE EXPLORER 7 THERMAL RADIATION EXPERIMENT WAS DESIGNED TO MEASURE INCIDENT AND REFLECTED SOLAR UV RADIATION AND TERRESTRIAL IR RADIATION IN ORDER TO OBTAIN A BETTER UNDERSTANDING OF THE DRIVING FORCES OF THE EARTH-ATMOSPHERE SYSTEM. THE PRIMARY INSTRUMENTATION CONSISTED OF FIVE BOLOMETERS IN THE FORM OF HOLLOW SILVER HEMISPHERES THAT WERE THERMALLY INSULATED FROM BUT IN CLOSE PROXIMITY TO SPECIALLY ALUMINIZED MIRRORS. THE HEMISPHERES THEREBY BEHAVED VERY MUCH LIKE ISOLATED SPHERES IN SPACE. TWO OF THE HEMISPHERES HAD BLACK COATINGS AND RESPONDED ABOUT EQUALLY TO SOLAR AND TERRESTRIAL RADIATION. A THIRD HEMISPHERE, WHICH WAS WHITE, WAS MORE SENSITIVE TO TERRESTRIAL RADIATION THAN TO SOLAR RADIATION. A FOURTH, WHICH HAD A GOLD METAL SURFACE, WAS MORE SENSITIVE TO SOLAR RADIATION THAN TO

TERRESTRIAL RADIATION. A TABOR-SURFACED HEMISPHERE, PROTECTED FROM DIRECT SUNLIGHT, WAS USED TO MEASURE THE REFLECTED SUNLIGHT. A GLASS-COATED BEAD THERMISTOR WAS MOUNTED ON THE TOP OF EACH HEMISPHERE TO MEASURE THE TEMPERATURE. A COMPLETE SET OF FOUR TEMPERATURE OBSERVATIONS AND ONE REFERENCE SAMPLE REQUIRED 30 SEC. THUS, IN EACH ORBIT, ABOUT 180 TEMPERATURE MEASUREMENTS COULD BE OBTAINED. THE EXPERIMENT WAS A SUCCESS, AND USABLE DATA WERE OBTAINED FROM LAUNCH UNTIL FEBRUARY 28, 1961.

REFERENCES

121, 132, 198, 241, 318, 473, 490, 529, 530, 573, 614, 674, 709, 779, 835, 836, 838, 839, 845, AND 847.



TIROS SERIES

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2. *Tiros Series*

SPACECRAFT COMMON NAME- TIROS 1 NSSDC ID 60-002B
ALTERNATE NAMES- 1960 BETA 2

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/01/60
APOGEE- 750.000 KM ALT
PERIGEE- 693.000 KM ALT
PERIOD- 99.16 MIN
INCLINATION- 48.4 DEG

OTHER INFORMATION
SPACECRAFT WT- 120. KG
LAUNCH DATE- 04/01/60
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 061560

SPACECRAFT PERSONNEL

PM - W.G.	STROUD	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 1 (TELEVISION AND INFRARED OBSERVATION SATELLITE), THE FIRST WEATHER SATELLITE, WAS DESIGNED TO TEST THE FEASIBILITY OF OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE SPIN-STABILIZED SATELLITE WAS IN THE FORM OF AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS, AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS SUPPLIED TO THE SPACECRAFT BY APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. A SINGLE MONOPOLE ANTENNA FOR RECEPTION OF GROUND COMMANDS EXTENDED OUT FROM THE TOP OF THE COVER ASSEMBLY. A PAIR OF CROSSED-DIPOLE TELEMETRY ANTENNAS (235 MHZ) PROJECTED DOWN AND DIAGONALLY OUT FROM THE BASEPLATE. MOUNTED AROUND THE EDGE OF THE BASEPLATE WERE FIVE DIAMETRICALLY OPPOSED PAIRS OF SMALL, SOLID-FUEL THRUSTERS THAT MAINTAINED THE SATELLITE SPIN RATE BETWEEN 8 AND 12 RPM. THE SATELLITE WAS EQUIPPED WITH TWO 1.27-CM-DIAMETER VIDICON TV CAMERAS, ONE WIDE ANGLE AND ONE NARROW ANGLE, FOR TAKING EARTH CLOUDCOVER PICTURES. THE PICTURES WERE TRANSMITTED DIRECTLY TO A GROUND RECEIVING STATION OR WERE STORED IN A TAPE RECORDER ON BOARD FOR LATER PLAYBACK, DEPENDING ON WHETHER THE SATELLITE WAS WITHIN OR BEYOND THE COMMUNICATION RANGE OF THE STATION. THE SATELLITE PERFORMED NORMALLY FROM LAUNCH UNTIL JUNE 15, 1960, WHEN AN ELECTRICAL POWER FAILURE PREVENTED FURTHER USEFUL TV TRANSMISSION.

REFERENCES

57, 145, 219, 241, 260, 316, 359, 405, 511, 551, 572, 573, 574, 639, 675, 700, 772, 789, 833, AND 924.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 60-002B-01

EXPERIMENT PERSONNEL

PI - H.I.	BUTLER	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 061560

EXPERIMENT BRIEF DESCRIPTION

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THE TIROS 1 TV SYSTEM WAS DESIGNED TO TEST THE FEASIBILITY OF OBTAINING CLOUDCOVER PICTURES FROM AN ORBITING SPACECRAFT. THE EXPERIMENT CONSISTED OF TWO INDEPENDENT TV CAMERAS, MAGNETIC TAPE RECORDERS, AND TV TRANSMITTERS. THE TWO SENSOR UNITS WERE CAPABLE OF EITHER CONCURRENT OR INDEPENDENT OPERATION. THE CAMERAS, ONE WIDE ANGLE (104 DEG) AND ONE NARROW ANGLE (12 DEG), WERE MOUNTED ON THE BASEPLATE OF THE SPACECRAFT WITH THEIR OPTICAL AXES PARALLEL TO THE SPIN AXIS OF THE SPACECRAFT, WHICH WAS IN THE ORBITAL PLANE. THE CAMERAS WERE AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN THEY CAME IN VIEW OF THE EARTH. THE SPACECRAFT COULD TRANSMIT THE PICTURES IN REAL TIME, WHEN IT WAS WITHIN RANGE OF A COMMAND AND DATA ACQUISITION (CDA) STATION, OR COULD RECORD THE PICTURES ON MAGNETIC TAPE FOR SUBSEQUENT TRANSMISSION TO A CDA STATION. THE TV CAMERAS USED 500-SCAN-LINE, 1.27-CM-DIAMETER VIDICONS. THE RECORDERS COULD STORE UP TO 32 FRAMES OF EARTH CLOUDCOVER PICTURES. TRANSMISSION OF THE 32-FRAME SEQUENCE WAS ACCOMPLISHED IN 100 SEC BY A 2-W FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE TAKEN BY THE WIDE-ANGLE CAMERA COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. THE NARROW-ANGLE CAMERA COVERED A 120- BY 120-KM SQUARE AND HAD A RESOLUTION OF 0.3 TO 0.8 KM. THE EXPERIMENT WAS CAPABLE OF PRODUCING DAYTIME CLOUDCOVER PICTURES FOR THE REGION 55 DEG SOUTH TO 55 DEG NORTH LATITUDE. THE EXPERIMENT WAS A SUCCESS, WITH OVER 19,000 OF THE TRANSMITTED TV PICTURES BEING USED FOR OPERATIONAL WEATHER ANALYSIS AND FORECASTING PURPOSES. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR A COMPLETE INDEX OF THESE DATA, SEE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - TIROS 1 TELEVISION CLOUD PHOTOGRAPHY' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS. AN ADDITIONAL SET OF PHOTOGRAPHS IS RETAINED AT THE NASA-GSFC LIBRARY FOR REFERENCE PURPOSES. AN INDEX OF THESE PHOTOGRAPHS IS AVAILABLE THROUGH NSSDC.

REFERENCES

36, 241, 371, 384, 409, 422, 437, 457, 458, 460, 573, 582, 591, 650, 674, 744, 791, 895, 902, 915, 922, 927, AND 933.

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SPACECRAFT COMMON NAME- TIROS 2 — NSSDC ID 60-016A

ALTERNATE NAMES- 1960 PI 1, A 2

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 11/27/60
- APOGEE- 626.000 KM ALT
- PERIGEE- 533.000 KM ALT
- PERIOD- 98.27 MIN
- INCLINATION- 48.534 DEG

OTHER INFORMATION
- SPACECRAFT WT- 125. KG
- LAUNCH DATE- 11/23/60
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE
  - DATA RECORDED- 092761

SPACECRAFT PERSONNEL

PM - R.A.	STAMPFL	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 2 (TELEVISION AND INFRARED OBSERVATION SATELLITE) WAS A SPIN-STABILIZED METEOROLOGICAL SPACECRAFT DESIGNED TO TEST EXPERIMENTAL TELEVISION TECHNIQUES AND INFRARED EQUIPMENT. THE SATELLITE WAS IN THE FORM

OF AN 18-SIDED RIGHT PRISM, 107 CM IN DIAMETER AND 56 CM HIGH. THE TOP AND SIDES OF THE SPACECRAFT WERE COVERED WITH APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS. TIROS 2 WAS EQUIPPED WITH TWO INDEPENDENT TELEVISION CAMERA SUBSYSTEMS FOR TAKING CLOUDCOVER PICTURES, PLUS A FIVE-CHANNEL MEDIUM-RESOLUTION SCANNING RADIOMETER AND A TWO-CHANNEL NONSCANNING LOW-RESOLUTION RADIOMETER FOR MEASURING RADIATION FROM THE EARTH AND ITS ATMOSPHERE. THE SATELLITE SPIN RATE WAS MAINTAINED BETWEEN 8 AND 12 RPM BY THE USE OF FIVE DIAMETRICALLY OPPOSED PAIRS OF SMALL, SOLID-FUEL THRUSTERS. THE SATELLITE SPIN AXIS COULD BE ORIENTED TO WITHIN 1- TO 2-DEG ACCURACY BY USE OF A MAGNETIC ATTITUDE CONTROL DEVICE CONSISTING OF 250 CORES OF WIRE WOUND AROUND THE OUTER SURFACE OF THE SPACECRAFT. THE INTERACTION BETWEEN THE INDUCED MAGNETIC FIELD IN THE SPACECRAFT AND THE EARTH'S MAGNETIC FIELD PROVIDED THE NECESSARY TORQUE FOR ATTITUDE CONTROL. THE SPACECRAFT PERFORMED NORMALLY FROM LAUNCH UNTIL SEPTEMBER 27, 1961, WHEN THE LAST EXPERIMENT FAILED. A MORE COMPLETE DESCRIPTION AND PERFORMANCE SUMMARY OF TIROS 2 IS PRESENTED IN THE JOURNAL OF THE BRITISH INTERPLANETARY SOCIETY, VOL. 19, PAGES 386-409, 1963-64.

REFERENCES
84, 145, 218, 219, 260, 331, 402, 511, 572, 573, 574, 603, 639, 675, 700, 743, 772, 789, 790, 810, 833, AND 924.

EXPERIMENT NAME- WIDEFIELD RADIOMETER　　　　NSSDC ID 60-016A-01

EXPERIMENT PERSONNEL
PI - R.A. HANEL　　　　NASA-GSFC　　　　GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092761

EXPERIMENT BRIEF DESCRIPTION
THE TIROS 2 LOW-RESOLUTION, NONSCANNING, TWO-CHANNEL RADIOMETER MEASURED THE THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM. THE RADIOMETER CONSISTED OF TWO DETECTORS - ONE BLACK AND ONE WHITE THERMISTOR BOLOMETER. EACH OF THE DETECTORS WAS MOUNTED IN THE APEX OF A HIGHLY REFLECTIVE MYLAR CONE. THE BLACK DETECTOR RESPONDED EQUALLY TO REFLECTED SOLAR RADIATION AND LONG-WAVE TERRESTRIAL RADIATION (0.2 TO 50 MICRONS). THE WHITE DETECTOR REFLECTED SOLAR AND VISIBLE RADIATION AND MEASURED ONLY LONG-WAVE THERMAL RADIATION (5 TO 50 MICRONS). THE OPTICAL AXIS OF EACH DETECTOR WAS PARALLEL TO THE SATELLITE SPIN AXIS. THE FIELD OF VIEW OF THE DETECTORS WHEN VIEWING THE EARTH DIRECTLY BELOW THE SATELLITE WAS A CIRCLE OF 632 KM DIAMETER (50-DEG FIELD OF VIEW). THIS AREA WAS WITHIN THE FIELD OBSERVED BY THE WIDE-ANGLE TELEVISION CAMERA, AND THUS A DIRECT MEASURE OF THE HEAT BALANCE OF THE EARTH-ATMOSPHERE SYSTEM VIEWED IN ANY OF THE PICTURES WAS PROVIDED. THE RADIATION DATA WERE RECORDED ON A CONTINUOUSLY RUNNING ENDLESS LOOP MAGNETIC TAPE THAT COMPLETED ITS CYCLE IN ABOUT 100 MIN. DATA OLDER THAN 100 MIN WERE ERASED AS NEWER DATA WERE RECORDED. THE EXPERIMENT PERFORMED NORMALLY, BUT THE QUALITY OF THE DATA WAS VERY POOR BECAUSE THE SENSITIVITY OF THE DETECTORS WAS LOWER THAN EXPECTED. THERE WAS ALSO EXCESSIVE THERMAL COUPLING BETWEEN THE RADIOMETER DETECTORS AND THE SATELLITE. THE WHITE DETECTOR DID NOT TOTALLY REFLECT THE SOLAR RADIATION OR ABSORB THE LONG-WAVE TERRESTRIAL INFRARED EMISSION. CONSEQUENTLY, THE COLLECTED DATA WERE TOO AMBIGUOUS FOR REDUCTION OR ANALYSIS. THE EXPERIMENT IS DESCRIBED IN GREATER DETAIL IN NASA DOCUMENT TN D-614, 'THE TIROS LOW RESOLUTION RADIOMETER.' IDENTICAL EXPERIMENTS WERE FLOWN ON TIROS 3 AND 4.

REFERENCES

105, 313, 318, 329, 490, 491, 573, 574, 674, 686, AND 839.

EXPERIMENT NAME- SCANNING RADIOMETER NSSDC ID 60-016A-02

EXPERIMENT PERSONNEL

PI - J.D. BARKSDALE	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 042261

EXPERIMENT BRIEF DESCRIPTION

THE SCANNING RADIOMETER OF THE TIROS 2 METEOROLOGICAL SATELLITE MEASURED THE EMITTED AND REFLECTED RADIATION OF THE EARTH AND ITS ATMOSPHERE. THE FIVE-CHANNEL RADIOMETER SCANNED THE EARTH AND SPACE AS THE SATELLITE SPUN ABOUT ITS AXIS. THE RADIOMETER'S BI-DIRECTIONAL OPTICAL AXES WERE INCLINED TO THE SATELLITE SPIN AXIS AT ANGLES OF 45 AND 135 DEG. THE SENSOR USED BOLOMETER DETECTORS AND FILTERS TO LIMIT THE SPECTRAL RESPONSE AND TO PROVIDE COMPREHENSIVE DATA BY MEASURING RADIATION INTENSITIES IN SELECTED PORTIONS OF THE INFRARED SPECTRUM. THE SPECTRAL BANDWIDTH OF EACH CHANNEL (IN MICRONS) AND ITS ASSOCIATED PARAMETER WERE - CHANNEL 1, 6.0 TO 6.5 (WATER VAPOR ABSORPTION), CHANNEL 2, 8.0 TO 12.0 (ATMOSPHERIC WINDOW), CHANNEL 3, 0.2 TO 6.0 (REFLECTED SOLAR RADIATION), CHANNEL 4, 7.5 TO 30 (TERRESTRIAL RADIATION), AND CHANNEL 5, 0.55 TO 0.75 (RESPONSE OF TV SYSTEM). INITIALLY, ALL CHANNELS PERFORMED NORMALLY. HOWEVER, CHANNELS 1 AND 4 GRADUALLY DETERIORATED AND BY JANUARY 1961 WERE USELESS. THE SIGNAL TO NOISE RATIO OF CHANNELS 3 AND 5 WAS EXTREMELY LOW, AND THE OUTPUT WAS HIGHLY QUESTIONABLE. FIVE MONTHS OF TERRESTRIAL RADIATION MEASUREMENTS WERE OBTAINED FOR THE REGION BETWEEN 55 DEG N AND 55 DEG S LATITUDE BEFORE THE RADIOMETER CHOPPER MOTOR FAILED ON APRIL 22, 1961. A COMPLETE DESCRIPTION OF THE TIROS 2 RADIOMETER EXPERIMENT CAN BE FOUND IN THE JOURNAL OF THE OPTICAL SOCIETY OF AMERICA, VOL. 51, NO. 12, 1386-1393, DECEMBER 1961.

REFERENCES

105, 289, 314, 317, 318, 330, 361, 362, 385, 487, 490, 495, 496, 499, 574, 596, 606, 6€4, 674, 686, 750, 818, 839, 891, 896, 898, 926, 931, AND 934.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 60-016A-03

EXPERIMENT PERSONNEL

PI - H.I. BUTLER	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092761

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 2 TV SYSTEM WAS DESIGNED TO FURTHER RESEARCH TOWARD OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE EXPERIMENT CONSISTED OF TWO INDEPENDENT PAIRS OF TV CAMERAS, MAGNETIC TAPE RECORDERS, AND TV TRANSMITTERS. THE TWO SENSOR UNITS WERE CAPABLE OF CONCURRENT OR INDEPENDENT OPERATION. THE CAMERAS, ONE WIDE ANGLE (104 DEG) AND ONE NARROW ANGLE (12 DEG), WERE MOUNTED ON THE BASEPLATE OF THE SPACECRAFT WITH THEIR OPTICAL AXES PARALLEL TO THE SPIN AXIS, WHICH WAS IN THE ORBITAL PLANE. THE CAMERAS WERE AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN THEY CAME IN VIEW

OF THE EARTH. THE PICTURES WERE TRANSMITTED DIRECTLY TC EITHER OF TWO GROUND RECEIVING STATIONS OR STORED ON MAGNETIC TAPE FOR LATER PLAYBACK, DEPENDING ON WHETHER THE SATELLITE WAS WITHIN OR BEYOND THE COMMUNICATION RANGE OF THE STATION. THE TV CAMERAS USED 500-SCAN-LINE, 1.27-CM-DIAMETER VIDICONS. THE RECORDERS COULD STORE UP TO 32 FRAMES OF PICTURES. TRANSMISSION OF THE 32-FRAME SEQUENCE WAS ACCOMPLISHED IN 100 SEC BY A 3-W FM TRANSMITTER OPERATING AT A NCMINAL FREQUENCY OF 237 MHZ. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE TAKEN BY THE WIDE-ANGLE CAMERA COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. THE NARROW-ANGLE CAMERA COVERED A 120- BY 120-KM SQUARE AND HAD A RESOLUTION OF 0.3 TO 0.8 KM. THE EXPERIMENT WAS CAPABLE OF PRODUCING DAYTIME CLOUDCOVER PICTURES FOR THE REGION 55 DEG S TO 55 DEG N LATITUDE. DEPOSITS ON THE LENS OF THE WIDE-ANGLE CAMERA CAUSED ALL ITS PICTURES TO BE UNUSABLE. THE REMAINING CAMERA OPERATED NCRMALLY UNTIL FEBRUARY 1, 1961, AND SPORADICALLY THEREAFTER UNTIL SEPTEMBER 27, 1961. THE EXPERIMENT WAS A SUCCESS, WITH OVER 25,000 USABLE PICTURES TRANSMITTED. DATA FROM THE EXPERIMENT ARE AVAILABLE FRCM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF THESE DATA, SEE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - TIROS 2, TELEVISION CLOUD PHOTOGRAPHY,' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

37, 384, 4C8, 457, 460, 650, AND 895.

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SPACECRAFT COMMON NAME- TIROS 3 NSSDC ID 61-017A

ALTERNATE NAMES- 1961 RHO 1, A 3

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 07/12/61
- APOGEE- 702.000 KM ALT
- PERIGEE- 631.000 KM ALT
- PERIOD- 100.4 MIN
- INCLINATION- 47.898 DEG

OTHER INFORMATION
- SPACECRAFT WT- 129. KG
- LAUNCH DATE- 07/12/61
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE
  - DATA RECORDED- 012362

SPACECRAFT PERSONNEL

PM - R.M.	RADOS	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 3 (TELEVISION AND INFRARED OBSERVATION SATELLITE) WAS A SPIN-STABILIZED METEOROLOGICAL SPACECRAFT DESIGNED TO TEST EXPERIMENTAL TELEVISION TECHNIQUES AND INFRARED EQUIPMENT. THE SATELLITE WAS IN THE FORM OF AN 18-SIDED RIGHT PRISM, 107 CM IN DIAMETER AND 56 CM HIGH. THE TOP AND SIDES OF THE SPACECRAFT WERE COVERED WITH APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS. TIROS 3 WAS EQUIPPED WITH TWO INDEPENDENT TELEVISION CAMERA SUBSYSTEMS FOR TAKING CLOUDCOVER PICTURES, PLUS A TWO-CHANNEL LOW-RESOLUTION RADIOMETER, AN OMNIDIRECTIONAL RADIOMETER, AND A FIVE-CHANNEL INFRARED SCANNING RADIOMETER. ALL THREE RADICMETERS WERE USED FOR MEASURING RADIATION FROM THE EARTH AND ITS ATMOSPHERE. THE SATELLITE SPIN RATE WAS MAINTAINED BETWEEN 8 AND 12 RPM BY THE USE OF FIVE DIAMETRICALLY OPPOSED PAIRS OF SMALL, SOLID-FUEL THRUSTERS. THE SATELLITE SPIN AXIS COULD BE ORIENTED TO WITHIN 1- TO 2-DEG ACCURACY BY USE OF A MAGNETIC CONTROL DEVICE

CONSISTING OF 250 CORES OF WIRE WOUND ARCUND THE OUTER SURFACE OF THE SPACECRAFT. THE INTERACTION BETWEEN THE INDUCED MAGNETIC FIELD IN THE SPACECRAFT AND THE EARTH'S MAGNETIC FIELD PROVIDED THE NECESSARY TORQUE FOR ATTITUDE CONTROL. THE FLIGHT CONTROL SYSTEM ALSO OPTIMIZED THE PERFORMANCE OF THE SOLAR CELLS AND TV CAMERAS AND PROTECTED THE FIVE-CHANNEL INFRARED RADIOMETER FROM PROLONGED EXPOSURE TO DIRECT SUNLIGHT. THE SPACECRAFT PERFORMED NORMALLY UNTIL NOVEMBER 30, 1961, AND SPORADICALLY UNTIL JANUARY 23, 1962. IT WAS DEACTIVATED ON FEBRUARY 28, 1962. A MORE COMPLETE DESCRIPTION AND PERFORMANCE SUMMARY OF TIROS 3 IS PRESENTED IN THE JOURNAL OF THE BRITISH INTERPLANETARY SOCIETY, VOL. 19, 386-409, 1963-64.

REFERENCES
84, 145, 218, 219, 260, 331, 511, 533, 571, 572, 573, 574, 603, 621, 639, 675, 700, 743, 772, 789, 790, 810, 833, 897, AND 924.

EXPERIMENT NAME- LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER — NSSDC ID 61-017A-01

EXPERIMENT PERSONNEL

PI - V.E. SUOMI	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 102061

EXPERIMENT BRIEF DESCRIPTION
THE TIROS 3 LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER CONSISTED PRIMARILY OF TWO SETS OF BOLOMETERS IN THE FORM OF HOLLOW ALUMINUM HEMISPHERES, MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT, WHOSE OPTICAL AXES WERE PARALLEL TO THE SPIN AXIS. THE BOLOMETERS WERE THERMALLY ISOLATED FROM, BUT IN CLOSE PROXIMITY TO REFLECTING MIRRORS SO THAT THE HEMISPHERES BEHAVED VERY MUCH LIKE ISOLATED SPHERES IN SPACE. THE EXPERIMENT WAS DESIGNED TO MEASURE THE AMOUNT OF SOLAR ENERGY ABSORBED, REFLECTED, AND EMITTED BY THE EARTH AND ITS ATMOSPHERE. ONE BOLOMETER IN EACH SET WAS PAINTED BLACK, AND ONE WAS PAINTED WHITE. THE BLACK BOLOMETER ABSORBED MOST OF THE INCIDENT RADIATION WHILE THE WHITE BOLOMETER WAS SENSITIVE MAINLY TO RADIATION WITH WAVELENGTHS LONGER THAN APPROXIMATELY 4 MICRONS. REFLECTED AND EMITTED RADIATION COULD THUS BE SEPARATED. THE SENSOR TEMPERATURES WERE MEASURED BY THERMISTORS FASTENED TO THE INSIDE OF THE HOLLOW HEMISPHERES. THE SENSOR TEMPERATURES, TAKEN EVERY 29 SEC, WERE AN AVERAGE OF THE TWO TEMPERATURES FROM THE MATCHED THERMISTORS. THE EXPERIMENT WAS A SUCCESS, AND USABLE DATA WERE RECEIVED FROM JULY 12, 1961, TO OCTOBER 20, 1961. IDENTICAL EXPERIMENTS WERE FLOWN ON TIROS 4 AND 7, AND A SIMILAR ONE WAS CARRIED ON EXPLORER 7.

REFERENCES
243, 318, 490, 531, 686, 687, 688, 839, 845, 846, AND 880.

EXPERIMENT NAME- WIDEFIELD RADIOMETER — NSSDC ID 61-017A-02

EXPERIMENT PERSONNEL

PI - R.A. HANEL	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 012362

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 3 LOW-RESOLUTION, NONSCANNING, TWO-CHANNEL RADIOMETER MEASURED THE THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM. THE RADIOMETER CONSISTED OF TWO DETECTORS - ONE BLACK AND ONE WHITE THERMISTOR BOLOMETER. EACH OF THE DETECTORS WAS MOUNTED IN THE APEX OF A HIGHLY REFLECTIVE MYLAR CONE. THE BLACK DETECTOR RESPONDED EQUALLY TO REFLECTED SOLAR RADIATION AND LONG-WAVE TERRESTRIAL RADIATION (0.2 TO 50 MICRONS). THE WHITE DETECTOR REFLECTED SOLAR AND VISIBLE RADIATION AND MEASURED ONLY LONG-WAVE THERMAL RADIATION (5 TO 50 MICRONS). THE OPTICAL AXIS OF EACH DETECTOR WAS PARALLEL TO THE SATELLITE SPIN AXIS. THE FIELD OF VIEW (50 DEG) OF THE DETECTORS WHEN VIEWING THE EARTH DIRECTLY BELOW THE SATELLITE WAS A CIRCLE OF 832 KM DIAMETER. THIS AREA WAS WITHIN THE FIELD OBSERVED BY THE WIDE-ANGLE TELEVISION CAMERA, AND THUS A DIRECT MEASURE OF THE HEAT BALANCE OF THE EARTH-ATMOSPHERE SYSTEM VIEWED IN ANY OF THE PICTURES WAS PROVIDED. THE RADIATION DATA WERE RECORDED ON A CONTINUOUSLY RUNNING ENDLESS LOOP MAGNETIC TAPE THAT COMPLETED ITS CYCLE IN ABOUT 100 MIN. DATA OLDER THAN 100 MIN WERE ERASED AS NEWER DATA WERE RECORDED. THE EXPERIMENT PERFORMED NORMALLY, BUT THE QUALITY OF THE DATA WAS VERY POOR BECAUSE THE DETECTORS EXPERIENCED PROBLEMS WITH DECREASED SENSITIVITY, DETECTOR-SPACECRAFT THERMAL COUPLING, AND LESS THAN NOMINAL RADIATIVE CHARACTERISTICS SIMILAR TO THOSE THAT OCCURRED ON TIROS 2. CONSEQUENTLY, THE COLLECTED DATA WERE TOO AMBIGUOUS FOR REDUCTION OR ANALYSIS. THE EXPERIMENT IS DESCRIBED IN GREATER DETAIL IN NASA DOCUMENT TN D-614, 'THE TIROS LOW RESOLUTION RADIOMETER.' IDENTICAL EXPERIMENTS WERE FLOWN ON TIROS 2 AND 4.

REFERENCES

318, 329, 378, 490, 574, 686, 839, AND 877.

EXPERIMENT NAME- SCANNING RADIOMETER NSSDC ID 61-017A-03

EXPERIMENT PERSONNEL

PI - R.M.	RADOS	NASA-GSFC	GREENBELT, MD.
OI - J.D.	BARKSDALE	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 100161

EXPERIMENT BRIEF DESCRIPTION

THE SCANNING RADIOMETER OF THE TIROS 3 METEOROLOGICAL SATELLITE MEASURED THE EMITTED AND REFLECTED RADIATION OF THE EARTH AND ITS ATMOSPHERE. THE FIVE-CHANNEL RADIOMETER SCANNED THE EARTH AND SPACE AS THE SATELLITE SPUN ABOUT ITS AXIS. THE RADIOMETER'S BI-DIRECTIONAL OPTICAL AXES WERE INCLINED TO THE SATELLITE SPIN AXIS AT ANGLES OF 45 AND 135 DEG. THE SENSOR USED BOLOMETER DETECTORS AND FILTERS TO LIMIT THE SPECTRAL RESPONSE AND TO PROVIDE COMPREHENSIVE DATA BY MEASURING RADIATION INTENSITIES IN SELECTED PORTIONS OF THE INFRARED SPECTRUM. THE SPECTRAL BANDWIDTH OF EACH CHANNEL (IN MICRONS) AND ITS ASSOCIATED PARAMETER WERE -- CHANNEL 1, 6.0 TO 6.5 (WATER VAPOR ABSORPTION), CHANNEL 2, 8.0 TO 12.0 (ATMOSPHERIC WINDOW), CHANNEL 3, 0.2 TO 6.0 (REFLECTED SOLAR RADIATION), CHANNEL 4, 7.5 TO 30 (TERRESTRIAL RADIATION), AND CHANNEL 5, 0.55 TO 0.75 (RESPONSE OF TV SYSTEM). RESPONSE CHARACTERISTICS OF ALL CHANNELS DEGRADED RAPIDLY AFTER LAUNCH. THE GREATEST UNCERTAINTY IN THE RADIATION MEASUREMENTS IS DUE TO THE APPARENT SHIFT IN THE ZERO RADIATION LEVEL. DATA ARE USABLE FOR CHANNELS 1, 2, 3, 4, AND 5 UP TO ORBITS 118, 875, 875, 130, AND 300, RESPECTIVELY. IDENTICAL EXPERIMENTS, EXCEPT FOR MINOR CHANGES IN THE OPTICAL SYSTEM, WERE FLOWN ON TIROS 2, 4, AND 7. A MORE COMPLETE DESCRIPTION OF THE SCANNING RADIOMETER INSTRUMENTATION IS GIVEN IN THE JOURNAL OF THE OPTICAL SOCIETY OF AMERICA, VOL. 51, 1386-1393, DECEMBER 1961.

REFERENCES

242, 243, 293, 298, 301, 317, 318, 320, 321, 322, 323, 330, 362, 365, 385, 404, 414, 440, 442, 443, 445, 446, 487, 490, 496, 574, 595, 606, 664, 666, 686, 687, 688, 703, 706, 760, 761, 769, 770, 839, 878, 880, 896, 912, AND 926.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 61-017A-04

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 012362

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 3 TV SYSTEM WAS DESIGNED TO OBTAIN DATA FOR OPERATIONAL METEOROLOGICAL USE AND TO FURTHER RESEARCH TOWARD OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE EXPERIMENT CONSISTED OF TWO REDUNDANT PAIRS OF TV CAMERAS, MAGNETIC TAPE RECORDERS, AND TV TRANSMITTERS. THE TWO SENSOR UNITS WERE CAPABLE OF CONCURRENT OR INDEPENDENT OPERATION. THE TWO WIDE-ANGLE (104 DEG) VIDICON CAMERAS WERE MOUNTED ON THE BASEPLATE OF THE SPACECRAFT WITH THEIR OPTICAL AXES PARALLEL TO THE SPACECRAFT SPIN AXIS, WHICH WAS IN THE ORBITAL PLANE. THE CAMERAS WERE AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN THEY CAME IN VIEW OF THE EARTH. THE PICTURES WERE TRANSMITTED DIRECTLY TO EITHER OF TWO GROUND RECEIVING STATIONS OR STORED ON MAGNETIC TAPE FOR LATER PLAYBACK, DEPENDING ON WHETHER THE SATELLITE WAS WITHIN OR BEYOND THE COMMUNICATION RANGE OF THE STATION. THE TV CAMERAS USED 500-SCAN-LINE, 1.27-CM-DIAMETER VIDICONS. THE RECORDERS COULD STORE UP TO 32 FRAMES OF PICTURES. TRANSMISSION OF THE 32-FRAME SEQUENCE WAS ACCOMPLISHED IN 100 SEC BY A 3-W FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 237 MHZ. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. THE EXPERIMENT WAS CAPABLE OF PRODUCING DAYTIME CLOUDCOVER PICTURES FOR THE REGION BETWEEN 55 DEG S TO 55 DEG N LATITUDE. ONE OF THE WIDE-ANGLE CAMERAS FAILED 13 DAYS AFTER LAUNCH. THE REMAINING CAMERA PRODUCED USEFUL OPERATIONAL DATA UNTIL JANUARY 23, 1962. THE EXPERIMENT WAS HIGHLY SUCCESSFUL. LAUNCHED AT THE START OF THE HURRICANE SEASON, THE EXPERIMENT WAS CREDITED WITH OBSERVING ALL SIX MAJOR HURRICANES OF THE 1961 SEASON. DURING THE OPERATIONAL LIFETIME OF THE EXPERIMENT, OVER 24,000 USABLE PICTURES WERE OBTAINED. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR A COMPLETE INDEX OF THESE DATA, SEE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - TIROS 3, TELEVISION CLOUD PHOTOGRAPHY,' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

38, 384, 409, 442, 460, 534, 535, 620, 650, 793, AND 822.

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SPACECRAFT COMMON NAME- TIROS 4 NSSDC ID 62-002A

ALTERNATE NAMES- 1962 BETA 1, A 9

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 02/08/62
APOGEE- 724.000 KM ALT
PERIGEE- 609.000 KM ALT
PERIOD- 100.4 MIN
INCLINATION- 48.297 DEG

OTHER INFORMATION
SPACECRAFT WT- 129. KG
LAUNCH DATE- 02/08/62
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 063062

SPACECRAFT PERSONNEL

PM - R.M.	RADOS	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 4 (TELEVISION AND INFRARED OBSERVATION SATELLITE) WAS A SPIN-STABILIZED METEOROLOGICAL SPACECRAFT DESIGNED TO TEST EXPERIMENTAL TELEVISION TECHNIQUES AND INFRARED EQUIPMENT. THE SATELLITE WAS IN THE FORM OF AN 18-SIDED RIGHT PRISM, 107 CM IN DIAMETER AND 56 CM HIGH. THE TOP AND SIDES OF THE SPACECRAFT WERE COVERED WITH APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS. IT WAS EQUIPPED WITH TWO INDEPENDENT TELEVISION CAMERA SUBSYSTEMS FOR TAKING CLOUDCOVER PICTURES AND THREE RADIOMETERS (TWO-CHANNEL LOW-RESOLUTION, OMNIDIRECTIONAL, AND FIVE-CHANNEL SCANNING) FOR MEASURING RADIATION FROM THE EARTH AND ITS ATMOSPHERE. THE SATELLITE SPIN RATE WAS MAINTAINED BETWEEN 8 AND 12 RPM BY THE USE OF FIVE DIAMETRICALLY OPPOSED PAIRS OF SMALL SOLID-FUEL THRUSTERS. THE SATELLITE SPIN AXIS COULD BE ORIENTED TO WITHIN 1- TO 2-DEG ACCURACY BY USE OF A MAGNETIC CONTROL DEVICE CONSISTING OF 250 CORES OF WIRE WOUND AROUND THE OUTER SURFACE OF THE SPACECRAFT. THE INTERACTION BETWEEN THE INDUCED MAGNETIC FIELD IN THE SPACECRAFT AND THE EARTH'S MAGNETIC FIELD PROVIDED THE NECESSARY TORQUE FOR ALTITUDE CONTROL. THE FLIGHT CONTROL SYSTEM ALSO OPTIMIZED THE PERFORMANCE OF THE SOLAR CELLS AND TV CAMERAS AND PROTECTED THE FIVE-CHANNEL INFRARED RADIOMETER FROM PROLONGED EXPOSURE TO DIRECT SUNLIGHT. THE SPACECRAFT PERFORMED NORMALLY UNTIL MAY 3, 1962, WHEN ONE CAMERA FAILED. ON JUNE 10, 1962, THE OTHER CAMERA'S TAPE RECORDER FAILED. THE SCANNING RADIOMETER PROVIDED USABLE DATA UNTIL JUNE 30, 1962. A COMPLETE DESCRIPTION AND PERFORMANCE SUMMARY FOR TIROS 4 IS PRESENTED IN THE JOURNAL OF THE BRITISH INTERPLANETARY SOCIETY, VOL. 19, 386-409, 1963-64.

REFERENCES

84, 145, 218, 219, 260, 331, 511, 533, 571, 572, 574, 603, 621, 675, 700, 743, 772, 785, 790, 810, 857, AND 924.

EXPERIMENT NAME- LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER — NSSDC ID 62-002A-01

EXPERIMENT PERSONNEL

PI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 062862

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 4 LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER CONSISTED PRIMARILY OF TWO SETS OF BOLOMETERS IN THE FORM OF HOLLOW ALUMINUM HEMISPHERES, MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT, WHOSE OPTICAL AXES WERE PARALLEL TO THE SPIN AXIS. THE BOLOMETERS WERE THERMALLY ISOLATED FROM

BUT IN CLOSE PROXIMITY TO REFLECTING MIRRORS SO THAT THE HEMISPHERES BEHAVED VERY MUCH LIKE ISOLATED SPHERES IN SPACE. THE EXPERIMENT WAS DESIGNED TO MEASURE THE AMOUNT OF SOLAR ENERGY ABSORBED, REFLECTED, AND EMITTED BY THE EARTH AND ITS ATMOSPHERE. ONE BOLOMETER IN EACH SET WAS PAINTED BLACK, AND ONE WAS PAINTED WHITE. THE BLACK BOLOMETER ABSORBED MOST OF THE INCIDENT RADIATION WHILE THE WHITE BOLOMETER WAS SENSITIVE MAINLY TO RADIATION WITH WAVELENGTHS LONGER THAN APPROXIMATELY 4 MICRONS. THE REFLECTED AND EMITTED RADIATION COULD THUS BE SEPARATED. THE SENSOR TEMPERATURES WERE MEASURED BY THERMISTORS FASTENED TO THE INSIDE OF THE HOLLOW HEMISPHERE. THE SENSOR TEMPERATURES, TAKEN EVERY 29 SEC, WERE AN AVERAGE OF THE TWO TEMPERATURES FROM THE MATCHED THERMISTORS. THE EXPERIMENT WAS A SUCCESS, AND USABLE DATA WERE RECEIVED FROM FEBRUARY 8, 1962, TO JUNE 28, 1962. IDENTICAL EXPERIMENTS WERE FLOWN ON TIROS 3 AND 7, AND A SIMILAR ONE WAS CARRIED ON EXPLORER 7.

REFERENCES

132, 318, 490, 503, 531, 688, 845, 846, 880, AND 932.

EXPERIMENT NAME- WIDEFIELD RADIOMETER　　　　NSSDC ID 62-002A-02

EXPERIMENT PERSONNEL

PI - R.A. HANEL	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 061062

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 4 LOW-RESOLUTION, NONSCANNING, TWO-CHANNEL RADIOMETER MEASURED THE THERMAL AND REFLECTED SOLAR RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM. THE RADIOMETER CONSISTED OF TWO DETECTORS - ONE BLACK AND ONE WHITE THERMISTOR BOLOMETER. EACH OF THE DETECTORS WAS MOUNTED IN THE APEX OF A HIGHLY REFLECTIVE MYLAR CONE. THE BLACK DETECTOR RESPONDED EQUALLY TO REFLECTED SOLAR RADIATION AND LONG-WAVE TERRESTRIAL RADIATION (0.2 TO 50 MICRONS). THE WHITE DETECTOR REFLECTED SOLAR AND VISIBLE RADIATION AND MEASURED ONLY LONG-WAVE THERMAL RADIATION (5 TO 50 MICRONS). THE OPTICAL AXIS OF EACH DETECTOR WAS PARALLEL TO THE SATELLITE SPIN AXIS. THE FIELD OF VIEW (50 DEG) OF THE DETECTORS WHEN VIEWING THE EARTH DIRECTLY BELOW THE SATELLITE WAS A CIRCLE OF 832 KM DIAMETER. THIS AREA WAS WITHIN THE FIELD OBSERVED BY THE WIDE-ANGLE TELEVISION CAMERA, AND THUS A DIRECT MEASURE OF THE HEAT BALANCE OF THE EARTH-ATMOSPHERE SYSTEM VIEWED IN ANY OF THE PICTURES WAS PROVIDED. THE RADIATION DATA WERE RECORDED ON A CONTINUOUSLY RUNNING ENDLESS LOOP MAGNETIC TAPE THAT COMPLETED ITS CYCLE IN ABOUT 100 MIN. DATA OLDER THAN 100 MIN WERE ERASED AS NEWER DATA WERE RECORDED. THE EXPERIMENT PERFORMED NORMALLY, BUT THE QUALITY OF THE DATA WAS VERY POOR BECAUSE THE DETECTORS EXPERIENCED PROBLEMS WITH DECREASED SENSITIVITY, DETECTOR-SPACECRAFT THERMAL COUPLING, AND LESS THAN NOMINAL RADIATIVE CHARACTERISTICS SIMILAR TO THOSE THAT OCCURRED WITH IDENTICAL EXPERIMENTS FLOWN ON TIROS 2 AND 3. CONSEQUENTLY, THE COLLECTED DATA WERE TOO AMBIGUOUS FOR REDUCTION OR ANALYSIS. THE EXPERIMENT IS DESCRIBED IN NASA DOCUMENT TN D-614, 'THE TIROS LOW RESOLUTION RADIOMETER.'

REFERENCES

105, 318, 329, 491, 549, AND 574.

EXPERIMENT NAME- SCANNING RADIOMETER　　　　NSSDC ID 62-002A-03

EXPERIMENT PERSONNEL
PI - J.D. BARKSDALE NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 063062

EXPERIMENT BRIEF DESCRIPTION

THE SCANNING RADIOMETER OF THE TIROS 4 METEOROLOGICAL SATELLITE MEASURED THE EMITTED AND REFLECTED RADIATION OF THE EARTH AND ITS ATMOSPHERE. THE FIVE-CHANNEL RADIOMETER SCANNED THE EARTH AND SPACE AS THE SATELLITE SPUN ABOUT ITS AXIS. THE RADIOMETER'S BI-DIRECTIONAL OPTICAL AXES WERE INCLINED TO THE SATELLITE SPIN AXIS AT ANGLES OF 45 AND 135 DEG. THE SENSOR USED BOLOMETER DETECTORS AND FILTERS TO LIMIT THE SPECTRAL RESPONSE AND TO PROVIDE COMPREHENSIVE DATA BY MEASURING RADIATION INTENSITIES IN SELECTED PORTIONS OF THE INFRARED SPECTRUM. THE SPECTRAL BANDWIDTH OF EACH CHANNEL (IN MICRONS) AND ITS ASSOCIATED PARAMETER WERE -- CHANNEL 1, 6.0 TO 6.5 (WATER VAPOR ABSORPTION), CHANNEL 2, 8.0 TO 12.0 (ATMOSPHERIC WINDOW), CHANNEL 3, 0.2 TO 6.0 (REFLECTED SOLAR RADIATION), CHANNEL 4 WAS USED TO TRANSMIT A REDUNDANT TIME REFERENCE SIGNAL THEREBY ELIMINATING THE BROADBAND THERMAL RADIATION CHANNEL THAT WAS CARRIED IN PREVIOUS TIROS SATELLITES, AND CHANNEL 5, 0.55 TO 0.75 (RESPONSE OF TV SYSTEM). INITIALLY ALL CHANNELS PERFORMED NORMALLY. THE MAJOR LIMITATION OF THE EXPERIMENT IS THE UNCERTAINTY IN THE ABSOLUTE VALUE OF THE MEASUREMENTS, RESULTING FROM THE POSTLAUNCH DEGRADATION OF THE SENSOR RESPONSE. IN STUDIES INVOLVING COMPARATIVE MEASUREMENTS OVER MANY DAYS, THE DATA FROM CHANNELS 2 AND 3 AFTER ORBIT 600 SHOULD BE USED WHENEVER POSSIBLE BECAUSE THE RESPONSE OF THESE TWO CHANNELS APPEARS TO STABILIZE AND REMAIN CONSTANT AFTER THAT TIME. THE LAST USABLE DATA WERE OBTAINED ON JUNE 30, 1962. IDENTICAL EXPERIMENTS, EXCEPT FOR MINOR CHANGES IN THE OPTICAL SYSTEM, WERE FLOWN ON TIROS 2, 3, AND 7. A MORE COMPLETE DESCRIPTION OF THE SCANNING RADIOMETER INSTRUMENTATION IS GIVEN IN THE JOURNAL OF THE OPTICAL SOCIETY OF AMERICA, VOL. 51, 1386-1393, DECEMBER 1961.

REFERENCES

244, 317, 318, 320, 330, 365, 445, 446, 487, 490, 507, 606, 664, 688, 703, 749, 753, 754, 769, 802, 803, 806, 836, 880, 896, 926, 935, AND 936.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 62-002A-04

EXPERIMENT PERSONNEL
PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 061862

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 4 TV SYSTEM WAS DESIGNED TO OBTAIN DATA FOR OPERATIONAL METEOROLOGICAL USE AND TO FURTHER RESEARCH TOWARD OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE EXPERIMENT CONSISTED OF TWO INDEPENDENT PAIRS OF TV CAMERAS, MAGNETIC TAPE RECORDERS, AND TV TRANSMITTERS. THE TWO SENSOR UNITS WERE CAPABLE OF CONCURRENT OR INDEPENDENT OPERATION. THE CAMERAS, ONE WIDE ANGLE (104 DEG) AND ONE MEDIUM ANGLE (80 DEG), WERE MOUNTED ON THE BASEPLATE OF THE SPACECRAFT WITH THEIR OPTICAL AXES PARALLEL TO THE SPACECRAFT SPIN AXIS, WHICH WAS IN THE ORBITAL PLANE. THE CAMERAS WERE AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN THEY CAME IN VIEW OF THE EARTH. THE PICTURES WERE TRANSMITTED DIRECTLY TO EITHER OF TWO GROUND RECEIVING STATIONS OR STORED ON MAGNETIC TAPE FOR LATER PLAYBACK, DEPENDING ON WHETHER THE SATELLITE WAS WITHIN OR BEYOND THE COMMUNICATION

RANGE OF THE STATION. THE TV CAMERAS USED 500-SCAN-LINE, 1.27-CM-DIAMETER VIDICONS. THE RECORDERS COULD STORE UP TO 32 FRAMES OF PICTURES. TRANSMISSION OF THE 32-FRAME SEQUENCE WAS ACCOMPLISHED IN 100 SEC BY A 3-W FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 237 MHZ. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE TAKEN BY THE WIDE-ANGLE CAMERA COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. THE MEDIUM-ANGLE CAMERA COVERED A 725- BY 725-KM SQUARE AND HAD A RESOLUTION OF 2 KM. THE EXPERIMENT WAS CAPABLE OF PRODUCING DAYTIME CLOUDCOVER PICTURES FOR THE REGION BETWEEN 55 DEG S TO 55 DEG N LATITUDE. THE EXPERIMENT PERFORMED NORMALLY UNTIL MAY 3, 1962, WHEN THE WIDE-ANGLE CAMERA FAILED. THE TAPE RECORDER ON THE REMAINING CAMERA FAILED ON JUNE 10, 1962. HOWEVER, LIMITED REAL-TIME TV PICTURES WERE AVAILABLE UP TO JUNE 18, 1962, AT WHICH TIME THE SYSTEM WAS DEACTIVATED. THE EXPERIMENT WAS HIGHLY SUCCESSFUL, WITH OVER 23,000 USABLE TV PICTURES TRANSMITTED. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR A COMPLETE INDEX OF THESE DATA, SEE 'CATALOG OF METEOROLOGICAL DATA - TIROS 4 TELEVISION CLOUD PHOTOGRAPHY,' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

39, 384, 409, 460, 650, 738, 740, 802, AND 879.

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SPACECRAFT COMMON NAME- TIROS 5 NSSDC ID 62-025A

ALTERNATE NAMES- 1962 ALPHA ALPHA 1, A 50

ORBITAL INFORMATION

ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 07/13/62
APOGEE- 974.000 KM ALT
PERIGEE- 588.000 KM ALT
PERIOD- 100.4 MIN
INCLINATION- 58. DEG

OTHER INFORMATION

SPACECRAFT WT- 129. KG
LAUNCH DATE- 06/19/62
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 051463

SPACECRAFT PERSONNEL

PM - R.M.	RADOS	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 5 (TELEVISION AND INFRARED OBSERVATION SATELLITE) WAS DESIGNED TO FURTHER DEMONSTRATE THE CAPABILITY OF A SPACECRAFT TO OBSERVE, RECORD, AND TRANSMIT TV CLOUDCOVER PICTURES FOR USE IN OPERATIONAL WEATHER ANALYSIS AND FORECASTING. THE SPIN-STABILIZED SATELLITE WAS IN THE FORM OF AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS SUPPLIED TO THE SPACECRAFT BY APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. A SINGLE MONOPOLE ANTENNA FOR RECEPTION OF GROUND COMMANDS EXTENDED OUT FROM THE TOP OF THE COVER ASSEMBLY. A PAIR OF CROSSED-DIPOLE TELEMETRY ANTENNAS (235 MHZ) PROJECTED DOWN AND DIAGONALLY OUT FROM THE BASEPLATE. THE SATELLITE SPIN RATE WAS MAINTAINED BETWEEN 8 AND 12 RPM BY THE USE OF FIVE DIAMETRICALLY OPPOSED PAIRS OF SMALL SOLID-FUEL THRUSTERS MOUNTED AROUND THE EDGE OF THE BASEPLATE. PROPER ATTITUDE WAS MAINTAINED TO WITHIN A 1- TO 2-DEG ACCURACY BY USE OF A MAGNETIC CONTROL

DEVICE CONSISTING OF 250 CORES OF WIRE WOUND AROUND THE OUTER SURFACE OF THE SPACECRAFT. THE INTERACTION BETWEEN THE INDUCED MAGNETIC FIELD IN THE SPACECRAFT AND THE EARTH'S MAGNETIC FIELD PROVIDED THE NECESSARY TORQUE FOR ATTITUDE CONTROL. THE SATELLITE WAS EQUIPPED WITH TWO 1.27-CM-DIAMETER VIDICON TV CAMERAS, ONE MEDIUM ANGLE AND ONE WIDE ANGLE, FOR TAKING EARTH CLOUDCOVER PICTURES. THE PICTURES WERE TRANSMITTED DIRECTLY TO EITHER OF TWO GROUND RECEIVING STATIONS OR WERE STORED IN A TAPE RECORDER ON BOARD FOR SUBSEQUENT PLAYBACK DEPENDING ON WHETHER THE SATELLITE WAS WITHIN OR BEYOND THE COMMUNICATION RANGE OF THE STATION. TIROS 5'S GREATER ORBITAL INCLINATION (58 DEG VS 48 DEG FOR PREVIOUS TIROS SPACECRAFT) EXTENDED THE EFFECTIVE TV COVERAGE TO 65 DEG N TO 65 DEG S LATITUDE. WITH THE EXCEPTION OF THE FAILURE OF THE MEDIUM-ANGLE CAMERA 17 DAYS AFTER LAUNCH, THE SATELLITE PERFORMED NORMALLY UNTIL MAY 14, 1963, WHEN IT WAS DEACTIVATED AFTER THE SHUTTER ELECTRONICS FAILED ON THE WIDE-ANGLE CAMERA.

REFERENCES

145, 219, 245, 260, 572, 574, 639, 675, 700, 772, 789, 810, AND 924.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 62-025A-01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 051463

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 5 TV SYSTEM WAS DESIGNED TO PROVIDE DATA FOR OPERATIONAL METEOROLOGICAL USE AND TO FURTHER RESEARCH TOWARD OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE EXPERIMENT CONSISTED OF TWO INDEPENDENT PAIRS OF TV CAMERAS, MAGNETIC TAPE RECORDERS, AND TV TRANSMITTERS. THE TWO SENSOR UNITS WERE CAPABLE OF CONCURRENT OR INDEPENDENT OPERATION. THE CAMERAS, ONE WIDE ANGLE (104 DEG) AND ONE MEDIUM ANGLE (80 DEG), WERE MOUNTED ON THE BASEPLATE OF THE SPACECRAFT WITH THEIR OPTICAL AXES PARALLEL TO THE SPACECRAFT SPIN AXIS, WHICH WAS IN THE ORBITAL PLANE. THE CAMERAS WERE AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN THEY CAME IN VIEW OF THE EARTH. THE TV CAMERA SYSTEM COULD OPERATE IN EITHER REAL-TIME OR TAPE RECORDER MODE, DEPENDING ON WHETHER THE SPACECRAFT WAS WITHIN OR BEYOND COMMUNICATION RANGE OF EITHER OF TWO GROUND RECEIVING STATIONS. THE TV CAMERAS USED 500-SCAN-LINE, 1.27-CM-DIAMETER VIDICONS. THE RECORDERS COULD STORE UP TO 32 FRAMES OF PICTURES. TRANSMISSION OF THE 32-FRAME SEQUENCE WAS ACCOMPLISHED IN 100 SEC BY A 2-W FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE TAKEN BY THE WIDE-ANGLE CAMERA COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. A PICTURE FROM THE MEDIUM-ANGLE CAMERA COVERED A 725- BY 725-KM SQUARE AND HAD A RESOLUTION OF 2 KM. THE TV COVERAGE ON TIROS 5 WAS INCREASED TO COVER THE REGION BETWEEN 65 DEG S TO 65 N, THE RESULT OF A 10 DEG INCREASE IN THE SPACECRAFT'S ORBITAL INCLINATION OVER PREVIOUS TIROS SATELLITES. THE MEDIUM-ANGLE CAMERA FAILED SOON AFTER LAUNCH. THE REMAINING WIDE-ANGLE CAMERA PERFORMED NORMALLY UNTIL MAY 14, 1963, WHEN THE SHUTTER ELECTRONICS FAILED. THE TV EXPERIMENT PRODUCED OVER 48,000 METEOROLOGICALLY USEFUL PICTURES. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR A COMPLETE INDEX OF THESE DATA, SEE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - TIROS 5 TELEVISION CLOUD PHOTOGRAPHY,' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

40, 352, 364, 409, 437, 460, 650, 698, 785, AND 793.

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SPACECRAFT COMMON NAME- TIROS 6 NSSDC ID 62-047A
ALTERNATE NAMES- 1962 ALPHA PSI 1, A 51

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 09/19/62
APOGEE- 713.000 KM ALT
PERIGEE- 686.000 KM ALT
PERIOD- 98.73 MIN
INCLINATION- 58.32 DEG

OTHER INFORMATION
SPACECRAFT WT- 127. KG
LAUNCH DATE- 09/18/62
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 102163

SPACECRAFT PERSONNEL

PM - R.M.	RADOS	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 6 (TELEVISION AND INFRARED OBSERVATION SATELLITE) WAS DESIGNED TO FURTHER DEMONSTRATE THE CAPABILITY OF A SATELLITE TO OBSERVE, RECORD, AND TRANSMIT TV CLOUDCOVER PICTURES FOR USE IN OPERATIONAL WEATHER ANALYSIS AND FORECASTING. THE SPIN-STABILIZED SATELLITE WAS IN THE FORM OF AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED BY APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. A SINGLE MONOPOLE ANTENNA FOR RECEPTION OF GROUND COMMANDS EXTENDED OUT FROM THE TOP OF THE COVER ASSEMBLY. A PAIR OF CROSSED-DIPOLE TELEMETRY ANTENNAS (235 MHZ) PROJECTED DOWN AND DIAGONALLY OUT FROM THE BASEPLATE. THE SATELLITE SPIN RATE WAS MAINTAINED BETWEEN 8 AND 12 RPM BY THE USE OF FIVE DIAMETRICALLY OPPOSED PAIRS OF SMALL SOLID-FUEL THRUSTERS MOUNTED AROUND THE EDGE OF THE BASEPLATE. PROPER ATTITUDE WAS MAINTAINED TO WITHIN A 1- TO 2-DEG ACCURACY BY USE OF A MAGNETIC CONTROL DEVICE CONSISTING OF 250 COILS OF WIRE WOUND AROUND THE OUTER SURFACE OF THE SPACECRAFT. THE INTERACTION BETWEEN THE INDUCED MAGNETIC FIELD IN THE SPACECRAFT AND THE EARTH'S MAGNETIC FIELD PROVIDED THE TORQUE NECESSARY FOR ATTITUDE CONTROL. THE SATELLITE WAS EQUIPPED WITH TWO 1.27-CM-DIAMETER VIDICON TV CAMERAS, ONE MEDIUM ANGLE AND ONE WIDE ANGLE, FOR TAKING EARTH CLOUDCOVER PICTURES. THE PICTURES WERE TRANSMITTED DIRECTLY TO EITHER OF TWO GROUND RECEIVING STATIONS OR WERE STORED IN A TAPE RECORDER ON BOARD FOR SUBSEQUENT PLAYBACK, DEPENDING ON WHETHER THE SATELLITE WAS WITHIN OR BEYOND THE COMMUNICATION RANGE OF THE STATION. THE SATELLITE PERFORMED NORMALLY FROM LAUNCH UNTIL NOVEMBER 29, 1962, WHEN THE MEDIUM-ANGLE CAMERA VIDICON FAILED. THE WIDE-ANGLE CAMERA VIDICON SYSTEM FAILED ON OCTOBER 21, 1963, AND THE SPACECRAFT WAS DEACTIVATED SHORTLY THEREAFTER.

REFERENCES

134, 145, 219, 245, 260, 297, 511, 533, 571, 572, 621, 639, 675, 700, 772, 789, 810, AND 924.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 62-047A-01

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 102163

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 6 TV SYSTEM WAS DESIGNED TO OBTAIN DATA FOR OPERATIONAL METEOROLOGICAL USE AND TO FURTHER RESEARCH TOWARD OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE EXPERIMENT CONSISTED OF TWO INDEPENDENT PAIRS OF TV CAMERAS, MAGNETIC TAPE RECORDERS, AND TV TRANSMITTERS. THE TWO SENSOR UNITS WERE CAPABLE OF CONCURRENT OR INDEPENDENT OPERATION. THE CAMERAS, ONE WIDE ANGLE (104 DEG) AND ONE MEDIUM ANGLE (80 DEG), WERE MOUNTED ON THE BASEPLATE OF THE SPACECRAFT WITH THEIR OPTICAL AXES PARALLEL TO THE SPACECRAFT SPIN AXIS, WHICH WAS IN THE ORBITAL PLANE. THE CAMERAS WERE AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN THEY CAME IN VIEW OF THE EARTH. THE TV CAMERA SYSTEM COULD OPERATE IN EITHER REAL-TIME OR TAPE RECORDER MODE, DEPENDING ON WHETHER THE SPACECRAFT WAS WITHIN OR BEYOND COMMUNICATION RANGE OF EITHER OF TWO GROUND RECEIVING STATIONS. THE TV CAMERAS USED 500-SCAN-LINE, 1.27-CM-DIAMETER VIDICONS. THE RECORDERS COULD STORE UP TO 32 FRAMES OF PICTURES. TRANSMISSION OF THE 32-FRAME SEQUENCE WAS ACCOMPLISHED IN 100 SEC BY A 2-W FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE TAKEN BY THE WIDE-ANGLE CAMERA COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. THE MEDIUM-ANGLE CAMERA COVERED A 725- BY 725-KM SQUARE AND HAD A RESOLUTION OF 2 KM. THE EXPERIMENT WAS CAPABLE OF PRODUCING DAYTIME CLOUDCOVER PICTURES FOR THE REGION 65 DEG S TO 65 DEG N LATITUDE. THE CAMERA SYSTEMS PERFORMED NORMALLY AFTER LAUNCH UNTIL NOVEMBER 29, 1962, WHEN THE MEDIUM-ANGLE CAMERA VIDICON FAILED. THE REMAINING CAMERA SYSTEM FAILED ON OCTOBER 21, 1963. THE EXPERIMENT TRANSMITTED APPROXIMATELY 60,000 METEOROLOGICALLY USEFUL PICTURES AND FURNISHED INFORMATION LEADING TO MANY STORM ADVISORIES IN BOTH THE U.S. AND ABROAD. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR A COMPLETE INDEX OF THESE DATA, SEE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - TIROS 6 TELEVISION CLOUD PHOTOGRAPHY,' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

41, 352, 364, 409, 437, 460, 534, 537, 650, 698, AND 793.

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SPACECRAFT COMMON NAME- TIROS 7 NSSDC ID 63-024A
ALTERNATE NAMES- A 52

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 08/19/63

OTHER INFORMATION
SPACECRAFT WT- 135. KG
LAUNCH DATE- 06/19/63

APOGEE- 649.000 KM ALT
PERIGEE- 621.000 KM ALT
PERIOD- 97.42 MIN
INCLINATION- 58.236 DEG

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 123165

SPACECRAFT PERSONNEL

PM - R.M.	RADOS	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 7 (TELEVISION AND INFRARED OBSERVATION SATELLITE) WAS A SPIN-STABILIZED METEOROLOGICAL SPACECRAFT DESIGNED TO TEST EXPERIMENTAL TELEVISION TECHNIQUES AND INFRARED EQUIPMENT. THE SATELLITE WAS IN THE FORM OF AN 18-SIDED RIGHT PRISM, 107 CM IN DIAMETER AND 56 CM HIGH. THE TOP AND SIDES OF THE SPACECRAFT WERE COVERED WITH APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS. IT WAS EQUIPPED WITH TWO INDEPENDENT TELEVISION CAMERA SUBSYSTEMS FOR TAKING CLOUDCOVER PICTURES, PLUS AN OMNIDIRECTIONAL RADIOMETER AND A FIVE-CHANNEL SCANNING RADIOMETER FOR MEASURING RADIATION FROM THE EARTH AND ITS ATMOSPHERE. THE SATELLITE SPIN RATE WAS MAINTAINED BETWEEN 8 AND 12 RPM BY THE USE OF FIVE DIAMETRICALLY OPPOSED PAIRS OF SMALL, SOLID-FUEL THRUSTERS. A MAGNETIC ATTITUDE CONTROL DEVICE PERMITTED THE SATELLITE SPIN AXIS TO BE ORIENTED TO WITHIN 1 TO 2 DEG OF A PREDETERMINED ATTITUDE. THE FLIGHT CONTROL SYSTEM ALSO OPTIMIZED THE PERFORMANCE OF THE SOLAR CELLS AND TV CAMERAS AND PROTECTED THE FIVE-CHANNEL INFRARED RADIOMETER FROM PROLONGED EXPOSURE TO DIRECT SUNLIGHT. THE SPACECRAFT PERFORMED NORMALLY UNTIL DECEMBER 31, 1965, AND SPORADICALLY UNTIL FEBRUARY 3, 1967. THE SPACECRAFT WAS OPERATED FOR AN ADDITIONAL 1.5 YEARS TO COLLECT ENGINEERING DATA. IT WAS DEACTIVATED ON JUNE 3, 1968. A MORE COMPLETE DESCRIPTION OF THE SPACECRAFT AND EXPERIMENT CONFIGURATIONS ARE PRESENTED IN THE JOURNAL OF THE BRITISH INTERPLANETARY SOCIETY, VOL. 19, 386-409, 1963-64.

REFERENCES

84, 145, 218, 219, 246, 260, 511, 533, 551, 572, 603, 621, 639, 700, 743, 772, 789, 790, 810, AND 924.

EXPERIMENT NAME- LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER

NSSDC ID 63-024A-01

EXPERIMENT PERSONNEL

PI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 091363

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 7 LOW-RESOLUTION OMNIDIRECTIONAL RADIOMETER CONSISTED PRIMARILY OF TWO SETS OF BOLOMETERS IN THE FORM OF HOLLOW ALUMINUM HEMISPHERES, MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT, WHOSE OPTICAL AXES WERE PARALLEL TO THE SPIN AXIS. THE BOLOMETERS WERE THERMALLY ISOLATED FROM BUT IN CLOSE PROXIMITY TO REFLECTING MIRRORS SO THAT THE HEMISPHERES BEHAVED VERY MUCH LIKE ISOLATED SPHERES IN SPACE. THE EXPERIMENT WAS DESIGNED TO MEASURE THE AMOUNT OF SOLAR ENERGY ABSORBED, REFLECTED, AND EMITTED BY THE EARTH AND ITS ATMOSPHERE. ONE BOLOMETER IN EACH SET WAS PAINTED BLACK, AND ONE WAS PAINTED WHITE. BOTH HAD A HIGH ABSORPTIVITY TO THE INFRARED RADIATION EMITTED FROM THE EARTH. THE BLACK BOLOMETER ALSO HAD A HIGH ABSORPTIVITY FOR SOLAR RADIATION, WHICH PROVIDED FOR SEPARATION OF THE

REFLECTED AND EMITTED RADIATION. THE SENSOR TEMPERATURES WERE MEASURED BY THERMISTORS FASTENED TO THE INSIDE OF THE HOLLOW HEMISPHERES. THE SENSOR TEMPERATURES, TAKEN EVERY 29 SEC, WERE AN AVERAGE OF THE TWO TEMPERATURES FROM THE MATCHED THERMISTORS. THE EXPERIMENT WAS A SUCCESS, AND USABLE DATA WERE RECEIVED FROM JUNE 19, 1963, TO SEPTEMBER 13, 1963. IDENTICAL EXPERIMENTS WERE FLOWN ON TIROS 3 (AND 4), AND A SIMILAR ONE WAS CARRIED ON EXPLORER 7.

REFERENCES

43, 132, 318, 531, 845, 846, 880, 885, AND 932.

EXPERIMENT NAME- SCANNING RADIOMETER NSSDC ID 63-024A-02

EXPERIMENT PERSONNEL

PI - J.D. BARKSDALE NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 061965

EXPERIMENT BRIEF DESCRIPTION

THE SCANNING RADIOMETER OF THE TIROS 7 METEOROLOGICAL SATELLITE MEASURED THE EMITTED AND REFLECTED RADIATION OF THE EARTH AND ITS ATMOSPHERE. THE FIVE-CHANNEL RADIOMETER SCANNED THE EARTH AND SPACE AS THE SATELLITE SPUN ABOUT ITS AXIS. THE RADIOMETER'S BI-DIRECTIONAL OPTICAL AXES WERE INCLINED TO THE SATELLITE SPIN AXIS AT ANGLES OF 45 AND 135 DEG. THE FIVE-CHANNEL SENSOR USED BOLOMETER DETECTORS AND FILTERS TO LIMIT THE SPECTRAL RESPONSE AND TO PROVIDE COMPREHENSIVE DATA BY MEASURING RADIATION INTENSITIES IN SELECTED PORTIONS OF THE INFRARED SPECTRUM. THE SPECTRAL BANDWIDTH OF EACH CHANNEL (IN MICRONS) AND ITS ASSOCIATED PARAMETER WERE AS FOLLOWS -- CHANNEL 1, 14.8 TO 15.5 (CARBON DIOXIDE ABSORPTION), CHANNEL 2, 8.0 TO 12.0 (ATMOSPHERIC WINDOW), CHANNEL 3, 0.2 TO 6.0 (REFLECTED SOLAR RADIATION), CHANNEL 4, 7.5 TO 30 (TERRESTRIAL RADIATION), AND CHANNEL 5, 0.55 TO 0.75 (RESPONSE OF TV SYSTEM). INITIAL PERFORMANCE WAS EXCELLENT. THE MAJOR LIMITATION OF THE EXPERIMENT IS THE UNCERTAINTY IN THE ABSOLUTE VALUES OF THE MEASUREMENTS, RESULTING FROM DEGRADATION OF THE SENSORS AND ALSO FROM ELECTRONIC DEGRADATION. IN UTILIZING MEASUREMENTS OVER EXTENDED PERIODS, CHANNEL 2 AND 5 DATA SHOULD BE USED INSTEAD OF CHANNEL 4 AND 3 DATA, RESPECTIVELY, WHEREVER POSSIBLE BECAUSE OF THE SUPERIOR STABILITY CHARACTERISTICS OF THE FORMER TWO CHANNELS. FOR STUDIES INVOLVING RELATIVE MEASUREMENTS OVER A SHORT PERIOD OF TIME, DATA FROM CHANNELS 4, 1, AND 3 ARE CONSIDERED TO BE VALID FROM LAUNCH TO FEBRUARY 23, 1964, NOVEMBER 14, 1964, AND DECEMBER 25, 1964, RESPECTIVELY. IDENTICAL EXPERIMENTS, EXCEPT FOR MINOR CHANGES IN THE OPTICAL SYSTEM, WERE FLOWN ON TIROS 2, 3, AND 4. A MORE COMPLETE DESCRIPTION OF THE SCANNING RADIOMETER INSTRUMENTATION IS GIVEN IN THE JOURNAL OF THE OPTICAL SOCIETY OF AMERICA, VOL. 51, 1386-1393, DECEMBER 1961.

REFERENCES

132, 248, 249, 250, 251, 296, 302, 303, 311, 318, 319, 320, 330, 344, 364, 403, 487, 563, 588, 606, 689, 690, 707, 762, 769, 798, 801, 836, 854, 880, 885, 903, 912, 914, 926, AND 941.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 63-024A-04

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 123165

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 7 TV SYSTEM WAS DESIGNED TO OBTAIN DATA FOR OPERATIONAL METEOROLOGICAL USE AND TO FURTHER RESEARCH TOWARD OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE EXPERIMENT CONSISTED OF TWO REDUNDANT PAIRS OF TV CAMERAS, MAGNETIC TAPE RECORDERS, AND TV TRANSMITTERS. THE TWO SENSOR UNITS WERE CAPABLE OF CONCURRENT OR INDEPENDENT OPERATION. THE TWO WIDE-ANGLE (104 DEG) VIDICON CAMERAS WERE MOUNTED ON THE BASEPLATE OF THE SPACECRAFT WITH THEIR OPTICAL AXES PARALLEL TO THE SPACECRAFT SPIN AXIS, WHICH WAS IN THE ORBITAL PLANE. THE CAMERAS WERE AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN THEY CAME IN VIEW OF THE EARTH. THE TV CAMERA SYSTEM COULD OPERATE IN EITHER REAL-TIME OR TAPE RECORDER MODE, DEPENDING ON WHETHER THE SPACECRAFT WAS WITHIN OR BEYOND COMMUNICATION RANGE OF EITHER OF TWO GROUND RECEIVING STATIONS. THE TV CAMERA USED 500-SCAN-LINE, 1.27-CM-DIAMETER VIDICONS. THE RECORDERS COULD STORE UP TO 32 FRAMES OF PICTURES. TRANSMISSION OF THE 32-FRAME SEQUENCE WAS ACCOMPLISHED IN 100 SEC BY A 2-W FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ. AT NOMINAL ATTIUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. THE EXPERIMENT WAS CAPABLE OF PRODUCING DAYTIME CLOUDCOVER PICTURES FOR THE REGION BETWEEN 65 DEG S TO 65 DEG N LATITUDE. THE EXPERIMENT YIELDED NUMEROUS METEOROLOGICALLY USEFUL PICTURES AND PROVIDED ALMOST CONTINUOUS HURRICANE COVERAGE DURING ITS APPROXIMATELY 2.5-YR OPERATIONAL LIFETIME. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR A COMPLETE INDEX OF THESE DATA, SEE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - TIROS 7 TELEVISION CLOUD PHOTOGRAPHY,' PARTS I THROUGH IV, FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

42, 43, 44, 45, 297, 352, 384, 409, 460, 534, 537, 552, 650, 698, AND 765.

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SPACECRAFT COMMON NAME- TIROS 8 NSSDC ID 63-054A
ALTERNATE NAMES- A 53

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 12/21/63
APOGEE- 765.000 KM ALT
PERIGEE- 691.000 KM ALT
PERIOD- 99.33 MIN
INCLINATION- 58.48 DEG

OTHER INFORMATION
SPACECRAFT WT- 119. KG
LAUNCH DATE- 12/21/63
OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 083165

SPACECRAFT PERSONNEL
PM - R.M. RADOS NASA-GSFC GREENBELT, MD.
PS - AERO. AND METEO. DIV NASA-GSFC GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 8 (TELEVISION AND INFRARED OBSERVATION SATELLITE) WAS DESIGNED TO DEVELOP IMPROVED CAPABILITIES FOR OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE SPIN-STABILIZED SPACECRAFT WAS IN THE FORM OF AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS SUPPLIED TO THE SPACECRAFT BY APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. A SINGLE MONOPOLE ANTENNA FOR RECEPTION OF GROUND COMMANDS EXTENDED OUT FROM THE TOP OF THE COVER ASSEMBLY. A PAIR OF CROSSED-DIPOLE TELEMETRY ANTENNAS (235 MHZ) PROJECTED DOWN AND DIAGONALLY OUT FROM THE BASEPLATE. MOUNTED AROUND THE EDGE OF THE BASEPLATE WERE FIVE DIAMETRICALLY OPPOSED PAIRS OF SMALL SOLID-FUEL THRUSTERS THAT MAINTAINED THE SATELLITE SPIN RATE BETWEEN 8 AND 12 RPM. PROPER ATTITUDE WAS MAINTAINED TO WITHIN A 1- TO 2-DEG ACCURACY BY USE OF A MAGNETIC CONTROL DEVICE CONSISTING OF 250 COILS OF WIRE WOUND AROUND THE OUTER SURFACE OF THE SPACECRAFT. THE INTERACTION BY THE INDUCED MAGNETIC FIELD IN THE SPACECRAFT AND THE EARTH'S MAGNETIC FIELD PROVIDED THE TORQUE NECESSARY FOR ATTITUDE CONTROL. TIROS 8 WAS THE FIRST SATELLITE TO BE EQUIPPED WITH AUTOMATIC PICTURE TRANSMISSION (APT) CAPABILITIES. THE APT EXPERIMENT PROVIDED REAL-TIME EARTH-CLOUD PICTURES TAKEN BY THE SATELLITE TO ANY PROPERLY EQUIPPED GROUND RECEIVING STATION. IN ADDITION TO AN APT CAMERA SYSTEM, THE SATELLITE CARRIED ONE WIDE-ANGLE (104 DEG) TV CAMERA. PICTURES TAKEN BY THE TV CAMERA WERE TRANSMITTED DIRECTLY OR WERE STORED IN A TAPE RECORDER ON BOARD FOR SUBSEQUENT PLAYBACK, DEPENDING ON WHETHER THE SPACECRAFT WAS WITHIN OR BEYOND COMMUNICATION RANGE OF EITHER OF TWO GROUND RECEIVING STATIONS. THE SPACECRAFT PERFORMED NORMALLY AFTER LAUNCH. OVER 50 GROUND STATIONS PARTICIPATED IN THE APT EXPERIMENT, WHICH WAS TERMINATED APPROXIMATELY 4 MONTHS AFTER LAUNCH OWING TO DEGRADATION OF THE APT CAMERA. THE WIDE-ANGLE TV CAMERA TRANSMITTED USEFUL DATA UNTIL AUGUST 31, 1965. THE SATELLITE WAS DEACTIVATED ON JULY 1, 1967, AFTER HAVING BEEN LEFT ON FOR AN ADDITIONAL TIME PERIOD FOR ENGINEERING PURPOSES.

REFERENCES

135, 145, 219, 252, 511, 551, 572, 639, 675, 700, 743, 772, 789, AND 924.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 63-054A-01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 083165

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 8 TV SYSTEM WAS DESIGNED TO FURTHER RESEARCH IN OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE EXPERIMENT INSTRUMENTATION CONSISTED OF A SINGLE WIDE-ANGLE (104 DEG) LENS TV CAMERA, A TWO-TRACK MAGNETIC TAPE RECORDER, AND A TRANSMITTER. THE CAMERA WAS MOUNTED ON THE BASEPLATE OF THE SPACECRAFT, WITH ITS OPTICAL AXIS PARALLEL TO THE SATELLITE SPIN AXIS. THE CAMERA SYSTEM COULD OPERATE IN EITHER REAL-TIME OR TAPE RECORDER MODE, DEPENDING ON WHETHER THE SPACECRAFT WAS WITHIN OR BEYOND COMMUNICATION RANGE OF EITHER OF TWO GROUND RECEIVING STATIONS. THE CAMERA WAS AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN IT CAME IN VIEW OF THE EARTH. THE TV TUBE WAS A 500-SCAN-LINE, 1.27-CM-DIAMETER VIDICON. THE

RECORDER COULD STORE UP TO 32 FRAMES OF PICTURES. THE PICTURE FRAMES WERE TRANSMITTED IN 100 SEC BY A 2-W FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. THE EXPERIMENT WAS CAPABLE OF PRODUCING CLOUDCOVER PICTURES FOR THE REGION BETWEEN 65 DEG S AND 65 DEG N. THE EXPERIMENT PERFORMED NORMALLY AFTER LAUNCH, AND GOOD DATA WERE OBTAINED UNTIL AUGUST 31, 1965. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF THESE DATA, SEE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - TIROS 8 TELEVISION CLOUD PHOTOGRAPHY,' PARTS I THROUGH III, SOLD BY THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

46, 47, 48, 297, 352, 384, 409, 437, 460, 552, 650, AND 698.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM — NSSDC ID 63-054A-02

EXPERIMENT PERSONNEL

PI - C.M. HUNTER — NASA-GSFC — GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 030064

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 8 AUTOMATIC PICTURE TRANSMISSION (APT) SUBSYSTEM WAS A CAMERA AND TRANSMITTER COMBINATION DESIGNED TO TEST THE FEASIBILITY OF TRANSMITTING LOCAL DAYTIME PICTURES OF CLOUDCOVER CONDITIONS TO PROPERLY EQUIPPED GROUND RECEIVING STATIONS ON A REAL-TIME BASIS. THE CAMERA SYSTEM CONSISTED OF A SINGLE CAMERA WITH A 2.54-CM-DIAMETER VIDICON. THE CAMERA USED A 108-DEG WIDE-ANGLE F/1.8 OBJECTIVE LENS, WITH A FOCAL LENGTH OF 5.7 MM, AND WAS MOUNTED ON THE SATELLITE BASEPLATE, WITH ITS OPTICAL AXIS PARALLEL TO THE SPACECRAFT SPIN AXIS. THE ACTUAL PICTURE TAKING REQUIRED 8 SEC AND THE TRANSMISSION 200 SEC. EARTH-CLOUD IMAGES RETAINED ON THE PHOTOSENSITIVE SURFACE OF THE VIDICON WERE READ OUT AT FOUR LINES PER SECOND TO PRODUCE AN 800-LINE PICTURE. A 5-W TV TRANSMITTER (136.95 MHZ) RELAYED THE PICTURES TO LOCAL APT STATIONS WITHIN COMMUNICATION RANGE. THE FACEPLATE OF THE VIDICON HAD RETICLE MARKS THAT APPEARED ON THE PICTURE FORMAT TO AID IN RELATING THE PICTURE TO ITS GEOGRAPHICAL POSITION ON THE EARTH'S SURFACE. AT NOMINAL SATELLITE ATTITUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE COVERED A 1200- BY 1200-KM SQUARE WITH A HORIZONTAL RESOLUTION OF 7.5 KM AT NADIR. THE EXPERIMENT PERFORMED NORMALLY, AND GOOD QUALITY PICTURES WERE OBTAINED UNTIL THE EXPERIMENT WAS TERMINATED OWING TO DEGRADATION OF THE APT CAMERA. THE APT EXPERIMENT SUCCESSFULLY DEMONSTRATED THE FEASIBILITY OF USING WEATHER SATELLITES TO PROVIDE METEOROLOGISTS WITH LOCAL CLOUDCOVER DATA ON A NEAR REAL-TIME BASIS REQUIRING ONLY THE USE OF A PHOTOFACSIMILE MACHINE AND A RELATIVELY INEXPENSIVE ANTENNA AND RECEIVER. APT DATA ARE PRIMARILY INTENDED FOR OPERATIONAL USE WITHIN THE LOCAL APT ACQUISITION STATIONS AND GENERALLY ARE NOT AVAILABLE FOR DISTRIBUTION.

REFERENCES

12, 276, 278, 279, 466, 524, 652, 743, 768, 827, 853, 860, 861, AND 871.

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SPACECRAFT COMMON NAME- TIROS 9 NSSDC ID 65-004A
ALTERNATE NAMES- A 54

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 01/31/65
APOGEE- 2582.00 KM ALT
PERIGEE- 705.000 KM ALT
PERIOD- 119.2 MIN
INCLINATION- 96.40 DEG

OTHER INFORMATION
SPACECRAFT WT- 138. KG
LAUNCH DATE- 01/22/65
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 072665

SPACECRAFT PERSONNEL

PM - R.M.	RADOS	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 9 (TELEVISION AND INFRARED OBSERVATION SATELLITE) WAS A SUN-SYNCHRONOUS METEOROLOGICAL SPACECRAFT DESIGNED TO DEVELOP IMPROVED CAPABILITIES FOR OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITIE TO TEST THE TOS (TIROS OPERATIONAL SYSTEM) CONCEPT. THE SPIN-STABILIZED SPACECRAFT WAS IN THE FORM OF AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS SUPPLIED TO THE SPACECRAFT FROM APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. A SINGLE MONOPOLE ANTENNA FOR RECEPTION OF GROUND COMMANDS EXTENDED OUT FROM THE TOP OF THE COVER ASSEMBLY. A PAIR OF CROSSED-DIPOLE TELEMETRY ANTENNAS (235 MHZ PROJECTED DOWN AND DIAGONALLY OUT FROM THE BASEPLATE. TIROS 9 WAS THE FIRST OF THE SO-CALLED 'CARTWHEEL' METEOROLOGICAL TV SATELLITES, THAT IS, THE SPACECRAFT SPIN AXIS WAS MAINTAINED NORMAL TO THE ORBITAL PLANE. THE SATELLITE WAS STILL EQUIPPED WITH SMALL SOLID-FUEL THRUSTERS AS IN THE CASE OF PREVIOUS TIROS SPACECRAFT. HOWEVER, THE SYSTEM WAS USED ONLY AS A BACKUP THE SATELLITE SPIN RATE AND ATTITUDE WERE PRIMARILY DETERMINED BY A QUARTER-ORBIT MAGNETIC ATTITUDE CONTROL (QOMAC) SYSTEM. FIRST INSTALLED ON TIROS 9, THE SYSTEM USED THE TORQUE DEVELOPED BY INTERACTION OF THE EARTH'S MAGNETIC FIELD WITH A CURRENT-CARRYING LOOP MOUNTED IN THE SATELLITE. THE SPACECRAFT CARRIED TWO IDENTICAL WIDE-ANGLE TV CAMERAS WITH 1.27-CM-DIAMETE VIDICONS FOR TAKING EARTH CLOUDCOVER PICTURES. THE PICTURES WERE TRANSMITTE DIRECTLY TO EITHER OF TWO GROUND RECEIVING STATIONS OR STORED IN A TAPE RECORDER ON BOARD FOR SUBSEQUENT PLAYBACK IF THE SPACECRAFT WAS BEYOND COMMUNICATION RANGE. A FAILURE IN THE SPACECRAFT GUIDANCE SYSTEM PLACED THE SPACECRAFT IN AN UNPLANNED ELLIPTICAL (700 TO 2500 KM) ORBIT. THE TV SYSTEM OPERATED NORMALLY UNTIL JULY 26, 1965, AND SPORADICALLY UNTIL FEBRUARY 15, 1967. TIROS 9 WAS THE FIRST SATELLITE IN THE TIROS SERIES TO BE PLACED IN A NEAR-POLAR ORBIT, THEREBY INCREASING TV COVERAGE TO THE ENTIRE DAYLIGHT PORTION OF THE GLOBE.

REFERENCES

253, 551, 572, 639, 647, 675, 700, 743, 772, AND 924.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 65-004A-01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 072665

EXPERIMENT BRIEF DESCRIPTION

THE TIROS 9 TV SYSTEM WAS DESIGNED TO OBTAIN DATA FOR OPERATIONAL METEOROLOGICAL USE AND TO FURTHER RESEARCH TOWARD OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE CAMERA SYSTEM WAS IDENTICAL TO THAT FLOWN ON ALL PREVIOUS TIROS MISSIONS AND ESSA 1, I.E., TWO WIDE-ANGLE 104-DEG TV CAMERAS EQUIPPED WITH 1.27-CM-DIAMETER VIDICONS. UNLIKE PREVIOUS TIROS TV CAMERAS, HOWEVER, THE CAMERAS ON TIROS 9 WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT AND CANTED 64 DEG FROM THE SPACECRAFT SPIN AXIS. THE CAMERAS WERE AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN THEY CAME IN VIEW OF THE EARTH. THE TV SYSTEM COULD OPERATE IN EITHER REAL-TIME OR TAPE RECORDER MODE, DEPENDING ON WHETHER THE SPACECRAFT WAS WITHIN OR BEYOND COMMUNICATION RANGE OF EITHER OF TWO GROUND RECEIVING STATIONS. THE RECORDER COULD STORE UP TO 48 FRAMES OF PICTURES. TRANSMISSION OF THE 48-FRAME SEQUENCE WAS ACCOMPLISHED IN 120 SEC USING A 5-W FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ. AT A PLANNED ALTITUDE OF 700 KM, A PICTURE COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. FROM A NEAR-POLAR ORBIT, THE CAMERA SYSTEM COULD PROVIDE COMPLETE TV COVERAGE OF THE ENTIRE DAYLIGHT PORTION OF THE GLOBE. IN SPITE OF AN UNPLANNED ELLIPTICAL ORBIT, THE EXPERIMENT PRODUCED OVER 70,000 METEOROLOGICALLY USEFUL PICTURES. THE EXPERIMENT PERFORMED NORMALLY UNTIL JULY 26, 1965, AND OPERATED SPORADICALLY THEREAFTER UNTIL FEBRUARY 15, 1967, WHEN ALL DATA ACQUISITION CEASED. DATA FROM THIS EXPERIMENT CAN BE OBTAINED FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF THESE DATA, SEE THE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - TIROS 9 TELEVISION CLOUD PHOTOGRAPHY,' PARTS 1 AND 2, FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

49, 50, 253, 288, 352, 384, 406, 409, 446, 460, 649, 650, AND 698.

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SPACECRAFT COMMON NAME- TIROS 10 NSSDC ID 65-051A
ALTERNATE NAMES- OT 1

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 07/02/65
APOGEE- 837.000 KM ALT
PERIGEE- 751.000 KM ALT
PERIOD- 100.7 MIN
INCLINATION- 98.65 DEG

OTHER INFORMATION
SPACECRAFT WT- 127. KG
LAUNCH DATE- 07/02/65
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 073166

SPACECRAFT PERSONNEL

PM - R.M.	RADOS	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS 10 (TELEVISION AND INFRARED OBSERVATION SATELLITE) WAS A SUN-SYNCHRONOUS METEOROLOGICAL SPACECRAFT DESIGNED TO DEVELOP IMPROVED CAPABILITIES FOR OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES AND OPERATED AS AN INTERIM OPERATIONAL SATELLITE. THE SPIN-STABILIZED SPACECRAFT WAS IN THE FORM OF AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS SUPPLIED TO THE SPACECRAFT BY APPROXIMATELY 9000 1- BY 2-CM SILICON SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. A SINGLE MONOPOLE ANTENNA FOR RECEPTION OF GROUND COMMANDS EXTENDED OUT FROM THE TOP OF THE COVER ASSEMBLY. A PAIR OF CROSSED-DIPOLE TELEMETRY ANTENNAS (235 MHZ) PROJECTED DOWN AND DIAGONALLY OUT FROM THE BASEPLATE. MOUNTED AROUND THE EDGE OF THE BASEPLATE WERE FIVE DIAMETRICALLY OPPOSED PAIRS OF SMALL SOLID-FUEL THRUSTERS THAT MAINTAINED THE SATELLITE SPIN RATE BETWEEN 8 AND 12 RPM. PROPER ATTITUDE WAS MAINTAINED TO WITHIN A 1- TO 2-DEG ACCURACY BY USE OF A MAGNETIC CONTROL DEVICE CONSISTING OF 250 COILS OF WIRE WOUND AROUND THE OUTER SURFACE OF THE SPACECRAFT. THE INTERACTION BY THE INDUCED MAGNETIC FIELD IN THE SPACECRAFT AND THE EARTH'S MAGNETIC FIELD PROVIDED THE TORQUE NECESSARY FOR ATTITUDE CONTROL. THE SATELLITE SPIN AXIS COULD THUS BE VARIED WHILE THE SATELLITE REMAINED IN THE CONVENTIONAL TIROS 'AXIAL' MODE. THE SATELLITE WAS EQUIPPED WITH TWO IDENTICAL WIDE-ANGLE TV CAMERAS WITH 1.27-CM-DIAMETER VIDICONS FOR TAKING EARTH CLOUDCOVER PICTURES. THE PICTURES COULD BE TRANSMITTED DIRECTLY TO EITHER OF TWO GROUND RECEIVING STATIONS OR STORED IN A TAPE RECORDER ON BOARD FOR SUBSEQUENT PLAYBACK IF THE SPACECRAFT WAS BEYOND THE COMMUNICATION RANGE OF THE STATION. THE SATELLITE WAS LAUNCHED INTO A NEAR-POLAR ORBIT AND SUCCESSFULLY PROVIDED TV COVERAGE OF THE ENTIRE DAYLIGHT PORTION OF THE GLOBE. THE TV SYSTEM OPERATED NORMALLY UNTIL SEPTEMBER 1965 AND SPORADICALLY UNTIL JULY 1966.

REFERENCES

511, 551, 572, 639, 675, 700, 743, 772, 789, AND 924.

EXPERIMENT NAME- TELEVISION CAMERA SYSTEM NSSDC ID 65-051A-01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 073168

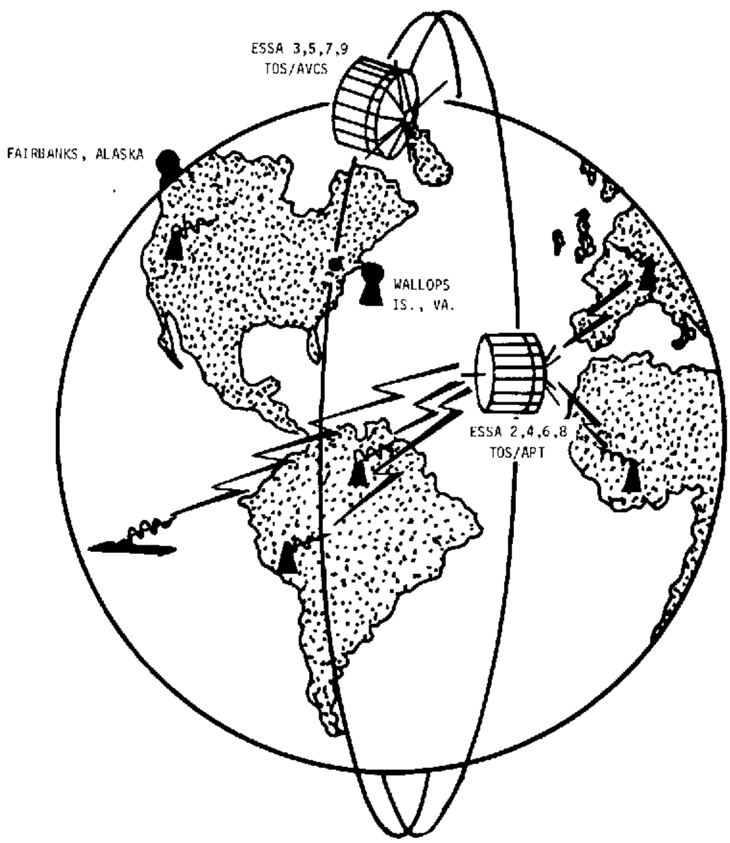
EXPERIMENT BRIEF DESCRIPTION

THE TIROS 10 TV SYSTEM WAS DESIGNED TO OBTAIN DATA FOR OPERATIONAL METEOROLOGICAL USE AND TO FURTHER RESEARCH TOWARD OBTAINING AND USING TV CLOUDCOVER PICTURES FROM SATELLITES. THE EXPERIMENT CONSISTED OF TWO REDUNDANT PAIRS OF TV CAMERAS, MAGNETIC TAPE RECORDERS, AND TV TRANSMITTERS. THE TWO SENSOR UNITS WERE CAPABLE OF CONCURRENT OR INDEPENDENT OPERATION. THE TWO WIDE-ANGLE (104 DEG) VIDICON CAMERAS WERE MOUNTED ON THE BASEPLATE OF THE SPACECRAFT WITH THEIR OPTICAL AXES PARALLEL TO THE SPACECRAFT SPIN AXIS. THE ABILITY OF THE MAGNETIC ATTITUDE CONTROL SYSTEM TO VARY THE SPACECRAFT SPIN AXIS ALLOWED THE CAMERAS TO VIEW THE EARTH AT VARIOUS ANGLES FROM NADIR. IN THIS RESPECT THE CAMERA SYSTEM WAS SIMILAR TO THAT FLOWN ON THE TIROS 9 'CARTWHEEL' SATELLITE. THE CAMERAS WERE AUTOMATICALLY TRIGGERED INTO ACTION ONLY WHEN THEY CAME IN VIEW OF THE EARTH, DEPENDING ON WHETHER OR NOT THE SATELLITE WAS WITHIN COMMUNICATION RANGE OF EITHER OF TWO GROUND RECEIVING STATIONS. THE TV CAMERA SYSTEM COULD OPERATE IN EITHER REAL-TIME

OR TAPE RECORDER MODE. THE TV CAMERAS USED 500-SCAN-LINE, 1.27-CM-DIAMETER VIDICONS. THE RECORDER COULD STORE UP TO 32 FRAMES OF PICTURES. TRANSMISSION OF THE 32-FRAME SEQUENCE WAS ACCOMPLISHED IN 100 SEC BY A 2-W FM TRANSMITTER OPERATING AT A NOMINAL FREQUENCY OF 235 MHZ. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 700 KM), A PICTURE COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF 2.5 TO 3.0 KM AT NADIR. FROM A NEAR POLAR ORBIT, THE CAMERA SYSTEM COULD PROVIDE COMPLETE PICTORIAL COVERAGE OF THE ENTIRE DAYLIGHT PORTION OF THE GLOBE. OVER 50,000 METEOROLOGICALLY USEFUL PICTURES WERE OBTAINED FROM LAUNCH UNTIL THE EXPERIMENT WAS TERMINATED ON JULY 31, 1966. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF THESE DATA, SEE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - TIROS 10, TELEVISION CLOUD PHOTOGRAPHY,' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

51, 288, 297, 352, 384, 406, 409, 460, AND 650.



TOS/ESSA SERIES

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3. TOS/ESSA Series

SPACECRAFT COMMON NAME- ESSA 1 NSSDC ID 66-008A
ALTERNATE NAMES- OT 3

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 02/03/66
APOGEE- 870.000 KM ALT
PERIGEE- 703.000 KM ALT
PERIOD- 100.3 MIN
INCLINATION- 97.91 DEG

OTHER INFORMATION
SPACECRAFT WT- 138. KG
LAUNCH DATE- 02/03/66
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 100666

SPACECRAFT PERSONNEL

PM - R.M.	RADOS	NASA-GSFC	GREENBELT, MD.
PS -	AERO. AND METEO. DIV	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ESSA 1 WAS A SPIN-STABILIZED OPERATIONAL METEOROLOGICAL SPACECRAFT DESIGNED TO TAKE AND RECORD DAYTIME CLOUDCOVER PICTURES ON A GLOBAL BASIS FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. THE SATELLITE HAD ESSENTIALLY THE SAME CONFIGURATION AS THAT OF THE TIROS SERIES, I.E., AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED BY APPROXIMATELY 10,000 1- BY 2-CM SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. TWO REDUNDANT WIDE-ANGLE CAMERAS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT AND CANTED 75 DEG FROM THE SPACECRAFT SPIN AXIS. A PAIR OF CROSSED-DIPOLE COMMAND AND RECEIVING ANTENNAS PROJECTED OUT AND DOWN FROM THE BASEPLATE. A MONOPOLE TELEMETRY AND TRACKING ANTENNA EXTENDED UP FROM THE TOP OF THE COVER ASSEMBLY. THE SATELLITE WAS PLACED IN A CARTWHEEL ORBITAL MODE, WITH ITS SPIN AXIS MAINTAINED NORMAL TO THE ORBITAL PLANE. THE SATELLITE SPIN RATE AND ATTITUDE WERE DETERMINED PRIMARILY BY A MAGNETIC ATTITUDE SPIN COIL (MASC). THE MASC WAS A CURRENT-CARRYING COIL MOUNTED IN THE COVER ASSEMBLY. THE MAGNETIC FIELD INDUCED BY THE CURRENT INTERACTED WITH THE EARTH'S MAGNETIC FIELD TO PROVIDE THE NECESSARY TORQUE TO MAINTAIN A DESIRED SPIN RATE OF 9.225 RPM. FIVE SMALL SOLID-FUEL THRUSTERS MOUNTED AROUND THE BASEPLATE PROVIDED A SECONDARY MEANS OF CONTROLLING THE SPACECRAFT'S SPIN RATE. THE SATELLITE PERFORMED NORMALLY AFTER LAUNCH UNTIL OCTOBER 6, 1966, WHEN THE CAMERA SYSTEM FAILED. THE SPACECRAFT WAS DEACTIVATED ON MAY 8, 1967, AFTER BEING LEFT ON FOR AN ADDITIONAL TIME PERIOD FOR ENGINEERING PURPOSES.

REFERENCES

359, 511, 647, 675, 700, 743, 772, 789, AND 924.

EXPERIMENT NAME- VIDICON CAMERA SYSTEM NSSDC ID 66-008A-01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 100666

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 1 VIDICON CAMERA SUBSYSTEM WAS A COMBINATION CAMERA, TAPE RECORDER, AND TRANSMITTER THAT COULD RECORD AND STORE A SERIES OF REMOTE DAYTIME CLOUDCOVER PICTURES FOR SUBSEQUENT PLAYBACK TO A GROUND DATA ACQUISITION FACILITY. THE SYSTEM WAS IDENTICAL TO THOSE FLOWN ON PREVIOUS TIROS MISSIONS, CONSISTING OF TWO REDUNDANT 500-SCAN-LINE TV CAMERAS WITH 1.27-CM-DIAMETER VIDICONS. HOWEVER, ON ESSA 1 THE CAMERAS WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT AND WERE CANTED 75 DEG FROM THE SPACECRAFT SPIN AXIS. THE CAMERAS WERE TRIGGERED INTO ACTION ONLY WHEN THEY CAME INTO VIEW OF THE EARTH. EACH TAPE RECORDER HAD TWO SEPARATE CHANNELS, ONE FOR STORING VIDEO SIGNALS AND ONE FOR SUN ANGLE DATA, WHICH SERVED AS A TIME REFERENCE. UP TO 32 PICTURES CONSISTING OF FIVE LEVELS OF GRAY COULD BE STORED FOR SUBSEQUENT PLAYBACK. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 1450 KM), THE CAMERAS COVERED A 1200- BY 1200-KM SQUARE WITH A SPATIAL RESOLUTION OF ABOUT 3.0 KM AT NADIR. THE EXPERIMENT WAS A SUCCESS, WITH OVER 100,000 USABLE PICTURES TRANSMITTED. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR A COMPLETE INDEX OF AVAILABLE DATA, SEE PARTS 1 AND 2 OF THE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - ESSA 1 TELEVISION CLOUD PHOTOGRAPHY' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS.

REFERENCES

52, 53, 286, 352, 460, 649, 650, 742, AND 883.

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SPACECRAFT COMMON NAME- ESSA 2 NSSDC ID 66-016A
ALTERNATE NAMES- OT 2

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 03/03/66
- APOGEE- 1418.00 KM ALT
- PERIGEE- 1356.00 KM ALT
- PERIOD- 113.5 MIN
- INCLINATION- 101.0 DEG

OTHER INFORMATION
- SPACECRAFT WT- 138. KG
- LAUNCH DATE- 02/28/66
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE DATA RECORDED- 032070

SPACECRAFT PERSONNEL

PM - W.W. JONES NASA-GSFC GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ESSA 2 WAS A SUN-SYNCHRONOUS OPERATIONAL METEOROLOGICAL SATELLITE DESIGNED TO PROVIDE REAL-TIME EARTH CLOUDCOVER TV PICTURES TO PROPERLY EQUIPPED GROUND RECEIVING STATIONS FOR USE IN WEATHER ANALYSIS AND FORECASTING. THE SATELLITE HAD ESSENTIALLY THE SAME CONFIGURATION AS THAT OF A TIROS SPACECRAFT, I.E., AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED BY APPROXIMATELY 10,000 1- BY 2-CM SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. TWO REDUNDANT WIDE-ANGLE AUTOMATIC PICTURE TRANSMISSION (APT) CAMERAS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. PROJECTING DOWNWARD FROM THE BASEPLATE WERE A PAIR OF CROSSED-DIPOLE COMMAND

RECEPTION ANTENNAS. A MONOPOLE TELEMETRY (136.500 MHZ) AND TRACKING (136.770 MHZ) ANTENNA EXTENDED OUTWARD FROM THE TOP OF THE COVER ASSEMBLY. THE SATELLITE SPIN RATE WAS CONTROLLED BY MEANS OF A MAGNETIC ATTITUDE SPIN COIL (MASC), WITH THE SPIN AXIS MAINTAINED NORMAL TO THE ORBITAL PLANE (CARTWHEEL ORBIT MODE) TO WITHIN PLUS OR MINUS 1 DEG. THE MASC WAS A CURRENT-CARRYING COIL MOUNTED IN THE COVER ASSEMBLY. THE MAGNETIC FIELD INDUCED BY THE CURRENT INTERACTED WITH THE EARTH'S MAGNETIC FIELD TO PROVIDE THE TORQUE NECESSARY TO MAINTAIN A DESIRED SPIN RATE OF 10.9 RPM. THE SPACECRAFT PERFORMED NORMALLY AFTER LAUNCH. OVER 4 YR OF USEFUL CLOUDCOVER PICTURES WERE OBTAINED BEFORE THE CAMERA SYSTEMS WERE PLACED IN A STANDBY MODE ON MARCH 20, 1970, OWING TO A TELEMETRY CONFLICT WITH ITOS 1. ESSA 2 WAS DEACTIVATED ON OCTOBER 16, 1970.

REFERENCES
98, 100, 141, 209, 359, 511, 647, 675, 700, 743, 772, 789, AND 924.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM   NSSDC ID 66-016A-01

EXPERIMENT PERSONNEL
PI - NESS STAFF   NOAA-NESS   SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 032070

EXPERIMENT BRIEF DESCRIPTION
THE ESSA 2 AUTOMATIC PICTURE TRANSMISSION (APT) SUBSYSTEM WAS A CAMERA AND TRANSMITTER COMBINATION DESIGNED TO TRANSMIT REAL-TIME, DAYLIGHT, SLOW-SCAN TELEVISION PICTURES OF CLOUD COVER TO ANY PROPERLY EQUIPPED GROUND RECEIVING STATION. THE CAMERA SYSTEM CONSISTED OF TWO REDUNDANT APT CAMERAS WITH 2.54-CM-DIAMETER VIDICONS. EACH CAMERA HAD A 108-DEG WIDE-ANGLE F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7 MM. THE CAMERAS WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPACECRAFT SPIN AXIS. THE CAMERAS WERE PROGRAMMED TO TAKE FOUR OR EIGHT APT PICTURES PER ORBIT. THE ACTUAL PHOTOGRAPHY REQUIRED 8 SEC AND THE TRANSMISSION 200 SEC. EARTH-CLOUD IMAGES RETAINED ON THE PHOTOSENSITIVE SURFACE OF THE VIDICON WERE READ OUT AT FOUR LINES PER SECOND TO PRODUCE AN 800-LINE PICTURE. TWO 5-W TV TRANSMITTERS (137.5 MHZ) RELAYED THE PICTURES TO LOCAL APT STATIONS WITHIN COMMUNICATION RANGE. THE FACEPLATE OF THE VIDICON HAD RETICLE MARKS THAT APPEARED ON THE PICTURE FORMAT TO AID IN RELATING THE PICTURE TO ITS GEOGRAPHICAL POSITION ON THE EARTH'S SURFACE. AT NOMINAL SATELLITE ATTITUDE AND ALTITUDE (APPROXIMATELY 1450 KM), A PICTURE COVERED A 3100- BY 3100-KM SQUARE WITH A HORIZONTAL RESOLUTION OF ABOUT 4 KM AT NADIR. THERE WAS A 30 PERCENT OVERLAP BETWEEN PICTURES ALONG THE TRACK TO ENSURE COMPLETE COVERAGE. THE EXPERIMENT WAS A SUCCESS, AND OVER 4 YR OF USEFUL CLOUDCOVER PICTURES WERE RECEIVED BY PARTICIPATING APT STATIONS. APT DATA ARE PRIMARILY INTENDED FOR OPERATIONAL USE WITHIN THE LOCAL APT ACQUISITION STATION. HOWEVER, COPIES OF PICTURES TAKEN OVER THE UNITED STATES ARE MAINTAINED ON FILE AT NOAA-NESS, SUITLAND, MARYLAND.

REFERENCES
12, 54, 98, 261, 276, 288, 326, 456, 639, 649, 652, 678, 742, 827, 861, AND 871.

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SPACECRAFT COMMON NAME- ESSA 3 NSSDC ID 66-087A
ALTERNATE NAMES- TOS A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 10/03/66
APOGEE- 1475.00 KM ALT
PERIGEE- 1378.00 KM ALT
PERIOD- 114.5 MIN
INCLINATION- 101.0 DEG

OTHER INFORMATION
SPACECRAFT WT- 144. KG
LAUNCH DATE- 10/02/66
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 100968

SPACECRAFT PERSONNEL
PM - W.W. JONES NASA-GSFC GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION
ESSA 3 WAS A SUN-SYNCHRONOUS OPERATIONAL METEOROLOGICAL SATELLITE DESIGNED TO TAKE AND RECORD DAYTIME EARTH CLOUDCOVER PICTURES ON A GLOBAL BASIS FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION FACILITY. THE SPACECRAFT WAS ALSO CAPABLE OF PROVIDING WORLDWIDE MEASUREMENTS OF REFLECTED SOLAR AND LONG-WAVE RADIATION LEAVING THE EARTH. THE SPACECRAFT HAD ESSENTIALLY THE SAME CONFIGURATION AS THAT OF A TIROS SATELLITE, I.E., AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED BY APPROXIMATELY 10,000, 1- BY 2-CM SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. TWO REDUNDANT ADVANCED VIDICON CAMERA SYSTEM (AVCS) CAMERAS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. TWO SETS OF FLAT PLATE RADIOMETERS WERE ALSO SUSPENDED ON OPPOSITE SIDES OF THE SATELLITE BENEATH THE EDGE OF THE BASEPLATE. A PAIR OF CROSSED-DIPOLE COMMAND RECEIVER ANTENNAS PROJECTED OUT AND DOWNWARD FROM THE BASEPLATE. A MONOPOLE TELEMETRY AND TRACKING ANTENNA EXTENDED OUTWARD FROM THE TOP OF THE COVER ASSEMBLY. THE SATELLITE SPIN RATE WAS CONTROLLED BY MEANS OF A MAGNETIC ATTITUDE SPIN COIL (MASC), WITH THE SPIN AXIS MAINTAINED NORMAL TO THE ORBITAL PLANE (CARTWHEEL ORBIT MODE) TO WITHIN PLUS OR MINUS 1 DEG. THE MASC WAS A CURRENT-CARRYING COIL MOUNTED IN THE COVER ASSEMBLY. THE MAGNETIC FIELD INDUCED BY THE CURRENT INTERACTED WITH THE EARTH'S MAGNETIC FIELD TO PROVIDE THE TORQUE NECESSARY TO MAINTAIN A DESIRED SPIN RATE OF 9.225 RPM. ESSA 3 PERFORMED NORMALLY UNTIL JANUARY 20, 1967, WHEN THE RADIOMETER EXPERIMENT FAILED. THE FIRST AVCS CAMERA FAILED ON SEPTEMBER 29, 1967. THE REMAINING CAMERA FAILED ON OCTOBER 9, 1968, AND THE SATELLITE WAS DEACTIVATED ON DECEMBER 2, 1968.

REFERENCES
73, 84, 98, 359, 438, 463, 511, 603, 675, 700, 772, AND 789.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS) NSSDC ID 66-087A-01

EXPERIMENT PERSONNEL
PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 100968

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 3 ADVANCED VIDICON CAMERA SYSTEM (AVCS) WAS A COMBINATION CAMERA, TAPE RECORDER, AND TRANSMITTER THAT COULD RECORD AND STORE A SERIES OF REMOTE DAYTIME CLOUDCOVER PICTURES FOR SUBSEQUENT PLAYBACK TO A GROUND DATA ACQUISITION FACILITY. THE CAMERAS AND TAPE RECORDER SYSTEM WERE ESSENTIALLY THE SAME AS THOSE ON NIMBUS 1 AND 2. THE ESSA AVCS SYSTEM CONSISTED OF TWO REDUNDANT WIDE-ANGLE CAMERAS WITH 2.54-CM-DIAMETER VIDICONS. THE CAMERAS WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. THE CAMERA OPTIC SYSTEM EMPLOYED A 108-DEG LENS WITH A FOCAL LENGTH OF 6.0 MM. EACH CAMERA WAS INDEPENDENTLY TRIGGERED INTO ACTION ONLY WHEN IT CAME IN VIEW OF THE EARTH. A VIDEO FRAME CONSISTED OF 0.25 SEC OF BLANKED VIDEO FOLLOWED BY 6.25 SEC OF VIDICON SCAN (833 LINES) AND A FINAL 0.25-SEC PERIOD OF BLANKED VIDEO. CONCURRENT WITH SHUTTER ACTUATION, A 16-INCREMENT GRAY SCALE WAS INCLUDED AT THE EDGE OF EACH PICTURE FRAME AS A CONTRAST CHECK. A FOUR-TRACK TAPE RECORDER COULD STORE UP TO 36 PICTURES. THE DATA COULD BE READ OUT BETWEEN PICTURE TAKING CYCLES WITHOUT LOSING A PICTURE OR INTERRUPTING A SEQUENCE. SIX OR 12 AVCS PICTURES PER ORBIT COULD BE PROGRAMMED. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 1450 KM), A PICTURE COVERED A 3100- BY 3100-KM SQUARE WITH A HORIZONTAL RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS A 50 PERCENT OVERLAP ALONG THE TRACK BETWEEN SUCCESSIVE PICTURES TO ENSURE COMPLETE COVERAGE. THE EXPERIMENT WAS A SUCCESS, WITH OVER 90,000 USABLE PICTURES TRANSMITTED. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF AVAILABLE DATA, SEE THE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - ESSA 3, ESSA 5, AND ESSA 7 TELEVISION CLOUD PHOTOGRAPHY' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS. IDENTICAL EXPERIMENTS WERE FLOWN ON ESSA 5, 7, AND 9.

REFERENCES

23, 24, 25, 29, 30, 32, 34, 35, 89, 98, 288, 297, 326, 352, 393, 415, 459, 476, 510, 547, 564, 639, 711, 742, 800, AND 883.

EXPERIMENT NAME- FLAT PLATE RADIOMETER (FPR) NSSDC ID 66-087A-02

EXPERIMENT PERSONNEL

PI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WIS.
OI - R.J.	PARENT	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 012067

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 3 FLAT PLATE RADIOMETER (FPR) SYSTEM WAS DESIGNED TO PROVIDE A MEASUREMENT OF THE GLOBAL DISTRIBUTION OF REFLECTED SOLAR AND LONG-WAVE RADIATION LEAVING THE EARTH. THE FPR SYSTEM WAS COMPRISED OF FOUR INFRARED SENSORS, AN ANALOG-TO-DIGITAL CONVERTER, A COMMUTATOR, AND A TAPE RECORDER. TWO PAIRS OF RADIOMETERS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT, WITH THEIR AXES PERPENDICULAR TO THE SPIN AXIS. A CONE SHIELD WAS EMPLOYED ON TWO OF THE RADIOMETERS TO ISOLATE OR REDUCE ANY RESPONSE DUE TO DIRECT SOLAR RADIATION. THE FIELD OF VIEW ON THE OTHER TWO INSTRUMENTS WAS UNRESTRICTED. BOTH TYPES OF RADIOMETERS USED A COATED (EITHER BLACK OR WHITE) ALUMINUM DISC AS THE SENSING ELEMENT. THE DISC TEMPERATURE WAS MEASURED BY TWO THERMISTORS MOUNTED ON THE BACK SURFACE OF THE DISC. THE BLACK-COATED DISC RESPONDED TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR,

AND EMITTED LONG-WAVE RADIATION. THE WHITE DISC REFLECTED IN THE VISUAL RANGE BUT ABSORBED IN THE INFRARED (7 TO 30 MICRON) RANGE. IDENTICAL EXPERIMENTS WERE FLOWN ON THE ESSA 5, 7, AND 9 SPACECRAFT. FOR A FULL DESCRIPTION OF THE ESSA FPR, SEE 'STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS, ANNUAL REPORT - 1966,' UNIVERSITY OF WISCONSIN, 111-129, MARCH 1967. THE RADIOMETER PERFORMED NORMALLY, AND GOOD DATA WERE OBTAINED FROM LAUNCH UNTIL THE TAPE RECORDER FAILED ON JANUARY 20, 1967. DATA FROM THIS EXPERIMENT ARE AVAILABLE ON MAGNETIC TAPE FROM NOAA-NESS, SUITLAND, MARYLAND.

REFERENCES

104, 204, 463, 610, 676, 677, 840, 884, AND 930.

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SPACECRAFT COMMON NAME- ESSA 4 NSSDC ID 67-006A

ALTERNATE NAMES- TOS B

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 01/29/67
- APOGEE- 1443.00 KM ALT
- PERIGEE- 1328.00 KM ALT
- PERIOD- 113.4 MIN
- INCLINATION- 102.0 DEG

OTHER INFORMATION
- SPACECRAFT WT- 132. KG
- LAUNCH DATE- 01/26/67
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE
  - DATA RECORDED- 120667

SPACECRAFT PERSONNEL

PM - W.W. JONES NASA-GSFC GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ESSA 4 WAS A SUN-SYNCHRONOUS OPERATIONAL METEOROLOGICAL SATELLITE DESIGNED TO PROVIDE REAL-TIME EARTH CLOUDCOVER TV PICTURES TO PROPERLY EQUIPPED GROUND RECEIVING STATIONS FOR USE IN WEATHER ANALYSIS AND FORECASTING. THE SATELLITE HAD ESSENTIALLY THE SAME CONFIGURATION AS THAT OF A TIROS SPACECRAFT, I.E., AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED BY APPROXIMATELY 10,000 1- BY 2-CM SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. TWO REDUNDANT WIDE-ANGLE AUTOMATIC PICTURE TRANSMISSION (APT) CAMERAS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. PROJECTING DOWNWARD FROM THE BASEPLATE WERE A PAIR OF CROSSED-DIPOLE COMMAND RECEPTION ANTENNAS. A MONOPOLE TELEMETRY (136.500 MHZ) AND TRACKING (136.770 MHZ) ANTENNA EXTENDED OUTWARD FROM THE TOP OF THE COVER ASSEMBLY. THE SATELLITE SPIN RATE WAS CONTROLLED BY MEANS OF A MAGNETIC ATTITUDE SPIN COIL (MASC), WITH THE SPIN AXIS MAINTAINED NORMAL TO THE ORBITAL PLANE (CARTWHEEL ORBIT MODE) TO WITHIN PLUS OR MINUS 1 DEG. THE MASC WAS A CURRENT-CARRYING COIL MOUNTED IN THE COVER ASSEMBLY. THE MAGNETIC FIELD INDUCED BY THE CURRENT INTERACTED WITH THE EARTH'S MAGNETIC FIELD TO PROVIDE THE TORQUE NECESSARY TO MAINTAIN A DESIRED SPIN RATE OF 10.9 RPM. WITH THE EXCEPTION OF THE FAILURE OF ONE OF THE APT CAMERAS, THE SPACECRAFT PERFORMED NORMALLY AFTER LAUNCH. IT WAS TURNED OPERATIONALLY OFF ON DECEMBER 6, 1967, AND WAS FINALLY DEACTIVATED ON MAY 5, 1968.

REFERENCES
98, 100, 359, 511, 675, 700, 772, AND 789.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM   NSSDC ID 67-006A-01

EXPERIMENT PERSONNEL
PI - NESS STAFF   NOAA-NESS   SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 120667

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 4 AUTOMATIC PICTURE TRANSMISSION (APT) SUBSYSTEM WAS A CAMERA AND TRANSMITTER COMBINATION DESIGNED TO TRANSMIT REAL-TIME, DAYLIGHT, SLOW-SCAN TELEVISION PICTURES OF CLOUD COVER TO PROPERLY EQUIPPED GROUND RECEIVING STATIONS. THE CAMERA SYSTEM CONSISTED OF TWO REDUNDANT APT CAMERAS WITH 2.54-CM-DIAMTER VIDICONS. EACH CAMERA HAD A 108-DEG WIDE-ANGLE F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7 MM. THE CAMERAS WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. THE CAMERAS WERE PROGRAMMED TO TAKE FOUR OR EIGHT APT PICTURES PER ORBIT. THE ACTUAL PHOTOGRAPH REQUIRED 8 SEC AND THE TRANSMISSION 200 SEC. EARTH-CLOUD IMAGES RETAINED ON THE PHOTOSENSITIVE SURFACE OF THE VIDICON WERE READ OUT AT FOUR LINES PER SECOND TO PRODUCE AN 800-LINE PICTURE. TWO 5-W TV TRANSMITTERS (137.5 MHZ) RELAYED THE PICTURES TO LOCAL APT STATIONS WITHIN COMMUNICATION RANGE. THE FACEPLATE OF THE VIDICON HAD RETICLE MARKS THAT APPEARED ON THE PICTURE FORMAT TO AID IN RELATING THE PICTURE TO ITS GEOGRAPHICAL POSITION ON THE EARTH'S SURFACE. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 1450 KM), A PICTURE COVERED A 3100- BY 3100-KM SQUARE WITH A HORIZONTAL RESOLUTION OF ABOUT 4 KM AT NADIR. THERE WAS A 30 PERCENT OVERLAP BETWEEN PICTURES ALONG THE TRACK TO ENSURE COMPLETE COVERAGE. ONE CAMERA FAILED ALMOST IMMEDIATELY AFTER LAUNCH. HOWEVER, THE EXPERIMENT WAS A SUCCESS, AND A CONSIDERABLE AMOUNT OF DATA WAS OBTAINED UNTIL DECEMBER 6, 1967, WHEN THE SPACECRAFT WAS TURNED OPERATIONALLY OFF. IDENTICAL EXPERIEMNTS WERE FLOWN ON ESSA 2, 6, AND 8. APT DATA ARE PRIMARILY INTENDED FOR OPERATIONAL USE WITHIN THE LOCAL APT STATION. HOWEVER, COPIES OF PICTURES TAKEN OVER THE UNITED STATES ARE MAINTAINED ON FILE AT NOAA-NESS, SUITLAND, MARYLAND.

REFERENCES
12, 98, 261, 288, 456, 652, 711, 742, 827, AND 871.

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SPACECRAFT COMMON NAME- ESSA 5   NSSDC ID 67-036A
ALTERNATE NAMES- TOS C

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/21/67
APOGEE- 1423.00 KM ALT

OTHER INFORMATION
SPACECRAFT WT- 144. KG
LAUNCH DATE- 04/20/67
OPERATING STATUS- INOPERABLE

PERIGEE- 1361.00 KM ALT
PERIOD- 113.6 MIN
INCLINATION- 101.97 DEG

DATE LAST USABLE
DATA RECORDED- 100869

SPACECRAFT PERSONNEL
PM - W.W. JONES NASA-GSFC GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ESSA 5 WAS A SUN-SYNCHRONOUS OPERATIONAL METEOROLOGICAL SATELLITE DESIGNED TO TAKE AND RECORD DAYTIME EARTH CLOUDCOVER PICTURES ON A GLOBAL BASIS FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION FACILITY. THE SPACECRAFT WAS ALSO CAPABLE OF PROVIDING WORLDWIDE MEASUREMENTS OF REFLECTED SOLAR AND LONG-WAVE RADIATION LEAVING THE EARTH. THE SPACECRAFT HAD ESSENTIALLY THE SAME CONFIGURATION AS THAT OF A TIROS SATELLITE, I.E., AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED BY APPROXIMATELY 10,000 1- BY 2-CM SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. TWO REDUNDANT ADVANCED VIDICON CAMERA SYSTEM (AVCS) CAMERAS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. TWO SETS OF FLAT PLATE RADIOMETERS WERE ALSO SUSPENDED ON OPPOSITE SIDES OF THE SATELLITE, BENEATH THE EDGE OF THE BASEPLATE. A PAIR OF CROSSED-DIPOLE COMMAND RECEIVER ANTENNAS PROJECTED OUT AND DOWNWARD FROM THE BASEPLATE. A MONOPOLE TELEMETRY AND TRACKING ANTENNA EXTENDED OUTWARD FROM THE TOP OF THE COVER ASSEMBLY. THE SATELLITE SPIN RATE WAS CONTROLLED BY MEANS OF A MAGNETIC ATTITUDE SPIN COIL (MASC), WITH THE SPIN AXIS MAINTAINED NORMAL TO THE ORBITAL PLANE (CARTWHEEL ORBIT MODE) TO WITHIN PLUS OR MINUS 1 DEG. THE MASC WAS A CURRENT-CARRYING COIL MOUNTED IN THE COVER ASSEMBLY. THE MAGNETIC FIELD INDUCED BY THE CURRENT INTERACTED WITH THE EARTH'S MAGNETIC FIELD TO PROVIDE THE TORQUE NECESSARY TO MAINTAIN A DESIRED SPIN RATE OF 9.225 RPM. THE SPACECRAFT PERFORMED NORMALLY AFTER LAUNCH UNTIL SEPTEMBER 22, 1967, WHEN THE RADIOMETER EXPERIMENT FAILED. THE AVCS FUNCTIONED UNTIL OCTOBER 8, 1969, WHEN THE SATELLITE WAS PLACED IN A STANDBY MODE. ESSA 5 WAS DEACTIVATED ON FEBRUARY 20, 1970.

REFERENCES

84, 98, 100, 359, 438, 511, 603, 675, 700, 772, AND 789.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS) NSSDC ID 67-036A-01

EXPERIMENT PERSONNEL
PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 100869

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 5 ADVANCED VIDICON CAMERA SYSTEM (AVCS) WAS A COMBINATION CAMERA, TAPE RECORDER, AND TRANSMITTER THAT COULD RECORD AND STORE A SERIES OF REMOTE DAYTIME CLOUDCOVER PICTURES FOR SUBSEQUENT PLAYBACK TO A GROUND DATA ACQUISITION FACILITY. THE ESSA AVCS SYSTEM CONSISTED OF TWO REDUNDANT WIDE-ANGLE CAMERAS WITH 2.54-CM-DIAMETER VIDICONS. THE CAMERAS WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. THE CAMERA OPTIC SYSTEM EMPLOYED A 108-DEG LENS WITH A FOCAL LENGTH OF 6.0 MM. EACH CAMERA WAS INDEPENDENTLY TRIGGERED INTO ACTION ONLY WHEN IT CAME IN VIEW OF THE EARTH. A VIDEO FRAME CONSISTED

OF 0.25 SEC OF BLANKED VIDEO FOLLOWED BY 6.25 SEC OF VIDICON SCAN (833 LINES) AND A FINAL 0.25-SEC PERIOD OF BLANKED VIDEO. CONCURRENT WITH SHUTTER ACTUATION, A 16-INCREMENT GRAY SCALE WAS INCLUDED AT THE EDGE OF EACH PICTURE FRAME AS A CONTRAST CHECK. A FOUR-TRACK TAPE RECORDER COULD STORE UP TO 36 PICTURES. THE DATA COULD BE READ OUT BETWEEN PICTURE-TAKING CYCLES WITHOUT LOSING A PICTURE OR INTERRUPTING A SEQUENCE. SIX OR 12 AVCS PICTURES PER ORBIT COULD BE PROGRAMMED. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 1450 KM), A PICTURE COVERED A 3100- BY 3100-KM SQUARE WITH A HORIZONTAL RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS A 50 PERCENT OVERLAP ALONG THE TRACK BETWEEN SUCCESSIVE PICTURES TO ENSURE COMPLETE COVERAGE. THE EXPERIMENT WAS A SUCCESS, AND GOOD DATA WERE OBTAINED UNTIL OCTOBER 8, 1969, WHEN THE SYSTEM WAS TURNED OPERATIONALLY OFF. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF AVAILABLE DATA, SEE THE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - ESSA 3, ESSA 5, AND ESSA 7 TELEVISION CLOUD PHOTOGRAPHY' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS. IDENTICAL EXPERIMENTS WERE FLOWN ON ESSA 3, 7, AND 9.

REFERENCES

23, 24, 25, 29, 30, 35, 89, 98, 288, 297, 332, 415, 459, 476, 510, 547, AND 742.

EXPERIMENT NAME- FLAT PLATE RADIOMETER (FPR) NSSDC ID 67-036A-02

EXPERIMENT PERSONNEL

PI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WIS.
OI - R.J.	PARENT	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092267

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 5 FLAT PLATE RADIOMETER (FPR) SYSTEM WAS DESIGNED TO PROVIDE A MEASUREMENT OF THE GLOBAL DISTRIBUTION OF REFLECTED SOLAR AND LONG-WAVE RADIATION LEAVING THE EARTH. THE FPR SYSTEM WAS COMPRISED OF FOUR INFRARED SENSORS, AN ANALOG-TO-DIGITAL CONVERTER, A COMMUTATOR, AND A TAPE RECORDER. TWO PAIRS OF RADIOMETERS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT WITH THEIR AXES PERPENDICULAR TO THE SPIN AXIS. A CONE SHIELD WAS EMPLOYED ON TWO OF THE RADIOMETERS TO ISOLATE OR REDUCE ANY RESPONSE DUE TO DIRECT SOLAR RADIATION. THE FIELD OF VIEW ON THE OTHER TWO INSTRUMENTS WAS UNRESTRICTED. BOTH TYPES OF RADIOMETERS USED A COATED (EITHER BLACK OR WHITE) ALUMINUM DISC AS THE SENSING ELEMENT. THE DISC TEMPERATURE WAS MEASURED BY TWO THERMISTORS MOUNTED ON THE BACK SURFACE OF THE DISC. THE BLACK-COATED DISC RESPONDED TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND EMITTED LONG-WAVE RADIATION. THE WHITE DISC REFLECTED IN THE VISUAL RANGE BUT ABSORBED IN THE INFRARED (7 TO 30 MICRON) RANGE. IDENTICAL EXPERIMENTS WERE FLOWN ON THE ESSA 3, 7, AND 9 SPACECRAFT. FOR A FULL DESCRIPTION OF THE ESSA FPR, SEE 'STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS, ANNUAL REPORT - 1966,' UNIVERSITY OF WISCONSIN, 111-129, MARCH 1967. THE EXPERIMENT PERFORMED NORMALLY, AND GOOD DATA WERE OBTAINED FROM LAUNCH UNTIL SEPTEMBER 22, 1967, WHEN THE RADIOMETER FAILED. DATA FROM THE EXPERIMENT ARE AVAILABLE ON MAGNETIC TAPE FROM NOAA-NESS, SUITLAND, MARYLAND.

REFERENCES

104, 204, 610, 676, 677, AND 930.

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SPACECRAFT COMMON NAME- ESSA 6 NSSDC ID 67-114A
ALTERNATE NAMES- TOS-D

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 11/23/67
APOGEE- 1488.00 KM ALT
PERIGEE- 1410.00 KM ALT
PERIOD- 114.8 MIN
INCLINATION- 102.12 DEG

OTHER INFORMATION
SPACECRAFT WT- 132. KG
LAUNCH DATE- 11/10/67
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 110469

SPACECRAFT PERSONNEL
PM - W.W. JONES NASA-GSFC GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION
ESSA 6 WAS A SUN-SYNCHRONOUS OPERATIONAL METEOROLOGICAL SATELLITE DESIGNED TO PROVIDE REAL-TIME EARTH CLOUDCOVER TV PICTURES TO PROPERLY EQUIPPED GROUND RECEIVING STATIONS FOR USE IN WEATHER ANALYSIS AND FORECASTING. THE SATELLITE HAD ESSENTIALLY THE SAME CONFIGURATION AS THAT OF A TIROS SPACECRAFT, I.E., AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED BY APPROXIMATELY 10,000 1- BY 2-CM SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. TWO REDUNDANT WIDE-ANGLE AUTOMATIC PICTURE TRANSMISSION (APT) CAMERAS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. PROJECTING DOWNWARD FROM THE BASEPLATE WERE A PAIR OF CROSSED-DIPOLE COMMAND RECEPTION ANTENNAS. A MONOPOLE TELEMETRY (136.500 MHZ) AND TRACKING (136.770 MHZ) ANTENNA EXTENDED OUTWARD FROM THE TOP OF THE COVER ASSEMBLY. THE SATELLITE SPIN RATE WAS CONTROLLED BY MEANS OF A MAGNETIC ATTITUDE SPIN COIL (MASC), WITH THE SPIN AXIS MAINTAINED NORMAL TO THE ORBITAL PLANE (CARTWHEEL ORBIT MODE) TO WITHIN PLUS OR MINUS 1 DEG. THE MASC WAS A CURRENT-CARRYING COIL MOUNTED IN THE COVER ASSEMBLY. THE MAGNETIC FIELD INDUCED BY THE CURRENT INTERACTED WITH THE EARTH'S MAGNETIC FIELD TO PROVIDE THE TORQUE NECESSARY TO MAINTAIN A DESIRED SPIN RATE OF 10.9 RPM. THE SATELLITE PERFORMED NORMALLY AFTER LAUNCH. THE APT SYSTEM WAS TURNED OPERATIONALLY OFF ON JULY 25, 1969, AND REACTIVATED ON SEPTEMBER 11, 1969. THE SPACECRAFT WAS DEACTIVATED ON NOVEMBER 4, 1969.

REFERENCES
98, 100, 438, 511, 675, 700, AND 772.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM NSSDC ID 67-114A-01

EXPERIMENT PERSONNEL
PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 110469

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 6 AUTOMATIC PICTURE TRANSMISSION (APT) SUBSYSTEM WAS A CAMERA AND TRANSMITTER COMBINATION DESIGNED TO TRANSMIT REAL-TIME, DAYLIGHT, SLOW-SCAN TELEVISION PICTURES OF CLOUD COVER TO ANY PROPERLY EQUIPPED GROUND RECEIVING STATION. THE CAMERA SYSTEM CONSISTED OF TWO REDUNDANT APT CAMERAS WITH 2.54-CM-DIAMETER VIDICONS. EACH CAMERA HAD A 108-DEG WIDE-ANGLE F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7 MM. THE CAMERAS WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. THE CAMERAS WERE PROGRAMMED TO TAKE FOUR OR EIGHT APT PICTURES PER ORBIT. THE ACTUAL PICTURE TAKING REQUIRED 8 SEC AND THE TRANSMISSION 200 SEC. EARTH-CLOUD IMAGES RETAINED ON THE PHOTOSENSITIVE SURFACE OF THE VIDICON READ OUT AT FOUR LINES PER SECOND TO PRODUCE AN 800-LINE PICTURE. TWO 5-W TV TRANSMITTERS (137.5 MHZ) RELAYED THE PICTURES TO LOCAL APT STATIONS WITHIN COMMUNICATION RANGE. THE FACEPLATE OF THE VIDICON HAD RETICLE MARKS THAT APPEARED ON THE PICTURE FORMAT TO AID IN RELATING THE PICTURE TO ITS GEOGRAPHICAL POSITION ON THE EARTH'S SURFACE. AT NOMINAL SATELLITE ATTITUDE AND ALTITUDE (APPROXIMATELY 1450 KM), A PICTURE COVERED A 3100- BY 3100-KM SQUARE WITH A HORIZONTAL RESOLUTION OF ABOUT 4 KM AT NADIR. THERE WAS 30 PERCENT OVERLAP BETWEEN PICTURES ALONG THE TRACK TO ENSURE COMPLETE COVERAGE. THE EXPERIMENT WAS SUCCESSFUL AND OPERATED NEARLY CONTINUOUSLY UNTIL THE CAMERA SYSTEM WAS DEACTIVATED ON NOVEMBER 4, 1969. IDENTICAL EXPERIMENTS WERE FLOWN ON ESSA 2, 4, AND 8. APT DATA ARE PRIMARILY INTENDED FOR OPERATIONAL USE WITHIN THE LOCAL APT ACQUISITION STATION. HOWEVER, COPIES OF PICTURES TAKEN OVER THE UNITED STATES ARE MAINTAINED ON FILE AT NOAA-NESS, SUITLAND, MARYLAND.

REFERENCES

12, 54, 98, 261, 288, 456, 509, 652, 671, 672, 678, 711, 742, 827, 866, AND 871.

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SPACECRAFT COMMON NAME- ESSA 7 NSSDC ID 68-069A
ALTERNATE NAMES- PL-683B, TOS E

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 08/16/68
APOGEE- 1476.00 KM ALT
PERIGEE- 1432.00 KM ALT
PERIOD- 114.9 MIN
INCLINATION- 101.826 DEG

OTHER INFORMATION
SPACECRAFT WT- 144. KG
LAUNCH DATE- 08/16/68
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 071969

SPACECRAFT PERSONNEL
PM - W.W. JONES NASA-GSFC GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ESSA 7 WAS A SUN-SYNCHRONOUS OPERATIONAL METEOROLOGICAL SATELLITE DESIGNED TO TAKE AND RECORD DAYTIME EARTH-CLOUD PICTURES ON A GLOBAL BASIS FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION FACILITY. THE SPACECRAFT WAS ALSO CAPABLE OF PROVIDING WORLDWIDE MEASUREMENTS OF REFLECTED SOLAR AND LONG-WAVE RADIATION LEAVING THE EARTH. THE SPACECRAFT HAD ESSENTIALLY THE SAME CONFIGURATION AS THAT OF A TIROS SATELLITE, I.E., AN 18-SIDED RIGHT

PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED BY APPROXIMATELY 10,000, 1- BY 2-CM SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. TWO REDUNDANT ADVANCED VIDICON CAMERA SYSTEM (AVCS) CAMERAS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. TWO SETS OF FLAT PLATE RADIOMETERS WERE ALSO SUSPENDED ON OPPOSITE SIDES OF THE SATELLITE, BENEATH THE EDGE OF THE BASEPLATE. A PAIR OF CROSSED-DIPOLE COMMAND RECEIVER ANTENNAS PROJECTED OUT AND DOWNWARD FROM THE BASEPLATE. A MONOPOLE TELEMETRY AND TRACKING ANTENNA EXTENDED OUTWARD FROM THE TOP OF THE COVER ASSEMBLY. THE SATELLITE SPIN RATE WAS CONTROLLED BY MEANS OF A MAGNETIC ATTITUDE SPIN COIL (MASC), WITH THE SPIN AXIS MAINTAINED NORMAL TO THE ORBITAL PLANE (CARTWHEEL ORBIT MODE) TO WITHIN PLUS OR MINUS 1 DEG. THE MASC WAS A CURRENT-CARRYING COIL MOUNTED IN THE COVER ASSEMBLY. THE INTERNAL MAGNETIC FIELD INDUCED BY THE CURRENT INTERACTED WITH THE EARTH'S MAGNETIC FIELD TO PROVIDE THE TORQUE NECESSARY TO MAINTAIN A DESIRED SPIN RATE OF 9.225 RPM. ONE AVCS CAMERA FAILED ALMOST IMMEDIATELY AFTER LAUNCH. THE RADIOMETER EXPERIMENT FAILED ON JUNE 23, 1969, AND THE REMAINING CAMERA SYSTEM FAILED ON JULY 19, 1969. THE SPACECRAFT WAS DEACTIVATED ON MARCH 10, 1970, AFTER BEING LEFT ON FOR AN ADDITIONAL TIME PERIOD FOR ENGINEERING PURPOSES.

REFERENCES
84, 98, 100, 266, 375, 438, 511, 603, 675, AND 772.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS)   NSSDC ID 68-069A-01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 071969

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 7 ADVANCED VIDICON CAMERA SYSTEM (AVCS) WAS A COMBINATION CAMERA, TAPE RECORDER, AND TRANSMITTER THAT COULD RECORD AND STORE A SERIES OF REMOTE DAYTIME CLOUDCOVER PICTURES FOR SUBSEQUENT PLAYBACK TO A GROUND DATA ACQUISITION FACILITY. THE CAMERAS AND TAPE RECORDER SYSTEM WERE ESSENTIALLY THE SAME AS THOSE ON NIMBUS 1 AND 2. THE ESSA AVCS SYSTEM CONSISTED OF TWO REDUNDANT WIDE-ANGLE CAMERAS WITH 2.54-CM-DIAMETER VIDICONS. THE CAMERAS WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT, WITH THE OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. THE CAMERA OPTIC SYSTEM EMPLOYED A 108-DEG LENS WITH A FOCAL LENGTH OF 6.0 MM. EACH CAMERA WAS INDEPENDENTLY TRIGGERED INTO ACTION ONLY WHEN IT CAME IN VIEW OF THE EARTH. A VIDEO FRAME CONSISTED OF 0.25 SEC OF BLANKED VIDEO FOLLOWED BY 6.25 SEC OF VIDICON SCAN (833 LINES) AND A FINAL 0.25-SEC PERIOD OF BLANKED VIDEO. CONCURRENT WITH SHUTTER ACTUATION, A 16-INCREMENT GRAY SCALE WAS INCLUDED AT THE EDGE OF EACH PICTURE FRAME AS A CONTRAST CHECK. A FOUR-TRACK TAPE RECORDER COULD STORE UP TO 36 PICTURES. THE DATA COULD BE READ OUT BETWEEN PICTURE TAKING CYCLES WITHOUT LOSING A PICTURE OR INTERRUPTING A SEQUENCE. SIX OR 12 AVCS PICTURES PER ORBIT COULD BE PROGRAMMED. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 1450 KM), A PICTURE COVERED A 3100- BY 3100-KM SQUARE WITH A HORIZONTAL RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS A 50 PERCENT OVERLAP ALONG THE TRACK BETWEEN SUCCESSIVE PICTURES TO ENSURE COMPLETE COVERAGE. ONE CAMERA FAILED SOON AFTER LAUNCH. HOWEVER, APPROXIMATELY 80,000 USABLE PICTURES WERE OBTAINED FROM THE REMAINING CAMERA

BEFORE ITS TAPE RECORDER FAILED ON JULY 19, 1969. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF AVAILABLE DATA, SEE THE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - ESSA 7 TELEVISION CLOUD PHOTOGRAPHY,' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS. IDENTICAL EXPERIMENTS WERE FLOWN ON ESSA 3, 5, AND 9.

REFERENCES

24, 26, 27, 89, 98, 288, 375, 430, 454, 711, 742, AND 937.

EXPERIMENT NAME- FLAT PLATE RADIOMETER (FPR) NSSDC ID 68-069A-02

EXPERIMENT PERSONNEL

PI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WIS.
OI - R.J.	PARENT	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 062369

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 7 FLAT PLATE RADIOMETER (FPR) SYSTEM WAS DESIGNED TO PROVIDE A MEASUREMENT OF THE GLOBAL DISTRIBUTION OF REFLECTED SOLAR AND LONG-WAVE RADIATION LEAVING THE EARTH. THE FPR SYSTEM WAS COMPRISED OF FOUR INFRARED SENSORS, AN ANALOG-TO-DIGITAL CONVERTER, A COMMUTATOR, AND A TAPE RECORDER. TWO PAIRS OF RADIOMETERS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT WITH THEIR AXES PERPENDICULAR TO THE SPIN AXIS. A CONE SHIELD WAS EMPLOYED ON TWO OF THE RADIOMETERS TO ISOLATE OR REDUCE ANY RESPONSE DUE TO DIRECT SOLAR RADIATION. THE FIELD OF VIEW ON THE OTHER TWO INSTRUMENTS WAS UNRESTRICTED. BOTH TYPES OF RADIOMETERS USED A COATED (EITHER BLACK OR WHITE) ALUMINUM DISC AS THE SENSING ELEMENT. THE DISC TEMPERATURE WAS MEASURED BY TWO THERMISTORS MOUNTED ON THE BACK SURFACE OF THE DISC. THE BLACK-COATED DISC RESPONDED TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND EMITTED LONG-WAVE RADIATION. THE WHITE DISC REFLECTED IN THE VISUAL RANGE BUT ABSORBED IN THE INFRARED (7 TO 30 MICRON) RANGE. IDENTICAL EXPERIMENTS WERE FLOWN ON THE ESSA 3, 5, AND 9 SPACECRAFT. FOR A FULL DESCRIPTION OF THE ESSA FPR, SEE 'STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS, ANNUAL REPORT - 1966,' UNIVERSITY OF WISCONSIN, 111-129, MARCH 1967. THE RADIOMETER PERFORMED NORMALLY, AND GOOD DATA WERE OBTAINED FROM LAUNCH UNTIL JUNE 23, 1969, WHEN THE RADIOMETER FAILED. DATA FROM THIS EXPERIMENT ARE AVAILABLE ON MAGNETIC TAPE FROM NOAA-NESS, SUITLAND, MARYLAND.

REFERENCES

104, 204, 610, 676, AND 677.

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SPACECRAFT COMMON NAME- ESSA 8 NSSDC ID 68-114A
ALTERNATE NAMES- PL-691A, TOS F

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC

OTHER INFORMATION
SPACECRAFT WT- 132. KG

EPOCH DATE- 12/16/68
APOGEE- 1473.00 KM ALT
PERIGEE- 1410.00 KM ALT
PERIOD- 114.7 MIN
INCLINATION- 101.90 DEG

LAUNCH DATE- 12/15/68
OPERATING STATUS- NORMAL

SPACECRAFT PERSONNEL
PM - W.W. JONES   NASA-GSFC   GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ESSA 8 WAS A SUN-SYNCHRONOUS OPERATIONAL METEOROLOGICAL SATELLITE DESIGNED TO PROVIDE REAL-TIME EARTH CLOUDCOVER TV PICTURES TO PROPERLY EQUIPPED GROUND RECEIVING STATIONS FOR USE IN WEATHER ANALYSIS AND FORECASTING. THE SATELLITE HAD ESSENTIALLY THE SAME CONFIGURATION AS THAT OF A TIROS SPACECRAFT, I.E., AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED BY APPROXIMATELY 10,000 1- BY 2-CM SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. TWO REDUNDANT WIDE-ANGLE AUTOMATIC PICTURE TRANSMISSION (APT) CAMERAS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. PROJECTING DOWNWARD FROM THE BASEPLATE WERE A PAIR OF CROSSED-DIPOLE COMMAND RECEPTION ANTENNAS. A MONOPOLE TELEMETRY (136.500 MHZ) AND TRACKING (136.770 MHZ) ANTENNA EXTENDED OUTWARD FROM THE TOP OF THE COVER ASSEMBLY. THE SATELLITE SPIN RATE WAS CONTROLLED BY MEANS OF A MAGNETIC ATTITUDE SPIN COIL (MASC), WITH THE SPIN AXIS MAINTAINED NORMAL TO THE ORBITAL PLANE (CARTWHEEL ORBIT MODE) TO WITHIN PLUS OR MINUS 1 DEG. THE MASC WAS A CURRENT-CARRYING COIL MOUNTED IN THE COVER ASSEMBLY. THE MAGNETIC FIELD INDUCED BY THE CURRENT INTERACTED WITH THE EARTH'S MAGNETIC FIELD TO PROVIDE THE TORQUE NECESSARY TO MAINTAIN A DESIRED SPIN RATE OF 10.9 RPM. AS OF APRIL 1972, THE SPACECRAFT CONTINUED TO OPERATE.

REFERENCES

98, 100, 141, 189, 190, 191, 208, 272, 375, 438, 511, 675, AND 772.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM   NSSDC ID 68-114A-01

EXPERIMENT PERSONNEL
PI - NESS STAFF   NOAA-NESS   SUITLAND, MD.

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE ESSA 8 AUTOMATIC PICTURE TRANSMISSION (APT) SUBSYSTEM WAS A CAMERA AND TRANSMITTER COMBINATION DESIGNED TO TRANSMIT REAL-TIME, DAYLIGHT, SLOW-SCAN TELEVISION PICTURES OF CLOUD COVER TO ANY PROPERLY EQUIPPED GROUND RECEIVING STATIONS. THE CAMERA SYSTEM CONSISTED OF TWO REDUNDANT APT CAMERAS WITH 2.54-CM-DIAMETER VIDICONS. EACH CAMERA HAD A 108-DEG WIDE-ANGLE F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7 MM. THE CAMERAS WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPACECRAFT SPIN AXIS. THE CAMERAS WERE PROGRAMMED TO TAKE FOUR OR EIGHT APT PICTURES PER ORBIT. THE ACTUAL PICTURE TAKING REQUIRED 8 SEC AND THE TRANSMISSION 200 SEC. EARTH-CLOUD IMAGES WERE RETAINED ON THE PHOTOSENSITIVE SURFACE OF THE VIDICON AND WERE READ OUT AT FOUR LINES PER SECOND TO PRODUCE AN 800-LINE PICTURE. TWO 5-W TV TRANSMITTERS (137.5 MHZ) RELAYED THE PICTURES TO LOCAL APT STATIONS WITHIN

COMMUNICATION RANGE. THE FACEPLATE OF THE VIDICON HAD RETICLE MARKS THAT APPEARED ON THE PICTURE FORMAT TO AID IN RELATING THE PICTURE TO ITS GEOGRAPHICAL POSITION ON THE EARTH'S SURFACE. AT NOMINAL SATELLITE ATTITUDE AND ALTITUDE (APPROXIMATELY 1450 KM), A PICTURE COVERED A 3100- BY 3100-KM SQUARE WITH A HORIZONTAL RESOLUTION OF ABOUT 4 KM AT NADIR. THERE WAS A 30 PERCENT OVERLAP BETWEEN PICTURES ALONG THE TRACK TO ENSURE COMPLETE COVERAGE. A SHIFT IN CAMERA NUMBER 2 VIDICON SCANNING OCCURRED IN THE SPRING OF 1969, AND ITS OPERATION HAS BEEN LIMITED SINCE THAT TIME. THE OTHER CAMERA CONTINUES TO FUNCTION NORMALLY AS OF APRIL 1972. IDENTICAL EXPERIMENTS WERE FLOWN ON ESSA 2, 4, AND 6. APT DATA ARE PRIMARILY INTENDED FOR OPERATIONAL USE WITHIN THE LOCAL APT ACQUISITION STATION. HOWEVER, COPIES OF PICTURES TAKEN OVER THE UNITED STATES ARE MAINTAINED ON FILE AT NOAA-NESS, SUITLAND, MARYLAND.

REFERENCES

12, 54, 72, 74, 75, 76, 98, 261, 288, 375, 430, 508, 524, 556, 652, 664, 711, 742, 827, 867, AND 871.

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SPACECRAFT COMMON NAME- ESSA 9 NSSDC ID 69-016A
ALTERNATE NAMES- PL-691L, TOS G

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 02/26/69
APOGEE- 1504.00 KM ALT
PERIGEE- 1423.00 KM ALT
PERIOD- 115.2 MIN
INCLINATION- 101.790 DEG

OTHER INFORMATION
SPACECRAFT WT- 144.0 KG
LAUNCH DATE- 02/26/69
OPERATING STATUS- NORMAL

SPACECRAFT PERSONNEL
PM - W.W. JONES NASA-GSFC GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ESSA 9 WAS A SUN-SYNCHRONOUS METEOROLOGICAL SATELLITE DESIGNED TO TAKE AND RECORD DAYTIME EARTH-CLOUD PICTURES ON A GLOBAL BASIS FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION FACILITY. THE SPACECRAFT WAS ALSO CAPABLE OF PROVIDING WORLDWIDE MEASUREMENTS OF REFLECTED SOLAR AND LONG-WAVE RADIATION LEAVING THE EARTH. THE SPACECRAFT HAD ESSENTIALLY THE SAME CONFIGURATION AS THAT OF A TIROS SATELLITE, I.E., AN 18-SIDED RIGHT PRISM, 107 CM ACROSS OPPOSITE CORNERS AND 56 CM HIGH, WITH A REINFORCED BASEPLATE CARRYING MOST OF THE SUBSYSTEMS AND A COVER ASSEMBLY (HAT). ELECTRICAL POWER WAS PROVIDED FROM APPROXIMATELY 10,000 1- BY 2-CM SOLAR CELLS THAT WERE MOUNTED ON THE COVER ASSEMBLY AND BY 21 NICKEL-CADMIUM BATTERIES. TWO REDUNDANT ADVANCED VIDICON CAMERA SYSTEM (AVCS) CAMERAS WERE MOUNTED ON OPPOSITE SIDES OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. TWO SETS OF FLAT PLATE RADIOMETERS WERE ALSO SUSPENDED ON OPPOSITE SIDES OF THE SATELLITE, BENEATH THE EDGE OF THE BASEPLATE. A PAIR OF CROSSED-DIPOLE COMMAND RECEIVER ANTENNAS PROJECTED OUT AND DOWN FROM THE BASEPLATE. A MONOPOLE TELEMETRY AND TRACKING ANTENNA EXTENDED OUTWARD FROM THE TOP OF THE COVER ASSEMBLY. THE SATELLITE SPIN RATE WAS CONTROLLED BY MEANS OF A MAGNETIC ATTITUDE SPIN COIL (MASC), WITH THE SPIN AXIS MAINTAINED NORMAL TO THE ORBITAL PLANE (CARTWHEEL ORBIT MODE) TO WITHIN PLUS OR MINUS 1 DEG. THE MASC WAS A CURRENT-CARRYING COIL MOUNTED IN THE COVER ASSEMBLY. THE

MAGNETIC FIELD INDUCED BY THE CURRENT INTERACTED WITH THE EARTH'S MAGNETIC FIELD TO PROVIDE THE TORQUE NECESSARY TO MAINTAIN A DESIRED SPIN RATE OF 9.225 RPM. WITH THE EXCEPTION OF THE RADIOMETER EXPERIMENT, WHICH WAS TERMINATED IN MAY 1970, THE SPACECRAFT AND ITS SUBSYSTEMS ARE OPERATING NORMALLY (JUNE 1972).

REFERENCES
84, 98, 100, 141, 208, 209, 265, 272, 438, 511, 603, AND 675.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS) NSSDC ID 69-016A-01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION
THE ESSA 9 ADVANCED VIDICON CAMERA SYSTEM (AVCS) WAS A COMBINATION CAMERA, TAPE RECORDER, AND TRANSMITTER THAT COULD RECORD AND STORE A SERIES OF REMOTE DAYTIME CLOUDCOVER TV PICTURES FOR SUBSEQUENT PLAYBACK TO A GROUND DATA ACQUISITION FACILITY. THE CAMERA AND TAPE RECORDER SYSTEM CONSISTED OF TWO REDUNDANT WIDE-ANGLE CAMERAS WITH 2.54-CM-DIAMETER VIDICONS. THE CAMERAS WERE MOUNTED 180 DEG APART ON THE SIDE OF THE SPACECRAFT, WITH THEIR OPTICAL AXES PERPENDICULAR TO THE SPIN AXIS. THE CAMERA OPTIC SYSTEM EMPLOYED A 108-DEG LENS WITH A FOCAL LENGTH OF 6.0 MM. EACH CAMERA WAS INDEPENDENTLY TRIGGERED INTO ACTION ONLY WHEN IT CAME IN VIEW OF THE EARTH. A VIDEO FRAME CONSISTED OF 0.25 SEC OF BLANKED VIDEO FOLLOWED BY 6.25 SEC OF VIDICON SCAN (833 LINES) AND A FINAL 0.25-SEC PERIOD OF BLANKED VIDEO. CONCURRENT WITH SHUTTER ACTUATION, A 16-INCREMENT GRAY SCALE WAS INCLUDED AT THE EDGE OF EACH PICTURE FRAME AS A CONTRAST CHECK. A FOUR-TRACK TAPE RECORDER COULD STORE UP TO 36 PICTURES. THE DATA COULD BE READ OUT BETWEEN PICTURE TAKING CYCLES WITHOUT LOSING A PICTURE OR INTERRUPTING A SEQUENCE. SIX OR 12 AVCS PICTURES PER ORBIT COULD BE PROGRAMMED. AT NOMINAL ATTITUDE AND ALTITUDE (APPROXIMATELY 1450 KM), A PICTURE COVERED A 3100- BY 3100-KM SQUARE WITH A HORIZONTAL RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS A 50 PERCENT OVERLAP ALONG THE TRACK BETWEEN SUCCESSIVE PICTURES TO ENSURE COMPLETE COVERAGE. DATA FROM THIS EXPERIMENT ARE AVAILABLE FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF AVAILABLE DATA, SEE THE 'CATALOG OF METEOROLOGICAL SATELLITE DATA - ESSA 9 TELEVISION CLOUD PHOTOGRAPHY.' FOR SALE FROM THE U.S. SUPERINTENDENT OF DOCUMENTS. AS OF APRIL 1972, THE EXPERIMENT CONTINUES TO FUNCTION NORMALLY. IDENTICAL EXPERIMENTS WERE FLOWN ON ESSA 3, 5, AND 7.

REFERENCES
28, 31, 33, 89, 98, 288, 543, 578, 811, 832, AND 881.

EXPERIMENT NAME- FLAT PLATE RADIOMETER (FPR) NSSDC ID 69-016A-02

EXPERIMENT PERSONNEL

PI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WIS.
OI - R.J.	PARENT	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 040470

EXPERIMENT BRIEF DESCRIPTION

THE FLAT PLATE RADIOMETER (FPR) SYSTEM WAS DESIGNED TO PROVIDE A MEASUREMENT OF THE GLOBAL DISTRIBUTICN CF REFLECTED SCLAR AND LONG-WAVE RADIATION LEAVING THE EARTH. THE FPR SYSTEM WAS COMPRISED OF FOUR INFRARED SENSORS, AN ANALCG-TO-DIGITAL CCNVERTER, A CCMMUTATOR, AND A TAPE RECORDER. TWO PAIRS OF RADIOMETERS WERE MCUNTED CN OPPCSITE SIDES OF THE SPACECRAFT. A CONE SHIELD WAS EMPLOYED ON TWO OF THE RADIOMETERS TO ISCLATE OR REDUCE ANY RESPONSE DUE TO CIRECT SOLAR RADIATICN. THE FIELD OF VIEW ON THE OTHER TWO INSTRUMENTS WAS UNRESTRICTED. BCTH TYPES CF RADICMETERS USED A COATED (EITHER BLACK OR WHITE) ALUMINUM DISC AS THE SENSING ELEMENT. THE DISC TEMPERATURE WAS MEASURED BY TWO THERMISTCRS HUNG ON THE BLACK SURFACE OF THE DISC. THE BLACK SURFACE RESPCNDED TO THE SUM OF THE REFLECTED SOLAR, DIRECT SOLAR, AND EMITTED LONG-WAVE RADIATICN. THE WHITE CISC REFLECTED IN THE VISUAL RANGE BUT ABSORBED IN THE INFRARED (7 TO 30 MICRCN) RANGE. IDENTICAL EXPERIMENTS WERE FLOWN ON THE ESSA 3, 5, AND 7 SPACECRAFT. FOR A FULL DESCRIPTION OF THE ESSA FLAT PLATE RADICMETER, SEE 'STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS, ANNUAL REPCRT - 1966,' UNIVERSITY OF WISCONSIN, 111-129, MAR. 1967. THE RADIOMETER PERFCRMED NORMALLY, AND GOOD DATA WERE OBTAINED FROM LAUNCH UNTIL APRIL 4, 1970, WHEN AN ELECTRONIC FAILURE OCCURRED IN THE TEMPERATURE CALIBRATION CIRCUITRY. THE EXPERIMENT WAS TURNED OFF ON MAY 21, 1970.

REFERENCES

104, 204, 265, 610, 676, 677, AND 742.

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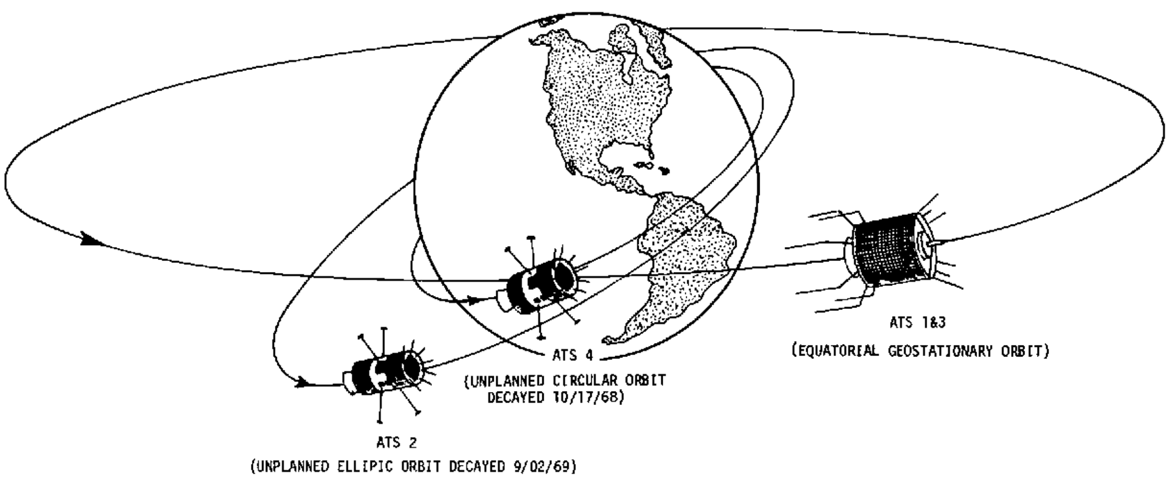

ATS SERIES

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4. ATS Series

SPACECRAFT COMMON NAME- ATS 1 NSSDC ID 66-110A
ALTERNATE NAMES- ATS-B

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 12/07/66
APOGEE- 36887.0 KM ALT
PERIGEE- 35852.0 KM ALT
PERIOD- 1466. MIN
INCLINATION- C.23 DEG

OTHER INFORMATION
SPACECRAFT WT- 352. KG
LAUNCH DATE- 12/07/66
OPERATING STATUS- PARTIAL

SPACECRAFT PERSONNEL

PM - D.V.	FORDYCE	NASA-GSFC	GREENBELT, MD.
PS - T.L.	AGGSON	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ATS 1 (APPLICATIONS TECHNOLOGY SATELLITE) WAS DESIGNED AND LAUNCHED FOR THE PURPOSE OF (1) TESTING NEW CONCEPTS IN SPACECRAFT DESIGN, PROPULSION, AND STABILIZATION, (2) COLLECTING HIGH-QUALITY CLOUDCOVER PICTURES AND RELAYING PROCESSED METEOROLOGICAL DATA VIA AN EARTH-SYNCHRONOUS SATELLITE, (3) PROVIDING IN SITU MEASUREMENTS OF THE AEROSPACE ENVIRONMENT, AND (4) TESTING IMPROVED COMMUNICATION SYSTEMS. THE SPIN-STABILIZED SPACECRAFT WAS CYLINDRICALLY SHAPED AND MEASURED 1.35 CM LONG AND 142 CM IN DIAMETER. THE PRIMARY STRUCTURAL MEMBERS WERE A HONEYCOMBED EQUIPMENT SHELF AND THRUST TUBE. SUPPORT RODS EXTENDED RADIALLY OUTWARD FROM THE THRUST TUBE AND WERE AFFIXED TO SOLAR PANELS THAT FORMED THE OUTER WALLS OF THE SPACECRAFT. EQUIPMENT COMPONENTS AND PAYLOAD WERE MOUNTED IN THE ANNULAR SPACE BETWEEN THE THRUST TUBE AND SOLAR PANELS. IN ADDITION TO SOLAR PANELS, THE SPACECRAFT WAS EQUIPPED WITH TWO RECHARGEABLE NICKEL-CADMIUM BATTERIES TO PROVIDE ELECTRICAL POWER. EIGHT 150-CM-LONG VHF EXPERIMENT WHIP ANTENNAS WERE MOUNTED AROUND THE AFT END OF THE SPACECRAFT, WHILE EIGHT TELEMETRY AND COMMAND ANTENNAS WERE PLACED ON THE FORWARD END. SPACECRAFT GUIDANCE AND ORBITAL CORRECTIONS WERE ACCOMPLISHED BY 2.3-KG HYDROGEN PEROXIDE AND HYDRAZINE THRUSTERS, WHICH WERE ACTIVATED BY GROUND COMMAND. THE SATELLITE WAS INITIALLY PLACED AT 151.16 DEG W LONGITUDE OVER THE PACIFIC OCEAN IN A GEOSTATIONARY EQUATORIAL ORBIT. IN GENERAL, MOST OF THE EXPERIMENTS WERE SUCCESSFUL AS OF APRIL 1972, GOOD DATA WERE STILL BEING RECEIVED FROM SOME OF THE EXPERIMENTS.

REFERENCES

6, 7, 11, 17, 18, 85, 128, 129, 130, 141, 271, 342, 359, 400, 405, 438, 700, 714, 774, AND 841.

EXPERIMENT NAME- SPIN-SCAN CLOUDCOVER CAMERA (SSCC) NSSDC ID 66-110A-09

EXPERIMENT PERSONNEL

PI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE ATS 1 SPIN-SCAN CLOUDCOVER CAMERA (SSCC) WAS DESIGNED TO PROVIDE NEARLY CONTINUOUS OBSERVATIONS OF CLOUDCOVER PATTERNS OVER THE WHOLE SUNLIT EARTH DISC. THE OPTICAL SYSTEM CONSISTED OF A TWO-ELEMENT CASSEGRAIN-TYPE TELESCOPE. LIGHT ENTERING THE SYSTEM WAS REFLECTED FROM A 13.7-CM-DIAMETER (25.4-CM FOCAL LENGTH) PRIMARY PARABOLIC MIRROR ONTO A FLAT SECONDARY QUARTZ MIRROR TO PRODUCE AN IMAGE ON THE FACE OF AN APERTURE PLATE. THE LIGHT THEN PASSED THROUGH THE 0.025-MM-DIAMETER APERTURE AND A HAZE FILTER TO IMPINGE ON A PHOTOCATHODE IN FRONT OF A PHOTOMULTIPLIER TUBE. THE TELESCOPE PHOTOMULTIPLIER ASSEMBLY COULD BE TILTED IN DISCRETE STEPS FROM 7.5 TO -7.5 DEG TO PRODUCE A NORTH-SOUTH SCAN, CORRESPONDING TO AN EARTH COVERAGE FROM 52 DEG N TO 52 DEG S. THE EAST-TO-WEST SCAN WAS PROVIDED BY THE SPIN OF THE SATELLITE ITSELF. A TOTAL TIME OF 20 MIN WAS REQUIRED TO SCAN ONE PICTURE AND 2 MIN TO RETRACE AT A NOMINAL SATELLITE ROTATION OF 100 RPM. FROM ITS GEOSTATIONARY EQUATORIAL ORBIT (APPROXIMATELY 30,000 KM ABOVE THE EARTH), THE CAMERA SYSTEM HAD A GROUND RESOLUTION OF BETTER THAN 4 KM AT THE SUBSATELLITE POINT. THE EXPERIMENT HAS BEEN HIGHLY SUCCESSFUL, WITH OVER 6 YR OF REAL-TIME CLOUDCOVER DATA HAVING BEEN OBTAINED. AS OF APRIL 1972, GOOD DATA WERE STILL BEING PRODUCED. FOR A LISTING AND DESCRIPTION OF THE DIFFERENT FORMS OF PHOTOGRAPHIC DATA AVAILABLE FROM THIS EXPERIMENT AND THEIR LOCATION, SEE THE 'METEOROLOGICAL DATA CATALOG FOR THE APPLICATIONS TECHNOLOGY SATELLITES' AVAILABLE THROUGH NSSDC.

REFERENCES

8, 9, 125, 126, 127, 128, 129, 130, 208, 209, 217, 227, 272, 280, 312, 393, 400, 435, 444, 477, 547, 578, 587, 604, 639, 647, 751, 753, 759, 796, 807, 837, 842, 843, 844, 864, 879, 882, 883, AND 920.

EXPERIMENT NAME- METEOROLOGICAL DATA RELAY SYSTEM NSSDC ID 66-110A-16

EXPERIMENT PERSONNEL

PI - S.	WISHNA	NOAA-NESS	SUITLAND, MD.
OI - D.W.	HOLMES	NOAA-NESS	GREENBELT, MD.

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE PRIMARY OBJECTIVE OF THE ATS 1 METEOROLOGICAL DATA RELAY SYSTEM (WEATHER FACSIMILE (WEFAX) EXPERIMENT) WAS TO TEST SATELLITE RETRANSMISSION OF FACSIMILE PRODUCTS PREPARED BY NOAA TO PARTICIPATING GROUND STATIONS. SECONDARY OBJECTIVES INCLUDED (1) TRANSMITTING SELECTED SPIN-SCAN CAMERA PICTURES VIA SATELLITE TO APT GROUND STATIONS AND (2) EXPLORING THE FEASIBILITY OF INCREASING THE AMOUNT OF DATA AVAILABLE TO APT GROUND STATIONS FROM ESSA AND NIMBUS SATELLITES. THE EXPERIMENT HAD NO UNIQUE HARDWARE ON BOARD. IT WAS PART OF THE ATS 1 VHF EXPERIMENT AND USED THE VHF TRANSPONDER TO RELAY THE DATA. THE TRANSPONDER TRANSMITTED AT 135.60 MHZ AND RECEIVED AT 149.22 MHZ. WEATHER FACSIMILE CHARTS AND SATELLITE CLOUDCOVER PICTURES WERE SENT VIA LAND LINE FROM NOAA, SUITLAND, MD., TO THE ATS WEFAX FIELD STATION AT MOJAVE, CALIFORNIA. THE CHARTS AND DATA WERE THEN TRANSMITTED TO THE SPACECRAFT FOR RELAY TO PARTICIPATING APT STATIONS. CLOUDCOVER PHOTOGRAPHS FROM THE ATS 1 SPIN-SCAN CAMERA WERE RETRANSMITTED THROUGH THE SPACECRAFT DIRECTLY FROM THE MOJAVE ATS GROUND STATION. THE EXPERIMENT WAS A SUCCESS AND CONTINUES TO OPERATE AS OF MAY 1972. A SIMILAR BUT MORE ADVANCED EXPERIMENT POSSESSING BETTER DATA REPRODUCTION CAPABILITIES WAS FLOWN ON ATS 3.

REFERENCES

209, 277, 359, 400, AND 483.

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SPACECRAFT COMMON NAME- ATS 2 NSSDC ID 67-031A
ALTERNATE NAMES- ATS-A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/07/67
APOGEE- 11180.0 KM ALT
PERIGEE- 186.000 KM ALT
PERIOD- 219.7 MIN
INCLINATION- 28.32 DEG

OTHER INFORMATION
SPACECRAFT WT- 319.11 KG
LAUNCH DATE- 04/06/67
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 090068

SPACECRAFT PERSONNEL

PM - D.V.	FORDYCE	NASA-GSFC	GREENBELT, MD.
PS - T.L.	AGGSON	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ATS 2 (APPLICATIONS TECHNOLOGY SATELLITE) WAS A MEDIUM ALTITUDE, GRAVITY-GRADIENT-STABILIZED SPACECRAFT DESIGNED TO (1) TEST NEW CONCEPTS IN SPACECRAFT DESIGN, PROPULSION, AND STABILIZATION, (2) TAKE HIGH-QUALITY CLOUDCOVER PICTURES, (3) PROVIDE IN SITU MEASUREMENTS OF THE AEROSPACE ENVIRONMENT, AND (4) TEST IMPROVED COMMUNICATION SYSTEMS. THE CYLINDRICALLY-SHAPED SPACECRAFT MEASURED 142 CM IN DIAMETER AND 183 CM IN LENGTH. THE SPACECRAFT STRUCTURE CONSISTED PRIMARILY OF A CORRUGATED THRUST TUBE WITH HONEYCOMBED BULKHEADS SECURED TO EACH END. EQUIPMENT COMPONENTS AND PAYLOAD WERE EXTERNALLY MOUNTED ON THE OUTER SURFACE OF THE THRUST TUBE AS WELL AS ON A STRUCTURE THAT SLID INTO THE INTERIOR OF THE THRUST TUBE. ELECTRIC POWER WAS PROVIDED BY TWO SOLAR ARRAYS MOUNTED ON EITHER END OF THE SPACECRAFT'S OUTER SHELL AND BY TWO RECHARGEABLE NICKEL-CADMIUM BATTERIES. EXTENDING RADIALLY OUTWARD FROM THE SIDE OF THE SPACECRAFT WERE FOUR 28.2-M, ADJUSTABLE GRAVITY-GRADIENT BOOMS. THE SPACECRAFT TELEMETRY SYSTEM CONSISTED OF FOUR 2.1-W TRANSMITTERS (TWO AT 136.47 MHZ AND TWO AT 137.35 MHZ), IN ADDITION TO A MICROWAVE COMMUNICATIONS EXPERIMENT. ATS 2 WAS PROGRAMMED TO BE LAUNCHED INTO AN 11,000-KM CIRCULAR EARTH ORBIT. HOWEVER, THE SECOND STAGE OF THE LAUNCH VEHICLE FAILED TO IGNITE, THUS RESULTING IN A HIGHLY ELLIPTICAL ORBIT. STRESSES INDUCED BY THIS UNPLANNED ORBIT EVENTUALLY INDUCED SPACECRAFT TUMBLING. IN SPITE OF THESE CONDITIONS, USEFUL DATA WERE OBTAINED FROM SOME OF THE EXPERIMENTS, MOST NOTABLY THE COSMIC-RAY AND PARTICLE EXPERIMENTS AND THE FIELD DETECTION EXPERIMENTS. DATA WERE SPORADICALLY TRANSMITTED UNTIL SEPTEMBER 1968. THE SATELLITE REENTERED THE ATMOSPHERE ON SEPTEMBER 2, 1969.

REFERENCES

7, 11, 17, 125, 130, 187, 359, AND 700.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS) NSSDC ID 67-031A-10

EXPERIMENT PERSONNEL

PI - H. OSTROW	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 071967

EXPERIMENT BRIEF DESCRIPTION

THE ATS 2 ADVANCED VIDICON CAMERA SYSTEM (AVCS) WAS A MODIFIED VERSION OF THE AVCS USED ON NIMBUS 1 AND 2. THE CAMERA SYSTEM WAS DESIGNED TO PROVIDE NEARLY CONTINUOUS CLOUDCOVER PICTURES FROM A MEDIUM ORBIT, GRAVITY-GRADIENT-STABILIZED SPACECRAFT. THE SYSTEM CONSISTED OF A TAPE RECORDER AND TWO CAMERAS -- ONE LOW-RESOLUTION WIDE-ANGLE (50 DEG) CAMERA AND ONE HIGH-RESOLUTION NARROW-ANGLE (3 DEG) CAMERA. THE WIDE-ANGLE CAMERA (12-MM LENS) WAS CAPABLE OF VIEWING THE FULL EARTH DISK WITH A GROUND RESOLUTION OF ABOUT 18 KM AT NADIR FROM A PLANNED SATELLITE HEIGHT OF 11,000 KM. THE NARROW-ANGLE CAMERA (200-MM LENS) VIEWED SELECTED SECTIONS OF THE EARTH WITH A GROUND RESOLUTION OF ABOUT 1 KM AT NADIR. EACH CAMERA WAS EQUIPPED WITH 2.54-CM-DIAMETER VIDICONS. A VIDEO FRAME CONSISTED OF 6.25 SEC OF SCAN (800 LINES). CONCURRENT WITH SHUTTER ACTUATION, A 16-INCREMENT GRAY SCALE WAS INCLUDED AT THE EDGE OF EACH PICTURE AS A CONTRAST CHECK. THE WIDE-ANGLE CAMERA WAS PROGRAMMED TO TAKE EARTH-CLOUD PICTURES AT 10-MIN INTERVALS AND THE NARROW-ANGLE CAMERA AT 5-MIN INTERVALS. THE SEQUENCING WAS TIMED SO THAT ONLY A SINGLE CAMERA OPERATED AT ANY ONE TIME. DATA FROM EITHER CAMERA COULD BE READ OUT DIRECTLY OR STORED ON A FOUR-TRACK TAPE RECORDER. UP TO 56 PICTURES COULD BE STORED FOR SUBSEQUENT PLAYBACK TO A GROUND DATA ACQUISITION STATION. ATS 2 FAILED TO ACHIEVE ITS PLANNED CIRCULAR ORBIT. THE SECOND STAGE OF THE LAUNCH VEHICLE FAILED TO IGNITE, THUS RESULTING IN A HIGHLY ELLIPTICAL ORBIT AND SUBSEQUENTLY LIMITING THE USEFULNESS OF THE COLLECTED DATA. THE WIDE-ANGLE CAMERA PRODUCED ONLY 33 USEFUL PICTURES, AND ONLY 19 USEFUL PICTURES WERE OBTAINED FROM THE NARROW-ANGLE CAMERA. THE LAST USEFUL DATA WERE TRANSMITTED ON JULY 19, 1967. DATA FROM THIS EXPERIMENT ARE ON FILE AT THE NIMBUS/ATS DATA UTILIZATION CENTER (NADUC), NASA-GSFC, GREENBELT, MD.

REFERENCES

125, 130, 359, 400, 435, AND 796.

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SPACECRAFT COMMON NAME- ATS 3 NSSDC ID 67-111A
ALTERNATE NAMES- ATS-C

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 11/06/67
- APOGEE- 35705.0 KM ALT
- PERIGEE- 35330.0 KM ALT
- PERIOD- 1422. MIN
- INCLINATION- 0.536 DEG

OTHER INFORMATION
- SPACECRAFT WT- 365.0 KG
- LAUNCH DATE- 11/05/67
- OPERATING STATUS- PARTIAL

SPACECRAFT PERSONNEL

PM - D.V. FORDYCE	NASA-GSFC	GREENBELT, MD.
PS - T.L. AGGSON	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ATS 3 (APPLICATIONS TECHNOLOGY SATELLITE) WAS ONE OF A SERIES OF SPACECRAFT DESIGNED TO DEMONSTRATE THE UTILITY AND FEASIBILITY OF A VARIETY OF TECHNOLOGICAL AND SCIENTIFIC ACTIVITIES THAT COULD BE CARRIED OUT BY AN EARTH-SYNCHRONOUS SPACECRAFT. OF THE 12 EXPERIMENTS ON BOARD, NINE WERE TECHNOLOGICAL ENGINEERING EXPERIMENTS CONCERNED WITH NAVIGATION, COMMUNICATIONS, AND SPACECRAFT OPERATION AND EQUIPMENT. TWO OF THE REMAINING EXPERIMENTS WERE PHOTOGRAPHIC IMAGING EXPERIMENTS THAT COULD PRODUCE NEAR REAL-TIME DAYLIGHT PICTURES OF THE EARTH-ATMOSPHERE SYSTEM. THE REMAINING EXPERIMENT WAS AN IONOSPHERIC BEACON. THE SPIN-STABILIZED SPACECRAFT WAS CYLINDRICALLY SHAPED AND MEASURED 180 CM IN LENGTH AND 142 CM IN DIAMETER. THE PRIMARY STRUCTURAL MEMBERS WERE A HONEYCOMBED EQUIPMENT SHELF AND THRUST TUBE. SUPPORT RODS EXTENDED RADIALLY OUTWARD FROM THE THRUST TUBE AND WERE AFFIXED TO SOLAR PANELS WHICH FORMED THE OUTER WALLS OF THE SPACECRAFT. EQUIPMENT COMPONENTS AND PAYLOAD WERE MOUNTED IN THE ANNULAR SPACE BETWEEN THE THRUST TUBE AND SOLAR PANELS. IN ADDITION TO SOLAR PANELS, THE SPACECRAFT WAS EQUIPPED WITH TWO RECHARGEABLE NICKEL-CADMIUM BATTERIES TO PROVIDE ELECTRICAL POWER. EIGHT 150-CM-LONG VHF EXPERIMENT WHIP ANTENNAS WERE MOUNTED AROUND THE AFT END OF THE SPACECRAFT, WHILE EIGHT TELEMETRY AND COMMAND WHIP ANTENNAS WERE PLACED ON THE FORWARD END. SPACECRAFT GUIDANCE AND ORBITAL CORRECTIONS WERE ACCOMPLISHED BY 2.3-KG HYDROGEN PEROXIDE AND HYDRAZINE THRUSTERS, WHICH WERE ACTIVATED BY GROUND COMMAND. INITIALLY PLACED AT 48 DEG W LONGITUDE OVER THE ATLANTIC OCEAN IN A GEOSTATIONARY EQUATORIAL ORBIT, THE SATELLITE POSITION HAS BEEN VARIED BETWEEN 45 AND 95 DEG W LONGITUDE IN SUPPORT OF METEOROLOGICAL OPERATIONS. IN GENERAL, THE VARIOUS EXPERIMENTS HAVE BEEN SUCCESSFUL AND, AS OF APRIL 1972, GOOD DATA WERE STILL BEING RECEIVED FROM MANY OF THE EXPERIMENTS.

REFERENCES

7, 11, 17, 122, 125, 136, 141, 187, 188, 271, 359, 405, 438, 511, 841, AND 904.

EXPERIMENT NAME- MULTICOLOR SPIN-SCAN CLOUDCOVER CAMERA (MSSCC) NSSDC ID 67-111A-01

EXPERIMENT PERSONNEL

PI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WIS.
OI - R.J.	PARENT	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- PARTIAL

EXPERIMENT BRIEF DESCRIPTION

THE ATS 3 MULTICOLOR SPIN-SCAN CLOUDCOVER CAMERA (MSSCC) REPRESENTED A SIGNIFICANT ADVANCE OVER A SIMILAR BUT MONOCHROMATIC SPIN-SCAN CAMERA ON ATS 1. THE MSSCC WAS MOUNTED WITH ITS OPTICAL AXIS PERPENDICULAR TO THE SPACECRAFT'S SPIN AXIS AND VIEWED THE EARTH THROUGH A SPECIAL APERTURE IN THE SPACECRAFT'S SIDE. THE CAMERA CONSISTED OF A HIGH-RESOLUTION TELESCOPE, THREE PHOTOMULTIPLIER LIGHT DETECTORS (RED, BLUE, AND GREEN), AND A PRECISION LATITUDE STEP MECHANISM. LIGHT ENTERING THE SYSTEM WAS FOCUSED ALTERNATELY ON A SET OF THREE 0.038-MM-DIAMETER APERTURE PLATES AND THEN PASSED THROUGH VARIOUS FILTERS TO IMPINGE ON THE APPROPRIATE PHOTODETECTOR. THE TELESCOPE MULTIPLIER ASSEMBLY COULD BE TILTED IN DISCRETE STEPS TO PROVIDE POLE-TO-POLE COVERAGE IN 2400 SCAN LINES. EAST-TO-WEST SCAN WAS PROVIDED BY THE SPIN OF THE SATELLITE ITSELF. A TOTAL TIME OF 24 MIN WAS REQUIRED TO SCAN ONE FRAME AND 4 MIN TO RETRACE WITH A NOMINAL SATELLITE ROTATION OF 100 RPM. FROM ITS GEOSTATIONARY EQUATORIAL ORBIT (APPROXIMATELY 36,000 KM ABOVE THE EARTH), THE CAMERA HAD A GROUND RESOLUTION OF BETTER

THAN 4 KM AT NADIR. THE EXPERIMENT WAS SUCCESSFUL, WITH ATS 3 BEING THE FIRST SPACECRAFT TO TRANSMIT OPERATIONAL MULTICOLOR EARTH-CLOUD PHOTOGRAPHS. APPROXIMATELY 3 MONTHS AFTER LAUNCH, HOWEVER, THE RED CHANNEL FAILED, AND THE SYSTEM SUBSEQUENTLY HAS BEEN LIMITED TO PRODUCING BLACK AND WHITE PICTURES. FOR A LISTING AND DESCRIPTION OF THE DIFFERENT FORMS OF PHOTOGRAPHIC DATA AVAILABLE FROM THIS EXPERIMENT, SEE THE 'METEOROLOGICAL DATA CATALOG FOR THE APPLICATIONS TECHNOLOGY SATELLITES' AVAILABLE THROUGH NSSDC, NASA-GSFC, GREENBELT, MD. AS OF MAY 1972, GOOD QUALITY BLACK AND WHITE PICTURES WERE STILL BEING RECEIVED.

REFERENCES

8, 9, 125, 127, 128, 129, 130, 193, 217, 227, 272, 280, 359, 336, 393, 400, 444, 447, 448, 454, 481, 538, 565, 578, 587, 627, 636, 639, 680, 742, 759, 796, 800, 842, 843, 844, 879, 882, 883, AND 904.

EXPERIMENT NAME- IMAGE DISSECTOR CAMERA (IDC) NSSDC ID 67-111A-03

EXPERIMENT PERSONNEL

PI - G.A. BRANCHFLOWER NASA-GSFC GREENBELT, MD.

OPERATING STATUS- OPERATIONAL OFF
DATE LAST USABLE DATA RECORDED- 053069

EXPERIMENT BRIEF DESCRIPTION

THE ATS 3 IMAGE DISSECTOR CAMERA (IDC) WAS A CAMERA SYSTEM DESIGNED TO (1) TEST THE FEASIBILITY OF USING ELECTRICAL SCANNING TECHNIQUES IN AN EARTH-CLOUD CAMERA AND (2) PROVIDE DAYLIGHT CLOUDCOVER DATA ON A REAL-TIME BASIS WITH FULL EARTH COVERAGE. THE CAMERA WAS MOUNTED WITH ITS OPTICAL AXIS PERPENDICULAR TO THE SPACECRAFT SPIN AXIS IN SUCH A MANNER THAT THE CAMERA PRODUCED A SCAN LINE WITH EACH REVOLUTION OF THE SPACECRAFT. THE DIRECTION OF THE SCAN, NORTH TO SOUTH OR EAST TO WEST, WAS DETERMINED BY GROUND COMMAND. THE IMAGE DISSECTOR TUBE CONSISTED OF A VISIBLE ELECTRICALLY SCANNING PHOTOCATHODE, A 0.018-MM SCANNING APERTURE, AND A 12-STAGE ELECTRON MULTIPLIER. LIGHT ENTERING THE CAMERA WAS FOCUSED ON THE FACE OF THE PHOTOCATHODE, CAUSING PHOTOELECTRONS TO BE EMITTED FROM THE SURFACE IN PROPORTION TO THE NUMBER OF IMPINGING LIGHT PHOTONS. THE EMITTED PHOTOELECTRONS WERE PROPELLED PAST THE APERTURE BY MEANS OF AN EXTERNAL MAGNETIC DEFLECTION COIL. AFTER PASSING THROUGH THE APERTURE, THE SIGNAL CURRENT WAS AMPLIFIED BY THE 12-STAGE MULTIPLIER. THE SIGNAL WAS FURTHER AMPLIFIED AND THEN TRANSMITTED AT 28 KHZ TO A GROUND ACQUISITION STATION. THE 2.54-CM-DIAMETER IMAGE DISSECTOR TUBE HAD A RESOLUTION CAPABILITY OF 1300 TV LINES, WHICH, AT NOMINAL SPACECRAFT ALTITUDE, CORRESPONDED TO A GROUND RESOLUTION OF ABOUT 7 KM AT NADIR. SUCCESSFULLY FLOWN FOR THE FIRST TIME, THE IDC SYSTEM ON ATS 3 SERVED AS A PROTOTYPE FOR SIMILAR EXPERIMENTS ON NIMBUS 3 AND 4. THE CAMERA PERFORMED NORMALLY UNTIL MAY 1969, WHEN THE IDC SYSTEM WAS BESET BY ERRATIC SPACECRAFT ANTENNA PERFORMANCE. ROUTINE DATA ACQUISITION CEASED AFTER MAY 30, 1969. THE IDC SYSTEM, ALTHOUGH STILL CAPABLE OF OPERATION, HAS BEEN LEFT IN AN OPERATIONALLY OFF MODE SINCE THAT TIME EXCEPT FOR PERIODIC ENGINEERING TESTS. FOR A LISTING AND DESCRIPTION OF THE DIFFERENT FORMS OF PHOTOGRAPHIC DATA AVAILABLE FROM THIS EXPERIMENT, SEE THE 'METEOROLOGICAL DATA CATALOG FOR THE APPLICATIONS TECHNOLOGY SATELLITES' AVAILABLE THROUGH NSSDC, NASA-GSFC, GREENBELT, MD.

REFERENCES

4, 94, 125, 127, 128, 129, 130, 366, 400, 619, 649, 796, 800, 864.

EXPERIMENT NAME- METEOROLOGICAL DATA RELAY SYSTEM   NSSDC ID 67-111A-10

EXPERIMENT PERSONNEL

PI - D.W. HOLMES	NOAA-NESS	SUITLAND, MD.
OI - S. WISHNA	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE PRIMARY OBJECTIVE OF THE ATS 3 METEOROLOGICAL DATA RELAY SYSTEM (WEATHER FACSIMILE (WEFAX) EXPERIMENT) WAS TO TEST SATELLITE RETRANSMISSION OF FACSIMILE PRODUCTS PREPARED BY NOAA TO PARTICIPATING GROUND STATIONS. SECONDARY OBJECTIVES INCLUDED (1) TRANSMITTING SELECTED SPIN-SCAN CAMERA PICTURES VIA SATELLITE TO APT GROUND STATIONS AND (2) EXPLORING THE FEASIBILITY OF INCREASING THE AMOUNT OF DATA AVAILABLE TO APT GROUND STATIONS FROM ESSA AND NIMBUS SATELLITES. THE EXPERIMENT HAD NO UNIQUE HARDWARE ON BOARD. IT WAS PART OF THE ATS 3 VHF EXPERIMENT AND USED THE VHF TRANSPONDER FOR DATA RELAY. THE TRANSPONDER TRANSMITTED AT 135.60 MHZ AND RECEIVED AT 149.22 MHZ. WEATHER FACSIMILE CHARTS AND SATELLITE CLOUDCOVER PICTURES WERE SENT VIA LAND LINE FROM NOAA, SUITLAND, MD., TO THE ATS WEFAX FIELD STATION AT MOJAVE, CALIFORNIA. THE CHARTS AND DATA WERE THEN TRANSMITTED TO THE SPACECRAFT FOR RELAY TO PARTICIPATING APT STATIONS. CLOUDCOVER PHOTOGRAPHS FROM THE ATS 3 SPIN-SCAN CAMERA WERE RETRANSMITTED THROUGH THE SPACECRAFT DIRECTLY FROM THE MOJAVE ATS GROUND STATION. THE EXPERIMENT WAS A SUCCESS AND CONTINUES TO OPERATE AS OF MAY 1972. A SIMILAR EXPERIMENT POSSESSING POORER DATA REPRODUCTION CAPABILITIES WAS FLOWN ON ATS 1.

REFERENCES

209, 277, AND 400.

EXPERIMENT NAME- OMEGA POSITION AND LOCATION EQUIPMENT (OPLE)   NSSDC ID 67-111A-11

EXPERIMENT PERSONNEL

PI - C.R. LAUGHLIN	NASA-GSFC	GREENBELT, MD.
OI - G.H. HILTON	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- OPERATIONAL OFF
DATE LAST USABLE DATA RECORDED- 062868

EXPERIMENT BRIEF DESCRIPTION

THE ATS 3 OMEGA POSITION AND LOCATION EQUIPMENT (OPLE) EXPERIMENT WAS DESIGNED TO DEMONSTRATE THE FEASIBILITY OF USING THE NAVY'S OMEGA NAVIGATION SYSTEM IN CONJUNCTION WITH A SYNCHRONOUS SATELLITE TO ESTABLISH AN OPERATIONAL GLOBAL LOCATION AND DATA COLLECTION SYSTEM. PLANNED PRIMARILY FOR NAVIGATION AND METEOROLOGICAL PURPOSES, OPLE COLLECTED AND RETRANSMITTED METEOROLOGICAL AND GEOPHYSICAL DATA FROM REMOTE UNMANNED DATA COLLECTION STATIONS (PLATFORMS). THE EXPERIMENT WAS ALSO CAPABLE OF LOCATING AND TRACKING THE MOVEMENT OF PLATFORMS SUCH AS BALLOONS, AIRCRAFT, AND SHIPS TO WITHIN 2 KM (DAYTIME) AND 4 KM (NIGHTTIME). THE EXPERIMENT CONSISTED OF (1) AN OPLE CONTROL CENTER (OCC), (2) THE ATS 3 SYNCHRONOUS SATELLITE, (3) THE OPLE PLATFORM ELECTRONIC PACKAGES (PEP), AND (4) THE NAVY OMEGA NAVIGATIONAL NETWORK. THE EXPERIMENT WORKED AS FOLLOWS. A PREPROGRAMMED INTERROGATION SEQUENCE WAS SENT FROM OCC OVER THE VHF BAND TO THE OPLE PLATFORMS VIA THE SATELLITE. AT THE END OF THE INTERROGATION SEQUENCE, THOSE PLATFORMS THAT WERE ADDRESSED SIMULTANEOUSLY TRANSMITTED THEIR ASSIGNED ACQUISITION/REFERENCE (A/R) SIGNAL. THE A/R TONE WAS MODULATED WITH

METEOROLOGICAL AND PLATFORM DATA. FOLLOWING THE DATA TRANSMISSION PERIOD, A VLF TRANSMISSION WAS INITIATED FROM THE OMEGA NAVIGATION STATIONS TO THE PLATFORM. AFTER RECEIVING SIGNALS FROM TWO PAIRS OF OMEGA STATIONS, THE PLATFORM CONVERTED THE VLF SIGNAL TO VHF FOR TRANSMISSION TO THE OCC VIA THE SATELLITE. BY COMPARING THE RELATIVE PHASE DIFFERENCE BETWEEN THE TWO PAIRS OF SIGNALS AND KNOWING THE LOCATION OF THE OMEGA STATIONS, THE LOCATION OF THE PLATFORM COULD BE DETERMINED. THE EXPERIMENT WAS JUDGED SUCCESSFUL DURING ITS OPERATIONAL TEST PERIOD (FEBRUARY 15 TO JUNE 28, 1968). OPLE SERVED AS A FORERUNNER OF THE MORE SOPHISTICATED PLATFORM DATA COLLECTION EXPERIMENTS (INTERROGATION, RECORDING AND LOCATION SYSTEM (IRLS)) FLOWN ON NIMBUS 3 AND 4.

REFERENCES
61, 131, 186, 195, 209, 359, 400, AND 636.

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SPACECRAFT COMMON NAME- ATS 4 NSSDC ID 68-068A
ALTERNATE NAMES- ATS-D, PL-683A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 08/10/68
APOGEE- 726.000 KM ALT
PERIGEE- 218.000 KM ALT
PERIOD- 93.9 MIN
INCLINATION- 29.08 DEG

OTHER INFORMATION
SPACECRAFT WT- 305. KG
LAUNCH DATE- 08/10/68
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 101768

SPACECRAFT PERSONNEL

PM - D.V.	FORDYCE	NASA-GSFC	GREENBELT, MD.
PS - T.L.	AGGSON	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION
ATS 4 (APPLICATIONS TECHNOLOGY SATELLITE) WAS A GRAVITY-GRADIENT-STABILIZED SPACECRAFT DESIGNED TO (1) TEST NEW CONCEPTS IN SPACECRAFT DESIGN, PROPULSION, AND STABILIZATION, (2) TAKE HIGH-QUALITY CLOUDCOVER PICTURES, (3) PROVIDE IN SITU MEASUREMENTS OF THE AEROSPACE ENVIRONMENT, AND (4) TEST IMPROVED COMMUNICATION SYSTEMS WHILE IN AN EARTH-SYNCHRONOUS ORBIT. THE CYLINDRICALLY SHAPED SPACECRAFT MEASURED 142 CM IN DIAMETER AND 183 CM IN LENGTH. THE SPACECRAFT STRUCTURE CONSISTED PRIMARILY OF A CORRUGATED THRUST TUBE WITH HONEYCOMBED BULKHEADS SECURED TO EACH END. EQUIPMENT COMPONENTS AND PAYLOAD WERE EXTERNALLY MOUNTED ON THE OUTER SURFACE OF THE THRUST TUBE AS WELL AS ON A STRUCTURE THAT SLID INTO THE INTERIOR OF THE THRUST TUBE. ELECTRIC POWER WAS PROVIDED BY TWO SOLAR ARRAYS MOUNTED ON EITHER END OF THE SPACECRAFT'S OUTER SHELL AND BY TWO RECHARGEABLE NICKEL-CADMIUM BATTERIES. EXTENDING RADIALLY OUTWARD FROM THE SIDE OF THE SPACECRAFT WERE FOUR 28.2-M-LONG ADJUSTABLE GRAVITY-GRADIENT BOOMS. THE SPACECRAFT TELEMETRY SYSTEM CONSISTED OF FOUR 2.1-W TRANSMITTERS, (TWO AT 136.47 MHZ AND TWO AT 137.35 MHZ), IN ADDITION TO A MICROWAVE COMMUNICATIONS EXPERIMENT. THE SECOND STAGE OF THE LAUNCH VEHICLE FAILED TO IGNITE, AND THE PLANNED SYNCHRONOUS ORBIT WAS NOT ACHIEVED. THE SPACECRAFT AND ITS CENTAUR BOOSTER ROCKET WERE LEFT ATTACHED TOGETHER IN A PARKING ORBIT. IN SPITE OF AN ANOMALISTIC ATTITUDE, SOME OF THE EXPERIMENTS DID PERFORM SUCCESSFULLY BEFORE THE SATELLITE AND ITS ATTACHED BOOSTER REENTERED THE EARTH'S ATMOSPHERE ON OCTOBER 17, 1968. HOWEVER, THE PRIMARY OBJECTIVE

OF INSERTING A GRAVITY-GRADIENT-STABILIZED SPACECRAFT INTO A GEOSYNCHRONOUS ORBIT WAS NOT ACCOMPLISHED.

REFERENCES

11, 15, 17, 19, 20, 21, 266, 400, AND 859.

EXPERIMENT NAME- IMAGE ORTHICON (DAY/NIGHT) CAMERA NSSDC ID 68-068A-03

EXPERIMENT PERSONNEL

PI - J.C. MCOOY NASA-GSFC GREENBELT,MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION

THE ATS 4 IMAGE ORTHICON (DAY/NIGHT) CAMERA WAS DESIGNED TO DETERMINE THE FEASIBILITY OF SIMULTANEOUS DAY/NIGHT IMAGING OF CLOUDCOVER PATTERNS FROM AN EARTH-SYNCHRONOUS SPACECRAFT. THE CAMERA, WHOSE OPTICAL AXIS WAS ORIENTED PERPENDICULAR TO THE SPACECRAFT SPIN AXIS, VIEWED THE EARTH THROUGH A SPECIAL APERTURE IN THE SPACECRAFT'S SIDE. CAMERA OPTICS CONSISTED OF A TWO-AXIS STEERABLE PRIMARY MIRROR, AN OBJECTIVE LENS, A BEAM SPLITTER, A PHOTOMULTIPLIER TUBE (PMT), A MECHANICAL SUN SHADE, TWO VARIABLE DENSITY FILTER WHEELS, AND A 5.08-CM-DIAMETER ORTHICON TUBE. THE TWO DENSITY FILTERS OPERATED IN CONJUNCTION WITH THE PMT TO AUTOMATICALLY REGULATE THE AMOUNT OF LIGHT STRIKING THE HIGHLY LIGHT-SENSITIVE ORTHICON TUBE. THE SUN SHADE WAS ALSO CONTROLLED BY THE PMT AND PROTECTED THE IMAGE ORTHICON CAMERA FROM ACCIDENTALLY POINTING THE OPTICS TOWARD THE SUN. THE OPTICS WERE STEERABLE BY GROUND COMMAND. STEPS OF 0.1 DEG THROUGH AN ANGLE OF PLUS OR MINUS 11.2 DEG IN BOTH PITCH AND ROLL WERE POSSIBLE. THUS THE CAMERA COULD TRACK AREAS OF METEOROLOGICAL INTEREST KNOWING THE SPACECRAFT ALTITUDE AND LOCATION OF THE DESIRED VIEWING AREA. THE CAMERA HAD A 3-DEG FIELD OF VIEW, WHICH, AT THE PLANNED SPACECRAFT ALTITUDE OF APPROXIMATELY 33,000 KM, WOULD CORRESPOND TO AN EARTH COVERAGE OF APPROXIMATELY 1700 SQ KM, WITH A HORIZONTAL RESOLUTION OF BETTER THAN 4 KM AT NADIR. FULL EARTH COVERAGE COULD BE ACHIEVED BY TAKING A SERIES OF OVERLAPPING PICTURES. THE DATA WERE TO BE TRANSMITTED (60 KHZ) IN NEAR REAL TIME. ATS 4 FAILED TO ACHIEVE ITS PLANNED GEOSYNCHRONOUS ORBIT. THE BOOSTER ROCKET REMAINED ATTACHED TO THE SPACECRAFT AND HINDERED ATTITUDE CONTROL. DUE TO THE SPACECRAFT'S ANOMALISTIC ATTITUDE, NO PICTURES WERE OBTAINED ALTHOUGH TELEMETRY DID INDICATE THAT THE SYSTEM WAS WORKING.

REFERENCES

95, 359, 400, AND 796.

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SPACECRAFT COMMON NAME- ATS-F NSSDC ID ATS-F
ALTERNATE NAMES- PL-721A

ORBITAL INFORMATION OTHER INFORMATION

ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 36300.0 KM ALT
PERIGEE- 36300.0 KM ALT
PERIOD- 1440. MIN
INCLINATION- 0. DEG

SPACECRAFT WT- 930. KG
LAUNCH DATE- 04/00/74
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - J.M.	THOLE	NASA-GSFC	GREENBELT, MD.
PS - R.W.	ROCHELLE	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

THE PRIMARY OBJECTIVES OF ATS-F (APPLICATIONS TECHNOLOGY SATELLITE) WILL BE TO ERECT IN ORBIT A LARGE HIGH-GAIN STEERABLE ANTENNA STRUCTURE CAPABLE OF PROVIDING A GOOD QUALITY TV SIGNAL TO A GROUND-BASED RECEIVER AND TO MEASURE AND EVALUATE THE PERFORMANCE OF SUCH AN ANTENNA. A SECONDARY OBJECTIVE WILL BE TO DEMONSTRATE NEW CONCEPTS IN SPACE TECHNOLOGY IN THE AREAS OF AIRCRAFT CONTROL, LASER COMMUNICATIONS, AND VISUAL AND INFRARED MAPPING OF THE EARTH-ATMOSPHERE SYSTEM. THE SPACECRAFT WILL ALSO BE CAPABLE OF (1) MEASURING RADIO FREQUENCY INTERFERENCE IN SHARED FREQUENCY BANDS AND PROPAGATION CHARACTERISTICS OF MILLIMETER WAVES, (2) PERFORMING SPACECRAFT-TO-SPACECRAFT COMMUNICATION AND TRACKING EXPERIMENTS, AND (3) MAKING PARTICLE AND RADIATION MEASUREMENTS OF THE GEOSYNCHRONOUS ENVIRONMENT. CONFIGURED SOMEWHAT LIKE AN OPEN PARASOL, THE ATS-F SPACECRAFT WILL CONSIST OF FOUR MAJOR ASSEMBLIES -- (1) A 9.15-M-DIAMETER DISH ANTENNA, (2) TWO SOLAR CELL PADDLES MOUNTED AT RIGHT ANGLES TO EACH OTHER ON OPPOSITE SIDES OF AN UPPER EQUIPMENT MODULE, (3) AN EARTH-VIEWING EQUIPMENT MODULE (EVM) CONNECTED BY A TUBULAR MAST TO THE UPPER EQUIPMENT MODULE, AND (4) AN ATTITUDE CONTROL AND STABILIZATION SYSTEM. THE EVM, IN ADDITION TO HOUSING THE EARTH-VIEWING EXPERIMENTS, WILL PROVIDE SUPPORT FOR THE PROPULSION SYSTEM AND TANKS, BATTERIES, A MULTIFREQUENCY TRANSPONDER, AND THE TELEMETRY, COMMAND, AND THERMAL CONTROL SYSTEMS. THE UPPER EQUIPMENT MODULE WILL PROVIDE A PLATFORM FOR THE SPACE-VIEWING EXPERIMENTS. INERTIA WHEELS WILL BE THE PRIME MEANS FOR TORQUING THE SPACECRAFT, WITH BOTH HYDRAZINE AND AMMONIA MULTIJET THRUSTER SYSTEMS INCLUDED TO PROVIDE THE NECESSARY TORQUES FOR UNLOADING THE WHEELS.

REFERENCES

10, 16, 56, 281, 455, 609, AND 618.

EXPERIMENT NAME- GEOSYNCHRONOUS VERY HIGH RESOLUTION RADIOMETER (GVHRR) NSSDC ID ATS-F -08

EXPERIMENT PERSONNEL

PI - W.E.	SHENK	NASA-GSFC	GREENBELT, MD.
OI - A.W.	MCCULLOCH	NASA-GSFC	GREENBELT, MD.
OI - I.L.	GOLDBERG	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE GEOSYNCHRONOUS VERY HIGH RESOLUTION RADIOMETER (GVHRR) EXPERIMENT IS DESIGNED TO PROVIDE BOTH DAY AND NIGHT CLOUD COVERAGE INFORMATION FOR DETERMINING CLOUD MOTIONS, TROPICAL AND EXTRATROPICAL STORM LIFE CYCLES, AND MESOSCALE PHENOMENA AND FOR CLOUD CLIMATOLOGY STUDIES. THE GVHRR HAS ONE INFRARED CHANNEL (10.5 TO 12.5 MICRONS) AND ONE VISIBLE CHANNEL (0.55 TO 0.75 MICRONS). THE INSTANTANEOUS FIELD OF VIEW IS 0.3 MILLIRADIANS FOR THE

INFRARED CHANNEL (10.8-KM RESOLUTION AT SUBSATELLITE POINT) AND 0.15 MILLIRADIANS FOR THE VISIBLE CHANNEL (5.4-KM RESOLUTION AT SUBSATELLITE POINT). THE DYNAMIC RANGE FOR THE INFRARED CHANNEL IS FROM 0 TO 340 DEG K AND 1 TO 100 PERCENT ALBEDO FOR THE VISIBLE CHANNEL. THE INFRARED CHANNEL HAS A NOISE EQUIVALENT TEMPERATURE DIFFERENCE OF 1.5 DEG C AT 200 DEG K AND 0.5 DEG C AT 300 DEG K. DATA FROM THIS EXPERIMENT WILL BE USED TO DETERMINE SURFACE TEMPERATURES AND HORIZONTAL WIND VECTORS BASED ON CLOUD MOTIONS DERIVED FROM SEQUENTIAL IMAGES FORMED BY BOTH CHANNELS OF THE GVHRR.

REFERENCES
2, 281, 462, AND 780.

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SPACECRAFT COMMON NAME- ATS-G
NSSDC ID ATS-G
ALTERNATE NAMES- PL-731A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 36300.0 KM ALT
PERIGEE- 36300.0 KM ALT
PERIOD- 1440. MIN
INCLINATION- 1. DEG

OTHER INFORMATION
SPACECRAFT WT- 1000. KG
LAUNCH DATE- 07/00/75
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - J.M.	THOLE	NASA-GSFC	GREENBELT, MD.
PS - R.W.	ROCHELLE	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION
THE PRIMARY OBJECTIVES OF ATS-G (APPLICATIONS TECHNOLOGY SATELLITE) ARE (1) TO ERECT IN ORBIT A LARGE HIGH-GAIN STEERABLE ANTENNA STRUCTURE THAT WILL BE CAPABLE OF PROVIDING A GOOD-QUALITY TV SIGNAL TO A GROUND-BASED RECEIVER AND (2) TO MEASURE AND EVALUATE THE PERFORMANCE OF SUCH AN ANTENNA. A SECONDARY OBJECTIVE IS TO DEMONSTRATE NEW CONCEPTS IN SPACE TECHNOLOGY IN THE AREAS OF AIRCRAFT CONTROL, LASER COMMUNICATIONS, AND VISUAL AND INFRARED MAPPING OF THE EARTH-ATMOSPHERE SYSTEM. THE SYNCHRONOUS SPACECRAFT WILL ALSO BE CAPABLE OF (1) MEASURING RADIO FREQUENCY INTERFERENCE IN SHARED FREQUENCY BANDS AND PROPAGATION CHARACTERISTICS OF MILLIMETER WAVES, (2) PERFORMING SPACECRAFT-TO-SPACECRAFT COMMUNICATION AND TRACKING EXPERIMENTS, AND (3) MAKING PARTICLE AND RADIATION MEASUREMENTS OF THE GEOSYNCHRONOUS ENVIRONMENT. CONFIGURED SOMEWHAT LIKE AN OPEN PARASOL, THE ATS-G SPACECRAFT WILL CONSIST OF FOUR MAJOR ASSEMBLIES -- (1) A 9.15-M-DIAMETER DISH ANTENNA, (2) TWO SOLAR CELL PADDLES MOUNTED AT RIGHT ANGLES TO EACH OTHER ON OPPOSITE SIDES OF AN UPPER EQUIPMENT MODULE, (3) AN EARTH-VIEWING EQUIPMENT MODULE (EVM) CONNECTED BY A TUBULAR MAST TO THE UPPER EQUIPMENT MODULE, AND (4) AN ATTITUDE CONTROL AND STABILIZATION SYSTEM. THE EVM, IN ADDITION TO HOUSING THE EARTH-VIEWING EXPERIMENTS, WILL PROVIDE SUPPORT FOR THE PROPULSION SYSTEM AND TANKS, BATTERIES, A MULTIFREQUENCY TRANSPONDER, AND TELEMETRY, COMMAND, AND THERMAL CONTROL SYSTEM. THE UPPER EQUIPMENT MODULE WILL PROVIDE A PLATFORM FOR THE SPACE-VIEWING EXPERIMENTS. INERTIA WHEELS WILL BE THE PRIME MEANS FOR TORQUING THE SPACECRAFT, WITH BOTH HYDRAZINE AND AMMONIA MULTIJET THRUSTER SYSTEMS INCLUDED TO PROVIDE THE NECESSARY TORQUES FOR UNLOADING THE WHEELS.

REFERENCES

10, 16, 56, 144, 455, AND 609.

EXPERIMENT NAME- ATMOSPHERIC SOUNDER NSSDC ID ATS-G -01

EXPERIMENT PERSONNEL

PI - W.E. SHENK NASA-GSFC GREENBELT, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ATMOSPHERIC SOUNDER PLANNED FOR ATS-G IS BEING DESIGNED TO TAKE ADVANTAGE OF THE INCREASED VIEWING TIME PROVIDED BY A THREE-AXIS STABILIZED SPACECRAFT AT A GEOSYNCHRONOUS ALTITUDE. THE SOUNDER WILL CONSIST OF A NUMBER OF CHANNELS IN THE 13- TO 15-MICRON CARBON-DIOXIDE BAND AND OTHER CHANNELS SENSITIVE TO WATER VAPOR ABSORPTION. IN ADDITION, THERE WILL BE TWO CHANNELS IN THE INFRARED WINDOW REGION OF THE SPECTRUM AND A CHANNEL IN THE 4-MICRON CARBON DIOXIDE BAND. THE SOUNDER WILL HAVE A HORIZONTAL RESOLUTION OF ABOUT 36 KM AT THE SUBSATELLITE POINT. OWING TO BUGETARY PROBLEMS, THIS EXPERIMENT MAY NOT BE FLOWN ON ATS-G.

REFERENCES

2, AND 462.

EXPERIMENT NAME- VISUAL/INFRARED IMAGER NSSDC ID ATS-G -02

EXPERIMENT PERSONNEL

PI - W.E. SHENK NASA-GSFC GREENBELT, MD

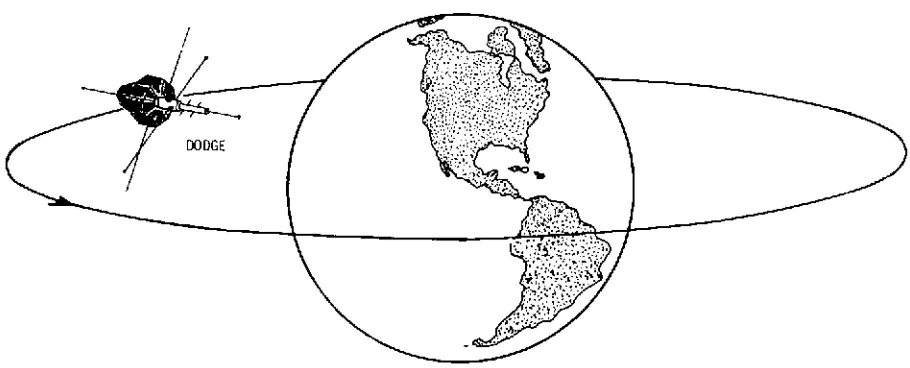
OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE VISUAL/INFRARED IMAGER PLANNED FOR ATS-G IS A THREE-CHANNEL INSTRUMENT DESIGNED TO MEASURE EMITTED INFRARED RADIATION IN THE 10.5- TO 12.5-MICRON REGION AND IN THE 6.7-MICRON WATER VAPOR ABSORPTION BAND. IT WILL ALSO BE CAPABLE OF MEASURING REFLECTED SOLAR RADIATION IN THE 0.55- TO 0.75-MICRON REGION. THE IMAGER WILL HAVE A SPATIAL RESOLUTION OF ABOUT 20 KM AT NADIR. DATA FROM THIS EXPERIMENT WILL BE USED TO DETERMINE SURFACE TEMPERATURE, WIND VELOCITY, A VERTICAL PROFILE OF THE TEMPERATURE UP TO 30 KM, AND A MOISTURE PROFILE TO THE UPPER TROPOSPHERE.

REFERENCES

2.



DODGE

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5. Dodge

SPACECRAFT COMMON NAME- DODGE
ALTERNATE NAMES-

NSSDC ID 67-066F

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 01/15/68
APOGEE- 33659.0 KM ALT
PERIGEE- 33178.0 KM ALT
PERIOD- 1318.9 MIN
INCLINATION- 6.2 DEG

OTHER INFORMATION
SPACECRAFT WT- 195.05 KG
LAUNCH DATE- 07/01/67
OPERATING STATUS- OPERATIONAL
DATE LAST USABLE
DATA RECORDED- 010071

SPACECRAFT PERSONNEL

PM - J.	DASSOULAS	APPLIED PHYSICS LAB	SILVER SPRING, MD.
PM - L.P.	PRESSLER	NAVAL RESEARCH LAB	WASHINGTON, D.C.
PS - R.E.	FISCHELL	APPLIED PHYSICS LAB	SILVER SPRING, MD.

SPACECRAFT BRIEF DESCRIPTION

THE DODGE (DEPARTMENT OF DEFENSE GRAVITY EXPERIMENT) SATELLITE WAS ORBITED PRIMARILY TO STUDY A NUMBER OF ADVANCED BIAXIAL AND TRIAXIAL GRAVITY-GRADIENT STABILIZATION TECHNIQUES AT NEAR-SYNCHRONOUS ALTITUDES. SECONDARY OBJECTIVES INCLUDED OBTAINING MEASUREMENTS OF THE EARTH'S MAGNETIC FIELD AT NEAR-SYNCHRONOUS ALTITUDES AND BLACK AND WHITE AND COLOR TV PHOTOGRAPHY OF THE ENTIRE EARTH DISK. DODGE WAS LAUNCHED AS PART OF A MULTIPLE DOD SATELLITE PAYLOAD THAT INCLUDED DATS 1, LES 5, AND IDCSP 16, 17, AND 18. THE SATELLITE WAS IN THE FORM OF AN OCTAGONAL ALUMINUM SHELL WITH A TRUNCATED PYRAMID AT THE TOP AND A 25.4-CM-DIAMETER CYLINDRICAL MAST EXTENDING 1.57 M FROM THE SATELLITE BASE. THE SATELLITE BODY WAS 2.41 M LONG AND 1.22 M IN DIAMETER. A TOTAL OF 10 KNOBBED BOOMS WERE CARRIED ON BOARD. UPON RADIO COMMAND, THESE BOOMS COULD BE INDEPENDENTLY EXTENDED OR RETRACTED ALONG THREE AXES TO VARIOUS LIMITS OUT TO 45.75 M. THE CYLINDRICAL MAST HOUSED A 4.6-M BOOM THAT EXTENDED THROUGH THE END OF THE MAST, TWO 15.25-M-LONG DAMPER BOOMS THAT EXTENDED IN THE X-Y PLANE, AND TRIAXIAL VECTOR MAGNETOMETER SENSORS. THE REMAINING SEVEN BOOMS WERE CONTAINED IN THE SATELLITE BODY ALONG WITH A TWO-CAMERA (ONE COLOR AND ONE BLACK AND WHITE) VIDICON CAMERA SYSTEM. THE COMMAND SYSTEM CONSISTED OF A DUAL COMMAND RECEIVER, DUAL COMMAND LOGIC, AND POWER SWITCHING CIRCUITRY. THE TELEMETRY SYSTEM INCLUDED TWO DIRECTIONAL ANTENNAS MOUNTED ON THE MAST, TWO 38-CHANNEL COMMUTATORS FOR HOUSEKEEPING DATA, AND A DUAL TRANSMITTER SYSTEM THAT TRANSMITTED ANALOG DATA AT A FREQUENCY OF 240 MHZ AND TV DATA AT 136.8 MHZ. THE SATELLITE WAS SUCCESSFULLY STABILIZED 12 DAYS AFTER LAUNCH BY MEANS OF THE GRAVITY-GRADIENT BOOMS AND LIBRATION DAMPENING SYSTEMS. IT WAS ORIENTED WITH ITS BASE AND MAST DIRECTED TOWARD THE CENTER OF THE EARTH'S DISK. THE MISSION WAS A SUCCESS AND PROVED THE FEASIBILITY OF ACHIEVING TRIAXIAL GRAVITY-GRADIENT STABILIZATION AT SYNCHRONOUS ALTITUDES USING PASSIVE AND SEMIPASSIVE TECHNIQUES. THE SATELLITE OPERATED FOR OVER 3 YR AND TOOK THOUSANDS OF BLACK AND WHITE AND COLOR PICTURES OF THE EARTH. EARLY IN 1971, PROBLEMS WITH THE BATTERIES ON BOARD LIMITED OPERATION TO ONLY SOLAR ACQUISITION PERIODS. THE SATELLITE WAS PLACED IN AN OPERATIONAL OFF MODE IN EARLY 1971.

REFERENCES
63, 425, 519, 638, AND 661.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 67-066F-01

EXPERIMENT PERSONNEL
PI - T. THOMPSON APPLIED PHYSICS LAB SILVER SPRING, MD.

OPERATING STATUS- OPERATIONAL OFF
DATE LAST USABLE DATA RECORDED- 010071

EXPERIMENT BRIEF DESCRIPTION

THE DODGE DUAL VIDICON CAMERA EXPERIMENT WAS DESIGNED PRIMARILY TO DETERMINE (1) THE ALIGNMENT OF THE SATELLITE WITH RESPECT TO THE EARTH AND (2) THE AMOUNT OF SOLAR AND GRAVITATIONALLY INDUCED BENDING OF THE DOWNWARD-POINTING STABILIZATION BOOM. IN ADDITION, THE CAMERAS WERE CAPABLE OF PROVIDING INFORMATION ON THE STRUCTURE AND DYNAMICS OF GLOBAL CLOUD SYSTEMS, CLOUD HEIGHTS, AIRGLOW, AND AURORAS. THE CAMERAS WERE MOUNTED IN THE BASE OF THE SATELLITE AND VIEWED DOWN THE 1.57-M-LONG CYLINDRICAL MAST TOWARD THE EARTH. THE EARTH REMAINED FIXED IN THE FIELD OF VIEW (FOV) WHEN ALL OSCILLATIONS WERE DAMPED OUT AND STABILIZATION WAS ACHIEVED. THE CAMERA SYSTEM CONSISTED OF TWO VIDICON CAMERAS, ONE WITH A 22-DEG FOV AND THE OTHER WITH A 60-DEG FOV, AND ASSOCIATED ELECTRONICS AND POWER CONVERTERS. BOTH CAMERAS WERE EQUIPPED WITH A 2.54-CM VIDICON TUBE (512 LINES/SCAN) AND A SPECIAL SLOW SCAN (200 SEC/SCAN) VIDEO PICKUP. THE 60-DEG FOV CAMERA TOOK BLACK AND WHITE PICTURES ONLY AND USED A SIMPLE BLADE-TYPE SHUTTER. THE 22-DEG FOV CAMERA, HOWEVER, WAS MODIFIED TO TAKE BOTH COLOR AND BLACK AND WHITE PICTURES. IT USED A ROTATING EIGHT-CHANNEL COLOR WHEEL PLACED IN FRONT OF THE CAMERA, WHICH PROVIDED SHUTTERING ACTION. THREE OF THE CHANNELS WERE EQUIPPED WITH BLUE, GREEN, AND RED FILTERS, ONE CHANNEL WAS LEFT BLANK, AND THE REMAINING FOUR HAD VARIOUS SHORTWAVE CUTOFF (HAZE OR RAYLEIGH) FILTERS. HIGH-PURITY QUARTZ COVER PLATES WERE PLACED OVER THE OPTICAL FILTERS FOR PROTECTION AGAINST RADIATION DAMAGE. THE NORMAL SEQUENCE OF OPERATION CONSISTED OF A 200-SEC CHARGE CYCLE AND ALTERNATE EXPOSURES AND 200-SEC READOUTS OF THE 60-DEG AND 22-DEG FOV VIDICON TUBES. IN CONTINUOUS OPERATION, A 60-DEG FOV CAMERA EXPOSURE AND READ CYCLE FOLLOWED IMMEDIATELY. MOST OF THE PICTURES TAKEN WERE BLACK AND WHITE. ON OCCASION, HOWEVER, A COMMAND WAS SENT FROM THE GROUND TO THE SATELLITE TO INITIATE THE COLOR PHOTOGRAPHY SEQUENCE. THIS SEQUENCE TOOK 13.3 MIN AND PRODUCED THREE FRAMES, WHICH WERE USED TO GENERATE A COMPOSITE COLOR PICTURE. THE SEQUENCE CONSISTED OF ALTERNATE 1.2-SEC EXPOSURES OF THE CAMERA TUBE WITH EACH OF THE COLOR FILTERS PLACED IN THE OPTICAL PATH OF THE CAMERA. THE INFORMATION ON THE VIDICON TUBE WAS READ OUT FOR ONE COLOR CHANNEL WHILE THE NEXT COLOR FILTER WAS MOVED INTO PLACE. THE VIDEO SIGNALS WERE THEN AMPLIFIED, PROCESSED, AND TRANSMITTED TO THE APL GROUND RECEIVING STATION IN HOWARD COUNTY, MARYLAND, WHERE THE COLOR PICTURE WAS RECONSTRUCTED. THE PICTURE INCLUDED A SPHERICAL COLOR STANDARD MOUNTED ON THE END OF THE 4.6-M BOOM THAT EXTENDED OUT FROM THE CYLINDRICAL MAST. AN IDENTICALLY COLORED SPHERE WAS KEPT IN THE GROUND ACQUISITION STATION TO MONITOR THE ACCURACY OF THE COLORS DISPLAYED IN THE PICTURE. TO OBTAIN DATA NEEDED FOR THE DYNAMIC BOOM BENDING STUDIES, A SPECIAL FAST SCAN (25 SEC/SCAN) MODE WAS INCLUDED. OWING TO THE MOTION OF THE SATELLITE ACROSS THE FACE OF THE EARTH, PICTURES WERE TAKEN FOR ONLY 5.5 DAYS OUT OF ITS 11.2-DAY PERIOD, WHEN THE SATELLITE WAS WITHIN COMMUNICATION RANGE OF THE GROUND RECEIVING STATION. DURING THIS PERIOD, THE SATELLITE PROGRAMMER TURNED THE CAMERA SYSTEM ON EVERY HOUR ON THE HOUR FOR 10 MIN. IN THE NORMAL MODE OF OPERATION (SLOW SCAN), ONE PICTURE PER CAMERA WAS OBTAINED EVERY HOUR. THE FAST SCAN AND COLOR PICTURE MODES WERE INITIATED AND CONTROLLED BY GROUND COMMANDS. THE PICTURES HAD A GROUND RESOLUTION OF 66.6 AND 24 KM FOR THE 60-DEG AND 22-DEG FOV CAMERAS, RESPECTIVELY. SEPARATE SUN SENSORS PROTECTED THE CAMERAS WHEN THE SUN WAS IN

THE FOV BY PREVENTING THE SHUTTER FROM OPENING. PICTURES TAKEN DURING THE TIME WHEN THE SUN WAS ECLIPSED BY THE EARTH PROVIDED INFORMATION ON AIRGLOW AND AURORAL PHENOMENA, WHILE NORMAL PICTURES OF THE EARTH PROVIDED DATA ON CLOUD HEIGHT BY CORRELATING THE COLOR BANDS OF ATMOSPHERIC SCATTERING WITH ALTITUDE. THE EXPERIMENT WAS A SUCCESS AND PRODUCED OVER 25,000 PICTURES. ON JULY 25, 1967, THE DODGE 22-DEG FOV CAMERA TOOK THE FIRST COLOR PICTURE OF THE EARTH EVER MADE FROM A NEAR-SYNCHRONOUS ALTITUDE. THE NEGATIVES AND POSITIVES OF THE PICTURES FROM 1967 AND 1968 ARE KEPT AT APL IN SILVER SPRING, MARYLAND. ABOUT 300 PICTURES FROM THE 1967-1968 PERIOD HAVE BEEN DIGITIZED AND RECORDED ON MAGNETIC TAPE AND ARE ALSO KEPT AT APL. PICTURES FROM 1969 TO 1971 ARE STORED ON MAGNETIC TAPE IN ANALOG FORM AND ON 4- BY 5-IN. POLAROID PRINTS. PROBLEMS WITH THE SPACECRAFT BATTERY LIMITED OPERATIONS IN 1971 TO SOLAR POWER ACQUISITION TIMES ONLY. THE LAST PICTURE WAS TAKEN IN JANUARY 1971. OWING TO LIMITED FUNDING, THE EXPERIMENT WAS PLACED IN AN OPERATIONAL OFF MODE IN THE FIRST QUARTER OF 1971.

REFERENCES

341, 786, AND 855.

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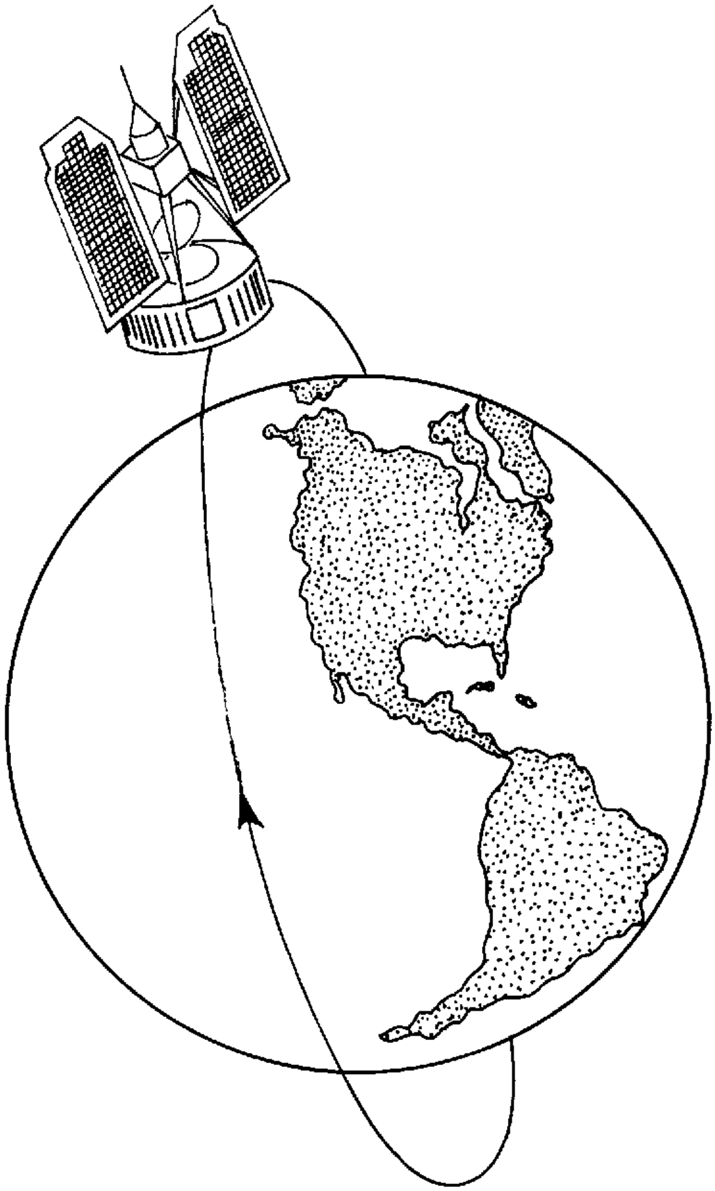

NIMBUS SERIES

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6. Nimbus Series

SPACECRAFT COMMON NAME- NIMBUS 1 NSSDC ID 64-052A
ALTERNATE NAMES-

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 08/28/64
APOGEE- 932.000 KM ALT
PERIGEE- 423.000 KM ALT
PERIOD- 103.4 MIN
INCLINATION- 98.663 DEG

OTHER INFORMATION
SPACECRAFT WT- 374.4 KG
LAUNCH DATE- 08/28/64
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 092264

SPACECRAFT PERSONNEL

PM - H.	PRESS	NASA-GSFC	GREENBELT, MD.
PS - W.P.	NORDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

NIMBUS 1, THE FIRST IN A SERIES OF SECOND-GENERATION METEOROLOGICAL R AND D SATELLITES, WAS DESIGNED TO SERVE AS A STABILIZED, EARTH-ORIENTED PLATFORM FOR THE TESTING OF ADVANCED SYSTEMS FOR SENSING AND COLLECTING METEOROLOGICAL DATA. THE POLAR-ORBITING SPACECRAFT CONSISTED OF THREE MAJOR ELEMENTS -- (1) A SENSORY RING, (2) SOLAR PADDLES, AND (3) A CONTROL HOUSING UNIT, WHICH WAS CONNECTED TO THE SENSORY RING BY A TRUSS STRUCTURE. SHAPED SOMEWHAT LIKE AN OCEAN BUOY, NIMBUS 1 WAS NEARLY 3.7 M TALL, 1.5 M IN DIAMETER AT THE BASE, AND ABOUT 3 M ACROSS WITH SOLAR PADDLES EXTENDED. THE SENSORY RING, WHICH FORMED THE SATELLITE BASE, HOUSED THE ELECTRONICS EQUIPMENT AND BATTERY MODULES. THE LOWER SURFACE OF THE TORUS-SHAPED SENSORY RING PROVIDED A MOUNTING SPACE FOR SENSORS AND TELEMETRY ANTENNAS. AN H-FRAME STRUCTURE MOUNTED WITHIN THE CENTER OF THE TORUS PROVIDED SUPPORT FOR THE LARGER EXPERIMENTS AND TAPE RECORDERS. MOUNTED ON THE CONTROL HOUSING UNIT, WHICH WAS LOCATED ON TOP OF THE SPACECRAFT, WERE SUN SENSORS, HORIZON SCANNERS, GAS NOZZLES FOR ATTITUDE CONTROL, AND A COMMAND ANTENNA. USE OF A STABILIZATION AND CONTROL SYSTEM ALLOWED THE SPACECRAFT'S ORIENTATION TO BE CONTROLLED TO WITHIN PLUS OR MINUS 1 DEG FOR ALL THREE AXES (PITCH, ROLL, AND YAW). THE SPACECRAFT CARRIED (1) AN ADVANCED VIDICON CAMERA SYSTEM (AVCS) FOR RECORDING AND STORING REMOTE CLOUDCOVER PICTURES, (2) AN AUTOMATIC PICTURE TRANSMISSION (APT) CAMERA FOR PROVIDING REAL-TIME CLOUDCOVER PICTURES, AND (2) A HIGH-RESOLUTION INFRARED RADIOMETER (HRIR) TO COMPLEMENT THE DAYTIME TV COVERAGE AND TO MEASURE NIGHTTIME RADIATIVE TEMPERATURES OF CLOUD TOPS AND SURFACE TERRAIN. A SHORT SECOND-STAGE BURN RESULTED IN AN UNPLANNED ECCENTRIC ORBIT. OTHERWISE, THE SPACECRAFT AND ITS EXPERIMENTS OPERATED SUCCESSFULLY UNTIL SEPTEMBER 22, 1964, WHEN THE SOLAR PADDLES BECAME LOCKED IN POSITION, CAUSING THE SPACECRAFT TO HAVE INADEQUATE ELECTRICAL POWER TO CONTINUE OPERATIONS.

REFERENCES

84, 146, 150, 185, 218, 219, 525, 542, 572, 603, 681, 684, 685, 700, 733, 734, 735, 737, 741, 772, 825, 826, 828, AND 917.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS) NSSDC ID 64-052A-01

EXPERIMENT PERSONNEL
PI - G.L. BURDETT NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092264

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 1 ADVANCED VIDICON CAMERA SYSTEM (AVCS) WAS A CAMERA, TAPE RECORDER, AND TRANSMITTER COMBINATION THAT COULD RECORD AND STORE A SERIES OF REMOTE DAYTIME CLOUDCOVER PICTURES FOR SUBSEQUENT PLAYBACK TO SELECTED GROUND DATA ACQUISITION STATIONS. THE AVCS SENSORS CONSISTED OF THREE VIDICON CAMERAS MOUNTED ON THE SATELLITE SENSORY RING, FACING EARTHWARD AND DEPLOYED IN A FAN-LIKE ARRAY TO PRODUCE A THREE-SEGMENT COMPOSITE PICTURE. EACH CAMERA COVERED A 37-DEG FIELD OF VIEW WITH THE CENTER CAMERA POINTING STRAIGHT DOWN. THE OPTICAL AXES OF THE OTHER TWO CAMERAS WERE DIRECTED 35 DEG TO EITHER SIDE. EACH OF THE CAMERAS EMPLOYED AN F/4 LENS WITH A FOCAL LENGTH OF 17.0 MM. A POTENTIOMETER ATTACHED TO THE SOLAR ARRAY CONTROLLED THE LENS OPENING FROM F/16 WHEN THE SPACECRAFT WAS OVER THE EQUATOR TO F/4 WHEN IT WAS NEAR THE POLES. THE 800-SCAN-LINE, 2.54-CM-DIAMETER VIDICON PICKUP TUBES YIELDED A LINEAR RESOLUTION OF BETTER THAN 1 KM AT ZERO NADIR ANGLE FROM AN ALTITUDE OF 800 KM. AT THIS ALTITUDE, THE CAMERA ARRAY PRODUCED A COMPOSITE PICTURE COVERING AN AREA OF 830 BY 2700 KM. UP TO 192 PICTURES (TWO FULL ORBITS OF DATA) OR 64 PICTURES PER CAMERA COULD BE STORED ON TAPE FOR SUBSEQUENT PLAYBACK TO AN ACQUISITION STATION. USING A TRANSMISSION FREQUENCY OF 1707.5 MHZ, THE TWO ORBITS OF PICTURES COULD BE TELEMETERED TO A GROUND STATION IN 4 MIN. THE AVCS EXPERIMENT WAS HIGHLY SUCCESSFUL. IT PROVIDED THE FIRST NEAR-GLOBAL, HIGH-RESOLUTION CLOUDCOVER PICTURES EVER ASSEMBLED AND CONFIRMED THE DECISION TO USE THIS PARTICULAR CAMERA ASSEMBLY AS A BASIS FOR THE FIRST OPERATIONAL SATELLITE SYSTEM (TOS/ESSA). DATA FROM THIS EXPERIMENT CAN BE OBTAINED FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF THE DATA, SEE 'NIMBUS I USERS' CATALOG AVCS AND APT,' AVAILABLE FROM NSSDC.

REFERENCES

22, 146, 159, 384, 482, 639, 682, 684, 697, 742, 825, AND 826.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM NSSDC ID 64-052A-02

EXPERIMENT PERSONNEL
PI - C.M. HUNTER NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092264

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 1 AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM WAS A CAMERA AND TRANSMITTER COMBINATION DESIGNED TO TRANSMIT LOCAL DAYTIME, SLOW-SCAN TELEVISION PICTURES OF CLOUDCOVER CONDITIONS TO PROPERLY EQUIPPED GROUND RECEIVING STATIONS ON A REAL-TIME BASIS. THE CAMERA USED A 108-DEG WIDE-ANGLE F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 5.7 MM. THE CAMERA WAS MOUNTED FACING EARTHWARD ON THE H-FRAME INSIDE THE SENSORY RING, WITH ITS OPTICAL AXIS PARALLEL TO THE SPACECRAFT SPIN AXIS. THE ACTUAL PICTURE TAKING REQUIRED 8 SEC AND THE TRANSMISSION 200 SEC. EARTH-CLOUD IMAGES RETAINED ON THE PHOTOSENSITIVE SURFACE OF THE 2.54-CM-DIAMETER VIDICON WERE READ OUT AT FOUR LINES PER SECOND TO PRODUCE AN 800-LINE PICTURE. A 5-W TV TRANSMITTER (136.95 MHZ) RELAYED THE PICTURES TO LOCAL APT STATIONS WITHIN COMMUNICATION RANGE. THE FACEPLATE OF THE VIDICON HAD RETICLE MARKS THAT APPEARED ON THE PICTURE FORMAT TO AID IN RELATING THE PICTURE TO ITS

GEOGRAPHICAL POSITION ON THE EARTH'S SURFACE. AT THE NOMINAL SATELLITE ALTITUDE, A PICTURE COVERED APPROXIMATELY A 1660- BY 1660-KM SQUARE WITH A HORIZONTAL RESOLUTION OF AROUND 3 KM AT NADIR. THE EXPERIMENT SUPPLIED OVER 1600 HIGH-QUALITY CLOUDCOVER PICTURES TO PARTICIPATING APT STATIONS DURING THE SPACECRAFT'S 3.5-WEEK LIFETIME. IT PROVED THE CAPABILITY OF WEATHER SATELLITES TO PROVIDE HIGH-QUALITY DAYTIME LOCAL CLOUDCOVER DATA TO OPERATIONAL METEOROLOGISTS ON AN ESSENTIALLY REAL-TIME BASIS. ITS SUCCESS BOLSTERED THE DECISION TO INCLUDE SUCH INSTRUMENTATION IN THE TIROS OPERATIONAL SYSTEM (TOS). APT DATA ARE PRIMARILY INTENDED FOR OPERATIONAL USE WITHIN THE LOCAL APT ACQUISITION STATION AND ARE GENERALLY NOT AVAILABLE FOR DISTRIBUTION.

REFERENCES

22, 146, 159, 430, 466, 652, 697, 768, 825, 826, 853, 860, 861, AND 871.

EXPERIMENT NAME- HIGH-RESOLUTION INFRARED RADIOMETER (HRIR) NSSDC ID 64-052A-03

EXPERIMENT PERSONNEL

PI - L.L. FOSHEE USAELECCOM FT. BELVOIR, VA.

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 092264

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-1 HIGH-RESOLUTION INFRARED RADIOMETER (HRIR) WAS DESIGNED (1) TO MAP THE EARTH'S NIGHTTIME CLOUD COVER AND THUS TO COMPLEMENT THE DAYTIME TELEVISION (AVCS) COVERAGE AND (2) TO MEASURE THE RADIATIVE TEMPERATURES OF CLOUD TOPS AND SURFACE TERRAIN. MOUNTED ON THE EARTH-ORIENTED SENSORY RING, THE RADIOMETER MEASURED THERMAL RADIATION IN THE 3.5- TO 4.1-MICRON 'WINDOW' REGION. THE HRIR SUBSYSTEM CONSISTED OF (1) AN OPTICAL SYSTEM, (2) AN INFRARED DETECTOR (LEAD SELENIDE PHOTOCONDUCTIVE MATERIAL), (3) ELECTRONICS, (4) A MAGNETIC TAPE RECORDER, AND (5) A FILTER TO MINIMIZE ATTENUATION EFFECTS OF WATER VAPOR AND CARBON DIOXIDE. IN CONTRAST TO THE AVCS CAMERA, NO IMAGE WAS FORMED WITHIN THE RADIOMETER. THE HRIR SENSOR MERELY TRANSFORMED THE RECEIVED RADIATION INTO AN ELECTRICAL VOLTAGE, WHICH WAS RECORDED ON THE TAPE RECORDER FOR SUBSEQUENT PLAYBACK WHEN THE SATELLITE CAME WITHIN RANGE OF AN AQUISITION STATION. THE RADIOMETER HAD AN INSTANTANEOUS FIELD OF VIEW OF ABOUT 1.5 DEG, WHICH AT A NOMINAL SPACECRAFT ALTITUDE CORRESPONDED TO A GROUND RESOLUTION OF APPROXIMATELY 8 KM AT NADIR. THE RADIOMETER WAS CAPABLE OF MEASURING RADIANCE TEMPERATURES FROM 210 TO 330 DEG K. SINCE THE RADIOMETER OPERATED IN THE 3.5- TO 4.1-MICRON REGION, THE DAYTIME PICTURES INCLUDE REFLECTED SOLAR RADIATION IN ADDITION TO THE EMITTED SURFACE IR RADIATION. HOWEVER, THE REFLECTED SOLAR RADIATION DID NOT SATURATE THE INSTRUMENT, AND A USABLE OUTPUT WAS STILL OBTAINED. IN SPITE OF A SHORT OPERATIONAL LIFETIME (3.5 WEEKS), THE HRIR SYSTEM SUCCESSFULLY DEMONSTRATED THE FEASIBILITY OF COMPLETE SURVEILLANCE OF SURFACE AND CLOUD FEATURES ON A GLOBAL SCALE DURING NIGHTTIME. WITH ITS IMPROVED SPATIAL RESOLUTION, THE RADIOMETER YIELDED MORE DETAILED VISUAL DATA ON THE STRUCTURE OF THE INTERTROPICAL CONVERGENCE ZONE (ITCZ) AND ON THE FORMATION OF TROPICAL STORMS AND FRONTAL SYSTEMS THAN HAD PREVIOUSLY BEEN POSSIBLE.

REFERENCES

22, 103, 146, 157, 158, 292, 294, 295, 392, 434, 453, 461, 480, 513, 557, 571, 574, 577, 578, 589, 592, 593, 631, 639, 642, 681, 682, 683, 684, 685, 692, 697, 723, 726, 735, 742, 781, 825, 826, AND 923.

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SPACECRAFT COMMON NAME- NIMBUS 2 NSSDC ID 66-040A
ALTERNATE NAMES-

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 05/15/66
APOGEE- 1179.00 KM ALT
PERIGEE- 1109.00 KM ALT
PERIOD- 108. MIN
INCLINATION- 100.311 DEG

OTHER INFORMATION
SPACECRAFT WT- 414. KG
LAUNCH DATE- 05/15/66
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 011769

SPACECRAFT PERSONNEL

PM - H.	PRESS	NASA-GSFC	GREENBELT, MD.
PS - W.P.	NORDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

NIMBUS 2, THE SECOND IN A SERIES OF SECOND-GENERATION METEOROLOGICAL R AND D SATELLITES, WAS DESIGNED TO SERVE AS A STABILIZED, EARTH-ORIENTED PLATFORM FOR THE TESTING OF ADVANCED SYSTEMS FOR SENSING AND COLLECTING METEOROLOGICAL DATA. THE POLAR-ORBITING SPACECRAFT CONSISTED OF THREE MAJOR ELEMENTS -- (1) A SENSORY RING, (2) SOLAR PADDLES, AND (3) THE CONTROL HOUSING UNIT, WHICH WAS CONNECTED TO THE SENSORY RING BY A TRUSS STRUCTURE. SHAPED SOMEWHAT LIKE AN OCEAN BUOY, NIMBUS 2 WAS NEARLY 3.7 M TALL, 1.5 M IN DIAMETER AT THE BASE, AND ABOUT 3 M ACROSS WITH SOLAR PADDLES EXTENDED. THE SENSORY RING, WHICH FORMED THE SATELLITE BASE, HOUSED THE ELECTRONICS EQUIPMENT AND BATTERY MODULES. THE LOWER SURFACE OF THE TORUS-SHAPED SENSORY RING PROVIDED A MOUNTING SPACE FOR SENSORS AND TELEMETRY ANTENNAS. AN H-FRAME STRUCTURE MOUNTED WITHIN THE CENTER OF THE TORUS PROVIDED SUPPORT FOR THE LARGER EXPERIMENTS AND TAPE RECORDERS. MOUNTED ON THE CONTROL HOUSING UNIT, WHICH WAS LOCATED ON TOP OF THE SPACECRAFT, WERE SUN SENSORS, HORIZON SCANNERS, GAS NOZZLES FOR ATTITUDE CONTROL, AND A COMMAND ANTENNA. USE OF A STABILIZATION AND CONTROL SYSTEM PERMITTED THE SPACECRAFT'S ORIENTATION TO BE CONTROLLED TO WITHIN PLUS OR MINUS 1 DEG FOR ALL THREE AXES (PITCH, ROLL, AND YAW). THE SPACECRAFT CARRIED (1) AN ADVANCED VIDICON CAMERA SYSTEM (AVCS) FOR RECORDING AND STORING REMOTE CLOUDCOVER PICTURES, (2) AN AUTOMATIC PICTURE TRANSMISSION (APT) CAMERA FOR PROVIDING REAL-TIME CLOUDCOVER PICTURES, AND (3) BOTH HIGH- AND MEDIUM-RESOLUTION INFRARED RADIOMETERS (HRIR AND MRIR) FOR MEASURING THE INTENSITY AND DISTRIBUTION OF ELECTROMAGNETIC RADIATION EMITTED BY AND REFLECTED FROM THE EARTH AND ITS ATMOSPHERE. THE SPACECRAFT AND EXPERIMENTS PERFORMED NORMALLY AFTER LAUNCH UNTIL JULY 26, 1966, WHEN THE SPACECRAFT TAPE RECORDER FAILED. ITS FUNCTION WAS TAKEN OVER BY THE HRIR TAPE RECORDER UNTIL NOVEMBER 15, 1966, WHEN IT ALSO FAILED. SOME REAL-TIME DATA WERE COLLECTED UP UNTIL JANUARY 17, 1969, WHEN THE SPACECRAFT MISSION WAS TERMINATED OWING TO DETERIORATION OF THE HORIZON SCANNER USED FOR EARTH REFERENCE.

REFERENCES

22, 84, 146, 166, 270, 511, 525, 571, 603, 647, 681, 691, 700, 733, 734, 737, 741, 772, AND 917.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS) NSSDC ID 66-040A-01

EXPERIMENT PERSONNEL
PI - J.R. SCHULMAN NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 111566

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 2 ADVANCED VIDICON CAMERA SYSTEM (AVCS) WAS A CAMERA, TAPE RECORDER, AND TRANSMITTER COMBINATION THAT COULD RECORD AND STORE A SERIES OF REMOTE DAYTIME CLOUDCOVER PICTURES FOR SUBSEQUENT PLAYBACK TO A GROUND A DATA ACQUISITION STATION. THE AVCS SENSORS CONSISTED OF THREE VIDICON CAMERAS MOUNTED ON THE SATELLITE SENSORY RING, FACING EARTHWARD AND DEPLOYED IN A FAN-LIKE ARRAY TO PRODUCE A THREE-SEGMENT COMPOSITE PICTURE. EACH CAMERA COVERED A 37-DEG FIELD OF VIEW WITH THE CENTER CAMERA POINTING STRAIGHT DOWN. THE OPTICAL AXES OF THE OTHER TWO CAMERAS WERE DIRECTED 35 DEG TO EITHER SIDE. EACH OF THE CAMERAS EMPLOYED AN F/4 LENS WITH A FOCAL LENGTH OF 17.0 MM. A POTENTIOMETER ATTACHED TO THE SOLAR ARRAY CONTROLLED THE LENS OPENING FROM F/16 WHEN THE SPACECRAFT WAS OVER THE EQUATOR TO F/4 WHEN IT WAS NEAR THE POLES. THE 800-SCAN-LINE, 2.54-CM-DIAMETER VIDICON PICKUP TUBES YIELDED A LINEAR RESOLUTION OF BETTER THAN 1 KM AT NADIR FROM AN APPROXIMATE ALTITUDE OF 1100 KM. AT THIS ALTITUDE, THE CAMERA ARRAY COULD PRODUCE A COMPOSITE PICTURE COVERING AN AREA OF 720 BY 3400 KM. SUCCESSIVE FRAMES WERE TAKEN AT 91-SEC INTERVALS PROVIDING ABOUT 20 PERCENT OVERLAP IN COVERAGE. A 40-MSEC EXPOSURE TIME WAS USED, AND THE IMAGE WAS SCANNED BY THE ELECTRON BEAM IN 6.5 SEC. THE RESULTING SIGNAL WAS FREQUENCY MODULATED AND RECORDED ON THREE TRACKS OF A MAGNETIC TAPE, ONE TRACK FOR EACH CAMERA. SUFFICIENT TAPE WAS PROVIDED FOR RECORDING 53 PICTURES (ABOUT 1-2/3 ORBITS OF DATA). THE AVCS DATA WERE MULTIPLEXED WITH THE HIGH-RESOLUTION INFRARED RADIOMETER (HRIR) DATA AND, USING A TRANSMISSION FREQUENCY OF 1707.5 MHZ, WERE TELEMETERED TO A GROUND STATION IN 4 MIN. THE EXPERIMENT WAS SUCCESSFUL. IT PROVIDED HIGH-QUALITY CLOUDCOVER PICTURES OVER AN ENTIRE SEASON ON A NEAR-GLOBAL BASIS IN ADDITION TO CONFIRMING THE RELIABILITY OF THE CAMERA SYSTEM FOR USE IN FUTURE OPERATIONAL WEATHER SATELLITES. DATA FROM THIS EXPERIMENT CAN BE OBTAINED FROM THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. FOR AN INDEX OF ALL DATA, SEE 'NIMBUS II AVCS WORLD MONTAGE CATALOG,' AVAILABLE FROM NSSDC.

REFERENCES

146, 160, 161, 162, 163, 401, 464, 506, 605, 639, 691, 741, AND 742.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM NSSDC ID 66-040A-02

EXPERIMENT PERSONNEL
PI - J.R. SCHULMAN NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 011769

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 2 AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM WAS A CAMERA AND TRANSMITTER COMBINATION DESIGNED TO TRANSMIT LOCAL DAYTIME SLOW-SCAN TELEVISION PICTURES OF CLOUDCOVER CONDITIONS TO PROPERLY EQUIPPED GROUND RECEIVING STATIONS ON A REAL-TIME BASIS. THE CAMERA USED A 108-DEG

WIDE-ANGLE F/1.8 OBJECTIVE LENS WITH A FOCAL LENGTH OF 6.0 MM. THE CAMERA WAS MOUNTED FACING EARTHWARD ON THE H-FRAME INSIDE THE SENSORY RING, WITH ITS OPTICAL AXIS PARALLEL TO THE SPACECRAFT SPIN AXIS. THE ACTUAL PHOTOGRAPHY REQUIRED .8 SEC AND THE TRANSMISSION 200 SEC. EARTH-CLOUD IMAGES RETAINED ON THE PHOTOSENSITIVE SURFACE OF THE 2.54-CM-DIAMETER VIDICON WERE READ OUT AT FOUR LINES PER SECOND TO PRODUCE AN 800-LINE PICTURE. A 5-W TV TRANSMITTER (137.5 MHZ) RELAYED THE PICTURES TO LOCAL APT STATIONS WITHIN COMMUNICATION RANGE. THE FACEPLATE OF THE VIDICON HAD RETICLE MARKS THAT APPEARED ON THE PICTURE FORMAT TO AID IN RELATING THE PICTURE TO ITS GEOGRAPHICAL POSITION ON THE EARTH'S SURFACE. FROM THE SATELLITE ATTITUDE AND ALTITUDE (APPROXIMATELY 1050 KM), A PICTURE COVERED A 1200- BY 1200-KM SQUARE WITH A HORIZONTAL RESOLUTION OF BETTER THAN 3 KM AT NADIR. THE NIMBUS 2 APT SYSTEM WAS CAPABLE OF TRANSMITTING THE NIGHTTIME HIGH-RESOLUTION INFRARED RADIOMETER (HRIR) SENSOR OUTPUT THROUGH THE APT TRANSMITTER. HENCE, WITH SOME MINOR MODIFICATIONS, AN APT STATION WITHIN TELEMETRY RANGE COULD RECEIVE HRIR DATA IN THE DIRECT READOUT INFRARED RADIOMETER (DRIR) MODE. THE EXPERIMENT WAS A SUCCESS, AND GOOD DATA WERE OBTAINED DURING ITS OPERATIONAL LIFETIME. APT/DRIR DATA ARE PRIMARILY INTENDED FOR OPERATIONAL USE WITHIN THE LOCAL APT ACQUISITION STATION AND ARE GENERALLY NOT AVAILABLE FOR DISTRIBUTION.

REFERENCES

146, 276, 647, 649, 652, 691, 699, 768, 827, 861, AND 871.

EXPERIMENT NAME- HIGH-RESOLUTION INFRARED RADIOMETER (HRIR) NSSDC ID 66-040A-03

EXPERIMENT PERSONNEL

PI - L.L. FOSHEE USAELECCOM FT. BELVOIR, VA.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 111566

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 2 HIGH-RESOLUTION INFRARED RADIOMETER (HRIR) WAS DESIGNED (1) TO MAP THE EARTH'S NIGHTTIME CLOUD COVER AND THUS TO COMPLEMENT THE DAYTIME TELEVISION (AVCS) COVERAGE AND (2) TO MEASURE THE RADIATIVE TEMPERATURES OF CLOUD TOPS AND SURFACE TERRAIN. MOUNTED ON THE EARTH-ORIENTED SENSORY RING, THE RADIOMETER MEASURED THERMAL RADIATION IN THE 3.5- TO 4.1-MICRON 'WINDOW' REGION. THE HRIR SUBSYSTEM CONSISTED OF (1) AN OPTICAL SYSTEM, (2) AN INFRARED DETECTOR (LEAD SELENIDE PHOTOCONDUCTIVE MATERIAL), (3) ELECTRONICS, (4) A MAGNETIC TAPE RECORDER, AND (5) A FILTER TO MINIMIZE ATTENUATION EFFECTS OF WATER VAPOR AND CARBON DIOXIDE. IN CONTRAST TO THE AVCS CAMERA, NO IMAGE WAS FORMED WITHIN THE RADIOMETER. THE HRIR SENSOR MERELY TRANSFORMED THE RECEIVED RADIATION INTO AN ELECTRICAL VOLTAGE, WHICH WAS RECORDED ON THE TAPE RECORDER FOR SUBSEQUENT PLAYBACK WHEN THE SATELLITE CAME WITHIN RANGE OF AN AQUISITION STATION. SOME HRIR DATA WERE ALSO TRANSMITTED IN A REAL-TIME MODE BY THE APT TRANSMITTER. THE RADIOMETER HAD AN INSTANTANEOUS FIELD OF VIEW OF ABOUT 0.5 DEG, WHICH AT AN ALTITUDE OF 1100 KM CORRESPONDED TO A GROUND RESOLUTION OF APPROXIMATELY 8 KM AT NADIR. THE RADIOMETER WAS CAPABLE OF MEASURING RADIANCE TEMPERATURES FROM 210 TO 330 DEG K. SINCE IT OPERATED IN THE 3.5- TO 4.1-MICRON REGION, THE DAYTIME PICTURES INCLUDED REFLECTED SOLAR RADIATION IN ADDITION TO THE EMITTED SURFACE IR RADIATION. HOWEVER, THE REFLECTED SOLAR RADIATION DID NOT SATURATE THE INSTRUMENT, AND A USABLE OUTPUT WAS STILL OBTAINED. THE EXPERIMENT WAS A SUCCESS, AND GOOD DATA WERE OBTAINED UNTIL THE TAPE RECORDER FAILED ON NOVEMBER 15, 1966.

REFERENCES

64, 93, 146, 161, 162, 163, 164, 165, 211, 300, 382, 464, 513, 520, 536, 557, 589, 590, 592, 607, 631, 639, 642, 643, 657, 683, 691, 705, 725, 741, 742, 746, 755, 759, 781, 782, 814, 816, 848, 849, 850, 905, 906, 907, 909, 910, 913, AND 928.

EXPERIMENT NAME- MEDIUM-RESOLUTION INFRARED RADIOMETER (MRIR) NSSDC ID 66-040A-04

EXPERIMENT PERSONNEL

PI - A.W. MCCULLOCH NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 072666

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 2 MEDIUM-RESOLUTION INFRARED RADIOMETER (MRIR) EXPERIMENT MEASURED THE INTENSITY AND DISTRIBUTION OF ELECTROMAGNETIC RADIATION EMITTED BY AND REFLECTED FROM THE EARTH AND ITS ATMOSPHERE IN FIVE SELECTED WAVELENGTH INTERVALS FROM 0.2 TO 30 MICRONS. DATA FOR HEAT BALANCE OF THE EARTH-ATMOSPHERE SYSTEM WERE OBTAINED, AS WELL AS MEASUREMENTS OF WATER VAPOR DISTRIBUTION, SURFACE OR NEAR-SURFACE TEMPERATURES, AND SEASONAL CHANGES OF STRATOSPHERIC TEMPERATURE DISTRIBUTION. THE FIVE WAVELENGTH REGIONS WERE (1) THE 6.4- TO 6.9-MICRON CHANNEL, WHICH COVERED THE 6.7-MICRON WATER VAPOR ABSORPTION BAND, (2) THE 10- TO 11-MICRON BAND, WHICH OPERATED IN THE 'ATMOSPHERIC WINDOW,' (3) THE 14- TO 16-MICRON BAND, WHICH COVERED THE 15-MICRON CARBON DIOXIDE ABSORPTION BAND, (4) THE 5- TO 30-MICRON BAND, WHICH MEASURED THE EMITTED LONG-WAVELENGTH INFRARED ENERGY FOR HEAT BUDGET PURPOSES, AND (5) THE 0.2- TO 4.0-MICRON CHANNEL, WHICH YIELDED INFORMATION ON THE INTENSITY OF REFLECTED SOLAR ENERGY (ALBEDO). RADIANT ENERGY FROM THE EARTH WAS COLLECTED BY A FLAT SCANNING MIRROR INCLINED AT 45 DEG TO THE OPTICAL AXIS. THE MIRROR ROTATED AT 8 RPM AND SCANNED IN A PLANE PERPENDICULAR TO THE DIRECTION OF MOTION OF THE SATELLITE. EACH OF THE FIVE CHANNELS CONTAINED A 4.33-CM-DIAMETER FOLDED TELESCOPE WITH A 2.8-DEG FIELD OF VIEW AND A THERMISTOR-BOLOMETER. THE COLLECTED ENERGY WAS MODULATED BY A MECHANICAL CHOPPER TO PRODUCE AN AC SIGNAL. THE SIGNAL WAS THEN AMPLIFIED AND RECORDED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. AT A SATELLITE ALTITUDE OF 1100 KM, A HORIZONTAL RESOLUTION OF 55 KM COULD BE OBTAINED. THE MRIR EXPERIMENT WAS SUCCESSFUL, AND GOOD DATA WERE OBTAINED FROM LAUNCH UNTIL THE RECORDER FAILED ON JULY 26, 1966.

REFERENCES

22, 123, 132, 146, 161, 162, 291, 346, 368, 439, 512, 607, 628, 629, 630, 681, 691, 705, 712, 713, 742, 752, 753, 755, 756, 757, 782, 784, 815, 840, 884, 908, AND 911.

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SPACECRAFT COMMON NAME- NIMBUS-B NSSDC ID 68-041X
ALTERNATE NAMES-

ORBITAL INFORMATION OTHER INFORMATION

ORBIT TYPE-
EPOCH DATE- / /
APOGEE-
PERIGEE-
PERIOD-
INCLINATION- DEG

SPACECRAFT WT- 591. KG
LAUNCH DATE- 05/18/68
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED-

SPACECRAFT PERSONNEL

PM - H.	PRESS	NASA-GSFC	GREENBELT, MD.
PS - W.P.	NORDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

THE NIMBUS-B METEOROLOGICAL R AND D SATELLITE WAS DESIGNED TO SERVE AS A STABILIZED, EARTH-ORIENTED PLATFORM FOR THE TESTING OF ADVANCED SYSTEMS FOR SENSING AND COLLECTING METEOROLOGICAL DATA. THE SPACECRAFT CONSISTED OF THREE MAJOR STRUCTURES -- (1) A SENSOR MOUNT, (2) SOLAR PADDLES, AND (3) THE CONTROL HOUSING UNIT, WHICH WAS CONNECTED TO THE SENSOR MOUNT BY A TRUSS STRUCTURE. SHAPED SOMEWHAT LIKE AN OCEAN BUOY, NIMBUS-B WAS NEARLY 3.7 M TALL, 1.5 M IN DIAMETER AT THE BASE, AND ABOUT 3 M ACROSS WITH SOLAR PADDLES EXTENDED. THE TORUS-SHAPED SENSOR MOUNT, WHICH FORMED THE SATELLITE BASE, HOUSED THE ELECTRONICS EQUIPMENT AND BATTERY MODULES. THE LOWER SURFACE OF THE TORUS PROVIDED A MOUNTING SPACE FOR SENSORS AND TELEMETRY ANTENNAS. AN H-FRAME STRUCTURE MOUNTED WITHIN THE CENTER OF THE TORUS PROVIDED SUPPORT FOR THE LARGER EXPERIMENTS AND TAPE RECORDERS. MOUNTED ON THE CONTROL HOUSING UNIT, WHICH WAS LOCATED ON TOP OF THE SPACECRAFT, WERE SUN SENSORS, HORIZON SCANNERS, GAS NOZZLES FOR ATTITUDE CONTROL, AND A COMMAND ANTENNA. USE OF THE ATTITUDE CONTROL SUBSYSTEM (ACS) PERMITTED THE SPACECRAFT'S ORIENTATION TO BE CONTROLLED TO WITHIN PLUS OR MINUS 1 DEG FOR ALL THREE AXES (PITCH, ROLL, AND YAW). PRIMARY EXPERIMENT SUBSYSTEMS ON NIMBUS-B CONSISTED OF (1) A SATELLITE INFRARED SPECTROMETER (SIRS) FOR DETERMINING THE VERTICLE TEMPERATURE PROFILES OF THE ATMOSPHERE, (2) AN INFRARED INTERFEROMETER SPECTROMETER (IRIS) FOR MEASURING THE EMISSION SPECTRA OF THE EARTH-ATMOSPHERE SYSTEM, (3) BOTH HIGH- AND MEDIUM-RESOLUTION INFRARED RADIOMETERS (HRIR AND MRIR) FOR YIELDING INFORMATION ON THE DISTRIBUTION AND INTENSITY OF INFRARED RADIATION EMITTED AND REFLECTED BY THE EARTH AND ITS ATMOSPHERE, (4) A MONITOR OF ULTRAVIOLET SOLAR ENERGY (MUSE) FOR DETECTING SOLAR UV RADIATION, (5) AN IMAGE DISSECTOR CAMERA SYSTEM (IDCS) FOR PROVIDING DAYTIME CLOUDCOVER PICTURES IN BOTH REAL-TIME MODE, USING THE REAL-TIME TRANSMISSION SYSTEM (RTTS), AND TAPE RECORDER MODE, USING THE HIGH DATA RATE STORAGE SYSTEM (HDRSS), (6) A RADIOISOTOPE THERMOELECTRIC GENERATOR (RTG), SNAP-19, TO ASSESS THE OPERATIONAL CAPABILITY OF RADIOISOTOPE POWER FOR SPACE APPLICATIONS, AND (7) AN INTERROGATION, RECORDING, AND LOCATION SYSTEM (IRLS) DESIGNED TO LOCATE, INTERROGATE, RECORD, AND RETRANSMIT METEOROLOGICAL DATA FROM REMOTE COLLECTION STATIONS. THE SPACECRAFT NEVER ACHIEVED ORBIT BECAUSE A MALFUNCTION IN THE BOOSTER GUIDANCE SYSTEM FORCED THE DESTRUCTION OF THE SPACECRAFT AND ITS PAYLOAD DURING LAUNCH. LESS THAN 1 YR LATER, AN IDENTICAL PAYLOAD WAS SUCCESSFULLY FLOWN ON NIMBUS 3.

REFERENCES

59, 694, 700, 733, 734, 737, AND 852.

EXPERIMENT NAME- HIGH-RESOLUTION INFRARED RADIOMETER NSSDC ID 68-041X-02

EXPERIMENT PERSONNEL

PI - L.L.	FOSHEE	USAELECCOM	FORT BELVOIR, VA.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-B HIGH-RESOLUTION INFRARED RADIOMETER (HRIR) WAS DESIGNED TO DETECT EMITTED THERMAL RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 3.4- TO 4.2-MICRON BAND TO PRODUCE CLOUDCOVER PICTURES AND TO MEASURE CLOUDTOP TEMPERATURES DURING THE NIGHTTIME PORTION OF THE ORBIT. BY DETECTING REFLECTED SOLAR RADIATION IN THE 0.7- TO 1.3-MICRON BAND, THE RADIOMETER COULD ALSO MAP THE EARTH'S CLOUD COVER DURING THE DAYTIME. RADIANT ENERGY FROM THE EARTH WAS TO BE COLLECTED BY A FLAT SCANNING MIRROR INCLINED AT 45 DEG TO THE OPTICAL AXIS. THE MIRROR WAS TO BE ROTATED AT 48 RPM AND TO SCAN IN A PLANE NORMAL TO THE SPACECRAFT VELOCITY. THE RADIATION REFLECTED FROM THE SCAN MIRROR WAS TO BE CHOPPED AT THE FOCUS OF A 10.2-CM F/1 MODIFIED CASSEGRAIN TELESCOPE. THE MODULATED ENERGY WAS THEN TO BE REFOCUSED ON A LEAD SELENIDE DETECTOR CELL THAT WOULD TRANSFORM THE RECEIVED RADIATION INTO AN ELECTRICAL OUTPUT. THE OUTPUT WAS TO BE AMPLIFIED AND RECORDED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. USING THE DIRECT READOUT INFRARED RADIOMETER (DRIR) SYSTEM, NIGHTTIME AND DAYTIME DATA COULD BE TRANSMITTED BY THE REAL-TIME TRANSMISSION SYSTEM (RTTS) TO GROUND APT STATIONS. A GROUND RESOLUTION OF 8.5 KM COULD BE OBTAINED AT NADIR. THE HRIR WAS DESIGNED TO MEASURE RADIANCE TEMPERATURES BETWEEN 210 TO 330 DEG K TO A GENERAL ACCURACY OF 1 DEG. THE EXPERIMENT WAS NEVER ACTIVATED BECAUSE NIMBUS-B AND ITS PAYLOAD WERE INTENTIONALLY DESTROYED DURING LAUNCH. AN IDENTICAL EXPERIMENT WAS LATER SUCCESSFULLY FLOWN ON NIMBUS 3.

REFERENCES

737.

EXPERIMENT NAME- INFRARED INTERFEROMETER SPECTROMETER (IRIS) NSSDC ID 68-041X-03

EXPERIMENT PERSONNEL

PI - R.A.	HANEL	NASA-GSFC	GREENBELT, MD.
OI - L.	CHANEY	U OF MICHIGAN	ANN ARBOR, MI.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-B INFRARED INTERFEROMETER SPECTROMETER (IRIS) EXPERIMENT WAS DESIGNED TO PROVIDE INFORMATION ON THE VERTICAL STRUCTURE OF THE ATMOSPHERE AND THE EMISSIVE PROPERTIES OF THE EARTH-ATMOSPHERE SYSTEM BY MEASURING RADIATION IN THE 5.0- TO 20-MICRON BAND USING A MODIFIED MICHELSON INTERFEROMETER. INCOMING RADIATION WAS TO BE REFLECTED INTO THE INSTRUMENT FROM A PLANE MIRROR. THE RADIATION WAS THEN TO BE SPLIT INTO TWO BEAMS, WHICH WERE TO RECOMBINE AND INTERFERE AFTER REFLECTION ON A FIXED MIRROR AND A MOVING MICHELSON MIRROR. THE RECOMBINED BEAM WAS THEN TO BE FOCUSED ON A BOLOMETER DETECTOR, WITH INTERFERENCE EFFECTS RESULTING FROM THE OPTICAL PATH DIFFERENCE BETWEEN THE TWO BEAMS AS THE MIRROR MOVED. THE MOVING MIRROR WAS TO TRAVEL ABOUT 2 MM IN 11 SEC TO GIVE AN INTERFEROGRAM, WHICH WAS TO BE RECORDED ON MAGNETIC TAPE. THE INTERFEROGRAMS COULD BE TRANSMITTED TO AN ACQUISITION STATION, WHERE A FOURIER TRANSFORM WAS TO BE PERFORMED TO PRODUCE A THERMAL EMISSION SPECTRUM OF THE EARTH. FROM THESE SPECTRA, VERTICAL PROFILES OF TEMPERATURE, WATER VAPOR, AND OZONE COULD BE DERIVED.

AS WELL AS OTHER PARAMETERS OF METEOROLOGICAL INTEREST. THE INSTRUMENT HAD A FIELD OF VIEW EQUIVALENT TO A 144-KM-DIAMETER CIRCLE ON THE SURFACE OF THE EARTH AT A PLANNED ORBITAL HEIGHT OF 1100 KM. THE EXPERIMENT WAS NEVER ACTIVATED BECAUSE NIMBUS-B AND ITS PAYLOAD WERE INTENTIONALLY DESTROYED DURING LAUNCH. AN IDENTICAL EXPERIMENT WAS LATER SUCCESSFULLY FLOWN ON NIMBUS 3.

REFERENCES
488, AND 737.

EXPERIMENT NAME- SATELLITE INFRARED SPECTROMETER (SIRS)   NSSDC ID 68-041X-04

EXPERIMENT PERSONNEL

PI - D.Q.	WARK	NOAA-NESS	SUITLAND, MD.
OI - D.T.	HILLEARY	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-B SATELLITE INFRARED SPECTROMETER (SIRS) EXPERIMENT WAS DESIGNED TO INDIRECTLY DETERMINE THE VERTICAL TEMPERATURE PROFILES OF THE ATMOSPHERE BY MEASURING THE INFRARED RADIATION EMITTED FROM THE EARTH AND ITS ATMOSPHERE IN SEVEN SPECTRAL INTERVALS IN THE CARBON DIOXIDE BAND (13 TO 15 MICRONS) AND ONE INTERVAL IN THE ATMOSPHERIC WINDOW CENTERED AT 11.1 MICRONS. THE MAIN COMPONENTS OF THE FASTIE-EBERT FIXED-GRATING SPECTROMETER WERE (1) A PLANE LIGHT-COLLECTING MIRROR TO PROVIDE A SINGLE EARTH-VIEWING BEAM FIXED IN THE VERTICAL, (2) A ROTATING CHOPPER MIRROR, (3) A SPHERICAL MIRROR, (4) A 12.7-CM DIFFRACTION GRATING WITH 1250 LINES/IN., (5) A SET OF EIGHT EXIT SLITS WITH A SINGLE INTERFERENCE FILTER, (6) EIGHT WEDGE-IMMERSED THERMISTOR BOLOMETERS, (7) A BLACKBODY RADIATION SOURCE FOR CALIBRATION, AND (8) EIGHT PREAMPLIFIERS AND EIGHT OPERATIONAL AMPLIFIERS. THE INCOMING RADIATION WAS TO BE CHOPPED, SPECTRALLY DISPERSED BY THE DIFFRACTION GRATING, FOCUSED ON THE EXIT SLITS AS A SPECTRUM BY THE SPHERICAL MIRROR, AND CONVERTED TO ELECTRICAL SIGNALS. THE SIGNALS WERE THEN TO BE AMPLIFIED AND STORED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. THE INSTRUMENT FIELD OF VIEW WAS TO BE 11.5 BY 11.5 DEG CENTERED ON NADIR, CORRESPONDING TO A 215- BY 215-KM SQUARE ON THE EARTH'S SURFACE. DATA FROM THE 11.1-MICRON CHANNEL WERE TO YIELD SURFACE AND/OR CLOUDTOP TEMPERATURES. DATA FROM THE CARBON DIOXIDE BAND COULD BE USED TO GENERATE TEMPERATURE-PRESSURE PROFILES BY A MATHEMATICAL INVERSION TECHNIQUE. THE INSTRUMENT WAS NEVER ACTIVATED BECAUSE NIMBUS-B AND ITS PAYLOAD WERE INTENTIONALLY DESTROYED DURING LAUNCH. AN IDENTICAL EXPERIMENT WAS LATER SUCCESSFULLY FLOWN ON NIMBUS 3.

REFERENCES
737.

EXPERIMENT NAME- MEDIUM-RESOLUTION INFRARED RADIOMETER   NSSDC ID 68-041X-05

EXPERIMENT PERSONNEL

PI - A.W.	MCCULLOCH	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-B MEDIUM-RESOLUTION INFRARED RADIOMETER (MRIR) EXPERIMENT WAS DESIGNED TO MEASURE THE INTENSITY AND DISTRIBUTION OF THE ELECTROMAGNETIC RADIATION EMITTED BY AND REFLECTED FROM THE EARTH AND ITS ATMOSPHERE IN FIVE SELECTED WAVELENGTH INTERVALS FROM 0.2 TO 23 MICRONS. DATA FOR HEAT BALANCE OF THE EARTH-ATMOSPHERE SYSTEM COULD BE OBTAINED, AS WELL AS WATER VAPOR DISTRIBUTION, SURFACE OR NEAR-SURFACE TEMPERATURES, AND SEASONAL CHANGES OF STRATOSPHERIC TEMPERATURE DISTRIBUTION. THE FIVE WAVELENGTH REGIONS WERE (1) THE 6.5- TO 7.0-MICRON CHANNEL, WHICH COVERED THE 6.7-MICRON WATER VAPOR ABSORPTION BAND, (2) THE 10- TO 11-MICRON BAND, WHICH OPERATED IN THE 'ATMOSPHERIC WINDOW,' (3) THE 14.5- TO 15.5-MICRON BAND, WHICH COVERED THE 15-MICRON CARBON DIOXIDE ABSORPTION BAND, (4) THE 20- TO 23-MICRON CHANNEL, WHICH COVERED THE SPECTRAL REGION CONTAINING THE BROAD ROTATIONAL ABSORPTION BANDS OF WATER VAPOR, AND (5) THE 0.2- TO 4.0-MICRON CHANNEL, WHICH YIELDED INFORMATION ON THE INTENSITY OF REFLECTED SOLAR ENERGY. RADIANT ENERGY FROM THE EARTH WAS TO BE COLLECTED BY A FLAT SCANNING MIRROR INCLINED AT 45 DEG TO THE OPTICAL AXIS. THE MIRROR WAS TO BE ROTATED AT 8 RPM AND TO SCAN IN A PLANE PERPENDICULAR TO THE DIRECTION OF MOTION OF THE SATELLITE. EACH OF THE FIVE CHANNELS CONTAINED A 4.33-CM-DIAMETER FOLDED TELESCOPE WITH A 2.8-DEG FIELD OF VIEW AND A THERMISTOR BOLOMETER. THE COLLECTED ENERGY WAS TO BE MODULATED BY A MECHANICAL CHOPPER TO PRODUCE AN AC SIGNAL. THE SIGNAL WAS THEN TO BE AMPLIFIED AND RECORDED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. AT A PLANNED SATELLITE ALTITUDE OF 1100 KM, A HORIZONTAL RESOLUTION OF 45 KM COULD BE OBTAINED. THE EXPERIMENT WAS NEVER ACTIVATED BECAUSE NIMBUS-B AND ITS PAYLOAD WERE INTENTIONALLY DESTROYED DURING LAUNCH. AN IDENTICAL EXPERIMENT WAS LATER SUCCESSFULLY FLOWN ON NIMBUS 3.

REFERENCES

737.

EXPERIMENT NAME- IMAGE DISSECTOR CAMERA SYSTEM (IDCS)   NSSDC ID 68-041X-06

EXPERIMENT PERSONNEL

PI - G.A. BRANCHFLOWER   NASA-GSFC   GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-B IMAGE DISSECTOR CAMERA SYSTEM (IDCS) WAS DESIGNED TO TAKE DAYTIME CLOUDCOVER PHOTOGRAPHS. THE PICTURES COULD BE TRANSMITTED TO APT STATIONS USING THE REAL-TIME TRANSMISSION SYSTEM (RTTS) OR STORED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO GROUND ACQUISITION STATIONS. THE CAMERA WAS MOUNTED ON THE BOTTOM OF THE SATELLITE SENSORY RING AND POINTED VERTICALLY DOWN TOWARD THE EARTH AT ALL TIMES. THE IMAGE DISSECTOR WAS A SHUTTERLESS ELECTRONIC SCAN AND STEP TUBE MOUNTED BEHIND A WIDE-ANGLE (108 DEG) 5.7-MM FOCAL LENGTH LENS. SCANNING AND STEPPING FUNCTIONS WERE TO OCCUR CONTINUOUSLY WHILE THE SATELLITE PROGRESSED ALONG ITS ORBITAL PATH. THE FIELD OF VIEW OF THE OPTICS WAS TO BE 73.6 DEG IN THE DIRECTION OF FLIGHT AND 98.2 DEG IN A PLANE NORMAL TO THE DIRECTION OF FLIGHT. THE IMAGE WAS TO BE WAS FOCUSED BY THE OPTICS ON A PHOTOSENSITIVE SURFACE OF THE IMAGE DISSECTOR TUBE. A LINE-SCANNING BEAM WAS TO SCAN THE PHOTOSENSITIVE SURFACE AT 4 HZ WITH A FRAME PERIOD OF 200 SEC. AT A PLANNED SPACECRAFT ALTITUDE OF 1100 KM, EACH RESULTING PICTURE WAS TO BE APPROXIMATELY 1400 KM ON A SIDE WITH A GROUND RESOLUTION OF 3 KM AT NADIR. THE EXPERIMENT WAS NEVER

ACTIVATED BECAUSE THE SPACECRAFT WAS INTENTIONALLY DESTROYED DURING LAUNCH. AN IDENTICAL EXPERIMENT WAS LATER SUCCESSFULLY FLOWN ON NIMBUS 3.

REFERENCES
737.

EXPERIMENT NAME- INTERROGATION, RECORDING, AND LOCATION SYSTEM (IRLS) NSSDC ID 68-041X-07

EXPERIMENT PERSONNEL

PI - G.	HOGAN	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION
THE NIMBUS-B INTERROGATION, RECORDING, AND LOCATION SYSTEM (IRLS) EXPERIMENT WAS DESIGNED TO COLLECT AND RETRANSMIT METEOROLOGICAL, GEOPHYSICAL, AND OTHER EXPERIMENTAL DATA FROM REMOTE UNMANNED DATA COLLECTION STATIONS (PLATFORMS) DEPLOYED ON A GLOBAL SCALE. THE IRLS COULD ALSO DETERMINE THE LOCATION AND TRACK THE MOVEMENT OF SUCH PLATFORMS AS BALLOONS, OCEAN BUOYS, AND SHIPS TO WITHIN AN ACCURACY OF 2 KM. THE IRLS CONSISTED OF (1) A 466-MHZ RECEIVER, (2) A 401.5-MHZ TRANSMITTER, (3) DECODING AND CODING CIRCUITS, (4) A RANGE DETECTOR, AND (5) A 20-KB SATELLITE DATA MEMORY CAPABLE OF STORING DATA OBTAINED DURING EACH ORBIT FOR UP TO 20 DIFFERENT INTERROGATIONS. ON EACH ORBITAL PASS, WHEN THE SATELLITE WAS WITHIN RANGE OF AN ACQUISITION AND COMMAND STATION, THE SATELLITE COMMAND MEMORY WAS PROGRAMMED TO COMMUNICATE WITH SELECTED PLATFORMS DURING THE COMING ORBIT. THE SATELLITE COULD STORE BOTH THE ADDRESS (NUMBER) OF EACH PLATFORM AND THE DESIRED TIME THAT EACH WAS TO BE CONTACTED. AT THE APPROPRIATE TIME IN ORBIT, THE SATELLITE COULD INTERROGATE EACH PLATFORM, MEASURE THE SATELLITE TO PLATFORM DISTANCE BY DETERMINING THE ROUND TRIP PROPAGATION TIME OF THE RF SIGNAL, RECEIVE THE ANALOG DATA FROM THE PLATFORM, CONVERT IT TO DIGITAL FORM, AND STORE IT. UPON RETURN TO THE LOCALE OF THE GROUND STATION, THE STATION WOULD COMMAND THE SATELLITE TO TRANSMIT THE STORED DATA AND ACCEPT NEW COMMANDS FOR THE NEXT ORBIT. THE EXPERIMENT WAS NEVER ACTIVATED BECAUSE THE SPACECRAFT AND ITS PAYLOAD WERE INTENTIONALLY DESTROYED DURING LAUNCH. AN IDENTICAL EXPERIMENT WAS LATER SUCCESSFULLY FLOWN ON NIMBUS 3.

REFERENCES
398, AND 737.

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SPACECRAFT COMMON NAME- NIMBUS 3 NSSDC ID 69-037A
ALTERNATE NAMES- PL-684G, NIMBUS-B2

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/14/69
APOGEE- 1132.00 KM ALT
PERIGEE- 1071.00 KM ALT

OTHER INFORMATION
SPACECRAFT WT- 576. KG
LAUNCH DATE- 04/14/69
OPERATING STATUS- INOPERABLE
DATE LAST USABLE

PERIOD- 107.3 MIN
INCLINATION- 99.922 DEG

DATA RECORDED- 012272

SPACECRAFT PERSONNEL

PM - H. PRESS	NASA-GSFC	GREENBELT, MD.
PS - W.P. NORDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

NIMBUS 3, THE THIRD IN A SERIES OF SECOND-GENERATION METEOROLOGICAL R AND D SATELLITES, WAS DESIGNED TO SERVE AS A STABILIZED, EARTH-ORIENTED PLATFORM FOR THE TESTING OF ADVANCED SYSTEMS FOR SENSING AND COLLECTING METEOROLOGICAL DATA. THE POLAR-ORBITING SPACECRAFT CONSISTED OF THREE MAJOR ELEMENTS -- (1) A SENSORY RING, (2) SOLAR PADDLES, AND (3) THE CONTROL HOUSING UNIT, WHICH WAS CONNECTED TO THE SENSORY RING BY A TRUSS STRUCTURE. SHAPED SOMEWHAT LIKE AN OCEAN BUOY, NIMBUS 3 WAS NEARLY 3.7 M TALL, 1.5 M IN DIAMETER AT THE BASE, AND ABOUT 3 M ACROSS WITH SOLAR PADDLES EXTENDED. THE TORUS-SHAPED SENSORY RING, WHICH FORMED THE SATELLITE BASE, HOUSED THE ELECTRONICS EQUIPMENT AND BATTERY MODULES. THE LOWER SURFACE OF THE TORUS RING PROVIDED A MOUNTING SPACE FOR SENSORS AND TELEMETRY ANTENNAS. AN H-FRAME STRUCTURE MOUNTED WITHIN THE CENTER OF THE TORUS PROVIDED SUPPORT FOR THE LARGER EXPERIMENTS AND TAPE RECORDERS. MOUNTED ON THE CONTROL HOUSING UNIT, WHICH WAS LOCATED ON TOP OF THE SPACECRAFT, WERE SUN SENSORS, HORIZON SCANNERS, GAS NOZZLES FOR ATTITUDE CONTROL, AND A COMMAND ANTENNA. USE OF THE ATTITUDE CONTROL SUBSYSTEM (ACS) PERMITTED THE SPACECRAFT'S ORIENTATION TO BE CONTROLLED TO WITHIN PLUS OR MINUS 1 DEG FOR ALL THREE AXES (PITCH, ROLL, AND YAW). PRIMARY EXPERIMENTS CONSISTED OF (1) A SATELLITE INFRARED SPECTROMETER (SIRS) FOR DETERMINING THE VERTICAL TEMPERATURE PROFILES OF THE ATMOSPHERE, (2) AN INFRARED INTERFEROMETER SPECTROMETER (IRIS) FOR MEASURING THE EMISSION SPECTRA OF THE EARTH-ATMOSPHERE SYSTEM, (3) BOTH HIGH- AND MEDIUM-RESOLUTION INFRARED RADIOMETERS (HRIR AND MRIR) FOR YIELDING INFORMATION ON THE DISTRIBUTION AND INTENSITY OF INFRARED RADIATION EMITTED AND REFLECTED BY THE EARTH AND ITS ATMOSPHERE, (4) A MONITOR OF ULTRAVIOLET SOLAR ENERGY (MUSE) FOR DETECTING SOLAR UV RADIATION, (5) AN IMAGE DISSECTOR CAMERA SYSTEM (IDCS) FOR PROVIDING DAYTIME CLOUDCOVER PICTURES IN BOTH REAL-TIME MODE, USING THE REAL TIME TRANSMISSION SYSTEM (RTTS), AND TAPE RECORDER MODE, USING THE HIGH DATA RATE STORAGE SYSTEM , (6) A RADIOISOTOPE THERMOELECTRIC GENERATOR (RTG), SNAP-19, TO ASSESS THE OPERATIONAL CAPABILITY OF RADIOISOTOPE POWER FOR SPACE APPLICATIONS, AND (7) AN INTERROGATION, RECORDING, AND LOCATION SYSTEM (IRLS) EXPERIMENT DESIGNED TO LOCATE, INTERROGATE, RECORD, AND RETRANSMIT METEOROLOGICAL AND GEOPHYSICAL DATA FROM REMOTE COLLECTION STATIONS. NIMBUS 3 WAS SUCCESSFUL AND PERFORMED NORMALLY UNTIL SEPTEMBER 25, 1970, WHEN THE REAR HORIZON SCANNER FAILED. WITHOUT THIS HORIZON SCANNER, IT WAS IMPOSSIBLE TO MAINTAIN PROPER SPACECRAFT ATTITUDE, THUS MAKING MOST EXPERIMENTAL OBSERVATIONS USELESS. ALL SPACECRAFT OPERATIONS WERE TERMINATED ON JANUARY 22, 1972.

REFERENCES

5, 22, 84, 141, 146, 174, 189, 190, 191, 240, 265, 271, 272, 280, 281, 405, 438, 511, 603, 636, 681, 693, 694, 710, 733, 736, 741, 778, 852, 917, AND 939.

EXPERIMENT NAME- HIGH-RESOLUTION INFRARED RADIOMETER (HRIR)

NSSDC ID 69-037A-02

EXPERIMENT PERSONNEL

PI - G.T. CHERRIX NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 012570

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 3 HIGH-RESOLUTION INFRARED RADIOMETER (HRIR) WAS DESIGNED TO DETECT EMITTED THERMAL RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 3.4- TO 4.2-MICRON BAND TO PRODUCE CLOUDCOVER PICTURES AND TO MEASURE CLOUDTOP TEMPERATURES DURING THE NIGHTTIME PORTION OF THE ORBIT. BY DETECTING REFLECTED SOLAR RADIATION IN THE 0.7- TO 1.3-MICRON BAND, THE RADIOMETER COULD ALSO MAP THE EARTH'S CLOUD COVER DURING THE DAYTIME. RADIANT ENERGY FROM THE EARTH WAS COLLECTED BY A FLAT SCANNING MIRROR INCLINED AT 45 DEG TO THE OPTICAL AXIS. THE MIRROR ROTATED AT 48 RPM AND SCANNED IN A PLANE NORMAL TO THE SPACECRAFT VELOCITY. THE RADIATION REFLECTED FROM THE SCAN MIRROR WAS CHOPPED AT THE FOCUS OF A 10.2-CM F/1 MODIFIED CASSEGRAIN TELESCOPE. THE MODULATED ENERGY WAS THEN REFOCUSED ON A LEAD SELENIDE DETECTOR CELL THAT TRANSFORMED THE RECEIVED RADIATION INTO AN ELECTRICAL OUTPUT. THE OUTPUT WAS AMPLIFIED AND RECORDED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. USING THE DIRECT READOUT INFRARED RADIOMETER (DRIR) SYSTEM, NIGHTTIME AND DAYTIME DATA COULD BE TRANSMITTED BY THE REAL-TIME TRANSMISSION SYSTEM (RTTS) TO GROUND APT STATIONS. A GROUND RESOLUTION OF 8.5 KM COULD BE OBTAINED AT NADIR. THE HRIR MEASURED RADIANCE TEMPERATURES BETWEEN 210 AND 330 DEG K TO A GENERAL ACCURACY OF 1 DEG. THE EXPERIMENT WAS SUCCESSFUL. HOWEVER, AFTER AUGUST 1969, NOISE IN THE TAPE RECORDER SYSTEM GRADUALLY REDUCED THE QUALITY OF THE DATA, WHICH CAUSED ROUTINE PROCESSING OF HRIR DATA TO BE TERMINATED AFTER JANUARY 25, 1970. ALL EXPERIMENT OPERATIONS CEASED ON JANUARY 22, 1972, WHEN THE SPACECRAFT WAS DEACTIVATED.

REFERENCES

5, 146, 167, 168, 211, 291, 318, 367, 381, 465, 520, 558, 559, 578, 609, 611, 612, 631, 647, 657, 741, 742, 746, 765, 814, 831, 848, 886, 887, AND 939.

EXPERIMENT NAME- INFRARED INTERFEROMETER SPECTROMETER (IRIS) NSSDC ID 69-037A-03

EXPERIMENT PERSONNEL

PI - R.A. HANEL	NASA-GSFC	GREENBELT, MD.
OI - L. CHANEY	U OF MICHIGAN	ANN ARBOR, MI.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 072269

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 3 INFRARED INTERFEROMETER SPECTROMETER (IRIS) EXPERIMENT WAS DESIGNED TO PROVIDE INFORMATION ON THE VERTICAL STRUCTURE OF THE ATMOSPHERE AND THE EMISSIVE PROPERTIES OF THE EARTH'S SURFACE BY MEASURING THE SURFACE AND ATMOSPHERIC RADIATION IN THE 5.0- TO 20-MICRON BAND USING A MODIFIED MICHELSON INTERFEROMETER. INCOMING RADIATION WAS REFLECTED INTO THE INSTRUMENT FROM A PLANE MIRROR. THE RADIATION WAS SPLIT INTO TWO BEAMS THAT RECOMBINED AND INTERFERED AFTER REFLECTION ON A FIXED MIRROR AND A MOVING MICHELSON MIRROR. THE RECOMBINED BEAM WAS THEN FOCUSED ON A BOLOMETER DETECTOR. INTERFERENCE EFFECTS RESULTED FROM THE OPTICAL PATH DIFFERENCE BETWEEN THE TWO BEAMS AS THE MIRROR MOVED. THE MOVING MIRROR TRAVELED ABOUT 2 MM IN 11 SEC TO GIVE AN INTERFEROGRAM, WHICH WAS RECORDED ON MAGNETIC TAPE. THE INTERFEROGRAMS WERE TRANSMITTED TO AN ACQUISITION STATION, WHERE A FOURIER TRANSFORM WAS PERFORMED TO PRODUCE A THERMAL EMISSION SPECTRUM OF

THE EARTH. FROM THESE SPECTRA, VERTICAL PROFILES OF TEMPERATURE, WATER VAPOR, AND OZONE, AS WELL AS OTHER PARAMETERS OF METEOROLOGICAL INTEREST, COULD BE DERIVED. THE INSTRUMENT HAD A FIELD OF VIEW EQUIVALENT TO A 144-KM-DIAMETER CIRCLE ON THE SURFACE OF THE EARTH AT A PLANNED ORBITAL HEIGHT OF 1100 KM. THE EXPERIMENT WAS SUCCESSFUL, AND GOOD DATA WERE OBTAINED UNTIL THE INSTRUMENT FAILED ON JULY 22, 1969.

REFERENCES

5, 22, 77, 91, 96, 97, 146, 167, 168, 206, 291, 307, 318, 382, 386, 387, 388, 389, 441, 485, 489, 492, 570, 587, 636, 663, 669, 679, 727, 728, 729, 730, 731, 732, 736, 739, 745, 759, 765, 775, 843, 844, AND 939.

EXPERIMENT NAME- SATELLITE INFRARED SPECTROMETER (SIRS) NSSDC ID 69-037A-04

EXPERIMENT PERSONNEL

PI - D.Q.	WARK	NOAA-NESS	SUITLAND, MD.
OI - D.T.	HILLEARY	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 062170

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 3 SATELLITE INFRARED SPECTROMETER (SIRS) EXPERIMENT WAS DESIGNED TO INDIRECTLY DETERMINE THE VERTICAL TEMPERATURE PROFILES OF THE ATMOSPHERE BY MEASURING THE INFRARED RADIATION EMITTED FROM THE EARTH AND ITS ATMOSPHERE IN SEVEN SPECTRAL INTERVALS IN THE CARBON DIOXIDE BAND (13 TO 15 MICRONS) AND ONE INTERVAL IN THE ATMOSPHERIC WINDOW CENTERED AT 11.1 MICRONS. THE MAIN COMPONENTS OF THE FASTIE-EBERT FIXED-GRATING SPECTROMETER CONSISTED OF (1) A PLANE, LIGHT-COLLECTING MIRROR TO PROVIDE A SINGLE EARTH-VIEWING BEAM FIXED IN THE VERTICAL, (2) A ROTATING CHOPPER MIRROR, (3) A SPHERICAL MIRROR, (4) A 12.7-CM DIFFRACTION GRATING WITH 1250 LINES PER INCH, (5) A SET OF EIGHT EXIT SLITS WITH A SINGLE INTERFERENCE FILTER, (6) EIGHT WEDGE-IMMERSED THERMISTOR BOLOMETERS, (7) A BLACKBODY RADIATION SOURCE FOR CALIBRATION, AND (8) EIGHT PREAMPLIFIERS AND EIGHT OPERATIONAL AMPLIFIERS. THE INCOMING RADIATION WAS CHOPPED, SPECTRALLY DISPERSED BY THE DIFFRACTION GRATING, FOCUSED ON THE EXIT SLITS AS A SPECTRUM BY THE SPHERICAL MIRROR, AND CONVERTED TO ELECTRICAL SIGNALS. THE SIGNALS WERE THEN AMPLIFIED AND STORED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. THE INSTRUMENT FIELD OF VIEW WAS 11.5 BY 11.5 DEG CENTERED ON NADIR. THIS PROVIDED DATA OVER AN AREA ROUGHLY 120 KM ON A SIDE AT A SATELLITE HEIGHT OF 1100 KM. DATA FROM THE 11.1-MICRON CHANNEL YIELDED SURFACE AND/OR CLOUDTOP TEMPERATURES. DATA FROM THE CARBON DIOXIDE BAND COULD BE USED TO GENERATE TEMPERATURE-PRESSURE PROFILES BY A MATHEMATICAL INVERSION TECHNIQUE. THE RESULTING TEMPERATURES HAD RMS ERRORS SLIGHTLY LESS THAN 1 DEG C. THE SIRS EXPERIMENT WAS SUCCESSFUL, AND GOOD DATA WERE OBTAINED FROM LAUNCH THROUGH JUNE 21, 1970, WHEN THE EXPERIMENT WAS TURNED OFF AND ALL DATA ACQUISITION EFFORT WAS TRANSFERRED TO THE SIRS EXPERIMENT ON NIMBUS 4.

REFERENCES

5, 22, 91, 146, 156, 167, 168, 206, 209, 281, 318, 376, 382, 411, 413, 429, 436, 514, 517, 521, 553, 566, 570, 587, 608, 615, 636, 653, 663, 668, 669, 719, 731, 736, 739, 759, 799, 817, 819, 821, 843, 863, 889, 892, 893, 894, 899, 900, 901, AND 939.

EXPERIMENT NAME- MEDIUM-RESOLUTION INFRARED RADIOMETER (MRIR) NSSDC ID 69-037A-05

EXPERIMENT PERSONNEL
PI - A.W. MCCULLOCH NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092570

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 3 MEDIUM-RESOLUTION INFRARED RADIOMETER (MRIR) EXPERIMENT MEASURED THE INTENSITY AND DISTRIBUTION OF THE ELECTROMAGNETIC RADIATION EMITTED BY AND REFLECTED FROM THE EARTH AND ITS ATMOSPHERE IN FIVE SELECTED WAVELENGTH INTERVALS FROM 0.2 TO 23 MICRONS. DATA ON THE HEAT BALANCE OF THE EARTH-ATMOSPHERE SYSTEM WERE OBTAINED AS WELL AS WATER VAPOR DISTRIBUTION DATA. SURFACE OR NEAR-SURFACE TEMPERATURES, AND DATA ON SEASONAL CHANGES OF STRATOSPHERIC TEMPERATURE DISTRIBUTION. THE FIVE WAVELENGTH REGIONS WERE (1) THE 6.5- TO 7.0-MICRON CHANNEL, WHICH COVERED THE 6.7-MICRON WATER VAPOR ABSORPTION BAND, (2) THE 10- TO 11-MICRON BAND, WHICH OPERATED IN THE 'ATMOSPHERIC WINDOW,' (3) THE 14.5- TO 15.5-MICRON BAND, WHICH COVERED THE 15-MICRON CARBON DIOXIDE ABSORPTION BAND, (4) THE 20- TO 23-MICRON CHANNEL, WHICH COVERED THE SPECTRAL REGION CONTAINING THE BROAD ROTATIONAL ABSORPTION BANDS OF WATER VAPOR, AND (5) THE 0.2- TO 4.0-MICRON CHANNEL, WHICH YIELDED INFORMATION ON THE INTENSITY OF REFLECTED SOLAR ENERGY. RADIANT ENERGY FROM THE EARTH WAS COLLECTED BY A FLAT SCANNING MIRROR INCLINED AT 45 DEG TO THE OPTICAL AXIS. THE MIRROR ROTATED AT 8 RPM AND SCANNED IN A PLANE PERPENDICULAR TO THE DIRECTION OF MOTION OF THE SATELLITE. EACH OF THE FIVE CHANNELS CONTAINED A 4.33-CM-DIAMETER FOLDED TELESCOPE WITH A 2.8-DEG FIELD OF VIEW AND A THERMISTOR BOLOMETER. THE COLLECTED ENERGY WAS MODULATED BY A MECHANICAL CHOPPER TO PRODUCE AN AC SIGNAL. THE SIGNAL WAS THEN AMPLIFIED AND RECORDED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. AT A SATELLITE ALTITUDE OF 1100 KM, A HORIZONTAL RESOLUTION OF 45 KM COULD BE OBTAINED. THE MRIR EXPERIMENT WAS SUCCESSFUL, IN SPITE OF A TELEMETRY CONFLICT THAT CAUSED THE EXPERIMENT TO BE PERIODICALLY TURNED OFF. DURING AUGUST AND SEPTEMBER 1970 (HURRICANE SEASON), THE MRIR WAS ON ESSENTIALLY FULL TIME TO COVER THE AREA FROM THE EQUATOR TO 70 DEG N AND FROM 10 DEG E TO 100 DEG W. ON SEPTEMBER 25, 1970, THE SATELLITE'S REAR HORIZON SCANNER FAILED, MAKING IT IMPOSSIBLE TO DETERMINE WHERE THE MRIR SENSOR WAS POINTING. THE EXPERIMENT WAS OPERATED PERIODICALLY UNTIL JANUARY 22, 1972, WHEN ALL SPACECRAFT OPERATIONS WERE TERMINATED.

REFERENCES

5, 146, 167, 168, 291, 306, 318, 558, 626, 631, 645, 679, 730, 745, 758, 766, 881, 883, AND 939.

EXPERIMENT NAME- IMAGE DISSECTOR CAMERA SYSTEM (IDCS) NSSDC ID 69-037A-06

EXPERIMENT PERSONNEL
PI - G.A. BRANCHFLOWER NASA-GSFC GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092570

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 3 IMAGE DISSECTOR CAMERA SYSTEM (IDCS) WAS DESIGNED TO TAKE DAYTIME CLOUDCOVER PHOTOGRAPHS. THE PICTURES COULD BE TRANSMITTED TO APT STATIONS USING THE REAL-TIME TRANSMISSION SYSTEM (RTTS) OR STORED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO GROUND ACQUISITION STATIONS. THE

CAMERA WAS MOUNTED ON THE BOTTOM OF THE SATELLITE SENSORY RING AND POINTED VERTICALLY DOWN TOWARD THE EARTH AT ALL TIMES. THE IMAGE DISSECTOR WAS A SHUTTERLESS ELECTRONIC SCAN AND STEP TUBE MOUNTED BEHIND A WIDE-ANGLE (108 DEG) 5.7-MM FOCAL LENGTH LENS. SCANNING AND STEPPING FUNCTIONS OCCURRED CONTINUOUSLY WHILE THE SATELLITE PROGRESSED ALONG ITS ORBITAL PATH. THE FIELD OF VIEW OF THE OPTICS WAS 73.6 DEG IN THE DIRECTION OF FLIGHT AND 98.2 DEG IN A PLANE NORMAL TO THE DIRECTION OF FLIGHT. THE IMAGE WAS FOCUSED BY THE OPTICS ON A PHOTOSENSITIVE SURFACE OF THE IMAGE DISSECTOR TUBE. A LINE-SCANNING BEAM SCANNED THE PHOTOSENSITIVE SURFACE AT 4 HZ WITH A FRAME PERIOD OF 200 SEC. AT THE NOMINAL SPACECRAFT ALTITUDE OF 1100 KM, EACH RESULTING PICTURE WAS APPROXIMATELY 1400 KM ON A SIDE WITH A GROUND RESOLUTION OF 3 KM AT NADIR. THE EXPERIMENT WAS A SUCCESS AND PRODUCED GOOD DATA UNTIL SEPTEMBER 25, 1970, WHEN OPERATIONS WERE TERMINATED OWING TO SPACECRAFT YAW PROBLEMS. DATA FROM THIS EXPERIMENT ARE AVAILABLE THROUGH THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA.

REFERENCES

5, 84, 146, 168, 170, 171, 172, 291, 465, 741, 742, AND 831.

EXPERIMENT NAME- INTERROGATION, RECORDING, AND LOCATION SYSTEM (IRLS)   NSSDC ID 69-037A-07

EXPERIMENT PERSONNEL

PI - C.E.	COTE	NASA-GSFC	GREENBELT, MD.
OI - G.	HOGAN	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092570

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 3 INTERROGATION, RECORDING, AND LOCATION SYSTEM (IRLS) EXPERIMENT WAS DESIGNED TO COLLECT AND RETRANSMIT METEOROLOGICAL, GEOPHYSICAL, AND OTHER EXPERIMENTAL DATA FROM REMOTE UNMANNED DATA COLLECTION STATIONS (PLATFORMS) DEPLOYED ON A GLOBAL SCALE. THE IRLS COULD ALSO DETERMINE THE LOCATION AND TRACK THE MOVEMENT OF SUCH PLATFORMS AS BALLOONS, OCEAN BUOYS, AND SHIPS TO WITHIN AN ACCURACY OF 2 KM. THE IRLS CONSISTED OF (1) A 466-MHZ RECEIVER, (2) A 401.5-MHZ TRANSMITTER, (3) DECODING AND CODING CIRCUITS, (4) A RANGE DETECTOR, AND (5) A 20-KB SATELLITE DATA MEMORY CAPABLE OF STORING DATA MEASUREMENTS DURING EACH ORBIT FOR UP TO 20 DIFFERENT INTERROGATIONS. ON EACH ORBITAL PASS, WHEN THE SATELLITE WAS WITHIN RANGE OF AN ACQUISITION AND COMMAND STATION, THE SATELLITE COMMAND MEMORY WAS PROGRAMMED TO COMMUNICATE WITH SELECTED PLATFORMS DURING THE COMING ORBIT. THE SATELLITE STORED BOTH THE ADDRESS (NUMBER) OF EACH PLATFORM AND THE DESIRED TIME THAT EACH SHOULD BE CONTACTED. AT THE APPROPRIATE TIME IN ORBIT, THE SATELLITE INTERROGATED EACH PLATFORM, MEASURED THE SATELLITE TO PLATFORM DISTANCE BY DETERMINING THE ROUND TRIP PROPAGATION TIME OF THE RF SIGNAL, RECEIVED THE ANALOG DATA FROM THE PLATFORM, CONVERTED IT TO DIGITAL FORM, AND STORED IT. UPON RETURN TO THE LOCALE OF THE GROUND STATION, THE STATION COMMANDED THE SATELLITE TO TRANSMIT THE STORED DATA AND TO ACCEPT NEW COMMANDS FOR THE NEXT ORBIT. THE EXPERIMENT WAS SUCCESSFUL AND FUNCTIONED NORMALLY FROM LAUNCH UNTIL SEPTEMBER 1970, WHEN THE OPERATIONAL CAPACITY WAS SEVERELY RESTRICTED BY SPACECRAFT YAW PROBLEMS. ALL DATA ACQUISITION CEASED ON JANUARY 22, 1972, WHEN SPACECRAFT OPERATIONS WERE TERMINATED. COPIES OF COMPUTER PRINTOUTS FROM INDIVIDUAL PLATFORM EXPERIMENTS ARE RETAINED AT THE NIMBUS/ATS DATA UTILIZATION CENTER, NASA-GSFC, GREENBELT, MD.

REFERENCES
5, 22, 69, 84, 146, 155, 281, 291, 395, AND 636.

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SPACECRAFT COMMON NAME- NIMBUS 4 NSSDC ID 70-025A
ALTERNATE NAMES- NIMBUS-D, PL-701E

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 05/04/70
APOGEE- 1097.00 KM ALT
PERIGEE- 1090.00 KM ALT
PERIOD- 107.1 MIN
INCLINATION- 99.5007 DEG

OTHER INFORMATION
SPACECRAFT WT- 585. KG
LAUNCH DATE- 04/08/70
OPERATING STATUS- PARTIAL

SPACECRAFT PERSONNEL

PM - H.	PRESS	NASA-GSFC	GREENBELT, MD.
PS - W.P.	NORDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

NIMBUS 4, THE FOURTH IN A SERIES OF SECOND-GENERATION METEOROLOGICAL R AND D SATELLITES, WAS DESIGNED TO SERVE AS A STABILIZED, EARTH-ORIENTED PLATFORM FOR THE TESTING OF ADVANCED SYSTEMS FOR SENSING AND COLLECTING METEOROLOGICAL DATA. THE POLAR-ORBITING SPACECRAFT CONSISTED OF THREE MAJOR STRUCTURES -- (1) A RING-SHAPED SENSOR MOUNT, (2) SOLAR PADDLES, AND (3) THE CONTROL HOUSING UNIT, WHICH WAS CONNECTED TO THE SENSOR MOUNT BY A TRUSS STRUCTURE. SHAPED SOMEWHAT LIKE AN OCEAN BUOY, NIMBUS 4 WAS NEARLY 3.7 M TALL, 1.5 M IN DIAMETER AT THE BASE, AND ABOUT 3 M ACROSS WITH SOLAR PADDLES EXTENDED. THE TORUS-SHAPED SENSOR MOUNT, WHICH FORMED THE SATELLITE BASE, HOUSED THE ELECTRONICS EQUIPMENT AND BATTERY MODULES. THE LOWER SURFACE OF THE TORUS PROVIDED A MOUNTING SPACE FOR SENSORS AND TELEMETRY ANTENNAS. AN H-FRAME STRUCTURE MOUNTED WITHIN THE CENTER OF THE TORUS PROVIDED SUPPORT FOR THE LARGER EXPERIMENTS AND TAPE RECORDERS. MOUNTED ON THE CONTROL HOUSING UNIT, WHICH WAS LOCATED ON TOP OF THE SPACECRAFT, WERE SUN SENSORS, HORIZON SCANNERS, GAS NOZZLES FOR ATTITUDE CONTROL, AND A COMMAND ANTENNA. USE OF AN ADVANCED ATTITUDE CONTROL SUBSYSTEM PERMITTED THE SPACECRAFT'S ORIENTATION TO BE CONTROLLED TO WITHIN PLUS OR MINUS 1 DEG FOR ALL THREE AXES (PITCH, ROLL, AND YAW). PRIMARY EXPERIMENTS CONSISTED OF (1) AN IMAGE DISSECTOR CAMERA SYSTEM (IDCS) FOR PROVIDING DAYTIME CLOUDCOVER PICTURES BOTH IN REAL-TIME AND RECORDED MODES, (2) A TEMPERATURE-HUMIDITY INFRARED RADIOMETER (THIR) FOR MEASURING DAYTIME AND NIGHTTIME SURFACE AND CLOUDTOP TEMPERATURES AS WELL AS THE WATER VAPOR CONTENT OF THE UPPER ATMOSPHERE, (3) AN INFRARED INTERFEROMETER SPECTROMETER (IRIS) FOR MEASURING THE EMISSION SPECTRA OF THE EARTH-ATMOSPHERE SYSTEM, (4) A SATELLITE INFRARED SPECTROMETER (SIRS) FOR DETERMINING THE VERTICAL PROFILES OF TEMPERATURE AND WATER VAPOR IN THE ATMOSPHERE, (5) A MONITOR OF ULTRAVIOLET SOLAR ENERGY (MUSE) FOR DETECTING SOLAR UV RADIATION, (6) A BACKSCATTER ULTRAVIOLET (BUV) SPECTROMETER FOR MONITORING THE VERTICAL DISTRIBUTION AND TOTAL AMOUNT OF ATMOSPHERIC OZONE ON A GLOBAL SCALE, (7) A FILTER WEDGE SPECTROMETER (FWS) FOR ACCURATE MEASUREMENT OF IR RADIANCE AS A FUNCTION OF WAVELENGTH FROM THE EARTH-ATMOSPHERE SYSTEM, (8) A SELECTIVE CHOPPER RADIOMETER (SCR) FOR DETERMINING THE TEMPERATURES OF SIX SUCCESSIVE 10-KM-THICK LAYERS IN THE ATMOSPHERE FROM ABSORPTION MEASUREMENTS IN THE 15-MICRON CARBON DIOXIDE BAND, AND (9) AN INTERROGATION, RECORDING, AND LOCATION SYSTEM (IRLS) FOR LOCATING, INTERROGATING, RECORDING, AND RETRANSMITTING METEOROLOGICAL AND

GEOPHYSICAL DATA FROM REMOTE COLLECTION STATIONS. THE SPACECRAFT OPERATION WAS A SUCCESS, AND IT PERFORMED NORMALLY UNTIL APRIL 8, 1971, WHEN THE YAW GYRO FAILED CAUSING THE SPACECRAFT TO FACE BACKWARDS IN ORBIT. IT WAS SUCCESSFULLY TURNED AROUND ON MAY 12, 1971. YAW PROBLEMS STILL EXIST, AND THE AMOUNT OF USEFUL DATA PRESENTLY BEING RECEIVED FROM MOST OF THE EXPERIMENTS ARE EXTREMELY LIMITED (APRIL 1972).

REFERENCES

3, 22, 141, 146, 147, 148, 149, 155, 179, 181, 183, 184, 271, 272, 438, 511, 603, 661, 733, 734, 736, 737, 741, 776, 795, 862, 917, 938, AND 939.

EXPERIMENT NAME- TEMPERATURE-HUMIDITY INFRARED RADIOMETER NSSDC ID 70-025A-02
(THIR)

EXPERIMENT PERSONNEL

PI - A.W.	MCCULLOCH	NASA-GSFC	GREENBELT, MD.
OI - I.L.	GOLDBERG	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 041371

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 4 TEMPERATURE-HUMIDITY INFRARED RADIOMETER (THIR) WAS DESIGNED TO DETECT EMITTED THERMAL RADIATION IN BOTH THE 10.5- TO 12.5-MICRON REGION (IR WINDOW) AND THE 6.5- TO 7.0-MICRON REGION (WATER VAPOR). THE WINDOW CHANNEL MEASURED CLOUDTOP TEMPERATURES AND WAS CAPABLE OF PRODUCING HIGH-RESOLUTION PICTURES OF CLOUD COVER AND THERMAL GRADIENTS ON LAND AND WATER SURFACES IN CLOUD-FREE AREAS DURING BOTH THE DAY AND NIGHT PORTIONS OF THE ORBIT. THE OTHER CHANNEL OPERATED PRIMARILY AT NIGHT TO MAP THE WATER VAPOR DISTRIBUTION IN THE UPPER TROPOSPHERE AND STRATOSPHERE. THE INSTRUMENT CONSISTED OF A 12.7-CM CASSEGRAIN SYSTEM, A SCANNING MIRROR COMMON TO BOTH CHANNELS, A BEAM SPLITTER, FILTERS, AND TWO GERMANIUM-IMMERSED THERMISTOR BOLOMETERS. IN CONTRAST TO TV, NO IMAGE WAS FORMED WITHIN THE RADIOMETER. INCOMING RADIANT ENERGY WAS COLLECTED BY A FLAT SCANNING MIRROR INCLINED AT 45 DEG TO THE OPTICAL AXIS. THE MIRROR ROTATED THROUGH 360 DEG AT 48 RPM AND SCANNED IN A PLANE NORMAL TO THE SPACECRAFT VELOCITY VECTOR. THE ENERGY WAS THEN FOCUSED INTO A DICHROMATIC BEAM SPLITTER, WHICH DIVIDED THE ENERGY SPECTRALLY AND SPATIALLY INTO TWO CHANNELS. BOTH CHANNELS OF THE THIR SENSOR TRANSFORMED THE RECEIVED RADIATION INTO AN ELECTRICAL (VOLTAGE) OUTPUT WITH AN INFORMATION BANDWIDTH OF 0.5 TO 360 HZ FOR THE 10.5 TO 12.5 CHANNEL AND 0.5 TO 120 HZ FOR THE WATER VAPOR CHANNEL. THE THIR SENSOR DATA WERE NORMALLY RECORDED ON TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. HOWEVER, DIRECT READOUT INFRARED RADIOMETER (DRIR) DATA COULD BE TRANSMITTED TO APT GROUND STATIONS FOR BOTH DAY AND NIGHT PORTIONS OF THE ORBIT USING THE NIMBUS 4 REAL-TIME TRANSMISSION SYSTEM (RTTS). AT A NOMINAL SPACECRAFT ALTITUDE, THE WINDOW CHANNEL HAD A GROUND RESOLUTION OF ABOUT 7 KM AND THE WATER VAPOR CHANNEL ABOUT 22 KM AT NADIR. THE THIR WAS INITIALLY SUCCESSFUL BUT FAILED ON JANUARY 11, 1971 (ORBIT 3731). IT WAS RESTARTED SEVERAL TIMES THEREAFTER FOR VERY SHORT PERIODS OF TIME BEFORE IT FINALLY CEASED ALL OPERATIONS ON APRIL 13, 1971. A SIMILAR EXPERIMENT WILL BE FLOWN ON NIMBUS-E AND -F.

REFERENCES

22, 84, 146, 176, 177, 178, 180, 181, 182, 290, 291, 299, 318, 561, 631, 646, 657, AND 939.

EXPERIMENT NAME- INFRARED INTERFERCMETER SPECTROMETER (IRIS) NSSDC ID 70-025A-03

EXPERIMENT PERSONNEL

PI - R.A. HANEL	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- OPERATIONAL OFF
DATE LAST USABLE DATA RECORDED- 020272

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 4 INFRARED INTERFEROMETER SPECTROMETER (IRIS) EXPERIMENT WAS DESIGNED TO PROVIDE INFORMATION ON THE VERTICAL STRUCTURE OF THE ATMOSPHERE AND EMISSIVE PROPERTIES OF THE EARTH'S SURFACE BY MEASURING THE SURFACE AND ATMOSPHERIC RADIATION IN THE 6.25- TO 50-MICRON RANGE USING A MODIFIED MICHELSON INTERFEROMETER. RADIATION FROM A CONE OF THE ATMOSPHERE, WHOSE BASE ON THE SURFACE OF THE EARTH WAS A CIRCLE ABOUT 92.5 KM IN DIAMETER FOR A NOMINAL SATELLITE ALTITUDE OF APPROXIMATELY 1100 KM, WAS RECEIVED AND REFLECTED BY A MIRROR. THE REFLECTED RADIATION WAS SPLIT INTO TWO APPROXIMATELY EQUAL BEAMS BY A BEAMSPLITTER. AFTER REFLECTION ON A FIXED AND MOVING MIRROR, RESPECTIVELY, THE TWO BEAMS INTERFERED WITH EACH OTHER WITH A PHASE DIFFERENCE PROPORTIONAL TO THE OPTICAL PATH DIFFERENCE BETWEEN BOTH BEAMS. THE MOVING MIRROR TRAVELED ABOUT 3 MM IN 13 SEC TO GIVE AN OUTPUT SIGNAL FROM THE BOLOMETER. THIS SIGNAL, AN INTERFEROGRAM, WAS RECORDED ON TAPE. THE INTERFEROGRAMS WERE TRANSMITTED TO A GROUND RECEIVING STATION, WHERE A FOURIER TRANSFORM WAS PERFORMED TO PRODUCE A THERMAL EMISSION SPECTRUM OF THE EARTH. FROM THESE SPECTRA, VERTICAL PROFILES OF TEMPERATURE, WATER VAPOR, AND OZONE WERE DERIVED, AS WELL AS OTHER PARAMETERS OF METEOROLOGICAL INTEREST. THE INSTRUMENT HAD A FIELD OF VIEW OF 5 DEG AND A SPECTRAL RESOLUTION OF 1.4 CM TO THE -1 POWER. FOR A COMPLETE DESCRIPTION OF THE IRIS EXPERIMENT, SEE SECTION 4 IN 'THE NIMBUS IV USER'S GUIDE.' THE IRIS EXPERIMENT WAS SUCCESSFUL IN SPITE OF A TRANSMISSION CONFLICT WITH THE REAL-TIME TRANSMISSION SYSTEM (RTTS) THAT RESULTED IN SOME PERIODS OF LOST DATA. THE IRIS EXPERIMENT WAS PLACED IN AN OPERATIONALLY OFF MODE ON FEBRUARY 2, 1972.

REFERENCES

84, 146, 175, 176, 177, 178, 180, 181, 206, 291, 318, 390, 391, 484, 493, 494, 739, 766, 921, AND 939.

EXPERIMENT NAME- SATELLITE INFRARED SPECTROMETER (SIRS) NSSDC ID 70-025A-04

EXPERIMENT PERSONNEL

PI - D.Q. WARK	NOAA-NESS	SUITLAND, MD.
OI - D.T. HILLEARY	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PARTIAL

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 4 SATELLITE INFRARED SPECTROMETER (SIRS) EXPERIMENT WAS DESIGNED TO INDIRECTLY DETERMINE THE VERTICAL TEMPERATURE AND WATER VAPOR PROFILES OF THE ATMOSPHERE BY USING A FASTIE-EBERT FIXED-GRATING SPECTROMETER TO MEASURE THE INFRARED RADIATION (11 TO 36 MICRONS) EMITTED FROM THE EARTH AND ITS ATMOSPHERE IN 13 SELECTED SPECTRAL INTERVALS IN THE CARBON DIOXIDE AND WATER VAPOR BANDS AND ALSO ONE CHANNEL IN THE 11-MICRON ATMOSPHERIC WINDOW. THE MAIN COMPONENTS OF THE SPECTROMETER CONSISTED OF (1) A PLANE, LIGHT-COLLECTING MIRROR TO PROVIDE ONE FIXED AND TWO VARIABLE EARTH

VIEWING ANGLES, (2) A ROTATING CHOPPING MIRROR THAT SERVED ALTERNATELY TO COLLECT SPACE RADIATION AND EARTH RADIATION, (3) A 2.5-IN. DIFFRACTION GRATING WITH 125C LINES PER IN., (4) 14 SLITS WITH ASSOCIATED INTERFERENCE FILTERS, (5) 14 THERMISTOR BOLOMETERS, AND (6) A BLACKBODY SOURCE FOR CALIBRATION PURPOSES. THE SIRS USED A SCAN MIRROR TO OBSERVE 12.5 DEG TO EITHER SIDE OF THE SUBSATELLITE TRACK. THE FIELD OF VIEW DIRECTLY BELOW THE SIRS WAS APPROXIMATELY 215 SQUARE KM. THE CARBON DIOXIDE BAND RADIATION DATA WERE TRANSFORMED TO A TEMPERATURE PROFILE BY A MATHEMATICAL INVERSION TECHNIQUE. BY A SIMILAR TECHNIQUE, THIS INFORMATION COULD THEN BE COMBINED WITH THE WATER VAPOR BAND DATA TO OBTAIN A WATER VAPOR PROFILE. THE 11-MICRON ATMOSPHERIC WINDOW DATA YIELDED SURFACE AND/OR CLOUDTOP TEMPERATURES. FOR A COMPLETE DESCRIPTION OF THE SIRS EXPERIMENT, SEE SECTION 5 OF 'THE NIMBUS IV USER'S GUIDE.' THE SIRS EXPERIMENT PERFORMED NORMALLY FOR SEVERAL MONTHS AFTER LAUNCH BUT BEGAN TO DETERIORATE IN EARLY 1971. PROBLEMS IN THE SIRS INSTRUMENT CALIBRATION AFTER APRIL 1971, IN ADDITION TO SPACECRAFT YAW PROBLEMS, HAVE SIGNIFICANTLY REDUCED THE NUMBER OF USEFUL SOUNDINGS BEING OBTAINED.

REFERENCES

22, 84, 146, 176, 177, 178, 180, 181, 205, 206, 208, 291, 318, 412, 421, 429, 515, 517, 636, 739, 817, 820, 823, 863, 890, 899, 921, AND 939.

EXPERIMENT NAME- BACKSCATTER ULTRAVIOLET (BUV) SPECTROMETER — NSSDC ID 70-025A-05

EXPERIMENT PERSONNEL

PI - D.F.	HEATH	NASA-GSFC	GREENBELT, MD.
OI - J.V.	DAVE	NATL CNTR ATMOS RSCH	BOULDER, COLO.
OI - A.J.	KRUEGER	NASA-GSFC	GREENBELT, MD.
OI - C.L.	MATEER	NATL CNTR ATMOS RSCH	BOULDER, COLO.

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 4 BACKSCATTER ULTRAVIOLET (BUV) SPECTROMETER EXPERIMENT WAS DESIGNED TO MONITOR THE VERTICAL DISTRIBUTION AND TOTAL AMOUNT OF ATMOSPHERIC OZONE ON A GLOBAL SCALE BY MEASURING THE INTENSITY OF ULTRAVIOLET RADIATION BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM DURING DAY AND NIGHT IN THE 2500- TO 3400-A SPECTRAL BAND. THE PRIMARY INSTRUMENTATION CONSISTED OF A DOUBLE MONOCHROMATOR CONTAINING ALL REFLECTIVE OPTICS AND A PHOTOMULTIPLIER DETECTOR. THE DOUBLE MONOCHROMATOR WAS COMPOSED OF TWO FASTIE-EBERT-TYPE MONOCHROMATORS IN TANDEM. EACH MONOCHROMATOR HAD A 64- BY 64-MM GRATING WITH 2400 LINES PER MM. LIGHT FROM A 0.05-STER SOLID ANGLE (SUBTENDING APPROXIMATELY A 222-KM-SQUARE AREA ON THE EARTH'S SURFACE FROM A SATELLITE HEIGHT OF APPROXIMATELY 1100 KM) ENTERED THE NADIR-POINTING INSTRUMENT THROUGH A DEPOLARIZING FILTER. A MOTOR-DRIVEN CAM STEP ROTATED THE GRATINGS TO MONITOR THE INTENSITY OF 12 OZONE ABSORPTION WAVELENGTHS. THE DETECTOR WAS A PHOTOMULTIPLIER TUBE. FOR BACKGROUND READINGS, A FILTER PHOTOMETER MEASURED THE REFLECTED ULTRAVIOLET RADIATION IN AN OZONE FREE ABSORPTION AREA NEAR 3800 A. SIGNALS FROM BOTH UNITS WERE READ BY SEPARATE RANGE-SWITCHING ELECTROMETERS WITH SEVEN RANGES. THE BUV EXPERIMENT CYCLE REQUIRED 6144 SEC. EACH CYCLE, IN TURN, WAS DIVIDED INTO 192 BUV FRAMES OF 32-SEC DURATION. CALIBRATION BY ONBOARD LIGHT SOURCES WAS PERFORMED IN 26 OF THE 192 FRAMES. THE OTHER FRAMES WERE USED FOR EXPERIMENTAL DATA. DURING EACH OF THESE DATA FRAMES, THE MONOCHROMATOR MEASURED THE INTENSITY OF THE UV RADIATION IN EACH OF THE 12 WAVELENGTH BANDS WHILE THE PHOTOMETER MEASURED THE UV INTENSITY IN A SINGLE WAVELENGTH BAND. THE DWELL TIME AT EACH WAVELENGTH WAS 1.8 SEC, AND, DURING THIS INTERVAL, FOUR ANALOG UV INTENSITY MEASUREMENTS WERE TAKEN AT 400-MSEC

INTERVALS IN ADDITION TO AN INTEGRATED PULSE COUNT MEASUREMENT OF THE UV INTENSITY AND ENERGETIC PARTICLE FLUX. ONCE EACH ORBIT, THE FIELD OF VIEW WAS CHANGED TO MONITOR THE SUN OR MOON DIRECTLY. THE MEASUREMENT RANGE OF THE SIGNAL CURRENT WAS FROM 0.2 TO 3000 MICROAMPS. THE VERTICAL DISTRIBUTION OF OZONE WAS OBTAINED BY MATHEMATICAL INVERSION TECHNIQUES. FOR A COMPLETE DESCRIPTION OF THE BUV EXPERIMENT, SEE SECTION 7 IN 'THE NIMBUS IV USER'S GUIDE.' THE BUV EXPERIMENT WAS SUCCESSFUL AND CONTINUES TO PERFORM NORMALLY AS OF APRIL 1972.

REFERENCES

22, 84, 146, 176, 177, 178, 180, 181, 518, AND 637.

EXPERIMENT NAME- IMAGE DISSECTOR CAMERA SYSTEM (IDCS) NSSDC ID 70-025A-06

EXPERIMENT PERSONNEL

PI - G.A. BRANCHFLOWER	NASA-GSFC	GREENBELT, MD.
OI - E.J. WERNER	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 040871

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 4 IMAGE DISSECTOR CAMERA SYSTEM (IDCS) EXPERIMENT WAS DESIGNED TO TAKE DAYTIME CLOUDCOVER PICTURES. THE PICTURES COULD BE TRANSMITTED TO APT STATIONS USING THE REAL-TIME TRANSMISSION SYSTEM (RTTS) OR STORED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO GROUND ACQUISITION STATIONS. THIS EXPERIMENT WAS SIMILAR TO THOSE FLOWN ON NIMBUS 3 AND ATS 3. THE CAMERA WAS MOUNTED ON THE BOTTOM OF THE SENSORY RING OF THE SATELLITE AND POINTED VERTICALLY DOWN TOWARD THE EARTH AT ALL TIMES. THE IMAGE DISSECTOR WAS A SHUTTERLESS ELECTRONIC SCAN AND STEP TUBE MOUNTED BEHIND A WIDE-ANGLE (108 DEG), 5.7-MM FOCAL LENGTH LENS. SCANNING AND STEPPING FUNCTIONS OCCURRED CONTINUOUSLY WHILE THE SATELLITE PROGRESSED ALONG ITS ORBITAL PATH. THE FIELD OF VIEW OF THE OPTICS WAS 73.6 DEG IN THE DIRECTION OF FLIGHT AND 98.2 DEG IN THE DIRECTION PERPENDICULAR TO THE DIRECTION OF FLIGHT. THE IMAGE WAS FOCUSED BY THE CAMERA OPTICS ON A PHOTOSENSITIVE SURFACE OF THE IMAGE DISSECTOR TUBE. A LINE-SCANNING BEAM SCANNED THE PHOTOSENSITIVE SURFACE AT 4 HZ WITH A FRAME PERIOD OF 200 SEC. AT THE NOMINAL SPACECRAFT ALTITUDE (APPROXIMATELY 1100 KM), EACH RESULTING PICTURE WAS APPROXIMATELY 1400 KM ON A SIDE WITH A GROUND RESOLUTION OF 3 KM AT NADIR. THE EXPERIMENT WAS A SUCCESS. HOWEVER, OWING TO SPACECRAFT YAW PROBLEMS, THE ARCHIVING OF IDCS DATA WAS TERMINATED IN APRIL 1971. DATA FROM THIS EXPERIMENT ARE AVAILABLE THROUGH THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA.

REFERENCES

84, 146, 180, 181, 182, 226, 291, 742, AND 918.

EXPERIMENT NAME- INTERROGATION, RECORDING, AND LOCATION SYSTEM (IRLS) NSSDC ID 70-025A-07

EXPERIMENT PERSONNEL

PI - C.E. COTE	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- PARTIAL

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 4 INTERROGATION, RECORDING, AND LOCATION SYSTEM (IRLS) EXPERIMENT WAS DESIGNED TO COLLECT AND RETRANSMIT METEOROLOGICAL, GEOPHYSICAL, AND OTHER EXPERIMENTAL DATA FROM REMOTE UNMANNED DATA COLLECTION STATIONS (PLATFORMS) DEPLOYED ON A GLOBAL SCALE. THE IRLS COULD ALSO DETERMINE THE LOCATION AND TRACK THE MOVEMENT OF SUCH PLATFORMS AS BALLOONS, OCEAN BUOYS, AND SHIPS TO WITHIN AN ACCURACY OF 2 KM. THE IRLS CONSISTED OF (1) A 466-MHZ RECEIVER, (2) A 401.5-MHZ TRANSMITTER, (3) DECODING AND CODING CIRCUITS, (4) A RANGE DETECTOR, AND (5) A 100-KB SATELLITE DATA MEMORY CAPABLE OF STORING DATA OBTAINED DURING EACH ORBIT FOR UP TO 370 DIFFERENT INTERROGATIONS. ON EACH ORBIT PASS, WHEN THE SATELLITE WAS WITHIN RANGE OF AN ACQUISITION AND COMMAND STATION, THE SATELLITE COMMAND MEMORY WAS PROGRAMMED TO COMMUNICATE WITH SELECTED PLATFORMS DURING THE COMING ORBIT. THE SATELLITE STORED BOTH THE ADDRESS (NUMBER) OF EACH PLATFORM AND THE DESIRED TIME THAT EACH SHOULD BE CONTACTED. AT THE APPROPRIATE TIME IN ORBIT, THE SATELLITE INTERROGATED EACH PLATFORM, MEASURED THE SATELLITE TO PLATFORM DISTANCE BY DETERMINING THE ROUND TRIP PROPAGATION TIME OF THE RF SIGNAL, RECEIVED THE ANALOG DATA FROM THE PLATFORM, CONVERTED IT TO DIGITAL FORM, AND STORED IT. UPON RETURN TO THE LOCALE OF THE GROUND STATION, THE STATION COMMANDED THE SATELLITE TO TRANSMIT THE STORED DATA AND TO ACCEPT NEW COMMANDS FOR THE NEXT ORBIT. THE EXPERIMENT WAS INITIALLY A SUCESS AND IS STILL OPERATIONAL -- HOWEVER, OWING TO SPACECRAFT YAW PROBLEMS, THE AMOUNT OF USEFUL DATA PRODUCED AFTER APRIL 1971 WAS EXTREMELY LIMITED. A LISTING OF IRLS TRACKING DATA FROM CONSTANT-LEVEL BALLOONS (30 AND 50 MB) APPEARS IN THE 'NIMBUS 4 DATA CATALOG,' VOLUME 4. COPIES OF COMPUTER OUTPUTS FROM INDIVIDUAL PLATFORM EXPERIMENTS ARE RETAINED AT THE NIMBUS/ATS DATA UTILIZATION CENTER, NASA-GSFC, GREENBELT, MD.

REFERENCES
22, 84, 146, 177, 178, 181, 291, 310, 394, 396, 471, AND 636.

EXPERIMENT NAME- FILTER WEDGE SPECTROMETER (FWS) NSSDC ID 70-025A-09

EXPERIMENT PERSONNEL

PI - W.A. HOVIS	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 4 FILTER WEDGE SPECTROMETER (FWS) EXPERIMENT WAS DESIGNED TO ACCURATELY DETERMINE THE RADIANCE FROM THE EARTH-ATMOSPHERE SYSTEM AS A FUNCTION OF WAVELENGTH BY MEASURING THE EMITTED AND REFLECTED INFRARED RADIATION IN THE 1.2- TO 2.4- AND 3.2- TO 6.4-MICRON BANDS. THE INSTRUMENTATION CONSISTED OF (1) A TELESCOPE, (2) A ROTATING DISC CHOPPER, (3) A ROTATING (3.75 RPM) CIRCULAR INTERFERENCE FILTER WHEEL, AND (4) A LEAD SELENIDE DETECTOR. THE FILTER WHEEL WAS A TWO-SEGMENT (ONE PER PASSBAND) (180 DEG) 100-LAYER INTERFERENCE FILTER WITH THE LAYER THICKNESS LINEARLY INCREASING AS A FUNCTION OF ANGULAR POSITION, CAUSING THE BANDPASS TO SHIFT TOWARD LONGER WAVELENGTHS. INCOMING RADIATION WAS REFLECTED OFF A SURFACE MIRROR AND WAS COLLECTED BY A TELESCOPE ORIENTED NORMAL TO THE EARTH'S SURFACE. THE TELESCOPE HAD A 3-DEG FIELD OF VIEW DIRECTLY BELOW THE SATELLITE, AND A POLE-TO-POLE STRIP APPROXIMATELY 57 KM WIDE WAS VIEWED ON EACH SATELLITE PASS WITH A 2461-KM SEPARATION BETWEEN SUCCESSIVE STRIPS AT THE EQUATOR. THE TELESCOPE FOCUSED THE COLLECTED RADIATION ONTO THE EDGE OF THE MULTITOOTHED CHOPPER WHEEL THAT CHOPPED THE ENERGY AT 333 HZ. AFTER PASSING THROUGH THE CHOPPER, THE ENERGY WAS REFOCUSED ONTO THE EDGE OF THE CIRCULAR VARIABLE FILTER AT AN APERTURE THAT ACTED AS BOTH SPECTROMETER SLIT

AND A SYSTEM FIELD STOP. THE ENERGY WAS THEN REIMAGED ON A LEAD SELENIDE DETECTOR RADIATIVELY COOLED TO 175 DEG K. THE INCIDENT RADIATION WAS SAMPLED 20 TIMES PER SEC, RESULTING IN A SPECTRAL INTENSITY PLOT OF 158 POINTS FOR EACH PASSBAND PER REVOLUTION. ONBOARD CALIBRATION WAS ACCOMPLISHED BY ALTERNATE VIEWING OF THE EARTH AND CALIBRATION STANDARDS BY THE DETECTOR. SPECTRAL PLOTS WERE ANALYZED BY APPLYING AN INVERSION TECHNIQUE TO THE RADIATIVE TRANSFER EQUATIONS TO OBTAIN THE WATER VAPOR CONTENT. AT ACTIVATION OF THIS EXPERIMENT ON ORBIT 5, THE DATA OUTPUT WAS DEGRADED, EXHIBITING ICE ABSORPTION PATTERNS IN BOTH CHANNELS. ON JUNE 8, 1970, THE FWS SUFFERED MECHANICAL FAILURE WHEN THE DRIVE MOTOR ON THE CHOPPER WHEEL FAILED. NO USEFUL DATA WERE COLLECTED FROM THIS EXPERIMENT.

REFERENCES
22, 84, 146, 181, 318, AND 532.

EXPERIMENT NAME- SELECTIVE CHOPPER RADIOMETER (SCR)   NSSDC ID 70-025A-10

EXPERIMENT PERSONNEL

PI - J.T.	HOUGHTON	OXFORD U	OXFORD, ENGLAND
OI - S.D.	SMITH	HERIOT-WATT U	EDINBOURGH, SCOTLAND

OPERATING STATUS- PARTIAL

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS 4 SELECTIVE CHOPPER RADIOMETER (SCR) OBSERVED THE EMITTED INFRARED RADIATION IN THE 15-MICRON ABSORPTION BAND OF CARBON DIOXIDE. FROM THESE MEASUREMENTS THE TEMPERATURE OF SIX SUCCESSIVE 10-KM-THICK LAYERS OF THE ATMOSPHERE WERE DETERMINED FROM EARTH OR CLOUDTOP LEVEL TO 60-KM HEIGHT. HEIGHT RESOLUTION WAS OBTAINED BY A COMBINATION OF OPTICAL MULTI-LAYER FILTERS AND SELECTIVE ABSORPTION OF RADIATION USING CARBON DIOXIDE-FILLED CELLS WITHIN THE EXPERIMENT. THE SCR HAD SIX CHANNELS, WHICH WERE ARRANGED IN THREE UNITS OF TWO. THE FOUR LOWER CHANNELS WERE CALLED SINGLE CELL CHANNELS. THE OPTICS OF EACH CHANNEL CONSISTED OF A CANTILEVER-MOUNTED BLADE SHUTTER THAT OSCILLATED AT 10 HZ AND SUCCESSIVELY CHOPPED THE FIELD OF VIEW BETWEEN EARTH AND SPACE. THE CHOPPED RADIATION WAS THEN PASSED THROUGH A 10-CM PATH LENGTH OF CARBON DIOXIDE, THE PRESSURE BEING SET FOR EACH CHANNEL TO DEFINE THE VIEWING DEPTH OF THE ATMOSPHERE. BEHIND THE CARBON DIOXIDE PATH WAS A NARROW-BAND FILTER, THE CENTERS OF WHICH WERE DIFFERENT FOR EACH CHANNEL, AND A LIGHT PIPE WHICH CONVERGED THE RADIATION ON A THERMISTOR BOLOMETER DETECTOR. TO OBTAIN ADEQUATE HEIGHT RESOLUTION IN THE UPPER LAYERS OF THE ATMOSPHERE, THE UPPER TWO CHANNELS OPERATED ON A SLIGHTLY DIFFERENT PRINCIPLE AND WERE KNOWN AS DOUBLE CELL CHANNELS. THE TECHNIQUE CONSISTED OF SWITCHING THE RADIATION BETWEEN TWO HALF-CELLS, SEMICIRCULAR IN SHAPE AND OF 1-CM PATH LENGTH, CONTAINING DIFFERENT PRESSURES OF CARBON DIOXIDE. A MOVABLE 45-DEG MIRROR WAS USED IN PLACE OF THE OSCILLATING SHUTTER USED IN THE LOWER FOUR CHANNELS. DURING ONE HALF-PERIOD, EARTH RADIATION PASSED THROUGH ONE HALF-CELL AND SPACE RADIATION THROUGH THE OTHER. THE SITUATION WAS REVERSED DURING THE OTHER HALF-PERIOD. THE RADIATION THEN PASSED THROUGH A LIGHT PIPE ONTO A THERMISTOR BOLOMETER DETECTOR. INFLIGHT CALIBRATION WAS CARRIED OUT BY VIEWING OF AN INTERNAL REFERENCE BLACKBODY OF KNOWN TEMPERATURE PRIOR TO THE VIEW OF SPACE. THE OUTPUT OF EACH CHANNEL WAS SAMPLED ONCE EVERY SECOND. FOR A COMPLETE DESCRIPTION OF THE SCR, SEE SECTION 9 IN 'THE NIMBUS IV USER'S GUIDE.' THE SCR EXPERIMENT WAS SUCCESSFUL. THE CHANNEL 1 TEMPERATURE MONITORING SYSTEM FAILED ON JUNE 15, 1970, THEREBY REDUCING THE ACCURACY OF THE SCR DATA. HOWEVER, THE EXPERIMENT IS CONTINUING TO PRODUCE USABLE DATA AS OF APRIL 1972.

REFERENCES
22, 84, 146, 180, 181, 206, 269, 282, 283, 284, 318, 327, 328, 419, 420, 505, 526, 527, 528, 739, 771, AND 929.

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SPACECRAFT COMMON NAME- NIMBUS-E NSSDC ID NIMBS-E
ALTERNATE NAMES- NIMBS-E, PL-721B

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 1100.00 KM ALT
PERIGEE- 1100.00 KM ALT
PERIOD- 108. MIN
INCLINATION- 100. DEG

OTHER INFORMATION
SPACECRAFT WT- 681. KG
LAUNCH DATE- 12/00/72
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - S.	WEILAND	NASA-GSFC	GREENBELT, MD.
PS - W.	NORDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION
THE NIMBUS-E R AND D SATELLITE IS DESIGNED TO SERVE AS A STABILIZED, EARTH-ORIENTED PLATFORM FOR THE TESTING OF ADVANCED SYSTEMS FOR SENSING AND COLLECTING METEOROLOGICAL AND GEOLOGICAL DATA ON A GLOBAL SCALE. THE POLAR-ORBITING SPACECRAFT CONSISTS OF THREE MAJOR STRUCTURES - (1) A HOLLOW RING-SHAPED SENSOR MOUNT, (2) SOLAR PADDLES, AND (3) A CONTROL HOUSING UNIT, WHICH IS CONNECTED TO THE SENSOR MOUNT BY A TRIPOD TRUSS STRUCTURE. CONFIGURED SOMEWHAT LIKE AN OCEAN BUOY, NIMBUS-E IS NEARLY 3.7 M TALL, 1.5 M IN DIAMETER AT THE BASE, AND ABOUT 3 M WIDE WITH SOLAR PADDLES EXTENDED. THE SENSOR MOUNT, WHICH FORMS THE SATELLITE BASE, HOUSES ELECTRONICS EQUIPMENT AND BATTERY MODULES. THE LOWER SURFACE OF THE TORUS PROVIDES MOUNTING SPACE FOR SENSORS AND ANTENNAS. A BOX-BEAM STRUCTURE MOUNTED WITHIN THE CENTER OF THE TORUS PROVIDES SUPPORT FOR THE LARGER SENSOR EXPERIMENTS. MOUNTED ON THE CONTROL HOUSING UNIT, WHICH IS LOCATED ON TOP OF THE SPACECRAFT, ARE SUN SENSORS, HORIZON SCANNERS, AND A COMMAND ANTENNA. AN ADVANCED ATTITUDE CONTROL SYSTEM WILL PERMIT THE SPACECRAFT'S ORIENTATION TO BE CONTROLLED TO WITHIN PLUS OR MINUS 1 DEG IN ALL THREE AXES (PITCH, ROLL, AND YAW). PRIMARY EXPERIMENTS WILL CONSIST OF (1) A TEMPERATURE-HUMIDITY INFRARED RADIOMETER (THIR) FOR MEASURING DAY AND NIGHT SURFACE AND CLOUDTOP TEMPERATURES AS WELL AS THE WATER VAPOR CONTENT OF THE UPPER ATMOSPHERE, (2) AN ELECTRICALLY SCANNING MICROWAVE RADIOMETER (ESMR) FOR MAPPING THE THERMAL RADIATION FROM THE EARTH'S SURFACE AND ATMOSPHERE, (3) AN INFRARED TEMPERATURE PROFILE RADIOMETER (ITPR) FOR OBTAINING VERTICAL PROFILES OF TEMPERATURE AND MOISTURE, (4) A NIMBUS-E MICROWAVE SPECTROMETER (NEMS) FOR DETERMINING TROPOSPHERIC TEMPERATURE PROFILES, ATMOSPHERIC WATER VAPOR ABUNDANCES, AND CLOUD LIQUID WATER CONTENT, (5) A SELECTIVE CHOPPER RADIOMETER (SCR) FOR OBSERVING THE GLOBAL TEMPERATURE STRUCTURE OF THE ATMOSPHERE, AND (6) A SURFACE COMPOSITION MAPPING RADIOMETER (SCMR) FOR MEASURING THE DIFFERENCES IN THE THERMAL EMISSION CHARACTERISTICS OF THE EARTH'S SURFACE.

REFERENCES
83, 143, 151, 152, 153, 272, 280, 281, 427, 733, 862, AND 938.

EXPERIMENT NAME- INFRARED TEMPERATURE PROFILE RADIOMETER (ITPR) NSSDC ID NIMBS-E-01

EXPERIMENT PERSONNEL

PI - W.L. SMITH	NOAA-NESS	SUITLAND, MD.
OI - D.Q. WARK	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-E INFRARED TEMPERATURE PROFILE RADIOMETER (ITPR) EXPERIMENT WILL TEST THE FEASIBILITY AND OPERATIONAL APPLICATIONS OF A REMOTE SOUNDING TECHNIQUE USING SIMULTANEOUS MEDIUM-RESOLUTION (32 KM) MEASUREMENTS IN NINE SPECTRAL INTERVALS. THE RADIOMETER WILL SENSE SIX INTERVALS IN THE 15-MICRON CARBON DIOXIDE BAND, ONE INTERVAL IN THE WATER VAPOR ROTATIONAL BAND NEAR 20 MICRONS, AND TWO SPECTRAL INTERVALS IN THE ATMOSPHERIC WINDOW REGIONS NEAR 3.8 AND 11 MICRONS. THE ITPR WILL VIEW THE EARTH SUCCESSIVELY AT VARIOUS ANGLES DISTRIBUTED SYMMETRICALLY ABOUT NADIR IN A PLANE NORMAL TO THE ORBITAL TRACK. FORTY-TWO GEOGRAPHICALLY INDEPENDENT SCAN SPOTS WILL BE TAKEN ALONG A SINGLE STRIP. AS THE SATELLITE PROGRESSES ALONG ITS ORBITAL PATH, THE RADIOMETER WILL SAMPLE TEN SUCH STRIPS TO FORM A 42 BY 10 MATRIX OF INDEPENDENT SCAN SPOTS. EACH MATRIX WILL BE PRODUCED IN 222 SEC WITH THE WHOLE SCANNING SEQUENCE BEING REPEATED EVERY 240 SEC. THE MATRIX DATA WILL BE RECORDED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. MATRIX MEASUREMENTS TAKEN IN THE CARBON DIOXIDE AND WATER VAPOR ABSORPTION BANDS WILL BE USED TO CALCULATE TEMPERATURE PROFILES AND TOTAL WATER VAPOR CONTENT IN THE TROPOSPHERE AND LOWER STRATOSPHERE. THE TWO WINDOW MEASUREMENTS SHOULD ENABLE CLOUD CONTAMINATION OF THE RADIANCES TO BE DETECTED AND ELIMINATED, THUS PERMITTING ACTUAL DETERMINATION OF PROFILES DOWN TO THE EARTH'S SURFACE IN ALL BUT COMPLETELY OVERCAST AREAS.

REFERENCES

2, 83, 84, 146, 151, 152, 195, 777, AND 939.

EXPERIMENT NAME- SELECTIVE CHOPPER RADIOMETER (SCR) NSSDC ID NIMBS-E-02

EXPERIMENT PERSONNEL

PI - J.T. HOUGHTON	OXFORD U	OXFORD, ENGLAND
OI - S.D. SMITH	HERIOT-WATT U	EDINBOURGH, SCOTLAND

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-E SELECTIVE CHOPPER RADIOMETER (SCR) IS DESIGNED TO (1) OBSERVE THE GLOBAL TEMPERATURE STRUCTURE OF THE ATMOSPHERE UP TO 50 KM IN ALTITUDE, (2) MAKE SUPPORTING OBSERVATIONS OF WATER VAPOR DISTRIBUTION, AND (3) DETERMINE THE DENSITY OF ICE PARTICLES IN CIRRUS CLOUDS. TO ACCOMPLISH THESE OBJECTIVES, THE SCR WILL MEASURE EMITTED RADIATION IN 16 SPECTRAL INTERVALS SEPARATED INTO THE FOLLOWING FOUR GROUPS - (A) FOUR CARBON DIOXIDE CHANNELS BETWEEN 13.8 AND 14.8 MICRONS, (B) FOUR MORE CARBON DIOXIDE CHANNELS AT APPROXIMATELY 15 MICRONS, (C) AN IR WINDOW CHANNEL AT 11.1 MICRONS, A WATER VAPOR CHANNEL AT 18.6 MICRONS, AND (D) CHANNELS AT 2.08, 2.59, 2.65, 3.5, 46.5, AND 100 MICRONS. FROM A PLANNED SATELLITE ALTITUDE OF 1100 KM, THE RADIOMETER WILL VIEW A 48-KM-DIAMETER CIRCLE ON THE EARTH'S SURFACE AND WILL HAVE A GROUND RESOLUTION OF ABOUT 13 KM AT NADIR. THE

REDUCED TEMPERATURE FIELDS SHOULD HAVE AN ACCURACY OF ABOUT PLUS OR MINUS 1 DEG C. A SIMILAR EXPERIMENT WAS FLOWN ON NIMBUS 4.

REFERENCES

2, 83, 84, 90, 146, 151, 152, 269, 777, AND 939.

EXPERIMENT NAME- NIMBUS-E MICROWAVE SPECTROMETER (NEMS) NSSDC ID NIMBS-E-03

EXPERIMENT PERSONNEL

PI - D.H.	STAELIN	MIT	CAMBRIDGE, MASS.
OI - F.T.	BARATH	NASA-JPL	PASADENA, CALIF.
OI - N.E.	GAUT	ENVIRON RES + TECH INC	STAMFORD, CONN.
OI - W.	NORDBERG	NASA-GSFC	GREENBELT, MD.
OI - P.	THADDEUS	GISS	NEW YORK, N.Y.
OI - W.B.	LENOIR	NASA-MSC	HOUSTON, TEXAS

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-E MICROWAVE SPECTROMETER (NEMS) IS PRIMARILY DESIGNED TO DEMONSTRATE THE CAPABILITIES AND LIMITATIONS OF MICROWAVE SENSORS FOR MEASURING TROPOSPHERIC TEMPERATURE PROFILES, WATER VAPOR ABUNDANCES, CLOUD LIQUID WATER CONTENT, AND EARTH SURFACE TEMPERATURES. A SECONDARY PURPOSE IS TO OBTAIN SUCH DATA FOR WEATHER PREDICTION PURPOSES EVEN IN THE PRESENCE OF CLOUDS WHICH BLOCK CONVENTIONAL SATELLITE INFRARED SENSORS. THE NEMS WILL CONTINUOUSLY MONITOR EMITTED THERMAL RADIATION AT WAVELENGTHS OF 11.1, 9.55, 5.58, 5.46, AND 5.10 MM. THE THREE CHANNELS NEAR THE 5-MM OXYGEN ABSORPTION BAND WILL BE USED PRIMARILY TO DETERMINE THE ATMOSPHERIC TEMPERATURE PROFILE. THE TWO WATER VAPOR CHANNELS NEAR 10 MM WILL PERMIT THE WATER VAPOR AND CLOUD LIQUID WATER CONTENT OVER OCEANS TO BE ESTIMATED AND ALSO WILL YIELD AN ESTIMATED TEMPERATURE ONCE THE SURFACE EMISSIVITY HAS BEEN CALIBRATED BY COMPARISON WITH DIRECT MEASUREMENTS. THE THREE OXYGEN CHANNELS WILL SHARE A COMMON SIGNAL AND REFERENCE ANTENNA. BOTH WATER VAPOR CHANNELS WILL HAVE THEIR OWN SIGNAL AND REFERENCE ANTENNAS. FROM A PLANNED SATELLITE HEIGHT OF 1100 KM, THE NEMS WILL VIEW A 180-KM-DIAMETER CIRCLE ON THE EARTH'S SURFACE. NEMS DATA WILL BE RECORDED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. A SIMILAR EXPERIMENT IS PLANNED FOR NIMBUS-F.

REFERENCES

2, 83, 84, 146, 151, 152, 773, 777, AND 916.

EXPERIMENT NAME- ELECTRICALLY SCANNING MICROWAVE RADIOMETER (ESMR) NSSDC ID NIMBS-E-04

EXPERIMENT PERSONNEL

PI - T.	WILHEIT	NASA-GSFC	GREENBELT, MD.
OI - P.	GLOERSEN	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE PRIMARY OBJECTIVES OF THE NIMBUS-E ELECTRICALLY SCANNING MICROWAVE RADIOMETER (ESMR) WILL BE (1) TO DERIVE THE LIQUID WATER CONTENT OF CLOUDS FROM BRIGHTNESS TEMPERATURES OVER OCEANS, (2) TO OBSERVE DIFFERENCES BETWEEN SEA ICE AND THE OPEN SEA OVER THE POLAR CAPS, AND (3) TO TEST THE FEASIBILITY OF INFERRING SURFACE COMPOSITION AND SOIL MOISTURE EVEN IN THE

PRESENCE OF CLOUDS, WHICH BLOCK CONVENTIONAL SATELLITE INFRARED SENSORS. TO ACCOMPLISH THESE OBJECTIVES, THE ESMR WILL BE CAPABLE OF CONTINUOUS GLOBAL MAPPING OF THE 1.55-CM (19.36 GHZ) RADIO THERMAL (MICROWAVE) RADIATION EMITTED BY THE EARTH-ATMOSPHERE SYSTEM. THE 90- BY 90-CM RADIOMETER ANTENNA SYSTEM, TO BE DEPLOYED AFTER LAUNCH, WILL SCAN THE EARTH SUCCESSIVELY AT VARIOUS ANGLES IN A PLANE PERPENDICULAR TO THE SPACECRAFT ORBITAL TRACK, PRODUCING A BRIGHTNESS TEMPERATURE MAP OF THE SURFACE OF THE EARTH AND ITS ATMOSPHERE. THE SCANNING PROCESS IS CONTROLLED BY A COMPUTER ON BOARD AND CONSISTS OF 78 SYMMETRICALLY DISTRIBUTED INDEPENDENT SCAN SPOTS EXTENDING 50 DEG TO EITHER SIDE OF NADIR. ANGULAR SEPARATION OF THE SCAN SPOTS ALLOWS FOR AN 8.5 PERCENT OVERLAP BETWEEN VIEW POSITIONS. FROM A PLANNED ORBITAL HEIGHT OF APPROXIMATELY 1100 KM, THE DEDUCED BRIGHTNESS TEMPERATURES SHOULD HAVE AN ACCURACY OF ABOUT PLUS OR MINUS 1 DEG C WITH A SPATIAL RESOLUTION OF ABOUT 25 KM. THE ESMR DATA WILL BE STORED ON MAGNETIC TAPE FOR TRANSMISSION TO GROUND ACQUISITION STATIONS. A SIMILAR EXPERIMENT WILL BE FLOWN ON NIMBUS-F.

REFERENCES
2, 83, 84, 146, 151, 152, 777, AND 857.

EXPERIMENT NAME- TEMPERATURE-HUMIDITY INFRARED RADIOMETER (THIR) NSSDC ID NIMBS-E-08

EXPERIMENT PERSONNEL
PI - A.W. MCCULLOCH NASA-GSFC GREENBELT, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-E TEMPERATURE-HUMIDITY INFRARED RADIOMETER (THIR) IS DESIGNED TO DETECT EMITTED THERMAL RADIATION IN BOTH THE 10.5- TO 12.5-MICRON REGION (IR WINDOW) AND THE 6.5- TO 7.0-MICRON REGION (WATER VAPOR). THE WINDOW CHANNEL WILL MEASURE CLOUDTOP TEMPERATURES AND WILL BE CAPABLE OF PRODUCING HIGH-RESOLUTION PICTURES OF CLOUD COVER AND THERMAL GRADIENTS ON LAND AND WATER SURFACES IN CLOUD-FREE AREAS DURING BOTH THE DAY AND NIGHT PORTIONS OF THE ORBIT. THE OTHER CHANNEL WILL OPERATE PRIMARILY AT NIGHT TO MAP THE WATER VAPOR DISTRIBUTION IN THE UPPER TROPOSPHERE AND STRATOSPHERE. SENSORY DATA FROM THESE TWO CHANNELS WILL PRIMARILY BE USED TO SUPPORT THE OTHER, MORE SOPHISTICATED METEOROLOGICAL EXPERIMENTS ON BOARD NIMBUS-E. THE INSTRUMENT WILL CONSIST OF A 12.7-CM CASSEGRAIN SYSTEM, A SCANNING MIRROR COMMON TO BOTH CHANNELS, A BEAM SPLITTER, FILTERS, AND TWO GERMANIUM-IMMERSED THERMISTOR BOLOMETERS. IN CONTRAST TO TV, NO IMAGE IS FORMED WITHIN THE RADIOMETER. INCOMING RADIANT ENERGY WILL BE COLLECTED BY A FLAT SCANNING MIRROR INCLINED AT 45 DEG TO THE OPTICAL AXIS. THE MIRROR WILL ROTATE THROUGH 360 DEG AT 48 RPM AND WILL SCAN IN A PLANE PERPENDICULAR TO THE SPACECRAFT VELOCITY. THE ENERGY WILL THEN BE FOCUSED ON A DICHROMATIC BEAM SPLITTER, WHICH WILL DIVIDE THE ENERGY SPECTRALLY AND SPATIALLY INTO THE TWO CHANNELS. BOTH CHANNELS OF THE THIR SENSOR WILL TRANSFORM THE RECEIVED RADIATION INTO AN ELECTRIC OUTPUT (VOLTAGES), WHICH WILL BE RECORDED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION. A SIMILAR EXPERIMENT IS PLANNED FOR NIMBUS-F.

REFERENCES
2, 83, 84, 146, 152, AND 777.

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SPACECRAFT COMMON NAME- NIMBUS-F NSSDC ID NIMBS-F
ALTERNATE NAMES- NIMBS-F, PL-731B

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 1100.00 KM ALT
PERIGEE- 1100.00 KM ALT
PERIOD- 108. MIN
INCLINATION- 100. DEG

OTHER INFORMATION
SPACECRAFT WT- 585. KG
LAUNCH DATE- 07/00/75
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - S.	WEILAND	NASA-GSFC	GREENBELT, MD.
PS - W.	NORDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

THE NIMBUS-F R AND D SATELLITE IS DESIGNED TO SERVE AS A STABILIZED, EARTH-ORIENTED PLATFORM FOR THE TESTING OF ADVANCED SYSTEMS FOR SENSING AND COLLECTING METEOROLOGICAL DATA ON A GLOBAL SCALE. THE POLAR-ORBITING SPACECRAFT CONSISTS OF THREE MAJOR STRUCTURES -- (1) A HOLLOW TORUS-SHAPED SENSOR MOUNT, (2) SOLAR PADDLES, AND (3) A CONTROL HOUSING UNIT THAT IS CONNECTED TO THE SENSOR MOUNT BY A TRIPOD TRUSS STRUCTURE. CONFIGURED SOMEWHAT LIKE AN OCEAN BUOY, NIMBUS-F WILL BE NEARLY 3.7 M TALL, 1.5 M IN DIAMETER AT THE BASE, AND ABOUT 3 M WIDE WITH SOLAR PADDLES EXTENDED. THE SENSOR MOUNT THAT FORMS THE SATELLITE BASE HOUSES THE ELECTRONICS EQUIPMENT AND BATTERY MODULES. THE LOWER SURFACE OF THE TORUS WILL PROVIDE MOUNTING SPACE FOR SENSORS AND ANTENNAS. A BOX-BEAM STRUCTURE MOUNTED WITHIN THE CENTER OF THE TORUS WILL PROVIDE SUPPORT FOR THE LARGER SENSOR EXPERIMENTS. MOUNTED ON THE CONTROL HOUSING UNIT, WHICH IS LOCATED ON TOP OF THE SPACECRAFT, ARE SUN SENSORS, HORIZON SCANNERS, AND A COMMAND ANTENNA. AN ADVANCED ATTITUDE CONTROL SYSTEM WILL PERMIT THE SPACECRAFT'S ORIENTATION TO BE CONTROLLED TO WITHIN PLUS OR MINUS 1 DEG IN ALL THREE AXES (PITCH, ROLL, AND YAW). NINE EXPERIMENTS HAVE BEEN SELECTED FOR NIMBUS-F. THEY ARE THE (1) EARTH RADIATION BUDGET (ERB), (2) ELECTRICALLY SCANNING MICROWAVE RADIOMETER (ESMR), (3) HIGH-RESOLUTION INFRARED RADIATION SOUNDER (HRIRS), (4) LIMB RADIANCE INVERSION RADIOMETER (LRIR), (5) PRESSURE MODULATED RADIOMETER (PMR), (6) SCANNING MICROWAVE SPECTROMETER (SCAMS), (7) TEMPERATURE-HUMIDITY INFRARED RADIOMETER (THIR), (8) SATELLITE TRACKING AND DATA RELAY EXPERIMENT, AND (9) TROPICAL WIND ENERGY CONVERSION AND REFERENCE LEVEL EXPERIMENT (TWERLE). THIS COMPLEMENT OF ADVANCED SENSORS WILL BE CAPABLE OF (1) MAPPING TROPOSPHERIC TEMPERATURE, WATER VAPOR ABUNDANCE, AND CLOUD WATER CONTENT, (2) PROVIDING VERTICAL PROFILES OF TEMPERATURE, OZONE, AND WATER VAPOR, (3) TRANSMITTING REAL-TIME DATA TO A GEOSTATIONARY SPACECRAFT (ATS-F), AND (4) YIELDING DATA ON THE EARTH'S RADIATION BUDGET.

REFERENCES

143, 152, 154, 281, 427, AND 733.

EXPERIMENT NAME- TROPICAL WIND ENERGY CONVERSION AND REFERENCE LEVEL EXPERIMENT (TWERLE) NSSDC ID NIMBS-F-01

EXPERIMENT PERSONNEL

PI - W.W.	KELLOGG	NATL CNTR ATMOS RSCH	BOULDER, COLO.

OI - P.	JULIAN	NATL CNTR ATMOS RSCH	BOULDER, COLO.
OI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WISC.
OI - C.R.	LAUGHLIN	NASA-GSFC	GREENBELT, MD.
OI - R.L.	TALLEY	PMI	SILVER SPRING, MD.
OI - W.R.	BANDEEN	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE GOALS OF THE NIMBUS-F TROPICAL WIND ENERGY CONVERSION AND REFERENCE LEVEL EXPERIMENT (TWERLE) ARE CLOSELY ASSOCIATED WITH THE OBJECTIVES OF GARP AND INCLUDE (1) MEASURING UPPER ATMOSPHERIC WINDS OVER REMOTE REGIONS, (2) STUDYING THE RELATIVE AIR MOTION ALONG ISOBARIC SURFACES TO DETERMINE THE CONVERSION OF ATMOSPHERIC POTENTIAL ENERGY INTO KINETIC ENERGY, AND (3) PROVIDING DIRECT MEASUREMENTS OF VARIOUS METEOROLOGICAL PARAMETERS THAT CAN SERVE AS REFERENCE POINTS IN ADJUSTING INDIRECT TEMPERATURE SOUNDINGS MADE FROM SATELLITES. THE EXPERIMENT CONSISTS OF TWO BASIC COMPONENTS - (1) APPROXIMATELY 300 CONSTANT LEVEL METEOROLOGICAL BALLOONS TO YIELD MEASUREMENTS OF WINDS, TEMPERATURE, AND PRESSURE IN THE TROPICS AND AT SOUTHERN HEMISPHERE MIDLATITUDES AT 150 MB (ABOUT 13.6-KM ALTITUDE), AND (2) THE NIMBUS-F RANDOM ACCESS MEASUREMENTS SYSTEM (RAMS) TO PROVIDE DATA COLLECTION AND LOCATION DETERMINATIONS FROM THE BALLOONS. THE 3.5-DIAMETER POLYESTER-MYLAR BALLOONS ARE EQUIPPED WITH A TRANSMITTER PACKAGE, SOLAR POWER SUPPLY, DIGITIZER/MODULATOR, AND SENSORS. THE SENSORS CONSIST OF A RADIO ALTIMETER THAT HAS AN EXPECTED ACCURACY OF BETTER THAN PLUS OR MINUS 20 M, A BEAD THERMISTOR THAT WILL MONITOR THE AMBIENT AIR TEMPERATURE TO AN ACCURACY OF PLUS OR MINUS 0.5 DEG C, AND A PRESSURE SENSOR TO MEASURE THE 150-MB FLIGHT ALTITUDE TO AN ACCURACY OF PLUS OR MINUS 0.5 MB. A MAGNETIC CUTDOWN DEVICE IS ALSO INCLUDED ON EACH BALLOON TO ELIMINATE ANY ACCIDENTAL OVERFLIGHTS INTO REGIONS OF THE NORTHERN HEMISPHERE NORTH OF 20 DEG N LATITUDE. THE RAMS ON BOARD THE SPACECRAFT HAS NO COMMAND OR CONTROL CAPABILITY OVER THE BALLOONS (THE BALLOONS ARE NOT INTERROGATED). IT MERELY DETECTS EACH BALLOON SIGNAL (401.2 MHZ) AND EXTRACTS THE CARRIER FREQUENCY, BALLOON IDENTIFICATION, AND SENSOR DATA. THIS INFORMATION, ALONG WITH TIME REFERENCES, IS STORED IN DIGITAL FORM FOR SUBSEQUENCT RELAY TO A GROUND ACQUISITION STATION. THE BALLOON'S POSITION AND VELOCITY ARE DERIVED FROM THE RELATIVE MOTION BETWEEN THE PLATFORM AND THE SATELLITE BY MEASURING DOPPLER SHIFTS IN THE CARRIER SIGNAL RECEIVED FROM THE BALLOON. TWERLE WILL BE CAPABLE OF A LOCATION ACCURACY OF 5 KM AND A PLATFORM VELOCITY ACCURACY OF 1 M/SEC.

REFERENCES

2, 83, 146, 152, 154, AND 562.

EXPERIMENT NAME- HIGH-RESOLUTION INFRARED RADIATION SOUNDER (HRIRS) NSSDC ID NIMBS-F-02

EXPERIMENT PERSONNEL

PI - A.W.	MCCULLOCH	NASA-GSFC	GREENBELT, MD.
OI - W.L.	SMITH	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-F HIGH-RESOLUTION INFRARED RADIATION SOUNDER (HRIRS) WILL SUPPORT THE GARP DATA TEST SET BY PROVIDING, TWICE DAILY ON A GLOBAL BASIS, VERTICAL TEMPERATURE PROFILES EXTENDING UP TO APPROXIMATELY 40 KM AND INFORMATION ON THE WATER VAPOR DISTRIBUTION IN THE TROPOSPHERE. THE HRIRS WILL MEASURE RADIANCES PRIMARILY IN FIVE SPECTRAL REGIONS - (1) SEVEN

CHANNELS NEAR THE 15-MICRON CARBON DIOXIDE ABSORPTION BAND, (2) TWO CHANNELS IN THE IR WINDOW, 11.1 AND 3.7 MICRONS, (3) TWO CHANNELS IN THE WATER VAPOR ABSORPTION BAND, 8.2 AND 6.7 MICRONS, (4) FIVE CHANNELS IN THE 4.3-MICRON CARBON DIOXIDE BAND AND (5) ONE CHANNEL IN THE VISIBLE, 0.69-MICRON REGION. THE SOUNDER WILL CONSIST OF A CASSEGRAIN TELESCOPE, SCANNING MIRROR, DICHROMATIC BEAM SPLITTER, FILTER WHEEL, CHOPPER, AND ASSOCIATED ELECTRONICS. THE HRIRS WILL SCAN THE EARTH'S SURFACE IN A PLANE NORMAL TO THE SPACECRAFT'S ORBITAL PATH WITH A MAXIMUM SCAN ANGLE OF 30 DEG TO EITHER SIDE OF NADIR.

REFERENCES

2, 83, 146, 152, AND 154.

EXPERIMENT NAME- ELECTRICALLY SCANNING MICROWAVE RADIOMETER (ESMR) NSSDC ID NIMBS-F-03

EXPERIMENT PERSONNEL

PI - T.T.	WILHEIT	NASA-GSFC	GREENBELT, MD.
OI - A.T.	EDGERTON	AEROJET ELECTROSYSTEMS	AZUSA, CALIF.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-F ELECTRICALLY SCANNING MICROWAVE RADIOMETER (ESMR) WILL MEASURE THE EARTH'S MICROWAVE EMISSION AT 37 GHZ. THE LIQUID WATER CONTENT OF CLOUDS, THE DISTRIBUTION AND VARIATION OF SEA ICE COVER, AND GROSS CHARACTERISTICS OF LAND SURFACES (VEGETATION, SOIL MOISTURE, AND SNOW COVER) WILL BE OBTAINED FROM THESE MEASUREMENTS. THE DICKE-TYPE RADIOMETER WILL CONSIST OF A SINGLE TIME-SHARING RECEIVER AND AN ELECTRICALLY SCANNING PHASED ARRAY ANTENNA OPERATING AT 0.8 CM (37 GHZ). THE ANTENNA BEAM ARRAY, A 90- BY 20- BY 12-CM BOX-LIKE STRUCTURE, WILL BE MOUNTED ON TOP OF THE SPACECRAFT SENSORY RING AND WILL BE POINTED IN THE DIRECTION OF THE SPACECRAFT'S FORWARD MOTION AND TILTED DOWN 40 DEG FROM THE SATELLITE VELOCITY VECTOR. THE ANTENNA BEAM WILL SCAN THE EARTH IN 100 DISCRETE STEPS FOR VARIOUS ANGLES EXTENDING UP TO 35 DEG ON EITHER SIDE OF THE ORBITAL PLANE. THE DEDUCED BRIGHTNESS TEMPERATURES SHOULD BE ACCURATE TO WITHIN 2 DEG K.

REFERENCES

83, 146, 152, AND 154.

EXPERIMENT NAME- LIMB RADIANCE INVERSION RADIOMETER (LRIR) NSSDC ID NIMBS-F-04

EXPERIMENT PERSONNEL

PI - J.C.	GILLE	NATL CNTR ATMOS RSCH	BOULDER, COLO.
OI - F.B.	HOUSE	DREXEL U	PHILADELPHIA, PA.
OI - R.C.	CRAIG	FLORIDA STATE U	TALLAHASSEE, FLA.
OI - J.C.	BATES	AERO. DIV., HONEYWELL	ST. PETERSBURG, FLA.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-F LIMB RADIANCE INVERSION RADIOMETER (LRIR) WILL PROVIDE CALIBRATED RADIANCE VERSUS ALTITUDE PROFILES BY INTERCEPTING RADIATION EMANATING FROM AN ATMOSPHERIC PATH WHICH IS TANGENTIAL TO A PARTICULAR GEOCENTRIC HEIGHT. THE LRIR WILL SENSE RADIATION IN FOUR SPECTRAL INTERVALS - (1) THE 14.6- TO 15.9-MICRON CARBON DIOXIDE BAND, (2) THE 14.2- TO

17.3-MICRON CARBON DIOXIDE BAND, (3) THE 8.3- TO 10.1-MICRON OZONE BAND, AND (4) THE 20- TO 25-MICRON WATER VAPOR ROTATIONAL BAND. MEASUREMENTS TAKEN IN THE TWO CARBON DIOXIDE CHANNELS AND WATER VAPOR CHANNEL WILL BE USED TO CALCULATE GLOBAL TEMPERATURE AND WATER VAPOR PROFILES IN THE STRATOSPHERE AND LOWER MESOSPHERE. IN ADDITION, VALUES OF THE GEOSTROPHIC WIND UP TO 1 MB (APPROXIMATELY 48 KM) WILL BE DERIVED ANALYTICALLY FROM THE DEDUCED TEMPERATURE PROFILES. THE RADIOMETER INCLUDES AN OPTICAL SYSTEM, A SCANNING MIRROR, CHOPPERS, AND ASSOCIATED ELECTRONICS AND WILL EMPLOY AN AMMONIA-METHANE COOLER SYSTEM FOR THREE OF THE FOUR DETECTOR CHANNELS. THE DEDUCED TEMPERATURE PROFILES WILL HAVE AN RMS ACCURACY OF PLUS OR MINUS 3 DEG AT HEIGHTS ABOVE 15 KM WHILE THE VALUES FOR OZONE WILL BE ACCURATE TO WITHIN PLUS OR MINUS 20 PERCENT AT 1 MB. WATER VAPOR VALUES AT THE SAME HEIGHT SHOULD BE WITHIN 50 PERCENT.

REFERENCES

83, 146, 152, AND 154.

EXPERIMENT NAME- EARTH RADIATION BUDGET (ERB) NSSDC ID NIMBS-F-05

EXPERIMENT PERSONNEL

PI - W.L.	SMITH	NOAA-NESS	SUITLAND, MD.
OI - A.J.	DRUMMOND	EPPLEY LABS INC	NEWPORT, R.I.
OI - I.	RUFF	NOAA-NESS	SUITLAND, MD.
OI - J.R.	HICKEY	EPPLEY LABS INC	NEWPORT, R.I.
OI - W.J.	SCHOLES	EPPLEY LABS INC	NEWPORT, R.I.
OI - D.T.	HILLEARY	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-F EARTH RADIATION BUDGET (ERB) EXPERIMENT IS DESIGNED TO (1) MEASURE REFLECTED AND EMITTED TERRESTRIAL RADIATION FLUXES IN CONJUNCTION WITH SOLAR RADIATION FOR DETERMINATION OF THE EARTH RADIATION BUDGET, (2) DETERMINE THE ANGULAR DISTRIBUTION OF TERRESTRIAL RADIATION FOR VARIOUS METEOROLOGICAL AND GEOGRAPHIC REGIMES, AND (3) CORRELATE MEASUREMENTS MADE USING IDENTICAL BUT INDEPENDENT CHANNELS CALIBRATED TO THE SAME STANDARD. INCOMING SOLAR RADIATION FROM 0.2 TO 50 MICRONS WILL BE MONITORED IN 10 SPECTRAL INTERVALS NORMALLY SEVERAL TIMES EACH DAY AND EVERY ORBIT DURING PERIODS OF SOLAR ACTIVITY. TERRESTRIAL RADIATION MEASUREMENTS WILL BE TAKEN CONTINUOUSLY IN 12 SPECTRAL INTERVALS ALSO FROM 0.2 TO 50 MICRONS. THE MEASUREMENTS WILL BE TAKEN IN TWO WAYS. FOUR CHANNELS USING WIDE-ANGLE OPTICS (133.3-DEG FIELD OF VIEW) WILL MEASURE THE TOTAL OUTGOING RADIATION INTEGRATED OVER THE ENTIRE EARTH DISC. THE SECOND SET OF MEASUREMENTS WILL COVER EIGHT SPECTRAL INTERVALS AND WILL EMPLOY HIGH-RESOLUTION SCANNING TECHNIQUES TO MEASURE THE TERRESTRIAL RADIATION EMANATING FROM RELATIVELY SMALL AREAS OVER A RANGE OF VARIOUS ZENITH AND AZIMUTH ANGLES. THE INSTRUMENT WILL CONSIST OF TWO IDENTICAL SCANNING MULTICHANNEL RADIOMETER HEADS. ONE WILL SCAN FORWARD OF THE SPACECRAFT, AND THE OTHER WILL SCAN AFT. BOTH HEADS WILL VIEW OPPOSITE HORIZONS AT THE SAME TIME AND WILL SCAN DOWN TO NADIR TOGETHER. THE SCAN SWEEP AND RETURN WILL OCCUR IN 64 SEC. EACH HEAD WILL CONTAIN FOUR SHORTWAVE CHANNELS (0.2 TO 4.0 MICRONS) AND FOUR LONGWAVE CHANNELS (4.0 TO 50 MICRONS) WITH 0.25- BY 5.14-DEG FIELDS OF VIEW. THE CHANNELS WILL BE ORIENTED IN A DIRECTIONAL FAN TO COVER 20 DEG TO EACH SIDE OF THE ORBITAL PLANE. THE 64-SEC SCAN PERIOD WILL ALLOW AN AREA TO BE MEASURED FROM AS MANY AS 17 DIFFERENT ANGLES AS THE SPACECRAFT PASSES OVERHEAD.

REFERENCES

83, 146, 152, AND 154.

EXPERIMENT NAME- PRESSURE MODULATED RADIOMETER (PMR)   NSSDC ID NIMBS-F-09

EXPERIMENT PERSONNEL

PI - J.T.	HOUGHTON	OXFORD U	OXFORD, ENGLAND
OI - C.D.	RODGERS	OXFORD U	OXFORD, ENGLAND
OI - E.J.	WILLIAMSON	OXFORD U	OXFORD, ENGLAND
OI - G.D.	PESKETT	OXFORD U	OXFORD, ENGLAND
OI - P.	CURTIS	OXFORD U	OXFORD, ENGLAND

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-F PRESSURE MODULATED RADIOMETER (PMR) EXPERIMENT WILL TAKE RADIOMETRIC MEASUREMENTS IN THE 15-MICRON CARBON DIOXIDE BAND AT ALTITUDES BETWEEN 45 AND 70 KM ON A GLOBAL SCALE. BY APPROPRIATE MATHEMATICAL RETRIEVAL METHODS, THE TEMPERATURE STRUCTURE OF THE UPPER STRATOSPHERE AND LOWER MESOSPHERE WILL THEN BE DEDUCED. THE PRESSURE MODULATION TECHNIQUE WILL PERMIT THE EXTENSION OF SELECTIVE CHOPPING TECHNIQUES TO HIGHER ALTITUDES WHERE THE PRESSURE-BROADENED EMISSION LINES IN THE 15-MICRON CARBON DIOXIDE BAND BECOME SO NARROW THAT CONVENTIONAL SPECTROMETERS AND INTERFEROMETERS HAVE INSUFFICIENT SPECTRAL RESOLUTION. IN ADDITION TO PRESSURE SCANNING (IN DISCRETE STEPS), THE RADIOMETER WILL ALSO EMPLOY DOPPLER SCANNING ALONG THE DIRECTION OF FLIGHT. THE PMR COMPRISES TWO SIMILAR RADIOMETER CHANNELS, EACH CONSISTING OF A PLANE SCANNING MIRROR, REFERENCE BLACKBODY, PRESSURE MODULATOR CELL, AND DETECTOR ASSEMBLY. THE PLANE MIRROR WILL BE GOLD-COATED AND MOUNTED AT 45 DEG ON A 90-DEG STEPPING MOTOR SO THAT THE FIELD OF VIEW OF THE CHANNEL MAY BE DIRECTED TO SPACE OR THE INTERNAL REFERENCE BLACKBODY FOR INFLIGHT RANGE AND ZERO CALIBRATION. THE MOTOR WILL BE MOUNTED ON A PAIR OF FLEXIBLE PIVOTS SO THAT THE MIRROR CAN BE ROTATED THROUGH PLUS OR MINUS 7-1/2 DEG FROM ITS REST POSITION TO GIVE THE REQUIRED DOPPLER SCAN. MAJOR COMPONENTS IN THE PRESSURE MODULATOR CELL ARE A MOVABLE PISTON, DIAPHRAGM, AND MAGNETIC DRIVE COIL. THE DETECTOR ASSEMBLY CONSISTS OF A FIELD LENS, A CONDENSING LIGHT PIPE, AND A PYROELECTRIC FLAKE BOLOMETER. EACH RADIOMETER HAS A FIELD OF VIEW THAT IS 20 DEG WHOLE ANGLE ACROSS THE SPACECRAFT'S LINE OF FLIGHT AND 40 DEG WHOLE ANGLE PARALLEL TO THE LINE OF FLIGHT. THE DEDUCED TEMPERATURE VALUES SHOULD BE WITHIN PLUS OR MINUS 2 DEG K AT 65 KM AND ABOUT PLUS OR MINUS 0.2 DEG K NEAR 50 KM.

REFERENCES

2, 83, 146, 152, 154, 196, AND 851.

EXPERIMENT NAME- SCANNING MICROWAVE SPECTROMETER (SCAMS)   NSSDC ID NIMBS-F-10

EXPERIMENT PERSONNEL

PI - D.H.	STAELIN	MIT	CAMBRIDGE, MASS.
OI - F.T.	BARATH	NASA-JPL	PASADENA, CALIF.
OI - A.H.	BARRETT	MIT	CAMBRIDGE, MASS.
OI - W.B.	LENOIR	NASA-MSC	HOUSTON, TEXAS
OI - N.	PHILLIPS	MIT	CAMBRIDGE, MASS.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-F SCANNING MICROWAVE SPECTROMETER (SCAMS) IS DESIGNED TO MAP TROPOSPHERIC TEMPERATURE PROFILES, WATER VAPOR ABUNDANCE, AND CLOUD WATER CONTENT, AND TO OBTAIN SUCH DATA FOR WEATHER PREDICTION PURPOSES EVEN IN THE PRESENCE OF CLOUDS, WHICH BLOCK CONVENTIONAL SATELLITE INFRARED SENSORS. THE SCAMS WILL CONTINUOUSLY MONITOR EMITTED THERMAL RADIATION AT WAVELENGTHS OF 13.5, 9.5, 5.7, 4.9, AND 4.6 MM. THE THREE CHANNELS NEAR THE 5.0-MM OXYGEN ABSORPTION BAND WILL BE USED PRIMARILY TO DEDUCE ATMOSPHERIC TEMPERATURE PROFILES. THE TWO CHANNELS NEAR 10 MM WILL PERMIT WATER VAPOR AND CLOUD WATER CONTENT OVER CALM OCEANS TO BE ESTIMATED SEPARATELY. THE INSTRUMENT, A DICKE-SUPERHETERODYNE TYPE, WILL SCAN PLUS OR MINUS 45 DEG NORMAL TO THE ORBITAL PLANE WITH A 10-DEG FIELD OF VIEW. THE THREE OXYGEN CHANNELS WILL SHARE COMMON SIGNAL AND REFERENCE ANTENNAS. BOTH WATER VAPOR CHANNELS WILL HAVE THEIR OWN SIGNALS AND REFERENCE ANTENNAS. THE ABSOLUTE RMS ACCURACY OF THE OXYGEN CHANNELS WILL BE BETTER THAN 2 DEG K AND THAT OF THE WATER VAPOR CHANNELS BETTER THAN 1 DEG K. THE DYNAMIC RANGE FOR ALL CHANNELS WILL BE FROM 0 TO 400 DEG K.

REFERENCES

2, 83, 146, 152, AND 154.

EXPERIMENT NAME- TEMPERATURE-HUMIDITY INFRARED RADIOMETER (THIR) NSSDC ID NIMBS-F-12

EXPERIMENT PERSONNEL

PI - W.R. BANDEEN NASA-GSFC GREENBELT, MD.

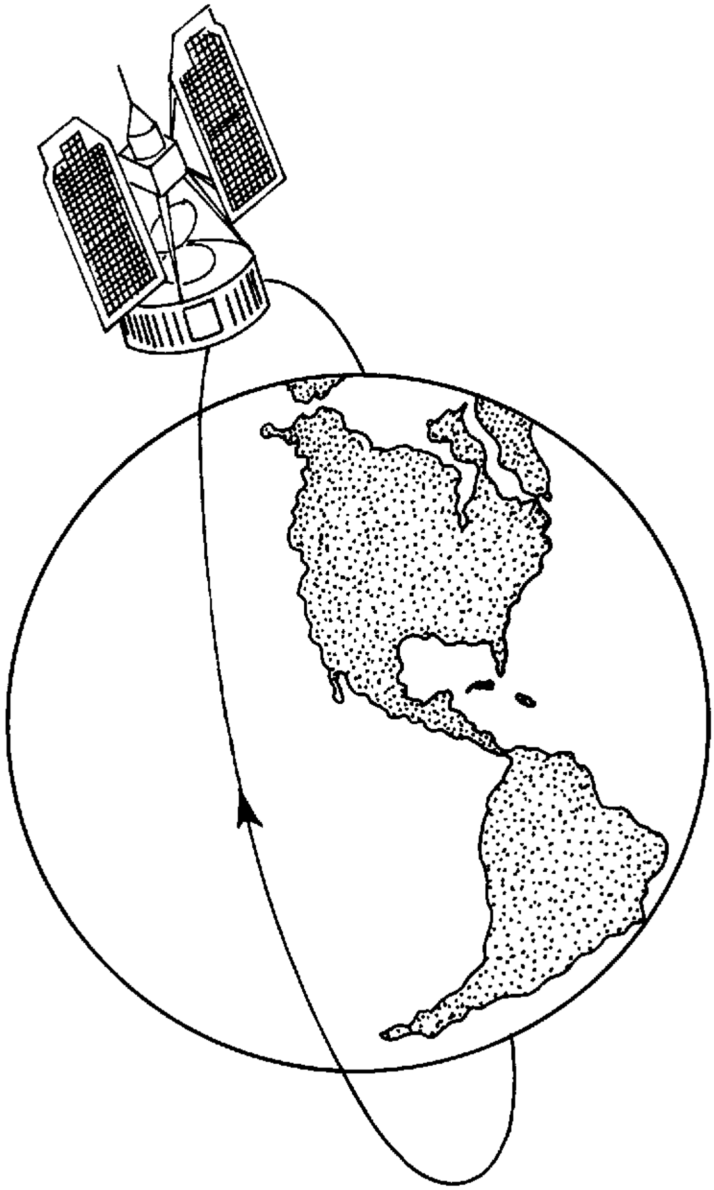
OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE NIMBUS-F TEMPERATURE-HUMIDITY INFRARED RADIOMETER (THIR) IS DESIGNED TO DETECT EMITTED THERMAL RADIATION IN BOTH THE 10.5- TO 12.5-MICRON REGION (IR WINDOW) AND THE 6.5- TO 7.0-MICRON REGION (WATER VAPOR). THE WINDOW CHANNEL WILL MEASURE CLOUDTOP TEMPERATURES AND WILL BE CAPABLE OF PRODUCING HIGH-RESOLUTION PICTURES OF CLOUD COVER AND THERMAL GRADIENTS ON LAND AND WATER SURFACES IN CLOUD-FREE AREAS DURING BOTH THE DAY AND NIGHT PORTIONS OF THE ORBIT. THE OTHER CHANNEL WILL OPERATE PRIMARILY AT NIGHT TO MAP THE WATER VAPOR DISTRIBUTION IN THE UPPER TROPOSPHERE AND STRATOSPHERE. SENSORY DATA FROM THESE TWO CHANNELS WILL PRIMARILY BE USED TO SUPPORT OTHER MORE SOPHISTICATED, METEOROLOGICAL EXPERIMENTS ON BOARD NIMBUS-F. THE INSTRUMENT WILL CONSIST OF A 12.7-CM CASSEGRAIN SYSTEM AND SCANNING MIRROR COMMON TO BOTH CHANNELS, A BEAM SPLITTER, FILTERS, AND TWO GERMANIUM-IMMERSED THERMISTOR BOLOMETERS. IN CONTRAST TO TV, NO IMAGE IS FORMED WITHIN THE RADIOMETER. INCOMING RADIANT ENERGY WILL BE COLLECTED BY A FLAT SCANNING MIRROR INCLINED AT 45 DEG TO THE OPTICAL AXIS. THE MIRROR WILL ROTATE THROUGH 360 DEG AT 48 RPM AND WILL SCAN IN A PLANE NORMAL TO THE SPACECRAFT VELOCITY. THE ENERGY WILL THEN BE FOCUSED ON A DICHROMATIC BEAM SPLITTER WHICH WILL DIVIDE THE ENERGY SPECTRALLY AND SPATIALLY INTO THE TWO CHANNELS. BOTH CHANNELS OF THE THIR SENSOR WILL TRANSFORM THE RECEIVED RADIATION INTO ELECTRIC OUTPUT (VOLTAGES), WHICH WILL BE RECORDED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK TO A GROUND ACQUISITION STATION.

REFERENCES

83, 146, AND 152.



ERTS SERIES

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7. ERTS Series

SPACECRAFT COMMON NAME- ERTS 1 NSSDC ID 72-058A
ALTERNATE NAMES- EARTH RESOURCES TECH SAT, PL 724A, ERTS-A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 07/23/72
APOGEE- 907.009 KM ALT
PERIGEE- 899.729 KM ALT
PERIOD- 103.2 MIN
INCLINATION- 99.125 DEG

OTHER INFORMATION
SPACECRAFT WT- 816. KG
LAUNCH DATE- 07/23/72
OPERATING STATUS- PARTIAL

SPACECRAFT PERSONNEL

PM - S.	WEILAND	NASA-GSFC	GREENBELT, MD
PS - W.P.	NORDBERG	NASA-GSFC	GREENBELT, MD

SPACECRAFT BRIEF DESCRIPTION
THE EARTH RESOURCES TECHNOLOGY SATELLITE ERTS 1 WAS A MODIFIED VERSION OF THE NIMBUS 4 METEOROLOGICAL SATELLITE. THE NEAR-POLAR ORBITING SPACECRAFT WAS DESIGNED TO SERVE AS A STABILIZED, EARTH-ORIENTED PLATFORM FOR OBTAINING INFORMATION ON AGRICULTURAL AND FORESTRY RESOURCES, GEOLOGY AND MINERAL RESOURCES, HYDROLOGY AND WATER RESOURCES, GEOGRAPHY, CARTOGRAPHY, ENVIRONMENTAL POLLUTION, OCEANOGRAPHY AND MARINE RESOURCES, AND METEOROLOGICAL PHENOMENA. TO ACCOMPLISH THESE OBJECTIVES, THE SPACECRAFT WAS EQUIPPED WITH (1) A FOUR-CHANNEL MULTISPECTRAL SCANNER (MSS) AND A THREE-CAMERA RETURN BEAM VIDICON (RBV) TO OBTAIN BOTH VISIBLE AND INFRARED PHOTOGRAPHIC AND RADIOMETRIC IMAGES OF THE EARTH AND (2) A DATA COLLECTION SYSTEM TO COLLECT INFORMATION FROM REMOTE, INDIVIDUALLY EQUIPPED GROUND STATIONS AND TO RELAY THE DATA TO CENTRAL ACQUISITION STATIONS. ERTS 1 CARRIED TWO WIDE-BAND VIDEO TAPE RECORDERS (WBVTR) CAPABLE OF STORING UP TO 30 MIN OF SCANNER OR CAMERA DATA TO GIVE THE SPACECRAFT'S SENSORS A NEAR-GLOBAL COVERAGE CAPABILITY. AN ADVANCED ATTITUDE CONTROL SYSTEM CONSISTING OF HORIZON SCANNERS, SUN SENSORS, AND A COMMAND ANTENNA COMBINED WITH A FREON GAS PROPULSION SYSTEM PERMITTED THE SPACECRAFT'S ORIENTATION TO BE CONTROLLED TO WITHIN PLUS OR MINUS 0.7 DEG IN ALL THREE AXES. SPACECRAFT COMMUNICATIONS INCLUDED A COMMAND SUBSYSTEM OPERATING AT 154.2 AND 2106.4 MHZ AND A PULSE CODE MODULATED (PCM) NARROW-BAND TELEMETRY SUBSYSTEM, OPERATING AT 2287.5 AND 137.86 MHZ, FOR SPACECRAFT HOUSEKEEPING, ATTITUDE, AND SENSOR PERFORMANCE DATA. VIDEO DATA FROM THE THREE-CAMERA RBV SYSTEM WERE TRANSMITTED IN BOTH REAL-TIME AND TAPE RECORDER MODES AT 2265.5 MHZ, WHILE INFORMATION FROM THE MSS WAS CONSTRAINED TO A 20-MHZ RF BANDWIDTH AT 2229.5 MHZ. WITH THE EXCEPTION OF THE RBV, WHICH WAS TURNED OFF 2 WEEKS AFTER LAUNCH WHEN AN EXCESSIVE POWER DRAIN WAS OBSERVED IN THE SPACECRAFT ELECTRICAL SYSTEM, AND ONE WBVTR THAT IS ALSO INOPERABLE, THE SPACECRAFT AND EXPERIMENTS WERE PERFORMING NORMALLY AS OF AUGUST 1972.

REFERENCES
140, 315, 397, 502, 539, 548, 554, 701, 702, 742, 767, 794, AND 834.

EXPERIMENT NAME- RETURN BEAM VIDICON (RBV) CAMERA SYSTEM NSSDC ID 72-058A-01

EXPERIMENT PERSONNEL

PI - O. WEINSTEIN	NASA-GSFC	GREENBELT, MD.
OI - T. RAGLAND	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- OPERATIONAL OFF
DATE LAST USABLE DATA RECORDED- 080672

EXPERIMENT BRIEF DESCRIPTION

THE ERTS 1 RETURN BEAM VIDICON (RBV) CAMERA SYSTEM CONTAINED THREE INDEPENDENT CAMERAS COVERING THE THREE SPECTRAL BANDS FROM BLUE-GREEN (0.47 TO 0.575 MICRON) THROUGH YELLOW-RED (0.58 TO 0.68 MICRON) TO NEAR INFRARED (0.69 TO 0.83 MICRON). WHILE DESIGNED PRIMARILY TO OBTAIN INFORMATION FOR EARTH RESOURCE TYPE STUDIES, THE RBV CAMERA SYSTEM WAS ALSO USED TO CONDUCT METEOROLOGICAL STUDIES, I.E., TO INVESTIGATE ATMOSPHERIC ATTENUATION AND TO OBSERVE MESOSCALE PHENOMENA, WINTER MONSOON CLOUDS (JAPAN), SNOW COVER, ETC. THE THREE EARTH-ORIENTED CAMERAS WERE MOUNTED TO A COMMON BASE, WHICH WAS STRUCTURALLY ISOLATED FROM THE SPACECRAFT TO MAINTAIN ACCURATE ALIGNMENT. EACH CAMERA CONTAINED AN OPTICAL LENS, A 5.08-CM RETURN BEAM VIDICON, A THERMOELECTRIC COOLER, DEFLECTION AND FOCUS COILS, A MECHANICAL SHUTTER, ERASE LAMPS, AND SENSOR ELECTRONICS. THE CAMERAS WERE SIMILAR EXCEPT FOR THE SPECTRAL FILTERS CONTAINED IN THE LENS ASSEMBLIES THAT PROVIDED SEPARATE SPECTRAL VIEWING REGIONS. THE VIEWED GROUND SCENE, 185 BY 185 KM IN AREA, WAS STORED ON THE PHOTOSENSITIVE SURFACE OF THE CAMERA TUBE, AND, AFTER SHUTTERING, THE IMAGE WAS SCANNED BY AN ELECTRON BEAM TO PRODUCE A VIDEO SIGNAL OUTPUT. EACH CAMERA WAS READ OUT SEQUENTIALLY, REQUIRING ABOUT 3.5 SEC FOR EACH OF THE SPECTRAL IMAGES. THE CAMERAS WERE RESHUTTERED EVERY 25 SEC TO PRODUCE OVERLAPPING IMAGES ALONG THE DIRECTION OF SPACECRAFT MOTION. VIDEO DATA FROM THE RBV WERE TRANSMITTED (2265.5 MHZ) IN BOTH REAL-TIME AND TAPE RECORDER MODES. FROM A NOMINAL SPACECRAFT ALTITUDE OF 900 KM, THE RBV HAD A HORIZONTAL RESOLUTION OF ABOUT 0.7 KM. DATA FROM THIS EXPERIMENT ARE HANDLED BY THE NASA DATA PROCESSING FACILITY, GSFC, GREENBELT, MD., AND ARE AVAILABLE TO APPROVED INVESTIGATORS AND AGENCIES THROUGH ITS ERTS USERS SERVICES SECTION. ALL OTHER INTERESTED PERSONS MAY OBTAIN DATA FROM THE EARTH RESOURCES DATA CENTER, DEPARTMENT OF THE INTERIOR, SIOUX FALLS, S.D. THE RBV PERFORMED NORMALLY AFTER LAUNCH BUT WAS PLACED OPERATIONALLY OFF ON AUGUST 6, 1972, WHEN AN EXCESSIVE POWER DRAIN OCCURRED IN THE SPACECRAFT ELECTRICAL SYSTEM.

REFERENCES

60, 71, 348, 383, 548, 550, 555, AND 654.

EXPERIMENT NAME- MULTISPECTRAL SCANNER (MSS) NSSDC ID 72-058A-02

EXPERIMENT PERSONNEL

PI - NONE ASSIGNED	NONE ASSIGNED	

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE ERTS 1 MULTISPECTRAL SCANNER (MSS) WAS DESIGNED TO PROVIDE REPETITIVE DAYTIME ACQUISITION OF HIGH-RESOLUTION, MULTISPECTRAL DATA OF THE EARTH'S SURFACE ON A GLOBAL BASIS AND TO DEMONSTRATE THAT REMOTE SENSING FROM SPACE IS A FEASIBLE AND PRACTICAL APPROACH TO EFFICIENT MANAGEMENT OF THE EARTH'S RESOURCES. IN ADDITION TO OBTAINING DATA FOR USE IN EARTH RESOURCE TYPE STUDIES, THE MSS SYSTEM WAS USED TO CONDUCT OCEANOGRAPHIC AND METEOROLOGICAL STUDIES, I.E., TO MAP SEA-ICE FIELDS, LOCATE AND TRACK MAJOR OCEAN CURRENTS, MONITOR BOTH AIR AND WATER POLLUTION, DETERMINE SNOW COVER, INVESTIGATE SEVERE STORM ENVIRONMENTS, ETC. THE MSS CONSISTED OF A 22.86-CM

DOUBLE REFLECTOR-TYPE TELESCOPE, SCANNING MIRROR, FILTERS, DETECTORS, AND ASSOCIATED ELECTRONICS. THE SCANNER OPERATED IN THE FOLLOWING SPECTRAL INTERVALS -- BAND 1, 0.5 TO 0.6 MICRON, BAND 2, 0.6 TO 0.7 MICRON, BAND 3, 0.7 TO 0.8 MICRON, AND BAND 4, 0.8 TO 1.1 MICRONS. INCOMING RADIATION WAS COLLECTED BY THE SCANNING MIRROR, WHICH OSCILLATED 2.89 DEG TO EITHER SIDE OF NADIR AND SCANNED CROSS-TRACK SWATHS 185 KM WIDE. THE ALONG-TRACK SCAN WAS PRODUCED BY THE ORBITAL MOTION OF THE SPACECRAFT. THE PRIMARY IMAGE PRODUCED AT THE IMAGE PLANE OF THE TELESCOPE WAS RELAYED BY USE OF FIBER OPTIC BUNDLES TO DETECTORS WHERE CONVERSION TO AN ELECTRONIC SIGNAL WAS ACCOMPLISHED. OPTICAL FILTERS WERE USED TO PRODUCE THE DESIRED SPECTRAL SEPARATION. SIX DETECTORS WERE EMPLOYED IN EACH OF THE FOUR SPECTRAL BANDS -- BANDS 1 THROUGH 3 USED PHOTOMULTIPLIER TUBES AS DETECTORS, AND BAND 4 USED SILICON PHOTODIODES. A MULTIPLEXER INCLUDED IN THE MSS SYSTEM PROCESSED THE SCANNER'S 24 CHANNELS OF VIDEO DATA. THE DATA WERE TIME-MULTIPLEXED AND THEN CONVERTED TO A PULSE CODE MODULATED (PCM) SIGNAL BY AN A/D CONVERTER. THE DATA WERE THEN TRANSMITTED (2229.5 MHZ) DIRECTLY TO AN ACQUISITION STATION OR, IN THE CASE OF REMOTE AREAS, STORED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK THE NEXT TIME THE SPACECRAFT CAME WITHIN COMMUNICATION RANGE OF AN ACQUISITION STATION. DATA FROM THIS EXPERIMENT ARE HANDLED BY THE NASA DATA PROCESSING FACILITY, GSFC, GREENBELT, MD., AND ARE AVAILABLE TO APPROVED INVESTIGATORS AND AGENCIES THROUGH ITS ERTS USERS SERVICES SECTION. ALL OTHER INTERESTED INDIVIDUALS MAY OBTAIN DATA THROUGH THE EARTH RESOURCES DATA CENTER, DEPARTMENT OF THE INTERIOR, SIOUX FALLS, S.D. AS OF AUGUST 1972, THE EXPERIMENT WAS OPERATING NORMALLY.

REFERENCES

60, 71, 217, 379, 383, 504, 548, 550, 555, AND 888.

EXPERIMENT NAME- DATA COLLECTION SYSTEM (DCS) NSSDC ID 72-058A-03

EXPERIMENT PERSONNEL

PI - NONE ASSIGNED NONE ASSIGNED

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE PURPOSE OF THE ERTS 1 DATA COLLECTION SYSTEM (DCS) WAS TO PROVIDE USERS WITH NEAR REAL-TIME DATA COLLECTED FROM VARIOUS REMOTE LOCATIONS. THE DCS WAS COMPOSED OF OF THREE DISTINCT SUBSYSTEMS -- (1) THE DATA COLLECTION PLATFORMS (DCP'S), (2) THE SATELLITE EQUIPMENT, AND (3) THE GROUND DATA CENTERS, WHICH INCLUDED REMOTE RECEIVING SITES AND THE GROUND DATA HANDLING SYSTEM AT GSFC. USE OF THE ERTS SPACEBORNE DCS PROVIDED A CONTINUAL FLOW OF INFORMATION TO BE USED FOR MANAGEMENT OF WILDLIFE, MARINE, AGRICULTURE, WATER, AND FORESTRY RESOURCES AND TO LEAD TO IMPROVED WEATHER FORECASTS, POLLUTION CONTROL, AND EARTHQUAKE PREDICTION AND WARNING. THE ENVIRONMENTAL SENSORS MOUNTED ON A DCP WERE SELECTED BY INDIVIDUAL INVESTIGATORS TO SATISFY THEIR PARTICULAR REQUIREMENTS. FROM A NOMINAL ORBIT OF APPROXIMATELY 900 KM, THE SPACECRAFT WAS CAPABLE OF ACQUIRING DATA FROM DCP'S WITHIN A RADIUS OF AROUND 3100 KM FROM THE SUBSATELLITE POINT, THUS ALLOWING DATA TO BE OBTAINED FROM ANY REMOTE PLATFORM AT LEAST ONCE EVERY 12 HR. THE DCPS' TRANSMITTER FREQUENCY WAS 401.55 MHZ. LACKING INTERROGATION CAPABILITIES, THE DCS EQUIPMENT IN THE SPACECRAFT WAS ESSENTIALLY A RECEIVER. THE DATA WERE SIMPLY RECEIVED AND RETRANSMITTED (AT 2287.5 MHZ) TO SELECTED GROUND RECEIVING STATIONS. THERE WAS NO SIGNAL MULTIPLEXING OR DATA PROCESSING ON THE SATELLITE. THE ERTS DCS WAS DESIGNED TO ACCOMMODATE UP TO 1000 DCP'S DEPLOYED THROUGHOUT THE CONTINENTAL UNITED STATES. HOWEVER, THE DCS INITIALLY CONSISTED OF A PILOT GROUP OF ONLY SIX DCP'S WITH USER AGENCIES PROCURING, INSTRUMENTING, AND DEVELOPING ADDITIONAL PLATFORMS ACCORDING TO

THEIR NEEDS. DATA FROM THIS EXPERIMENT ARE HANDLED AND DISTRIBUTED TO THE VARIOUS PLATFORM INVESTIGATORS BY THE NASA DATA PROCESSING FACILITY, GSFC, GREENBELT, MD.

REFERENCES

60, AND 68.

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SPACECRAFT COMMON NAME- ERTS-B NSSDC ID ERTS-B
ALTERNATE NAMES- EARTH RESOURCES TECH SAT, PL-733D

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 912.000 KM ALT
PERIGEE- 912.000 KM ALT
PERIOD- 103. MIN
INCLINATION- 99.088 DEG

OTHER INFORMATION
SPACECRAFT WT- 816. KG
LAUNCH DATE- 11/00/73
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - S.	WEILAND	NASA-GSFC	GREENBELT, MD
PS - W.P.	NORDBERG	NASA-GSFC	GREENBELT, MD

SPACECRAFT BRIEF DESCRIPTION

THE EARTH RESOURCES TECHNOLOGY SATELLITE ERTS-B WILL BE A MODIFIED VERSION OF THE NIMBUS 4 METEOROLOGICAL SATELLITE. THE NEAR-POLAR ORBITING SPACECRAFT WILL SERVE AS A STABILIZED, EARTH-ORIENTED PLATFORM FOR OBTAINING INFORMATION ON AGRICULTURAL AND FORESTRY RESOURCES, GEOLOGY AND MINERAL RESOURCES, HYDROLOGY AND WATER RESOURCES, GEOGRAPHY, CARTOGRAPHY, ENVIRONMENTAL POLLUTION, OCEANOGRAPHY AND MARINE RESOURCES, AND METEOROLOGICAL PHENOMENA. TO ACCOMPLISH THESE OBJECTIVES THE SPACECRAFT WILL BE EQUIPPED WITH (1) A FOUR-CHANNEL MULTISPECTRAL SCANNER (MSS) AND A THREE-CAMERA RETURN BEAM VIDICON (RBV) TO OBTAIN BOTH VISIBLE AND INFRARED PHOTOGRAPHIC AND RADIOMETRIC IMAGES OF THE EARTH, (2) A DATA COLLECTION SYSTEM TO COLLECT INFORMATION FROM REMOTE INDIVIDUALLY EQUIPPED GROUND STATIONS AND TO RELAY THE DATA TO CENTRAL ACQUISITION STATIONS. ERTS-B WILL CARRY TWO WIDE-BAND VIDEO TAPE RECORDERS (WBVTR) CAPABLE OF STORING UP TO 30 MIN OF SCANNER OR CAMERA DATA TO GIVE THE SPACECRAFT'S SENSORS A NEAR-GLOBAL COVERAGE CAPABILITY. AN ADVANCED ATTITUDE CONTROL SYSTEM CONSISTING OF HORIZON SCANNERS, SUN SENSORS, AND A COMMAND ANTENNA COMBINED WITH A FREON GAS PROPULSION SYSTEM WILL PERMIT THE SPACECRAFT'S ORIENTATION TO BE CONTROLLED TO WITHIN PLUS OR MINUS 0.7 DEG IN ALL THREE AXES. SPACECRAFT COMMUNICATIONS WILL INCLUDE A COMMAND SUBSYSTEM OPERATING AT 154.2 AND 2106.4 MHZ AND A PULSE CODE MODULATED (PCM) NARROW-BAND TELEMETRY SUBSYSTEM, OPERATING AT 2287.5 AND 137.86 MHZ, FOR SPACECRAFT HOUSEKEEPING, ATTITUDE, AND SENSOR PERFORMANCE DATA. VIDEO DATA FROM THE THREE-CAMERA RBV SYSTEM WILL BE TRANSMITTED IN BOTH REAL TIME AND FROM THE WIDE-BAND RECORDER SYSTEM AT 2265.5 MHZ, WHILE INFORMATION FROM THE MSS WILL BE CONSTRAINED TO A 20-MHZ RF BANDWIDTH AT 2229.5 MHZ.

REFERENCES

60, 65, 66, 67, 315, 397, 399, 516, 539, 548, 554, 701, 702, AND 794.

EXPERIMENT NAME- RETURN BEAM VIDICON (RBV) CAMERA SYSTEM NSSDC ID ERTS-B -01

EXPERIMENT PERSONNEL

PI - O.	WEINSTEIN	NASA-GSFC	GREENBELT, MD.
OI - T.	RAGLAND	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ERTS-B RETURN BEAM VIDICON (RBV) CAMERA SYSTEM CONTAINS THREE INDEPENDENT CAMERAS COVERING THE THREE SPECTRAL BANDS FROM BLUE-GREEN (0.47 TO 0.575 MICRON) THROUGH YELLOW-RED (0.58 TO 0.68 MICRON) TO NEAR INFRARED (0.69 TO 0.83 MICRON). WHILE DESIGNED PRIMARILY TO OBTAIN INFORMATION FOR EARTH RESOURCE TYPE STUDIES, THE RBV CAMERA SYSTEM CAN ALSO BE USED TO CONDUCT METEOROLOGICAL STUDIES, I.E., TO INVESTIGATE ATMOSPHERIC ATTENUATION AND TO OBSERVE MESOSCALE PHENOMENA, WINTER MONSOON CLOUDS (JAPAN), SNOW COVER, ETC. THE THREE EARTH-ORIENTED CAMERAS ARE MOUNTED TO A COMMON BASE, WHICH IS STRUCTURALLY ISOLATED FROM THE SPACECRAFT TO MAINTAIN ACCURATE ALIGNMENT. EACH CAMERA CONTAINS AN OPTICAL LENS, A 5.08-CM RETURN BEAM VIDICON, A THERMOELECTRIC COOLER DEFLECTION AND FOCUS COILS, A MECHANICAL SHUTTER, ERASE LAMPS, AND SENSOR ELECTRONICS. THE CAMERAS ARE SIMILAR EXCEPT FOR THE SPECTRAL FILTERS CONTAINED IN THE LENS ASSEMBLIES THAT PROVIDE SEPARATE SPECTRAL VIEWING REGIONS. THE VIEWED GROUND SCENE, 185 BY 185 KM IN AREA, WILL BE STORED ON THE PHOTOSENSITIVE SURFACE OF THE CAMERA TUBE, AND, AFTER SHUTTERING, THE IMAGE WILL BE SCANNED BY AN ELECTRON BEAM TO PRODUCE A VIDEO SIGNAL OUTPUT. EACH CAMERA WILL BE READ OUT SEQUENTIALLY, REQUIRING ABOUT 3.5 SEC FOR EACH OF THE SPECTRAL IMAGES. THE CAMERAS WILL BE RESHUTTERED EVERY 25 SEC TO PRODUCE OVERLAPPING IMAGES ALONG THE DIRECTION OF SPACECRAFT MOTION. VIDEO DATA FROM THE RBV WILL BE TRANSMITTED (2265.5) IN BOTH REAL-TIME AND TAPE RECORDER MODES. FROM A NOMINAL SPACECRAFT ALTITUDE OF 912 KM, THE RBV WILL HAVE A HORIZONTAL RESOLUTION OF ABOUT 0.7 KM. DATA FROM THIS EXPERIMENT WILL BE HANDLED BY THE NASA DATA PROCESSING FACILITY, GSFC, GREENBELT, MD., AND WILL BE MADE AVAILABLE TO APPROVED INVESTIGATORS AND AGENCIES THROUGH ITS ERTS USERS SERVICES SECTION. ALL OTHER INTERESTED INDIVIDUALS WILL BE ABLE TO OBTAIN DATA THROUGH THE EARTH RESOURCES DATA CENTER, DEPARTMENT OF THE INTERIOR, SIOUX FALLS, S.D.

REFERENCES

60, 548, 550, 555, AND 654.

EXPERIMENT NAME- MULTISPECTRAL SCANNER (MSS) NSSDC ID ERTS-B -02

EXPERIMENT PERSONNEL

PI -	NONE ASSIGNED	NONE ASSIGNED

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ERTS-B MULTISPECTRAL SCANNER (MSS) IS DESIGNED TO PROVIDE REPETITIVE DAY/NIGHT ACQUISITION OF HIGH-RESOLUTION MULTISPECTRAL DATA OF THE EARTH'S SURFACE ON A GLOBAL BASIS. WHILE ITS PRIMARY FUNCTION IS TO OBTAIN INFORMATION IN VARIOUS AREAS SUCH AS AGRICULTURE, FORESTRY, GEOLOGY, AND HYDROLOGY, THE MSS SYSTEM CAN ALSO BE USED FOR OCEANOGRAPHIC AND METEOROLOGICAL PURPOSES, I.E., TO MAP SEA-ICE FIELDS, LOCATE AND TRACK MAJOR

OCEAN CURRENTS, MONITOR BOTH AIR AND WATER POLLUTION, DETERMINE SNOW COVER, INVESTIGATE SEVERE STORM ENVIRONMENTS, ETC. THE MSS WILL CONSIST OF A 22.86-CM DOUBLE REFLECTOR-TYPE TELESCOPE, SCANNING MIRROR, FILTERS, DETECTORS, AND ASSOCIATED ELECTRONICS. THE SCANNER WILL OPERATE IN THE FOLLOWING SPECTRAL INTERVALS -- BAND 1, 0.5 TO 0.6 MICRON, BAND 2, 0.6 TO 0.7 MICRON, BAND 3, 0.7 TO 0.8 MICRON, BAND 4, 0.8 TO 1.1 MICRONS, AND BAND 5, 10.4 TO 12.6 MICRONS. THIS LAST BAND, WHICH LIES IN THE THERMAL (EMISSIVE) PART OF THE SPECTRUM, WILL GIVE ERTS-B NIGHTTIME SENSING CAPABILITIES, A FEATURE LACKING IN THE MSS ON ERTS 1. INCOMING RADIATION WILL BE COLLECTED BY THE SCANNING MIRROR, WHICH WILL OSCILLATE 2.89 DEG TO EITHER SIDE OF NADIR AND SCAN CROSS-TRACK SWATHS 185 KM WIDE. THE ALONG-TRACK SCAN WILL BE PRODUCED BY THE ORBITAL MOTION OF THE SPACECRAFT. THE PRIMARY IMAGE PRODUCED AT THE IMAGE PLANE WILL BE RELAYED BY USE OF FIBER OPTIC BUNDLES TO DETECTORS WHERE CONVERSION TO AN ELECTRONIC SIGNAL WILL BE ACCOMPLISHED. OPTICAL FILTERS WILL BE USED TO PRODUCE THE DESIRED SPECTRAL SEPARATION. SIX DETECTORS WILL BE EMPLOYED IN EACH OF THE FIRST FOUR SPECTRAL BANDS AND TWO IN THE FIFTH BAND -- BANDS 1 THROUGH 3 WILL USE PHOTOMULTIPLIER TUBES AS DETECTORS, BAND 4 WILL USE SILICON PHOTODIODES, AND BAND 5 WILL USE MERCURY-CADMIUM-TELLURIDE DETECTORS. A MULTIPLEXER INCLUDED IN THE MSS SYSTEM WILL PROCESS THE SCANNER'S 26 CHANNELS OF DATA. THESE DATA WILL BE TIME-MULTIPLEXED AND THEN CONVERTED TO A PULSE CODE MODULATED (PCM) SIGNAL BY AN AD CONVERTER. THE DATA CAN THEN BE TRANSMITTED (2229.5 MHZ) DIRECTLY TO AN ACQUISITION STATION OR STORED ON MAGNETIC TAPE FOR SUBSEQUENT PLAYBACK THE NEXT TIME THE SPACECRAFT COMES WITHIN COMMUNICATION RANGE OF AN ACQUISITION STATION. DATA FROM THIS EXPERIMENT WILL BE HANDLED BY THE NASA DATA PROCESSING FACILITY, GSFC, GREENBELT, MD., AND WILL BE MADE AVAILABLE TO APPROVED INVESTIGATORS THROUGH ITS ERTS USERS SERVICES SECTION. ALL OTHER INTERESTED INDIVIDUALS WILL BE ABLE TO OBTAIN DATA THROUGH THE EARTH RESOURCES DATA CENTER, DEPARTMENT OF THE INTERIOR, SIOUX FALLS, S.D.

REFERENCES

60, 217, 379, 504, 548, 550, 555, AND 888.

EXPERIMENT NAME- DATA COLLECTION SYSTEM (DCS) NSSDC ID ERTS-B -03

EXPERIMENT PERSONNEL
PI - NONE ASSIGNED NONE ASSIGNED

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE PURPOSE OF THE ERTS-B DATA COLLECTION SYSTEM (DCS) IS TO PROVIDE USERS WITH NEAR REAL-TIME DATA COLLECTED FROM VARIOUS REMOTE LOCATIONS. THE DCS IS COMPOSED OF THREE DISTINCT SUBSYSTEMS -- (1) THE DATA COLLECTION PLATFORMS (DCP'S), (2) THE SATELLITE EQUIPMENT, AND (3) THE GROUND DATA CENTERS, WHICH INCLUDE REMOTE RECEIVING SITES AND THE GROUND DATA HANDLING SYSTEM AT GSFC. USE OF THE ERTS SPACEBORNE DCS WILL PROVIDE A CONTINUAL FLOW OF INFORMATION FOR BETTER MANAGEMENT OF WILDLIFE, MARINE, AGRICULTURE, WATER, AND FORESTRY RESOURCES AND WILL LEAD TO IMPROVED WEATHER FORECASTS, POLLUTION CONTROL, AND EARTHQUAKE PREDICTION AND WARNING. THE ENVIRONMENTAL SENSORS TO BE MOUNTED ON A DCP WILL BE SELECTED BY INDIVIDUAL INVESTIGATORS TO SATISFY THEIR PARTICULAR REQUIREMENTS. FROM A PLANNED ORBIT OF 912 KM, THE SPACECRAFT WILL BE CAPABLE OF ACQUIRING DATA FROM DCP'S WITHIN A RADIUS OF 3143 KM FROM THE SUBSATELLITE POINT, THUS ALLOWING DATA TO BE OBTAINED FROM ANY REMOTE PLATFORM AT LEAST ONCE EVERY 12 HR. THE DCP'S WILL TRANSMIT AT 401.55 MHZ. LACKING INTERROGATION CAPABILITIES, THE DCS EQUIPMENT IN THE SPACECRAFT IS ESSENTIALLY A RECEIVER. THE DATA WILL BE SIMPLY RECEIVED AND RETRANSMITTED (AT 2287.5 MHZ) TO SELECTED GROUND RECEIVING STATIONS. THERE

WILL BE NO SIGNAL MULTIPLEXING OR DATA PROCESSING ON THE SATELLITE. THE ERTS DCS IS DESIGNED TO ACCOMMODATE UP TO 1000 DCP'S DEPLOYED THROUGHOUT THE CONTINENTAL UNITED STATES. HOWEVER, THE DCS PROBABLY WILL CONSIST OF ONLY A SMALL NUMBER OF INITIAL DCP'S, AND USER AGENCIES WILL BE ABLE TO PROCURE, INSTRUMENT, AND DEVELOP ADDITIONAL PLATFORMS ACCORDING TO THEIR NEEDS. DATA FROM THIS EXPERIMENT WILL BE HANDLED AND DISTRIBUTED TO THE VARIOUS PLATFORM INVESTIGATORS BY THE NASA DATA PROCESSING FACILITY, GSFC, GREENBELT, MD.

REFERENCES
60, AND 68.

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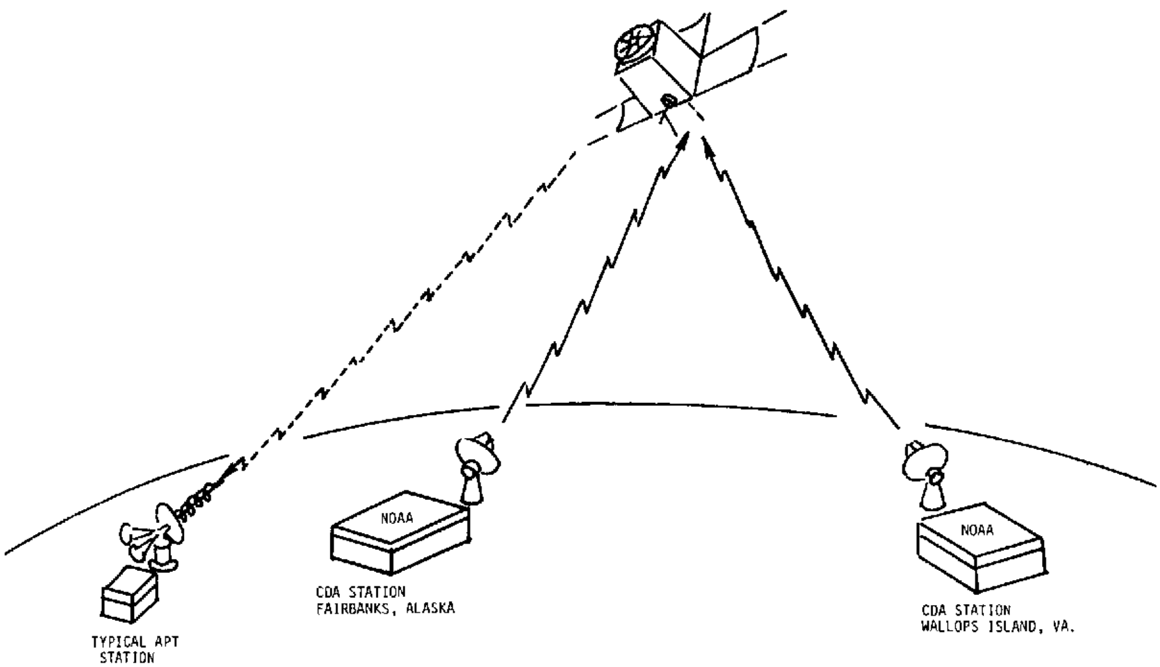

ITOS / NOAA SERIES

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8. ITOS/NOAA Series

SPACECRAFT COMMON NAME- ITOS 1 NSSDC ID 70-008A
ALTERNATE NAMES- TIROS-M

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 02/13/70
APOGEE- 1478.50 KM ALT
PERIGEE- 1432.79 KM ALT
PERIOD- 115.0 MIN
INCLINATION- 101.991 DEG

OTHER INFORMATION
SPACECRAFT WT- 306.9 KG
LAUNCH DATE- 01/23/70
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 061871

SPACECRAFT PERSONNEL

PM - W.W.	JONES	NASA-GSFC	GREENBELT, MD.
PS - I.L.	GOLDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ITOS 1 (TIROS-M) WAS THE PROTOTYPE SPACECRAFT FOR THE SECOND GENERATION OF OPERATIONAL SUN-SYNCHRONOUS METEOROLOGICAL SPACECRAFT. THE PRIMARY OBJECTIVE OF ITOS 1 WAS TO PROVIDE IMPROVED OPERATIONAL INFRARED AND VISUAL OBSERVATIONS OF EARTH CLOUD COVER FOR USE IN WEATHER ANALYSIS AND FORECASTING. SECONDARY OBJECTIVES INCLUDED PROVIDING BOTH SOLAR PROTON AND GLOBAL HEAT BALANCE DATA ON A REGULAR DAILY BASIS. TO ACCOMPLISH THESE TASKS, THE SPACECRAFT CARRIED FOUR CAMERAS, TWO TELEVISION CAMERAS FOR AUTOMATIC PICTURE TRANSMISSION (APT) AND TWO ADVANCED VIDICON CAMERA SYSTEM (AVCS) CAMERAS. IT ALSO CARRIED A LOW-RESOLUTION FLAT PLATE RADIOMETER (FPR), A SOLAR PROTON MONITOR (SPM), AND TWO SCANNING RADIOMETERS THAT NOT ONLY MEASURED EMITTED INFRARED RADIATION BUT ALSO SERVED AS A BACKUP SYSTEM FOR THE APT AND AVCS CAMERAS. THE NEARLY CUBICAL SPACECRAFT MEASURED 1 BY 1 BY 1.2 M. THE TV CAMERAS AND INFRARED SENSORS WERE MOUNTED ON THE SATELLITE BASEPLATE WITH THEIR OPTICAL AXES DIRECTED VERTICALLY EARTHWARD. THE SATELLITE WAS EQUIPPED WITH THREE CURVED SOLAR PANELS THAT WERE FOLDED DURING LAUNCH AND DEPLOYED AFTER ORBIT WAS ACHIEVED. EACH PANEL MEASURED OVER 4.2 M IN LENGTH WHEN UNFOLDED AND WAS COVERED WITH 3420 SOLAR CELLS, EACH MEASURING 2 BY 2 CM. THE ITOS 1 DYNAMICS AND ATTITUDE CONTROL SYSTEM MAINTAINED DESIRED SPACECRAFT ORIENTATION THROUGH GYROSCOPIC PRINCIPLES INCORPORATED INTO THE SATELLITE DESIGN. EARTH ORIENTATION OF THE SATELLITE BODY WAS MAINTAINED BY TAKING ADVANTAGE OF THE PRECESSION INDUCED FROM A MOMENTUM FLYWHEEL SO THAT THE SATELLITE BODY PRECESSION RATE OF ONE REVOLUTION PER ORBIT PROVIDED THE DESIRED 'EARTH LOOKING' ATTITUDE. MINOR ADJUSTMENTS IN ATTITUDE AND ORIENTATION WERE MADE BY MEANS OF MAGNETIC COILS AND BY VARYING THE SPEED OF THE MOMENTUM FLYWHEEL. LAUNCHED INTO A NEAR-POLAR ORBIT, THE SPACECRAFT AND EXPERIMENTS PERFORMED NORMALLY UNTIL THE INCREMENTAL TAPE RECORDER (ITR) FAILED ON NOVEMBER 16, 1970, RESULTING IN PARTIAL LOSS OF SPM AND FPR DATA. OVERHEATING DEVELOPED IN THE SATELLITE ATTITUDE CONTROL SYSTEM DURING MARCH 1971. ATTEMPTS TO CORRECT THE PROBLEM WERE UNSUCCESSFUL, AND THE SPACECRAFT WAS DEACTIVATED ON JUNE 18, 1971.

REFERENCES

98, 99, 100, 101, 102, 110, 111, 112, 114, 115, 141, 202, 208, 254, 255, 271, 272, 280, 281, 285, 405, 438, 501, 511, 540, 569, 639, 675, 759, 788, AND 938.

EXPERIMENT NAME- FLAT PLATE RADIOMETER (FPR)   NSSDC ID 70-008A-02

EXPERIMENT PERSONNEL
PI - V.E. SUOMI   U OF WISCONSIN   MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 061871

EXPERIMENT BRIEF DESCRIPTION
THE ITOS 1 FLAT PLATE RADIOMETER (FPR) SYSTEM WAS DESIGNED TO PROVIDE A MEASUREMENT OF THE GLOBAL DISTRIBUTION OF REFLECTED SOLAR AND LONGWAVE RADIATION LEAVING THE EARTH. THE FPR SYSTEM CONSISTED OF FOUR DETECTORS, AN ANALOG-TO-DIGITAL CONVERTER, AND A TAPE RECORDER. THE DETECTORS HAD A HEMISPHERIC FIELD OF VIEW OF 2 PI STER AND WERE MOUNTED ON THE SATELLITE BASEPLATE FACING EARTHWARD. THE DETECTORS USED COATED ALUMINUM DISCS AS A SENSING ELEMENT. TWO OF THE DISCS WERE WHITE AND RESPONDED ONLY TO INFRARED ENERGY (7 TO 30 MICRONS) RADIATED FROM THE EARTH AND ITS ATMOSPHERE. THE OTHER TWO DISCS WERE PAINTED BLACK AND HAD A BROADER BAND SENSITIVITY (0.3 TO 30 MICRONS). TWO DISCS (ONE OF EACH TYPE) HAD A THERMISTOR BOLOMETER MOUNTED ON THE BACK SURFACE TO MEASURE THE DISC TEMPERATURE. THE OTHER TWO DISCS USED THERMOPILES. AN IDENTICAL EXPERIMENT WAS FLOWN ON ESSA 3, 5, 7, AND 9. FOR A FULL DESCRIPTION OF THE FPR SYSTEM, SEE 'STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS, ANNUAL REPORT - 1967,' PAGES 179 TO 189, DEPT. OF METEOROLOGY, UNIVERSITY OF WISCONSIN, MARCH 1968. THE EXPERIMENT WAS A SUCCESS, AND GOOD DATA WERE OBTAINED UNTIL NOVEMBER 16, 1970, WHEN THE INCREMENTAL TAPE RECORDER ON BOARD FAILED. HOWEVER, LIMITED REAL-TIME DATA WERE OBTAINED UNTIL JUNE 18, 1971. DATA FROM THIS EXPERIMENT ARE MAINTAINED ON MAGNETIC TAPE AT NOAA-NESS, SUITLAND, MD.

REFERENCES
111, 114, 115, 195, 254, 285, 709, 720, 788, AND 939.

EXPERIMENT NAME- SCANNING RADIOMETER (SR)   NSSDC ID 70-008A-03

EXPERIMENT PERSONNEL
PI - NESS STAFF   NOAA-NESS   SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 040071

EXPERIMENT BRIEF DESCRIPTION
THE ITOS 1 SCANNING RADIOMETER (SR) SUBSYSTEM CONSISTED OF TWO SCANNING RADIOMETERS, A DUAL SR PROCESSOR, AND TWO SR RECORDERS. THIS SUBSYSTEM PERMITTED THE DETERMINATION OF SURFACE TEMPERATURES OF THE GROUND, THE SEA, OR CLOUD TOPS VIEWED BY THE RADIOMETER. THE RADIOMETER MEASURED REFLECTED RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 0.52- TO 0.73-MICRON BAND DURING THE DAY AND EMITTED RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN THE 10.5- TO 12.5-MICRON BAND DURING THE DAY AND NIGHT. UNLIKE A CAMERA, THE SR DID NOT TAKE A PICTURE BUT INSTEAD FORMED AN IMAGE USING A CONTINUOUSLY ROTATING MIRROR. THE MIRROR SCANNED THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH AT A RATE OF 48 RPM. AS THE SATELLITE PROGRESSED ALONG ITS ORBITAL PATH, EACH ROTATION OF THE MIRROR PROVIDED ONE SCAN LINE OF PICTURE. RADIATION COLLECTED BY THE MIRROR WAS PASSED THROUGH A BEAM SPLITTER AND SPECTRAL FILTER TO PRODUCE THE DESIRED SPECTRAL SEPARATION. UP TO TWO FULL ORBITS OF DATA (145 MIN) COULD BE STORED ON MAGNETIC TAPE FOR SUBSEQUENT TRANSMISSION (1697.5 MHZ) TO AN ACQUISITION

STATION. THE DATA COULD ALSO BE TRANSMITTED IN REAL TIME TO LOCAL APT STATIONS. ONCE THE SIGNAL WAS RECEIVED BY THE GROUND STATION, A CONTINUOUS PICTURE WAS FORMED BY USING A FACSIMILE RECORDER WHOSE SCAN WAS IN PHASE WITH THE SATELLITE'S FORWARD MOTION. AT NOMINAL SPACECRAFT ALTITUDE (APPROXIMATELY 1450 KM), THE RADIOMETER HAD A GROUND RESOLUTION OF BETTER THAN 4 KM AT NADIR. THE RADIOMETER WAS CAPABLE OF YIELDING RADIANCE TEMPERATURES FROM 185 TO 330 DEG K TO AN ACCURACY OF 4 AND 1 DEG K, RESPECTIVELY. THE SR SUBSYSTEM FUNCTIONED NORMALLY UNTIL APRIL 1971, WHEN THE SPACECRAFT WAS PLACED IN A STANDBY STATUS OWING TO OVERHEATING IN THE SPACECRAFT ATTITUDE CONTROL SYSTEM. SOME DATA WERE RECEIVED DURING SUBSEQUENT ATTEMPTS TO CORRECT THE PROBLEM. ALL DATA ACQUISITION CEASED AFTER JUNE 18, 1971, WHEN THE SPACECRAFT WAS DEACTIVATED. DATA FROM THIS EXPERIMENT ARE AVAILABLE THROUGH NOAA-NESS, SUITLAND, MD. AN IDENTICAL EXPERIMENT WAS FLOWN ON NOAA 1.

REFERENCES

83, 110, 112, 114, 115, 254, 285, 305, 318, 325, 369, 370, 558, 561, 569, 594, 711, 742, 746, 747, 748, 759, 871, 925, 938, AND 939.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS)   NSSDC ID 70-008A-04

EXPERIMENT PERSONNEL

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 061871

EXPERIMENT BRIEF DESCRIPTION

THE ITOS 1 ADVANCED VIDICON CAMERA SYSTEM (AVCS) WAS A REDUNDANT CAMERA AND TAPE RECORDER COMBINATION DESIGNED TO RECORD A SERIES OF WIDE-ANGLE, HIGH-RESOLUTION TELEVISION PICTURES OF THE EARTH AND ITS CLOUD COVER DURING DAYLIGHT. THE AVCS OPERATED IN THREE MODES -- RECORD, PLAYBACK, AND DIRECT READOUT. THE AVCS SYSTEM FOR ITOS 1 WAS ESSENTIALLY THE SAME AS THAT USED ON ALL AVCS-TOS SPACECRAFT (ESSA 3, 5, 7, AND 9). THE TWO MAJOR ELEMENTS OF THE SYSTEM WERE (1) THE CAMERA SENSOR ASSEMBLY, WHICH CONTAINED LENS, SHUTTER, GRAYSCALE CALIBRATOR, VIDICON, DEFLECTION YOKE, CAMERA ELECTRONICS MODULE, AND POWER CIRCUITS AND (2) A PREAMPLIFIER FOR CONVERTING OPTICAL IMAGES INTO ELECTRICAL SIGNALS. THE EARTH-ORIENTED CAMERA USED A 108-DEG WIDE-ANGLE LENS (5.7-MM FOCAL LENGTH) WITH AN F/1.8 APERTURE AND A 2.54-CM-DIAMETER VIDICON WITH 833 SCAN LINES. A VIDEO FRAME CONSISTED OF A 0.25-SEC PERIOD OF BLANKED VIDEO, FOLLOWED BY 6.25 SEC OF VIDICON SCAN VIDEO (833 LINES), AND A FINAL 0.25-SEC PERIOD OF BLANKED VIDEO. ELEVEN PICTURES WERE TAKEN AT 260-SEC INTERVALS TO COVER THE SUNLIT PORTION OF THE EARTH (SUN ELEVATION GREATER THAN 15 DEG). THE TAPE RECORDER COULD BE READ OUT BETWEEN PHOTOGRAPHIC CYCLES WITHOUT LOSING A PICTURE OR INTERRUPTING A SEQUENCE. AT NOMINAL SATELLITE ALTITUDE (1450 KM), THE AVCS PICTURES COVERED A 3000- BY 3000-KM SQUARE WITH A GROUND RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS A 50 PERCENT PICTURE OVERLAP ALONG THE TRACK TO INSURE COMPLETE COVERAGE. THE TAPE RECORDER COULD STORE UP TO 38 PICTURES (THREE ORBITS OF DATA) IN A SINGLE START-STOP OPERATION. THE AVCS FUNCTIONED NORMALLY UNTIL IT WAS PLACED IN A STANDBY MODE ON MARCH 23, 1971, WHEN OVERHEATING DEVELOPED IN THE SATELLITE CONTROL SYSTEM. THE EXPERIMENT WAS OPERATED INTERMITTENTLY UNTIL JUNE 18, 1971, WHEN THE SPACECRAFT WAS DEACTIVATED. DATA FROM THIS EXPERIMENT ARE AVAILABLE THROUGH THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA.

REFERENCES

83, 98, 101, 110, 112, 114, 115, 285, 288, 742, 788, 925, 938, AND 939.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM — NSSDC ID 70-008A-05

EXPERIMENT PERSONNEL

PI - NESS STAFF — NOAA-NESS — SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 061871

EXPERIMENT BRIEF DESCRIPTION

THE ITOS 1 AUTOMATIC PICTURE TRANSMISSION (APT) EXPERIMENT WAS DESIGNED TO AUTOMATICALLY TAKE WIDE-ANGLE, SLOW SCAN TELEVISION PICTURES OF THE EARTH AND ITS CLOUD COVER DURING DAYLIGHT. THE PHOTOGRAPHIC OPERATIONS OF THE APT SUBSYSTEM WERE CONTROLLED BY PROGRAM COMMANDS TRANSMITTED TO THE SATELLITE BY THE COMMAND AND DATA ACQUISITION (CDA) STATIONS. A COMPLETE APT PICTURE SEQUENCE LASTED APPROXIMATELY 46 MIN, DURING WHICH 11 PICTURES WERE TAKEN AT 260-SEC INTERVALS. THESE PICTURES WERE TRANSMITTED BY 137.5-MHZ REAL-TIME TRANSMITTERS TO APT-EQUIPPED GROUND STATIONS WITHIN COMMUNICATIONS RANGE OF THE SATELLITE. THE APT SUBSYSTEM FOR ITOS 1 WAS ESSENTIALLY THE SAME AS THAT USED ON THE APT-TOS SPACECRAFT (ESSA 2, 4, 6, AND 8). THE MAJOR ELEMENTS OF THE SUBSYSTEM WERE THE CAMERA SENSOR ASSEMBLY, VIDEO AMPLIFIER, CAMERA ELECTRONICS MODULE, AND POWER CIRCUITS. THE EARTH-ORIENTED CAMERA USED A 108-DEG (5.7-MM FOCAL LENGTH) WIDE-ANGLE LENS WITH A MAXIMUM APERTURE OF F/1.8 AND A 2.54-CM-DIAMETER VIDICON WITH 600 SCAN LINES. AT THE NOMINAL SATELLITE ALTITUDE OF 1450 KM, EACH PICTURE COVERED APPROXIMATELY 3140 KM ACROSS THE TRACK AND 2400 KM ALONG THE TRACK WITH A GROUND RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS AN APPROXIMATE 20 PERCENT OVERLAP BETWEEN PICTURES ALONG THE TRACK TO INSURE COMPLETE COVERAGE. THE APT SYSTEM FUNCTIONED NORMALLY UNTIL IT WAS PLACED IN A STANDBY MODE ON MARCH 23, 1971, WHEN OVERHEATING DEVELOPED IN THE SATELLITE ATTITUDE CONTROL SYSTEM. THE SYSTEM WAS OPERATED INTERMITTENTLY UNTIL JUNE 18, 1971, WHEN THE SPACECRAFT WAS DEACTIVITED. APT DATA ARE INTENDED PRIMARILY FOR LOCAL OPERATIONAL USE WITHIN AN APT ACQUISITION STATION AND GENERALLY ARE NOT AVAILABLE FOR DISTRIBUTION.

REFERENCES

72, 83, 98, 110, 112, 114, 115, 285, 288, 742, 788, 871, 925, 938, AND 939.

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SPACECRAFT COMMON NAME- NOAA 1 — NSSDC ID 70-106A
ALTERNATE NAMES- ITOS-A

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 12/25/70
- APOGEE- 1472.00 KM ALT
- PERIGEE- 1423.00 KM ALT
- PERIOD- 114.8 MIN
- INCLINATION- 101.948 DEG

OTHER INFORMATION
- SPACECRAFT WT- 306. KG
- LAUNCH DATE- 12/11/70
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE DATA RECORDED- 081971

SPACECRAFT PERSONNEL

PM - W.W. JONES	NASA-GSFC	GREENBELT, MD.
PS - I.L. GOLDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

THE PRIMARY OBJECTIVE OF THE NOAA 1 SUN-SYNCHRONOUS METEOROLOGICAL SATELLITE WAS TO PROVIDE IMPROVED OPERATIONAL INFRARED AND VISUAL OBSERVATIONS OF EARTH CLOUD COVER FOR USE IN WEATHER ANALYSIS AND FORECASTING. SECONDARY OBJECTIVES INCLUDED PROVIDING BOTH SOLAR PROTON AND GLOBAL HEAT BALANCE DATA ON A REGULAR DAILY BASIS. TO ACCOMPLISH THESE TASKS, THE SPACECRAFT CARRIED FOUR CAMERAS -- TWO TELEVISION CAMERAS FOR AUTOMATIC PICTURE TRANSMISSION (APT) AND TWO ADVANCED VIDICON CAMERA SYSTEM (AVCS) CAMERAS. THE SATELLITE ALSO CARRIED A LOW-RESOLUTION FLAT PLATE RADIOMETER, A SOLAR PROTON MONITOR, AND TWO SCANNING RADIOMETERS THAT NOT ONLY MEASURED EMITTED IR RADIATION BUT ALSO SERVED AS A BACKUP SYSTEM FOR THE APT AND AVCS CAMERAS. THE NEARLY CUBICAL SPACECRAFT MEASURED 1 BY 1 BY 1.2 M. THE TV CAMERAS AND INFRARED SENSORS WERE MOUNTED ON THE SATELLITE BASEPLATE WITH THEIR OPTICAL AXES DIRECTED VERTICALLY EARTHWARD. THE SPACECRAFT WAS EQUIPPED WITH THREE CURVED SOLAR PANELS THAT WERE FOLDED DURING LAUNCH AND DEPLOYED AFTER ORBIT WAS ACHIEVED. EACH PANEL MEASURED OVER 4.2 M IN LENGTH WHEN UNFOLDED AND WAS COVERED WITH 3420 SOLAR CELLS, EACH MEASURING 2 BY 2 CM. THE NOAA 1 ATTITUDE CONTROL SYSTEM MAINTAINED DESIRED SPACECRAFT ORIENTATION THROUGH GYROSCOPIC PRINCIPLES INCORPORATED INTO THE SATELLITE DESIGN. EARTH ORIENTATION OF THE SATELLITE BODY WAS MAINTAINED BY TAKING ADVANTAGE OF THE PRECESSION INDUCED FROM A MOMENTUM FLYWHEEL SO THAT THE SATELLITE BODY PRECESSION RATE OF ONE REVOLUTION PER ORBIT PROVIDED THE DESIRED 'EARTH LOOKING' ATTITUDE. MINOR ADJUSTMENTS IN ATTITUDE AND ORIENTATION WERE MADE BY MEANS OF MAGNETIC COILS AND BY VARYING THE SPEED OF THE MOMENTUM FLYWHEEL. LAUNCHED INTO A NEAR-POLAR ORBIT, THE SPACECRAFT AND ITS SUBSYSTEMS PERFORMED NORMALLY UNTIL MAY 29, 1971, WHEN THE INCREMENTAL TAPE RECORDER FAILED, RESULTING IN PARTIAL LOSS OF SOLAR PROTON DATA AND TOTAL LOSS OF FLAT PLATE RADIOMETER DATA. THE APT AND DIRECT READOUT INFRARED (DRIR) SUBSYSTEMS WERE TURNED OFF ON JUNE 20, 1971, IN AN ATTEMPT TO REDUCE THE ABOVE NORMAL TEMPERATURE DUE TO OVERHEATING IN THE ATTITUDE CONTROL SYSTEM. THE AVCS WAS TURNED OFF SHORTLY THEREAFTER, AND THE SCANNING RADIOMETER CONTINUED PARTIAL OPERATIONS UNTIL THE SPACECRAFT WAS DEACTIVED ON AUGUST 19, 1971.

REFERENCES

98, 99, 100, 101, 102, 113, 115, 141, 208, 272, 405, 511, 675, 788, AND 938.

EXPERIMENT NAME- FLAT PLATE RADIOMETER (FPR) NSSDC ID 70-106A-02

EXPERIMENT PERSONNEL

PI - V.E. SUOMI	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 052971

EXPERIMENT BRIEF DESCRIPTION

THE FLAT PLATE RADIOMETER (FPR) SYSTEM WAS DESIGNED TO PROVIDE A MEASUREMENT OF THE GLOBAL DISTRIBUTION OF REFLECTED SOLAR AND LONGWAVE RADIATION LEAVING THE EARTH. THE FPR SYSTEM CONSISTED OF FOUR DETECTORS, AN ANALOG-TO-DIGITAL CONVERTER, AND A TAPE RECORDER. THE DETECTORS HAD A HEMISPHERIC FIELD OF VIEW OF 2 PI STER AND WERE MOUNTED ON THE SATELLITE

BASEPLATE FACING EARTH. THE DETECTORS USED COATED ALUMINUM DISCS AS A SENSING ELEMENT. TWO OF THE DISCS WERE WHITE AND RESPONDED ONLY TO INFRARED ENERGY (7 TO 30 MICRONS) RADIATED FROM THE EARTH AND ITS ATMOSPHERE. THE OTHER TWO DISCS WERE PAINTED BLACK AND HAD A BROADER BAND SENSITIVITY (0.3 TO 30 MICRONS). TWO DISCS (ONE OF EACH TYPE) HAD A THERMISTOR BOLOMETER MOUNTED ON THE BACK SURFACE TO MEASURE THE DISC TEMPERATURE. THE OTHER TWO DISCS USED THERMOPILES. AN IDENTICAL EXPERIMENT WAS FLOWN ON ITOS 1, AND SIMILAR EXPERIMENTS WERE FLOWN ON ESSA 3, 5, 7, AND 9. FOR A FULL DESCRIPTION OF THE FPR SYSTEM, SEE 'STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS, ANNUAL REPORT - 1967,' PAGES 179 TO 189, DEPT. OF METEOROLOGY, UNIVERSITY OF WISCONSIN, MARCH 1968. THE FPR FUNCTIONED NORMALLY FROM LAUNCH UNTIL MAY 29, 1971, WHEN THE INCREMENTAL TAPE RECORDER FAILED, RESULTING IN TOTAL DATA LOSS. DATA FROM THIS EXPERIMENT ARE MAINTAINED ON MAGNETIC TAPE AT NOAA-NESS, SUITLAND, MD.

REFERENCES
113, 115, 708, AND 720.

EXPERIMENT NAME- SCANNING RADIOMETER (SR) NSSDC ID 70-106A-03

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 081971

EXPERIMENT BRIEF DESCRIPTION

THE NOAA 1 SCANNING RADIOMETER (SR) SUBSYSTEM CONSISTED OF TWO SCANNING RADIOMETERS, A DUAL SR PROCESSOR, AND TWO SR RECORDERS. THIS SUBSYSTEM PERMITTED THE DETERMINATION OF SURFACE TEMPERATURES OF THE GROUND, THE SEA, OR CLOUD TOPS VIEWED BY THE RADIOMETER. THE RADIOMETER MEASURED REFLECTED RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 0.52- TO 0.73-MICRON BAND DURING THE DAY AND EMITTED RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN THE 10.5- TO 12.5-MICRON BAND DURING THE DAY AND NIGHT. UNLIKE A CAMERA, THE SR DID NOT TAKE A PICTURE BUT INSTEAD FORMED AN IMAGE USING A CONTINUOUSLY ROTATING MIRROR. THE MIRROR SCANNED THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH AT A RATE OF 48 RPM. AS THE SATELLITE PROGRESSED ALONG ITS ORBITAL PATH, EACH ROTATION OF THE MIRROR PROVIDED ONE SCAN LINE OF PICTURE. RADIATION COLLECTED BY THE MIRROR WAS PASSED THROUGH A BEAM SPLITTER AND SPECTRAL FILTER TO PRODUCE THE DESIRED SPECTRAL SEPARATION. UP TO TWO FULL ORBITS OF DATA (145 MIN) COULD BE STORED ON MAGNETIC TAPE FOR SUBSEQUENT TRANSMISSION (1697.5 MHZ) TO AN ACQUISITION STATION. THE DATA COULD ALSO BE TRANSMITTED IN REAL TIME TO LOCAL APT STATIONS. ONCE THE SIGNAL WAS RECEIVED BY THE GROUND STATION, A CONTINUOUS PICTURE WAS FORMED BY USING A FACSIMILE RECORDER WHOSE SCAN WAS IN PHASE WITH THE SATELLITE'S FORWARD MOTION. AT NOMINAL SPACECRAFT ALTITUDE (APPROXIMATELY 1450 KM), THE RADIOMETER HAD A GROUND RESOLUTION OF BETTER THAN 4 KM AT NADIR. THE RADIOMETER WAS CAPABLE OF YIELDING RADIANCE TEMPERATURES BETWEEN 185 AND 330 DEG K TO AN ACCURACY OF 4 AND 1 DEG K, RESPECTIVELY. THE SR SUBSYSTEM FUNCTIONED NORMALLY UNTIL JANUARY 5, 1971, WHEN THE NUMBER 1 SCANNING RADIOMETER BECAME INOPERATIVE OWING TO FAILURE OF THE SCANNING MIRROR MOTOR. THE REMAINING RADIOMETER WAS PLACED IN A PARTIAL RECORD MODE AT THE END OF JUNE 1971 AS A RESULT OF OVERHEATING IN THE SPACECRAFT ATTITUDE CONTROL SYSTEM. ALL DATA ACQUISITION CEASED AFTER AUGUST 19, 1971, WHEN THE SPACECRAFT WAS DEACTIVATED. DATA FROM THIS EXPERIMENT ARE AVAILABLE THROUGH NOAA-NESS, SUITLAND, MD.

REFERENCES

113, 115, 305, 318, 325, 558, 788, 813, AND 871.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS)   NSSDC ID 70-106A-04

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 062271

EXPERIMENT BRIEF DESCRIPTION

THE NOAA 1 ADVANCED VIDICON CAMERA SYSTEM (AVCS) WAS A REDUNDANT CAMERA AND TAPE RECORDER COMBINATION DESIGNED TO RECORD A SERIES OF WIDE-ANGLE, HIGH-RESOLUTION TELEVISION PICTURES OF THE EARTH AND ITS CLOUD COVER DURING DAYLIGHT. THE AVCS OPERATED IN THREE MODES -- RECORD, PLAYBACK, AND DIRECT READOUT. THE AVCS SYSTEM FOR NOAA 1 WAS ESSENTIALLY THE SAME AS THAT USED ON ALL AVCS-TOS SPACECRAFT (ESSA 3, 5, 7, AND 9). THE TWO MAJOR ELEMENTS OF THE SYSTEM WERE (1) THE CAMERA SENSOR ASSEMBLY, WHICH CONTAINED LENS, SHUTTER, GRAYSCALE CALIBRATOR, VIDICON, DEFLECTION YOKE, CAMERA ELECTRONICS MODULE, AND POWER CIRCUITS AND (2) A PREAMPLIFIER FOR CONVERTING OPTICAL IMAGES INTO ELECTRICAL SIGNALS. THE EARTH-ORIENTED CAMERA USED A 108-DEG WIDE-ANGLE LENS (5.7-MM FOCAL LENGTH) WITH AN F/1.8 APERTURE AND A 2.54-CM-DIAMETER VIDICON WITH 833 SCAN LINES. A VIDEO FRAME CONSISTED OF 0.25-SEC OF BLANKED VIDEO, FOLLOWED BY 6.25 SEC OF VIDICON SCAN VIDEO (833 LINES), AND A FINAL 0.25-SEC PERIOD OF BLANKED VIDEO. ELEVEN PICTURES WERE TAKEN AT 260-SEC INTERVALS TO COVER THE SUNLIT PORTION OF THE EARTH (SUN ELEVATION GREATER THAN 15 DEG). THE TAPE RECORDER COULD BE READ OUT BETWEEN PHOTOGRAPHIC CYCLES WITHOUT LOSING A PICTURE OR INTERRUPTING A SEQUENCE. AT NOMINAL SATELLITE ALTITUDE (1450 KM), THE AVCS PICTURES COVERED A 3000- BY 3000-KM SQUARE WITH A GROUND RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS A 50 PERCENT PICTURE OVERLAP ALONG THE TRACK TO INSURE COMPLETE COVERAGE. THE RECORDER COULD STORE UP TO 38 PICTURES (THREE ORBITS OF DATA) IN A SINGLE START-STOP OPERATION. THE EXPERIMENT OPERATED NORMALLY AFTER LAUNCH UNTIL IT WAS PLACED OPERATIONALLY OFF ON JUNE 22, 1971, WHEN OVERHEATING DEVELOPED IN THE SPACECRAFT ATTITUDE CONTROL SYSTEM, AND WAS NEVER REACTIVATED DURING THE SPACECRAFT'S REMAINING OPERATIONAL LIFETIME. DATA ARE HANDLED BY NOAA AND WILL EVENTUALLY BE AVAILABLE THROUGH THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA.

REFERENCES

101, 113, 115, 393, AND 788.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM   NSSDC ID 70-106A-05

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 062071

EXPERIMENT BRIEF DESCRIPTION

THE NOAA 1 AUTOMATIC PICTURE TRANSMISSION (APT) EXPERIMENT WAS DESIGNED TO AUTOMATICALLY TAKE WIDE-ANGLE, SLOW SCAN TELEVISION PICTURES OF THE EARTH AND ITS CLOUD COVER DURING DAYLIGHT. THE PHOTOGRAPHIC OPERATIONS OF THE APT SUBSYSTEM WERE CONTROLLED BY PROGRAM COMMANDS TRANSMITTED TO THE

SATELLITE BY THE COMMAND AND DATA ACQUISITION (CDA) STATIONS. A COMPLETE APT PICTURE SEQUENCE LASTED APPROXIMATELY 46 MIN, DURING WHICH 11 PICTURES WERE TAKEN AT 260-SEC INTERVALS. THESE PICTURES WERE TRANSMITTED BY 137.62-MHZ REAL-TIME TRSNAMITTERS TO APT-EQUIPPED GROUND STATIONS WITHIN COMMUNICATIONS RANGE OF THE SATELLITE. THE APT SUBSYSTEM FOR NOAA 1 WAS ESSENTIALLY THE SAME AS THAT USED ON THE APT-TOS SPACECRAFT (ESSA 2, 4, 6, AND 8). FOR NOAA 1, THE MAJOR ELEMENTS OF THE SUBSYSTEM WERE THE CAMERA SENSOR ASSEMBLY, VIDEO AMPLIFIER, CAMERA ELECTRONICS MODULE, AND POWER CIRCUITS. THE EARTH-ORIENTED CAMERA USED A 108-DEG (5.7-MM FOCAL LENGTH) WIDE-ANGLE LENS WITH A MAXIMUM APERTURE OF F/1.8 AND A 2.54-CM-DIAMETER VIDICON WITH 600 SCAN LINES. AT THE NOMINAL SATELLITE ALTITUDE OF 1450 KM, EACH PICTURE COVERED APPROXIMATELY 3140 KM ACROSS THE TRACK AND 2400 KM ALONG THE TRACK WITH A GROUND RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS AN APPROXIMATE 20 PERCENT OVERLAP BETWEEN PICTURES ALONG THE TRACK TO INSURE COMPLETE COVERAGE. THE SYSTEM WAS PLACED OPERATIONALLY OFF ON JUNE 20, 1971, WHEN OVERHEATING DEVELOPED IN THE SPACECRAFT'S ATTITUDE CONTROL SYSTEM, AND WAS NEVER REACTIVATED DURING THE SPACECRAFT'S REMAINING OPERATIONAL LIFETIME. APT DATA ARE INTENDED PRIMARILY FOR LOCAL OPERATIONAL USE WITHIN AN APT ACQUISITION STATION AND GENERALLY ARE NOT AVAILABLE FOR DISTRIBUTION.

REFERENCES

72, 113, 115, 788, AND 871.

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SPACECRAFT COMMON NAME- ITOS-B   NSSDC ID 71-091X
ALTERNATE NAMES- PL-701G

ORBITAL INFORMATION

ORBIT TYPE-
EPOCH DATE- / /
APOGEE-
PERIGEE-
PERIOD-
INCLINATION- DEG

OTHER INFORMATION

SPACECRAFT WT- 327. KG
LAUNCH DATE- 10/21/71
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED-

SPACECRAFT PERSONNEL

PM - W.W.	JONES	NASA-GSFC	GREENBELT, MD.
PS - I.L.	GOLDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

THE ITOS-B METEOROLOGICAL SATELLITE WAS DESIGNED TO PROVIDE IMPROVED OPERATIONAL INFRARED AND VISUAL OBSERVATIONS OF EARTH CLOUD COVER FOR USE IN WEATHER ANALYSIS AND FORECASTING. SECONDARY OBJECTIVES INCLUDED OBTAINING BOTH SOLAR PROTON AND GLOBAL HEAT BALANCE DATA ON A DAILY BASIS. TO ACCOMPLISH THESE TASKS, THE SUN-SYNCHRONOUS SPACECRAFT CARRIED FOUR CAMERAS -- TWO TELEVISION CAMERAS FOR AUTOMATIC PICTURE TRANSMISSION (APT) AND TWO ADVANCED VIDICON CAMERA SYSTEM (AVCS) CAMERAS. IT ALSO CARRIED A LOW-RESOLUTION FLAT PLATE RADIOMETER, A SOLAR PROTON MONITOR, AND TWO SCANNING RADIOMETERS THAT NOT ONLY COULD MEASURE EMITTED IR RADIATION BUT COULD ALSO SERVE AS A BACKUP SYSTEM FOR THE APT AND AVCS CAMERAS. THE NEARLY CUBICAL SPACECRAFT MEASURED 1 BY 1 BY 1.2 M. THE TV CAMERAS AND INFRARED SENSORS WERE MOUNTED ON THE SATELLITE BASEPLATE WITH THEIR OPTICAL AXES DIRECTED VERTICALLY EARTHWARD. THE SATELLITE WAS EQUIPPED WITH THREE CURVED

SOLAR PANELS THAT WERE FOLDED DURING LAUNCH AND WERE TO BE DEPLOYED AFTER ORBIT WAS ACHIEVED. EACH PANEL MEASURED OVER 4.2 M IN LENGTH WHEN UNFOLDED AND WAS COVERED WITH 3420 SOLAR CELLS, EACH 2 BY 2 CM. A DYNAMICS AND ATTITUDE CONTROL SYSTEM WAS DESIGNED TO MAINTAIN DESIRED SPACECRAFT ORIENTATION THROUGH GYROSCOPIC PRINCIPLES INCORPORATED INTO THE SATELLITE DESIGN. EARTH ORIENTATION WAS TO BE MAINTAINED BY TAKING ADVANTAGE OF THE PRECESSION INDUCED FROM A MOMENTUM FLYWHEEL SO THAT THE SATELLITE BODY PRECESSION RATE OF ONE REVOLUTION PER ORBIT WOULD PROVIDE THE DESIRED 'EARTH LOOKING' ATTITUDE. MINOR ADJUSTMENTS IN ATTITUDE AND ORIENTATION COULD BE MADE BY MEANS OF MAGNETIC COILS AND BY VARYING THE SPEED OF THE MOMENTUM FLYWHEEL. ITOS-B FAILED TO ACHIEVE A SUCCESSFUL EARTH ORBIT. A MALFUNCTION IN THE SECOND STAGE LAUNCH VEHICLE CAUSED THE SPACECRAFT TO REENTER THE EARTH'S ATMOSPHERE ABOUT 1 HR AFTER LIFT-OFF.

REFERENCES
98, 99, 10(, 101, 102, 114, 208, 285, 393, 423, 540, 788, AND 938.

EXPERIMENT NAME- FLAT PLATE RADIOMETER (FPR) NSSDC ID 71-091X-02

EXPERIMENT PERSONNEL

PI - V.E.	SUOMI	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION
THE ITOS-B FLAT PLATE RADIOMETER (FPR) SYSTEM WAS DESIGNED TO PROVIDE A MEASUREMENT OF THE GLOBAL DISTRIBUTION OF REFLECTED SOLAR AND LONGWAVE RADIATION LEAVING THE EARTH. THE FPR SYSTEM CONSISTED OF FOUR DETECTORS, AN ANALOG-TO-DIGITAL CONVERTER, AND A TAPE RECORDER. THE DETECTORS HAD A PLANNED HEMISPHERIC FIELD OF VIEW OF 2 PI STER AND WERE MOUNTED ON THE SATELLITE BASEPLATE FACING EARTHWARD. THE DETECTORS WERE DESIGNED TO USE COATED ALUMINUM DISCS AS A SENSING ELEMENT. TWO OF THE DISCS WERE WHITE AND COULD RESPOND ONLY TO INFRARED ENERGY (7 TO 30 MICRONS) RADIATED FROM THE EARTH AND ITS ATMOSPHERE. THE OTHER TWO DISCS WERE PAINTED BLACK AND HAD A BROADER BAND SENSITIVITY (0.3 TO 30 MICRONS). TWO DISCS (ONE OF EACH TYPE) HAD A THERMISTOR BOLOMETER MOUNTED ON THE BACK SURFACE TO MEASURE THE DISC TEMPERATURE. THE OTHER TWO DISCS USED THERMOPILES. IDENTICAL EXPERIMENTS WERE FLOWN ON ITOS 1 AND NOAA 1. FOR A FULL DESCRIPTION OF THE FPR SYSTEM, SEE 'STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS, ANNUAL REPORT - 1967,' PAGES 179 TO 189, DEPT. OF METEOROLOGY, UNIVERSITY OF WISCONSIN, MARCH 1968. ITOS-B FAILED TO ACHIEVE ORBIT, AND THE EXPERIMENT WAS NEVER ACTIVATED.

REFERENCES
114, 285, 708, 788, AND 938.

EXPERIMENT NAME- SCANNING RADIOMETER (SR) NSSDC ID 71-091X-03

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-B SCANNING RADIOMETER (SR) SUBSYSTEM CONSISTED OF TWO SCANNING RADIOMETERS, A DUAL SR PROCESSOR, AND TWO SR RECORDERS. THIS SUBSYSTEM WOULD PERMIT THE DETERMINATION OF SURFACE TEMPERATURES OF THE GROUND, THE SEA, OR CLOUD TOPS VIEWED BY THE RADIOMETER. THE RADIOMETER COULD MEASURE REFLECTED RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 0.52- TO 0.73-MICRON BAND DURING THE DAY AND EMITTED RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN THE 10.5- TO 12.5-MICRON BAND DURING DAY AND NIGHT. UNLIKE A CAMERA, THE SR COULD NOT TAKE A PICTURE BUT INSTEAD WAS TO FORM AN IMAGE USING A CONTINUOUSLY ROTATING MIRROR. THE MIRROR WAS TO SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S OBITAL PATH AT A RATE OF 48 RPM. AS THE SATELLITE PROGRESSED ALONG ITS ORBITAL PATH, EACH ROTATION OF THE MIRROR WAS TO PROVIDE ONE SCAN LINE OF PICTURE. RADIATION COLLECTED BY THE MIRROR WAS TO BE PASSED THROUGH A BEAM SPLITTER AND SPECTRAL FILTER TO PRODUCE THE DESIRED SPECTRAL SEPARATION. UP TO TWO FULL ORBITS OF DATA (145 MIN) COULD BE STORED ON MAGNETIC TAPE FOR SUBSEQUENT TRANSMISSION (1697.5 MHZ) TO AN ACQUISITION STATION. THE DATA COULD ALSO BE TRANSMITTED IN REAL TIME TO LOCAL APT STATIONS. ONCE THE SIGNAL WAS RECEIVED BY THE GROUND STATION, A CONTINUOUS PICTURE WOULD BE FORMED BY USING A FACSIMILE RECORDER WHOSE SCAN WAS IN PHASE WITH THE SATELLITE'S FORWARD MOTION. AT NOMINAL SPACECRAFT ALTITUDE (APPROXIMATELY 1460 KM), THE RADIOMETER HAD A PLANNED GROUND RESOLUTION OF BETTER THAN 4 KM AT NADIR. THE RADIOMETER WAS DESIGNED TO YIELD RADIANCE TEMPERATURES BETWEEN 185 AND 330 DEG TO AN ACCURACY OF 4 AND 1 DEG K, RESPECTIVELY. ITOS-B FAILED TO ACHIEVE ORBIT, AND THE EXPERIMENT WAS NEVER ACTIVATED.

REFERENCES

114, 285, 318, 788, AND 938.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS) NSSDC ID 71-091X-04

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-B ADVANCED VIDICON SYSTEM (AVCS) WAS A REDUNDANT CAMERA AND TAPE RECORDER COMBINATION DESIGNED TO RECORD A SERIES OF WIDE-ANGLE, HIGH-RESOLUTION TELEVISION PICTURES OF THE EARTH AND ITS CLOUD COVER DURING DAYLIGHT. THE AVCS WAS TO OPERATE IN THREE MODES -- RECORD, PLAYBACK, AND DIRECT READOUT. THE AVCS SYSTEM FOR ITOS-B WAS ESSENTIALLY THE SAME AS THAT USED ON ALL AVCS-TOS SPACECRAFT (ESSA 3, 5, 7, AND 9). THE TWO MAJOR ELEMENTS OF THE SYSTEM WERE (1) THE CAMERA SENSOR ASSEMBLY, WHICH CONTAINED LENS, SHUTTER, GRAYSCALE CALIBRATOR, VIDICON, DEFLECTION YOKE, CAMERA ELECTRONICS MODULE, AND POWER CIRCUITS AND (2) A PREAMPLIFIER FOR CONVERTING OPTICAL IMAGES INTO ELECTRICAL SIGNALS. THE EARTH-ORIENTED CAMERA WAS TO USE A 108-DEG WIDE-ANGLE LENS (5.7-MM FOCAL LENGTH) WITH AN F/1.8 APERTURE AND A 2.54-CM-DIAMETER VIDICON WITH 833 SCAN LINES. A VIDEO FRAME WAS TO CONSIST OF 0.25 SEC OF BLANKED VIDEO, FOLLOWED BY 6.25 SEC OF VIDICON SCAN VIDEO (833 LINES), AND A FINAL 0.25-SEC PERIOD OF BLANKED VIDEO. ELEVEN PICTURES WERE TO BE TAKEN AT 260-SEC INTERVALS TO COVER THE SUNLIT PORTION OF THE EARTH (SUN ELEVATION GREATER THAN 15 DEG). THE TAPE RECORDER COULD BE READ OUT BETWEEN PHOTOGRAPHIC CYCLES WITHOUT LOSING A PICTURE OR INTERRUPTING A SEQUENCE. AT A PLANNED SPACECRAFT ALTITUDE OF 1460 KM, AN

AVCS PICTURE WAS TO COVER A 3000- BY 3000-KM SQUARE WITH A GROUND RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS TO BE A 50 PERCENT PICTURE OVERLAP ALONG THE TRACK TO INSURE COMPLETE COVERAGE. THE TAPE RECORDER COULD STORE UP TO 38 PICTURES (THREE ORBITS OF DATA) IN A SINGLE START-STOP OPERATION. THE AVCS WAS NEVER ACTIVATED BECAUSE ITOS-B FAILED TO ACHIEVE A SUCCESSFUL EARTH ORBIT.

REFERENCES
101, 114, 285, 788, AND 938.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM   NSSDC ID 71-091X-05

EXPERIMENT PERSONNEL
PI - NESS STAFF   NOAA-NESS   SUITLAND, MD.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED-

EXPERIMENT BRIEF DESCRIPTION
THE ITOS-B AUTOMATIC PICTURE TRANSMISSION (APT) EXPERIMENT WAS DESIGNED TO AUTOMATICALLY TAKE WIDE-ANGLE, SLOW-SCAN TELEVISION PICTURES OF THE EARTH AND ITS CLOUD COVER DURING DAYLIGHT FOR USE IN LOCAL WEATHER ANALYSIS AND FORECASTING. THE PHOTOGRAPHIC OPERATIONS OF THE APT SUBSYSTEM WERE TO BE CONTROLLED BY PROGRAM COMMANDS TRANSMITTED TO THE SATELLITE BY THE COMMAND AND DATA ACQUISITION (CDA) STATIONS. A COMPLETE APT PICTURE SEQUENCE WAS TO LAST APPROXIMATELY 46 MIN, DURING WHICH TIME 11 PICTURES WERE TO BE TAKEN AT 260-SEC INTERVALS. THESE PICTURES WERE THEN TO BE TRANSMITTED IN REAL TIME TO APT-EQUIPPED GROUND STATIONS WITHIN COMMUNICATION RANGE OF THE SATELLITE. THE APT SUBSYSTEM FOR ITOS-B WAS ESSENTIALLY THE SAME AS THAT USED ON THE APT-TOS SPACECRAFT (ESSA 2, 4, 6, AND 8). THE MAJOR ELEMENTS OF THE SUBSYSTEM WERE THE CAMERA SENSOR ASSEMBLY, VIDEO AMPLIFIER, CAMERA ELECTRONICS MODULE, AND POWER CIRCUITS. THE EARTH-ORIENTED CAMERA HAD A 108-DEG (5.7-MM FOCAL LENGTH) WIDE-ANGLE LENS WITH 600 SCAN LINES. AT THE NOMINAL SATELLITE ALTITUDE OF 1460 KM, EACH PICTURE WAS TO COVER APPROXIMATELY 3140 KM ACROSS THE TRACK AND 2400 KM ALONG THE TRACK WITH A GROUND RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WAS TO BE APPROXIMATELY 20 PERCENT OVERLAP BETWEEN PICTURES ALONG THE TRACK TO INSURE COMPLETE COVERAGE. THE APT EXPERIMENT WAS NEVER ACTIVATED BECAUSE THE SATELLITE FAILED TO ACHIEVE ORBIT.

REFERENCES
114, 285, 788, AND 938.

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SPACECRAFT COMMON NAME- ITOS-C   NSSDC ID ITOS-C
ALTERNATE NAMES- PL-701I

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 1460.00 KM ALT

OTHER INFORMATION
SPACECRAFT WT- 327. KG
LAUNCH DATE- / /
OPERATING STATUS- STORED

PERIGEE- 1460.00 KM ALT
PERIOD- 115.2 MIN
INCLINATION- 101.7 DEG

SPACECRAFT PERSONNEL

PM - W.W. JONES	NASA-GSFC	GREENBELT, MD.
PS - I.L. GOLDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

THE PRIMARY OBJECTIVES OF THE ITOS-C METEOROLOGICAL SATELLITE ARE TO PROVIDE IMPROVED OPERATIONAL INFRARED AND VISUAL OBSERVATIONS OF EARTH CLOUD COVER FOR USE IN WEATHER ANALYSIS AND FORECASTING. SECONDARY OBJECTIVES INCLUDE PROVIDING BOTH SOLAR PROTON AND GLOBAL HEAT BALANCE DATA ON A REGULAR DAILY BASIS. TO ACCOMPLISH THESE TASKS, THE SUN-SYNCHRONOUS SPACECRAFT WILL CARRY FOUR CAMERAS--TWO TELEVISION CAMERAS FOR AUTOMATIC PICTURE TRANSMISSION (APT) AND TWO ADVANCED VIDICON CAMERA SYSTEM (AVCS) CAMERAS. IT WILL ALSO CARRY A LOW-RESOLUTION FLAT PLATE RADIOMETER, A SOLAR PROTON MONITOR, AND TWO SCANNING RADIOMETERS THAT NOT ONLY CAN MEASURE EMITTED IR RADIATION BUT CAN ALSO SERVE AS A BACKUP SYSTEM FOR THE APT AND AVCS CAMERAS. THE NEARLY CUBICAL SPACECRAFT MEASURES 1 BY 1 BY 1.2 M. THE TV CAMERAS AND INFRARED SENSORS ARE MOUNTED ON THE SATELLITE BASEPLATE WITH THEIR OPTICAL AXES DIRECTED VERTICALLY EARTHWARD. THE SATELLITE IS EQUIPPED WITH THREE CURVED SOLAR PANELS THAT WILL BE FOLDED DURING LAUNCH AND DEPLOYED AFTER ORBIT IS ACHIEVED. EACH PANEL MEASURES OVER 4.2 M IN LENGTH WHEN UNFOLDED AND IS COVERED WITH 3420 SOLAR CELLS, EACH MEASURING 2 BY 2 CM. THE ITOS-C DYNAMICS AND ATTITUDE CONTROL SYSTEM WILL MAINTAIN DESIRED SPACECRAFT ORIENTATION THROUGH GYROSCOPIC PRINCIPLES INCORPORATED INTO THE SATELLITE DESIGN. EARTH ORIENTATION OF THE SATELLITE BODY WILL BE MAINTAINED BY TAKING ADVANTAGE OF THE PRECESSION INDUCED FROM A MOMENTUM FLYWHEEL SO THAT THE SATELLITE BODY PRECESSION RATE OF ONE REVOLUTION PER ORBIT WILL PROVIDE THE DESIRED 'EARTH LOOKING' ATTITUDE. MINOR ADJUSTMENTS IN ATTITUDE AND ORIENTATION WILL BE MADE BY MEANS OF MAGNETIC COILS AND BY VARYING THE SPEED OF THE MOMEMTUM FLYWHEEL. THE SATELLITE HAD BEEN SCHEDULED FOR LAUNCH IN FEBRUARY 1972. HOWEVER, OWING TO LONG DELAYS IN EQUIPPING THE LAUNCH VEHICLE WITH AN ONBOARD INERTIAL GUIDANCE COMPUTER, THE LAUNCH WAS CANCELLED AND THE SATELLITE WAS PLACED IN STORAGE. IT WILL BE REPLACED IN THE LAUNCH SEQUENCE BY THE MORE SOPHISTICATED ITOS-D SATELLITE, WHICH IS SCHEDULED FOR LAUNCH IN THE FALL OF 1972. ITOS-C WILL BE REFITTED WITH IMPROVED INSTRUMENTATION AND WILL SERVE AS A BACKUP FOR ITOS-D. ITOS-C WILL BE LAUNCHED SOMETIME AFTER ITOS-D SUCCESSFULLY ATTAINS ORBIT.

REFERENCES

98, 99, 100, 101, 102, 114, 116, 272, 285, 540, 788, AND 938.

EXPERIMENT NAME- FLAT PLATE RADIOMETER (FPR) NSSDC ID ITOS-C -02

EXPERIMENT PERSONNEL

PI - V.E. SUOMI	U OF WISCONSIN	MADISON, WIS.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-C FLAT PLATE RADIOMETER (FPR) SYSTEM IS DESIGNED TO PROVIDE A MEASUREMENT OF THE GLOBAL DISTRIBUTION OF REFLECTED SOLAR AND LONGWAVE RADIATION LEAVING THE EARTH. THE FPR SYSTEM CONSISTS OF FOUR DETECTORS, AN ANALOG-TO-DIGITAL CONVERTER, AND A TAPE RECORDER. THE DETECTORS HAVE A

HEMISPHERIC FIELD OF VIEW OF 2 PI STER AND ARE MOUNTED ON THE SATELLITE BASEPLATE FACING EARTHWARD. THE DETECTORS USE COATED ALUMINUM DISCS AS A SENSING ELEMENT. TWO OF THE DISCS ARE WHITE AND RESPOND ONLY TO INFRARED ENERGY (7 TO 30 MICRONS) RADIATED FROM THE EARTH AND ITS ATMOSPHERE. THE OTHER TWO DISCS ARE PAINTED BLACK AND HAVE A BROADER BAND SENSITIVITY (0.3 TO 30 MICRONS). TWO DISCS (ONE OF EACH TYPE) HAVE A THERMISTOR BOLOMETER MOUNTED ON THE BACK SURFACE TO MEASURE THE DISC TEMPERATURE. THE OTHER TWO DISCS USE THERMOPILES. AN IDENTICAL EXPERIMENT WAS FLOWN ON NOAA 1 AND ITOS 1 AND SIMILAR EXPERIMENTS WERE FLOWN ON ESSA 3, 5, 7, AND 9. FOR A FULL DESCRIPTION OF THE FPR SYSTEM, SEE 'STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS, ANNUAL REPORT - 1967,' PAGES 179 TO 189, DEPT. OF METEOROLOGY, UNIVERSITY OF WISCONSIN, MARCH 1968. WHEN ITOS-C IS LAUNCHED, DATA FROM THIS EXPERIMENT WILL BE MAINTAINED AT NOAA-NESS, SUITLAND, MD.

REFERENCES

114, 285, 706, 788, AND 938.

EXPERIMENT NAME- SCANNING RADIOMETER (SR) NSSDC ID ITOS-C -03

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-C SCANNING RADIOMETER (SR) SUBSYSTEM CONSISTS OF TWO SCANNING RADIOMETERS, A DUAL SR PROCESSOR, AND TWO SR RECORDERS. THIS SUBSYSTEM WILL PERMIT THE DETERMINATION OF SURFACE TEMPERATURES OF THE GROUND, THE SEA, OR CLOUD TOPS VIEWED BY THE RADIOMETER. THE RADIOMETER WILL MEASURE REFLECTED RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 0.52- TO 0.73-MICRON BAND DURING THE DAY AND EMITTED RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN THE 10.5- TO 12.5-MICRON BAND DURING DAY AND NIGHT. UNLIKE A CAMERA, THE SR DOES NOT TAKE A PICTURE BUT INSTEAD FORMS AN IMAGE USING A CONTINUOUSLY ROTATING MIRROR. THE MIRROR WILL SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH AT A RATE OF 48 RPM. AS THE SATELLITE PROGRESSES ALONG ITS ORBITAL PATH, EACH ROTATION OF THE MIRROR WILL PROVIDE ONE SCAN LINE OF PICTURE. RADIATION COLLECTED BY THE MIRROR WILL BE PASSED THROUGH A BEAM SPLITTER AND SPECTRAL FILTER TO PRODUCE THE DESIRED SPECTRAL SEPARATION. UP TO TWO FULL ORBITS OF DATA (145 MIN) CAN BE STORED ON MAGNETIC TAPE FOR SUBSEQUENT TRANSMISSION (1697.5 MHZ) TO AN ACQUISITION STATION. THE DATA CAN ALSO BE TRANSMITTED IN REAL TIME TO LOCAL APT STATIONS. ONCE THE SIGNAL IS RECEIVED BY THE GROUND STATION, A CONTINUOUS PICTURE CAN BE FORMED BY USING A FACSIMILE RECORDER WHOSE SCAN IS IN PHASE WITH THE SATELLITE'S FORWARD MOTION. AT A PLANNED SPACECRAFT ALTITUDE OF 1460 KM, THE RADIOMETER WILL HAVE A GROUND RESOLUTION OF BETTER THAN 4 KM AT NADIR. THE RADIOMETER IS DESIGNED TO YIELD RADIANCE TEMPERATURES BETWEEN 185 AND 330 DEG K TO AN ACCURACY OF 4 AND 1 DEG K, RESPECTIVELY. WHEN ITOS-C IS LAUNCHED, DATA FROM THE EXPERIMENT WILL BE AVAILABLE THROUGH NOAA-NESS, SUITLAND, MD.

REFERENCES

114, 116, 285, 318, AND 938.

EXPERIMENT NAME- ADVANCED VIDICON CAMERA SYSTEM (AVCS) NSSDC ID ITOS-C -04

EXPERIMENT PERSONNEL
PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-C ADVANCED VIDICON CAMERA SYSTEM (AVCS) IS A REDUNDANT CAMERA AND TAPE RECORDER COMBINATION DESIGNED TO RECORD A SERIES OF WIDE-ANGLE, HIGH-RESOLUTION TELEVISION PICTURES OF THE EARTH AND ITS CLOUD COVER DURING DAYLIGHT. THE AVCS WILL OPERATE IN THREE MODES -- RECORD, PLAYBACK, AND DIRECT READOUT. THE SYSTEM IS ESSENTIALLY THE SAME AS THAT USED ON ALL AVCS-TOS SPACECRAFT (ESSA 3, 5, 7, AND 9). FOR ITOS-C, THE TWO MAJOR ELEMENTS OF THE SYSTEM ARE (1) THE CAMERA SENSOR ASSEMBLY, WHICH CONTAINS LENS, SHUTTER, GRAYSCALE CALIBRATOR, VIDICON, DEFLECTION YOKE, CAMERA ELECTRONICS MODULE, AND POWER CIRCUITS AND (2) A PREAMPLIFIER FOR CONVERTING OPTICAL IMAGES INTO ELECTRICAL SIGNALS. THE EARTH-ORIENTED CAMERA WILL USE A 108-DEG WIDE-ANGLE LENS (5.7-MM FOCAL LENGTH) WITH AN F/1.8 APERTURE AND A 2.54-CM-DIAMETER VIDICON WITH 833 SCAN LINES. A VIDEO FRAME WILL CONSIST OF 0.25 SEC OF BLANKED VIDEO, FOLLOWED BY 6.25 SEC OF VIDICON SCAN VIDEO (833 LINES), AND A FINAL 0.25-SEC PERIOD OF BLANKED VIDEO. ELEVEN PICTURES WILL BE TAKEN AT 260-SEC INTERVALS TO COVER THE SUNLIT PORTION OF THE EARTH (SUN ELEVATION GREATER THAN 15 DEG). THE TAPE RECORDER WILL BE READ OUT BETWEEN PHOTOGRAPHIC CYCLES WITHOUT LOSING A PICTURE OR INTERRUPTING A SEQUENCE. AT A PLANNED SATELLITE ALTITUDE OF 1460 KM, AVCS PICTURES WILL COVER A 3000- BY 3000-KM SQUARE WITH A GROUND RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WILL BE A 50 PERCENT PICTURE OVERLAP ALONG THE TRACK TO INSURE COMPLETE COVERAGE. THE TAPE RECORDER WILL STORE UP TO 38 PICTURES (THREE ORBITS OF DATA) IN A SINGLE START-STOP OPERATION. AFTER ITOS-C IS LAUNCHED, DATA FROM THE EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY WILL BE MADE AVAILABLE THROUGH THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA.

REFERENCES

101, 114, 116, 285, 768, AND 938.

EXPERIMENT NAME- AUTOMATIC PICTURE TRANSMISSION (APT) SYSTEM NSSDC ID ITOS-C -05

EXPERIMENT PERSONNEL
PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-C AUTOMATIC PICTURE TRANSMISSION (APT) EXPERIMENT IS DESIGNED TO AUTOMATICALLY TAKE WIDE-ANGLE, SLOW SCAN TELEVISION PICTURES OF THE EARTH AND ITS CLOUD COVER DURING DAYLIGHT FOR USE IN LOCAL WEATHER ANALYSIS AND FORECASTING. THE PHOTOGRAPHIC OPERATIONS OF THE APT SUBSYSTEM WILL BE CONTROLLED BY PROGRAM COMMANDS TRANSMITTED TO THE SATELLITE BY THE COMMAND AND DATA ACQUISITION (CDA) STATIONS. A COMPLETE APT PICTURE SEQUENCE WILL LAST APPROXIMATELY 46 MIN, DURING WHICH 11 PICTURES WILL BE TAKEN AT 260-SEC INTERVALS. THESE PICTURES WILL BE TRANSMITTED IN REAL TIME TO APT-EQUIPPED GROUND STATIONS WITHIN COMMUNICATIONS RANGE OF THE SATELLITE. THE APT SUBSYSTEM FOR ITOS-C IS ESSENTIALLY THE SAME AS THAT USED ON THE APT-TOS SPACECRAFT (ESSA 2, 4, 6, AND 8). FOR ITOS, THE MAJOR ELEMENTS OF THE SUBSYSTEM ARE THE CAMERA SENSOR ASSEMBLY, VIDEO AMPLIFIER, CAMERA ELECTRONICS MODULE, AND POWER CIRCUITS. THE EARTH-ORIENTED CAMERA WILL USE A 108-DEG (5.7-MM FOCAL LENGTH) WIDE-ANGLE LENS WITH A MAXIMUM APERTURE OF F/1.8 AND A 2.54-CM-DIAMETER VIDICON WITH 600 SCAN LINES. AT A PLANNED

SATELLITE ALTITUDE OF 1460 KM. EACH PICTURE WILL COVER APPROXIMATELY 3140 KM ACROSS THE TRACK AND 2400 KM ALONG THE TRACK WITH A GROUND RESOLUTION OF ABOUT 3 KM AT NADIR. THERE WILL BE AN APPROXIMATE 20 PERCENT OVERLAP BETWEEN PICTURES ALONG THE TRACK TO INSURE COMPLETE COVERAGE. APT DATA OBTAINED AFTER ITOS-C IS LAUNCHED WILL BE INTENDED PRIMARILY FOR OPERATIONAL USE WITHIN A LOCAL APT ACQUISITION STATION AND GENERALLY WILL NOT BE MADE AVAILABLE FOR DISTRIBUTION.

REFERENCES

114, 116, 265, 788, AND, 538.

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SPACECRAFT COMMON NAME- ITOS-D
ALTERNATE NAMES- PL-701J, NOAA 2

NSSDC ID ITOS-D

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 1460.00 KM ALT
PERIGEE- 1460.00 KM ALT
PERIOD- 115.2 MIN
INCLINATION- 101.7 DEG

OTHER INFORMATION
SPACECRAFT WT- 409. KG
LAUNCH DATE- 09/00/72
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - J.	SARGENT	NASA-GSFC	GREENBELT, MD.
PS - I.L.	GOLDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ITOS-D IS THE FIRST IN A SERIES OF RECONFIGURED TIROS-M SATELLITES THAT WILL BE LAUNCHED WITH NEW METEOROLOGICAL SENSORS ON BOARD TO EXPAND THE OPERATIONAL CAPABILITY OF THE ITOS SYSTEM. THE PRIMARY OBJECTIVES OF THE ITOS-D METEOROLOGICAL SATELLITE ARE TO PROVIDE GLOBAL DAYTIME AND NIGHTTIME DIRECT READOUT CLOUDCOVER DATA ON A DAILY BASIS. THE SUN-SYNCHRONOUS SPACECRAFT WILL ALSO BE CAPABLE OF SUPPLYING GLOBAL ATMOSPHERIC TEMPERATURE SOUNDINGS AND VERY HIGH RESOLUTION INFRARED CLOUDCOVER DATA FOR SELECTED AREAS IN EITHER A DIRECT READOUT OR A TAPE RECORDER MODE. A SECONDARY OBJECTIVE IS TO OBTAIN GLOBAL SOLAR PROTON FLUX DATA ON A ROUTINE DAILY BASIS. THE PRIMARY SENSORS CONSIST OF A VERY HIGH RESOLUTION RADIOMETER (VHRR), A VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR), AND A SCANNING RADIOMETER (SR). THE VHRR, VTPR, AND SR ARE MOUNTED ON THE SATELLITE BASEPLATE WITH THEIR OPTICAL AXES DIRECTED VERTICALLY EARTHWARD. THE NEARLY CUBICAL SPACECRAFT MEASURES 1 BY 1 BY 1.2 M. THE SATELLITE IS EQUIPPED WITH THREE CURVED SOLAR PANELS THAT WILL BE FOLDED DURING LAUNCH AND DEPLOYED AFTER ORBIT IS ACHIEVED. EACH PANEL MEASURES OVER 4.2 M IN LENGTH WHEN UNFOLDED AND IS COVERED WITH 3420 SOLAR CELLS MEASURING 2 BY 2 CM. THE ITOS-D DYNAMICS AND ATTITUDE CONTROL SYSTEM WILL MAINTAIN DESIRED SPACECRAFT ORIENTATION THROUGH GYROSCOPIC PRINCIPLES INCORPORATED INTO THE SATELLITE DESIGN. EARTH ORIENTATION OF THE SATELLITE BODY WILL BE MAINTAINED BY TAKING ADVANTAGE OF THE PRECESSION INDUCED FROM A MOMENTUM FLYWHEEL SO THAT THE SATELLITE BODY PRECESSION RATE OF ONE REVOLUTION PER ORBIT WILL PROVIDE THE DESIRED 'EARTH LOOKING' ATTITUDE. MINOR ADJUSTMENTS IN ATTITUDE AND ORIENTATION WILL BE MADE BY MEANS OF MAGNETIC COILS AND BY VARYING THE SPEED OF THE MOMENTUM FLYWHEEL.

REFERENCES
106, 107, 108, 109, 117, 118, 119, 120, 195, 257, 272, 716, 788, AND 792.

EXPERIMENT NAME- SCANNING RADIOMETER (SR) NSSDC ID ITOS-D -02

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION
THE ITOS-D SCANNING RADIOMETER (SR) SUBSYSTEM WILL CONSIST OF TWO SCANNING RADIOMETERS, A DUAL SR PROCESSOR, AND TWO SR RECORDERS. THIS SUBSYSTEM WILL PERMIT THE DETERMINATION OF SURFACE TEMPERATURES OF THE GROUND, THE SEA, OR CLOUD TOPS VIEWED BY THE RADIOMETER. THE RADIOMETER WILL MEASURE REFLECTED RADIATION FROM THE EARTH ATMOSPHERE SYSTEM IN THE 0.52- TO 0.73-MICRON BAND DURING THE DAY AND EMITTED RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN THE 10.5- TO 12.5-MICRON BAND DURING THE DAY AND NIGHT. UNLIKE A CAMERA, THE SR WILL NOT TAKE A PICTURE BUT INSTEAD WILL FORM AN IMAGE USING A CONTINUOUSLY ROTATING MIRROR. THE MIRROR WILL SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH AT A RATE OF 48 RPM. AS THE SATELLITE PROGRESSES ALONG ITS ORBITAL PATH, EACH ROTATION OF THE MIRROR WILL PROVIDE ONE SCAN LINE OF PICTURE. RADIATION COLLECTED BY THE MIRROR WILL BE PASSED THROUGH A BEAM SPLITTER AND SPECTRAL FILTER TO PRODUCE THE DESIRED SPECTRAL SEPARATION. UP TO TWO FULL ORBITS OF DATA (145 MIN) CAN BE STORED ON MAGNETIC TAPE FOR SUBSEQUENT TRANSMISSION (1697.5 MHZ) TO AN ACQUISITION STATION. THE DATA CAN ALSO BE TRANSMITTED IN REAL TIME TO LOCAL APT STATIONS. ONCE THE SIGNAL IS RECEIVED BY THE GROUND STATION, A CONTINUOUS PICTURE WILL BE FORMED BY USING A FACSIMILE RECORDER WHOSE SCAN IS IN PHASE WITH THE SATELLITE'S FORWARD MOTION. AT A PLANNED SPACECRAFT ALTITUDE OF 1460 KM, THE RADIOMETER WILL HAVE A GROUND RESOLUTION OF BETTER THAN 4 KM AT NADIR. THE RADIOMETER WILL BE CAPABLE OF YIELDING RADIANCE TEMPERATURES BETWEEN 185 AND 330 DEG K TO AN ACCURACY OF 4 AND 1 DEG K, RESPECTIVELY. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-E, -F, AND -G.

REFERENCES
106, 109, 117, 119, 120, 195, 579, AND 792.

EXPERIMENT NAME- VERY HIGH RESOLUTION RADIOMETER (VHRR) NSSDC ID ITOS-D -03

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION
THE ITOS-D VERY HIGH RESOLUTION RADIOMETER (VHRR) EXPERIMENT IS DESIGNED TO CONTINUOUSLY MEASURE SURFACE TEMPERATURES OF THE EARTH, SEA, AND CLOUD TOPS IN DAYLIGHT AS WELL AS AT NIGHT AND TO TRANSMIT THE TEMPERATURE DATA IN REAL TIME TO COMMAND AND DATA ACQUISITION (CDA) STATIONS THROUGHOUT

THE WORLD FOR USE IN LOCAL WEATHER FORECASTING. THE SPACECRAFT CAN ALSO BE PROGRAMMED TO RECORD UP TO 5 MIN OF DATA FOR REMOTE AREAS WHERE NO CDA STATIONS ARE WITHIN RANGE OF THE SPACECRAFT, WITH THE RECORDED DATA BEING PLAYED BACK TO THE NEXT CDA STATION THAT THE SPACECRAFT PASSES. THE EXPERIMENT WILL INCLUDE TWO SCANNING RADIOMETERS, A MAGNETIC TAPE RECORDER, AND ASSOCIATED ELECTRONICS. THE TWO-CHANNEL VHRR WILL OPERATE SIMILARLY TO THE SCANNING RADIOMETER (SR) BUT WITH MUCH GREATER RESOLUTION (0.9 KM COMPARED TO 4 KM FOR THE SR AT NADIR). ONE VHRR CHANNEL WILL MEASURE REFLECTED VISUAL RADIATION FROM CLOUD TOPS IN THE LIMITED SPECTRAL RANGE OF 0.6 TO 0.7 MICRON. THIS WILL PROVIDE MORE CONTRAST THAN THE SR BETWEEN THE EARTH AND CLOUDS BY REDUCING THE EFFECT OF HAZE. THE SECOND CHANNEL WILL MEASURE INFRARED RADIATION EMITTED FROM THE EARTH, SEA, AND CLOUD TOPS IN THE 10.5- TO 12.5-MICRON REGION. THIS SPECTRAL REGION PERMITS BOTH DAYTIME AND NIGHTTIME RADIANCE MEASUREMENTS. THE VHRR WILL FORM AN IMAGE BY USING A SCANNING MIRROR TECHNIQUE SIMILAR TO THE SR EXCEPT THAT BOTH RADIOMETERS WILL OPERATE SIMULTANEOUSLY. AS THE SATELLITE PROCEEDS IN ITS ORBIT, THE 400-RPM REVOLVING MIRRORS WILL SCAN THE EARTH'S SURFACE 180 DEG OUT OF PHASE (ONE MIRROR AT A TIME) AND PERPENDICULAR TO THE ORBIT PATH. THE VISIBLE AND INFRARED DATA WILL BE TIME-MULTIPLEXED SO THAT THE SCAN OF THE INFRARED CHANNEL WILL BE TRANSMITTED FIRST, FOLLOWED BY THE EARTH SCAN PORTION OF THE VISIBLE CHANNEL. THIS PROCESS WILL BE REPEATED 400 TIMES PER MINUTE (EQUIVALENT TO THE SCAN RATE). IF ONE OF THE RADIOMETERS FAILS, THE SYSTEM IS STILL CAPABLE OF MEASURENG BOTH VISIBLE AND INFRARED RADIATION USING ONLY THE REMAINING RADIOMETER. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-E, -F, AND -G.

REFERENCES

2, 106, 107, 108, 109, 117, 119, 120, 195, 256, 318, 579, 788, 792, AND 939.

EXPERIMENT NAME- VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR) NSSDC ID ITOS-D -04

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-D VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR) WILL SENSE THE RADIANT ENERGY FROM ATMOSPHERIC CARBON DIOXIDE IN SIX NARROW SPECTRAL REGIONS CENTERED AT 15.0, 14.8, 14.4, 14.1, 13.8, AND 13.4 MICRONS. THE ATMOSPHERIC GROSS WATER VAPOR CONTENT WILL BE DETERMINED FROM MEASUREMENTS CENTERED AT 18.7 MICRONS. MEASUREMENTS WILL ALSO BE TAKEN IN THE 12.0-MICRON SPECTRAL REGION TO DETERMINE SURFACE/CLOUD TOP TEMPERATURES. THE VTPR WILL CONSIST OF AN OPTICAL SYSTEM, A DETECTOR AND ASSOCIATED ELECTRONICS, AND A SCANNING MIRROR. THE MIRROR WILL SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH. AS EACH AREA IS SCANNED, THE OPTICAL SYSTEM WILL COLLECT, FILTER, AND DETECT THE RADIATION FROM THE EARTH INTO THE EIGHT SPECTRAL INTERVALS. THE GROUND AREA COVERED BY ONE SAMPLE OF DATA WILL BE APPROXIMATELY 50 KM BY 50 KM. THE RADIOMETER WILL OPERATE CONTINUOUSLY, TAKING MEASUREMENTS OVER EVERY PART OF THE EARTH'S SURFACE TWICE A DAY. THE DATA WILL BE RECORDED THROUGHOUT THE ORBIT AND PLAYED BACK ON COMMAND WHEN THE SATELLITE IS WITHIN COMMUNICATION RANGE OF A COMMAND AND ACQUISITION STATION. GROUND PERSONNEL WILL USE THE DATA TO COMPUTE TEMPERATURE-PRESSURE PROFILES TO ALTITUDES AS HIGH AS 30 KM. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL

CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-E, -F, AND -G.

REFERENCES
2, 107, 115, 120, 195, 256, 318, 424, 523, 579, 788, 792, AND 939.

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SPACECRAFT COMMON NAME- ITOS-E
ALTERNATE NAMES- PL-701K

NSSDC ID ITOS-E

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 1460.00 KM ALT
PERIGEE- 1460.00 KM ALT
PERIOD- 115.2 MIN
INCLINATION- 102. DEG

OTHER INFORMATION
SPACECRAFT WT- 409. KG
LAUNCH DATE- 06/00/73
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - J.	SARGENT	NASA-GSFC	GREENBELT, MD.
PS - I.L.	GOLDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION
ITOS-E IS ONE IN A SERIES OF IMPROVED TIROS-M TYPE SATELLITES THAT WILL BE LAUNCHED WITH NEW METEOROLOGICAL SENSORS ON BOARD TO EXPAND THE OPERATIONAL CAPABILITY OF THE ITOS SYSTEM. THE PRIMARY OBJECTIVES OF THE ITOS-E METEOROLOGICAL SATELLITE ARE TO PROVIDE GLOBAL DAYTIME AND NIGHTTIME DIRECT READOUT CLOUDCOVER DATA ON A DAILY BASIS. THE SUN-SYNCHRONOUS SPACECRAFT WILL ALSO BE CAPABLE OF SUPPLYING GLOBAL ATMOSPHERIC TEMPERATURE SOUNDINGS AND VERY HIGH RESOLUTION INFRARED CLOUDCOVER DATA FOR SELECTED AREAS IN EITHER A DIRECT READOUT OR A TAPE RECORDER MODE. A SECONDARY OBJECTIVE IS TO OBTAIN GLOBAL SOLAR PROTON FLUX DATA ON A ROUTINE DAILY BASIS. THE PRIMARY SENSORS CONSIST OF A VERY HIGH RESOLUTION RADIOMETER (VHRR), A VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR), AND A SCANNING RADIOMETER (SR). THE VHRR, VTPR, AND SR ARE MOUNTED ON THE SATELLITE BASEPLATE WITH THEIR OPTICAL AXES DIRECTED VERTICALLY EARTHWARD. THE NEARLY CUBICAL SPACECRAFT MEASURES 1 BY 1 BY 1.2 M. THE SATELLITE IS EQUIPPED WITH THREE CURVED SOLAR PANELS THAT WILL BE FOLDED DURING LAUNCH AND DEPLOYED AFTER ORBIT IS ACHIEVED. EACH PANEL MEASURES OVER 4.2 M IN LENGTH WHEN UNFOLDED AND IS COVERED WITH 3420 SOLAR CELLS MEASURING 2 BY 2 CM. THE ITOS DYNAMICS AND ATTITUDE CONTROL SYSTEM WILL MAINTAIN DESIRED SPACECRAFT ORIENTATION THROUGH GYROSCOPIC PRINCIPLES INCORPORATED INTO THE SATELLITE DESIGN. EARTH ORIENTATION OF THE SATELLITE BODY WILL BE MAINTAINED BY TAKING ADVANTAGE OF THE PRECESSION INDUCED FROM A MOMENTUM FLYWHEEL SO THAT THE SATELLITE BODY PRECESSION RATE OF ONE REVOLUTION PER ORBIT WILL PROVIDE THE DESIRED 'EARTH LOOKING' ATTITUDE. MINOR ADJUSTMENTS IN ATTITUDE AND ORIENTATION WILL BE MADE BY MEANS OF MAGNETIC COILS AND BY VARYING THE SPEED OF THE MOMENTUM FLYWHEEL.

REFERENCES
106, 107, 108, 109, 195, 257, 788, AND 792.

C3

EXPERIMENT NAME- SCANNING RADIOMETER (SR) NSSDC ID ITOS-E -02

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-E SCANNING RADIOMETER (SR) SUBSYSTEM WILL CONSIST OF TWO SCANNING RADIOMETERS, A DUAL SR PROCESSOR, AND TWO SR RECORDERS. THIS SUBSYSTEM WILL PERMIT THE DETERMINATION OF SURFACE TEMPERATURES OF THE GROUND, THE SEA, OR CLOUD TOPS VIEWED BY THE RADIOMETER. THE RADIOMETER WILL MEASURE REFLECTED RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 0.52- TO 0.73-MICRON BAND DURING THE DAY AND EMITTED RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN THE 10.5- TO 12.5-MICRON BAND DURING THE DAY AND NIGHT. UNLIKE A CAMERA, THE SR WILL NOT TAKE A PICTURE BUT INSTEAD WILL FORM AN IMAGE USING A CONTINUOUSLY ROTATING MIRROR. THE MIRROR WILL SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH AT A RATE OF 48 RPM. AS THE SATELLITE PROGRESSES ALONG ITS ORBITAL PATH, EACH ROTATION OF THE MIRROR WILL PROVIDE ONE SCAN LINE OF PICTURE. RADIATION COLLECTED BY THE MIRROR WILL BE PASSED THROUGH A BEAM SPLITTER AND SPECTRAL FILTER TO PRODUCE THE DESIRED SPECTRAL SEPARATION. UP TO TWO FULL ORBITS OF DATA (145 MIN) CAN BE STORED ON MAGNETIC TAPE FOR SUBSEQUENT TRANSMISSION (1697.5 MHZ) TO AN ACQUISITION STATION. THE DATA CAN ALSO BE TRANSMITTED IN REAL TIME TO LOCAL APT STATIONS. ONCE THE SIGNAL IS RECEIVED BY THE GROUND STATION, A CONTINUOUS PICTURE WILL BE FORMED BY USING A FACSIMILE RECORDER WHOSE SCAN IS IN PHASE WITH THE SATELLITE'S FORWARD MOTION. FROM A PLANNED ALTITUDE OF 1460 KM, THE RADIOMETER WILL HAVE A GROUND RESOLUTION OF APPROXIMATELY 4 KM AT NADIR AND WILL BE CAPABLE OF YIELDING RADIANCE TEMPERATURES BETWEEN 185 AND 330 DEG K TO WITHIN AN ACCURACY OF 4 AND 1 DEG K, RESPECTIVELY. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-D, -F, AND -G.

REFERENCES

106, 109, 155, 579, AND 792.

EXPERIMENT NAME- VERY HIGH RESOLUTION RADIOMETER (VHRR) NSSDC ID ITOS-E -03

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-E VERY HIGH RESOLUTION RADIOMETER (VHRR) EXPERIMENT IS DESIGNED TO CONTINUOUSLY MEASURE SURFACE TEMPERATURES OF THE EARTH, SEA, AND CLOUD TOPS IN DAYLIGHT AS WELL AS AT NIGHT AND TO TRANSMIT THE TEMPERATURE DATA IN REAL TIME TO COMMAND AND DATA ACQUISITION (CDA) STATIONS THROUGHOUT THE WORLD FOR USE IN LOCAL WEATHER FORECASTING. THE SPACECRAFT CAN BE PROGRAMMED TO RECORD UP TO 5 MIN OF DATA FOR REMOTE AREAS WHERE NO CDA STATION IS WITHIN RANGE OF THE SPACECRAFT, WITH THE RECORDED DATA BEING PLAYED BACK TO THE NEXT CDA STATION THAT THE SPACECRAFT PASSES. THE EXPERIMENT WILL INCLUDE TWO SCANNING RADIOMETERS, A MAGNETIC TAPE RECORDER, AND ASSOCIATED ELECTRONICS. THE TWO-CHANNEL VHRR WILL OPERATE SIMILARLY TO

THE SCANNING RADIOMETER (SR) BUT WITH MUCH GREATER RESOLUTION (0.9 KM COMPARED TO 4 KM FOR THE SR AT NADIR). ONE VHRR CHANNEL WILL MEASURE REFLECTED VISUAL RADIATION FROM CLOUD TOPS IN THE SPECTRAL RANGE 0.6 TO 0.7 MICRON. THIS WILL PROVIDE MORE CONTRAST THAN THE SR BETWEEN THE EARTH AND CLOUDS BY REDUCING THE EFFECT OF HAZE. THE SECOND CHANNEL WILL MEASURE INFRARED RADIATION EMITTED FROM THE EARTH, SEA, AND CLOUD TOPS IN THE 10.5- TO 12.5-MICRON REGION. THIS SPECTRAL REGION PERMITS BOTH DAYTIME AND NIGHTTIME RADIANCE MEASUREMENTS. THE VHRR WILL FORM AN IMAGE BY USING A SCANNING MIRROR TECHNIQUE SIMILAR TO THE SR EXCEPT THAT BOTH RADIOMETERS WILL OPERATE SIMULTANEOUSLY. AS THE SATELLITE PROCEEDS IN ITS ORBIT, THE TWO 400-RPM REVOLVING MIRRORS WILL SCAN THE EARTH'S SURFACE 180 DEG OUT OF PHASE (ONE MIRROR AT A TIME) AND PERPENDICULAR TO THE ORBIT PATH. THE VISIBLE AND INFRARED DATA WILL BE TIME-MULTIPLEXED SO THAT THE SCAN OF THE INFRARED CHANNEL WILL BE TRANSMITTED FIRST, FOLLOWED BY THE EARTH SCAN PORTION OF THE VISIBLE CHANNEL. THIS PROCESS WILL BE REPEATED 400 TIMES PER MINUTE (EQUIVALENT TO THE SCAN RATE). IF ONE OF THE RADIOMETERS FAILS, THE SYSTEM IS STILL CAPABLE OF MEASURING BOTH VISIBLE AND INFRARED RADIATION USING ONLY THE REMAINING RADIOMETER. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-D, -F, AND -G.

REFERENCES
107, 108, 109, 195, 256, 579, 788, AND 792.

EXPERIMENT NAME- VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR)   NSSDC ID ITOS-E -04

EXPERIMENT PERSONNEL
PI - NESS STAFF   NOAA-NESS   SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION
THE ITOS-E VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR) WILL SENSE THE RADIANT ENERGY FROM ATMOSPHERIC CARBON DIOXIDE IN SIX NARROW SPECTRAL REGIONS CENTERED AT 15.0, 14.8, 14.4, 14.1, 13.8, AND 13.4 MICRONS. THE GROSS ATMOSPHERIC WATER VAPOR CONTENT WILL BE DETERMINED FROM MEASUREMENTS CENTERED AT 18.7 MICRONS. MEASUREMENTS WILL ALSO BE TAKEN IN THE 12.0-MICRON SPECTRAL REGION TO DETERMINE SURFACE/CLOUDTOP TEMPERATURES. THE VTPR WILL CONSIST OF AN OPTICAL SYSTEM, DETECTOR AND ASSOCIATED ELECTRONICS, AND A SCANNING MIRROR. THE MIRROR WILL SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH. AS EACH AREA IS SCANNED, THE OPTICAL SYSTEM WILL COLLECT, FILTER, AND DETECT THE RADIATION FROM THE EARTH INTO THE EIGHT SPECTRAL INTERVALS. THE GROUND AREA COVERED BY ONE SAMPLE OF DATA WILL BE APPROXIMATELY 50 BY 50 KM. THE RADIOMETER WILL OPERATE CONTINUOUSLY, TAKING MEASUREMENTS OVER EVERY PART OF THE EARTH'S SURFACE TWICE A DAY. THE DATA WILL BE RECORDED THROUGHOUT THE ORBIT AND WILL BE PLAYED BACK UPON COMMAND WHEN THE SATELLITE IS WITHIN COMMUNICATION RANGE OF A COMMAND AND DATA ACQUISITION STATION. GROUND PERSONNEL WILL USE THE DATA TO COMPUTE TEMPERATURE-PRESSURE PROFILES TO ALTITUDES AS HIGH AS 30 KM. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-D, -F, AND -G.

REFERENCES
107, 108, 195, 256, 318, 424, 523, 579, AND 792.

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SPACECRAFT COMMON NAME- ITOS-F NSSDC ID ITOS-F

ALTERNATE NAMES-

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- / /
- APOGEE- 1460.00 KM ALT
- PERIGEE- 1460.00 KM ALT
- PERIOD- 115.2 MIN
- INCLINATION- 102. DEG

OTHER INFORMATION
- SPACECRAFT WT- 409. KG
- LAUNCH DATE- 06/00/74
- OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - J.	SARGENT	NASA-GSFC	GREENBELT, MD.
PS - I.L.	GOLDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ITOS-F IS ONE IN A SERIES OF IMPROVED TIROS-M TYPE SATELLITES THAT WILL BE LAUNCHED WITH NEW METEOROLOGICAL SENSORS ON BOARD TO EXPAND THE OPERATIONAL CAPABILITY OF THE ITOS SYSTEM. THE PRIMARY OBJECTIVES OF THE ITOS-F METEOROLOGICAL SATELLITE ARE TO PROVIDE GLOBAL DAYTIME AND NIGHTTIME DIRECT READOUT CLOUDCOVER DATA ON A DAILY BASIS. THE SUN-SYNCHRONOUS SPACECRAFT WILL ALSO BE CAPABLE OF SUPPLYING GLOBAL ATMOSPHERIC TEMPERATURE SOUNDINGS AND VERY HIGH RESOLUTION INFRARED CLOUDCOVER DATA OF SELECTED AREAS IN EITHER A DIRECT READOUT OR A TAPE RECORDER MODE. A SECONDARY OBJECTIVE IS TO OBTAIN GLOBAL SOLAR PROTON FLUX DATA ON A ROUTINE DAILY BASIS. THE PRIMARY SENSORS CONSIST OF A VERY HIGH RESOLUTION RADIOMETER (VHRR), A VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR), AND A SCANNING RADIOMETER (SR). THE VHRR, VTPR, AND SR ARE MOUNTED ON THE SATELLITE BASEPLATE WITH THEIR OPTICAL AXES DIRECTED VERTICALLY EARTHWARD. THE NEARLY CUBICAL SPACECRAFT MEASURES 1 BY 1 BY 1.2 M. THE SATELLITE IS EQUIPPED WITH THREE CURVED SOLAR PANELS THAT WILL BE FOLDED DURING LAUNCH AND DEPLOYED AFTER ORBIT IS ACHIEVED. EACH PANEL MEASURES OVER 4.2 M IN LENGTH WHEN UNFOLDED AND IS COVERED WITH 3420 SOLAR CELLS MEASURING 2 BY 2 CM. THE ITOS DYNAMICS AND ATTITUDE CONTROL SYSTEM WILL MAINTAIN DESIRED SPACECRAFT ORIENTATION THROUGH GYROSCOPIC PRINCIPLES INCORPORATED INTO THE SATELLITE DESIGN. EARTH ORIENTATION OF THE SATELLITE BODY WILL BE MAINTAINED BY TAKING ADVANTAGE OF THE PRECESSION INDUCED FROM A MOMENTUM FLYWHEEL SO THAT THE SATELLITE BODY PRECESSION RATE OF ONE REVOLUTION PER ORBIT WILL PROVIDE THE DESIRED 'EARTH LOOKING' ATTITUDE. MINOR ADJUSTMENTS IN ATTITUDE AND ORIENTATION WILL BE MADE BY MEANS OF MAGNETIC COILS AND BY VARYING THE SPEED OF THE MOMENTUM FLYWHEEL.

REFERENCES

195, 257, 788, AND 792.

EXPERIMENT NAME- SCANNING RADIOMETER (SR) NSSDC ID ITOS-F -02

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-F SCANNING RADIOMETER (SR) SUBSYSTEM WILL CONSIST OF TWO SCANNING RADIOMETERS, A DUAL SR PROCESSOR, AND TWO SR RECORDERS. THIS SUBSYSTEM WILL PERMIT THE DETERMINATION OF SURFACE TEMPERATURES OF THE GROUND, THE SEA, OR CLOUD TOPS VIEWED BY THE RADIOMETER. THE RADIOMETER WILL MEASURE REFLECTED RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 0.52- TO 0.73-MICRON CHANNEL DURING THE DAY AND EMITTED RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN THE 10.5- TO 12.5-MICRON CHANNEL DURING THE DAY AND NIGHT. UNLIKE A CAMERA, THE SR WILL NOT TAKE A PICTURE BUT INSTEAD WILL FORM AN IMAGE USING A CONTINUOUSLY ROTATING MIRROR. THE MIRROR WILL SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH AT A RATE OF 48 RPM. AS THE SATELLITE PROGRESSES ALONG ITS ORBITAL PATH, EACH ROTATION OF THE MIRROR WILL PROVIDE ONE SCAN LINE OF PICTURE. RADIATION COLLECTED BY THE MIRROR WILL BE PASSED THROUGH A BEAM SPLITTER AND SPECTRAL FILTER TO PRODUCE THE DESIRED SPECTRAL SEPARATION. UP TO TWO FULL ORBITS OF DATA (145 MIN) CAN BE STORED ON MAGNETIC TAPE FOR SUBSEQUENT TRANSMISSION (1697.5 MHZ) TO AN ACQUISITION STATION. THE DATA CAN ALSO BE TRANSMITTED IN REAL TIME TO LOCAL APT STATIONS. ONCE THE SIGNAL IS RECEIVED BY THE GROUND STATION, A CONTINUOUS PICTURE WILL BE FORMED BY USING A FACSIMILE RECORDER WHOSE SCAN IS IN PHASE WITH THE SATELLITE'S FORWARD MOTION. FROM A PLANNED ALTITUDE OF 1460 KM, THE RADIOMETER WILL HAVE A GROUND RESOLUTION OF APPROXIMATELY 4 KM AT NADIR AND WILL BE CAPABLE OF YIELDING RADIANCE TEMPERATURES BETWEEN 185 AND 330 DEG K TO AN ACCURACY OF 4 AND 1 DEG K, RESPECTIVELY. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-D, -E, AND -G.

REFERENCES

195, 579, AND 792.

EXPERIMENT NAME- VERY HIGH RESOLUTION RADIOMETER (VHRR) NSSDC ID ITOS-F -03

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-F VERY HIGH RESOLUTION RADIOMETER (VHRR) EXPERIMENT IS DESIGNED TO CONTINUOUSLY MEASURE SURFACE TEMPERATURES OF THE EARTH, SEA, AND CLOUD TOPS IN DAYLIGHT AS WELL AS AT NIGHT AND TO TRANSMIT THE TEMPERATURE DATA IN REAL TIME TO COMMAND AND DATA ACQUISITION (CDA) STATIONS THROUGHOUT THE WORLD FOR USE IN LOCAL WEATHER FORECASTING. THE SPACECRAFT CAN BE PROGRAMMED TO RECORD UP TO 9 MIN OF DATA FOR REMOTE AREAS WHERE NO CDA STATION IS WITHIN RANGE OF THE SPACECRAFT, WITH THE RECORDED DATA BEING PLAYED BACK TO THE NEXT CDA STATION THAT THE SPACECRAFT PASSES. THE EXPERIMENT WILL INCLUDE TWO SCANNING RADIOMETERS, A MAGNETIC TAPE RECORDER, AND ASSOCIATED ELECTRONICS. THE TWO-CHANNEL VHRR WILL OPERATE SIMILARLY TO THE SCANNING RADIOMETER (SR) BUT WITH MUCH GREATER RESOLUTION (0.9 KM COMPARED TO 4 KM FOR THE SR AT NADIR). ONE VHRR CHANNEL WILL MEASURE REFLECTED VISUAL RADIATION FROM CLOUD TOPS IN THE LIMITED SPECTRAL RANGE 0.6 TO 0.7 MICRON. THIS WILL PROVIDE MORE CONTRAST THAN THE SR BETWEEN THE EARTH AND CLOUDS BY REDUCING THE EFFECT OF HAZE. THE SECOND CHANNEL WILL MEASURE INFRARED RADIATION EMITTED FROM THE EARTH, SEA, AND CLOUD TOPS IN THE 10.5-

TO 12.5-MICRON REGION. THIS SPECTRAL REGION PERMITS BOTH DAYTIME AND NIGHTTIME RADIANCE MEASUREMENTS. THE VHRR WILL FORM AN IMAGE BY USING A SCANNING MIRROR TECHNIQUE SIMILAR TO THE SR EXCEPT THAT BOTH RADIOMETERS WILL OPERATE SIMULTANEOUSLY. AS THE SATELLITE PROCEEDS IN ITS ORBIT, THE 400-RPM REVOLVING MIRRORS WILL SCAN THE EARTH'S SURFACE 180 DEG OUT OF PHASE (ONE MIRROR AT A TIME) AND PERPENDICULAR TO THE ORBIT PATH. THE VISIBLE AND INFRARED DATA WILL BE TIME-MULTIPLEXED SO THAT THE SCAN OF THE INFRARED CHANNEL WILL BE TRANSMITTED FIRST, FOLLOWED BY THE EARTH SCAN PORTION OF THE VISIBLE CHANNEL. THIS PROCESS WILL BE REPEATED 400 TIMES PER MINUTE (EQUIVALENT TO THE SCAN RATE). IF ONE OF THE RADIOMETERS FAILS, THE SYSTEM IS STILL CAPABLE OF MEASURING BOTH VISIBLE AND INFRARED RADIATION USING ONLY THE REMAINING RADIOMETER. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-D, -E, AND -G.

REFERENCES
195, 256, 318, 579, AND 792.

EXPERIMENT NAME- VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR)   NSSDC ID ITOS-F -04

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-F VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR) WILL SENSE THE RADIANT ENERGY FROM ATMOSPHERIC CARBON DIOXIDE IN SIX NARROW SPECTRAL REGIONS CENTERED AT 15.0, 14.8, 14.4, 14.1, 13.8, AND 13.4 MICRONS. THE GROSS ATMOSPHERIC WATER VAPOR CONTENT WILL BE DETERMINED FROM MEASUREMENTS CENTERED AT 18.7 MICRONS. MEASUREMENTS WILL ALSO BE TAKEN IN THE 12.0-MICRON SPECTRAL REGION TO DETERMINE SURFACE/CLOUDTOP TEMPERATURES. THE VTPR WILL CONSIST OF AN OPTICAL SYSTEM, DETECTOR AND ASSOCIATED ELECTRONICS, AND A SCANNING MIRROR. THE MIRROR WILL SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH. THE GROUND AREA COVERED BY ONE SAMPLE OF DATA WILL BE APPROXIMATELY 50 BY 50 KM. AS EACH AREA IS SCANNED, THE OPTICAL SYSTEM WILL COLLECT, FILTER, AND DETECT THE RADIATION FROM THE EARTH INTO THE EIGHT SPECTRAL INTERVALS. THE RADIOMETER WILL OPERATE CONTINUOUSLY, TAKING MEASUREMENTS OVER EVERY PART OF THE EARTH'S SURFACE TWICE A DAY. THE DATA WILL BE RECORDED THROUGHOUT THE ORBIT AND PLAYED BACK UPON COMMAND WHEN THE SATELLITE IS WITHIN COMMUNICATION RANGE OF A COMMAND AND DATA ACQUISITION STATION. GROUND PERSONNEL WILL USE THE DATA TO COMPUTE TEMPERATURE-PRESSURE PROFILES TO ALTITUDES AS HIGH AS 30 KM. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-D, -E, AND -G.

REFERENCES
195, 256, 318, 523, 579, 788, AND 792.

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SPACECRAFT COMMON NAME- ITOS-G   NSSDC ID ITOS-G
ALTERNATE NAMES-

ORBITAL INFORMATION
    ORBIT TYPE- GEOCENTRIC
    EPOCH DATE-   / /
    APOGEE- 1460.00 KM ALT
    PERIGEE- 1460.00 KM ALT
    PERIOD- 115.2 MIN
    INCLINATION- 102. DEG

OTHER INFORMATION
    SPACECRAFT WT- 409. KG
    LAUNCH DATE- 06/00/75
    OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - J	SARGENT	NASA-GSFC	GREENBELT, MD.
PS - I.L.	GOLDBERG	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ITOS-G IS ONE IN A SERIES OF IMPROVED TIROS-M TYPE SATELLITES THAT WILL BE LAUNCHED WITH NEW METEOROLOGICAL SENSORS ON BOARD TO EXPAND THE OPERATIONAL CAPABILITY OF THE ITOS SYSTEM. THE PRIMARY OBJECTIVES OF THE ITOS-G METEOROLOGICAL SATELLITE ARE TO PROVIDE GLOBAL DAYTIME AND NIGHTTIME DIRECT READOUT CLOUDCOVER DATA ON A DAILY BASIS. THE SUN-SYNCHRONOUS SPACECRAFT WILL ALSO BE CAPABLE OF SUPPLYING GLOBAL ATMOSPHERIC TEMPERATURE SOUNDINGS AND VERY HIGH RESOLUTION INFRARED CLOUDCOVER DATA OF SELECTED AREAS IN EITHER A DIRECT READOUT OR A TAPE RECORDER MODE. A SECONDARY OBJECTIVE IS TO OBTAIN GLOBAL SOLAR PROTON DENSITY DATA ON A ROUTINE DAILY BASIS. THE PRIMARY SENSORS CONSIST OF A VERY HIGH RESOLUTION RADIOMETER (VHRR), A VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR), AND A SCANNING RADIOMETER (SR). THE VHRR, VTPR, AND SR ARE MOUNTED ON THE SATELLITE BASEPLATE WITH THEIR OPTICAL AXES DIRECTED VERTICALLY EARTHWARD. THE NEARLY CUBICAL SPACECRAFT MEASURES 1 BY 1 BY 1.2 M. THE SATELLITE IS EQUIPPED WITH THREE CURVED SOLAR PANELS THAT WILL BE FOLDED DURING LAUNCH AND DEPLOYED AFTER ORBIT IS ACHIEVED. EACH PANEL MEASURES OVER 4.2 M IN LENGTH WHEN UNFOLDED AND IS COVERED WITH 3420 SOLAR CELLS MEASURING 2 BY 2 CM. THE ITOS DYNAMICS AND ATTITUDE CONTROL SYSTEM WILL MAINTAIN DESIRED SPACECRAFT ORIENTATION THROUGH GYROSCOPIC PRINCIPLES INCORPORATED INTO THE SATELLITE DESIGN. EARTH ORIENTATION OF THE SATELLITE BODY WILL BE MAINTAINED BY TAKING ADVANTAGE OF THE PRECESSION INDUCED FROM A MOMENTUM FLYWHEEL SO THAT THE SATELLITE BODY PRECESSION RATE OF ONE REVOLUTION PER ORBIT WILL PROVIDE THE DESIRED 'EARTH LOOKING' ATTITUDE. MINOR ADJUSTMENTS IN ATTITUDE AND ORIENTATION WILL BE MADE BY MEANS OF MAGNETIC COILS AND BY VARYING THE SPEED OF THE MOMENTUM FLYWHEEL.

REFERENCES

195, 257, 788, AND 792.

EXPERIMENT NAME- SCANNING RADIOMETER (SR)   NSSDC ID ITOS-G -02

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-G SCANNING RADIOMETER (SR) SUBSYSTEM WILL CONSIST OF TWO SCANNING RADIOMETERS, A DUAL SR PROCESSOR, AND TWO SR RECORDERS. THIS

SUBSYSTEM WILL PERMIT THE DETERMINATION OF SURFACE TEMPERATURES OF THE GROUND, THE SEA, OR CLOUD TOPS VIEWED BY THE RADIOMETER. THE RADIOMETER WILL MEASURE REFLECTED RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 0.52- TO 0.73-MICRON BAND DURING THE DAY AND EMITTED RADIATION FROM THE EARTH AND ITS ATMOSPHERE IN THE 10.5- TO 12.5-MICRON REGION DURING THE DAY AND NIGHT. UNLIKE A CAMERA, THE SR WILL NOT TAKE A PICTURE BUT INSTEAD WILL FORM AN IMAGE USING A CONTINUOUSLY ROTATING MIRROR. THE MIRROR WILL SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH AT A RATE OF 48 RPM. AS THE SATELLITE PROGRESSES ALONG ITS ORBITAL PATH, EACH ROTATION OF THE MIRROR WILL PROVIDE ONE SCAN LINE OF PICTURE. RADIATION COLLECTED BY THE MIRROR WILL BE PASSED THROUGH A BEAM SPLITTER AND SPECTRAL FILTER TO PRODUCE THE DESIRED SPECTRAL SEPARATION. UP TO TWO FULL ORBITS OF DATA (145 MIN) CAN BE STORED ON MAGNETIC TAPE FOR SUBSEQUENT TRANSMISSION (1697.5 MHZ) TO AN ACQUISITION STATION. THE DATA CAN ALSO BE TRANSMITTED IN REAL TIME TO LOCAL APT STATIONS. ONCE THE SIGNAL IS RECEIVED BY THE GROUND STATION, A CONTINUOUS PICTURE WILL BE FORMED BY USING A FACSIMILE RECORDER, WHOSE SCAN IS IN PHASE WITH THE SATELLITE'S FORWARD MOTION. FROM A PLANNED ALTITUDE OF 1460 KM, THE RADIOMETER WILL HAVE A GROUND RESOLUTION OF APPROXIMATELY 4 KM AT NADIR AND WILL BE CAPABLE OF YIELDING RADIANCE TEMPERATURES BETWEEN 185 AND 330 DEG K TO AN ACCURACY OF 4 AND 1 DEG K, RESPECTIVELY. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-D, -E, AND -F.

REFERENCES

195, 579, AND 792.

EXPERIMENT NAME- VERY HIGH RESOLUTION RADIOMETER (VHRR)   NSSDC ID ITOS-G -03

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE VERY HIGH RESOLUTION RADIOMETER (VHRR) EXPERIMENT IS DESIGNED TO CONTINUOUSLY MEASURE SURFACE TEMPERATURES OF THE EARTH, SEA, AND CLOUD TOPS IN DAYLIGHT AS WELL AS AT NIGHT AND TO TRANSMIT THE TEMPERATURE DATA IN REAL TIME TO COMMAND AND DATA ACQUISITION (CDA) STATIONS THROUGHOUT THE WORLD FOR USE IN LOCAL WEATHER FORECASTING. THE SPACECRAFT CAN BE PROGRAMMED TO RECORD UP TO 9 MIN OF DATA FOR REMOTE AREAS WHERE NO CDA STATION IS WITHIN RANGE OF THE SPACECRAFT, WITH THE RECORDED DATA BEING PLAYED BACK TO THE NEXT CDA STATION THAT THE SPACECRAFT PASSES. THE EXPERIMENT WILL INCLUDE TWO SCANNING RADIOMETERS, A MAGNETIC TAPE RECORDER, AND ASSOCIATED ELECTRONICS. THE TWO-CHANNEL VHRR WILL OPERATE SIMILARLY TO THE SCANNING RADIOMETER (SR) BUT WITH MUCH GREATER RESOLUTION (0.9 KM COMPARED TO 4 KM FOR THE SR AT NADIR). ONE CHANNEL WILL MEASURE REFLECTED VISUAL RADIATION FROM CLOUDTOPS IN THE LIMITED SPECTRAL RANGE 0.6 TO 0.7 MICRONS. THIS WILL PROVIDE MORE CONTRAST THAN THE SR BETWEEN THE EARTH AND CLOUDS BY REDUCING THE EFFECT OF HAZE. THE SECOND CHANNEL WILL MEASURE INFRARED RADIATION EMITTED FROM THE EARTH, SEA, AND CLOUDTOPS IN THE 10.5- TO 12.5-MICRON REGION. THIS SPECTRAL REGION PERMITS BOTH DAYTIME AND NIGHTTIME RADIANCE MEASUREMENTS. THE VHRR WILL FORM AN IMAGE BY USING A SCANNING MIRROR TECHNIQUE SIMILAR TO THE SR EXCEPT THAT BOTH RADIOMETERS WILL OPERATE SIMULTANEOUSLY. AS THE SATELLITE PROCEEDS IN ITS ORBIT, TWO 400-RPM REVOLVING MIRRORS WILL SCAN THE EARTH'S SURFACE 180 DEG OUT OF PHASE (ONE MIRROR AT A TIME) IN A LINE PERPENDICULAR TO THE ORBIT PATH. THE VISIBLE AND INFRARED DATA WILL BE TIME-MULTIPLEXED SO THAT THE SCAN OF THE INFRARED CHANNEL WILL BE TRANSMITTED FIRST, FOLLOWED BY THE

EARTH SCAN PORTION OF THE VISIBLE CHANNEL. THIS PROCESS WILL BE REPEATED 400 TIMES PER MINUTE (EQUIVALENT TO THE SCAN RATE). IF ONE OF THE RADIOMETERS FAILS, THE SYSTEM IS STILL CAPABLE OF MEASURING BOTH VISIBLE AND INFRARED RADIATION USING ONLY THE REMAINING RADIOMETER. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-E, -F, AND -G.

REFERENCES

195, 256, 318, 579, 788, AND 792.

EXPERIMENT NAME- VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR) NSSDC ID ITOS-G -04

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-G VERTICAL TEMPERATURE PROFILE RADIOMETER (VTPR) WILL SENSE THE RADIANT ENERGY FROM ATMOSPHERIC CARBON DIOXIDE IN SIX NARROW SPECTRAL REGIONS CENTERED AT 15.0, 14.8, 14.4, 14.1, 13.8, AND 13.4 MICRONS. THE GROSS ATMOSPHERIC WATER VAPOR CONTENT WILL BE DETERMINED FROM MEASUREMENTS CENTERED AT 18.7 MICRONS. MEASUREMENTS WILL ALSO BE TAKEN IN THE 12.0-MICRON SPECTRAL REGION TO DETERMINE SURFACE/CLOUDTOP TEMPERATURES. THE VTPR WILL CONSIST OF AN OPTICAL SYSTEM, DETECTOR AND ASSOCIATED ELECTRONICS, AND A SCANNING MIRROR. THE MIRROR WILL SCAN THE EARTH'S SURFACE PERPENDICULAR TO THE SATELLITE'S ORBITAL PATH. AS EACH AREA IS SCANNED, THE OPTICAL SYSTEM WILL COLLECT, FILTER, AND DETECT THE RADIATION FROM THE EARTH INTO THE EIGHT SPECTRAL INTERVALS. THE GROUND AREA COVERED BY ONE SAMPLE OF DATA WILL BE APPROXIMATELY 50 BY 50 KM. THE RADIOMETER WILL OPERATE CONTINUOUSLY, TAKING MEASUREMENTS OVER EVERY PART OF THE EARTH'S SURFACE TWICE A DAY. THE DATA WILL BE RECORDED THROUGHOUT THE ORBIT AND WILL BE PLAYED BACK UPON COMMAND WHEN THE SATELLITE IS WITHIN COMMUNICATION RANGE OF A COMMAND AND DATA ACQUISITION STATION. GROUND PERSONNEL WILL USE THE DATA TO COMPUTE TEMPERATURE-PRESSURE PROFILES TO ALTITUDES AS HIGH AS 30 KM. ALL OPERATIONAL DATA FROM THIS EXPERIMENT WILL BE HANDLED BY NOAA AND EVENTUALLY ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-D, -E, AND -F.

REFERENCES

195, 256, 318, 523, 579, 788, AND 792.

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SPACECRAFT COMMON NAME- TIROS-N NSSDC ID TIROS-N

ALTERNATE NAMES-

ORBITAL INFORMATION

ORBIT TYPE- GEOCENTRIC

EPOCH DATE- / /

APOGEE- 1678.00 KM ALT

OTHER INFORMATION

SPACECRAFT WT- 633. KG

LAUNCH DATE- 08/00/76

OPERATING STATUS- PLANNED

PERIGEE- 1678.00 KM ALT
PERIOD- 120. MIN
INCLINATION- 103. DEG

SPACECRAFT PERSONNEL

PM - R.A.	STAMPFL	NASA-GSFC	GREENBELT, MD.
PS - W.	SHENK	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

TIROS-N WILL BE THE PROTOTYPE FOR THE THIRD-GENERATION SPACECRAFT IN THE NATIONAL OPERATIONAL METEOROLOGICAL SATELLITE SYSTEM (NOMSS). THE SATELLITE WILL BE DESIGNED TO SERVE AS AN ECONOMICAL AND STABLE SUN-SYNCHRONOUS PLATFORM FOR TESTING ADVANCED OPERATIONAL SUBSYSTEMS FOR USE IN WEATHER ANALYSIS AND FORECASTING. PRIMARY SENSORS WILL INCLUDE AN ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) FOR OBSERVING DAYTIME AND NIGHTTIME GLOBAL CLOUD COVER AND A TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) FOR OBTAINING TEMPERATURE AND WATER VAPOR PROFILES THROUGH THE EARTH'S ATMOSPHERE. SECONDARY EXPERIMENTS WILL BE A SPACE ENVIRONMENT MONITOR (SEM), WHICH WILL MEASURE THE PROTON AND ELECTRON FLUX NEAR THE EARTH, AND A DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS), WHICH WILL PROCESS AND RELAY TO CENTRAL DATA ACQUISITION STATIONS VARIOUS METEOROLOGICAL DATA RECEIVED FROM FREE FLOATING BALLOONS AND OCEAN BUOYS DISTRIBUTED AROUND THE GLOBE. THE SATELLITE WILL BE ABLE TO MAINTAIN AN EARTH-POINTING ACCURACY OF BETTER THAN PLUS OR MINUS 1 DEG IN ALL THREE AXES, WITH MOTION RATES OF LESS THAN 0.036 DEG/SEC.

REFERENCES

83, 257, 258, 259, 405, AND 541.

EXPERIMENT NAME- ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) NSSDC ID TIROS-N-01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE TIROS-N ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) WILL BE CAPABLE OF PROVIDING GLOBAL DAYTIME AND NIGHTTIME EARTH CLOUDCOVER PICTURES ON A REGULAR DAILY BASIS FOR USE IN WEATHER ANALYSIS AND FORECASTING. THE MULTISPECTRAL SCANNING INSTRUMENT WILL OPERATE IN BOTH REAL-TIME AND TAPE RECORDER MODES. THE FOUR-CHANNEL UNIT WILL USE THE FOLLOWING SPECTRAL WAVELENGTHS--CHANNEL 1, 0.4 TO 1.0 MICRON (VISIBLE), CHANNEL 2, 0.75 TO 1.00 MICRONS (NEAR IR), CHANNEL 3, 10.5 TO 12.5 MICRONS (IR WINDOW) AND CHANNEL 4, 6.5 TO 7.0 MICRONS (WATER VAPOR). THE VISIBLE, NEAR IR, AND IR WINDOW CHANNELS HAVE A PLANNED GROUND RESOLUTION OF 1 KM. THE RESOLUTION OF THE WATER VAPOR CHANNEL WILL BE SOMEWHAT LESS, ABOUT 4 KM AT NADIR. EACH CHANNEL WILL HAVE ITS OWN ELECTRONICS PACKAGE CONSISTING OF AN AMPLIFIER, AN ANALOG-TO-DIGITAL CONVERTER, AND OTHER AUXILIARY ELECTRONICS. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-H, -I, AND -J.

REFERENCES

83, 256, 258, 259, AND 541.

EXPERIMENT NAME- TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) NSSDC ID TIROS-N-02

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.
OI -	UNKNOWN	METEOROLOGICAL OFFICE	LONDON, ENGLAND

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) TO BE FLOWN ON TIROS-N IS DESIGNED TO INDIRECTLY DETERMINE THE VERTICAL DISTRIBUTION OF TEMPERATURE, WATER VAPOR, AND OZONE BY MEASURING THE INFRARED RADIATION EMITTED FROM THE EARTH AND ITS ATMOSPHERE. THE TOVS TENTATIVELY WILL CONSIST OF TWO OPTICAL UNITS INTEGRATED INTO A SINGLE SOUNDING SYSTEM. UNIT 1 WILL HAVE 14 CHANNELS AND WILL VIEW THE FOLLOWING SPECTRAL INTERVALS -- (1) CHANNEL 1, THE 3.8-MICRON WINDOW REGION, (2) CHANNEL 2, THE 9.6-MICRON OZONE BAND, (3) CHANNEL 3, THE 11.1-MICRON WINDOW REGION, (4) EIGHT CHANNELS IN THE 15-MICRON CARBON DIOXIDE BAND, AND (5) THREE CHANNELS IN THE 18- TO 30-MICRON ROTATIONAL WATER VAPOR BAND. THE SECOND UNIT WILL HAVE THREE CHANNELS OPERATING AT 14.97 MICRONS USING SELECTIVE ABSORPTION BY PASSING THE INCOMING RADIATION THROUGH THREE DOUBLE CELLS CONTAINING GASEOUS CARBON DIOXIDE AT DIFFERENT PRESSURES. THE SOUNDER WILL USE A STEP SCAN DEVICE TO PROVIDE PLUS OR MINUS 40 DEG OF TRAVERSE SCAN, WHILE THE SPACECRAFT'S ORBITAL MOTION WILL PROVIDE SCANNING IN THE ORTHOGONAL DIRECTION. THE DESIGN WILL ALLOW SOUNDINGS TO BE TAKEN AS CLOSE AS 400 KM APART AS COMPARED TO A 900-KM SEPARATION THAT PRESENTLY EXISTS WITH THE SIRS-B EXPERIMENT ON NIMBUS 4. VERTICAL PROFILES OF TEMPERATURE, OZONE, AND WATER VAPOR CAN BE OBTAINED FROM THE REDUCED RADIANCE MEASUREMENTS BY MATHEMATICAL INVERSION TECHNIQUES. THE RESULTING TEMPERATURE PROFILE WILL GO FROM THE SURFACE TO 1 MB AND WILL HAVE AN ACCURACY OF PLUS OR MINUS 1 DEG K. THE WATER VAPOR PROFILE WILL EXTEND FROM THE SURFACE TO THE TROPOPAUSE AND WILL BE ACCURATE TO 20 PERCENT, WHILE THE OZONE WILL BE MEASURED TO WITHIN PLUS OR MINUS 0.01 CM. THE TOVS MAY EVENTUALLY INCLUDE TWO ADDITIONAL INSTRUMENTS - ONE TO MEASURE INTERVALS IN THE 4.3-MICRON CARBON DIOXIDE BAND AND THE OTHER, A MICROWAVE DEVICE, TO MEASURE RADIATION IN THE 5.5-MM OXYGEN BAND. PRESENTLY, THESE TWO ADDITIONAL UNITS WILL NOT FLY ON TIROS-N BUT WILL BE ADDED TO SUBSEQUENT MISSIONS (ITOS-H, -I, AND -J).

REFERENCES

83, 256, 258, 259, AND 541.

EXPERIMENT NAME- DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS) NSSDC ID TIROS-N-03

EXPERIMENT PERSONNEL

PI -	UNKNOWN	NASA-GSFC	GREENBELT, MD

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS) WILL BE DESIGNED TO MEET THE METEOROLOGICAL DATA NEEDS OF THE UNITED STATES AND TO SUPPORT THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM (GARP). THE SYSTEM WILL RECEIVE LOW DUTY CYCLE TRANSMISSIONS OF METEOROLOGICAL OBSERVATIONS FROM FREE FLOATING BALLOONS, OCEAN BUOYS, OTHER SATELLITES, AND FIXED

GROUND-BASED SENSOR PLATFORMS DISTRIBUTED ARCUND THE GLOBE. THE OBSERVATIONS FROM THESE RANDOMLY LOCATED SOURCES WILL BE ORGANIZED ON BOARD THE SPACECRAFT AND WILL BE RETRANSMITTED WHEN IT COMES IN RANGE OF A COMMAND AND DATA ACQUISITION (CDA) STATION. FOR THE FREE-MOVING BALLOONS, THE DOPPLER FREQUENCY SHIFT OF THE TRANSMITTER WILL BE OBSERVED IN ORDER TO LATER CALCULATE THE LOCATION OF THE BALLOONS. ALL INFORMATION RECEIVED BY THE SPACECRAFT WILL BE STORED IN A 320-KB SOLID-STATE BUFFER MEMORY. THE SYSTEM WILL BE BUILT WITH A READOUT CAPABILITY OF 0.8 KBS AS WELL AS AN 8-KBS CAPABILITY FOR DATA TRANSMISSION TO A CDA STATION. THE DCS SYSTEM WILL CONSIST OF THE RANDOM ACCESS MEASUREMENT (RAM) SYSTEM THAT WILL ALSO BE USED IN THE TROPICAL WIND ENERGY CONVERSION AND REFERENCE LEVEL EXPERIMENT (TWERLE) TO BE FLOWN ON NIMBUS-F.

REFERENCES

83, 256, 258, 259, AND 541.

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SPACECRAFT COMMON NAME- ITOS-H — NSSDC ID ITOS-H

ALTERNATE NAMES-

ORBITAL INFORMATION

ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 1678.00 KM ALT
PERIGEE- 1678.00 KM ALT
PERIOD- 120. MIN
INCLINATION- 103. DEG

OTHER INFORMATION

SPACECRAFT WT- 633. KG
LAUNCH DATE- 12/00/76
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - R.A.	STAMPFL	NASA-GSFC	GREENBELT, MD.
PS - W.E.	SHENK	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ITOS-H WILL BE THE SECOND IN A SERIES OF THIRD-GENERATION SPACECRAFT IN THE NATIONAL OPERATIONAL METEOROLOGICAL SATELLITE SYSTEM (NOMSS). THE SATELLITE WILL BE DESIGNED TO SERVE AS AN ECONOMICAL AND STABLE PLATFORM FOR TESTING ADVANCED OPERATIONAL SUBSYSTEMS FOR USE IN WEATHER ANALYSIS AND FORECASTING. PRIMARY SENSORS WILL INCLUDE AN ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) FOR OBSERVING DAYTIME AND NIGHTTIME GLOBAL CLOUD COVER AND A TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) FOR OBTAINING TEMPERATURE, WATER VAPOR, AND OZONE PROFILES THROUGH THE EARTH'S ATMOSPHERE. SECONDARY EXPERIMENTS ARE THE SPACE ENVIRONMENT MONITOR (SEM), WHICH WILL MEASURE THE PROTON AND ELECTRON FLUX NEAR THE EARTH, AND THE DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS), WHICH WILL PROCESS AND RELAY TO CENTRAL DATA ACQUISITION STATIONS VARIOUS METEOROLOGICAL DATA RECEIVED FROM FREE FLOATING BALLOONS AND OCEAN BUOYS DISTRIBUTED AROUND THE GLOBE. THE SATELLITE WILL BE ABLE TO MAINTAIN AN EARTH-POINTING ACCURACY OF BETTER THAN PLUS OR MINUS 1 DEG IN ALL THREE AXES, WITH MOTION RATES OF LESS THAN 0.035 DEG/SEC.

REFERENCES

83, 257, 258, 259, 541, AND 721.

EXPERIMENT NAME- ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) — NSSDC ID ITOS-H -01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-H ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) WILL BE CAPABLE OF PROVIDING GLOBAL DAYTIME AND NIGHTTIME EARTH CLOUDCOVER PICTURES ON A REGULAR DAILY BASIS FOR USE IN WEATHER ANALYSIS AND FORECASTING. THE MULTISPECTRAL SCANNING INSTRUMENT WILL OPERATE IN BOTH REAL-TIME AND TAPE RECORDER MODES. THE FOUR-CHANNEL UNIT WILL USE THE FOLLOWING SPECTRAL WAVELENGTHS -- CHANNEL 1 - 0.5 TO 0.7 MICRON (VISIBLE), CHANNEL 2 - 0.75 TO 1.00 MICRONS (NEAR IR), CHANNEL 3 - 10.5 TO 12.5 MICRONS (IR WINDOW), AND CHANNEL 4 - 6.5 TO 7.0 MICRONS (WATER VAPOR). THE VISIBLE, NEAR IR, AND IR WINDOW CHANNELS HAVE A PLANNED GROUND RESOLUTION OF 1 KM. THE RESOLUTION OF THE WATER VAPOR CHANNEL WILL BE SOMEWHAT LESS -- ABOUT 4 KM AT NADIR. EACH CHANNEL WILL HAVE ITS OWN ELECTRONICS PACKAGE CONSISTING OF AN AMPLIFIER, AN ANALOG-TO-DIGITAL CONVERTER, AND OTHER AUXILIARY ELECTRONICS. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-I AND -J.

REFERENCES

83, 256, 257, 258, 259, AND 541.

EXPERIMENT NAME- TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) NSSDC ID ITOS-H -02

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.
OI -	UNKNOWN	METEOROLOGICAL OFFICE	LONDON, ENGLAND

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) TO BE FLOWN ON ITOS-H IS DESIGNED TO INDIRECTLY DETERMINE THE VERTICAL DISTRIBUTION OF TEMPERATURE, WATER VAPOR, AND OZONE BY MEASURING THE INFRARED RADIATION EMITTED FROM THE EARTH AND ITS ATMOSPHERE. THE TOVS TENTATIVELY CONSISTS OF TWO OPTICAL UNITS INTEGRATED INTO A SINGLE SOUNDING SYSTEM. UNIT 1 WILL HAVE 14 CHANNELS AND WILL VIEW THE FOLLOWING SPECTRAL INTERVALS -- CHANNEL 1 - THE 3.8-MICRON WINDOW REGION, CHANNEL 2 - THE 9.6-MICRON OZONE BAND, CHANNEL 3 - THE 11.1-MICRON WINDOW REGION, EIGHT CHANNELS IN THE 15-MICRON CARBON DIOXIDE BAND, AND THREE CHANNELS IN THE 18- TO 30-MICRON ROTATIONAL WATER VAPOR BAND. THE SECOND UNIT WILL HAVE THREE CHANNELS OPERATING AT 14.97 MICRONS USING SELECTIVE ABSORPTION BY PASSING THE INCOMING RADIATION THROUGH THREE DOUBLE CELLS CONTAINING GASEOUS CARBON DIOXIDE AT DIFFERENT PRESSURES. THE SOUNDER WILL USE A STEP SCAN DEVICE TO PROVIDE PLUS OR MINUS 40 DEG OF TRAVERSE SCAN, WHILE THE SPACECRAFT'S ORBITAL MOTION WILL PROVIDE SCANNING IN THE ORTHOGONAL DIRECTION. THE DESIGN WILL ALLOW SOUNDINGS TO BE TAKEN AS CLOSE AS 400 KM APART AS COMPARED TO A 900-KM SEPARATION THAT PRESENTLY EXISTS WITH THE SIRS-B EXPERIMENT ON NIMBUS 4. VERTICAL PROFILES OF TEMPERATURE, OZONE, AND WATER VAPOR WILL BE OBTAINED FROM THE REDUCED RADIANCE MEASUREMENTS BY MATHEMATICAL INVERSION TECHNIQUES. THE RESULTING TEMPERATURE PROFILE WILL GO FROM THE SURFACE TO 1 MB AND WILL HAVE AN ACCURACY OF PLUS OR MINUS 1 DEG K. THE WATER VAPOR PROFILE FROM THE SURFACE TO THE TROPOPAUSE WILL BE ACCURATE TO 20 PERCENT, WHILE THE OZONE WILL BE MEASURED TO WITHIN PLUS OR MINUS 0.01 CM. THE ITOS-I TOVS WILL PROBABLY INCLUDE TWO ADDITIONAL INSTRUMENTS, ONE TO MEASURE INTERVALS IN THE

4.3-MICRON CARBON DIOXIDE BAND AND THE OTHER A MICROWAVE DEVICE TO MEASURE RADIATION IN THE 5.5-MM OXYGEN BAND.

REFERENCES
83, 256, 258, 259, AND 541.

EXPERIMENT NAME- DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS) NSSDC ID ITOS-H -03

EXPERIMENT PERSONNEL

PI -	UNKNOWN	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS) WILL BE DESIGNED TO MEET THE METEOROLOGICAL DATA NEEDS OF THE UNITED STATES AND TO SUPPORT THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM (GARP). THE SYSTEM WILL RECEIVE LOW DUTY CYCLE TRANSMISSIONS OF METEOROLOGICAL OBSERVATIONS FROM FREE FLOATING BALLOONS, OCEAN BUOYS, OTHER SATELLITES, AND FIXED GROUND-BASED SENSOR PLATFORMS DISTRIBUTED AROUND THE GLOBE. THE OBSERVATIONS FROM THESE RANDOMLY LOCATED SOURCES WILL BE ORGANIZED ON BOARD THE SPACECRAFT AND RETRANSMITTED WHEN IT COMES WITHIN RANGE OF A COMMAND AND DATA ACQUISITION (CDA) STATION. FOR THE FREE MOVING BALLOONS, THE DOPPLER FREQUENCY SHIFT OF THE TRANSMITTER WILL BE OBSERVED IN ORDER TO LATER CALCULATE THE LOCATION OF THE BALLOONS. ALL INFORMATION RECEIVED BY THE SPACECRAFT WILL BE STORED IN A 320-KB SOLID-STATE BUFFER MEMORY. THE BUFFER WILL BE DESIGNED TO HANDLE AN AVERAGE OF 10 TRANSMISSIONS PER ORBIT FROM UP TO 320 OBSERVATION PLATFORMS. THE SYSTEM WILL BE BUILT WITH A READOUT CAPABILITY OF 0.5 KBS AS WELL AS AN 8-KBS CAPABILITY FOR DATA TRANSMISSION TO A CDA STATION. THE GSFC-DEVELOPED DCS SYSTEM WILL CONSIST OF THE RANDOM ACCESS MEASUREMENT (RAM) SYSTEM THAT WILL ALSO BE USED IN THE TROPICAL WINDS ENERGY CONVERSION AND REFERENCE LEVEL EXPERIMENT (TWERLE) TO BE FLOWN ON NIMBUS-F.

REFERENCES
83, 256, 258, 259, AND 541.

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SPACECRAFT COMMON NAME- ITOS-I NSSDC ID ITOS-I
ALTERNATE NAMES-

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 1678.00 KM ALT
PERIGEE- 1678.00 KM ALT
PERIOD- 120. MIN
INCLINATION- 103. DEG

OTHER INFORMATION
SPACECRAFT WT- 633. KG
LAUNCH DATE- 06/00/78
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - R.A.	STAMPFL	NASA-GSFC	GREENBELT, MD.
PS - W.E.	SHENK	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

ITOS-I WILL BE THE THIRD IN A SERIES OF THIRD-GENERATION SPACECRAFT IN THE NATIONAL OPERATIONAL METEOROLOGICAL SATELLITE SYSTEM (NOMSS). THE SATELLITE WILL BE DESIGNED TO SERVE AS AN ECONOMICAL AND STABLE PLATFORM FOR TESTING ADVANCED OPERATIONAL SUBSYSTEMS FOR USE IN WEATHER ANALYSIS AND FORECASTING. PRIMARY SENSORS INCLUDE AN ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) FOR OBSERVING DAYTIME AND NIGHTTIME GLOBAL CLOUD COVER AND A TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) FOR OBTAINING TEMPERATURE, WATER VAPOR, AND OZONE PROFILES THROUGH THE EARTH'S ATMOSPHERE. SECONDARY EXPERIMENTS ARE THE SPACE ENVIRONMENT MONITOR (SEM), WHICH WILL MEASURE THE PROTON AND ELECTRON FLUX NEAR THE EARTH, AND THE DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS), WHICH WILL PROCESS AND RELAY TO CENTRAL DATA ACQUISITION STATIONS VARIOUS METEOROLOGICAL DATA RECEIVED FROM FREE FLOATING BALLOONS AND OCEAN BUOYS DISTRIBUTED AROUND THE GLOBE. THE SATELLITE WILL BE ABLE TO MAINTAIN AN EARTH-POINTING ACCURACY OF BETTER THAN PLUS OR MINUS 1 DEG IN ALL THREE AXES, WITH MOTION RATES OF LESS THAN 0.035 DEG/SEC.

REFERENCES

83, 257, 258, 259, 541, AND 721.

EXPERIMENT NAME- ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) — NSSDC ID ITOS-I -01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-I ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) WILL BE CAPABLE OF PROVIDING GLOBAL DAYTIME AND NIGHTIME EARTH CLOUDCOVER PICTURES ON A REGULAR DAILY BASIS FOR USE IN WEATHER ANALYSIS AND FORECASTING. THE MULTISPECTRAL SCANNING INSTRUMENT WILL OPERATE IN BOTH REAL-TIME AND TAPE RECORDER MODES. THE FOUR-CHANNEL UNIT WILL USE THE FOLLOWING SPECTRAL WAVELENGTHS -- CHANNEL 1 - 0.5 TO 0.7 MICRON (VISIBLE), CHANNEL 2 - 0.75 TO 1.00 MICRONS (NEAR IR), CHANNEL 3 - 10.5 TO 12.5 MICRONS (IR WINDOW), AND CHANNEL 4 - 6.5 TO 7.0 MICRONS (WATER VAPOR). THE VISIBLE, NEAR IR, AND IR WINDOW CHANNELS HAVE A PLANNED GROUND RESOLUTION OF 1 KM. THE RESOLUTION OF THE WATER VAPOR CHANNEL WILL BE SOMEWHAT LESS, ABOUT 4 KM AT NADIR. EACH CHANNEL WILL HAVE ITS OWN ELECTRONICS PACKAGE CONSISTING OF AN AMPLIFIER, AN ANALOG-TO-DIGITAL CONVERTER, AND OTHER AUXILIARY ELECTRONICS. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-H AND -J.

REFERENCES

83, 256, 257, 258, 259, AND 541.

EXPERIMENT NAME- TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) — NSSDC ID ITOS-I -02

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.
OI -	UNKNOWN	METEOROLOGICAL OFFICE	LONDON, ENGLAND

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) TO BE FLOWN ON ITOS-I IS DESIGNED TO INDIRECTLY DETERMINE THE VERTICAL DISTRIBUTION OF TEMPERATURE, WATER VAPOR, AND OZONE BY MEASURING THE INFRARED RADIATION EMITTED FROM THE EARTH AND ITS ATMOSPHERE. THE TOVS TENTATIVELY WILL CONSIST OF TWO OPTICAL UNITS INTEGRATED INTO A SINGLE SOUNDING SYSTEM. UNIT 1 WILL HAVE 14 CHANNELS AND WILL VIEW THE FOLLOWING SPECTRAL INTERVALS -- CHANNEL 1 - THE 3.8-MICRON WINDOW REGION, CHANNEL 2 - THE 9.6-MICRON OZONE BAND, CHANNEL 3 - THE 11.1-MICRON WINDOW REGION, EIGHT CHANNELS IN THE 15-MICRON CARBON DIOXIDE BAND, AND THREE CHANNELS IN THE 18- TO 30-MICRON ROTATIONAL WATER VAPOR BAND. THE SECOND UNIT WILL HAVE THREE CHANNELS OPERATING AT 14.97 MICRONS USING SELECTIVE ABSORPTION BY PASSING THE INCOMING RADIATION THROUGH THREE DOUBLE CELLS CONTAINING GASEOUS CARBON DIOXIDE AT DIFFERENT PRESSURES. THE SOUNDER WILL USE A STEP SCAN DEVICE TO PROVIDE PLUS OR MINUS 40 DEG OF TRAVERSE SCAN, WHILE THE SPACECRAFT'S ORBITAL MOTION WILL PROVIDE SCANNING IN THE ORTHOGONAL DIRECTION. THE DESIGN WILL ALLOW SOUNDINGS TO BE TAKEN AS CLOSE AS 400 KM APART AS COMPARED TO A 900-KM SEPARATION THAT PRESENTLY EXISTS WITH THE SIRS-B EXPERIMENT ON NIMBUS 4. VERTICAL PROFILES OF TEMPERATURE, OZONE, AND WATER VAPOR WILL BE OBTAINED FROM THE REDUCED RADIANCE MEASUREMENTS BY MATHEMATICAL INVERSION TECHNIQUES. THE RESULTING TEMPERATURE PROFILE WILL GO FROM THE SURFACE TO 1 MB AND WILL HAVE AN ACCURACY OF PLUS OR MINUS 1 DEG K. THE WATER VAPOR PROFILE FROM THE SURFACE TO THE TROPOPAUSE WILL BE ACCURATE TO 20 PERCENT, WHILE THE OZONE WILL BE MEASURED TO WITHIN PLUS OR MINUS 0.01 CM. THE TOVS WILL PROBABLY INCLUDE TWO ADDITIONAL INSTRUMENTS, ONE TO MEASURE INTERVALS IN THE 4.3-MICRON CARBON DIOXIDE BAND AND THE OTHER A MICROWAVE DEVICE TO MEASURE IN THE 5.5-MM OXYGEN BAND.

REFERENCES

83, 256, 258, 259, AND 541.

EXPERIMENT NAME- DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS) — NSSDC ID ITOS-I -03

EXPERIMENT PERSONNEL

PI -	UNKNOWN	NASA-GSFC	GREENBELT, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS) WILL BE DESIGNED TO MEET THE METEOROLOGICAL DATA NEEDS OF THE UNITED STATES AND TO SUPPORT THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM (GARP). THE SYSTEM WILL RECEIVE LOW DUTY CYCLE TRANSMISSIONS OF METEOROLOGICAL OBSERVATIONS FROM FREE FLOATING BALLOONS, OCEAN BUOYS, OTHER SATELLITES, AND FIXED GROUND-BASED SENSOR PLATFORMS DISTRIBUTED AROUND THE GLOBE. THE OBSERVATIONS FROM THESE RANDOMLY LOCATED SOURCES WILL BE ORGANIZED ON BOARD THE SPACECRAFT AND RETRANSMITTED WHEN IT COMES WITHIN RANGE OF A COMMAND AND DATA ACQUISITION (CDA) STATION. FOR THE FREE MOVING BALLOONS, THE DOPPLER FREQUENCY SHIFT OF THE TRANSMITTER WILL BE OBSERVED IN ORDER TO LATER CALCULATE THE LOCATION OF THE BALLOONS. ALL INFORMATION RECEIVED BY THE SPACECRAFT WILL BE STORED IN A 320-KB SOLID-STATE BUFFER MEMORY. THE BUFFER

WILL BE DESIGNED TO HANDLE AN AVERAGE OF 10 TRANSMISSIONS PER ORBIT FROM UP TO 320 OBSERVATION PLATFORMS. THE SYSTEM WILL BE BUILT WITH A READOUT CAPABILITY OF 0.8 KBS AS WELL AS AN 8-KBS CAPABILITY FOR DATA TRANSMISSION TO A CDA STATION. THE GSFC-DEVELOPED DCS SYSTEM WILL CONSIST OF THE RANDOM ACCESS MEASUREMENT (RAM) SYSTEM THAT WILL ALSO BE USED IN THE TROPICAL WINDS ENERGY CONVERSION AND REFERENCE LEVEL EXPERIMENT (TWERLE) TO BE FLOWN ON NIMBUS-F.

REFERENCES
83, 256, 258, 259, AND 541.

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SPACECRAFT COMMON NAME- ITOS-J　　　　NSSDC ID ITOS-J
ALTERNATE NAMES-

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 1678.00 KM ALT
PERIGEE- 1678.00 KM ALT
PERIOD- 120. MIN
INCLINATION- 103. DEG

OTHER INFORMATION
SPACECRAFT WT- 633. KG
LAUNCH DATE- 12/00/79
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - R.A.	STAMPFL	NASA-GSFC	GREENBELT, MD.
PS - W.E.	SHENK	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION
ITOS-J WILL BE THE FOURTH IN A SERIES OF THIRD-GENERATION SPACECRAFT IN THE NATIONAL OPERATIONAL METEOROLOGICAL SATELLITE SYSTEM (NOMSS). THE SATELLITE WILL BE DESIGNED TO SERVE AS AN ECONOMICAL AND STABLE PLATFORM FOR TESTING ADVANCED OPERATIONAL SUBSYSTEMS FOR USE IN WEATHER ANALYSIS AND FORECASTING. PRIMARY SENSORS INCLUDE AN ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) FOR OBSERVING DAYTIME AND NIGHTTIME GLOBAL CLOUD COVER AND A TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) FOR OBTAINING TEMPERATURE, WATER VAPOR, AND OZONE PROFILES THROUGH THE EARTH'S ATMOSPHERE. SECONDARY EXPERIMENTS ARE THE SPACE ENVIRONMENT MONITOR (SEM), WHICH WILL MEASURE THE PROTON AND ELECTRON FLUX NEAR THE EARTH, AND THE DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS), WHICH WILL PROCESS AND RELAY TO CENTRAL DATA ACQUISITION STATIONS VARIOUS METEOROLOGICAL DATA RECEIVED FROM FREE FLOATING BALLOONS AND OCEAN BUOYS DISTRIBUTED AROUND THE GLOBE. THE SATELLITE WILL BE ABLE TO MAINTAIN AN EARTH-POINTING ACCURACY OF BETTER THAN PLUS OR MINUS 1 DEG IN ALL THREE AXES, WITH MOTION RATES OF LESS THAN 0.035 DEG/SEC.

REFERENCES
83, 257, 258, 259, 541, AND 721.

EXPERIMENT NAME- ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR)　　　　NSSDC ID ITOS-J -01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE ITOS-J ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) WILL BE CAPABLE OF PROVIDING GLOBAL DAYTIME AND NIGHTTIME EARTH CLOUDCOVER PICTURES ON A REGULAR DAILY BASIS FOR USE IN WEATHER ANALYSIS AND FORECASTING. THE MULTISPECTRAL SCANNING INSTRUMENT WILL OPERATE IN BOTH REAL-TIME AND TAPE RECORDER MODES. THE FOUR-CHANNEL UNIT WILL USE THE FOLLOWING SPECTRAL WAVELENGTHS -- CHANNEL 1 - 0.5 TO 0.7 MICRON (VISIBLE), CHANNEL 2 - 0.75 TO 1.00 MICRON (NEAR IR), CHANNEL 3 - 10.5 TO 12.5 MICRONS (IR WINDOW), AND CHANNEL 4 - 6.5 TO 7.0 MICRONS (WATER VAPOR). THE VISIBLE, NEAR IR, AND IR WINDOW CHANNELS HAVE A PLANNED GROUND RESOLUTION OF 1 KM. THE RESOLUTION OF THE WATER VAPOR CHANNEL WILL BE SOMEWHAT LESS, ABOUT 4 KM AT NADIR. EACH CHANNEL WILL HAVE ITS OWN ELECTRONICS PACKAGE CONSISTING OF AN AMPLIFIER, AN ANALOG-TO-DIGITAL CONVERTER, AND OTHER AUXILIARY ELECTRONICS. IDENTICAL EXPERIMENTS WILL BE FLOWN ON ITOS-H AND -I.

REFERENCES

83, 256, 257, 258, 259, AND 541.

EXPERIMENT NAME- TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) NSSDC ID ITOS-J -02

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.
OI -	UNKNOWN	METEOROLOGICAL OFFICE	LONDON, ENGLAND

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) TO BE FLOWN ON ITOS-J IS DESIGNED TO INDIRECTLY DETERMINE THE VERTICAL DISTRIBUTION OF TEMPERATURE, WATER VAPOR, AND OZONE BY MEASURING THE INFRARED RADIATION EMITTED FROM THE EARTH AND ITS ATMOSPHERE. THE TOVS TENTATIVELY WILL CONSIST OF TWO OPTICAL UNITS INTEGRATED INTO A SINGLE SOUNDING SYSTEM. UNIT 1 WILL HAVE 14 CHANNELS AND WILL VIEW THE FOLLOWING SPECTRAL INTERVALS -- CHANNEL 1 - THE 3.8-MICRON WINDOW REGION, CHANNEL 2 - THE 9.6-MICRON OZONE BAND, CHANNEL 3 - THE 11.1-MICRON WINDOW REGION, EIGHT CHANNELS IN THE 15-MICRON CARBON DIOXIDE BAND, AND THREE CHANNELS IN THE 18- TO 30-MICRON ROTATIONAL WATER VAPOR BAND. THE SECOND UNIT WILL HAVE THREE CHANNELS OPERATING AT 14.97 MICRONS USING SELECTIVE ABSORPTION BY PASSING THE INCOMING RADIATION THROUGH THREE DOUBLE CELLS CONTAINING GASEOUS CARBON DIOXIDE AT DIFFERENT PRESSURES. THE SOUNDER WILL USE A STEP SCAN DEVICE TO PROVIDE PLUS OR MINUS 40 DEG OF TRAVERSE SCAN, WHILE THE SPACECRAFT'S ORBITAL MOTION WILL PROVIDE SCANNING IN THE ORTHOGONAL DIRECTION. THE DESIGN WILL ALLOW SOUNDINGS TO BE TAKEN AS CLOSE AS 400 KM APART AS COMPARED TO A 900-KM SEPARATION THAT PRESENTLY EXISTS WITH THE SIRS-B EXPERIMENT ON NIMBUS 4. VERTICAL PROFILES OF TEMPERATURE, OZONE, AND WATER VAPOR WILL BE OBTAINED FROM THE REDUCED RADIANCE MEASUREMENTS BY MATHEMATICAL INVERSION TECHNIQUES. THE RESULTING TEMPERATURE PROFILE WILL GO FROM THE SURFACE TO 1 MB AND WILL HAVE AN ACCURACY OF PLUS OR MINUS 1 DEG K. THE WATER VAPOR PROFILE FROM THE SURFACE TO THE TROPOPAUSE WILL BE ACCURATE TO 20 PERCENT, WHILE THE OZONE WILL BE MEASURED TO WITHIN PLUS OR MINUS 0.01 CM. THE TOVS WILL PROBABLY INCLUDE TWO ADDITIONAL INSTRUMENTS, ONE TO MEASURE INTERVALS IN THE 4.3-MICRON CARBON

DIOXIDE BAND AND THE OTHER A MICROWAVE DEVICE TO MEASURE RADIATION IN THE 5.5-MM OXYGEN BAND.

REFERENCES

83, 256, 258, 259, AND 541.

EXPERIMENT NAME- DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS) NSSDC ID ITOS-J -03

EXPERIMENT PERSONNEL

PI -	UNKNOWN	NASA-GSFC	GREENBELT, MD.

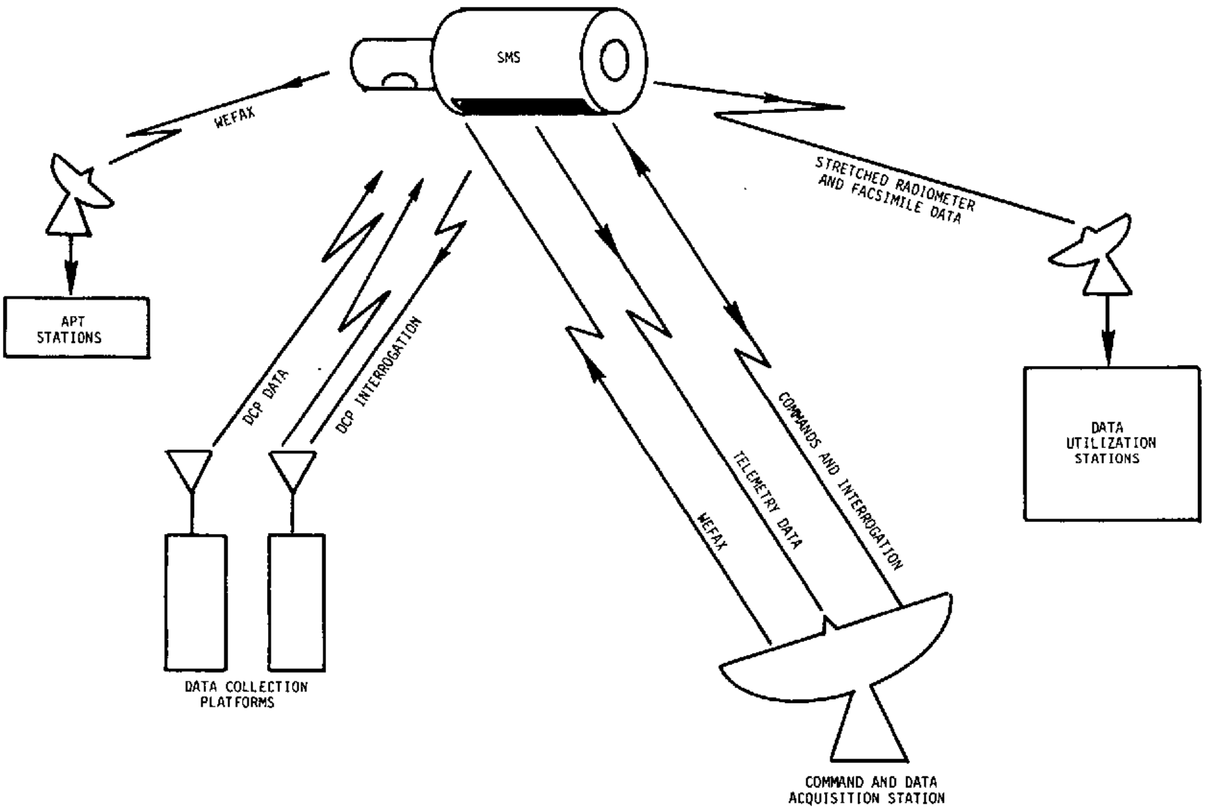
OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE DATA COLLECTION AND PLATFORM LOCATION SYSTEM (DCS) WILL BE DESIGNED TO MEET THE METEOROLOGICAL DATA NEEDS OF THE UNITED STATES AND TO SUPPORT THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM (GARP). THE SYSTEM WILL RECEIVE LOW DUTY CYCLE TRANSMISSIONS OF METEOROLOGICAL OBSERVATIONS FROM FREE FLOATING BALLOONS, OCEAN BUOYS, OTHER SATELLITES, AND FIXED GROUND-BASED SENSOR PLATFORMS DISTRIBUTED AROUND THE GLOBE. THE OBSERVATIONS FROM THESE RANDOMLY LOCATED SOURCES WILL BE ORGANIZED ON BOARD THE SPACECRAFT AND RETRANSMITTED WHEN IT COMES WITHIN RANGE OF A COMMAND AND DATA ACQUISITION (CDA) STATION. FOR THE FREE MOVING BALLOONS, THE DOPPLER FREQUENCY SHIFT OF THE TRANSMITTER WILL BE OBSERVED IN ORDER TO LATER CALCULATE THE LOCATION OF THE BALLOONS. ALL INFORMATION RECEIVED BY THE SPACECRAFT WILL BE STORED IN A 320-KB SOLID-STATE BUFFER MEMORY. THE BUFFER WILL BE DESIGNED TO HANDLE AN AVERAGE OF 10 TRANSMISSIONS PER ORBIT FROM UP TO 320 OBSERVATION PLATFORMS. THE SYSTEM WILL BE BUILT WITH A READOUT CAPABILITY OF 0.6 KBS AS WELL AS AN 8-KBS CAPABILITY FOR DATA TRANSMISSION TO A CDA STATION. THE GSFC-DEVELOPED DCS SYSTEM WILL CONSIST OF THE RANDOM ACCESS MEASUREMENT (RAM) SYSTEM, WHICH WILL ALSO BE USED IN THE TROPICAL WINDS ENERGY CONVERSION AND REFERENCE LEVEL EXPERIMENT (TWERLE) TO BE FLOWN ON NIMBUS-F.

REFERENCES

83, 256, 258, 259, AND 541.



SMS/GOES SERIES

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9. SMS/GOES Series

SPACECRAFT COMMON NAME- SMS-A
ALTERNATE NAMES- PL-712D

NSSDC ID SMS-A

ORBITAL INFORMATION
CRBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 35700.0 KM ALT
PERIGEE- 35700.0 KM ALT
PERIOD- 1440. MIN
INCLINATION- DEG

OTHER INFORMATION
SPACECRAFT WT- 243. KG
LAUNCH DATE- 10/00/73
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - D.V.	FORDYCE	NASA-GSFC	GREENBELT, MD.
PS - W.E.	SHENK	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

THE SMS-A IS A NASA-DEVELOPED, NOAA-OPERATED SPACECRAFT. THE SPIN-STABILIZED, EARTH-SYNCHRONOUS SPACECRAFT WILL CARRY (1) A VISIBLE-INFRARED SPIN-SCAN RADIOMETER (VISSR) TO PROVIDE HIGH-QUALITY DAY/NIGHT CLOUDCOVER DATA AND TO TAKE RADIANCE TEMPERATURES OF THE EARTH-ATMOSPHERE SYSTEM, (2) A METEOROLOGICAL DATA COLLECTION AND TRANSMISSION SYSTEM TO RELAY PROCESSED DATA FROM CENTRAL WEATHER FACILITIES TO SMALL APT-EQUIPPED REGIONAL STATIONS AND TO COLLECT AND RETRANSMIT DATA FROM REMOTELY LOCATED EARTH-BASED PLATFORMS, AND (3) A SPACE ENVIRONMENTAL MONITOR (SEM) SYSTEM TO MEASURE PROTON, ELECTRON, AND SOLAR X-RAY FLUXES AND MAGNETIC FIELDS. THE CYLINDRICALLY SHAPED SPACECRAFT MEASURES 190.5 CM IN DIAMETER AND 230 CM IN LENGTH, EXCLUSIVE OF A MAGNETOMETER THAT WILL EXTEND AN ADDITIONAL 83 CM BEYOND THE CYLINDER SHELL. THE PRIMARY STRUCTURAL MEMBERS ARE A HONEYCOMBED EQUIPMENT SHELF AND THRUST TUBE. THE VISSR TELESCOPE WILL BE MOUNTED ON THE EQUIPMENT SHELF AND WILL VIEW THE EARTH THROUGH A SPECIAL APERTURE IN THE SPACECRAFT'S SIDE. A SUPPORT STRUCTURE WILL EXTEND RADIALLY OUT FROM THE THRUST TUBE AND WILL BE AFFIXED TO THE SOLAR PANELS, WHICH WILL FORM THE OUTER WALLS OF THE SPACECRAFT AND PROVIDE THE PRIMARY SOURCE OF ELECTRICAL POWER. LOCATED IN THE ANNULUS-SHAPED SPACE BETWEEN THE THRUST TUBE AND THE SOLAR PANELS WILL BE STATIONKEEPING AND DYNAMICS CONTROL EQUIPMENT, BATTERIES, AND MOST OF THE SEM EQUIPMENT. PROPER SPACECRAFT ATTITUDE AND SPIN RATE (APPROXIMATELY 100 RPM) WILL BE MAINTAINED BY TWO SEPARATE SETS OF JET THRUSTERS MOUNTED AROUND THE SPACECRAFT'S EQUATOR AND ACTIVATED BY GROUND COMMAND. THE SPACECRAFT WILL USE BOTH UHF- AND S-BAND FREQUENCIES IN ITS TELEMETRY AND COMMAND SUBSYSTEM. A LOW-POWER UHF-TRANSPONDER WILL PROVIDE TELEMETRY AND COMMAND DURING LAUNCH AND THEN WILL SERVE AS A BACKUP FOR THE PRIMARY SUBSYSTEM ONCE THE SPACECRAFT HAS ATTAINED SYNCHRONOUS ORBIT.

REFERENCES

1, 83, 88, 92, 195, 197, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 272, 280, 281, 304, 405, 431, 432, 433, 667, 675, AND 865.

EXPERIMENT NAME- VISIBLE-INFRARED SPIN-SCAN RADIOMETER (VISSR)

NSSDC ID SMS-A -01

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE VISIBLE-INFRARED SPIN-SCAN RADIOMETER (VISSR) TO BE FLOWN ON SMS-A WILL BE CAPABLE OF PROVIDING BOTH DAY/NIGHT OBSERVATIONS OF CLOUD COVER AND EARTH/CLOUD RADIANCE TEMPERATURE MEASUREMENTS FROM A SYNCHRONOUS, SPIN-STABILIZED, GEOSTATIONARY SATELLITE FOR USE IN OPERATIONAL WEATHER ANALYSIS AND FORECASTING. THE TWO-CHANNEL INSTRUMENT WILL BE ABLE TO TAKE BOTH FULL AND PARTIAL PICTURES OF THE EARTH'S DISC. BOTH THE INFRARED CHANNEL (10.5 TO 12.5 MICRONS) AND THE VISIBLE CHANNEL (0.55 TO 0.75 MICRON) WILL USE A COMMON OPTICS SYSTEM. INCOMING RADIATION WILL BE RECEIVED BY AN ELLIPTICALLY SHAPED SCAN MIRROR AND COLLECTED BY A RITCHEY-CHRETIEN OPTICAL SYSTEM. THE SCAN MIRROR WILL BE SET AT A NOMINAL ANGLE OF 45 DEG TO THE VISSR OPTICAL AXIS, WHICH WILL BE ALIGNED PARALLEL TO THE SPIN AXIS OF THE SPACECRAFT. THE SPINNING MOTION OF THE SPACECRAFT (APPROXIMATELY 100 RPM) WILL PROVIDE A WEST-TO-EAST SCAN MOTION WHEN THE SPIN AXIS OF THE SPACECRAFT IS ORIENTED PARALLEL WITH THE EARTH'S AXIS. THE LATITUDINAL SCAN WILL BE ACCOMPLISHED BY SEQUENTIALLY TILTING THE SCANNING MIRROR NORTH TO SOUTH AT THE COMPLETION OF EACH SPIN. A FULL PICTURE WILL TAKE 18.2 MIN TO COMPLETE AND ABOUT 2 MIN TO RETRACE. DURING EACH SCAN, EIGHT VISIBLE-SPECTRUM DETECTORS WILL SWEEP THE EARTH, WITH A GROUND RESOLUTION OF 0.9 KM AT ZERO NADIR ANGLE. A MERCURY-CADMIUM TELLURIDE DETECTOR WILL SENSE THE INFRARED PORTION OF THE SPECTRUM WITH A HORIZONTAL RESOLUTION OF APPROXIMATELY 9 KM AT ZERO NADIR ANGLE. THE INFRARED PORTION OF THE DETECTOR WILL MEASURE RADIANCE TEMPERATURES BETWEEN 180 AND 315 DEG K WITH A PROPOSED SENSITIVITY BETWEEN 0.4 AND 1.4 DEG K. THE VISSR OUTPUT WILL BE DIGITIZED AND TRANSMITTED TO THE NOAA COMMAND DATA ACQUISITION STATION, WALLOPS ISLAND, VA. THERE THE SIGNAL WILL BE FED INTO A 'LINE STRETCHER,' WHERE IT WILL BE STORED AND TIME STRETCHED FOR TRANSMISSION BACK TO THE SATELLITE AT REDUCED BANDWIDTH FOR REBROADCAST AT APT USER STATIONS. AS WITH ALL OPERATIONAL TYPE DATA, THE VISSR DATA WILL BE HANDLED BY NOAA AND EVENTUALLY SENT TO THE NATIONAL CLIMATIC CENTER AT ASHEVILLE, NORTH CAROLINA, FOR ARCHIVING.

REFERENCES

1, 2, 83, 92, 195, 231, 235, 236, 237, 238, 318, 667, AND 865.

EXPERIMENT NAME- METEOROLOGICAL DATA COLLECTION AND TRANSMISSION SYSTEM NSSDC ID SMS-A -05

EXPERIMENT PERSONNEL

PI - NONE ASSIGNED NONE ASSIGNED

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE METEOROLOGICAL DATA COLLECTION AND TRANSMISSION SYSTEM IS AN EXPERIMENTAL COMMUNICATIONS AND DATA HANDLING SYSTEM DESIGNED TO RECEIVE AND PROCESS METEOROLOGICAL DATA COLLECTED FROM REMOTELY LOCATED EARTH-BASED DATA COLLECTION (OBSERVATION) PLATFORMS (DCP). THE COLLECTED DATA WILL BE RETRANSMITTED FROM THE SATELLITE TO SMALL, GROUND-BASED, REGIONAL DATA UTILIZATION CENTERS. DATA FROM UP TO 10,000 DCP STATIONS CAN BE HANDLED BY THE SYSTEM. THE SYSTEM WILL ALSO ALLOW FOR THE RETRANSMISSION OF NARROW-BAND (WEFAX TYPE) DATA TO EXISTING SMALL GROUND-BASED APT RECEIVING STATIONS FROM A LARGER WEATHER CENTRAL FACILITY. THIS COMMUNICATIONS SYSTEM WILL OPERATE ON S-BAND FREQUENCIES. THE MINIMUM DATA COLLECTION SYSTEM FOR ONE SMS WILL CONSIST OF APPROXIMATELY 3500 DCP STATIONS TO BE CONTACTED IN A 6-HR PERIOD.

THE TOTAL AMOUNT OF DATA COLLECTED DURING THE 6-HR PERIOD WILL BE BETWEEN 350K AND 600K BITS, DEPENDING ON THE CODING TECHNIQUES. DATA RECEIVED FROM INDIVIDUAL STATIONS WILL VARY FROM 50 TO 3000 BITS, DEPENDING ON THE TYPE AND VARIETY OF SENSORS USED AT AN INDIVIDUAL DCP STATION.

REFERENCES

1, 2, 83, 139, 195, 231, 235, 236, 237, 238, 304, 667, AND 865.

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SPACECRAFT COMMON NAME- SMS-B NSSDC ID SMS-B

ALTERNATE NAMES- PL731E

ORBITAL INFORMATION

ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 35700.0 KM ALT
PERIGEE- 35700.0 KM ALT
PERIOD- 1440. MIN
INCLINATION- DEG

OTHER INFORMATION

SPACECRAFT WT- 243. KG
LAUNCH DATE- 02/00/74
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - D.V.	FORDYCE	NASA-GSFC	GREENBELT, MD.
PS - W.E.	SHENK	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

THE SMS-B IS A NASA-DEVELOPED, NOAA-OPERATED SPACECRAFT. THE SPIN-STABILIZED, EARTH-SYNCHRONOUS SPACECRAFT WILL CARRY (1) A VISIBLE-INFRARED SPIN-SCAN RADIOMETER (VISSR) TO PROVIDE HIGH-QUALITY DAY/NIGHT CLOUDCOVER DATA AND TO TAKE RADIANCE TEMPERATURES OF THE EARTH-ATMOSPHERE SYSTEM, (2) A METEOROLOGICAL DATA COLLECTION AND TRANSMISSION SYSTEM TO RELAY PROCESSED DATA FROM CENTRAL WEATHER FACILITIES TO SMALL APT-EQUIPPED REGIONAL STATIONS AND TO COLLECT AND RETRANSMIT DATA FROM REMOTELY LOCATED EARTH-BASED PLATFORMS, AND (3) A SPACE ENVIRONMENT MONITOR (SEM) SYSTEM TO MEASURE PROTON, ELECTRON, AND SOLAR X-RAY FLUXES AND MAGNETIC FIELDS. THE CYLINDRICALLY SHAPED SPACECRAFT MEASURES 190.5 CM IN DIAMETER AND 230 CM IN LENGTH, EXCLUSIVE OF A MAGNETOMETER THAT WILL EXTEND AN ADDITIONAL 83 CM BEYOND THE CYLINDER SHELL. THE PRIMARY STRUCTURAL MEMBERS ARE A HONEYCOMBED EQUIPMENT SHELF AND THRUST TUBE. THE VISSR TELESCOPE WILL BE MOUNTED ON THE EQUIPMENT SHELF AND WILL VIEW THE EARTH THROUGH A SPECIAL APERTURE IN THE SPACECRAFT'S SIDE. A SUPPORT STRUCTURE WILL EXTEND RADIALLY OUT FROM THE THRUST TUBE AND WILL BE AFFIXED TO THE SOLAR PANELS, WHICH WILL FORM THE OUTER WALLS OF THE SPACECRAFT AND PROVIDE THE PRIMARY SOURCE OF ELECTRICAL POWER. LOCATED IN THE ANNULUS-SHAPED SPACE BETWEEN THE THRUST TUBE AND THE SOLAR PANELS WILL BE STATIONKEEPING AND DYNAMICS CONTROL EQUIPMENT, BATTERIES, AND MOST OF THE SEM EQUIPMENT. PROPER SPACECRAFT ATTITUDE AND SPIN RATE (APPROXIMATELY 100 RPM) WILL BE MAINTAINED BY TWO SEPARATE SETS OF JET THRUSTERS MOUNTED AROUND THE SPACECRAFT'S EQUATOR AND ACTIVATED BY GROUND COMMAND. THE SPACECRAFT WILL USE BOTH UHF-BAND AND S-BAND FREQUENCIES IN ITS TELEMETRY AND COMMAND SUBSYSTEMS. A LOW-POWER VHF TRANSPONDER WILL PROVIDE TELEMETRY AND COMMAND DURING LAUNCH AND THEN WILL SERVE AS A BACKUP FOR THE PRIMARY SUBSYSTEM ONCE THE SPACECRAFT HAS OBTAINED SYNCHRONOUS ORBIT.

REFERENCES

1, 88, 92, 229, 230, 232, 233, 234, 235, 236, 237, 238, 272, 304, AND 865.

EXPERIMENT NAME- VISIBLE-INFRARED SPIN-SCAN RADIOMETER (VISSR) NSSDC ID SMS-B -04

EXPERIMENT PERSONNEL

PI - NESS STAFF NOAA-NESS SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE VISIBLE-INFRARED SPIN-SCAN RADIOMETER (VISSR) TO BE FLOWN ON SMS-B WILL BE CAPABLE OF PROVIDING BOTH DAY/NIGHT OBSERVATIONS OF CLOUDCOVER AND EARTH/CLOUD RADIANCE TEMPERATURE MEASUREMENTS FROM A SYNCHRONOUS, SPIN-STABILIZED, GEOSTATIONARY SATELLITE FOR USE IN OPERATIONAL WEATHER ANALYSIS AND FORECASTING. THE TWO-CHANNEL INSTRUMENT WILL BE ABLE TO TAKE BOTH FULL AND PARTIAL PICTURES OF THE EARTH'S DISC. BOTH THE INFRARED CHANNEL (10.5 TO 12.5 MICRONS) AND THE VISIBLE CHANNEL (0.55 TO 0.75 MICRON) WILL USE A COMMON OPTICS SYSTEM. INCOMING RADIATION WILL BE RECEIVED BY AN ELLIPTICALLY SHAPED SCAN MIRROR AND COLLECTED BY A RITCHEY-CHRETIEN OPTICAL SYSTEM. THE SCAN MIRROR WILL BE SET AT A NOMINAL ANGLE OF 45 DEG TO THE VISSR OPTICAL AXIS, WHICH WILL BE ALIGNED PARALLEL TO THE SPIN AXIS OF THE SPACECRAFT. THE SPINNING MOTION OF THE SPACECRAFT (APPROXIMATELY 100 RPM) WILL PROVIDE A WEST-TO-EAST SCAN MOTION WHEN THE SPIN AXIS OF THE SPACECRAFT IS ORIENTED PARALLEL WITH THE EARTH'S AXIS. THE LATITUDINAL SCAN WILL BE ACCOMPLISHED BY SEQUENTIALLY TILTING THE SCANNING MIRROR NORTH TO SOUTH AT THE COMPLETION OF EACH SPIN. A FULL PICTURE WILL TAKE 18.2 MIN TO COMPLETE AND ABOUT 2 MIN TO RETRACE. DURING EACH SCAN, EIGHT VISIBLE-SPECTRUM DETECTORS WILL SWEEP THE EARTH, WITH A GROUND RESOLUTION OF 0.9 KM AT ZERO NADIR ANGLE. A MERCURY-CADMIUM TELLURIDE DETECTOR WILL SENSE THE INFRARED PORTION OF THE SPECTRUM WITH A HORIZONTAL RESOLUTION OF APPROXIMATELY 9 KM AT ZERO NADIR ANGLE. THE INFRARED PORTION OF THE DETECTOR WILL MEASURE RADIANCE TEMPERATURES BETWEEN 180 AND 315 DEG K WITH A PROPOSED SENSITIVITY BETWEEN 0.4 AND 1.4 DEG K. THE VISSR OUTPUT WILL BE DIGITIZED AND TRANSMITTED TO THE NOAA COMMAND DATA ACQUISITION STATION, WALLOPS ISLAND, VA. THERE THE SIGNAL WILL BE FED INTO A 'LINE STRETCHER,' WHERE IT WILL BE STORED AND TIME-STRETCHED FOR TRANSMISSION BACK TO THE SATELLITE AT REDUCED BANDWIDTH FOR REBROADCAST TO APT USER STATIONS. AS WITH ALL OPERATIONAL TYPE DATA, THE VISSR DATA WILL BE HANDLED BY NOAA AND EVENTUALLY SENT TO THE NATIONAL CLIMATIC CENTER AT ASHEVILLE, NORTH CAROLINA, FOR ARCHIVING.

REFERENCES

2, 83, 92, 235, 236, 237, 238, 318, AND 865.

EXPERIMENT NAME- METEOROLOGICAL DATA COLLECTION AND TRANSMISSION SYSTEM NSSDC ID SMS-B -05

EXPERIMENT PERSONNEL

PI - NONE ASSIGNED NONE ASSIGNED

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE METEOROLOGICAL DATA CCLLECTI ON AND TRANSMISSION SYSTEM IS AN EXPERIMENTAL COMMUNICATIONS AND DATA HANDLING SYSTEM CESIGNED TO RECEIVE AND PROCESS METEOROLOGICAL DATA COLLECTED FRCM REMOTELY LCCATED EARTH-EASED DATA COLLECTION (OBSERVATION) PLATFORMS (DCP). THE CCLLECTED CATA WILL BE RETRANSMITTED FROM THE SATELLITE TO SMALL, GROUND-EASED, REGIONAL CATA UTILIZATION CENTERS. DATA FRCM UP TO 10,000 DCP STATICNS CAN BE HANDLED BY THE SYSTEM. THE SYSTEM WILL ALSC ALLCW FOR THE RETRANSMISSION OF NARROWBAND (WEFAX TYPE) DATA TO EXISTING SMALL GROUND-BASED APT RECEIVING STATIONS FROM A LARGER WEATHER CENTRAL FACILITY. THIS COMMUNICATIONS SYSTEM WILL OPERATE ON S-BAND FREQUENCIES. THE MINIMUM DATA COLLECTICN FOR ONE SMS WILL CONSIST OF APPROXIMATELY 3500 DCP STATICNS TO BE CONTRACTED IN A 6-HR PERIOD. THE TOTAL AMOUNT OF DATA COLLECTED DURING THE 6-HR PERIOD WILL BE BETWEEN 350K AND 600K BITS, DEPENDING ON THE CODING TECHNIQUES. DATA RECEIVED FROM INDIVIDUAL STATICNS WILL VARY FRCM 50 TO 3000 BITS, DEPENDING ON THE TYPE AND VARIETY OF SENSORS USED AT AN INDIVIDUAL DCP STATICN.

REFERENCES

2, 83, 139, 231, 235, 237, 238, 304, AND 865.

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SPACECRAFT COMMON NAME- SMS-C
ALTERNATE NAMES- GOES-A

NSSDC ID SMS-C

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- / /
- APOGEE- 35700.0 KM ALT
- PERIGEE- 35700.0 KM ALT
- PERIOD- 1440. MIN
- INCLINATION- DEG

OTHER INFORMATION
- SPACECRAFT WT- 243. KG
- LAUNCH DATE- 06/00/74
- OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM - D.V.	FORDYCE	NASA-GSFC	GREENBELT, MD.
PS - W.E.	SHENK	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

THE SMS-C/GEOS-A IS A NASA-DEVELOPED, NCAA-OPERATED SPACECRAFT. THE SPIN-STABILIZED, EARTH-SYNCHRONCUS SPACECRAFT WILL CARRY (1) A VISIBLE-INFRARED SPIN-SCAN RADICMETER (VISSR) TO PROVIDE HIGH-QUALITY DAY/NIGHT CLOUDCOVERR DATA AND TO TAKE RADIANCE TEMPERATURES OF THE EARTH-ATMOSPHERE SYSTEM, (2) A METEOROLOGICAL DATA COLLECTION AND TRANSMISSION SYSTEM TO RELAY PROCESSED DATA FRCM CENTRAL WEATHER FACILITIES TO SMALL APT-EQUIPPED REGIONAL STATIONS AND TO CCLLECT AND RETRANSMIT DATA FROM REMOTELY LOCATED EARTH-BASED PLATFORMS, AND (3) A SPACE ENVIRONMENT MONITOR (SEM) SYSTEM TO MEASURE PROTON, ELECTRON, AND SOLAR X-RAY FLUXES AND MAGNETIC FIELDS. THE CYLINDRICALLY SHAPED SPACECRAFT MEASURES 190.5 CM IN DIAMETER AND 230 CM IN LENGTH, EXCLUSIVE OF A MAGNETOMETER THAT WILL EXTEND AN ADDITIONAL 83 CM BEYOND THE CYLINDER SHELL. THE PRIMARY STRUCTURAL MEMBERS ARE A HONEYCOMBED EQUIPMENT SHELF AND THRUST TUBE. THE VISSR TELESCOPE WILL BE MOUNTED ON THE EQUIPMENT SHELF AND WILL VIEW THE EARTH THROUGH A SPECIAL APERTURE IN THE SPACECRAFT'S SIDE. A SUPPORT STRUCTURE WILL EXTEND RADIALLY OUT FRCM THE THRUST TUBE AND WILL BE AFFIXED TO THE SOLAR PANELS, WHICH WILL FORM THE OUTER WALLS OF THE SPACECRAFT AND PROVIDE THE PRIMARY SOURCE OF ELECTRICAL POWER. LOCATED IN THE ANNULUS-SHAPED SPACE

BETWEEN THE THRUST TUBE AND THE SOLAR PANELS WILL BE STATIONKEEPING AND DYNAMICS CONTROL EQUIPMENT, BATTERIES, AND MOST OF THE SEM EQUIPMENT. PROPER SPACECRAFT ATTITUDE AND SPIN RATE (APPROXIMATELY 100 RPM) WILL BE MAINTAINED BY TWO SEPARATE SETS OF JET THRUSTERS MOUNTED AROUND THE SPACECRAFT'S EQUATOR AND ACTIVATED BY GROUND COMMAND. THE SPACECRAFT WILL USE BOTH UHF-BAND AND S-BAND FREQUENCIES IN ITS TELEMETRY AND COMMAND SUBSYSTEM. A LOW-POWER VHF TRANSPONDER WILL PROVIDE TELEMETRY AND COMMAND DURING LAUNCH AND THEN WILL SERVE AS A BACKUP FOR THE PRIMARY SUBSYSTEM ONCE THE SPACECRAFT HAS ATTAINED SYNCHRONOUS ORBIT.

REFERENCES
88, 92, 225, 230, 232, 233, 234, 235, 236, 237, 238, AND 272.

EXPERIMENT NAME- VISIBLE-INFRARED SPIN-SCAN RADIOMETER (VISSR) NSSDC ID SMS-C -01

EXPERIMENT PERSONNEL

PI -	NESS STAFF	NOAA-NESS	SUITLAND, MD.

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION
THE VISIBLE-INFRARED SPIN-SCAN RADIOMETER (VISSR) TO BE FLOWN ON SMS-C WILL BE CAPABLE OF PROVIDING BOTH DAY/NIGHT OBSERVATIONS OF CLOUD COVER AND EARTH/CLOUD RADIANCE TEMPERATURE MEASUREMENTS FROM A SYNCHRONOUS, SPIN-STABILIZED, GEOSTATIONARY SATELLITE FOR USE IN OPERATIONAL WEATHER ANALYSIS AND FORECASTING. THE TWO-CHANNEL INSTRUMENT WILL BE ABLE TO TAKE BOTH FULL AND PARTIAL PICTURES OF THE EARTH'S DISC. BOTH THE INFRARED CHANNEL (10.5 TO 12.5 MICRONS) AND THE VISIBLE CHANNEL (0.55 TO 0.75 MICRON) WILL USE A COMMON OPTICS SYSTEM. INCOMING RADIATION WILL BE RECEIVED BY AN ELLIPTICALLY SHAPED SCAN MIRROR AND COLLECTED BY A RITCHEY-CHRETIEN OPTICAL SYSTEM. THE SCAN MIRROR WILL BE SET AT A NOMINAL ANGLE OF 45 DEG TO THE VISSR OPTICAL AXIS, WHICH WILL BE ALIGNED PARALLEL TO THE SPIN AXIS OF THE SPACECRAFT. THE SPINNING MOTION OF THE SPACECRAFT (APPROXIMATELY 100 RPM) WILL PROVIDE A WEST-TO-EAST SCAN MOTION WHEN THE SPIN AXIS OF THE SPACECRAFT IS ORIENTED PARALLEL WITH THE EARTH'S AXIS. THE LATITUDINAL SCAN WILL BE ACCOMPLISHED BY SEQUENTIALLY TILTING THE SCANNING MIRROR NORTH TO SOUTH AT THE COMPLETION OF EACH SPIN. A FULL PICTURE WILL TAKE 18.2 MIN TO COMPLETE AND ABOUT 2 MIN TO RETRACE. DURING EACH SCAN, EIGHT VISIBLE-SPECTRUM DETECTORS WILL SWEEP THE EARTH, WITH A GROUND RESOLUTION OF 0.9 KM AT ZERO NADIR ANGLE. A MERCURY-CADMIUM TELLURIDE DETECTOR WILL SENSE THE INFRARED PORTION OF THE SPECTRUM WITH A HORIZONTAL RESOLUTION OF APPROXIMATELY 9 KM AT ZERO NADIR ANGLE. THE INFRARED PORTION OF THE DETECTOR WILL MEASURE RADIANCE TEMPERATURES BETWEEN 180 AND 315 DEG K WITH A PROPOSED SENSITIVITY BETWEEN 0.4 AND 1.4 DEG K. THE VISSR OUTPUT WILL BE DIGITIZED AND TRANSMITTED TO THE NOAA COMMAND DATA ACQUISITION STATION, WALLOPS ISLAND, VA. THERE THE SIGNAL WILL BE FED INTO A 'LINE STRETCHER,' WHERE IT WILL BE STORED AND TIME-STRETCHED FOR TRANSMISSION BACK TO THE SATELLITE AT REDUCED BANDWIDTH FOR REBROADCAST TO APT USER STATIONS. AS WITH ALL OPERATIONAL TYPE DATA, THE VISSR DATA WILL BE HANDLED BY NOAA AND EVENTUALLY SENT TO THE NATIONAL CLIMATIC CENTER AT ASHEVILLE, NORTH CAROLINA, FOR ARCHIVING.

REFERENCES
2, 83, 92, 231, 235, 236, 237, 238, 318, AND 865.

EXPERIMENT NAME- METEOROLOGICAL DATA COLLECTION AND TRANSMISSION SYSTEM NSSDC ID SMS-C -05

EXPERIMENT PERSONNEL

PI - NONE ASSIGNED NONE ASSIGNED

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION

THE METEOROLOGICAL DATA COLLECTION AND TRANSMISSION SYSTEM IS AN EXPERIMENTAL COMMUNICATIONS AND DATA HANDLING SYSTEM DESIGNED TO RECEIVE AND PROCESS METLOROLOGICAL DATA COLLECTED FROM REMOTELY LOCATED EARTH-BASED DATA COLLECTION (OBSERVATION) PLATFORMS (DCP). THE COLLECTED DATA WILL BE RETRANSMITTED FROM THE SATELLITE TO SMALL, GROUND-BASED, REGIONAL DATA UTILIZATION CENTERS. DATA FROM UP TO 10,000 DCP STATIONS CAN BE HANDLED BY THE SYSTEM. THE SYSTEM WILL ALSO ALLOW FOR THE RETRANSMISSION OF NARROW-BAND (WEFAX TYPE) DATA FROM CENTRALIZED WEATHER FACILITIES TO EXISTING SMALL, GROUND-BASED APT RECEIVING STATIONS. THIS COMMUNICATIONS SYSTEM WILL OPERATE ON S-BAND FREQUENCIES. THE MINIMUM DATA COLLECTION SYSTEM FOR ONE SMALL METEOROLOGICAL SATELLITE WILL CONSIST OF APPROXIMATELY 3500 DCP STATIONS TO BE CONTACTED IN A 6-HR PERIOD. THE TOTAL AMOUNT OF DATA COLLECTED DURING THE 6-HR PERIOD WILL BE BETWEEN 350K AND 600K BITS, DEPENDING ON THE CODING TECHNIQUES. DATA RECEIVED FROM INDIVIDUAL STATIONS WILL VARY FROM 50 TO 3000 BITS, DEPENDING ON THE TYPE AND VARIETY OF SENSORS USED AT AN INDIVIDUAL DCP STATION.

REFERENCES

2, 83, 139, 231, 235, 236, 237, 238, AND 865.

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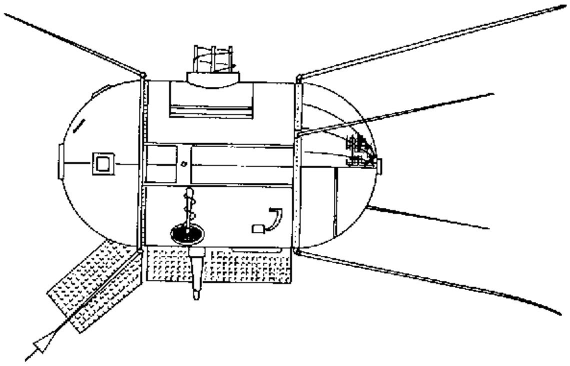
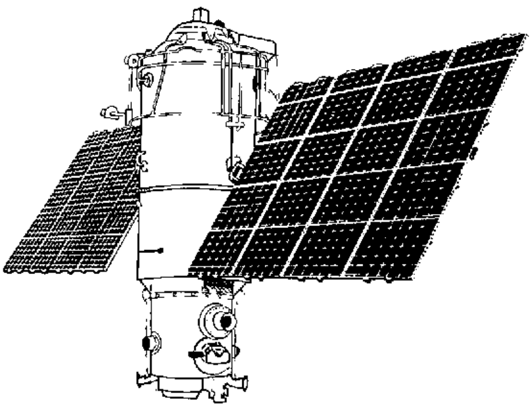
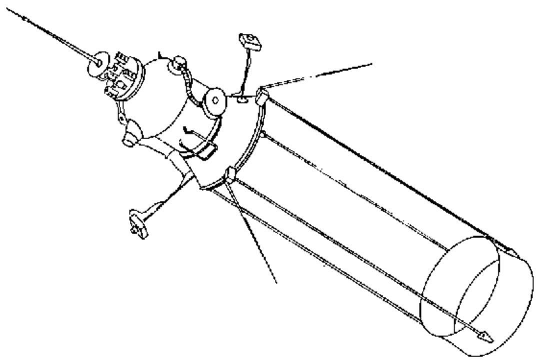
The Programs of the Union of Soviet Socialist Republics







COSMOS SERIES

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B. THE PROGRAMS OF THE UNION OF SOVIET SOCIALIST REPUBLICS

1. Cosmos Series

SPACECRAFT COMMON NAME- COSMOS 14 NSSDC ID 63-010A
ALTERNATE NAMES- KOSMOS 14

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/13/63
APOGEE- 499.000 KM ALT
PERIGEE- 252.000 KM ALT
PERIOD- 92.1 MIN
INCLINATION- 48.95 DEG

OTHER INFORMATION
SPACECRAFT WT- 500. KG
LAUNCH DATE- 04/13/63
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 082963

SPACECRAFT PERSONNEL
PM - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION
COSMOS 14 WAS THE FIRST RUSSIAN EXPERIMENTAL WEATHER SATELLITE. THE SATELLITE WAS ORIGINALLY CONSIDERED TO HAVE BEEN ORBITED FOR THE PURPOSE OF CONDUCTING VARIOUS GEOPHYSICAL STUDIES. HOWEVER, NEARLY 4.5 YEARS AFTER ITS LAUNCH, IT WAS SPECIFICALLY IDENTIFIED AS A TEST PLATFORM FOR ELECTROTECHNICAL SYSTEMS LATER USED TO INSURE THE ORIENTATION AND STABILIZATION OF WEATHER SATELLITES. IN ADDITION, TESTS WERE MADE OF POWER SUPPLIES USING SOLAR CELL BATTERIES. THE SATELLITE WAS IN THE FORM OF A CYLINDER, WITH TWO HEMISPHERICAL ENDS, AND WAS 1.8 M LONG AND 1.2 M IN DIAMETER. THE CONTROL STABILIZATION SYSTEM CONSISTED OF FLYWHEELS DRIVEN BY ELECTRIC MOTORS. THE KINETIC ENERGY OF THE FLYWHEELS WAS DAMPENED BY USING ELECTROMAGNETS THAT PRODUCED TORQUE BY INTERACTING WITH THE EARTH'S MAGNETIC FIELD. THIS SYSTEM PROVIDED THREE-AXIS STABILIZATION AND ORIENTED THE SATELLITE ON THE CENTER OF THE EARTH. EQUIPMENT ON BOARD MONITORED THE OPERATION OF AUTOMATIC DEVICES THAT CONTROLLED THE SOLAR AND CHEMICAL BATTERIES. THE SATELLITE COMMUNICATED VIA A 'MAYAK' RADIO TRANSMITTER OPERATING AT A FREQUENCY OF 20 MHZ. THE RESULTS OF THESE TESTS WERE INCORPORATED IN COSMOS 122 AND SUBSEQUENT LAUNCHES IN THE COSMOS 'METEOR' SYSTEM. A SIMILAR TEST FLIGHT WAS MADE NEARLY 8 MONTHS LATER WITH COSMOS 23. THESE TWO FLIGHTS COMPRISED THE FIRST STAGE IN THE DEVELOPMENT OF RUSSIAN WEATHER SATELLITES. COSMOS 14 REENTERED THE ATMOSPHERE ON AUGUST 29, 1963, AFTER 137 DAYS IN ORBIT.

REFERENCES
58, 223, 308, 451, AND 797.

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SPACECRAFT COMMON NAME- COSMOS 23 NSSDC ID 63-050A
ALTERNATE NAMES- KOSMOS 23

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC

OTHER INFORMATION
SPACECRAFT WT- 500. KG

EPOCH DATE- 12/13/63
APOGEE- 613.000 KM ALT
PERIGEE- 240.000 KM ALT
PERIOD- 92.90 MIN
INCLINATION- 49.0 DEG

LAUNCH DATE- 12/13/63
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 032764

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 23 WAS THE SECOND TEST PLATFORM ORBITED BY RUSSIA FOR THE PURPOSE OF EVALUATING ELECTROTECHNICAL SYSTEMS LATER USED TO INSURE THE ORIENTATION AND STABILIZATION OF WEATHER SATELLITES. LIKE ITS PREDECESSOR, COSMOS 14, THE SATELLITE WAS IN THE FORM OF A CYLINDER, WITH TWO HEMISPHERICAL ENDS, AND WAS 1.8 M LONG AND 1.2 M IN DIAMETER. TESTS WERE MADE OF POWER SUPPLIES THAT USED SOLAR CELL BATTERIES, AND EQUIPMENT ON BOARD MONITORED THE OPERATION OF AUTOMATIC DEVICES THAT CONTROLLED THE SOLAR AND CHEMICAL BATTERIES. THE CONTROL STABILIZATION SYSTEM CONSISTED OF FLYWHEELS DRIVEN BY ELECTRIC MOTORS. THE KINETIC ENERGY OF THE FLYWHEELS WAS DAMPENED BY USING ELECTROMAGNETS THAT PRODUCED TORQUE BY INTERACTING WITH THE EARTH'S MAGNETIC FIELD. THIS SYSTEM PROVIDED THREE-AXIS STABILIZATION AND ORIENTED THE SATELLITE ON THE CENTER OF THE EARTH. THE SATELLITE COMMUNICATED VIA A 'MAYAK' RADIO TRANSMITTER OPERATING AT 20 MHZ. COSMOS 23 MAY HAVE ALSO CARRIED THE FIRST RUSSIAN METEOROLOGICAL SCANNING IR RADIOMETER TO OBTAIN CRUDE NIGHTTIME PICTURES OF THE EARTH'S CLOUD COVER. THE RESULTS OF THESE TESTS AND SIMILAR ONES CONDUCTED 8 MONTHS EARLIER ON COSMOS 14 WERE INCORPORATED IN COSMOS 122 AND SUBSEQUENT LAUNCHES IN THE COSMOS 'METEOR' SYSTEM. THESE TWO FLIGHTS COMPRISED THE FIRST STAGE IN THE DEVELOPMENT OF RUSSIAN WEATHER SATELLITES. COSMOS 23 REENTERED THE ATMOSPHERE ON MARCH 27, 1964, AFTER 105 DAYS IN ORBIT.

REFERENCES

58, 223, 353, 451, 700, 797, AND 856.

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SPACECRAFT COMMON NAME- COSMOS 44
ALTERNATE NAMES- KOSMOS 44

NSSDC ID 64-053A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 08/29/64
APOGEE- 857.000 KM ALT
PERIGEE- 615.000 KM ALT
PERIOD- 99.48 MIN
INCLINATION- 65.04 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 08/28/64
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED-

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 44 WAS THE THIRD RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE FIRST LAUNCHED FROM THE TYURATAM SITE. IT WAS THE FIRST IN A SERIES OF PROTOTYPE SATELLITES THAT EVENTUALLY LED TO THE ORBITING OF RUSSIA'S FIRST ANNOUNCED EXPERIMENTAL WEATHER SATELLITE, COSMOS 122. NO OFFICIAL DESCRIPTION OF THE COSMOS 44 FLIGHT HAS EVER BEEN RELEASED. HOWEVER, THE ORBITAL PARAMETERS AND CONFIGURATION OF THE SATELLITE WERE SO SIMILAR TO THOSE OF COSMOS 122 THAT IT IS GENERALLY ASSUMED THAT COSMOS 44 WAS A PRECURSOR TO THE SATELLITES OF THE EXPERIMENTAL COSMOS 'METEOR' SYSTEM. THE SATELLITE WAS IN THE FORM OF A CYLINDER 3 M LONG AND 1 M IN DIAMETER WITH TWO SOLAR PANELS ATTACHED TO THE SIDES. A STEERABLE ANTENNA, ALSO MOUNTED ON THE SIDE, OPERATED AT 90 MHZ. THE PRIMARY OBJECTIVE OF THE FLIGHT PROBABLY WAS TO TEST THE BASIC SPACECRAFT HARDWARE. TESTS WERE PROBABLY ALSO MADE ON CRUDE TV AND IR CLOUD CAMERAS AND ACTINOMETRIC INSTRUMENTS, WHICH MAY HAVE FAILED TO OPERATE PROPERLY. AS OF JUNE 1972, THE SATELLITE REMAINS IN ORBIT IN A DEACTIVATED MODE. SIMILAR FLIGHTS WERE MADE BY COSMOS 58, 100, AND 118.

REFERENCES

58, 223, 451, 797, AND 830.

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SPACECRAFT COMMON NAME- COSMOS 45
ALTERNATE NAMES- KOSMOS 45

NSSDC ID 64-055A

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 09/14/64
- APOGEE- 313.000 KM ALT
- PERIGEE- 207.000 KM ALT
- PERIOD- 89.68 MIN
- INCLINATION- 64.89 DEG

OTHER INFORMATION
- SPACECRAFT WT- UNKNOWN KG
- LAUNCH DATE- 09/13/64
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE DATA RECORDED- 091864

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 45 WAS THE FOURTH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE SECOND LAUNCHED FROM THE TYURATAM SITE. ALTHOUGH THE FLIGHT WAS AT FIRST THOUGHT TO BE PART OF THE RECONNAISSANCE RECOVERABLE PAYLOAD SERIES, IT WAS LATER REVEALED THAT THE SATELLITE CARRIED SUPPLEMENTAL EXPERIMENTS TO TEST METEOROLOGICAL SENSORS AND TO OBTAIN DATA IN SUPPORT OF THE OPERATIONAL WEATHER SATELLITE DEVELOPMENT PROGRAM. THE INSTRUMENTATION INCLUDED (1) A CLOUDCOVER PHOTOMETER TO MEASURE THE BRIGHTNESS CHARACTERISTICS OF CLOUDS IN THE 0.6- TO 0.85-MICRON BAND, (2) A SCANNING IR RADIOMETER TO DETERMINE THE ANGULAR, SPECTRAL, AND LATITUDINAL DISTRIBUTION OF TERRESTRIAL IR RADIATION IN THE 0.8- TO 35-MICRON BAND, (3) A UV SPECTROPHOTOMETER TO MEASURE THE SOLAR UV RADIATION REFLECTED AND SCATTERED BY THE EARTH'S ATMOSPHERE, AND (4) A COLORIMETER TO MEASURE THE RADIATION CHARACTERISTICS OF THE NIGHT AIRGLOW IN THE 0.25- TO 0.60-MICRON BAND. THE SPIN-STABILIZED SATELLITE WAS IN THE FORM OF A CYLINDER WITH HEMISPHERICAL ENDS AND WAS 5 M LONG AND 2.44 M IN DIAMETER. ANTENNAS WERE MOUNTED ON THE ENDS OF THE SATELLITE AND

OPERATED ON A FREQUENCY OF 19.995 MHZ. THE SATELLITE REENTERED THE ATMOSPHERE ON SEPTEMBER 18, 1964, AFTER NEARLY 5 DAYS IN ORBIT AND WAS SUCCESSFULLY RECOVERED. SIMILAR FLIGHTS WERE MADE BY COSMOS 65 AND 92.

REFERENCES
58, 223, 355, 451, 717, 757, AND 830.

EXPERIMENT NAME- SCANNING IR RADIOMETER (0.8 TO 38 MICRONS) NSSDC ID 64-055A-01

EXPERIMENT PERSONNEL

PI - P.A.	BAZHULIN	SAS-IPA	MOSCOW, USSR
OI - A.V.	KARTASHEV	SAS-IPA	MOSCOW, USSR
OI - M.N.	MARKOV	SAS-IPA	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 091364

EXPERIMENT BRIEF DESCRIPTION
THE COSMOS 45 SCANNING IR RADIOMETER EXPERIMENT MEASURED THE ANGULAR, SPECTRAL, AND GEOGRAPHIC DISTRIBUTION OF OUTGOING TERRESTRIAL RADIATION IN SIX INTERVALS OF THE 0.8- TO 38-MICRON SPECTRAL RANGE WITH A MULTICHANNEL SCANNING DIFFRACTION SPECTROPHOTOMETER (SCANNING RADIOMETER). THE INSTRUMENT CONSISTED OF (1) AN INLET WINDOW MADE OF KRS-5 CRYSTAL, (2) SCANNING DIFFRACTION GRID MONOCHROMATORS, (3) A TWO-SIDED, FOUR-BLADED, GOLD-PLATED CHOPPER, (4) EXTRA-AXIAL PARABOLOIDAL MIRROR OBJECTIVES, (5) COLLIMATED CAMERAS, (6) A VACUUM TUBE AMPLIFIER WITH TWO PREAMPLIFIERS, (7) LOW INERTIA SEMICONDUCTOR BOLOMETRIC RADIATION RECEIVERS, AND (8) A SIX-CHANNEL MINIATURIZED LOOP OSCILLOGRAPH. THE OUTGOING TERRESTRIAL RADIATION AND BACKGROUND-COMPARISON (SPACE) RADIATION ENTERED THE INSTRUMENT THROUGH THE INLET WINDOW AND WERE REFLECTED FROM THE MIRROR OBJECTIVES ONTO THE CHOPPER, WHICH SUCCESSIVELY REPLACED THE EARTH RADIATION WITH THE SPACE RADIATION, AND VICE VERSA, AT A RATE OF 27 HZ AT THE INPUT SLITS OF THEIR RESPECTIVE MONOCHROMATORS. THE RADIATION FLUXES FROM EARTH AND SPACE ENTERING THE MONOCHROMATORS WERE DISPERSED BY THE PLANE REFLECTING DIFFRACTION GRIDS AND WERE SIMULTANEOUSLY FOCUSED BY THE COLLIMATED CAMERA MIRROR OBJECTIVES ONTO THE BOLOMETERS IN SUCH A WAY THAT WHEN THE EARTH RADIATION REACHED ONE BOLOMETER THE SPACE RADIATION ARRIVED AT THE OTHER BOLOMETER. THE RADIATION IMPINGING ON THE BOLOMETERS WAS CONVERTED INTO 27-HZ SIGNALS, WHICH, IN TURN, WERE AMPLIFIED AND CONVERTED INTO DC VOLTAGES PROPORTIONAL TO THE RADIATION FLUXES. THESE SIGNALS WERE THEN RECORDED ON TWO CHANNELS OF THE LOOP OSCILLOGRAPH FILM STRIP AND STORED ON BOARD. THE SPECTRUM WAS SCANNED BY ROTATING THE DIFFRACTION GRIDS ABOUT AXES PARALLEL TO THE GRID LINES BY MEANS OF CAM MECHANISMS. THE SCANNING RATE OF THE RADIOMETER SCANNING MIRROR OBJECTIVES WAS 2 TIMES 10 TO THE MINUS 2 POWER RAD/SEC. THE RADIATION MEASUREMENTS CONSISTED OF OBSERVATIONS IN THE FOLLOWING SIX SPECTRAL INTERVALS -- (1) 0.8 TO 38 MICRONS, (2) 4.5 TO 38 MICRONS, (3) 8.5 TO 38 MICRONS, (4) 12.5 TO 38 MICRONS, (5) 7 TO 20 MICRONS, AND (6) 14 TO 38 MICRONS. THE FIRST FOUR INTERVALS WERE SCANNED OVER A PERIOD OF 0.10 SEC, WHICH CORRESPONDED TO A DISPLACEMENT OF THE OPTICAL SYSTEM OF 2 TIMES 10 TO THE MINUS 3 POWER RADIANS. THE LAST TWO INTERVALS WERE MEASURED ALTERNATELY FOR ABOUT 19 SEC EACH TIME. EACH OF THESE, IN TURN, WAS ALTERNATED WITH A 19-SEC VIEW OF SPACE BACKGROUND RADIATION. THE REMAINDER OF THE INSTRUMENT'S 81-SEC COMPLETE OPERATING CYCLE WAS OCCUPIED BY TRANSITIONS BETWEEN OPERATING REGIMES. THIS 81-SEC INTERVAL BETWEEN INTENSITY MEASUREMENTS AT ONE WAVELENGTH CORRESPONDED TO A SURFACE DISPLACEMENT OF 5 DEG LONGITUDE NEAR THE EQUATOR TO NEARLY 0 DEG AT 65 DEG LATITUDE. THE SPECTRAL RESOLUTION

VARIED FROM 1 TO 2.5 MICRONS DEPENDING ON THE WAVELENGTH. THE OPTICAL AXIS OF THE INSTRUMENT WAS DIRECTED ALONG THE LOCAL VERTICAL, AND IT SCANNED WITHIN PLUS OR MINUS 90 DEG FROM NADIR. WITH THE SATELLITE ORBITAL INCLINATION OF 65 DEG, THE INSTRUMENT WAS ABLE TO RECORD TERRESTRIAL RADIATION FROM 65 DEG N TO 65 DEG S LATITUDE. THE ANGLE OF INSTANTANEOUS VIEW IN THE SCANNING PLANE WAS 1 DEG 46 MIN BY 2 DEG 20 MIN. AT AN AVERAGE SATELLITE ALTITUDE OF 250 KM, THE INSTRUMENT VIEWED A SURFACE AREA 75 BY 75 KM. THE DIFFRACTION MONOCHROMATORS PERMITTED AN ACCURACY OF ABOUT 6 PERCENT IN THE FLUX MEASUREMENTS TO BE ACHIEVED IN INDIVIDUAL REGIONS PLUS OR MINUS 2 MICRONS WIDE, WITH A 1 PERCENT ACCURACY IN RECORDING THE INTEGRATED RADIATION. THE EXPERIMENT OBTAINED THOUSANDS OF HIGH-QUALITY SPECTRA DURING ONE ORBIT ON SEPTEMBER 13, 1964. THE DATA WERE RETURNED TO EARTH ON SEPTEMBER 18, 1964, IN A SPECIAL REENTRY CONTAINER AND WERE SUCCESSFULLY RECOVERED.

REFERENCES

340, 597, 599, 600, 602, 622, 625, 715, AND 759.

EXPERIMENT NAME- CLOUDCOVER PHOTOMETER NSSDC ID 64-055A-02

EXPERIMENT PERSONNEL

PI - UNKNOWN UNKNOWN
OI - UNKNOWN UNKNOWN

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 091864

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 45 CLOUDCOVER PHOTOMETER EXPERIMENT WAS DESIGNED TO MEASURE BRIGHTNESS IN THE 0.6- TO 0.85-MICRON BAND TO PROVIDE A METHOD OF DISTINGUISHING CLOUDS FROM LAND AND SEA SURFACES INDEPENDENT OF IR MEASUREMENTS. THIS SPECTRAL BAND WAS USED TO TAKE ADVANTAGE OF THE HIGH ALBEDO OF CLOUDS IN THIS REGION AS COMPARED TO WATER SURFACES AND DRY LAND. THE INSTRUMENT WAS DIRECTED EARTHWARD WITH ITS OPTICAL AXIS PARALLEL TO NADIR. THE LIGHT REFLECTED FROM THE EARTH-ATMOSPHERE SYSTEM ENTERED THE INSTRUMENT THROUGH A SHORTWAVE CUTOFF FILTER, PASSED THROUGH AN OBJECTIVE LENS, AND WAS FOCUSED ON A PHOTOELECTRIC RECEIVER. THE RESPONSE OF THE RECEIVER WAS RECORDED ON ONE CHANNEL OF A MINIATURE SIX-CHANNEL OSCILLOGRAPH THAT USED A MOVING STRIP OF 35-MM PHOTOGRAPHIC FILM PASSING BY THE RECEIVER AT 0.8 MM/SEC TO RECORD AND STORE THE DATA UNTIL THE SATELLITE WAS RECOVERED AFTER REENTRY. THE SCANNING OF THE EARTH'S SURFACE AND ATMOSPHERE WAS PROVIDED BY THE SATELLITE'S ORBITAL MOTION -- 15 SEC OF SCANNING TIME CORRESPONDED TO A SATELLITE TRAVEL OF 120 KM. FROM AN AVERAGE SATELLITE ALTITUDE OF 250 KM, THE SPATIAL RESOLUTION OF THE PHOTOMETER AT NADIR WAS ABOUT 30 KM. THE EXPERIMENT WAS A SUCCESS, AND USEFUL DATA WERE OBTAINED DURING DAYLIGHT HOURS OVER THE PERIOD SEPTEMBER 13 TO 18, 1964. IDENTICAL EXPERIMENTS WERE FLOWN ON COSMOS 65 AND 92. A SIMILAR BUT HIGHER RESOLUTION EXPERIMENT WAS LATER FLOWN ON COSMOS 121.

REFERENCES

354, AND 597.

EXPERIMENT NAME- ULTRAVIOLET SPECTROPHOTOMETER NSSDC ID 64-055A-03

EXPERIMENT PERSONNEL

PI - A.I.	LEBEDINSKIY	SAS-IPA	MOSCOW, USSR
OI - A.P.	KUZNETSOV	MOSCOW STATE U	MOSCOW, USSR
OI - V.A.	IOZENAS	MOSCOW STATE U	MOSCOW, USSR
OI - V.A.	KRASNOPOL'SKIY	MOSCOW STATE U	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 091364

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 45 ULTRAVIOLET SPECTROPHOTOMETER EXPERIMENT MEASURED SOLAR SHORTWAVE RADIATION REFLECTED AND SCATTERED FROM THE EARTH-ATMOSPHERE SYSTEM. THE INSTRUMENT WAS A DOUBLE DIFFRACTION MONOCHROMATOR OPERATING IN THE 0.225- TO 0.307-MICRON REGION ONLY ON THE DAYSIDE OF THE EARTH. LIGHT ENTERED THE INSTRUMENT THROUGH A QUARTZ WINDOW AND WAS MODULATED AT A FREQUENCY OF 600 HZ BY A SHUTTER SITUATED IMMEDIATELY BEHIND THE WINDOW. THE LIGHT WAS THEN FOCUSED AT AN INLET SLIT BY A CONDENSING LENS AND PROCEEDED ON TO A CONCAVE DIFFRACTION GRID (600 LINES/MM) WITH A FOCAL LENGTH OF 125 MM. THE LIGHT WAS DISPERSED INTO A SPECTRUM (DISPERSION OF 0.67 MICRON/MM) AND FELL ON A MOVABLE OUTLET SLIT THAT SEPARATED A NARROW BAND OF WAVELENGTHS FROM THE SPECTRUM. THE OUTLET SLIT WAS MOVED THROUGH 150 STEPS OVER A 30-SEC CYCLE AND WENT FROM THE LONGWAVE POSITION TO THE EXTREME SHORTWAVE POSITION, AFTER WHICH IT RETURNED TO THE ORIGINAL POSITION. AFTER PASSING THROUGH THE OUTLET SLIT, THE DIVERGING BEAM WAS CONVERTED TO A PARALLEL BEAM BY A LENS AND FELL ON A FLAT DIFFRACTION GRID HAVING 2400 LINES/MM. THE LINEAR DISPERSION WAS SUCH THAT, REGARDLESS OF WAVELENGTH, THE LIGHT HIT THE SAME SPOT ON A PHOTOMULTIPLIER PHOTOCATHODE. THE OUTPUT OF THE PHOTOMULTIPLIER WAS FIRST AMPLIFIED BY A PREAMPLIFIER AND THEN WENT TO THE MAIN AMPLIFIER AND DETECTOR. THE RECTIFIED SIGNAL WAS THEN RECORDED ON A 35-MM FILM STRIP IN A MINIATURIZED LOOP OSCILLOGRAPH. THE SPECTRAL RESOLUTION OF THE INSTRUMENT WAS 0.0015 MICRON. THE OPTICAL AXIS OF THE INSTRUMENT WAS DIRECTED TO NADIR, AND THE AREA VIEWED FROM AN AVERAGE SATELLITE ALTITUDE OF 250 KM WAS 20 SQ KM AT NADIR. ONBOARD CALIBRATION WAS OBTAINED BY VIEWING TWO STANDARD LAMPS WITH UVIOL WINDOWS -- A STANDARD RIBBON FILAMENT INCANDESCENT LAMP AND A HYDROGEN LAMP. THOUSANDS OF SPECTRA WERE OBTAINED ON SEPTEMBER 13, 1964, AND WERE STORED ON BOARD UNTIL THEY WERE RETURNED TO EARTH IN A SPECIAL REENTRY CONTAINER ON SEPTEMBER 18, 1964. SIMILAR EXPERIMENTS WERE FLOWN ON COSMOS 65 AND 92.

REFERENCES

598.

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SPACECRAFT COMMON NAME- COSMOS 58 — NSSDC ID 65-014A
ALTERNATE NAMES- KOSMOS 58

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 02/27/65
APOGEE- 647.000 KM ALT
PERIGEE- 563.000 KM ALT
PERIOD- 96.78 MIN
INCLINATION- 65.00 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 02/26/65
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED-

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 58 WAS THE FIFTH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE THIRD LAUNCHED FROM THE TYURATAM SITE. IT WAS THE SECOND IN A SERIES OF PROTOTYPE SATELLITES THAT EVENTUALLY LED TO THE ORBITING OF RUSSIA'S FIRST ANNOUNCED EXPERIMENTAL WEATHER SATELLITE, COSMOS 122. NO OFFICIAL DESCRIPTION OF THE COSMOS 58 FLIGHT HAS EVER BEEN RELEASED. HOWEVER, THE ORBITAL PARAMETERS AND CONFIGURATION OF THE SATELLITE WERE SO SIMILAR TO THOSE OF COSMOS 122 THAT IT IS GENERALLY ASSUMED THAT COSMOS 58 WAS A PRECURSOR TO THE SATELLITES OF THE EXPERIMENTAL 'METEOR' SYSTEM. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO SOLAR PANELS ATTACHED TO THE SIDES. A STEERABLE ANTENNA, ALSO MOUNTED ON THE SIDE, OPERATED AT 90 MHZ. THE PRIMARY OBJECTIVE OF THE FLIGHT PROBABLY WAS TO TEST THE BASIC SPACECRAFT HARDWARE. TESTS WERE PROBABLY ALSO MADE ON CRUDE TV AND IR CLOUD CAMERAS AND ACTINOMETRIC INSTRUMENTS, WHICH MAY HAVE FAILED TO OPERATE PROPERLY. AS OF JUNE 1972, THE SATELLITE REMAINS IN ORBIT IN A DEACTIVATED MODE. SIMILAR FLIGHTS WERE MADE BY COSMOS 44, 100, AND 118.

REFERENCES

58, 223, 451, 797, AND 830.

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SPACECRAFT COMMON NAME- COSMOS 65 NSSDC ID 65-029A
ALTERNATE NAMES- KOSMOS 65

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 04/20/65
- APOGEE- 319.000 KM ALT
- PERIGEE- 207.000 KM ALT
- PERIOD- 89.75 MIN
- INCLINATION- 65.00 DEG

OTHER INFORMATION
- SPACECRAFT WT- UNKNOWN KG
- LAUNCH DATE- 04/17/65
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE DATA RECORDED- 042565

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 65 WAS THE SIXTH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE FOURTH LAUNCHED FROM THE TYURATAM SITE. ALTHOUGH THE FLIGHT WAS AT FIRST THOUGHT TO BE PART OF THE RECONNAISSANCE RECOVERABLE PAYLOAD SERIES, IT WAS LATER REVEALED THAT THE SATELLITE CARRIED SUPPLEMENTAL EXPERIMENTS TO TEST METEOROLOGICAL SENSORS AND TO OBTAIN DATA IN SUPPORT OF THE OPERATIONAL WEATHER SATELLITE DEVELOPMENT PROGRAM. THE INSTRUMENTATION INCLUDED (1) A CLOUDCOVER PHOTOMETER TO MEASURE THE BRIGHTNESS CHARACTERISTICS OF CLOUDS IN THE 0.60- TO 0.85-MICRON BAND, (2) A SCANNING IR RADIOMETER TO DETERMINE THE ANGULAR, SPECTRAL, AND LATITUDINAL DISTRIBUTION OF TERRESTRIAL IR RADIATION IN THE 0.8- TO 45-MICRON BAND, (3) A UV SPECTROPHOTOMETER TO MEASURE THE SOLAR UV RADIATION REFLECTED AND SCATTERED BY THE EARTH'S ATMOSPHERE, AND

(4) A COLORIMETER TO MEASURE THE RADIATION CHARACTERISTICS OF THE NIGHT AIRGLOW IN THE 0.25- TO 0.60-MICRON BAND. THE SPIN-STABILIZED SATELLITE WAS IN THE FORM OF A CYLINDER WITH HEMISPHERICAL ENDS AND WAS 5 M LONG AND 2.44 M IN DIAMETER. ANTENNAS WERE MOUNTED ON THE ENDS OF THE SATELLITE AND OPERATED ON A FREQUENCY OF 19.995 MHZ. THE SATELLITE REENTERED THE ATMOSPHERE ON APRIL 25, 1965, AFTER NEARLY 8 DAYS IN ORBIT, AND WAS SUCCESSFULLY RECOVERED. SIMILAR FLIGHTS WERE MADE BY COSMOS 45 AND 92.

REFERENCES

58, 223, 451, 717, 797, AND 830.

EXPERIMENT NAME- SCANNING IR RADIOMETER (0.8 TO 45 MICRONS) NSSDC ID 65-029A-01

EXPERIMENT PERSONNEL

PI - M.N. MARKOV SAS-IPA MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 041765

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 65 SCANNING RADIOMETER EXPERIMENT MEASURED THE ANGULAR, SPECTRAL, AND GEOGRAPHIC DISTRIBUTION OF OUTGOING TERRESTRIAL RADIATION IN SIX INTERVALS OF THE 0.8- TO 45-MICRON SPECTRAL RANGE WITH A MULTICHANNEL SCANNING DIFFRACTION SPECTROPHOTOMETER (SCANNING RADIOMETER). THE INSTRUMENT CONSISTED OF (1) AN INLET WINDOW MADE OF KRS-5 CRYSTAL, (2) SCANNING DIFFRACTION GRID MONOCHROMATORS, (3) A TWO-SIDED, FOUR-BLADED, GOLD-PLATED CHOPPER, (4) EXTRA-AXIAL PARABOLOIDAL MIRROR OBJECTIVES, (5) COLLIMATED CAMERAS, (6) A VACUUM TUBE AMPLIFIER WITH TWO PREAMPLIFIERS, (7) LOW INERTIA SEMICONDUCTOR BOLOMETRIC RADIATION RECEIVERS, AND (8) A SIX-CHANNEL MINIATURIZED LOOP OSCILLOGRAPH. THE OUTGOING TERRESTRIAL RADIATION AND BACKGROUND-COMPARISON (SPACE) RADIATION ENTERED THE INSTRUMENT THROUGH THE INLET WINDOW AND WERE REFLECTED FROM THE MIRROR OBJECTIVES ONTO THE CHOPPER, WHICH SUCCESSIVELY REPLACED THE EARTH RADIATION WITH THE SPACE RADIATION, AND VICE VERSA, AT A RATE OF 27 HZ AT THE INPUT SLITS OF THEIR RESPECTIVE MONOCHROMATORS. THE RADIATION FLUXES FROM EARTH AND SPACE ENTERING THE MONOCHROMATORS WERE DISPERSED BY THE PLANE REFLECTING DIFFRACTION GRIDS AND WERE SIMULTANEOUSLY FOCUSED BY THE COLLIMATED CAMERA MIRROR OBJECTIVES ON TO THE BOLOMETERS IN SUCH A WAY THAT WHEN THE EARTH RADIATION REACHED ONE BOLOMETER THE SPACE RADIATION ARRIVED AT THE OTHER BOLOMETER. THE RADIATION IMPINGING ON THE BOLOMETERS WAS CONVERTED INTO 27-HZ SIGNALS, WHICH, IN TURN, WERE AMPLIFIED AND CONVERTED INTO DC VOLTAGES PROPORTIONAL TO THE RADIATION FLUXES. THESE SIGNALS WERE THEN RECORDED ON TWO CHANNELS OF THE LOOP OSCILLOGRAPH FILM STRIP AND STORED ON BOARD. THE SPECTRUM WAS SCANNED BY ROTATING THE DIFFRACTION GRIDS ABOUT AXES PARALLEL TO THE GRID LINES BY MEANS OF CAM MECHANISMS. THE SCANNING PLANE, WHICH WAS PERPENDICULAR TO THE ORBITAL PLANE, MOVED WITH AN ANGULAR VELOCITY OF ABOUT 1 DEG/SEC AND TOOK ABOUT 5 TO 6 SEC TO SCAN FROM THE GEOMETRIC HORIZON TO AN ALTITUDE OF 200 TO 300 KM. THE ANGULAR RESOLUTION OF THE INSTRUMENT WAS ABOUT 0.15 DEG. THE RADIATION MEASUREMENTS CONSISTED OF OBSERVATIONS IN THE FOLLOWING SIX SPECTRAL INTERVALS -- (1) 0.8 TO 45 MICRONS, (2) 4.5 TO 45 MICRONS, (3) 8.5 TO 45 MICRONS, (4) 12.5 TO 45 MICRONS, (5) 7 TO 20 MICRONS, AND (6) 14 TO 38 MICRONS. THE FIRST FOUR INTERVALS WERE SCANNED OVER A PERIOD OF 0.10 SEC, WHICH CORRESPONDED TO A DISPLACEMENT OF THE OPTICAL SYSTEM OF 2 TIMES 10 TO THE MINUS 3 POWER RADIANS. THE LAST TWO INTERVALS WERE MEASURED ALTERNATELY FOR ABOUT 19 SEC EACH TIME. EACH OF THESE, IN TURN, WAS ALTERNATED WITH A 19-SEC VIEW OF SPACE BACKGROUND RADIATION. THE REMAINDER OF THE INSTRUMENT'S

81-SEC COMPLETE OPERATING CYCLE WAS OCCUPIED BY TRANSITIONS BETWEEN OPERATING REGIMES. THIS 81-SEC INTERVAL BETWEEN INTENSITY MEASUREMENTS AT ONE WAVELENGTH CORRESPONDED TO A SURFACE DISPLACEMENT OF 5 DEG OF LONGITUDE NEAR THE EQUATOR TO NEARLY 0 DEG AT 65 DEG LATITUDE. THE SPECTRAL RESOLUTION VARIED FROM 1 TO 2.5 MICRONS DEPENDING ON THE WAVELENGTH. THE OPTICAL AXIS OF THE INSTRUMENT WAS DIRECTED ALONG THE LOCAL VERTICAL, AND IT SCANNED WITHIN PLUS OR MINUS 90 DEG FROM NADIR. WITH THE SATELLITE ORBITAL INCLINATION OF 65 DEG, THE INSTRUMENT WAS ABLE TO RECORD TERRESTRIAL RADIATION FROM 65 DEG N TO 65 DEG S LATITUDE. THE ANGLE OF INSTANTANEOUS VIEW IN THE SCANNING PLANE WAS 1 DEG 46 MIN BY 2 DEG 20 MIN. AT AN AVERAGE SATELLITE ALTITUDE OF 250 KM, THE INSTRUMENT VIEWED A SURFACE AREA 75 BY 75 KM. THE DIFFRACTION MONOCHROMATORS PERMITTED AN ACCURACY OF ABOUT 6 PERCENT IN THE FLUX MEASUREMENTS TO BE ACHIEVED IN INDIVIDUAL REGIONS PLUS OR MINUS 2 MICRONS WIDE WITH A 1 PERCENT ACCURACY IN RECORDING THE INTEGRATED RADIATION. THE EXPERIMENT OBTAINED THOUSANDS OF HIGH-QUALITY SPECTRA DURING ONE ORBIT ON APRIL 17, 1965. THE DATA WERE RETURNED TO EARTH ON APRIL 25, 1965, IN A SPECIAL REENTRY CONTAINER AND WERE SUCCESSFULLY RECOVERED.

REFERENCES

599, 602, 622, 623, 624, 625, 715, AND 759.

EXPERIMENT NAME- CLOUDCOVER PHOTOMETER NSSDC ID 65-029A-02

EXPERIMENT PERSONNEL

PI -	UNKNOWN	UNKNOWN
CI -	UNKNOWN	UNKNOWN

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 042565

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 65 CLOUDCOVER PHOTOMETER EXPERIMENT WAS DESIGNED TO MEASURE BRIGHTNESS IN THE 0.6- TO 0.85-MICRON BAND TO PROVIDE A METHOD OF DISTINGUISHING CLOUDS FROM LAND AND SEA SURFACES INDEPENDENT OF IR MEASUREMENTS. THIS SPECTRAL BAND WAS USED TO TAKE ADVANTAGE OF THE HIGH ALBEDO OF CLOUDS IN THIS REGION AS COMPARED TO WATER SURFACES AND DRY LAND. THE INSTRUMENT WAS DIRECTED EARTHWARD WITH ITS OPTICAL AXIS PARALLEL TO NADIR. THE LIGHT REFLECTED FROM THE EARTH-ATMOSPHERE SYSTEM ENTERED THE INSTRUMENT THROUGH A SHORTWAVE CUTOFF FILTER, PASSED THROUGH AN OBJECTIVE LENS, AND WAS FOCUSED ON A PHOTOELECTRIC RECEIVER. THE RESPONSE OF THE RECEIVER WAS RECORDED ON ONE CHANNEL OF A MINIATURE SIX-CHANNEL OSCILLOGRAPH THAT USED A MOVING STRIP OF 35-MM PHOTOGRAPHIC FILM PASSING BY THE RECEIVER AT 0.8 MM/SEC TO RECORD AND STORE THE DATA UNTIL THE SATELLITE WAS RECOVERED AFTER REENTRY. THE SCANNING OF THE EARTH'S SURFACE AND ATMOSPHERE WAS PROVIDED BY THE SATELLITE'S ORBITAL MOTION -- 15 SEC OF SCANNING TIME CORRESPONDED TO A SATELLITE TRAVEL OF 120 KM. THE SPATIAL RESOLUTION OF THE PHOTOMETER AT NADIR FROM AN AVERAGE SATELLITE ALTITUDE OF 250 KM WAS ABOUT 30 KM. THE EXPERIMENT WAS A SUCCESS, AND USEFUL DATA WERE OBTAINED DURING DAYLIGHT HOURS OVER THE PERIOD APRIL 17 TO 25, 1965. IDENTICAL EXPERIMENTS WERE FLOWN ON COSMOS 45 AND 92. A SIMILAR BUT HIGHER RESOLUTION EXPERIMENT WAS LATER FLOWN ON COSMOS 121.

REFERENCES

586.

EXPERIMENT NAME- ULTRAVIOLET SPECTROPHOTOMETER NSSDC ID 65-029A-03

EXPERIMENT PERSONNEL

PI - A.I.	LEBEDINSKIY	SAS-IPA	MOSCOW, USSR
OI - V.A.	KRASNOPOL'SKIY	MOSCOW STATE U	MOSCOW, USSR
OI - A.P.	KUZNETSOV	MOSCOW STATE U	MOSCOW, USSR
OI - V.A.	IOZENAS	MOSCOW STATE U	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 041765

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 65 ULTRAVIOLET SPECTROPHOTOMETER EXPERIMENT MEASURED SOLAR SHORTWAVE RADIATION REFLECTED AND SCATTERED FROM THE EARTH-ATMOSPHERE SYSTEM. THE INSTRUMENT WAS A DOUBLE DIFFRACTION MONOCHROMATOR OPERATING IN THE 0.225- TO 0.307-MICRON REGION ONLY ON THE DAYSIDE OF THE EARTH. LIGHT ENTERED THE INSTRUMENT THROUGH A QUARTZ WINDOW AND WAS MODULATED AT A FREQUENCY OF 600 HZ BY A SHUTTER SITUATED IMMEDIATELY BEHIND THE WINDOW. THE LIGHT WAS THEN FOCUSED AT AN INLET SLIT BY A CONDENSING LENS AND PROCEEDED ON TO A CONCAVE DIFFRACTION GRID (600 LINES/MM) WITH A FOCAL LENGTH OF 125 MM. THE LIGHT WAS DISPERSED INTO A SPECTRUM (DISPERSION OF 0.67 MICRON/MM) AND FELL ON A MOVABLE OUTLET SLIT THAT SEPARATED A NARROW BAND OF WAVELENGTHS FROM THE SPECTRUM. THE OUTLET SLIT WAS MOVED THROUGH A NUMBER OF STEPS OVER A 1-MIN CYCLE AND WENT FROM THE LONGWAVE POSITION TO THE EXTREME SHORTWAVE POSITION, AFTER WHICH IT RETURNED TO THE ORIGINAL POSITION. AFTER PASSING THROUGH THE OUTLET SLIT, THE DIVERGING BEAM WAS CONVERTED TO A PARALLEL BEAM BY A LENS AND FELL ON A FLAT DIFFRACTION GRID HAVING 2400 LINES/MM. THE LINEAR DISPERSION WAS SUCH THAT, REGARDLESS OF WAVELENGTH, THE LIGHT HIT THE SAME SPOT ON A PHOTOMULTIPLIER PHOTOCATHODE. THE OUTPUT OF THE PHOTOMULTIPLIER WAS FIRST AMPLIFIED BY A PREAMPLIFIER AND THEN WENT TO THE MAIN AMPLIFIER AND DETECTOR. THE RECTIFIED SIGNAL WAS THEN RECORDED ON A 35-MM FILM STRIP IN A MINIATURIZED LOOP OSCILLOGRAPH. THE SPECTRAL RESOLUTION OF THE INSTRUMENT WAS 0.0015 MICRON. THE OPTICAL AXIS OF THE INSTRUMENT WAS DIRECTED AT AN ANGLE OF 7 DEG TO NADIR, AND THE EFFECTIVE FIELD OF VIEW WAS 2.5 TIMES 10 TO THE MINUS 3 POWER STER. ONBOARD CALIBRATION WAS OBTAINED BY VIEWING TWO STANDARD LAMPS WITH UVIOL WINDOWS -- A STANDARD RIBBON FILAMENT INCANDESCENT LAMP AND A HYDROGEN LAMP. ABOUT 2500 SPECTRA WERE OBTAINED ON APRIL 17, 1965, AND WERE STORED ON BOARD UNTIL THEY WERE RETURNED TO EARTH IN A SPECIAL REENTRY CONTAINER ON APRIL 25, 1965. THE DATA INDICATED VARIATIONS IN THE UV ENERGY DISTRIBUTION ASSOCIATED WITH LOCAL CHANGES IN THE OZONE CONCENTRATION. CLOUDS ALSO HAD AN EFFECT ON THE FORM OF THE SPECTRUM IN THE LONGWAVE PORTION. SIMILAR EXPERIMENTS WERE FLOWN ON COSMOS 45 AND 92.

REFERENCES

544, 586, AND 597.

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SPACECRAFT COMMON NAME- COSMOS 92 NSSDC ID 65-083A
ALTERNATE NAMES- KOSMOS 92

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG

EPOCH DATE- 10/17/65
APOGEE- 334.000 KM ALT
PERIGEE- 201.000 KM ALT
PERIOD- 89.85 MIN
INCLINATION- 64.97 DEG

LAUNCH DATE- 10/16/65
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 102465

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 92 WAS THE SEVENTH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE FIFTH LAUNCHED FROM THE TYURATAM SITE. ALTHOUGH THE FLIGHT WAS AT FIRST THOUGHT TO BE PART OF THE RECONNAISSANCE RECOVERABLE PAYLOAD SERIES, IT WAS LATER REVEALED THAT THE SATELLITE CARRIED SUPPLEMENTAL EXPERIMENTS TO TEST METEOROLOGICAL SENSORS AND OBTAIN DATA IN SUPPORT OF THE OPERATIONAL WEATHER SATELLITE DEVELOPMENT PROGRAM. THE INSTRUMENTATION INCLUDED (1) A CLOUDCOVER PHOTOMETER TO MEASURE THE BRIGHTNESS CHARACTERISTICS OF CLOUDS IN THE 0.60- TO 0.85-MICRON BAND, (2) A SCANNING IR RADIOMETER TO DETERMINE THE ANGULAR, SPECTRAL, AND LATITUDINAL DISTRIBUTION OF TERRESTRIAL IR RADIATION IN THE 0.8- TO 45-MICRON BAND, (3) A UV SPECTROPHOTOMETER TO MEASURE THE SOLAR UV RADIATION REFLECTED AND SCATTERED BY THE EARTH'S ATMOSPHERE, AND (4) A COLORIMETER TO MEASURE THE RADIATION CHARACTERISTICS FROM THE NIGHT AIRGLOW IN THE 0.25- TO 0.60-MICRON BAND. THE SPIN-STABILIZED SATELLITE WAS IN THE FORM OF A CYLINDER WITH HEMISPHERICAL ENDS AND WAS 5 M LONG AND 2.44 M IN DIAMETER. ANTENNAS WERE MOUNTED ON THE ENDS OF THE SATELLITE AND OPERATED ON A FREQUENCY OF 19.995 MHZ. THE SATELLITE REENTERED THE ATMOSPHERE ON OCTOBER 24, 1965, AFTER NEARLY 8 DAYS IN ORBIT AND WAS SUCCESSFULLY RECOVERED. SIMILAR FLIGHTS WERE MADE BY COSMOS 45 AND 65.

REFERENCES

58, 223, 451, 585, 602, 717, 797, AND 830.

EXPERIMENT NAME- SCANNING IR RADIOMETER (0.8 TO 45 MICRONS)   NSSDC ID 65-083A-01

EXPERIMENT PERSONNEL

PI - M.N.	MARKOV	SAS-IPA	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 101665

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 92 SCANNING IR RADIOMETER EXPERIMENT MEASURED THE ANGULAR, SPECTRAL, AND GEOGRAPHIC DISTRIBUTION OF OUTGOING TERRESTRIAL RADIATION IN SIX INTERVALS OF THE 0.8- TO 45-MICRON SPECTRAL RANGE WITH A MULTICHANNEL SCANNING DIFFRACTION SPECTROPHOTOMETER (SCANNING RADIOMETER). THE INSTRUMENT CONSISTED OF (1) AN INLET WINDOW MADE OF KRS-5 CRYSTAL, (2) SCANNING DIFFRACTION GRID MONOCHROMATORS, (3) A TWO-SIDED, FOUR-BLADED, GOLD-PLATED CHOPPER, (4) EXTRA-AXIAL PARABOLOIDAL MIRROR OBJECTIVES, (5) COLLIMATED CAMERAS, (6) A VACUUM TUBE AMPLIFIER WITH TWO PREAMPLIFIERS, (7) LOW INERTIA SEMICONDUCTOR BOLOMETRIC RADIATION RECEIVERS, AND (8) A SIX-CHANNEL MINIATURIZED LOOP OSCILLOGRAPH. THE OUTGOING TERRESTRIAL RADIATION AND BACKGROUND-COMPARISON (SPACE) RADIATION ENTERED THE INSTRUMENT THROUGH THE INLET WINDOW AND WERE REFLECTED FROM THE MIRROR OBJECTIVES ONTO THE CHOPPER, WHICH SUCCESSIVELY REPLACED THE EARTH RADIATION WITH THE SPACE RADIATION.

AND VICE VERSA, AT A RATE OF 27 HZ AT THE INPUT SLITS OF THEIR RESPECTIVE MONOCHROMATORS. THE RADIATION FLUXES FROM EARTH AND SPACE ENTERING THE MONOCHROMATORS WERE DISPERSED BY THE PLANE REFLECTING DIFFRACTION GRIDS AND WERE SIMULTANEOUSLY FOCUSED BY THE COLLIMATED CAMERA MIRROR OBJECTIVES ON TO THE BOLOMETERS IN SUCH A WAY THAT WHEN THE EARTH RADIATION REACHED ONE BOLOMETER THE SPACE RADIATION ARRIVED AT THE OTHER BOLOMETER. THE RADIATION IMPINGING ON THE BOLOMETERS WAS CONVERTED INTO 27-HZ SIGNALS, WHICH, IN TURN, WERE AMPLIFIED AND CONVERTED INTO DC VOLTAGES PROPORTIONAL TO THE RADIATION FLUXES. THESE SIGNALS WERE THEN RECORDED ON TWO CHANNELS OF THE LOOP OSCILLOGRAPH FILM STRIP AND STORED ON BOARD. THE SPECTRUM WAS SCANNED BY ROTATING THE DIFFRACTION GRIDS ABOUT AXES PARALLEL TO THE GRID LINES BY MEANS OF CAM MECHANISMS. THE SCANNING RATE OF THE RADIOMETER SCANNING MIRROR OBJECTIVES WAS 2 TIMES 10 TO THE MINUS 2 POWER RAD/SEC. THE RADIATION MEASUREMENTS CONSISTED OF OBSERVATIONS IN THE FOLLOWING SIX SPECTRAL INTERVALS -- (1) 0.8 TO 45 MICRONS, (2) 4.5 TO 45 MICRONS, (3) 8.5 TO 45 MICRONS, (4) 12.5 TO 45 MICRONS, (5) 7 TO 20 MICRONS, AND (6) 14 TO 38 MICRONS. THE FIRST FOUR INTERVALS WERE SCANNED OVER A PERIOD OF 0.10 SEC, WHICH CORRESPONDED TO A DISPLACEMENT OF THE OPTICAL SYSTEM OF 2 TIMES 10 TO THE MINUS 3 POWER RADIANS. THE LAST TWO INTERVALS WERE MEASURED ALTERNATELY FOR ABOUT 19 SEC EACH TIME. EACH OF THESE, IN TURN, WAS ALTERNATED WITH A 19-SEC VIEW OF SPACE BACKGROUND RADIATION. THE REMAINDER OF THE INSTRUMENT'S 81-SEC COMPLETE OPERATING CYCLE WAS OCCUPIED BY TRANSITIONS BETWEEN OPERATING REGIMES. THIS 81-SEC INTERVAL BETWEEN INTENSITY MEASUREMENTS AT ONE WAVELENGTH CORRESPONDED TO A SURFACE DISPLACEMENT OF 5 DEG OF LONGITUDE NEAR THE EQUATOR TO NEARLY 0 DEG AT 65 DEG LATITUDE. THE SPECTRAL RESOLUTION VARIED FROM 1 TO 2.5 MICRONS DEPENDING ON THE WAVELENGTH. THE OPTICAL AXIS OF THE INSTRUMENT WAS DIRECTED ALONG THE LOCAL VERTICAL, AND IT SCANNED WITHIN PLUS OR MINUS 90 DEG FROM NADIR. WITH THE SATELLITE ORBITAL INCLINATION OF 65 DEG, THE INSTRUMENT WAS ABLE TO RECORD TERRESTRIAL RADIATION FROM 65 DEG N TO 65 DEG S LATITUDE. THE ANGLE OF INSTANTANEOUS VIEW IN THE SCANNING PLANE WAS 1 DEG 45 MIN BY 2 DEG 20 MIN. AT AN AVERAGE SATELLITE ALTITUDE OF 250 KM, THE INSTRUMENT VIEWED A SURFACE AREA 75 BY 75 KM. THE DIFFRACTION MONOCHROMATORS PERMITTED AN ACCURACY OF ABOUT 6 PERCENT IN THE FLUX MEASUREMENTS TO BE ACHIEVED IN INDIVIDUAL REGIONS PLUS OR MINUS 2 MICRONS WIDE, WITH A 1 PERCENT ACCURACY IN RECORDING THE INTEGRATED RADIATION. THE EXPERIMENT OBTAINED NUMEROUS SPECTRA ON OCTOBER 16, 1965. THE DATA ACQUIRED WERE RETURNED TO EARTH ON OCTOBER 24, 1965, IN A SPECIAL REENTRY CONTAINER AND WERE SUCCESSFULLY RECOVERED.

REFERENCES
223, 602, AND 759.

EXPERIMENT NAME- CLOUDCOVER PHOTOMETER   NSSDC ID 65-083A-02

EXPERIMENT PERSONNEL

PI -	UNKNOWN	UNKNOWN
OI -	UNKNOWN	UNKNOWN

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 102465

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 92 CLOUDCOVER PHOTOMETER EXPERIMENT WAS DESIGNED TO MEASURE BRIGHTNESS IN THE 0.6- TO 0.85-MICRON BAND TO PROVIDE A METHOD OF DISTINGUISHING CLOUDS FROM LAND AND SEA SURFACES INDEPENDENT OF IR MEASUREMENTS. THIS SPECTRAL BAND WAS USED TO TAKE ADVANTAGE OF THE HIGH ALBEDO OF CLOUDS IN THIS REGION AS COMPARED TO WATER SURFACES AND DRY LAND REGIONS. THE INSTRUMENT WAS DIRECTED EARTHWARD WITH ITS OPTICAL AXIS

PARALLEL TO NADIR. THE LIGHT REFLECTED FROM THE EARTH-ATMOSPHERE SYSTEM ENTERED THE INSTRUMENT THROUGH A SHORTWAVE CUTOFF FILTER, PASSED THROUGH AN OBJECTIVE LENS, AND WAS FOCUSED ON A PHOTOELECTRIC RECEIVER. THE RESPONSE OF THE RECEIVER WAS RECORDED ON ONE CHANNEL OF A MINIATURE SIX-CHANNEL OSCILLOGRAPH THAT USED A MOVING STRIP OF 35-MM PHOTOGRAPHIC FILM PASSING BY THE RECEIVER AT 0.8 MM/SEC TO RECORD AND STORE THE DATA UNTIL THE SATELLITE WAS RECOVERED AFTER REENTRY. THE SCANNING OF THE EARTH'S SURFACE AND ATMOSPHERE WAS PROVIDED BY THE SATELLITE'S ORBITAL MOTION -- 15 SEC OF SCANNING TIME CORRESPONDED TO A SATELLITE TRAVEL OF 120 KM. THE SPATIAL RESOLUTION OF THE PHOTOMETER AT NADIR FROM AN AVERAGE SATELLITE ALTITUDE OF 250 KM WAS ABOUT 30 KM. THE EXPERIMENT WAS A SUCCESS, AND USEFUL DATA WERE OBTAINED DURING DAYLIGHT HOURS OVER THE PERIOD OCTOBER 16 TO 24, 1965. IDENTICAL EXPERIMENTS WERE FLOWN ON COSMOS 45 AND 65. A SIMILAR BUT HIGHER RESOLUTION EXPERIMENT WAS LATER FLOWN ON COSMOS 121.

REFERENCES

223.

EXPERIMENT NAME- ULTRAVIOLET SPECTROPHOTOMETER NSSDC ID 65-083A-03

EXPERIMENT PERSONNEL

PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 101665

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 92 ULTRAVIOLET SPECTROPHOTOMETER EXPERIMENT MEASURED SOLAR SHORTWAVE RADIATION REFLECTED AND SCATTERED FROM THE EARTH-ATMOSPHERE SYSTEM. THE INSTRUMENT WAS A DOUBLE DIFFRACTION MONOCHROMATOR OPERATING IN THE 0.225- TO 0.307-MICRON REGION ONLY ON THE DAYSIDE OF THE EARTH. LIGHT ENTERED THE INSTRUMENT THROUGH A QUARTZ WINDOW AND WAS MODULATED AT A FREQUENCY OF 600 HZ BY A SHUTTER SITUATED IMMEDIATELY BEHIND THE WINDOW. THE LIGHT WAS THEN FOCUSED AT AN INLET SLIT BY A CONDENSING LENS AND PROCEEDED ON TO A CONCAVE DIFFRACTION GRID (600 LINES/MM) WITH A FOCAL LENGTH OF 125 MM. THE LIGHT WAS DISPERSED INTO A SPECTRUM (DISPERSION OF 0.67 MICRON/MM) AND FELL ON A MOVABLE OUTLET SLIT THAT SEPARATED A NARROW BAND OF WAVELENGTHS FROM THE SPECTRUM. THE OUTLET SLIT WAS MOVED THROUGH A NUMBER OF STEPS OVER A 1-MIN CYCLE AND WENT FROM THE LONGWAVE POSITION TO THE EXTREME SHORTWAVE POSITION, AFTER WHICH IT RETURNED TO THE ORIGINAL POSITION. AFTER PASSING THROUGH THE OUTLET SLIT, THE DIVERGING BEAM WAS CONVERTED TO A PARALLEL BEAM BY A LENS AND FELL ON A FLAT DIFFRACTION GRID HAVING 2400 LINES/MM. THE LINEAR DISPERSION WAS SUCH THAT, REGARDLESS OF WAVELENGTH, THE LIGHT HIT THE SAME SPOT ON A PHOTOMULTIPLIER PHOTOCATHODE. THE OUTPUT OF THE PHOTOMULTIPLIER WAS FIRST AMPLIFIED BY A PREAMPLIFIER AND THEN WENT TO THE MAIN AMPLIFIER AND DETECTOR. THE RECTIFIED SIGNAL WAS THEN RECORDED ON A 35-MM FILM STRIP IN A MINIATURIZED LOOP OSCILLOGRAPH. THE SPECTRAL RESOLUTION OF THE INSTRUMENT WAS 0.0015 MICRON. THE OPTICAL AXIS OF THE INSTRUMENT WAS DIRECTED AT AN ANGLE OF 7 DEG TO NADIR. ONBOARD CALIBRATION WAS OBTAINED BY VIEWING TWO STANDARD LAMPS WITH UVIOL WINDOWS -- A STANDARD RIBBON FILAMENT INCANDESCENT LAMP AND A HYDROGEN LAMP. THOUSANDS OF SPECTRA WERE OBTAINED ON OCTOBER 16, 1965, AND WERE STORED ON BOARD UNTIL RETURNED TO EARTH IN A SPECIAL REENTRY CONTAINER ON OCTOBER 24, 1965. SIMILAR EXPERIMENTS WERE FLOWN ON COSMOS 45 AND 65.

REFERENCES

223.

SPACECRAFT COMMON NAME- COSMOS 100
ALTERNATE NAMES- KOSMOS 100

NSSDC ID 65-106A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 12/17/65
APOGEE- 658.000 KM ALT
PERIGEE- 630.000 KM ALT
PERIOD- 97.58 MIN
INCLINATION- 65.00 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 12/17/65
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED-

SPACECRAFT PERSONNEL
PM - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION
COSMOS 100 WAS THE EIGHTH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE SIXTH LAUNCHED FROM THE TYURATAM SITE. IT WAS THE THIRD IN A SERIES OF PROTOTYPE SATELLITES THAT LED EVENTUALLY TO THE ORBITING OF RUSSIA'S FIRST ANNOUNCED EXPERIMENTAL WEATHER SATELLITE, COSMOS 122. NO OFFICIAL DESCRIPTION OF THE COSMOS 100 FLIGHT HAS EVER BEEN RELEASED. HOWEVER, THE ORBITAL PARAMETERS AND CONFIGURATION OF THE SATELLITE WERE SO SIMILAR TO THOSE OF COSMOS 122 THAT IT IS GENERALLY ASSUMED THAT COSMOS 100 WAS A PRECURSOR TO THE SATELLITES OF THE EXPERIMENTAL COSMOS 'METEOR' SYSTEM. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO SOLAR PANELS ATTACHED TO THE SIDES. A STEERABLE ANTENNA WAS ALSO MOUNTED ON THE SIDE AND OPERATED AT 90 MHZ. THE PRIMARY OBJECTIVE OF THE FLIGHT PROBABLY WAS TO TEST THE BASIC SPACECRAFT HARDWARE. TESTS WERE PROBABLY ALSO MADE ON IMPROVED TV AND IR CLOUD CAMERAS AND ACTINOMETRIC INSTRUMENTS, WHICH MAY HAVE FAILED TO OPERATE PROPERLY. AS OF JUNE 1972, THE SATELLITE REMAINS IN ORBIT IN A DEACTIVATED MODE. SIMILAR FLIGHTS WERE MADE BY COSMOS 44, 58, AND 118.

REFERENCES
58, 223, 451, 797, AND 830.

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SPACECRAFT COMMON NAME- COSMOS 118
ALTERNATE NAMES- KOSMOS 118

NSSDC ID 66-038A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 05/12/66

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 05/11/66

APOGEE- 657.000 KM ALT
PERIGEE- 587.000 KM ALT
PERIOD- 97.13 MIN
INCLINATION- 65.00 DEG

OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED-

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 118 WAS THE NINTH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE SEVENTH LAUNCHED FROM THE TYURATAM SITE. IT WAS THE FOURTH IN A SERIES OF PROTOTYPE SATELLITES THAT LED EVENTUALLY TO THE ORBITING OF RUSSIA'S FIRST ANNOUNCED EXPERIMENTAL WEATHER SATELLITE, COSMOS 122. NO OFFICIAL DESCRIPTION OF THE COSMOS 118 FLIGHT HAS EVER BEEN RELEASED. HOWEVER, THE ORBITAL PARAMETERS AND CONFIGURATION OF THE SATELLITE WERE SO SIMILAR TO THOSE OF COSMOS 122 THAT IT IS GENERALLY ASSUMED THAT COSMOS 118 WAS A PRECURSOR TO THE SATELLITES OF THE EXPERIMENTAL COSMOS 'METEOR' SYSTEM. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO SOLAR PANELS ATTACHED TO THE SIDES. A STEERABLE ANTENNA, ALSO MOUNTED ON THE SIDE, TRANSMITTED AT 90 MHZ. THE PRIMARY OBJECTIVE OF THE FLIGHT PROBABLY WAS TO TEST THE BASIC SPACECRAFT HARDWARE. TESTS WERE PROBABLY ALSO MADE ON IMPROVED TV AND IR CLOUD CAMERAS AND ACTINOMETRIC INSTRUMENTS, WHICH MAY HAVE FAILED TO OPERATE PROPERLY. AS OF JUNE 1972, THE SATELLITE REMAINS IN ORBIT IN A DEACTIVATED MODE. SIMILAR FLIGHTS WERE MADE BY COSMOS 44, 58, AND 100.

REFERENCES

58, 223, 452, 797, AND 830.

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SPACECRAFT COMMON NAME- COSMOS 121
ALTERNATE NAMES- KOSMOS 121

NSSDC ID 66-054A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 06/17/66
APOGEE- 333.000 KM ALT
PERIGEE- 200.000 KM ALT
PERIOD- 89.86 MIN
INCLINATION- 72.83 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 06/17/66
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 062566

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 121 WAS THE TENTH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE FIRST LAUNCHED FROM THE PLESETSK SITE. ALTHOUGH THE SATELLITE WAS INTENDED PRIMARILY FOR NONSCIENTIFIC RECONNAISSANCE PURPOSES, IT CARRIED SUPPLEMENTAL EQUIPMENT FOR CONDUCTING METEOROLOGICAL STUDIES TO AID IN THE DEVELOPMENT OF INSTRUMENTS FOR OPERATIONAL METEOROLOGICAL SATELLITES. THE

PRIMARY METEOROLOGICAL OBJECTIVE OF THE COSMOS 121 MISSION WAS TO MEASURE THE INTENSITY OF REFLECTED AND SCATTERED RADIATION IN THE 0.6- TO 0.8-MICRON BAND TO DETERMINE THE SPATIAL VARIATION OF THE RADIATION SPECTRUM IN THE MESOSCALE RANGE. THE SPIN-STABILIZED SATELLITE WAS IN THE FORM OF A CYLINDER WITH HEMISPHERICAL ENDS AND WAS 5 M LONG AND 2.44 M IN DIAMETER. THE ANNOUNCED SCIENTIFIC INSTRUMENTATION CONSISTED OF AN EARTHWARD-FACING HIGH-RESOLUTION PHOTOMETER WHOSE OPTICAL AXIS WAS PARALLEL TO THE LOCAL VERTICAL. SPACECRAFT TELEMETRY (19.995 MHZ) WAS HANDLED VIA ANTENNAS MOUNTED ON THE ENDS OF THE SATELLITE BODY. THE MISSION WAS A SUCCESS. AFTER NEARLY 8 DAYS IN ORBIT, THE SATELLITE REENTERED THE ATMOSPHERE ON JUNE 25, 1966, AND THE SATELLITE INSTRUMENTATION PACKAGE WAS SUCCESSFULLY RECOVERED.

REFERENCES

58, 249, 357, 717, 797, AND 830.

EXPERIMENT NAME- HIGH-RESOLUTION PHOTOMETER NSSDC ID 66-054A-01

EXPERIMENT PERSONNEL

PI - V.G.	BOLDYREV	GUGMS	MOSCOW, USSR
CI - V.I.	TULUPOV	MOSCOW STATE U	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 062566

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 121 HIGH-RESOLUTION PHOTOMETER EXPERIMENT MEASURED THE INTENSITY OF SOLAR RADIATION REFLECTED AND SCATTERED FROM THE EARTH'S SURFACE AND CLOUDS IN THE 0.6- TO 0.8-MICRON BAND AND DETERMINED THE NATURE OF THE SPATIAL FLUCTUATION OF THE RADIATION SPECTRUM IN THE MESOSCALE RANGE. THE INSTRUMENTATION CONSISTED OF A PHOTOELECTRIC PHOTOMETER WITH A 1-DEG FIELD OF VIEW WHOSE OPTICAL AXIS WAS PARALLEL TO THE LOCAL VERTICAL. THE RADIATION PASSED INTO THE INSTRUMENT THROUGH A THREE-LENS OBJECTIVE (WITH A 41-MM FOCAL LENGTH AND A 1 TO 2 APERTURE RATIO), THEN PASSED THROUGH A SHORTWAVE CUTOFF FILTER, AND WAS FINALLY FOCUSED ONTO A LIGHT-SENSITIVE CADMIUM SELENIDE PHOTORESISTOR WINDOW. THE INTENSITY DATA WERE TRANSFERRED ONTO PHOTOGRAPHIC FILM USING A RECORDING DEVICE ON BOARD AND WERE STORED UNTIL THE SATELLITE WAS RECOVERED. THE LONGWAVE CUTOFF OF THE INSTRUMENT'S OPERATING RANGE (0.8 MICRON) WAS DETERMINED BY THE RECEIVER'S SPECTRAL SENSITIVITY, WHILE THE SHORTWAVE CUTOFF (0.6 MICRON) WAS FORMED BY THE LIGHT FILTER. THE PEAK OF THE PHOTOMETER SENSITIVITY WAS IN THE VICINITY OF 0.67 MICRON. INSTRUMENT CALIBRATION WAS ACCOMPLISHED BY PERIODICALLY VIEWING SOLAR RADIATION REFLECTED FROM A MAGNESIUM OXIDE COATED SCREEN. THE INSTRUMENT WAS IN CONTINUOUS OPERATION ON THE EARTH'S SUNLIT SIDE FOR SEVERAL DAYS. THE GROUND RESOLUTION OF THE PHOTOMETER WAS 4 TO 6 KM AT NADIR, WHICH WAS SUFFICIENT TO STUDY THE STRUCTURE OF INDIVIDUAL CLOUD AND GEOGRAPHIC FORMATIONS. THE RESULTS OF THE DATA ANALYSIS INDICATED THE ABSENCE OF PRONOUNCED, ORDERED FLUCTUATIONS IN THE REFLECTED AND SCATTERED MESOSCALE RADIATION FIELDS. THE EXPERIMENT WAS A SUCCESS AND WAS TERMINATED WHEN THE SATELLITE REENTERED THE EARTH'S ATMOSPHERE ON JUNE 25, 1966.

REFERENCES

357.

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SPACECRAFT COMMON NAME- COSMOS 122 NSSDC ID 66-057A
ALTERNATE NAMES- KOSMOS 122

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 06/25/66
APOGEE- 690.000 KM ALT
PERIGEE- 550.000 KM ALT
PERIOD- 97.12 MIN
INCLINATION- 65.14 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 06/25/66
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 102666

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 122 WAS THE FIRST ANNOUNCED RUSSIAN METEOROLOGICAL SATELLITE AND THE LAST IN A SERIES OF PROTOTYPE METEOROLOGICAL SATELLITES THAT INCLUDED COSMOS 44, 58, 100, AND 118. IT WAS THE LAST METEOROLOGICAL SATELLITE LAUNCHED FROM THE TYURATAM SITE WITH AN A-1 LAUNCH VEHICLE AT A 65-DEG ORBITAL INCLINATION, AND IT PROVIDED A TRANSITION FROM THE PROTOTYPE SERIES TO THE COSMOS 'METEOR' EXPERIMENTAL WEATHER SATELLITE SYSTEM. COSMOS 122 WAS ORBITED TO TEST METEOROLOGICAL INSTRUMENTATION DESIGNED FOR OBTAINING IMAGES OF CLOUD COVER, SNOW COVER, AND ICE FIELDS ON THE DAY AND NIGHT SIDES OF THE EARTH AND FOR MEASURING FLUXES OF OUTGOING RADIATION REFLECTED AND RADIATED BY THE EARTH-ATMOSPHERE SYSTEM. THE INSTRUMENTATION CONSISTED OF (1) TWO VIDICON CAMERAS FOR DAYTIME CLOUDCOVER PICTURES, (2) A HIGH-RESOLUTION SCANNING IR RADIOMETER FOR NIGHTTIME AND DAYTIME IMAGING OF THE EARTH AND CLOUDS, AND (3) AN ARRAY OF NARROW- AND WIDE-ANGLE RADIOMETERS COVERING THE 0.3- TO 3-, 8- TO 12-, AND 3- TO 30-MICRON CHANNELS FOR MEASURING THE INTENSITY OF RADIATION REFLECTED FROM THE CLOUDS AND OCEANS, THE SURFACE TEMPERATURES OF THE EARTH AND CLOUD TOPS, AND THE TOTAL FLUX OF THERMAL ENERGY FROM THE EARTH-ATMOSPHERE SYSTEM INTO SPACE, RESPECTIVELY. THE SATELLITE WAS IN THE FORM OF A LARGE CYLINDRICAL CAPSULE, 5 M LONG AND 1.5 M IN DIAMETER. TWO LARGE SOLAR CELL PANELS OF THREE SEGMENTS EACH WERE DEPLOYED FROM OPPOSITE SIDES OF THE CYLINDER AFTER SATELLITE SEPARATION FROM THE LAUNCH VEHICLE. THE SOLAR PANELS WERE ROTATED TO CONSTANTLY FACE THE SUN DURING SATELLITE DAYTIME BY MEANS OF A SUN SENSOR CONTROLLED DRIVE MECHANISM FITTED IN THE TOP END OF THE CENTER BODY. THE METEOROLOGICAL INSTRUMENTS WERE HOUSED IN A HERMETICALLY SEALED COMPARTMENT LOCATED IN THE LOWER PART OF THE CAPSULE, WHILE THE BASIC SATELLITE SERVICING SYSTEMS WERE CONTAINED IN A SPECIAL HERMETICALLY SEALED COMPARTMENT IN THE UPPER PART OF THE CAPSULE. DATA WERE TRANSMITTED TO EARTH AT A FREQUENCY OF 90 MHZ BY MEANS OF A STEERABLE HIGH-GAIN PARABOLIC ANTENNA THAT WAS ATTACHED TO THE CENTER SECTION OF THE SATELLITE BODY BY A LONG ARM. THE SATELLITE WAS TRIAXIALLY STABILIZED BY A SERIES OF INERTIAL FLYWHEELS, DRIVEN BY ELECTRIC MOTORS, WHOSE KINETIC ENERGY WAS DAMPENED BY TORQUES PRODUCED BY ELECTROMAGNETS INTERACTING WITH THE EARTH'S MAGNETIC FIELD. COSMOS 122 WAS ORIENTED BY EARTH SENSORS WITH ONE OF ITS AXES DIRECTED EARTHWARD ALONG THE LOCAL VERTICAL, A SECOND ORIENTED ALONG THE ORBITAL VELOCITY VECTOR, AND A THIRD ORIENTED PERPENDICULAR TO THE ORBITAL PLANE. THIS ORIENTATION ENSURED THAT THE OPTICAL AXES OF THE INSTRUMENTS WERE CONSTANTLY DIRECTED EARTHWARD. COSMOS 122 CEASED OPERATIONS IN LATE OCTOBER 1966.

REFERENCES
223, 225, 308, 353, 359, 452, 453, 480, 571, 700, 718, 804, 830, 856, AND 876.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 66-057A-01

EXPERIMENT PERSONNEL
PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 102666

EXPERIMENT BRIEF DESCRIPTION
THE COSMOS 122 DUAL VIDICON CAMERA EXPERIMENT WAS DESIGNED TO TEST THE CAPABILITY OF RUSSIAN WEATHER SATELLITES TO PROVIDE DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND GLOBAL WEATHER SYSTEMS FOR USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF TWO GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. THE COSMOS 122 CAMERAS, ALTHOUGH HAVING 2.5 TIMES THE RESOLUTION OF THOSE CARRIED ON THE ESSA SATELLITES, COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE COSMOS 122 SATELLITE (620 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED SOME OF THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM SEPTEMBER 11, 1966, THROUGH OCTOBER 26, 1966. THESE PICTURES WERE ARCHIVED AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED. THE EXPERIMENT TERMINATED OPERATIONS IN OCTOBER 1966.

REFERENCES
308, 309, 350, 359, 378, 567, 678, 700, 783, 812, 868, AND 876.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 66-057A-02

EXPERIMENT PERSONNEL
PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 102666

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 122 HIGH-RESOLUTION SCANNING IR RADIOMETER WAS DESIGNED TO MAKE MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED CONSTRUCTION OF BRIGHTNESS PATTERNS OF THE THERMAL RELIEF AND DETERMINATION OF EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR THAT FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 2 TO 3 DEG FOR TEMPERATURES ABOVE 273 DEG K AND WITHIN 7 TO 8 DEG FOR TEMPERATURES BELOW 273 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIOTELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH, DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTER AT THE SOVIET HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE

TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM MID-SEPTEMBER UNTIL LATE OCTOBER 1966. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED. THE EXPERIMENT TERMINATED OPERATIONS IN OCTOBER 1966.

REFERENCES

308, 345, 359, 378, 410, 416, 472, 546, 567, 580, 641, 874, 875, AND 876.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT   NSSDC ID 66-057A-03

EXPERIMENT PERSONNEL

PI - UNKNOWN   SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 102666

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 122 ACTINOMETRIC EXPERIMENT WAS DESIGNED TO MEASURE (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS). THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW (FOV)) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FOV) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO-TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO-TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED

SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETERS BY THE INPUT OF A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD HAVE BEEN ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE COSMOS 122 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWNWARD TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED IN BINARY FORM TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM MID-AUGUST 1966 UNTIL LATE OCTOBER 1966. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA. THE EXPERIMENT TERMINATED OPERATIONS IN OCTOBER 1966.

REFERENCES

13, 308, 345, 351, 359, 378, 584, 706, 804, 858, AND 876.

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SPACECRAFT COMMON NAME- COSMOS 144 NSSDC ID 67-018A
ALTERNATE NAMES- KOSMOS 144

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 02/28/67
- APOGEE- 644.000 KM ALT
- PERIGEE- 574.000 KM ALT
- PERIOD- 96.88 MIN
- INCLINATION- 81.25 DEG

OTHER INFORMATION
- SPACECRAFT WT- UNKNOWN KG
- LAUNCH DATE- 02/28/67
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE DATA RECORDED- 030068

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 144 WAS THE SECOND ANNOUNCED RUSSIAN METEOROLOGICAL SATELLITE AND THE FIRST INTERIM OPERATIONAL WEATHER SATELLITE IN THE EXPERIMENTAL COSMOS 'METEOR' SYSTEM. IT WAS ALSO THE FIRST LAUNCH OF A SEMI-OPERATIONAL WEATHER SATELLITE FROM THE PLESETSK SITE INTO A NEAR-POLAR, NEAR-CIRCULAR ORBIT. UNLIKE U.S. WEATHER SATELLITES, HOWEVER, THE ORBIT WAS PROGRADE (NOT SUN-SYNCHRONOUS) BECAUSE, AS A RESULT OF GEOGRAPHIC LIMITATIONS, A RETROGRADE ORBIT WAS NOT POSSIBLE. COSMOS 144 WAS ORBITED TO TEST, IN A SEMI-OPERATIONAL MODE, METEOROLOGICAL INSTRUMENTS DESIGNED FOR OBTAINING

IMAGES OF CLOUD COVER, SNOW COVER, AND ICE FIELDS ON THE DAY AND NIGHT SIDES OF THE EARTH AND FOR MEASURING FLUXES OF OUTGOING RADIATION REFLECTED AND RADIATED BY THE EARTH-ATMOSPHERE SYSTEM. THIS INSTRUMENTATION CONSISTED OF (1) TWO VIDICON CAMERAS FOR DAYTIME CLOUDCOVER PICTURES, (2) A HIGH-RESOLUTION SCANNING IR RADIOMETER FOR NIGHTTIME AND DAYTIME IMAGING OF THE EARTH AND CLOUDS, AND (3) AN ARRAY OF NARROW- AND WIDE-ANGLE RADIOMETERS COVERING THE 0.3- TO 3-, 8- TO 12-, AND 3- TO 30-MICRON CHANNELS FOR MEASURING THE INTENSITY OF RADIATION REFLECTED FROM THE CLOUDS AND OCEANS, THE SURFACE TEMPERATURES OF THE EARTH AND CLOUD TOPS, AND THE TOTAL FLUX OF THERMAL ENERGY FROM THE EARTH-ATMOSPHERE SYSTEM INTO SPACE, RESPECTIVELY. THE SATELLITE WAS IN THE FORM OF A LARGE CYLINDRICAL CAPSULE, 5 M LONG AND 1.5 M IN DIAMETER. TWO LARGE SOLAR CELL PANELS OF FOUR SEGMENTS EACH WERE DEPLOYED FROM OPPOSITE SIDES OF THE CYLINDER AFTER SATELLITE SEPARATION FROM THE LAUNCH VEHICLE. THE SOLAR PANELS WERE ROTATED TO CONSTANTLY FACE THE SUN DURING SATELLITE DAYTIME BY MEANS OF A SUN SENSOR-CONTROLLED DRIVE MECHANISM FITTED IN THE TOP END OF THE CENTER BODY. THE METEOROLOGICAL INSTRUMENTS, A MAGNETOMETER, 465-MHZ RADIO ANTENNAS, AND ORBITAL CONTROL DEVICES WERE HOUSED IN A COMPLEX, SMALLER, HERMETICALLY SEALED CYLINDER LOCATED ON THE EARTHWARD-FACING END OF THE CYLINDRICAL SATELLITE BODY. THE SATELLITE WAS TRIAXIALLY STABILIZED BY A SERIES OF INERTIAL FLYWHEELS, DRIVEN BY ELECTRIC MOTORS, WHOSE KINETIC ENERGY WAS DAMPENED BY TORQUES PRODUCED BY ELECTROMAGNETS INTERACTING WITH THE EARTH'S MAGNETIC FIELD. COSMOS 144 WAS ORIENTED BY EARTH SENSORS WITH ONE OF ITS AXES DIRECTED EARTHWARD ALONG THE LOCAL VERTICAL, A SECOND ORIENTED ALONG THE ORBITAL VELOCITY VECTOR, AND A THIRD ORIENTED PERPENDICULAR TO THE ORBITAL PLANE. THIS ORIENTATION ENSURED THAT THE OPTICAL AXES OF THE INSTRUMENTS WERE CONSTANTLY DIRECTED EARTHWARD. WHEN TWO OF THE COSMOS 'METEOR' SYSTEM SATELLITES WERE IN OPERATION AT THE SAME TIME IN NEAR-POLAR ORBITS AND WITH SUITABLE DIFFERENCES IN THE LONGITUDES OF THE ASCENDING NODES, DATA COULD BE RECEIVED FROM ONE-HALF THE EARTH'S SURFACE IN A 24-HR PERIOD. IT IS BELIEVED THAT THE SATELLITE OPERATIONS ENDED IN MARCH 1968, AS INDICATED BY THE TERMINATION OF DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW.

REFERENCES

225, 267, 308, 349, 353, 355, 359, 452, 453, 575, 700, 718, 772, 830, 856, AND 876.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 67-018A-01

EXPERIMENT PERSONNEL

PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 031668

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 144 DUAL VIDICON CAMERA EXPERIMENT WAS DESIGNED TO TEST THE CAPABILITY OF RUSSIAN WEATHER SATELLITES TO PROVIDE DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND GLOBAL WEATHER SYSTEMS FOR USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH

SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH EITHER OF THE TWO GROUND STATIONS IN MOSCOW OR NOVOSIBIRSK OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. THE COSMOS 144 CAMERAS, ALTHOUGH HAVING 2.5 TIMES THE RESOLUTION OF THOSE CARRIED ON THE ESSA SATELLITES, COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE COSMOS 144 SATELLITE (605 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED SOME OF THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES FROM COSMOS 144 WERE TRANSMITTED TO NESS FROM MARCH 2, 1967, THROUGH OCTOBER 25, 1967, INTERSPERSED WITH SOME FROM COSMOS 156. TRANSMISSION WAS RENEWED ON DECEMBER 23, 1967, AND CONTINUED UNTIL MARCH 16, 1968, WHEN IT IS BELIEVED THAT EXPERIMENT OPERATIONS WERE TERMINATED. THESE PICTURES WERE ARCHIVED AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

286, 308, 309, 359, 417, 567, 575, 678, 700, 724, 866, AND 876.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 67-018A-02

EXPERIMENT PERSONNEL

PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 031668

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 144 HIGH-RESOLUTION SCANNING IR RADIOMETER WAS DESIGNED TO MAKE MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED CONSTRUCTION OF BRIGHTNESS PATTERNS OF THE THERMAL RELIEF AND DETERMINATION OF EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE

SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR THAT FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH. WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 2 TO 3 DEG FOR TEMPERATURES ABOVE 273 DEG K AND WITHIN 7 TO 8 DEG FOR TEMPERATURES BELOW 273 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO-TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH, DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTER AT THE SOVIET HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM EARLY MARCH 1967 UNTIL MID-MARCH 1968, WHEN IT IS BELIEVED THAT EXPERIMENT OPERATIONS ENDED. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

228, 308, 359, 374, 416, 417, 472, 567, 575, 580, 874, AND 875.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 67-018A-03

EXPERIMENT PERSONNEL

PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 031668

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 144 ACTINOMETRIC EXPERIMENT WAS DESIGNED TO MEASURE (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE

SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS). THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW (FOV)) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FOV) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO-TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO-TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY THE INPUT OF A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD HAVE BEEN ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE COSMOS 144 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWNWARD TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED IN BINARY FORM TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM EARLY MARCH 1967 TO LATE OCTOBER 1967 AND LATE FEBRUARY 1968 TO MID-MARCH 1968, WHEN IT IS BELIEVED THAT EXPERIMENT OPERATIONS TERMINATED. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CARLONIA.

REFERENCES

228, 308, 347, 351, 358, 359, 374, 418, 575, 578, 858, AND 876.

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SPACECRAFT COMMON NAME- COSMOS 149 NSSDC ID 67-024A
ALTERNATE NAMES- KOSMOS 149

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 03/23/67
APOGEE- 285.000 KM ALT
PERIGEE- 245.000 KM ALT
PERIOD- 89.76 MIN
INCLINATION- 48.40 DEG

OTHER INFORMATION
SPACECRAFT WT- 300. KG
LAUNCH DATE- 03/21/67
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 040767

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 149 WAS THE THIRTEENTH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE, THE THIRD ANNOUNCED METEOROLOGICAL SATELLITE, AND THE THIRD LAUNCHED FROM THE KAPUSTIN YAR SITE. THE SATELLITE, WHICH WAS BASICALLY AN ORBITING OPTICAL STATION, WAS EQUIPPED WITH (1) TWO MEDIUM-RESOLUTION, NARROW-ANGLE, THREE-CHANNEL SCANNING TELEPHOTOMETERS OPERATING IN THE VISIBLE SPECTRAL REGION TO DETERMINE THE STATISTICAL VALUES OF CLOUD FIELDS AND SURFACE FORMATIONS, CLOUDTOP HEIGHTS, AND ATMOSPHERIC WATER VAPOR CONTENT, (2) A HIGH-RESOLUTION, NARROW-ANGLE, IR RADIOMETER OPERATING IN THE 8- TO 12-MICRON WINDOW TO DETERMINE SURFACE AND CLOUDTOP TEMPERATURES, (3) A PAIR OF THREE-CHANNEL, WIDE-ANGLE RADIOMETERS TO DETERMINE THE RADIATIVE BALANCE OF THE EARTH-ATMOSPHERE SYSTEM, AND (4) A TELEVISION CAMERA SYSTEM TO PROVIDE CLOUDCOVER PICTURES FOR CORRELATION WITH THE RADIATION DATA. THE SATELLITE WAS IN THE FORM OF A DOMED CYLINDER WITH AN ANNULAR BASE AND WAS 6.5 M LONG AND 1.2 M IN DIAMETER. MOUNTED IN THE TOP OF THE DOMED NOSE SECTION OF THE SPACECRAFT WAS ONE OF THE TELEPHOTOMETERS, WHICH SCANNED IN A PLANE PERPENDICULAR TO THE FLIGHT PATH. THE OTHER TELEPHOTOMETER WAS MOUNTED ON THE LEFT SIDE OF THE CYLINDRICAL CENTER SECTION AND SCANNED ALONG THE FLIGHT PATH. THE TELEVISION SYSTEM WAS HOUSED IN THE SIDE OF THE DOMED NOSE SECTION AND ITS OPTICAL AXIS WAS DIRECTED PARALLEL TO NADIR. THE RADIATION BALANCE SENSOR UNITS WERE ATTACHED TO BOOMS THAT TELESCOPED OUT FROM THE LOWER AND UPPER SIDES OF THE SATELLITE BASE. THE LOWER SENSOR UNIT FACED NADIR, AND THE UPPER ONE VIEWED IN THE ZENITH DIRECTION. ALSO ATTACHED TO THE BASE, BY MEANS OF FOUR LONG BARS, WAS AN ANNULAR DYNAMIC AIR STABILIZER. THIS WAS THE FIRST TIME SUCH AN AEROGYROSCOPIC SYSTEM HAD BEEN EMPLOYED FOR SATELLITE STABILIZATION, AND IT WAS CAPABLE OF PROVIDING AN ORIENTATION IN SPACE WITH AN ERROR LESS THAN 5 DEG RELATIVE TO THE THREE COORDINATE AXES. THE SATELLITE'S ORIENTATION WAS ALSO REGULATED WITH RATHER HIGH ACCURACY FROM THE MEASUREMENTS MADE BY THE SCIENTIFIC INSTRUMENTS THEMSELVES. THE ORIENTATION AND STABILIZATION SYSTEMS MADE IT POSSIBLE TO RELATE DATA TO GEOGRAPHICAL LOCATION WITH AN ACCURACY OF 10 TO 15 KM AT NADIR. ALL THE INSTRUMENTS OPERATED IN EITHER OF TWO MODES -- (1) THE 'CONTINUOUS CYCLE MODE' OR (2) THE 'DATA STORING MODE.' THE SATELLITE INSTRUMENTATION INCLUDED A PROGRAMMING AND TIMING DEVICE FOR CONTROLLING THE VARIOUS UNITS AND THE

TELEMETRY SYSTEM IN BOTH THE DATA STORAGE MODE AND THE CONTINUOUS CYCLE MODE. THE SATELLITE TRANSMITTED DATA AT 90 MHZ VIA AN ANTENNA MOUNTED ON THE UPPER SIDE OF THE SATELLITE BASE. THE TEMPERATURES OF THE VARIOUS INSTRUMENTS WERE MONITORED BY RESISTANCE THERMOMETERS, AND THE DATA WERE USED TO REGULATE THE TEMPERATURE AND TO ADJUST THE RESULTS OF THE BASIC MEASUREMENTS. IN GENERAL, THE EQUIPMENT WORKED AS PLANNED. HOWEVER, PROBLEMS WITH THE STABILIZATION SYSTEM DEVELOPED DURING THE EARLY PART OF THE FLIGHT. THIS RESULTED IN SATELLITE ROLL ABOUT THE LONGITUDINAL AXIS AND, CONSEQUENTLY, THE AMOUNT OF DATA ACQUIRED WAS RELATIVELY LIMITED. COSMOS 149 REENTERED THE EARTH'S ATMOSPHERE ON APRIL 7, 1967, AFTER 17 DAYS IN ORBIT.

REFERENCES

223, 355, 449, 452, 470, 759, AND 805.

EXPERIMENT NAME- THREE-CHANNEL NARROW-ANGLE TELEPHOTOMETERS   NSSDC ID 67-024A-01

EXPERIMENT PERSONNEL

PI - M.S.	MALKEVICH	SAS-IPA	MOSCOW, U.S.S.R.
OI - V.I.	SYACHINOV	SAS-IPA	MOSCOW, U.S.S.R.
OI - L.G.	ISTOMINA	SAS-IPA	MOSCOW, U.S.S.R.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 040767

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 149 THREE-CHANNEL, NARROW-ANGLE TELEPHOTOMETER EXPERIMENT WAS DESIGNED PRIMARILY TO MEASURE QUANTITATIVELY THE ANGULAR, SPATIAL, AND SPECTRAL PARAMETERS OF THE STRUCTURE OF CLOUD FIELDS, AEROSOLS, AND THE UNDERLYING SURFACE THAT DETERMINE THE RADIATION FIELD OF THE EARTH. SECONDARY GOALS WERE TO MEASURE REFLECTED SOLAR RADIATION IN VARIOUS SECTIONS OF THE SPECTRUM IN ORDER TO DETERMINE CLOUDTOP HEIGHTS AND TO TEST THE FEASIBILITY OF DETERMINING THE MASS OF ATMOSPHERIC WATER VAPOR FROM MEASUREMENTS IN THE 0.72-MICRON WATER VAPOR ABSORPTION BAND. THE INSTRUMENTATION CONSISTED OF TWO THREE-CHANNEL, MEDIUM-RESOLUTION TELEPHOTOMETERS THAT SCANNED IN TWO MUTUALLY ORTHOGONAL PLANES AND PRODUCED TWO PHOTOMETRIC PROFILES OF THE EARTH'S BRIGHTNESS FIELD IN NARROW INTERVALS OF THE VISIBLE SPECTRAL REGION. THEY BOTH OPERATED IN THE INTENSITY RANGE OF 0.5 TO 70 MW/SQ CM-STER-MICRON, AND EACH HAD A 3-DEG FIELD OF VIEW. THE FIRST TELEPHOTOMETER (TF-3A) WAS MOUNTED ON TOP OF THE NOSE SECTION OF THE SATELLITE AND SCANNED PERPENDICULAR TO THE FLIGHT TRAJECTORY. IT MEASURED THE INTENSITY OF REFLECTED SOLAR RADIATION IN NARROW BANDS CENTERED AT 0.34, 0.47, AND 0.74 MICRON. THE SECOND TELEPHOTOMETER (TF-3B) WAS MOUNTED ON THE LEFT SIDE OF THE CYLINDRICAL CENTER SECTION AND SCANNED ALONG THE FLIGHT TRAJECTORY. IT MEASURED THE INTENSITY OF REFLECTED SOLAR RADIATION IN THE ABSORPTION BANDS OF WATER VAPOR (0.76 MICRON) AND MOLECULAR OXYGEN (0.75 MICRON) AND IN THE COMPARISON BAND OF 0.74 MICRON. RADIATION FIRST ENTERED THE TELEPHOTOMETER THROUGH A SYNTHETIC QUARTZ PROTECTIVE CAP, WAS REFLECTED FROM A PLANE SCANNING MIRROR THAT SCANNED IN A CIRCULAR MOTION, AND PASSED THROUGH A PROTECTIVE TUBULAR DIAPHRAGM CONSISTING OF 1400 BLACKENED TUBES 50 MM LONG AND WITH A 6-MM INNER DIAMETER. THE RADIATION THEN PASSED THROUGH ONE OF THREE INTERFERENCE FILTERS ON TO ONE OF FOUR OPENINGS IN A ROTATING PROGRAMMING DISC. THE PROGRAMMING DISC PERFORMED FOUR SUCCESSIVE OPERATIONS DURING THE MEASUREMENT CYCLE -- (1) IT ALLOWED EACH CHANNEL TO RECORD ITS OWN ZERO LEVEL, (2) IT OPENED THE APERTURE FOR LOW LIGHT FLUX MEASUREMENTS FROM EARTH, SPACE, SUN, AND SATELLITE STABILIZER, (3) IT ALLOWED THE VIEWING OF A BRIGHTNESS STANDARD FOR SENSITIVITY CALIBRATION, AND (4) IT INSERTED A

NEUTRAL ATTENUATION FILTER FOR CCMPARISCN MEASUREMENTS OF THE RADIATION FLUXES. THE RADIATION FLUXES THAT WERE PASSED THROUGH THE PROGRAMMING DISC APERTURE FELL ON ONE OF THREE PHCTCMULTIPLIERS, WHCSE CUTPUTS WERE AMPLIFIED AND WENT EITHER TO THE TELEMETRY SYSTEM FOR DIRECT TRANSMISSION OR TO A RECORDING DEVICE. EACH CYCLE OF MEASUREMENT BEGAN WITH THE SCANNING MIRROR POSITIONED SUCH THAT THE OPTICAL AXES OF THE THREE CHANNELS DEVIATED FROM THE ZENITH BY 15 DEG. THE CYCLE CCNSISTED OF TWO FULL REVOLUTIONS OF THE SCANNING MIRROR AND LASTED 3.6 SEC. COMPLETE CYCLES WERE REPEATED CONTINUOUSLY WHEN THE EXPERIMENT WAS IN THE DIRECT TRANSMISSION MODE, WHILE IN THE MEMORY MODE THE CYCLES WERE SEPARATED BY 3-MIN INTERVALS. EACH CYCLE PROVIDED 100 INDIVIDUAL MEASUREMENTS OF RADIATION AT MAXIMUM SENSITIVITY AND 100 COMPARISON MEASUREMENTS MADE WITH THE NEUTRAL ATTENUATING FILTER. AFTER THE FIRST FEW CYCLES ON THE FIRST ORBIT, THE ABSOLUTE SENSITIVITY OF THE TELEPHOTOMETERS FELL OFF AND THEIR ZERO LEVELS BEGAN TO VARY. THE DECLINE IN SENSITIVITY FOR TF-3A WAS CAUSED BY A FLASH OF SUNLIGHT OVERLOADING THE PHOTOMULTIPLIER, PARTICULARLY IN THE 0.74-MICRON CHANNEL. BY THE THIRD ORBIT, THE SENSITIVITIES WERE SO DEGRADED THAT REFERENCE SIGNALS WERE NO LONGER RECORDED AND DATA ON TERRESTRIAL BRIGHTNESS WERE NOT RELIABLE. ALL THREE CHANNELS OF TF-3B, HOWEVER, PRODUCED TERRESTRIAL BRIGHTNESS PROFILES THROUGHOUT THE LIFE OF THE EXPERIMENT, DESPITE CONSIDERABLE VARIATION (UP TO 30 PERCENT) IN THE ABSOLUTE SENSITIVITY. THE ERROR IN THE MEASUREMENT OF ABSOLUTE TERRESTRIAL BRIGHTNESS FOR THESE CHANNELS PLUS THE 0.34- AND 0.74-MICRON CHANNELS OF TF-3A FOR CHARACTERISTIC INTENSITIES WAS LESS THAN 5 PERCENT AND NO MORE THAN 2 PERCENT FOR WEAK SIGNALS. THE CROSS SECTIONS OF THE SCANNING BANDS AT NADIR FROM AN AVERAGE SATELLITE ALTITUDE OF 265 KM WERE ABOUT 20 KM WIDE AND 30 KM APART. WHEN THE OPTICAL AXIS OF THE INSTRUMENT WAS SHIFTED FROM NADIR THROUGH AN ANGLE OF MORE THAN 30 DEG, THE AREAS OF SUCCESSIVE SCANS OVERLAPPED AND INDEPENDENT INFORMATION WAS OBTAINED. THE GROUND RESOLUTION OF THE TELEPHOTOMETERS WAS 10 TO 15 KM AT NADIR. PROBLEMS WITH THE SATELLITE ORIENTATION AND STABILIZATION SYSTEMS FURTHER LIMITED THE AMOUNT OF USEFUL DATA OBTAINED. A SIMILAR EXPERIMENT WAS FLOWN ON COSMOS 320.

REFERENCES
449, 470, 545, 568, 581, 613, 616, 617, AND 759.

EXPERIMENT NAME- NARROW-ANGLE IR RADIOMETER   NSSDC ID 67-024A-02

EXPERIMENT PERSONNEL

PI - A.K.	GORODETSKIY	SAS-IPA	MOSCOW, USSR
OI - M.S.	MALKEVICH	SAS-IPA	MOSCOW, USSR
OI - E.F.	KLIMCHUK	SAS-IPA	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 040767

EXPERIMENT BRIEF DESCRIPTION
THE COSMOS 149 NARROW-ANGLE IR RADIOMETER EXPERIMENT WAS DESIGNED TO DETERMINE SURFACE AND CLOUDTOP TEMPERATURES BY MEASURING THE OUTGOING RADIATION IN THE 8- TO 12-MICRON WINDOW. THE INSTRUMENTATION CONSISTED OF A HIGH-RESOLUTION, NARROW-ANGLE, NONSCANNING IR RADIOMETER WITH A 2- BY 4-DEG FIELD OF VIEW. THE RADIOMETER WAS MOUNTED WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL WHEN THE SATELLITE ASSUMED ITS NORMAL ORIENTATION. THE RADIOMETER SCANNED THE EARTH OWING TO THE PROGRESSION OF THE SATELLITE ALONG ITS ORBITAL PATH. THE MAIN COMPONENTS OF THE RADIOMETER WERE (1) A PARABOLIC MIRROR WITH A 30-MM FOCAL LENGTH, (2) A CHOPPER, (3) AN INTERFERENCE FILTER, (4) A 1- BY 4-MM BOLOMETER PLATFORM, (5) A THERMISTOR, AND (6) BLINDS. RADIATION FROM EARTH AND SPACE ENTERING THE RADIOMETER WAS

COMBINED BY THE MIRROR, MODULATED BY THE CHOPPER, PASSED THROUGH THE INTERFERENCE FILTER, AND FOCUSED ON THE BOLOMETER. THE SIGNAL WAS AMPLIFIED AND SENT EITHER TO THE TELEMETRY SYSTEM FOR DIRECT TRANSMISSION OR TO A RECORDING DEVICE. A THERMISTOR WAS MOUNTED ON THE RADIOMETER CASING TO DETERMINE THE INSTRUMENT TEMPERATURE, WHICH ALLOWED THE DATA TO BE CORRECTED BASED ON THE TEMPERATURE DEPENDENCE OF THE RADIOMETER SENSITIVITY. BLINDS WITH A SET OF DIAPHRAGMS IN FRONT OF THE LENSES WERE USED TO REDUCE THE EFFECT OF LATERAL EXPOSURE. IN THE CONTINUOUS CYCLE MODE, THE RADIOMETER HAD A 4-SEC CYCLE OBSERVING PERIOD WITH CONTINUOUS REPETITIONS, WHILE IN THE MEMORY MODE THE OBSERVATION INTERVAL WAS 8 SEC WITH A 3-MIN PAUSE. DURING THE LATTER PART OF THE FLIGHT, THE STABILITY OF THE INSTRUMENT ZERO LEVEL WAS TESTED AS THE SATELLITE ROTATED ABOUT ITS LONGITUDINAL AXIS. WHEN THE OPTICAL AXIS OF THE RADIOMETER WAS IN THE PLANE OF THE LOCAL HORIZON, RADIATION FROM SPACE REACHED BOTH INPUTS AND WAS USED AS A ZERO REFERENCE SIGNAL IN MOST OF THE MEASUREMENTS. THE INSTRUMENT ZERO WAS STABLE AND REMAINED AT ITS CALIBRATION VALUE. LABORATORY CALIBRATION INDICATED THAT THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITH AN ERROR OF NO MORE THAN 1 DEG FOR 250 TO 320 DEG K AND 2 TO 3 DEG FOR 200 TO 250 DEG K. THE RATHER HIGH SPATIAL RESOLUTION OF THE RADIOMETER (10 TO 15 KM AT NADIR) MADE IT POSSIBLE TO OBSERVE THE DETAILS OF THE THERMAL STRUCTURE OF THE CLOUD COVER AND TO ESTIMATE THE PROBLEMS INVOLVED IN DETERMINING THE TEMPERATURE OF THE UNDERLYING SURFACE. THIS HIGH ACCURACY ALSO MADE IT POSSIBLE TO DETERMINE THE CONTRIBUTION OF THE AEROSOL COMPONENT TO THE TRANSFORMATION OF THE THERMAL RADIATION EMITTED FROM THE EARTH'S SURFACE AND THE LOWER LAYER OF THE ATMOSPHERE. THE RADIOMETER WORKED AS PLANNED. HOWEVER, AFTER A FEW DAYS IN ORBIT, PROBLEMS WITH THE SATELLITE STABILIZATION CAUSED THE SATELLITE TO ROLL ABOUT ITS LONGITUDINAL AXIS AND LIMITED THE AMOUNT OF USEFUL DATA ACQUIRED.

REFERENCES

449, 468, 469, 470, 563, AND 613.

EXPERIMENT NAME- THREE-CHANNEL WIDE-ANGLE RADIOMETERS　　NSSDC ID 67-024A-03

EXPERIMENT PERSONNEL

PI - G.P.	FARAPANOVA	SAS-IPA	MOSCOW, USSR
OI - B.P.	KOZYREV	SAS-IPA	MOSCOW, USSR
OI - E.F.	KLIMCHUK	SAS-IPA	MOSCOW, USSR
OI - A.I.	PASHKOV	SAS-IPA	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 040767

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 149 THREE-CHANNEL WIDE-ANGLE RADIOMETER EXPERIMENT WAS DESIGNED TO DETERMINE THE GLOBAL DISTRIBUTION OF THE BALANCE BETWEEN INCOMING SOLAR RADIATION AND OUTGOING TERRESTRIAL AND REFLECTED SOLAR RADIATION. THE INSTRUMENTATION CONSISTED OF TWO THREE-CHANNEL WIDE-ANGLE (180 DEG) RADIOMETERS THAT WERE PLACED IN SPECIAL CONTAINERS TO PROVIDE OPTICAL AND THERMAL ISOLATION FROM THE SATELLITE. THEY WERE MOUNTED ON TELESCOPING BOOMS THAT EXTENDED FROM OPPOSITE SIDES OF THE SATELLITE BASE, WITH ONE DIRECTED TOWARD THE ZENITH AND THE OTHER TOWARD NADIR. EACH RADIOMETER CONTAINED THREE RADIATION THERMOCOUPLES, WHICH MEASURED THE TOTAL RADIATION FLUX IN THE SHORTWAVE (0.3 TO 3 MICRONS), NEAR-IR (0.8 TO 3 MICRONS), AND LONGWAVE (3 TO 30 MICRONS) SPECTRAL BANDS. EACH RADIATION THERMOCOUPLE, IN TURN, CONSISTED OF A XENON-FILLED BALLOON THAT WAS COVERED BY A HEMISPHERICAL FILTER, WITH A RADIATION RECEIVING AREA AND THE THERMOPILES MOUNTED BELOW ON A LEAD BASE. THE FILTERS DETERMINED THE

PASSBAND FOR EACH CHANNEL -- A UVIOL-GLASS FILTER FOR THE SHORTWAVE CHANNEL, A NO. 3 IR GLASS FILTER FOR THE NEAR-IR CHANNEL, AND A NO. 5 CRYSTAL FILTER FOR THE LONGWAVE CHANNEL. THE RADIATION RECEIVING AREA WAS DIVIDED INTO TWO SECTIONS -- THE INNER AND OUTER AREAS. THE INNER AREA WAS DISC-SHAPED, WAS COATED WITH BLACK AND WHITE PAINT, AND WAS ATTACHED TO THE HOT THERMOPILE JUNCTIONS. THE OUTER AREA WAS ANNULAR, WAS ALSO COATED WITH BLACK AND WHITE PAINT, BUT WAS ATTACHED TO THE COLD THERMOPILE JUNCTIONS. PLATINUM RESISTANCE THERMOMETERS WERE LOCATED NEAR THE COLD JUNCTIONS AND HEMISPHERICAL FILTERS TO MONITOR THEIR TEMPERATURES. THE EARTH-ORIENTED RADIOMETER MEASURED SOLAR RADIATION IN THE LONGWAVE AND SHORTWAVE CHANNELS AND SPACE RADIATION OR CHANNEL NOISE IN THE NEAR-IR CHANNEL. THE EARTH-ORIENTED UNIT, HOWEVER, DID NOT REMAIN IN THE PLANNED ORIENTATION. INSTEAD, THE OPTICAL AXES OF THE RADIOMETERS WERE DIRECTED AT AN ANGLE TO THE HORIZON AND MEASURED THE SUM OF FLUXES FROM BOTH THE SATELLITE BODY AND THE EARTH. DURING THE INITIAL PHASE OF THE FLIGHT, WHEN THE SATELLITE WAS OPERATED IN AN ORIENTED STATE, THE SOLAR FLUX MEASUREMENTS WERE USED TO ESTIMATE THE EFFICIENCY AND RELIABILITY OF THE DATA FROM THE EARTH-ORIENTED RADIOMETER AND TO DETERMINE THE SATELLITE ORIENTATION WITH RESPECT TO THE SUN. AFTER SATELLITE ROLL HAD DEVELOPED AND THE ORIENTATION SYSTEM WAS DISCONNECTED, HOWEVER, THE ZENITH-ORIENTED RADIOMETER RECEIVED RADIATION FROM ZENITH TO NADIR DURING ONE ROTATION OF THE SATELLITE AND MEASURED THE RELECTED SOLAR, INCIDENT SOLAR, OUTGOING TERRESTRIAL THERMAL, AND SPACE RADIATION. THE SENSITIVITY OF THE SHORTWAVE AND LONGWAVE CHANNELS IN THIS RADIOMETER DECREASED GRADUALLY BY 40 PERCENT DURING THE FIRST 10 DAYS OF THE MISSION. THE RADIOMETER RESOLUTION WAS SUCH THAT AT NADIR THE RADIOMETER AVERAGED THE RADIATION BEING EMITTED FROM A CIRCULAR AREA OF 100 KM RADIUS. IN THE CONTINUOUS CYCLE (DIRECT TRANSMISSION) MODE, DATA WERE OBTAINED OVER A 4-SEC OBSERVING PERIOD WITH CONTINUOUS REPETITIONS, WHILE IN THE MEMORY (DELAYED TRANSMISSION) MODE THE OBSERVING PERIOD WAS 8 SEC LONG WITH A 3-MIN PAUSE. OWING TO THE PROBLEM OF SATELLITE ROTATION, THE VOLUME OF DATA ACQUIRED WAS SMALL BUT WAS CONSIDERED TO BE QUITE RELIABLE. RESULTS INDICATED THAT THE RADIATION BALANCE DURING DAYTIME FOR OPTIMAL SOLAR ELEVATIONS VARIED IN THE RANGE 0.5 TO 0.7 CAL/SQ CM-MIN. A SIMILAR EXPERIMENT WAS FLOWN ON COSMOS 320.

REFERENCES
425, 449, AND 470.

EXPERIMENT NAME- TV CAMERA SYSTEM NSSDC ID 67-024A-04

EXPERIMENT PERSONNEL

PI -	UNKNOWN	SAS-IPA	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 040767

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 149 TV CAMERA SYSTEM PROVIDED CLOUDCOVER AND EARTH PICTURES FOR USE IN ANALYSIS OF THE VARIOUS MEASURED QUANTITIES OF THE RADIATION FIELD OF THE EARTH-ATMOSPHERE SYSTEM OBTAINED BY THE OTHER THREE EXPERIMENTS (I.E., A THREE-CHANNEL TELEPHOTOMETER AND A NARROW-ANGLE AND A WIDE-ANGLE IR RADIOMETER). THE CAMERA, WHICH WAS MOUNTED IN THE LOWER SIDE OF THE DOMED NOSE SECTION, HAD ITS OPTICAL AXIS DIRECTED ALONG NADIR AND PRODUCED TELEVISION PICTURES WITH A 30-DEG FIELD OF VIEW AT NADIR. AT THE SAME TIME, THE CAMERA GAVE A PICTURE OF THE TRANSITION ZONE BETWEEN THE EARTH'S ATMOSPHERE AND SPACE IN FOUR DIRECTIONS. THIS ALLOWED VISUAL CONTROL OF THE SATELLITE'S ORIENTATION. THE SYSTEM WORKED AS PLANNED. HOWEVER, SPACECRAFT STABILIZATION PROBLEMS LIMITED THE AMOUNT OF USEFUL DATA COLLECTED.

REFERENCES
449. AND 470.

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SPACECRAFT COMMON NAME- COSMOS 156 NSSDC ID 67-039A
ALTERNATE NAMES- KOSMOS 156

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/28/67
APOGEE- 635.000 KM ALT
PERIGEE- 593.000 KM ALT
PERIOD- 96.96 MIN
INCLINATION- 81.17 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 04/27/67
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 082667

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 156 WAS THE FOURTH ANNOUNCED RUSSIAN METEOROLOGICAL SATELLITE AND THE SECOND INTERIM OPERATIONAL WEATHER SATELLITE IN THE EXPERIMENTAL 'METEOR' SYSTEM. IT WAS ALSO THE SECOND LAUNCH OF A SEMI-OPERATIONAL WEATHER SATELLITE FROM THE PLESETSK SITE INTO A NEAR-POLAR, NEAR-CIRCULAR ORBIT. UNLIKE THE U.S. WEATHER SATELLITES, HOWEVER, THE ORBIT WAS PROGRADE (NOT SUN-SYNCHRONOUS) BECAUSE, AS A RESULT OF GEOGRAPHIC LIMITATIONS, A RETROGRADE ORBIT WAS NOT POSSIBLE. COSMOS 156 WAS ORBITED TO TEST, IN A SEMI-OPERATIONAL MODE, METEOROLOGICAL INSTRUMENTS DESIGNED FOR OBTAINING IMAGES OF CLOUD COVER, SNOW COVER, AND ICE FIELDS ON THE DAY AND NIGHT SIDES OF THE EARTH AND FOR MEASURING FLUXES OF OUTGOING RADIATION REFLECTED AND RADIATED BY THE EARTH-ATMOSPHERE SYSTEM. THIS INSTRUMENTATION CONSISTED OF (1) TWO VIDICON CAMERAS FOR DAYTIME CLOUDCOVER PICTURES, (2) A HIGH-RESOLUTION SCANNING IR RADIOMETER FOR NIGHTTIME AND DAYTIME IMAGING OF THE EARTH AND CLOUDS, AND (3) AN ARRAY OF NARROW- AND WIDE-ANGLE RADIOMETERS COVERING THE 0.3- TO 3, 8- TO 12-, AND 3- TO 30-MICRON CHANNELS FOR MEASURING THE INTENSITY OF RADIATION REFLECTED FROM THE CLOUDS AND OCEANS, THE SURFACE TEMPERATURES OF THE EARTH AND CLOUD TOPS, AND THE TOTAL FLUX OF THERMAL ENERGY FROM THE EARTH-ATMOSPHERE SYSTEM INTO SPACE, RESPECTIVELY. THE SATELLITE WAS IN THE FORM OF A LARGE CYLINDRICAL CAPSULE, 5 M LONG AND 1.5 M IN DIAMETER. TWO LARGE SOLAR CELL PANELS OF FOUR SEGMENTS EACH WERE DEPLOYED FROM OPPOSITE SIDES OF THE CYLINDER AFTER SATELLITE SEPARATION FROM THE LAUNCH VEHICLE. THE SOLAR PANELS WERE ROTATED TO CONSTANTLY FACE THE SUN DURING SATELLITE DAYTIME BY MEANS OF A SUN SENSOR-CONTROLLED DRIVE MECHANISM FITTED IN THE TOP END OF THE CENTER BODY. THE METEOROLOGICAL INSTRUMENTS, A MAGNETOMETER, 465-MHZ RADIO ANTENNAS, AND ORBITAL CONTROL DEVICES WERE HOUSED IN A HERMETICALLY SEALED CYLINDER LOCATED ON THE EARTHWARD-FACING END OF THE CYLINDRICAL SATELLITE BODY. THE SATELLITE WAS TRIAXIALLY STABILIZED BY A SERIES OF INERTIAL FLYWHEELS, DRIVEN BY ELECTRIC MOTORS, WHOSE KINETIC ENERGY WAS DAMPENED BY TORQUES PRODUCED BY ELECTROMAGNETS INTERACTING WITH THE EARTH'S MAGNETIC FIELD. COSMOS 156 WAS ORIENTED BY EARTH SENSORS WITH ONE OF ITS AXES DIRECTED EARTHWARD ALONG THE LOCAL VERTICAL, A SECOND ORIENTED ALONG THE ORBITAL VELOCITY VECTOR, AND A THIRD ORIENTED PERPENDICULAR TO THE ORBITAL PLANE. THIS ORIENTATION ENSURED THAT THE

OPTICAL AXES OF THE INSTRUMENTS WERE CONSTANTLY DIRECTED VERTICALLY EARTHWARD ALONG NADIR. WHEN TWO OF THE 'METEOR' SYSTEM SATELLITES WERE IN OPERATION AT THE SAME TIME IN NEAR-POLAR ORBITS AND WITH SUITABLE DIFFERENCES IN THE LONGITUDES OF THE ASCENDING NODES, DATA COULD BE RECEIVED FROM ONE-HALF THE EARTH'S SURFACE IN A 24-HR PERIOD. IT IS BELIEVED THAT THE SATELLITE ENDED OPERATIONS IN LATE AUGUST 1967, AS INDICATED BY THE TERMINATION OF DATA TRANSMISSION TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW.

REFERENCES
223, 225, 3C6, 324, 349, 353, 355, 359, 452, 575, 700, 718, 772, 830, 856, AND 876.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 67-039A-01

EXPERIMENT PERSONNEL
PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 082667

EXPERIMENT BRIEF DESCRIPTION
THE COSMOS 156 DUAL VIDICON CAMERA EXPERIMENT WAS DESIGNED TO TEST THE CAPABILITY OF RUSSIAN WEATHER SATELLITES TO PROVIDE DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND GLOBAL WEATHER SYSTEMS FOR USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF TWO GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. THE COSMOS 156 CAMERAS, ALTHOUGH HAVING 2.5 TIMES THE RESOLUTION OF THOSE CARRIED ON THE ESSA SATELLITES, COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE COSMOS 156 SATELLITE (614 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED SOME OF THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. THE EXPERIMENT APPEARED TO HAVE A SHORT USEFUL

LIFE AS PICTURES WERE TRANSMITTED TO NESS FOR ONLY 4 MONTHS -- FROM LATE APRIL TO LATE AUGUST 1967 AT WHICH TIME THE EXPERIMENT IS BELIEVED TO HAVE TERMINATED OPERATIONS. THESE PICTURES WERE ARCHIVED AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

286, 308, 418, 567, 575, 678, 700, AND 876.

EXPERIMENT NAME- SCANNING HRIR   NSSDC ID 67-039A-02

EXPERIMENT PERSONNEL

PI - UNKNOWN   SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 082667

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 156 HIGH-RESOLUTION SCANNING IR RADIOMETER WAS DESIGNED TO MAKE MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED CONSTRUCTION OF BRIGHTNESS PATTERNS OF THE THERMAL RELIEF AND DETERMINATION OF EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR THAT FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT, DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR. LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 2 TO 3 DEG FOR TEMPERATURES ABOVE 273 DEG K AND WITHIN 7 TO 8 DEG FOR TEMPERATURES BELOW 273 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIOTELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH, DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A

GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTER AT THE SOVIET HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM EARLY MAY UNTIL LATE AUGUST 1967, WHEN IT IS BELIEVED THE EXPERIMENT OPERATIONS TERMINATED. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

308, 567, 575, 580, AND 876.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 67-039A-03

EXPERIMENT PERSONNEL

PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 082667

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 156 ACTINOMETRIC EXPERIMENT WAS DESIGNED TO MEASURE (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS). THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW (FOV)) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FOV) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION

ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO-TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO-TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY THE INPUT OF A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD HAVE BEEN ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE COSMOS 156 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWNWARD TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED IN BINARY FORM TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM MAY 1967 UNTIL LATE AUGUST 1967 WHEN IT IS BELIEVED THE EXPERIMENT OPERATIONS TERMINATED. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA.

REFERENCES

308, 351, 575, AND 876.

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SPACECRAFT COMMON NAME- COSMOS 184 NSSDC ID 67-102A

ALTERNATE NAMES- KOSMOS 184

ORBITAL INFORMATION

ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 10/25/67
APOGEE- 638.000 KM ALT
PERIGEE- 600.000 KM ALT
PERIOD- 97.16 MIN
INCLINATION- 81.19 DEG

OTHER INFORMATION

SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 10/24/67
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 052368

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 184 WAS THE FIFTH ANNOUNCED RUSSIAN METEOROLOGICAL SATELLITE AND THE THIRD INTERIM OPERATIONAL WEATHER SATELLITE IN THE EXPERIMENTAL 'METEOR' SYSTEM. IT WAS ALSO THE THIRD LAUNCH OF A SEMI-OPERATIONAL WEATHER SATELLITE FROM THE PLESETSK SITE INTO A NEAR-POLAR, NEAR-CIRCULAR ORBIT. UNLIKE THE U.S. WEATHER SATELLITES, HOWEVER, THE ORBIT WAS PROGRADE (NOT SUN-SYNCHRONOUS) BECAUSE, AS A RESULT OF GEOGRAPHIC LIMITATIONS, A RETROGRADE ORBIT WAS NOT POSSIBLE. COSMOS 184 WAS ORBITED TO TEST, IN A SEMI-OPERATIONAL MODE, METEOROLOGICAL INSTRUMENTS DESIGNED FOR OBTAINING IMAGES OF CLOUD COVER, SNOW COVER, AND ICE FIELDS ON THE DAY AND NIGHT SIDES OF THE EARTH AND FOR MEASURING FLUXES OF OUTGOING RADIATION REFLECTED AND RADIATED BY THE EARTH-ATMOSPHERE SYSTEM. THIS INSTRUMENTATION CONSISTED OF (1) TWO VIDICON CAMERAS FOR DAYTIME CLOUDCOVER PICTURES, (2) A HIGH-RESOLUTION SCANNING IR RADIOMETER FOR NIGHTTIME AND DAYTIME IMAGING OF THE EARTH AND CLOUDS, AND (3) AN ARRAY OF NARROW- AND WIDE-ANGLE RADIOMETERS COVERING THE 0.3- TO 3-, 8- TO 12-, AND 3- TO 30-MICRON CHANNELS FOR MEASURING THE INTENSITY OF RADIATION REFLECTED FROM THE CLOUDS AND OCEANS, THE SURFACE TEMPERATURES OF THE EARTH AND CLOUD TOPS, AND THE TOTAL FLUX OF THERMAL ENERGY FROM THE EARTH-ATMOSPHERE SYSTEM INTO SPACE, RESPECTIVELY. THE SATELLITE WAS IN THE FORM OF A LARGE CYLINDRICAL CAPSULE, 5 M LONG AND 1.5 M IN DIAMETER. TWO LARGE SOLAR CELL PANELS OF FOUR SEGMENTS EACH WERE DEPLOYED FROM OPPOSITE SIDES OF THE CYLINDER AFTER SATELLITE SEPARATION FROM THE LAUNCH VEHICLE. THE SOLAR PANELS WERE ROTATED TO CONSTANTLY FACE THE SUN DURING SATELLITE DAYTIME BY MEANS OF A SUN SENSOR-CONTROLLED DRIVE MECHANISM FITTED IN THE TOP END OF THE CENTER BODY. THE METEOROLOGICAL INSTRUMENTS, A MAGNETOMETER, 465-MHZ RADIO ANTENNAS, AND ORBITAL CONTROL DEVICES WERE HOUSED IN A HERMETICALLY SEALED CYLINDER LOCATED ON THE EARTHWARD-FACING END OF THE CYLINDRICAL SATELLITE BODY. THE SATELLITE WAS TRIAXIALLY STABILIZED BY A SERIES OF INERTIAL FLYWHEELS, DRIVEN BY ELECTRIC MOTORS, WHOSE KINETIC ENERGY WAS DAMPENED BY TORQUES PRODUCED BY ELECTROMAGNETS INTERACTING WITH THE EARTH'S MAGNETIC FIELD. COSMOS 184 WAS ORIENTED BY EARTH SENSORS WITH ONE OF ITS AXES DIRECTED EARTHWARD ALONG THE LOCAL VERTICAL, A SECOND ORIENTED ALONG THE ORBITAL VELOCITY VECTOR, AND A THIRD ORIENTED PERPENDICULAR TO THE ORBITAL PLANE. THIS ORIENTATION ENSURED THAT THE OPTICAL AXES OF THE INSTRUMENTS WERE CONSTANTLY DIRECTED EARTHWARD. WHEN TWO OF THE 'METEOR' SYSTEM SATELLITES WERE IN OPERATION AT THE SAME TIME IN NEAR-POLAR ORBITS AND WITH SUITABLE DIFFERENCES IN THE LONGITUDES OF THE ASCENDING NODES, DATA COULD BE RECEIVED FROM ONE-HALF THE EARTH'S SURFACE IN A 24-HR PERIOD. IT IS BELIEVED THAT THE SATELLITE ENDED OPERATIONS IN MAY 1968, AS INDICATED BY THE TERMINATION OF DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW.

REFERENCES

213, 223, 225, 308, 359, 452, 700, 718, 772, AND 830.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 67-102A-01

EXPERIMENT PERSONNEL

PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 052368

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 184 DUAL VIDICON CAMERA EXPERIMENT WAS DESIGNED TO TEST THE CAPABILITY OF RUSSIAN WEATHER SATELLITES TO PROVIDE DAYTIME PICTURES OF THE

EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND GLOBAL WEATHER SYSTEMS FOR USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH TWO GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. THE COSMOS 184 CAMERAS, ALTHOUGH HAVING 2.5 TIMES THE RESOLUTION OF THOSE CARRIED ON THE ESSA SATELLITES, COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE COSMOS 184 SATELLITE (619 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED SOME OF THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE RECEIVED AT NESS FROM NOVEMBER 2, 1967, UNTIL FEBRUARY 23, 1968, AND AGAIN FROM MARCH 16 UNTIL MAY 23, 1968, WHEN THE EXPERIMENT IS BELIEVED TO HAVE TERMINATED OPERATIONS. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES
213, 286, 308, 359, 567, 678, 700, AND 866.

EXPERIMENT NAME- SCANNING HRIR   NSSDC ID 67-102A-02

EXPERIMENT PERSONNEL
PI - UNKNOWN   SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 052368

EXPERIMENT BRIEF DESCRIPTION
THE COSMOS 184 HIGH-RESOLUTION SCANNING IR RADIOMETER WAS DESIGNED TO MAKE MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED CONSTRUCTION OF BRIGHTNESS PATTERNS OF THE THERMAL RELIEF AND DETERMINATION OF EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE

IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR THAT FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 2 TO 3 DEG FOR TEMPERATURES ABOVE 273 DEG K AND WITHIN 7 TO 8 DEG FOR TEMPERATURES BELOW 273 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO-TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH, DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTER AT THE SOVIET HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM EARLY NOVEMBER 1967 UNTIL LATE MAY 1968. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED. IT IS BELIEVED THAT THE EXPERIMENT TERMINATED OPERATIONS IN MAY 1968.

REFERENCES

228, 308, 359, 567, 580, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 67-102A-03

EXPERIMENT PERSONNEL

PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 052368

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 184 ACTINOMETRIC EXPERIMENT WAS DESIGNED TO MEASURE (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS). THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW (FOV)) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FOV) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO-TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO-TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY THE INPUT OF A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD HAVE BEEN ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE COSMOS 184 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWNWARD TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED IN BINARY FORM TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS

INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM NOVEMBER 1967 TO LATE MAY 1968. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA. IT IS BELIEVED THAT EXPERIMENT OPERATIONS TERMINATED IN MAY 1968.

REFERENCES
228, 308, AND 359.

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SPACECRAFT COMMON NAME- COSMOS 206 NSSDC ID 68-019A
ALTERNATE NAMES- KOSMOS 206

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 03/26/68
APOGEE- 640.000 KM ALT
PERIGEE- 598.000 KM ALT
PERIOD- 97.08 MIN
INCLINATION- 81.23 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 03/14/68
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 050668

SPACECRAFT PERSONNEL
PM - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION
COSMOS 206 WAS THE SIXTH ANNOUNCED RUSSIAN METEOROLOGICAL SATELLITE AND THE FOURTH INTERIM OPERATIONAL WEATHER SATELLITE IN THE EXPERIMENTAL 'METEOR' SYSTEM. IT WAS ALSO THE FOURTH LAUNCH OF A SEMI-OPERATIONAL WEATHER SATELLITE FROM THE PLESETSK SITE INTO A NEAR-POLAR, NEAR-CIRCULAR ORBIT. UNLIKE U.S. WEATHER SATELLITES, HOWEVER, THE ORBIT WAS PROGRADE (NOT SUN-SYNCHRONOUS) BECAUSE, AS A RESULT OF GEOGRAPHIC LIMITATIONS, A RETROGRADE ORBIT WAS NOT POSSIBLE. COSMOS 206 WAS ORBITED TO TEST, IN A SEMI-OPERATIONAL MODE, METEOROLOGICAL INSTRUMENTS DESIGNED FOR OBTAINING IMAGES OF CLOUD COVER, SNOW COVER, AND ICE FIELDS ON THE DAY AND NIGHT SIDES OF THE EARTH AND FOR MEASURING FLUXES OF OUTGOING RADIATION REFLECTED AND RADIATED BY THE EARTH-ATMOSPHERE SYSTEM. THIS INSTRUMENTATION CONSISTED OF (1) TWO VIDICON CAMERAS FOR DAYTIME CLOUDCOVER PICTURES, (2) A HIGH-RESOLUTION SCANNING IR RADIOMETER FOR NIGHTTIME AND DAYTIME IMAGING OF THE EARTH AND CLOUDS, AND (3) AN ARRAY OF NARROW- AND WIDE-ANGLE RADIOMETERS COVERING THE 0.3- TO 3, 8- TO 12-, AND 3- TO 30-MICRON CHANNELS FOR MEASURING THE INTENSITY OF RADIATION REFLECTED FROM THE CLOUDS AND OCEANS, THE SURFACE TEMPERATURES OF THE EARTH AND CLOUD TOPS, AND THE TOTAL FLUX OF THERMAL ENERGY FROM THE EARTH-ATMOSPHERE SYSTEM INTO SPACE, RESPECTIVELY. THE SATELLITE WAS IN THE FORM OF A LARGE CYLINDRICAL CAPSULE, 5 M LONG AND 1.5 M IN DIAMETER. TWO LARGE SOLAR CELL PANELS OF FOUR SEGMENTS EACH WERE DEPLOYED FROM OPPOSITE SIDES OF THE CYLINDER AFTER SATELLITE SEPARATION FROM THE LAUNCH VEHICLE. THE SOLAR PANELS WERE ROTATED TO CONSTANTLY FACE THE SUN DURING SATELLITE DAYTIME BY MEANS OF A SUN SENSOR-CONTROLLED DRIVE MECHANISM FITTED IN THE TOP END OF THE CENTER BODY. THE METEOROLOGICAL INSTRUMENTS, A MAGNETOMETER, 465-MHZ RADIO ANTENNAS, AND ORBITAL CONTROL DEVICES WERE HOUSED IN A COMPLEX, SMALLER, HERMETICALLY SEALED CYLINDER LOCATED ON THE EARTHWARD-FACING END OF THE CYLINDRICAL SATELLITE BODY. THE SATELLITE WAS

TRIAXIALLY STABILIZED BY A SERIES OF INERTIAL FLYWHEELS, DRIVEN BY ELECTRIC MOTORS, WHOSE KINETIC ENERGY WAS DAMPENED BY TORQUES PRODUCED BY ELECTROMAGNETS INTERACTING WITH THE EARTH'S MAGNETIC FIELD. COSMOS 206 WAS ORIENTED BY EARTH SENSORS WITH ONE OF ITS AXES DIRECTED EARTHWARD ALONG THE LOCAL VERTICAL, A SECOND ORIENTED ALONG THE ORBITAL VELOCITY VECTOR, AND A THIRD ORIENTED PERPENDICULAR TO THE ORBITAL PLANE. THIS ORIENTATION ENSURED THAT THE OPTICAL AXES OF THE INSTRUMENTS WERE CONSTANTLY DIRECTED EARTHWARD. WHEN TWO OF THE 'METEOR' SYSTEM SATELLITES WERE IN OPERATION AT THE SAME TIME IN NEAR-POLAR ORBITS AND WITH SUITABLE DIFFERENCES IN THE LONGITUDES OF THE ASCENDING NODES, DATA COULD BE RECEIVED FROM ONE-HALF THE EARTH'S SURFACE IN A 24-HR PERIOD. COSMOS 206 HAD A BRIEF USEFUL LIFETIME. COSMOS 206 IS BELIEVED TO HAVE CEASED OPERATIONS ON MAY 6, 1968, AS INDICATED BY THE TERMINATION OF DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' WITH MOSCOW.

REFERENCES

223, 225, 308, 509, 700, 772, 830, AND 940.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 68-019A-01

EXPERIMENT PERSONNEL

PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 050668

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 206 DUAL VIDICON CAMERA EXPERIMENT WAS DESIGNED TO TEST THE CAPABILITY OF RUSSIAN WEATHER SATELLITES TO PROVIDE DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND GLOBAL WEATHER SYSTEMS FOR USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500-BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF TWO GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. THE COSMOS 206 CAMERAS, ALTHOUGH HAVING 2.5 TIMES THE RESOLUTION OF THOSE CARRIED ON THE ESSA SATELLITES, COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE COSMOS 206 SATELLITE (622 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE

CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED SOME OF THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. THE PICTURES WERE TRANSMITTED TO NESS FOR LESS THAN 2 MONTHS AFTER LAUNCH. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED. IT IS BELIEVED THAT THE EXPERIMENT TERMINATED OPERATIONS IN MAY 1968.

REFERENCES
213, 308, 567, 673, 700, AND 870.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 68-019A-02

EXPERIMENT PERSONNEL
PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 050668

EXPERIMENT BRIEF DESCRIPTION
THE COSMOS 206 HIGH-RESOLUTION SCANNING IR RADIOMETER WAS DESIGNED TO MAKE MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED CONSTRUCTION OF BRIGHTNESS PATTERNS OF THE THERMAL RELIEF AND DETERMINATION OF EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR THAT FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 2 TO 3 DEG FOR TEMPERATURES ABOVE 273 DEG K AND WITHIN 7 TO 8 DEG FOR

TEMPERATURES BELOW 273 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO-TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH, DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTER AT THE SOVIET HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM MID-MARCH UNTIL MAY 6, 1968, WHEN IT IS BELIEVED THAT THE EXPERIMENT OPERATIONS WERE TERMINATED. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES
308, 567, 580, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 68-019A-03

EXPERIMENT PERSONNEL
PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 050668

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 206 ACTINOMETRIC EXPERIMENT WAS DESIGNED TO MEASURE (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS). THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW (FOV)) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FOV) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC

RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO-TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO-TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY THE INPUT OF A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD HAVE BEEN ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE COSMOS 206 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWNWARD TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED IN BINARY FORM TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM MID-MARCH 1968 MAY 6, 1968, WHEN IT IS BELIEVED THAT EXPERIMENT OPERATIONS WERE TERMINATED. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA.

REFERENCES

221, 262, 266, 308, 560, AND 879.

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SPACECRAFT COMMON NAME- COSMOS 226 NSSDC ID 68-049A

ALTERNATE NAMES- KOSMOS 226

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 07/23/68
- APOGEE- 639.000 KM ALT
- PERIGEE- 579.000 KM ALT
- PERIOD- 96.87 MIN
- INCLINATION- 81.24 DEG

OTHER INFORMATION
- SPACECRAFT WT- UNKNOWN KG
- LAUNCH DATE- 06/12/68
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE DATA RECORDED- 021969

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES	MOSCOW, USSR
PS -	UNKNOWN	SOV. OF SCIENCES	MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 226 WAS THE SEVENTH ANNOUNCED RUSSIAN METEOROLOGICAL SATELLITE AND THE FIFTH AND LAST INTERIM OPERATIONAL WEATHER SATELLITE IN THE EXPERIMENTAL 'METEOR' SYSTEM. IT WAS ALSO THE FIFTH LAUNCH OF A SEMI-OPERATIONAL WEATHER SATELLITE FROM THE PLESETSK SITE INTO A NEAR-POLAR, NEAR-CIRCULAR ORBIT. UNLIKE U.S. WEATHER SATELLITES, HOWEVER, THE ORBIT WAS PROGRADE (NOT SUN-SYNCHRONOUS) BECAUSE, AS A RESULT OF GEOGRAPHIC LIMITATIONS, A RETROGRADE ORBIT WAS NOT POSSIBLE. COSMOS 226 WAS ORBITED TO TEST, IN A SEMI-OPERATIONAL MODE, METEOROLOGICAL INSTRUMENTS DESIGNED FOR OBTAINING IMAGES OF CLOUD COVER, SNOW COVER, AND ICE FIELDS ON THE DAY AND NIGHT SIDES OF THE EARTH AND FOR MEASURING FLUXES OF OUTGOING RADIATION REFLECTED AND RADIATED BY THE EARTH-ATMOSPHERE SYSTEM. THIS INSTRUMENTATION CONSISTED OF (1) TWO VIDICON CAMERAS FOR DAYTIME CLOUDCOVER PICTURES, (2) A HIGH-RESOLUTION SCANNING IR RADIOMETER FOR NIGHTTIME AND DAYTIME IMAGING OF THE EARTH AND CLOUDS, AND (3) AN ARRAY OF NARROW- AND WIDE-ANGLE RADIOMETERS COVERING THE 0.3- TO 3, 8- TO 12-, AND 3- TO 30-MICRON CHANNELS FOR MEASURING THE INTENSITY OF RADIATION REFLECTED FROM THE CLOUDS AND OCEANS, THE SURFACE TEMPERATURES OF THE EARTH AND CLOUD TOPS, AND THE TOTAL FLUX OF THERMAL ENERGY FROM THE EARTH-ATMOSPHERE SYSTEM INTO SPACE, RESPECTIVELY. THE SATELLITE WAS IN THE FORM OF A LARGE CYLINDRICAL CAPSULE, 5 M LONG AND 1.5 M IN DIAMETER. TWO LARGE SOLAR CELL PANELS OF FOUR SEGMENTS EACH WERE DEPLOYED FROM OPPOSITE SIDES OF THE CYLINDER AFTER SATELLITE SEPARATION FROM THE LAUNCH VEHICLE. THE SOLAR PANELS WERE ROTATED TO CONSTANTLY FACE THE SUN DURING SATELLITE DAYTIME BY MEANS OF A SUN SENSOR-CONTROLLED DRIVE MECHANISM FITTED IN THE TOP END OF THE CENTER BODY. THE METEOROLOGICAL INSTRUMENTS, A MAGNETOMETER, 465-MHZ RADIO ANTENNAS, AND ORBITAL CONTROL DEVICES WERE HOUSED IN A HERMETICALLY SEALED CYLINDER LOCATED ON THE EARTHWARD-FACING END OF THE CYLINDRICAL SATELLITE BODY. THE SATELLITE WAS TRIAXIALLY STABILIZED BY A SERIES OF INERTIAL FLYWHEELS, DRIVEN BY ELECTRIC MOTORS, WHOSE KINETIC ENERGY WAS DAMPENED BY TORQUES PRODUCED BY ELECTROMAGNETS INTERACTING WITH THE EARTH'S MAGNETIC FIELD. COSMOS 226 WAS ORIENTED BY EARTH SENSORS WITH ONE OF ITS AXES DIRECTED EARTHWARD ALONG THE LOCAL VERTICAL, A SECOND ORIENTED ALONG THE ORBITAL VELOCITY VECTOR, AND A THIRD ORIENTED PERPENDICULAR TO THE ORBITAL PLANE. THIS ORIENTATION ENSURED THAT THE OPTICAL AXES OF THE INSTRUMENTS WERE CONSTANTLY DIRECTED EARTHWARD. WHEN TWO OF THE 'METEOR' SYSTEM SATELLITES WERE IN OPERATION AT THE SAME TIME IN NEAR-POLAR ORBITS AND WITH SUITABLE DIFFERENCES IN THE LONGITUDES OF THE ASCENDING NODES, DATA COULD BE RECEIVED FROM ONE-HALF THE EARTH'S SURFACE IN A 24-HR PERIOD. COSMOS 226 OPERATED FOR 8 MONTHS AFTER LAUNCH AND TERMINATED OPERATIONS IN MID-FEBRUARY 1969.

REFERENCES

223, 225, 772, 830, AND 940.

EXPERIMENT NAME- DUAL VIDICON CAMERAS — NSSDC ID 68-049A-01

EXPERIMENT PERSONNEL

PI -	UNKNOWN	SOV. ACAD. OF SCIENCES	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 021069

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 226 DUAL VIDICON CAMERA EXPERIMENT WAS DESIGNED TO TEST THE CAPABILITY OF RUSSIAN WEATHER SATELLITES TO PROVIDE DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND GLOBAL WEATHER SYSTEMS FOR USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF TWO GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. THE COSMOS 226 CAMERAS, ALTHOUGH HAVING 2.5 TIMES THE RESOLUTION OF THOSE CARRIED ON THE ESSA SATELLITES, COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE COSMOS 226 SATELLITE (621 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED SOME OF THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM JUNE 17, 1968, UNTIL JANUARY 29, 1969, AND AGAIN ON FEBRUARY 10, 1969, AFTER WHICH IT IS BELIEVED THAT EXPERIMENT OPERATIONS WERE TERMINATED. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

213, 372, AND 567.

EXPERIMENT NAME- SCANNING HRIR   NSSDC ID 68-049A-02

EXPERIMENT PERSONNEL

PI - UNKNOWN   SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 121868

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 226 HIGH-RESOLUTION SCANNING IR RADIOMETER WAS DESIGNED TO MAKE MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED CONSTRUCTION OF BRIGHTNESS PATTERNS OF THE THERMAL RELIEF AND DETERMINATION

OF EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR THAT FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 2 TO 3 DEG FOR TEMPERATURES ABOVE 273 DEG K AND WITHIN 7 TO 8 DEG FOR TEMPERATURES BELOW 273 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO-TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH, DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTER AT THE SOVIET HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM MID-JUNE UNTIL MID-DECEMBER 1968 WHEN IT IS BELIEVED THAT EXPERIMENT OPERATIONS WERE TERMINATED. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

580, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT   NSSDC ID 68-049A-03

EXPERIMENT PERSONNEL
PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 021969

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 226 ACTINOMETRIC EXPERIMENT WAS DESIGNED TO MEASURE (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS). THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW (FOV)) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FOV) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIOTELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIOTELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY THE INPUT OF A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD HAVE BEEN ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE COSMOS 226 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWNWARD TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED IN BINARY FORM TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS

SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM MID-JUNE 1968 TO MID-FEBRUARY 1969 WHEN IT IS BELIEVED THAT EXPERIMENT OPERATIONS CEASED. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA.

REFERENCES

199, AND 351.

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SPACECRAFT COMMON NAME- COSMOS 232 NSSDC ID 68-060A
ALTERNATE NAMES- KOSMOS 232

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 07/16/68
- APOGEE- 348.000 KM ALT
- PERIGEE- 189.000 KM ALT
- PERIOD- 89.85 MIN
- INCLINATION- 65.32 DEG

OTHER INFORMATION
- SPACECRAFT WT- UNKNOWN KG
- LAUNCH DATE- 07/16/68
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE DATA RECORDED- 072468

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

COSMOS 232 WAS THE EIGHTEENTH RUSSIAN EXPERIMENTAL WEATHER SATELLITE AND THE SEVENTH LAUNCHED FROM THE PLESETSK SITE. PRIMARILY, THIS MISSION WAS A PART OF THE 8-DAY RECOVERABLE PAYLOAD RECONNAISSANCE SERIES. HOWEVER, BECAUSE OF ITS SIMILARITY IN SIZE, SHAPE, WEIGHT, AND ORBITAL PARAMETERS TO THE COSMOS 45, 65, AND 92 FLIGHTS, COSMOS 232 WAS LIKELY A CONTINUATION OF THESE MISSIONS. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 2 M IN DIAMETER. IT PROBABLY CARRIED IR, UV, AND VISIBLE RADIATION DETECTORS SIMILAR TO THOSE CARRIED ON COSMOS 45, 65, AND 92. THE SATELLITE TELEMETRY SYSTEM OPERATED AT A FREQUENCY OF 19.995 MHZ. NO INFORMATION HAS BEEN RELEASED ON THE FLIGHT OR ITS SCIENTIFIC RESULTS. THE SATELLITE REENTERED THE ATMOSPHERE ON JULY 24, 1968, AFTER NEARLY 8 DAYS IN ORBIT, AND IT WAS SUCCESSFULLY RECOVERED.

REFERENCES

223, AND 830.

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SPACECRAFT COMMON NAME- COSMOS 243 NSSDC ID 68-080A
ALTERNATE NAMES- KOSMOS 243

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 09/23/68
APOGEE- 293.000 KM ALT
PERIGEE- 213.000 KM ALT
PERIOD- 89.54 MIN
INCLINATION- 71.29 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 09/23/68
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 100468

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 243 WAS THE NINETEENTH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE EIGHTH LAUNCHED FROM THE PLESETSK SITE. ALTHOUGH IT WAS PRIMARILY PART OF THE RECOVERABLE PAYLOAD RECONNAISSANCE SERIES, COSMOS 243 ALSO CARRIED A SUPPLEMENTAL SCIENTIFIC PAYLOAD DESIGNED TO TEST INSTRUMENTS THAT COULD BE USED TO INCREASE THE VIEWING CAPABILITY OF CONVENTIONAL WEATHER SATELLITES. THE PAYLOAD CONSISTED OF A NARROW-ANGLE, NONSCANNING, IR RADIOMETER THAT MEASURED OUTGOING TERRESTRIAL RADIATION IN THE 10- TO 12-MICRON WINDOW AND FOUR MICROWAVE RADIOMETERS THAT MEASURED OUTGOING TERRESTRIAL THERMAL RADIO (MICROWAVE) EMISSIONS AT 0.8, 1.35, 3.4, AND 8.5 CM. THE IR AND MICROWAVE RADIOMETERS MADE SYNCHRONIZED MEASUREMENTS OF THE VARIOUS BRIGHTNESS TEMPERATURES TO PROVIDE SURFACE AND ATMOSPHERIC CONDITIONS, AS WELL AS CLOUDCOVER PARAMETERS. THE DATA WERE STORED IN A MEMORY DEVICE AND THEN TRANSMITTED BY TELEMETRY AT 19.995 MHZ. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 2 M IN DIAMETER. IT REENTERED THE ATMOSPHERE AFTER NEARLY 11 DAYS IN ORBIT. A SIMILAR FLIGHT WAS MADE BY COSMOS 384.

REFERENCES

223, 426, 717, AND 805.

EXPERIMENT NAME- MICROWAVE RADIOMETERS NSSDC ID 68-080A-01

EXPERIMENT PERSONNEL

PI - A.E.	BASHARINOV	SAS-IPA	MOSCOW, U.S.S.R.
OI - A.S.	GURVICH	SAS-IPA	MOSCOW, U.S.S.R.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092768

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 243 MICROWAVE RADIOMETER EXPERIMENT WAS DESIGNED TO MEASURE THE EARTH'S THERMAL RADIO (MICROWAVE) EMISSION TO DEVELOP TECHNIQUES FOR THE DETERMINATION OF THE GEOPHYSICAL PARAMETERS OF THE ATMOSPHERE, CLOUDS, AND THE UNDERLYING SURFACE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETRIC RECEIVERS TUNED TO FOUR WAVELENGTHS (8.5, 3.4, 1.35, AND 0.8 CM) BY MEANS OF AN ANTENNA SYSTEM WHOSE AXIS POINTED TOWARD NADIR. THE RECEIVERS AND ANTENNAS RESEMBLED GROUND-BASED RADIO TELESCOPES IN DESIGN BUT WERE FULLY AUTOMATED. THE SENSITIVITY OF THE RECEIVERS WAS ABOUT 0.7 DEG K FOR THE 8.5-

AND 3.4-CM BANDS AND ABOUT 2 DEG K FOR THE 1.35- AND 0.8-CM BANDS. THE ANTENNAS HAD HALF-POWER DIRECTIONAL PATTERN WIDTHS OF ABOUT 3.5 DEG AT 0.8, 1.35, AND 3.4 CM AND 8.8 DEG AT 8.5 CM. THE REFERENCE SIGNAL IN THE RADIOMETERS WAS THE SPACE BACKGROUND RADIATION, WHICH WAS RECEIVED BY SMALL HORNS DIRECTED TOWARD THE ZENITH. CALIBRATION IN FLIGHT WAS PROVIDED BY SWITCHING THE RADIOMETERS FROM THE ANTENNAS TO A NOISE GENERATOR AT A TEMPERATURE OF ABOUT 300 DEG K, WHICH PROVIDED A ZERO LEVEL CONTROL. THE FINE ADJUSTMENT OF THE RADIOMETER SCALES WAS BASED ON MEASUREMENTS MADE OVER SPECIFIC REFERENCE POINTS WITH KNOWN BRIGHTNESS TEMPERATURES AND ON AVERAGE CLIMATIC DATA. THESE REFERENCE POINTS MADE IT POSSIBLE TO OBTAIN RELATIVE RADIO BRIGHTNESS TEMPERATURES ACCURATE TO WITHIN 1 TO 2 DEG K AND ABSOLUTE RADIO BRIGHTNESS TEMPERATURES TO WITHIN 4 TO 6 DEG K. THE RESULTS OF THE MEASUREMENTS WERE ACCUMULATED IN A RECORDING DEVICE AND TRANSMITTED TO THE GROUND BY RADIO TELEMETRY WHEN THE SATELLITE PASSED OVER THE SOVIET UNION. FOR THE MOST PART, THE RESULTS OF THE MEASUREMENTS MADE AT 8.5 CM WERE USED TO ESTIMATE THE LATITUDINAL VARIATIONS IN THE THERMODYNAMIC TEMPERATURES OF THE SURFACE OF THE OCEAN, LAND, AND ICE FIELDS. MEASUREMENTS AT 0.8 AND 3.4 CM WERE USED TO ACCOUNT FOR THE EFFECTS OF CLOUD DROPLET AND RAINDROP ABSORPTION ON THE MEASUREMENTS MADE AT 8.5 CM. THE 1.35-CM BANDS WERE ALSO USED TO DETECT AREAS OF ROUGH SEAS AND TO DELINEATE THE BOUNDARIES OF SEA ICE FIELDS. THE MEASUREMENTS AT 0.8 CM PROVIDED A UNIQUE SOURCE OF INFORMATION ON THE LATITUDINAL DISTRIBUTION OF CLOUD LIQUID WATER CONTENT (LWC) AND ALLOWED AN ESTIMATE OF THE TOTAL LWC IN THE EARTH'S ATMOSPHERE. THE RADIOMETER MEASURED THE CLOUD LWC WITH A RELATIVE ERROR OF 0.1 KG/SQ. M, WHILE THE ABSOLUTE ACCURACY OF A SINGLE MEASUREMENT OF CLOUD LWC IN THE RANGE 0.2 TO 0.8 KG/SQ. M WAS ESTIMATED TO BE 30 TO 50 PERCENT. THE AVERAGE CLOUD LWC FOR THE EARTH WAS FOUND TO BE 0.2 KG/SQ. M, WHILE THE TOTAL LWC FOR THE EARTH'S ATMOSPHERE IN SEPTEMBER 1968 WAS ESTIMATED TO BE 8.7 TIMES 10 TO THE 16 POWER GRAMS. THESE MEASUREMENTS WERE AVERAGED OVER AN AREA OF ABOUT 500 SQ. KM. THE MAIN ADVANTAGE OF THIS EXPERIMENT WAS THAT THE TOTAL MOISTURE CONTENT OF THE ATMOSPHERE AND THE TEMPERATURE OF THE UNDERLYING SURFACE WERE MEASURED SIMULTANEOUSLY WITH THE CLOUD LWC, THUS PERMITTING THEIR CORRELATION. THE EXPERIMENT OBTAINED DATA DURING THE PERIOD SEPTEMBER 23 TO 27, 1968. A SIMILAR EXPERIMENT WAS FLOWN ON COSMOS 384.

REFERENCES

332, 333, 334, 335, 336, 337, 338, 343, 407, 408, 478, 479, 576, 578, 583, 632, 633, 640, 658, 659, 695, 696, 787.

EXPERIMENT NAME- NARROW-ANGLE IR RADIOMETER — NSSDC ID 68-080A-02

EXPERIMENT PERSONNEL

PI - A.K.	GORODETSKIY	SAS-IPA	MOSCOW, U.S.S.R.
OI - M.S.	MALKEVICH	SAS-IPA	MOSCOW, U.S.S.R.

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 092768

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 243 NARROW-ANGLE IR RADIOMETER EXPERIMENT WAS DESIGNED TO DETERMINE SURFACE AND CLOUDTOP TEMPERATURES BY MEASURING THE OUTGOING RADIATION IN THE 10- TO 12-MICRON WINDOW. THE INSTRUMENTATION CONSISTED OF A HIGH-RESOLUTION, NARROW-ANGLE, NONSCANNING IR RADIOMETER WHOSE BASIC PRINCIPLES OF DESIGN AND OPERATION WERE IDENTICAL TO THE RADIOMETERS FLOWN ON COSMOS 149, 320, AND 384. THE MAIN COMPONENTS OF THE RADIOMETER WERE (1) A PARABOLIC MIRROR, (2) A CHOPPER, (3) AN IMPROVED INTERFERENCE FILTER THAT ELIMINATED POSSIBLE EFFECTS FROM WATER VAPOR, CARBON DIOXIDE, AND OZONE ABSORPTION BANDS, (4) A BOLOMETER PLATFORM, (5) A THERMISTOR, AND (6)

BLINDS. EARTH AND SPACE RADIATION THAT ENTERED THE RADIOMETER WERE COMBINED BY THE MIRROR, MODULATED BY THE CHOPPER, PASSED THROUGH THE INTERFERENCE FILTER, AND FOCUSED ON THE BOLOMETER. THE SIGNAL WAS AMPLIFIED AND SENT TO A MEMORY DEVICE FOR LATER TRANSMISSION. AN IMPROVEMENT OVER THE COSMOS 149 IR RADIOMETER WAS MADE BY CONTROLLING THE AMPLIFICATION FACTOR, WHICH MADE IT POSSIBLE TO INTRODUCE A CORRECTION WHEN A CHANGE IN SENSITIVITY OCCURRED AND THUS INCREASED THE RELIABILITY OF THE MEASURED VALUES. THE THERMISTOR MOUNTED ON THE RADIOMETER CASING MONITORED THE INSTRUMENT TEMPERATURE AND PROVIDED INFORMATION FOR THIS CORRECTION. BLINDS WITH A SET OF DIAPHRAGMS IN FRONT OF THE LENSES WERE USED TO REDUCE THE EFFECT OF LATERAL EXPOSURE. LABORATORY CALIBRATION INDICATED THAT THE RADIOMETER WAS CAPABLE OF MEASURING BRIGHTNESS TEMPERATURES WITH AN ERROR OF 1 TO 2 DEG IN THE 300- TO 250-DEG K RANGE AND 2 TO 4 DEG IN THE 250- TO 220-DEG K RANGE. THE OPTICAL AXIS OF THE RADIOMETER WAS ALIGNED PARALLEL TO THE LOCAL VERTICAL AND WAS DIRECTED TOWARD NADIR. THE RADIOMETER VIEWED SUCCESSIVE RECTANGULAR STRIPS 15 KM WIDE AND 300 KM LONG AS THE SATELLITE PROGRESSED ALONG ITS ORBITAL PATH AT AN AVERAGE ALTITUDE OF 250 KM. THE HIGH SPATIAL RESOLUTION MADE IT POSSIBLE TO OBSERVE THE DETAILS OF THE CLOUD COVER'S THERMAL STRUCTURE AND TO DETERMINE THE TEMPERATURE OF THE UNDERLYING SURFACE. THE RESULTS FROM THE EXPERIMENT INDICATED THAT THE AVERAGE DIFFERENCE BETWEEN THE EARTH'S BRIGHTNESS TEMPERATURE MEASURED OVER CLOUDLESS OCEAN OR LAND SURFACES AND THE ACTUAL AIR TEMPERATURE WAS 15 DEG WITH A PLUS OR MINUS 3-DEG VARIATION AND THAT THESE ACCURACIES COULD BE APPLIED IN THE DETERMINATION OF CLOUDTOP TEMPERATURE. IN ADDITION, IT WAS DISCOVERED THAT AEROSOL ABSORPTION WAS THE MAIN CONTRIBUTION TO THE TRANSFORMATION OF THE INTRINSIC RADIATION OF THE UNDERLYING SURFACE IN THE 10- TO 12-MICRON RANGE FOR CLEAR CONDITIONS.

REFERENCES

467, AND 583.

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SPACECRAFT COMMON NAME- COSMOS 258 NSSDC ID 68-111A
ALTERNATE NAMES- KOSMOS 258

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 12/11/68
APOGEE- 298.000 KM ALT
PERIGEE- 205.000 KM ALT
PERIOD- 89.59 MIN
INCLINATION- 64.98 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 12/10/68
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 121868

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

COSMOS 258 WAS THE TWENTIETH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE NINTH LAUNCHED FROM THE TYURATAM SITE. ALTHOUGH IT WAS PRIMARILY PART OF THE 8-DAY RECOVERABLE PAYLOAD RECONNAISSANCE SERIES, COSMOS 258 CARRIED A SUPPLEMENTAL SCIENTIFIC PAYLOAD TO TEST METEOROLOGICAL SENSORS AND TO OBTAIN DATA IN SUPPORT OF THE OPERATIONAL WEATHER SATELLITE DEVELOPMENT PROGRAM. THE ANNOUNCED INSTRUMENTATION CONSISTED OF A SCANNING IR RADIOMETER, SIMILAR TO THOSE CARRIED ON COSMOS 45, 65, AND 92, WHICH

RECORDED THE SPECTRAL INTENSITY OF TERRESTRIAL RADIATICN IN THE 15- TO 28-MICRON BAND. THE INSTRUMENTATION ALSO MAY HAVE INCLUDED A CLOUDCOVER PHOTOMETER, A UV SPECTROPHOTOMETER, AND A NIGHT AIRGLCW COLORIMETER SIMILAR TO THOSE FLOWN ON COSMOS 45, 65, 92, AND 232. THE SATELLITE WAS CYLINDRICAL, 5 M LONG AND 2 M IN DIAMETER. IT TRANSMITTED ON A FREQUENCY OF 19.995 MHZ. THE SATELLITE REENTERED THE EARTH'S ATMCSPHERE ON DECEMBER 18, 1968, AFTER NEARLY 8 DAYS IN ORBIT, AND WAS SUCCESSFULLY RECCVERED.

REFERENCES
223, AND 830.

EXPERIMENT NAME- SCANNING IR RADIOMETER NSSDC ID 68-111A-01

EXPERIMENT PERSONNEL
PI - V.I. TULUPOV MOSCOW STATE U MCSCOW, USSR

OPERATING STATUS- INCPERABLE
DATE LAST USABLE DATA RECORDED- 121168

EXPERIMENT BRIEF DESCRIPTION
THE COSMOS 258 SCANNING IR RADIOMETER EXPERIMENT MEASURED THE ANGULAR, SPECTRAL, AND GECGRAPHIC DISTRIBUTION OF OUTGOING TERRESTRIAL RADIATION DURING BOTH DAY AND NIGHT CVER CONTINENTS AND OCEANS IN THE 15- TO 28-MICRON BAND. THE MEASUREMENTS WERE MADE IN LATE WINTER FOR CCMPARISON WITH PREVIOUS MEASUREMENTS MADE IN AUTUMN AND EARLY SPRING BY SIMILAR EXPERIMENTS FLOWN ON COSMOS 45, 65, AND 92. THE INSTRUMENTATICN CCNSISTED OF A SCANNING DIFFRACTION SPECTROPHOTOMETER ESSENTIALLY THE SAME AS THOSE FLOWN ON THE EARLIER FLIGHTS. THE OUTGOING TERRESTRIAL RADIATION AND BACKGROUND COMPARISON (SPACE) RADIATION ENTERED THE INSTRUMENT THROUGH AN INLET WINDOW AND WERE REFLECTED FROM MIRROR CBJECTIVES CNTO A CHOPPER. THE CHOPPER SUCCESSIVELY REPLACED THE EARTH RADIATICN WITH SPACE RADIATION AT THE INPUT SLITS OF THEIR RESPECTIVE MONOCHRCMATORS. THE RADIATICN FLUXES ENTERING THE MONOCHROMATORS WERE DISPERSED BY PLANE DIFFRACTING GRIDS AND WERE SIMULTANEOUSLY FCCUSED BY CCLLIMATED CAMERA MIRRCR OBJECTIVES ONTO BOLOMETRIC DETECTORS IN SUCH A WAY THAT, WHEN THE EARTH RADIATION REACHED ONE BOLOMETER, THE SPACE RADIATION ARRIVED AT THE CTHER. THIS RADIATION WAS CONVERTED BY THE BOLOMETERS INTC ELECTRICAL SIGNALS AND THEN WAS AMPLIFIED AND CONVERTED INTO DC VOLTAGES PROPORTICNAL TO THE RADIATION FLUXES. THESE SIGNALS WERE RECCRDED ON TWO CHANNELS OF A MINIATURIZED LOOP OSCILLOGRAPH 35-MM FILM STRIP AND STORED CN BOARD. THE SPECTRUM WAS SCANNED BY ROTATING THE DIFFRACTION GRIDS ABOUT AXES PARALLEL TO THE GRID LINES BY MEANS OF CAM MECHANISMS. THE INSTRUMENT'S 40.5-SEC OPERATING CYCLE WAS ONE HALF AS LONG AS THAT OF THE EARLIER FLIGHTS. THE SPECTRAL INTERVAL FRCM 15 TO 28 MICRONS WAS SCANNED IN 9.1 SEC. THE TIME INTERVAL BETWEEN MEASUREMENTS AT THE SAME WAVELENGTH WAS EQUAL TO THE OPERATING CYCLE OF THE INSTRUMENT. THE SPECTRAL RESOLUTION WAS ABOUT 2.5 MICRONS. DURING THE TIME THAT ONE SPECTROGRAM WAS RECORDED, THE SATELLITE MOVED 70 KM ALCNG THE ORBIT. THE OPTICAL AXIS OF THE INSTRUMENT WAS DIRECTED ALONG THE LOCAL VERTICAL AND WAS POINTED TOWARD NADIR. THE SCANNING PLANE WAS PERPENDICULAR TO THE ORBITAL PLANE AND ROTATED WITHIN PLUS OR MINUS 90 DEG FROM NADIR. AT AN AVERAGE SATELLITE ALTITUDE OF ABOUT 250 KM, THE INSTRUMENT VIEWED AN AREA 75 BY 75 KM AT NADIR. THE MEASUREMENTS WERE MADE CONTINUOUSLY FOR 28 HR BEGINNING CN DECEMBER 10, 1968, AND ABOUT 2500 SPECTRA FRCM THE SURFACE OF THE EARTH BETWEEN LATITUDES 65 DEG N TO 65 DEG S WERE RECORDED, HALF OF THEM DURING THE DAY AND THE OTHER HALF AT NIGHT. FIVE NARROW INTERVALS WITHIN THE 15- TO 28-MICRON RANGE WERE SELECTED FOR ANALYSIS -- (1) A BAND CENTERED AT 15 MICRONS (CARBON

DIOXIDE ABSORPTION BAND), (2) BANDS CENTERED AT 18 AND 20 MICRONS (ATMOSPHERIC WINDOWS), AND (3) BANDS CENTERED AT 24 AND 28 MICRONS (WATER VAPOR ABSORPTION BANDS). THE DATA ACQUIRED WERE RETURNED TO THE EARTH ON DECEMBER 18, 1966, IN A SPECIAL REENTRY CONTAINER, AND WERE SUCCESSFULLY RECOVERED.

REFERENCES

651.

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SPACECRAFT COMMON NAME- COSMOS 320 NSSDC ID 70-005A
ALTERNATE NAMES- KOSMOS 320

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 01/17/70
APOGEE- 326.000 KM ALT
PERIGEE- 247.000 KM ALT
PERIOD- 90.18 MIN
INCLINATION- 48.4 DEG

OTHER INFORMATION
SPACECRAFT WT- 300. KG
LAUNCH DATE- 01/16/70
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 021070

SPACECRAFT PERSONNEL
PM - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR
PS - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

COSMOS 320 WAS THE TWENTIETH RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE FOURTH LAUNCHED FROM THE KAPUSTIN YAR SITE. THE SATELLITE WAS ORBITED TO CONTINUE THE RADIATION STUDIES OF THE EARTH'S SURFACE, ATMOSPHERE, AND CLOUD COVER BEGUN BY COSMOS 149. THE SATELLITE, WHICH WAS BASICALLY AN ORBITING OPTICAL STATION, WAS EQUIPPED WITH (1) TWO MEDIUM-RESOLUTION, NARROW-ANGLE, THREE-CHANNEL SCANNING TELEPHOTOMETERS OPERATING IN THE VISIBLE SPECTRAL REGION TO DETERMINE THE STATISTICAL VALUES OF CLOUD FIELDS AND SURFACE FORMATIONS, CLOUDTOP HEIGHTS, AND ATMOSPHERIC WATER VAPOR CONTENT, (2) A HIGH-RESOLUTION, NARROW-ANGLE, IR RADIOMETER OPERATING IN THE 10- TO 12-MICRON WINDOW TO DETERMINE SURFACE AND CLOUDTOP TEMPERATURES, (3) A PAIR OF THREE-CHANNEL, WIDE-ANGLE RADIOMETERS TO DETERMINE THE RADIATIVE BALANCE OF THE EARTH-ATMOSPHERE SYSTEM, AND (4) A TELEVISION CAMERA SYSTEM TO PROVIDE CLOUDCOVER PICTURES FOR CORRELATION WITH THE RADIATION DATA. THE CONFIGURATION AND SIZE OF COSMOS 320 WERE IDENTICAL TO THOSE OF COSMOS 149. IT WAS SHAPED LIKE A DOMED CYLINDER WITH AN ANNULAR BASE AND AERODYNAMIC STABILIZER AND WAS 6.5 M LONG AND 1.2 M IN DIAMETER. ONE OF THE TELEPHOTOMETERS WAS MOUNTED IN THE DOMED NOSE SECTION AND SCANNED IN A PLANE PERPENDICULAR TO THE FLIGHT PATH, WHILE THE OTHER WAS MOUNTED ON THE LEFT SIDE OF THE CYLINDRICAL CENTER SECTION AND SCANNED ALONG THE FLIGHT PATH. THE TELEVISION SYSTEM WAS HOUSED IN THE SIDE OF THE DOMED NOSE SECTION, AND ITS OPTICAL AXIS WAS DIRECTED ALONG NADIR. THE RADIATION BALANCE SENSOR UNITS WERE ATTACHED TO BOOMS THAT TELESCOPED OUT FROM THE LOWER AND UPPER SIDES OF THE SATELLITE BASE. THE LOWER SENSOR UNIT FACED NADIR, AND THE UPPER SENSOR UNIT VIEWED IN THE ZENITH DIRECTION. ALSO ATTACHED TO THE BASE, BY MEANS OF FOUR LONG BARS, WAS THE ANNULAR AERODYNAMIC STABILIZER, WHICH WAS CAPABLE OF PROVIDING AN ORIENTATION IN SPACE WITH AN ERROR LESS THAN 5 DEG RELATIVE TO THE THREE COORDINATE AXES. THE SATELLITE'S ORIENTATION WAS ALSO REGULATED WITH RATHER HIGH ACCURACY

FROM THE MEASUREMENTS MADE BY THE SCIENTIFIC INSTRUMENTS. THE ORIENTATION AND STABILIZATION SYSTEM MADE IT POSSIBLE TO RELATE CATA TO GEOGRAPHICAL LOCATION WITH AN ACCURACY OF 10 TO 15 KM AT NADIR. THE SATELLITE TRANSMITTED DATA IN EITHER A DIRECT READOUT OR A MEMORY MODE AT 90 MHZ VIA AN ANTENNA MOUNTED ON THE UPPER SIDE OF THE SATELLITE BASE. THE SATELLITE INSTRUMENTATION INCLUDED A PROGRAMMING AND TIMING DEVICE FOR CONTROLLING THE VARIOUS UNITS AND THE TELEMETRY SYSTEM IN BOTH DATA TRANSMISSION MODES. THE MISSION WAS A SUCCESS, AND GOOD DATA ON THE RADIATION FIELD OF THE EARTH-ATMOSPHERE SYSTEM WERE OBTAINED. COSMOS 320 REENTERED THE EARTH'S ATMOSPHERE ON FEBRUARY 10, 1970, AFTER 25 DAYS IN ORBIT.

REFERENCES

223, 656, AND 805.

EXPERIMENT NAME- THREE-CHANNEL NARROW-ANGLE TELEPHOTOMETERS — NSSDC ID 70-005A-01

EXPERIMENT PERSONNEL

PI - UNKNOWN — SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 021070

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 320 THREE-CHANNEL NARROW-ANGLE TELEPHOTOMETER EXPERIMENT WAS DESIGNED PRIMARILY TO MEASURE QUANTITATIVELY THE ANGULAR, SPATIAL, AND SPECTRAL PARAMETERS OF THE STRUCTURE OF CLOUD FIELDS, AEROSOLS, AND THE UNDERLYING SURFACE THAT DETERMINE THE RADIATION FIELD OF THE EARTH. OTHER GOALS WERE TO MEASURE REFLECTED SOLAR RADIATION IN VARIOUS SECTIONS OF THE SPECTRUM TO DETERMINE CLOUDTOP HEIGHTS AND THE ATMOSPHERIC WATER VAPOR CONTENT. THE INSTRUMENTATION CONSISTED OF TWO THREE-CHANNEL, MEDIUM-RESOLUTION TELEPHOTOMETERS THAT SCANNED IN TWO MUTUALLY ORTHOGONAL PLANES AND PRODUCED TWO PHOTOMETRIC PROFILES OF THE EARTH'S BRIGHTNESS FIELD IN NARROW INTERVALS OF THE VISIBLE AND NEAR IR SPECTRAL REGIONS. THEY EACH HAD A 3-DEG FIELD OF VIEW. THE FIRST TELEPHOTOMETER WAS MOUNTED ON TOP OF THE NOSE SECTION OF THE SPACECRAFT AND SCANNED PERPENDICULAR TO THE FLIGHT TRAJECTORY. IT MEASURED THE INTENSITY OF REFLECTED SOLAR RADIATION IN NARROW BANDS CENTERED AT 0.75, 0.94, AND 1.03 MICRONS. THE SECOND TELEPHOTOMETER WAS MOUNTED ON THE LEFT SIDE OF THE CYLINDRICAL CENTER SECTION AND SCANNED ALONG THE FLIGHT TRAJECTORY. IT MEASURED THE INTENSITY OF REFLECTED SOLAR RADIATION IN THE WATER VAPOR ABSORPTION BANDS OF 0.72 AND 0.94 MICRON AND IN THE MOLECULAR OXYGEN BAND OF 0.76 MICRON. THE SPECTRAL RESOLUTION OF THE INSTRUMENTS WAS 3 TO 5 MILLIMICRONS. EACH CHANNEL WAS CALIBRATED INTEGRALLY AND SPECTRALLY IN ORBIT. THE PRINCIPAL ELEMENTS OF THE TELEPHOTOMETERS WERE (1) A PROTECTIVE QUARTZ CAP, (2) A PLANE SCANNING MIRROR, (3) A COLLIMATOR, (4) A SET OF INTERFERENCE FILTERS, (5) A PROGRAMMING DISK, (6) THREE PHOTOMULTIPLIERS, (7) A PROTECTIVE TUBULAR DIAPHRAGM, AND (8) A REVERSING MOTOR. REFLECTED SOLAR RADIATION ENTERED THE INSTRUMENT BY FIRST PASSING THROUGH THE PROTECTIVE CAP. IT WAS REFLECTED BY THE CIRCULARLY SCANNING MIRROR AND THEN PASSED THROUGH THE TUBULAR DIAPHRAGM, THE INTERFERENCE FILTERS, AND AN OPENING IN THE PROGRAMMING DISK. THE RADIATION FELL ON THE THREE PHOTOMULTIPLIERS, WHOSE OUTPUT SIGNALS WERE AMPLIFIED AND FED EITHER TO THE TELEMETRY SYSTEM FOR DIRECT TRANSMISSION OR TO A RECORDING DEVICE. A GEAR SYSTEM HELPED TO TRANSMIT THE ROTATION OF THE REVERSING MOTOR TO THE SCANNING MIRROR AND TO A CAM, WHICH ROTATED THE PROGRAMMING DISK. THE RADIATION DATA FROM THE 0.72- AND 0.94-MICRON WATER VAPOR ABSORPTION BANDS AND FROM THE 0.76-MICRON MOLECULAR OXYGEN ABSORPTION BAND WERE USED TO

DETERMINE THE WATER VAPOR CONTENT OF THE ATMOSPHERE AND TO ESTIMATE THE HEIGHT OF CLOUD TOPS, RESPECTIVELY. THE VERTICAL RESOLUTION IN DETERMINING CLOUDTOP HEIGHTS WAS ABOUT 1 KM. THE EXPERIMENT WAS A SUCCESS AND WAS TERMINATED WHEN THE SATELLITE REENTERED THE ATMOSPHERE ON FEBRUARY 10, 1970.

REFERENCES

613. AND 8CS.

EXPERIMENT NAME- NARROW-ANGLE IR RADIOMETER NSSDC ID 70-005A-02

EXPERIMENT PERSONNEL

PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 021070

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 320 NARROW-ANGLE IR RADIOMETER EXPERIMENT WAS DESIGNED TO DETERMINE SURFACE AND CLOUDTOP TEMPERATURES BY MEASURING THE OUTGOING RADIATION IN THE 10- TO 12-MICRON WINDOW. THE INSTRUMENTATION CONSISTED OF A HIGH-RESOLUTION, NARROW-ANGLE, NONSCANNING IR RADIOMETER WITH A 1- TO 2-DEG FIELD OF VIEW. IT WAS MOUNTED WITH ITS OPTICAL AXIS ALONG THE LOCAL VERTICAL WHEN THE SATELLITE ASSUMED ITS NORMAL ORIENTATION. THE RADIOMETER WAS ABLE TO SCAN THE EARTH OWING TO THE PROGRESSION OF THE SATELLITE ALONG ITS ORBITAL PATH. THE MAIN COMPONENTS OF THE RADIOMETER WERE (1) A PARABOLIC MIRROR, (2) A CHOPPER, (3) AN INTERFERENCE FILTER, (4) A BOLOMETER PLATFORM, (5) A THERMISTOR, AND (6) BLINDS. RADIATION ENTERING THE RADIOMETER FROM EARTH AND SPACE WAS COMBINED BY THE MIRROR, MODULATED BY THE CHOPPER, PASSED THROUGH THE INTERFERENCE FILTERS, AND FOCUSED ON THE BOLOMETER. THE SIGNAL WAS AMPLIFIED AND SENT EITHER TO THE TELEMETRY SYSTEM FOR DIRECT TRANSMISSION OR TO A RECORDING DEVICE. THE RADIOMETER WAS CALIBRATED IN ORBIT BY A BLACK BODY, AND THE ZERO SIGNAL WAS CHECKED. A THERMISTOR WAS MOUNTED ON THE BOLOMETER CASING TO DETERMINE THE INSTRUMENT TEMPERATURE, WHICH ALLOWED THE DATA TO BE CORRECTED BASED ON THE TEMPERATURE DEPENDENCE OF THE RADIOMETER SENSITIVITY. BLINDS WITH A SET OF DIAPHRAGMS IN FRONT OF THE LENSES WERE USED TO REDUCE THE EFFECT OF LATERAL EXPOSURE. THE HIGH SPATIAL RESOLUTION OF THE RADIOMETER (ABOUT 10 KM AT NADIR) MADE IT POSSIBLE TO OBSERVE THE DETAILS OF THE THERMAL STRUCTURE OF THE CLOUD COVER AND THE EARTH'S SURFACE. UNDER CLOUDLESS CONDITIONS, THE TEMPERATURE OF THE OCEAN SURFACE WAS DETERMINED WITH AN RMS ERROR OF APPROXIMATELY 2 DEG. THE HIGH RESOLUTION OF THE RADIOMETER ALSO MADE IT POSSIBLE TO DETERMINE THE CONTRIBUTION OF THE AEROSOL COMPONENT TO THE TRANSFORMATION OF THE THERMAL RADIATION EMITTED FROM THE EARTH'S SURFACE AND THE LOWER LAYER OF THE ATMOSPHERE. IN ADDITION, THE HEIGHTS OF CLOUD TOPS COULD BE DETERMINED TO AN ACCURACY OF 1 KM, PROVIDED SUFFICIENT INFORMATION ON THE ATTENUATION OF THE CLOUD RADIATION BY THE ATMOSPHERE WAS AVAILABLE. THE EXPERIMENT WAS A SUCCESS AND TERMINATED WHEN THE SATELLITE REENTERED THE EARTH'S ATMOSPHERE ON FEBRUARY 10, 1970.

REFERENCES

613. AND 8CS.

EXPERIMENT NAME- THREE-CHANNEL WIDE-ANGLE RADIOMETERS NSSDC ID 70-005A-03

EXPERIMENT PERSONNEL

PI - G.P. FORAPANOVA SAS-IPA MCSCOW. USSR

OPERATING STATUS- INCPERABLE
CATE LAST USABLE DATA RECORDED- 021C70

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 320 THREE-CHANNEL WIDE-ANGLE RADICMETER EXPERIMENT WAS DESIGNED TO DETERMINE THE GLOBAL DISTRIBUTION OF THE BALANCE BETWEEN INCOMING SOLAR RADIATION AND OUTGCING TERRESTRIAL AND REFLECTED SOLAR RADIATION. THE INSTRUMENTATICN CCNSISTED OF TWC THREE-CHANNEL WIDE-ANGLE (180-DEG) RADIOMETERS THAT WERE PLACED IN SPECIAL CONTAINERS TO PROVIDE OPTICAL AND THERMAL ISOLATICN FRCM THE SATELLITE. THEY WERE MOUNTED ON TELESCOPING BCOMS THAT EXTENDED FROM OPPCSITE SIDES OF THE SATELLITE BASE, WITH ONE DIRECTED TOWARD THE ZENITH AND THE CTHER TOWARD NADIR. EACH RADIOMETER CONTAINED THREE RADIATION THERMOCOUPLES, WHICH MEASURED THE TOTAL RADIATION FLUX IN THE SHORTWAVE (0.3 TO 30 MICRON), NEAR-IR (0.8 TO 3 MICRONS), AND LONGWAVE (3 TC 30 MICRCNS) SPECTRAL BANDS. EACH RADIATION THERMOCOUPLE, IN TURN, CONSISTED OF A XENON-FILLED BALLOON THAT WAS COVERED BY A HEMISPHERICAL FILTER, WITH A RADIATION RECEIVING AREA AND THE THERMOPILES MOUNTED BELOW ON A LEAD BASE. THE FILTERS DETERMINED THE PASSBAND FOR EACH CHANNEL -- A UVIOL-GLASS FILTER FOR THE SHORTWAVE CHANNEL, A NO. 3 IR GLASS FILTER FOR THE NEAR-IR CHANNEL, AND A NO. 5 CRYSTAL FILTER FOR THE LONGWAVE CHANNEL. THE RADIATION RECEIVING AREA WAS DIVIDED INTO TWO SECTIONS -- THE INNER AND CUTER AREAS. THE INNER AREA WAS DISC-SHAPED, WAS COATED WITH BLACK AND WHITE PAINT, AND WAS ATTACHED TC THE HOT THERMOPILE JUNCTIONS. THE OUTER AREA WAS ANNULAR, WAS ALSO COATED WITH BLACK AND WHITE PAINT, BUT WAS ATTACHED TO THE COLD THERMOPILE JUCTIONS. PLATINUM RESISTANCE THERMOMETERS WERE LOCATED NEAR THE COLD JUNCTIONS AND HEMISPHERICAL FILTERS TO MONITOR THEIR TEMPERATURES. THE EARTH-ORIENTED RADICMETER MEASURED OUTGOING TERRESTRIAL AND REFLECTED SOLAR RADIATICN IN ALL THREE CHANNELS, WHILE THE ZENITH-ORIENTED RADIOMETER MEASURED SOLAR RACIATION IN THE LONGWAVE AND SHORTWAVE CHANNELS AND SPACE RADIATION OR CHANNEL NOISE IN THE NEAR-IR CHANNEL. THE EXPERIMENT WAS A SUCCESS AND CBTAINED RELIABLE DATA ON THE EARTH'S RADIATIVE BALANCE. A SIMILAR EXPERIMENT WAS FLOWN ON COSMOS 149.

REFERENCES

805.

EXPERIMENT NAME- TV CAMERA SYSTEM NSSDC ID 70-005A-04

EXPERIMENT PERSONNEL
PI - UNKNOWN SOV. ACAD. OF SCIENCES MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 021C70

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 320 TV CAMERA SYSTEM PRCVIDED CLOUDCCVER AND EARTH PICTURES FOR USE IN ANALYSIS OF THE VARICUS MEASURED QUANTITIES OF THE RADIATION FIELD OF THE EARTH-ATMOSPHERE SYSTEM OBTAINED BY THE CTHER THREE EXPERIMENTS (I.E., A THREE-CHANNEL TELEPHOTCMETER AND A NARROW-ANGLE AND A WIDE-ANGLE RADIOMETER). THE CAMERA, WHICH WAS MOUNTED IN THE LOWER SIDE OF THE DOMED NOSE SECTION, HAD ITS OPTICAL AXIS DIRECTED ALONG NADIR AND PRODUCED TELEVISION PICTURES WITH A 30-DEG FIELD OF VIEW AT NADIR. AT THE SAME TIME, IT GAVE A PICTURE OF THE TRANSITION ZONE BETWEEN THE EARTH'S ATMOSPHERE AND SPACE IN FOUR DIRECTIONS. THIS ALLOWED VISUAL CONTROL OF THE SATELLITE'S ORIENTATION. THE SYSTEM PERFORMED SUCCESSFULLY AND TERMINATED OPERATION WHEN THE SATELLITE REENTERED THE ATMOSPHERE ON FEBRUARY 10, 1970. A SIMILAR

SYSTEM WAS FLOWN ON COSMOS 149

REFERENCES
805.

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SPACECRAFT COMMON NAME- COSMOS 384 NSSDC ID 70-105A
ALTERNATE NAMES- KOSMOS 384

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 12/11/70
APOGEE- 314.000 KM ALT
PERIGEE- 212.000 KM ALT
PERIOD- 89.5 MIN
INCLINATION- 72.88 DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 12/10/70
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 122270

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW. USSR
PS -	UNKNOWN	SOV. ACAD. OF SCIENCES MOSCOW. USSR

SPACECRAFT BRIEF DESCRIPTION
COSMOS 384 WAS THE TWENTY-SECOND RUSSIAN EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE NINTH LAUNCHED FROM THE PLESETSK SITE. ALTHOUGH IT WAS PRIMARILY PART OF THE RECOVERABLE PAYLOAD RECONNAISSANCE SERIES, COSMOS 384 ALSO CARRIED A SUPPLEMENTAL SCIENTIFIC PAYLOAD DESIGNED TO TEST INSTRUMENTS THAT COULD BE USED TO INCREASE THE VIEWING CAPABILITY OF CONVENTIONAL WEATHER SATELLITES AND CONTINUE THE INVESTIGATIONS BEGUN BY COSMOS 243. THE PAYLOAD CONSISTED OF A NARROW-ANGLE, NONSCANNING, IR RADIOMETER THAT MEASURED OUTGOING TERRESTRIAL RADIATION IN THE 10- TO 12-MICRON WINDOW AND FOUR MICROWAVE RADIOMETERS THAT MEASURED OUTGOING TERRESTRIAL THERMAL RADIO (MICROWAVE) EMISSIONS AT 0.8, 1.35, 3.4, AND 8.5 CM. THE IR AND MICROWAVE RADIOMETERS MADE SYNCHRONIZED MEASUREMENTS OF THE VARIOUS BRIGHTNESS TEMPERATURES TO PROVIDE SURFACE AND ATMOSPHERIC CONDITIONS, AS WELL AS CLOUDCOVER PARAMETERS. THE DATA WERE STORED IN A MEMORY DEVICE AND THEN WERE TRANSMITTED BY TELEMETRY AT 19.995 MHZ. THE SATELLITE WAS IN THE FORM OF A CYLINDER WITH HEMISPHERICAL ENDS AND WAS 5 M LONG AND 2.44 M IN DIAMETER. COSMOS 384 REENTERED THE ATMOSPHERE AFTER MORE THAN 11 DAYS IN ORBIT AND WAS RECOVERED. ON DECEMBER 17, 1970, A 2-M-DIAMETER SPHERICAL CAPSULE WAS EJECTED FROM THE SATELLITE AND REMAINED IN ORBIT UNTIL DECEMBER 27, 1970.

REFERENCES
223, AND 805.

EXPERIMENT NAME- MICROWAVE RADIOMETERS NSSDC ID 70-105A-01

EXPERIMENT PERSONNEL

PI - A.E.	BASHARINOV	SAS-IPA	MOSCOW, USSR
OI - A.S.	GURVICH	SAS-IPA	MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 120C70

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 384 MICROWAVE RADIOMETER EXPERIMENT WAS DESIGNED TO MEASURE THE EARTH'S THERMAL RADIO (MICROWAVE) EMISSION WITH THE PURPOSE OF DEVELOPING TECHNIQUES FOR THE DETERMINATION OF THE GEOPHYSICAL PARAMETERS OF THE ATMOSPHERE, CLOUDS, AND THE UNDERLYING SURFACE. IT CONTINUED THE STUDIES BEGUN BY THE COSMOS 243 MICROWAVE EXPERIMENT. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETRIC RECEIVERS TUNED TO FOUR WAVELENGTHS (8.5, 3.4, 1.35, AND 0.8 CM) BY MEANS OF AN ANTENNA SYSTEM WHOSE AXIS POINTED TOWARD NADIR. THE RECEIVERS AND ANTENNAS RESEMBLED GROUND-BASED RADIO TELESCOPES IN DESIGN BUT WERE FULLY AUTOMATED. THE SENSITIVITY OF THE RECEIVERS WAS ABOUT 0.7 DEG K FOR THE 8.5- AND 3.4-CM BANDS AND ABOUT 2 DEG K FOR THE 1.35- AND 0.8-CM BANDS. THE ANTENNAS HAD HALF-POWER DIRECTIONAL PATTERN WIDTHS OF ABOUT 3.5 DEG AT 0.8, 1.35, AND 3.4 CM AND 8.8 DEG AT 8.5 CM. THE REFERENCE SIGNAL IN THE RADIOMETERS WAS THE SPACE BACKGROUND RADIATION, WHICH WAS RECEIVED BY SMALL HORNS DIRECTED TOWARD THE ZENITH. CALIBRATION IN FLIGHT WAS PROVIDED BY SWITCHING THE RADIOMETERS FROM THE ANTENNAS TO A NOISE GENERATOR AT A TEMPERATURE OF ABOUT 300 DEG K, WHICH PROVIDED A ZERO LEVEL CONTROL. THE FINE ADJUSTMENT OF THE RADIOMETER SCALES WAS BASED ON MEASUREMENTS MADE OVER SPECIFIC REFERENCE POINTS WITH KNOWN BRIGHTNESS TEMPERATURES AND ON AVERAGE CLIMATIC DATA. THESE REFERENCE POINTS MADE IT POSSIBLE TO OBTAIN RELATIVE RADIO BRIGHTNESS TEMPERATURES ACCURATE TO WITHIN 1 TO 2 DEG K AND ABSOLUTE RADIO BRIGHTNESS TEMPERATURES TO WITHIN 4 TO 6 DEG K. THE RESULTS OF THE MEASUREMENTS WERE ACCUMULATED IN A RECORDING DEVICE AND WERE TRANSMITTED TO THE GROUND BY RADIO TELEMETRY WHEN THE SATELLITE PASSED OVER THE SOVIET UNION. FOR THE MOST PART, THE RESULTS OF MEASUREMENTS MADE AT 8.5 CM WERE USED TO ESTIMATE THE LATITUDINAL VARIATIONS IN THE THERMODYNAMIC TEMPERATURES OF THE SURFACE OF THE OCEAN, LAND, AND ICE FIELDS. MEASUREMENTS AT 0.8 AND 3.4 CM WERE USED TO ACCOUNT FOR THE EFFECTS OF CLOUD DROPLET AND RAINDROP ABSORPTION ON THE MEASUREMENTS MADE AT 8.5 CM. THE 1.35-CM MEASUREMENTS ACCOUNTED FOR THE ABSORPTION DUE TO WATER VAPOR AND WERE USED TO OBTAIN THE TOTAL ATMOSPHERIC MOISTURE CONTENT OVER THE OCEANS. CHANGES IN RADIO BRIGHTNESS TEMPERATURES IN THE 8.5- AND 3.4-CM BANDS WERE ALSO USED TO DETECT AREAS OF ROUGH SEAS AND TO DELINEATE THE BOUNDARIES OF SEA-ICE FIELDS. THE MEASUREMENTS AT 0.8 CM PROVIDED A UNIQUE SOURCE OF INFORMATION ON THE LATITUDINAL DISTRIBUTION OF CLOUD LIQUID WATER CONTENT (LWC) AND ALLOWED AN ESTIMATE OF THE TOTAL LWC IN THE EARTH'S ATMOSPHERE. THE MAIN ADVANTAGE OF THIS EXPERIMENT WAS THAT THE TOTAL MOISTURE CONTENT OF THE ATMOSPHERE AND THE TEMPERATURE OF THE UNDERLYING SURFACE WERE MEASURED SIMULTANEOUSLY WITH THE CLOUD LWC, THUS PERMITTING THEIR CORRELATION.

REFERENCES

408, 658, AND 805.

EXPERIMENT NAME- NARROW-ANGLE IR RADIOMETER NSSDC ID 70-105A-02

EXPERIMENT PERSONNEL

PI - A.K.	GORODETSKIY	SAS-IPA	MOSCOW, USSR
OI - M.S.	MALKEVICH	SAS-IPA	MOSCOW, USSR

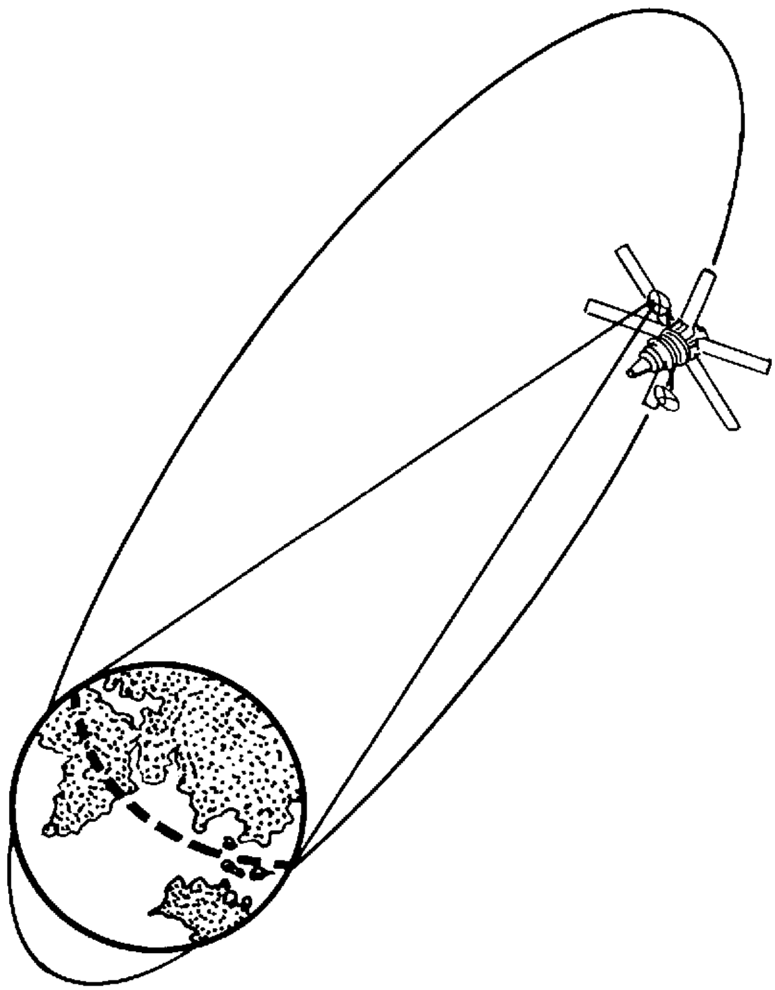
OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 120C70

EXPERIMENT BRIEF DESCRIPTION

THE COSMOS 384 NARROW-ANGLE IR RADIOMETER EXPERIMENT WAS DESIGNED TO DETERMINE SURFACE AND CLOUDTOP TEMPERATURES BY MEASURING THE OUTGOING RADIATION IN THE 10- TO 12-MICRON WINDOW. THE INSTRUMENTATION CONSISTED OF A HIGH-RESOLUTION, NARROW-ANGLE, NONSCANNING IR RADIOMETER WHOSE BASIC PRINCIPLES OF DESIGN AND OPERATION WERE IDENTICAL TO THE RADIOMETERS FLOWN ON COSMOS 149, 243, AND 320. THE MAIN COMPONENTS OF THE RADIOMETER WERE (1) A PARABOLIC MIRROR, (2) A CHOPPER, (3) AN IMPROVED INTERFERENCE FILTER THAT ELIMINATED POSSIBLE EFFECTS FROM WATER VAPOR, CARBON DIOXIDE, AND OZONE ABSORPTION BANDS, (4) A BOLOMETER PLATFORM, (5) A THERMISTOR, AND (6) BLINDS. EARTH AND SPACE RADIATION THAT ENTERED THE RADIOMETER WERE COMBINED BY THE MIRROR, MODULATED BY THE CHOPPER, PASSED THROUGH THE INTERFERENCE FILTER, AND FOCUSED ON THE BOLOMETER. THE SIGNAL WAS AMPLIFIED AND SENT TO A MEMORY DEVICE FOR LATER TRANSMISSION. AN IMPROVEMENT OVER THE COSMOS 149 AND 320 INSTRUMENTS WAS MADE BY CONTROLLING THE AMPLIFICATION FACTOR, WHICH MADE IT POSSIBLE TO INTRODUCE A CORRECTION WHEN A CHANGE IN SENSITIVITY OCCURRED AND THUS INCREASED THE RELIABILITY OF THE MEASURED VALUES. THE THERMISTOR MOUNTED ON THE RADIOMETER CASING MONITORED THE INSTRUMENT TEMPERATURE AND PROVIDED INFORMATION FOR THIS CORRECTION. BLINDS WITH A SET OF DIAPHRAGMS IN FRONT OF THE LENSES WERE USED TO REDUCE THE EFFECT OF LATERAL EXPOSURE. LABORATORY CALIBRATION INDICATED THAT THE RADIOMETER WAS CAPABLE OF MEASURING BRIGHTNESS TEMPERATURES WITH AN ERROR OF 1 TO 2 DEG IN THE 300- TO 250-DEG K RANGE AND 2 TO 4 DEG IN THE 250- TO 220-DEG K RANGE. THE OPTICAL AXIS OF THE RADIOMETER WAS ALIGNED PARALLEL TO THE LOCAL VERTICAL AND WAS DIRECTED TOWARD NADIR. THE RADIOMETER VIEWED SUCCESSIVE RECTANGULAR STRIPS 15 KM WIDE AND 300 KM LONG AS THE SATELLITE PROGRESSED ALONG ITS ORBITAL PATH AT AN ALTITUDE OF ABOUT 300 KM. THE HIGH SPATIAL RESOLUTION MADE IT POSSIBLE TO OBSERVE THE DETAILS OF THE CLOUD COVER'S THERMAL STRUCTURE AND TO DETERMINE THE TEMPERATURE OF THE UNDERLYING SURFACE.

REFERENCES

805.



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MOLNIYA 1 SERIES

2. *Molniya 1 Series*

SPACECRAFT COMMON NAME- MOLNIYA 1C NSSDC ID 66-035A
ALTERNATE NAMES- MOLNIYA 1/3

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/26/66
APOGEE- 39492.0 KM ALT
PERIGEE- 506.000 KM ALT
PERIOD- 710.4 MIN
INCLINATION- 65.04 DEG

OTHER INFORMATION
SPACECRAFT WT- 998. KG
LAUNCH DATE- 04/25/66
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED-

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

MOLNIYA 1C WAS A FIRST-GENERATION RUSSIAN COMMUNICATIONS SATELLITE (COMSAT) ORBITED TO TEST AND PERFECT A SYSTEM OF RADIO COMMUNICATIONS AND TELEVISION BROADCASTING USING EARTH SATELLITES AS ACTIVE TRANSPONDERS AND TO EXPERIMENT WITH THE SYSTEM IN PRACTICAL USE. THE BASIC FUNCTION OF THE SATELLITE WAS TO RELAY TELEVISION PROGRAMS AND LONG-DISTANCE TWO-WAY MULTICHANNEL TELEPHONE, PHOTOTELEPHONE, AND TELEGRAPH LINKS FROM MOSCOW TO THE VARIOUS STANDARD GROUND RECEIVING STATIONS IN THE 'ORBITA' SYSTEM. THE SATELLITE WAS IN THE FORM OF A HERMETICALLY SEALED CYLINDER WITH CONICAL ENDS -- ONE END CONTAINED THE ORBITAL CORRECTING ENGINE AND A SYSTEM OF MICROJETS, AND THE OTHER END CONTAINED EXTERNALLY MOUNTED SOLAR AND EARTH SENSORS. INSIDE THE CYLINDER WERE (1) A HIGH-SENSITIVITY RECEIVER AND THREE 800-MHZ 40-W TRANSMITTERS (ONE OPERATIONAL AND TWO IN RESERVE), (2) TELEMETERING DEVICES THAT MONITORED EQUIPMENT OPERATION, (3) CHEMICAL BATTERIES THAT WERE CONSTANTLY RECHARGED BY SOLAR CELLS, AND (4) AN ELECTRONIC COMPUTER THAT CONTROLLED ALL EQUIPMENT ON BOARD. MOUNTED AROUND THE CENTRAL CYLINDER WERE SIX LARGE SOLAR BATTERY PANELS AND TWO DIRECTIONAL, HIGH-GAIN PARABOLIC AERIALS, 180 DEG APART. ONE OF THE AERIALS WAS DIRECTED CONTINUALLY TOWARD THE EARTH BY THE HIGHLY SENSITIVE EARTH SENSORS. THE SECOND AERIAL WAS HELD IN RESERVE. SIGNALS WERE TRANSMITTED IN A FAIRLY NARROW BEAM ENSURING A STRONG RECEPTION AT THE EARTH'S SURFACE. THE SATELLITE RECEIVED TELEMETRY AT 1000 MHZ. TELEVISION SERVICE WAS PROVIDED IN A FREQUENCY RANGE OF 3.4 TO 4.1 GHZ AT 40 W. MOLNIYA 1C, WHOSE CYLINDRICAL BODY WAS 3.4 M LONG AND 1.6 M IN DIAMETER, WAS MUCH HEAVIER THAN CORRESPONDING U.S. COMSATS, AND IT HAD ABOUT 10 TIMES THE POWER OUTPUT OF THE EARLY BIRD COMSAT. IN ADDITION, IT DID NOT EMPLOY A GEOSYNCHRONOUS EQUATORIAL ORBIT AS HAVE MOST U.S. COMSATS BECAUSE SUCH AN ORBIT WOULD NOT PROVIDE COVERAGE FOR AREAS NORTH OF 70 DEG N LATITUDE. INSTEAD, THE SATELLITE WAS BOOSTED FROM A LOW-ALTITUDE PARKING ORBIT INTO A HIGHLY ELLIPTICAL ORBIT WITH TWO HIGH APOGEES DAILY OVER THE NORTHERN HEMISPHERE -- ONE OVER RUSSIA AND ONE OVER NORTH AMERICA -- AND RELATIVELY LOW PERIGEES OVER THE SOUTHERN HEMISPHERE. DURING ITS APOGEE, MOLNIYA 1C REMAINED RELATIVELY STATIONARY WITH RESPECT TO THE EARTH BELOW FOR NEARLY 8 OF EVERY 12 HR. BY PLACING THREE OR MORE MOLNIYA 1 SATELLITES IN THIS TYPE OF ORBIT, SPACING THEM SUITABLY, AND SHIFTING THEIR ORBITAL PLANES RELATIVE TO EACH OTHER BY 120 DEG, A 24-HR/DAY COMMUNICATION SYSTEM COULD BE OBTAINED. MOLNIYA 1C RELAYED COLOR TV TRANSMISSIONS FROM MOSCOW TO FRANCE IN A TEST OF THE FRENCH-RUSSIAN SECAM-III TELEVISION TRANSMISSION SYSTEM. IN ADDITION, MOLNIYA 1C WAS THE FIRST OF THE SERIES TO CARRY A TELEVISION CAMERA TO TRANSMIT BACK CLOUDCOVER PICTURES. THE CAMERA WAS EXTERNALLY MOUNTED AND WAS

EQUIPPED WITH VARIOUS FILTERS AND INTERCHANGEABLE WIDE- AND NARROW-ANGLE LENSES. FROM ITS HIGH APOGEES OVER THE NORTHERN HEMISPHERE, THE SATELLITE TRANSMITTED DETAILED CLOUDCOVER PICTURES OF THE ENTIRE DISC OF THE EARTH THAT WERE SIMILAR TO THE ATS PICTURES. THESE PICTURES FROM MOLNIYA 1C WERE USED IN CONJUNCTION WITH CLOUDCOVER PICTURES TAKEN BY THE LOWER ORBITING SATELLITES OF THE 'METEOR' WEATHER SATELLITE SYSTEM TO OBTAIN A COMPREHENSIVE AND DETAILED VIEW OF GLOBAL WEATHER SYSTEMS. AS OF MAY 1972, THE SATELLITE REMAINED IN ORBIT.

REFERENCES
137, 221, 223, 263, 353, 377, 560, 718, 797, 856, AND 879.

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SPACECRAFT COMMON NAME- MOLNIYA 1D
ALTERNATE NAMES- MOLNIYA 1/4

NSSDC ID 66-092A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 10/21/66
APOGEE- 39685.0 KM ALT
PERIGEE- 505.000 KM ALT
PERIOD- 714.4 MIN
INCLINATION- 65.35 DEG

OTHER INFORMATION
SPACECRAFT WT- 998. KG
LAUNCH DATE- 10/20/66
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 091168

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION
MOLNIYA 1D WAS A FIRST-GENERATION RUSSIAN COMMUNICATIONS SATELLITE (COMSAT) ORBITED TO TEST AND PERFECT A SYSTEM OF RADIO COMMUNICATIONS AND TELEVISION BROADCASTING USING EARTH SATELLITES AS ACTIVE TRANSPONDERS AND TO EXPERIMENT WITH THE SYSTEM IN PRACTICAL USE. THE BASIC FUNCTION OF THE SATELLITE WAS TO RELAY TELEVISION PROGRAMS AND LONG-DISTANCE TWO-WAY MULTICHANNEL TELEPHONE, PHOTOTELEPHONE, AND TELEGRAPH LINKS FROM MOSCOW TO THE VARIOUS STANDARD GROUND RECEIVING STATIONS IN THE 'ORBITA' SYSTEM. THE SATELLITE WAS IN THE FORM OF A HERMETICALLY SEALED CYLINDER WITH CONICAL ENDS -- ONE END CONTAINED THE ORBITAL CORRECTING ENGINE AND A SYSTEM OF MICROJETS, AND THE OTHER END CONTAINED EXTERNALLY MOUNTED SOLAR AND EARTH SENSORS. INSIDE THE CYLINDER WERE (1) A HIGH-SENSITIVITY RECEIVER AND THREE 800-MHZ 40-W TRANSMITTERS (ONE OPERATIONAL AND TWO IN RESERVE), (2) TELEMETERING DEVICES THAT MONITORED EQUIPMENT OPERATION, (3) CHEMICAL BATTERIES THAT WERE CONSTANTLY RECHARGED BY SOLAR CELLS, AND (4) AN ELECTRONIC COMPUTER THAT CONTROLLED ALL EQUIPMENT ON BOARD. MOUNTED AROUND THE CENTRAL CYLINDER WERE SIX LARGE SOLAR BATTERY PANELS AND TWO DIRECTIONAL, HIGH-GAIN PARABOLIC AERIALS, 180 DEG APART. ONE OF THE AERIALS WAS DIRECTED CONTINUALLY TOWARD THE EARTH BY THE HIGHLY SENSITIVE EARTH SENSORS. THE SECOND AERIAL WAS HELD IN RESERVE. SIGNALS WERE TRANSMITTED IN A FAIRLY NARROW BEAM ENSURING A STRONG RECEPTION AT THE EARTH'S SURFACE. THE SATELLITE RECEIVED TELEMETRY AT 1000 MHZ. TELEVISION SERVICE WAS PROVIDED IN A FREQUENCY RANGE OF 3.4 TO 4.1 GHZ AT 40 W. MOLNIYA 1D, WHOSE CYLINDRICAL BODY WAS 3.4 M LONG AND 1.6 M IN DIAMETER, WAS MUCH HEAVIER THAN

CORRESPONDING U.S. COMSATS, AND IT HAD ABOUT 10 TIMES THE POWER OUTPUT OF THE EARLY BIRD COMSAT. IN ADDITION, IT DID NOT EMPLOY A GEOSYNCHRONOUS EQUATORIAL ORBIT AS HAVE MOST U.S. COMSATS BECAUSE SUCH AN ORBIT WOULD NOT PROVIDE COVERAGE FOR AREAS NORTH OF 70 DEG N LATITUDE. INSTEAD, THE SATELLITE WAS BOOSTED FROM A LOW-ALTITUDE PARKING ORBIT INTO A HIGHLY ELLIPTICAL ORBIT WITH TWO HIGH APOGEES DAILY OVER THE NORTHERN HEMISPHERE -- ONE OVER RUSSIA AND ONE OVER NORTH AMERICA -- AND RELATIVELY LOW PERIGEES OVER THE SOUTHERN HEMISPHERE. DURING ITS APOGEE, MOLNIYA 1D REMAINED RELATIVELY STATIONARY WITH RESPECT TO THE EARTH BELOW FOR NEARLY 8 OF EVERY 12 HR. BY PLACING THREE OR MORE MOLNIYA 1 SATELLITES IN THIS TYPE OF ORBIT, SPACING THEM SUITABLY, AND SHIFTING THEIR ORBITAL PLANES RELATIVE TO EACH OTHER BY 120 DEG, A 24-HR/DAY COMMUNICATION SYSTEM COULD BE OBTAINED. IN ADDITION, MOLNIYA 1D CARRIED AN EXTERNALLY MOUNTED TELEVISION CAMERA EQUIPPED WITH VARIOUS FILTERS AND INTERCHANGEABLE WIDE- AND NARROW-ANGLE LENSES TO SEND BACK DETAILED PICTURES OF LARGE CLOUD SYSTEMS. FROM ITS HIGH APOGEES OVER THE NORTHERN HEMISPHERE, THE SATELLITE TRANSMITTED PICTURES OF THE EARTH'S ENTIRE DISC THAT WERE SIMILAR TO THE ATS PICTURES. THESE PICTURES FROM MOLNIYA 1D WERE USED IN CONJUNCTION WITH CLOUDCOVER PICTURES TAKEN BY THE LOWER ORBITING SATELLITES OF THE COSMOS 'METEOR' WEATHER SATELLITE SYSTEM TO OBTAIN A COMPREHENSIVE AND DETAILED VIEW OF GLOBAL WEATHER SYSTEMS. THE SATELLITE REENTERED THE ATMOSPHERE ON SEPTEMBER 11, 1968, AFTER 692 DAYS IN ORBIT.

REFERENCES

138, 221, 223, 353, 560, 718, 856, AND 879.

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SPACECRAFT COMMON NAME- MOLNIYA 1E   NSSDC ID 67-052A
ALTERNATE NAMES- MOLNIYA 1/5

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 05/25/67
- APOGEE- 39785.0 KM ALT
- PERIGEE- 4[illegible].000 KM ALT
- PERIOD- 715.5 MIN
- INCLINATION- 64.88 DEG

OTHER INFORMATION
- SPACECRAFT WT- 998. KG
- LAUNCH DATE- 05/24/67
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE
- DATA RECORDED- 092671

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

MOLNIYA 1E WAS A FIRST-GENERATION RUSSIAN COMMUNICATIONS SATELLITE (COMSAT) ORBITED TO TEST AND PERFECT A SYSTEM OF RADIO COMMUNICATIONS AND TELEVISION BROADCASTING USING EARTH SATELLITES AS ACTIVE TRANSPONDERS AND TO EXPERIMENT WITH THE SYSTEM IN PRACTICAL USE. THE BASIC FUNCTION OF THE SATELLITE WAS TO RELAY TELEVISION PROGRAMS AND LONG-DISTANCE TWO-WAY MULTICHANNEL TELEPHONE, PHOTOTELEPHONE, AND TELEGRAPH LINKS FROM MOSCOW TO THE VARIOUS STANDARD GROUND RECEIVING STATIONS IN THE 'ORBITA' SYSTEM. THE SATELLITE WAS IN THE FORM OF A HERMETICALLY SEALED CYLINDER WITH CONICAL ENDS -- ONE END CONTAINED THE ORBITAL CORRECTING ENGINE AND A SYSTEM OF

MICROJETS, AND THE OTHER END CONTAINED EXTERNALLY MOUNTED SOLAR AND EARTH SENSORS. INSIDE THE CYLINDER WERE (1) A HIGH-SENSITIVITY RECEIVER AND THREE 800-MHZ 40-W TRANSMITTERS (ONE OPERATIONAL AND TWO IN RESERVE), (2) TELEMETERING DEVICES THAT MONITORED EQUIPMENT OPERATION, (3) CHEMICAL BATTERIES THAT WERE CONSTANTLY RECHARGED BY SOLAR CELLS, AND (4) AN ELECTRONIC COMPUTER THAT CONTROLLED ALL EQUIPMENT ON BOARD. MOUNTED AROUND THE CENTRAL CYLINDER WERE SIX LARGE SOLAR BATTERY PANELS AND TWO DIRECTIONAL, HIGH-GAIN PARABOLIC AERIALS, 180 DEG APART. ONE OF THE AERIALS WAS DIRECTED CONTINUALLY TOWARD THE EARTH BY THE HIGHLY SENSITIVE EARTH SENSORS. THE SECOND AERIAL WAS HELD IN RESERVE. SIGNALS WERE TRANSMITTED IN A FAIRLY NARROW BEAM ENSURING A STRONG RECEPTION AT THE EARTH'S SURFACE. THE SATELLITE RECEIVED TELEMETRY AT 1000 MHZ. TELEVISION SERVICE WAS PROVIDED IN A FREQUENCY RANGE OF 3.4 TO 4.1 GHZ AT 40 W. MOLNIYA 1E, WHOSE CYLINDRICAL BODY WAS 3.4 M LONG AND 1.6 M IN DIAMETER, WAS MUCH HEAVIER THAN CORRESPONDING U.S. COMSATS, AND IT HAD ABOUT 10 TIMES THE POWER OUTPUT OF THE EARLY BIRD COMSAT. IN ADDITION, IT DID NOT EMPLOY A GEOSYNCHRONOUS EQUATORIAL ORBIT AS HAVE MOST U.S. COMSATS BECAUSE SUCH AN ORBIT WOULD NOT PROVIDE COVERAGE FOR AREAS NORTH OF 70 DEG N LATITUDE. INSTEAD, THE SATELLITE WAS BOOSTED FROM A LOW-ALTITUDE PARKING ORBIT INTO A HIGHLY ELLIPTICAL ORBIT WITH TWO HIGH APOGEES DAILY OVER THE NORTHERN HEMISPHERE -- ONE OVER RUSSIA AND ONE OVER NORTH AMERICA -- AND RELATIVELY LOW PERIGEES OVER THE SOUTHERN HEMISPHERE. DURING ITS APOGEE, MOLNIYA 1E REMAINED RELATIVELY STATIONARY WITH RESPECT TO THE EARTH BELOW FOR NEARLY 8 OF EVERY 12 HR. BY PLACING THREE OR MORE MOLNIYA 1 SATELLITES IN THIS TYPE OF ORBIT, SPACING THEM SUITABLY, AND SHIFTING THEIR ORBITAL PLANES RELATIVE TO EACH OTHER BY 120 DEG, A 24-HR/DAY COMMUNICATION SYSTEM COULD BE OBTAINED. IN ADDITION, MOLNIYA 1E CARRIED AN EXTERNALLY MOUNTED TELEVISION CAMERA EQUIPPED WITH VARIOUS FILTERS AND INTERCHANGEABLE WIDE- AND NARROW-ANGLE LENSES TO SEND BACK DETAILED PICTURES OF LARGE CLOUD SYSTEMS. FROM ITS HIGH APOGEES OVER THE NORTHERN HEMISPHERE, THE SATELLITE TRANSMITTED PICTURES OF THE EARTH'S ENTIRE DISC THAT WERE SIMILAR TO THE ATS PICTURES. THESE PICTURES FROM MOLNIYA 1E WERE USED IN CONJUNCTION WITH CLOUDCOVER PICTURES TAKEN BY THE LOWER ORBITING SATELLITES OF THE 'METEOR' WEATHER SATELLITE SYSTEM TO OBTAIN A COMPREHENSIVE AND DETAILED VIEW OF GLOBAL WEATHER SYSTEMS. THE SATELLITE REENTERED THE ATMOSPHERE ON SEPTEMBER 26, 1971.

REFERENCES
137, 221, 239, 264, 353, 560, 856, 873, AND 879.

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SPACECRAFT COMMON NAME- MOLNIYA 1F   NSSDC ID 67-095A
ALTERNATE NAMES- MOLNIYA 1/6

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 10/05/67
APOGEE- 39868.0 KM ALT
PERIGEE- 502.000 KM ALT
PERIOD- 718. MIN
INCLINATION- 64.96 DEG

OTHER INFORMATION
SPACECRAFT WT- 998. KG
LAUNCH DATE- 10/03/67
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 030469

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

MOLNIYA 1F WAS A FIRST-GENERATION RUSSIAN COMMUNICATIONS SATELLITE (COMSAT) ORBITED TO TEST AND PERFECT A SYSTEM OF RADIO COMMUNICATIONS AND TELEVISION BROADCASTING USING EARTH SATELLITES AS ACTIVE TRANSPONDERS AND TO EXPERIMENT WITH THE SYSTEM IN PRACTICAL USE. THE BASIC FUNCTION OF THE SATELLITE WAS TO RELAY TELEVISION PROGRAMS AND LONG-DISTANCE TWO-WAY MULTICHANNEL TELEPHONE, PHOTOTELEPHONE, AND TELEGRAPH LINKS FROM MOSCOW TO THE VARIOUS STANDARD GROUND RECEIVING STATIONS IN THE 'ORBITA' SYSTEM. THE SATELLITE WAS IN THE FORM OF A HERMETICALLY SEALED CYLINDER WITH CONICAL ENDS -- ONE END CONTAINED THE ORBITAL CORRECTING ENGINE AND A SYSTEM OF MICROJETS, AND THE OTHER END CONTAINED EXTERNALLY MOUNTED SOLAR AND EARTH SENSORS. INSIDE THE CYLINDER WERE (1) A HIGH-SENSITIVITY RECEIVER AND THREE 800-MHZ 40-W TRANSMITTERS (ONE OPERATIONAL AND TWO IN RESERVE), (2) TELEMETERING DEVICES THAT MONITORED EQUIPMENT OPERATION, (3) CHEMICAL BATTERIES THAT WERE CONSTANTLY RECHARGED BY SOLAR CELLS, AND (4) AN ELECTRONIC COMPUTER THAT CONTROLLED ALL EQUIPMENT ON BOARD. MOUNTED AROUND THE CENTRAL CYLINDER WERE SIX LARGE SOLAR BATTERY PANELS AND TWO DIRECTIONAL, HIGH-GAIN PARABOLIC AERIALS, 180 DEG APART. ONE OF THE AERIALS WAS DIRECTED CONTINUALLY TOWARD THE EARTH BY THE HIGHLY SENSITIVE EARTH SENSORS. THE SECOND AERIAL WAS HELD IN RESERVE. SIGNALS WERE TRANSMITTED IN A FAIRLY NARROW BEAM ENSURING A STRONG RECEPTION AT THE EARTH'S SURFACE. THE SATELLITE RECEIVED TELEMETRY AT 1000 MHZ. TELEVISION SERVICE WAS PROVIDED IN A FREQUENCY RANGE OF 3.4 TO 4.1 GHZ AT 40 W. MOLNIYA 1F, WHOSE CYLINDRICAL BODY WAS 3.4 M LONG AND 1.6 M IN DIAMETER, WAS MUCH HEAVIER THAN CORRESPONDING U.S. COMSATS, AND IT HAD ABOUT 10 TIMES THE POWER OUTPUT OF THE EARLY BIRD COMSAT. IN ADDITION, IT DID NOT EMPLOY A GEOSYNCHRONOUS EQUATORIAL ORBIT AS HAVE MOST U.S. COMSATS BECAUSE SUCH AN ORBIT WOULD NOT PROVIDE COVERAGE FOR AREAS NORTH OF 70 DEG N LATITUDE. INSTEAD, THE SATELLITE WAS BOOSTED FROM A LOW-ALTITUDE PARKING ORBIT INTO A HIGHLY ELLIPTICAL ORBIT WITH TWO HIGH APOGEES DAILY OVER THE NORTHERN HEMISPHERE -- ONE OVER RUSSIA AND ONE OVER NORTH AMERICA -- AND RELATIVELY LOW PERIGEES OVER THE SOUTHERN HEMISPHERE. DURING ITS APOGEE, MOLNIYA 1F REMAINED RELATIVELY STATIONARY WITH RESPECT TO THE EARTH BELOW FOR NEARLY 8 OF EVERY 12 HR. BY PLACING THREE OR MORE MOLNIYA 1 SATELLITES IN THIS TYPE OF ORBIT, SPACING THEM SUITABLY, AND SHIFTING THEIR ORBITAL PLANES RELATIVE TO EACH OTHER BY 120 DEG, A 24-HR/DAY COMMUNICATION SYSTEM COULD BE OBTAINED. IN ADDITION, MOLNIYA 1F CARRIED AN EXTERNALLY MOUNTED TELEVISION CAMERA EQUIPPED WITH VARIOUS FILTERS AND INTERCHANGEABLE WIDE- AND NARROW-ANGLE LENSES TO SEND BACK DETAILED PICTURES OF LARGE CLOUD SYSTEMS. FROM ITS HIGH APOGEES OVER THE NORTHERN HEMISPHERE, THE SATELLITE TRANSMITTED PICTURES OF THE EARTH'S ENTIRE DISC THAT WERE SIMILAR TO THE ATS PICTURES. THESE PICTURES FROM MOLNIYA 1F WERE USED IN CONJUNCTION WITH CLOUDCOVER PICTURES TAKEN BY THE LOWER ORBITING SATELLITES OF THE 'METEOR' WEATHER SATELLITE SYSTEM TO OBTAIN A COMPREHENSIVE AND DETAILED VIEW OF GLOBAL WEATHER SYSTEMS. THE SATELLITE REENTERED THE ATMOSPHERE ON MARCH 4, 1969, AFTER 518 DAYS IN ORBIT.

REFERENCES

221, 268, 560, AND 879.

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SPACECRAFT COMMON NAME- MOLNIYA 1G
ALTERNATE NAMES- MOLNIYA 1/7

NSSDC ID 67-101A

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 10/22/67
APOGEE- 39710.0 KM ALT
PERIGEE- 508.000 KM ALT
PERIOD- 715. MIN
INCLINATION- 65. DEG

OTHER INFORMATION
SPACECRAFT WT- 998. KG
LAUNCH DATE- 10/22/67
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 123169

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

MOLNIYA 1G WAS A FIRST-GENERATION RUSSIAN COMMUNICATIONS SATELLITE (COMSAT) ORBITED TO TEST AND PERFECT A SYSTEM OF RADIO COMMUNICATIONS AND TELEVISION BROADCASTING USING EARTH SATELLITES AS ACTIVE TRANSPONDERS AND TO EXPERIMENT WITH THE SYSTEM IN PRACTICAL USE. THE BASIC FUNCTION OF THE SATELLITE WAS TO RELAY TELEVISION PROGRAMS AND LONG-DISTANCE TWO-WAY MULTICHANNEL TELEPHONE, PHOTOTELEPHONE, AND TELEGRAPH LINKS FROM MOSCOW TO THE VARIOUS STANDARD GROUND RECEIVING STATIONS IN THE 'ORBITA' SYSTEM. THE SATELLITE WAS IN THE FORM OF A HERMETICALLY SEALED CYLINDER WITH CONICAL ENDS -- ONE END CONTAINED THE ORBITAL CORRECTING ENGINE AND A SYSTEM OF MICROJETS, AND THE OTHER END CONTAINED EXTERNALLY MOUNTED SOLAR AND EARTH SENSORS. INSIDE THE CYLINDER WERE (1) A HIGH-SENSITIVITY RECEIVER AND THREE 800-MHZ 40-W TRANSMITTERS (ONE OPERATIONAL AND TWO IN RESERVE), (2) TELEMETERING DEVICES THAT MONITORED EQUIPMENT OPERATION, (3) CHEMICAL BATTERIES THAT WERE CONSTANTLY RECHARGED BY SOLAR CELLS, AND (4) AN ELECTRONIC COMPUTER THAT CONTROLLED ALL EQUIPMENT ON BOARD. MOUNTED AROUND THE CENTRAL CYLINDER WERE SIX LARGE SOLAR BATTERY PANELS AND TWO DIRECTIONAL, HIGH-GAIN PARABOLIC AERIALS, 180 DEG APART. ONE OF THE AERIALS WAS DIRECTED CONTINUALLY TOWARD THE EARTH BY THE HIGHLY SENSITIVE EARTH SENSORS. THE SECOND AERIAL WAS HELD IN RESERVE. SIGNALS WERE TRANSMITTED IN A FAIRLY NARROW BEAM ENSURING A STRONG RECEPTION AT THE EARTH'S SURFACE. THE SATELLITE RECEIVED TELEMETRY AT 1000 MHZ. TELEVISION SERVICE WAS PROVIDED IN A FREQUENCY RANGE OF 3.4 TO 4.1 GHZ AT 40 W. MOLNIYA 1G, WHOSE CYLINDRICAL BODY WAS 3.4 M LONG AND 1.6 M IN DIAMETER, WAS MUCH HEAVIER THAN CORRESPONDING U.S. COMSATS, AND IT HAD ABOUT 10 TIMES THE POWER OUTPUT OF THE EARLY BIRD COMSAT. IN ADDITION, IT DID NOT EMPLOY A GEOSYNCHRONOUS EQUATORIAL ORBIT AS HAVE MOST U.S. COMSATS BECAUSE SUCH AN ORBIT WOULD NOT PROVIDE COVERAGE FOR AREAS NORTH OF 70 DEG N LATITUDE. INSTEAD, THE SATELLITE WAS BOOSTED FROM A LOW-ALTITUDE PARKING ORBIT INTO A HIGHLY ELLIPTICAL ORBIT WITH TWO HIGH APOGEES DAILY OVER THE NORTHERN HEMISPHERE -- ONE OVER RUSSIA AND ONE OVER NORTH AMERICA -- AND RELATIVELY LOW PERIGEES OVER THE SOUTHERN HEMISPHERE. DURING ITS APOGEE, MOLNIYA 1G REMAINED RELATIVELY STATIONARY WITH RESPECT TO THE EARTH BELOW FOR NEARLY 8 OF EVERY 12 HR. BY PLACING THREE OR MORE MOLNIYA 1 SATELLITES IN THIS TYPE OF ORBIT, SPACING THEM SUITABLY, AND SHIFTING THEIR ORBITAL PLANES RELATIVE TO EACH OTHER BY 120 DEG, A 24-HR/DAY COMMUNICATION SYSTEM COULD BE OBTAINED. IN ADDITION, MOLNIYA 1G CARRIED AN EXTERNALLY MOUNTED TELEVISION CAMERA EQUIPPED WITH VARIOUS FILTERS AND INTERCHANGEABLE WIDE- AND NARROW-ANGLE LENSES TO SEND BACK DETAILED PICTURES OF LARGE CLOUD SYSTEMS. FROM ITS HIGH APOGEES OVER THE NORTHERN HEMISPHERE, THE SATELLITE TRANSMITTED PICTURES OF THE EARTH'S ENTIRE DISC THAT WERE SIMILAR TO THE ATS PICTURES. THESE

PICTURES FROM MOLNIYA 1G WERE USED IN CONJUNCTION WITH CLOUDCOVER PICTURES TAKEN BY THE LOWER ORBITING SATELLITES OF THE 'METEOR' WEATHER SATELLITE SYSTEM TO OBTAIN A COMPREHENSIVE AND DETAILED VIEW OF GLOBAL WEATHER SYSTEMS. THE SATELLITE REENTERED THE ATMOSPHERE ON DECEMBER 31, 1969, AFTER 801 DAYS IN ORBIT.

REFERENCES

221, 268, 560, AND 879.

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SPACECRAFT COMMON NAME- MOLNIYA 1H — NSSDC ID 68-035A

ALTERNATE NAMES- MOLNIYA 1/8

ORBITAL INFORMATION

ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/29/68
APOGEE- 39738.0 KM ALT
PERIGEE- 391.000 KM ALT
PERIOD- 713.1 MIN
INCLINATION- 64.85 DEG

OTHER INFORMATION

SPACECRAFT WT- 998. KG
LAUNCH DATE- 04/21/68
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 080069

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

MOLNIYA 1H WAS A FIRST-GENERATION RUSSIAN COMMUNICATIONS SATELLITE (COMSAT) ORBITED TO TEST AND PERFECT A SYSTEM OF RADIO COMMUNICATIONS AND TELEVISION BROADCASTING USING EARTH SATELLITES AS ACTIVE TRANSPONDERS AND TO EXPERIMENT WITH THE SYSTEM IN PRACTICAL USE. THE BASIC FUNCTION OF THE SATELLITE WAS TO RELAY TELEVISION PROGRAMS AND LONG-DISTANCE TWO-WAY MULTICHANNEL TELEPHONE, PHOTOTELEPHONE, AND TELEGRAPH LINKS FROM MOSCOW TO THE VARIOUS STANDARD GROUND RECEIVING STATIONS IN THE 'ORBITA' SYSTEM. THE SATELLITE WAS IN THE FORM OF A HERMETICALLY SEALED CYLINDER WITH CONICAL ENDS -- ONE END CONTAINED THE ORBITAL CORRECTING ENGINE AND A SYSTEM OF MICROJETS, AND THE OTHER END CONTAINED EXTERNALLY MOUNTED SOLAR AND EARTH SENSORS. INSIDE THE CYLINDER WERE (1) A HIGH-SENSITIVITY RECEIVER AND THREE 800-MHZ 40-W TRANSMITTERS (ONE OPERATIONAL AND TWO IN RESERVE), (2) TELEMETERING DEVICES THAT MONITORED EQUIPMENT OPERATION, (3) CHEMICAL BATTERIES THAT WERE CONSTANTLY RECHARGED BY SOLAR CELLS, AND (4) AN ELECTRONIC COMPUTER THAT CONTROLLED ALL EQUIPMENT ON BOARD. MOUNTED AROUND THE CENTRAL CYLINDER WERE SIX LARGE SOLAR BATTERY PANELS AND TWO DIRECTIONAL, HIGH-GAIN PARABOLIC AERIALS, 180 DEG APART. ONE OF THE AERIALS WAS DIRECTED CONTINUALLY TOWARD THE EARTH BY THE HIGHLY SENSITIVE EARTH SENSORS. THE SECOND AERIAL WAS HELD IN RESERVE. SIGNALS WERE TRANSMITTED IN A FAIRLY NARROW BEAM ENSURING A STRONG RECEPTION AT THE EARTH'S SURFACE. THE SATELLITE RECEIVED TELEMETRY AT 1000 MHZ. TELEVISION SERVICE WAS PROVIDED IN A FREQUENCY RANGE OF 3.4 TO 4.1 GHZ AT 40 W. MOLNIYA 1H, WHOSE CYLINDRICAL BODY WAS 3.4 M LONG AND 1.6 M IN DIAMETER, WAS MUCH HEAVIER THAN CORRESPONDING U.S. COMSATS, AND IT HAD ABOUT 10 TIMES THE POWER OUTPUT OF THE EARLY BIRD COMSAT. IN ADDITION, IT DID NOT EMPLOY A GEOSYNCHRONOUS EQUATORIAL ORBIT AS HAVE MOST U.S. COMSATS BECAUSE SUCH AN ORBIT WOULD NOT

PROVIDE COVERAGE FOR AREAS NORTH OF 70 DEG N LATITUDE. INSTEAD, THE SATELLITE WAS BOOSTED FROM A LOW-ALTITUDE PARKING ORBIT INTO A HIGHLY ELLIPTICAL ORBIT WITH TWO HIGH APOGEES DAILY OVER THE NORTHERN HEMISPHERE -- ONE OVER RUSSIA AND ONE OVER NORTH AMERICA -- AND RELATIVELY LOW PERIGEES OVER THE SOUTHERN HEMISPHERE. DURING ITS APOGEE, MOLNIYA 1H REMAINED RELATIVELY STATIONARY WITH RESPECT TO THE EARTH BELOW FOR NEARLY 8 OF EVERY 12 HR. BY PLACING THREE OR MORE MOLNIYA 1 SATELLITES IN THIS TYPE OF ORBIT, SPACING THEM SUITABLY, AND SHIFTING THEIR ORBITAL PLANES RELATIVE TO EACH OTHER BY 120 DEG, A 24-HR/DAY COMMUNICATION SYSTEM COULD BE OBTAINED. IN ADDITION, MOLNIYA 1H CARRIED AN EXTERNALLY MOUNTED TELEVISION CAMERA EQUIPPED WITH VARIOUS FILTERS AND INTERCHANGEABLE WIDE- AND NARROW-ANGLE LENSES TO SEND BACK DETAILED PICTURES OF LARGE CLOUD SYSTEMS. FROM ITS HIGH APOGEES OVER THE NORTHERN HEMISPHERE, THE SATELLITE TRANSMITTED PICTURES OF THE EARTH'S ENTIRE DISC THAT WERE SIMILAR TO THE ATS PICTURES. THESE PICTURES FROM MOLNIYA 1H WERE USED IN CONJUNCTION WITH CLOUDCOVER PICTURES TAKEN BY THE LOWER ORBITING SATELLITES OF THE 'METEOR' WEATHER SATELLITE SYSTEM TO OBTAIN A COMPREHENSIVE AND DETAILED VIEW OF GLOBAL WEATHER SYSTEMS. THE SATELLITE PROBABLY CEASED TRANSMITTING IN AUGUST 1969. HOWEVER, AS OF MAY 8, 1972, IT STILL REMAINED IN ORBIT.

REFERENCES

221, 262, 266, 560, AND 879.

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SPACECRAFT COMMON NAME- MOLNIYA 1J　　　　NSSDC ID 68-057A

ALTERNATE NAMES- MOLNIYA 1/9

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 07/07/68
- APOGEE- 39803.0 KM ALT
- PERIGEE- 401.000 KM ALT
- PERIOD- 713.8 MIN
- INCLINATION- 65.05 DEG

OTHER INFORMATION
- SPACECRAFT WT- 998. KG
- LAUNCH DATE- 07/05/68
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE DATA RECORDED- 051771

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

MOLNIYA 1J WAS A FIRST-GENERATION RUSSIAN COMMUNICATIONS SATELLITE (COMSAT) ORBITED TO TEST AND PERFECT A SYSTEM OF RADIO COMMUNICATIONS AND TELEVISION BROADCASTING USING EARTH SATELLITES AS ACTIVE TRANSPONDERS AND TO EXPERIMENT WITH THE SYSTEM IN PRACTICAL USE. THE BASIC FUNCTION OF THE SATELLITE WAS TO RELAY TELEVISION PROGRAMS AND LONG-DISTANCE TWO-WAY MULTICHANNEL TELEPHONE, PHOTOTELEPHONE, AND TELEGRAPH LINKS FROM MOSCOW TO THE VARIOUS STANDARD GROUND RECEIVING STATIONS IN THE 'ORBITA' SYSTEM. THE SATELLITE WAS IN THE FORM OF A HERMETICALLY SEALED CYLINDER WITH CONICAL ENDS -- ONE END CONTAINED THE ORBITAL CORRECTING ENGINE AND A SYSTEM OF MICROJETS, AND THE OTHER END CONTAINED EXTERNALLY MOUNTED SOLAR AND EARTH SENSORS. INSIDE THE CYLINDER WERE (1) A HIGH-SENSITIVITY RECEIVER AND THREE 800-MHZ 40-W TRANSMITTERS (ONE OPERATIONAL AND TWO IN RESERVE), (2)

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TELEMETERING DEVICES THAT MONITORED EQUIPMENT OPERATION, (3) CHEMICAL BATTERIES THAT WERE CONSTANTLY RECHARGED BY SOLAR CELLS, AND (4) AN ELECTRONIC COMPUTER THAT CONTROLLED ALL EQUIPMENT ON BOARD. MOUNTED AROUND THE CENTRAL CYLINDER WERE SIX LARGE SOLAR BATTERY PANELS AND TWO DIRECTIONAL, HIGH-GAIN PARABOLIC AERIALS, 180 DEG APART. ONE OF THE AERIALS WAS DIRECTED CONTINUALLY TOWARD THE EARTH BY THE HIGHLY SENSITIVE EARTH SENSORS. THE SECOND AERIAL WAS HELD IN RESERVE. SIGNALS WERE TRANSMITTED IN A FAIRLY NARROW BEAM ENSURING A STRONG RECEPTION AT THE EARTH'S SURFACE. THE SATELLITE RECEIVED TELEMETRY AT 1000 MHZ. TELEVISION SERVICE WAS PROVIDED IN A FREQUENCY RANGE OF 3.4 TO 4.1 GHZ AT 40 W. MOLNIYA 1J, WHOSE CYLINDRICAL BODY WAS 3.4 M LONG AND 1.6 M IN DIAMETER, WAS MUCH HEAVIER THAN CORRESPONDING U.S. COMSATS, AND IT HAD ABOUT 10 TIMES THE POWER OUTPUT OF THE EARLY BIRD COMSAT. IN ADDITION, IT DID NOT EMPLOY A GEOSYNCHRONOUS EQUATORIAL ORBIT AS HAVE MOST U.S. COMSATS BECAUSE SUCH AN ORBIT WOULD NOT PROVIDE COVERAGE FOR AREAS NORTH OF 70 DEG N LATITUDE. INSTEAD, THE SATELLITE WAS BOOSTED FROM A LOW-ALTITUDE PARKING ORBIT INTO A HIGHLY ELLIPTICAL ORBIT WITH TWO HIGH APOGEES DAILY OVER THE NORTHERN HEMISPHERE -- ONE OVER RUSSIA AND ONE OVER NORTH AMERICA -- AND RELATIVELY LOW PERIGEES OVER THE SOUTHERN HEMISPHERE. DURING ITS APOGEE, MOLNIYA 1J REMAINED RELATIVELY STATIONARY WITH RESPECT TO THE EARTH BELOW FOR NEARLY 8 OF EVERY 12 HR. BY PLACING THREE OR MORE MOLNIYA 1 SATELLITES IN THIS TYPE OF ORBIT, SPACING THEM SUITABLY, AND SHIFTING THEIR ORBITAL PLANES RELATIVE TO EACH OTHER BY 120 DEG, A 24-HR/DAY COMMUNICATION SYSTEM COULD BE OBTAINED. IN ADDITION, MOLNIYA 1J CARRIED AN EXTERNALLY MOUNTED TELEVISION CAMERA EQUIPPED WITH VARIOUS FILTERS AND INTERCHANGEABLE WIDE- AND NARROW-ANGLE LENSES TO SEND BACK DETAILED PICTURES OF LARGE CLOUD SYSTEMS. FROM ITS HIGH APOGEES OVER THE NORTHERN HEMISPHERE, THE SATELLITE TRANSMITTED PICTURES OF THE EARTH'S ENTIRE DISC THAT WERE SIMILAR TO THE ATS PICTURES. THESE PICTURES FROM MOLNIYA 1J WERE USED IN CONJUNCTION WITH CLOUDCOVER PICTURES TAKEN BY THE LOWER ORBITING SATELLITES OF THE 'METEOR' WEATHER SATELLITE SYSTEM TO OBTAIN A DETAILED AND COMPREHENSIVE VIEW OF GLOBAL WEATHER SYSTEMS. THE SATELLITE REENTERED THE ATMOSPHERE ON MAY 15, 1971, AFTER 1044 DAYS IN ORBIT.

REFERENCES

221, 266, 560, AND 879.

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SPACECRAFT COMMON NAME- MOLNIYA 1K NSSDC ID 68-085A
ALTERNATE NAMES- MOLNIYA 1/10

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 11/17/68
APOGEE- 39909.0 KM ALT
PERIGEE- 466.000 KM ALT
PERIOD- 718.2 MIN
INCLINATION- 65.03 DEG

OTHER INFORMATION
SPACECRAFT WT- 998. KG
LAUNCH DATE- 10/05/68
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
02/00/70

SPACECRAFT PERSONNEL
PM - UNKNOWN UNKNOWN

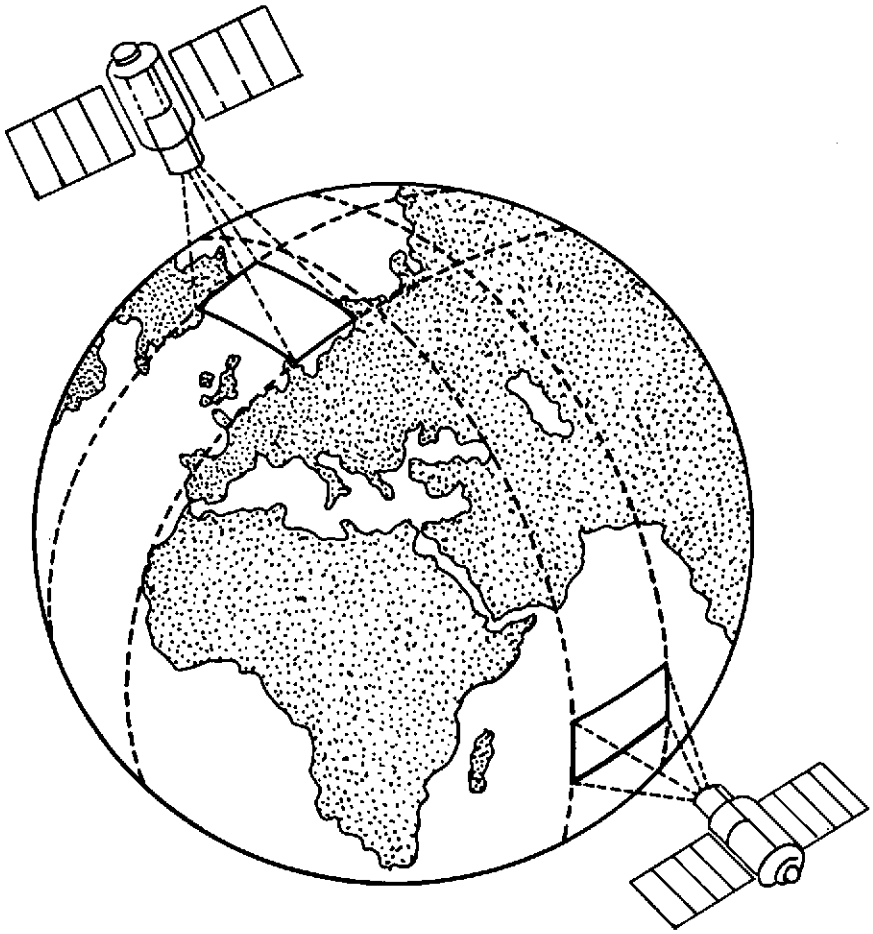
PS - UNKNOWN UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

MOLNIYA 1K WAS A FIRST-GENERATION RUSSIAN COMMUNICATIONS SATELLITE (COMSAT) ORBITED TO TEST AND PERFECT A SYSTEM OF RADIO COMMUNICATIONS AND TELEVISION BROADCASTING USING EARTH SATELLITES AS ACTIVE TRANSPONDERS AND TO EXPERIMENT WITH THE SYSTEM IN PRACTICAL USE. THE BASIC FUNCTION OF THE SATELLITE WAS TO RELAY TELEVISION PROGRAMS AND LONG-DISTANCE TWO-WAY MULTICHANNEL TELEPHONE, PHOTOTELEPHONE, AND TELEGRAPH LINKS FROM MOSCOW TO THE VARIOUS STANDARD GROUND RECEIVING STATIONS IN THE 'ORBITA' SYSTEM. THE SATELLITE WAS IN THE FORM OF A HERMETICALLY SEALED CYLINDER WITH CONICAL ENDS -- ONE END CONTAINED THE ORBITAL CORRECTING ENGINE AND A SYSTEM OF MICROJETS, AND THE OTHER END CONTAINED EXTERNALLY MOUNTED SOLAR AND EARTH SENSORS. INSIDE THE CYLINDER WERE (1) A HIGH-SENSITIVITY RECEIVER AND THREE 800-MHZ 40-W TRANSMITTERS (ONE OPERATIONAL AND TWO IN RESERVE), (2) TELEMETERING DEVICES THAT MONITORED EQUIPMENT OPERATION, (3) CHEMICAL BATTERIES THAT WERE CONSTANTLY RECHARGED BY SOLAR CELLS, AND (4) AN ELECTRONIC COMPUTER THAT CONTROLLED ALL EQUIPMENT ON BOARD. MOUNTED AROUND THE CENTRAL CYLINDER WERE SIX LARGE SOLAR BATTERY PANELS AND TWO DIRECTIONAL, HIGH-GAIN PARABOLIC AERIALS, 180 DEG APART. ONE OF THE AERIALS WAS DIRECTED CONTINUALLY TOWARD THE EARTH BY THE HIGHLY SENSITIVE EARTH SENSORS. THE SECOND AERIAL WAS HELD IN RESERVE. SIGNALS WERE TRANSMITTED IN A FAIRLY NARROW BEAM ENSURING A STRONG RECEPTION AT THE EARTH'S SURFACE. THE SATELLITE RECEIVED TELEMETRY AT 1000 MHZ. TELEVISION SERVICE WAS PROVIDED IN A FREQUENCY RANGE OF 3.4 TO 4.1 GHZ AT 40 W. MOLNIYA 1K, WHOSE CYLINDRICAL BODY WAS 3.4 M LONG AND 1.6 M IN DIAMETER, WAS MUCH HEAVIER THAN CORRESPONDING U.S. COMSATS, AND IT HAD ABOUT 10 TIMES THE POWER OUTPUT OF THE EARLY BIRD COMSAT. IN ADDITION, IT DID NOT EMPLOY A GEOSYNCHRONOUS EQUATORIAL ORBIT AS HAVE MOST U.S. COMSATS BECAUSE SUCH AN ORBIT WOULD NOT PROVIDE COVERAGE FOR AREAS NORTH OF 70 DEG N LATITUDE. INSTEAD, THE SATELLITE WAS BOOSTED FROM A LOW-ALTITUDE PARKING ORBIT INTO A HIGHLY ELLIPTICAL ORBIT WITH TWO HIGH APOGEES DAILY OVER THE NORTHERN HEMISPHERE -- ONE OVER RUSSIA AND ONE OVER NORTH AMERICA -- AND RELATIVELY LOW PERIGEES OVER THE SOUTHERN HEMISPHERE. DURING ITS APOGEE, MOLNIYA 1K REMAINED RELATIVELY STATIONARY WITH RESPECT TO THE EARTH BELOW FOR NEARLY 8 OF EVERY 12 HR. BY PLACING THREE OR MORE MOLNIYA 1 SATELLITES IN THIS TYPE OF ORBIT, SPACING THEM SUITABLY, AND SHIFTING THEIR ORBITAL PLANES RELATIVE TO EACH OTHER BY 120 DEG, A 24-HR/DAY COMMUNICATION SYSTEM COULD BE OBTAINED. IN ADDITION, MOLNIYA 1K CARRIED AN EXTERNALLY MOUNTED TELEVISION CAMERA EQUIPPED WITH VARIOUS FILTERS AND INTERCHANGEABLE WIDE- AND NARROW-ANGLE LENSES TO SEND BACK DETAILED PICTURES OF LARGE CLOUD SYSTEMS. FROM ITS HIGH APOGEES OVER THE NORTHERN HEMISPHERE, THE SATELLITE TRANSMITTED PICTURES OF THE EARTH'S ENTIRE DISC THAT WERE SIMILAR TO THE ATS PICTURES. THESE PICTURES FROM MOLNIYA 1K WERE USED IN CONJUNCTION WITH CLOUDCOVER PICTURES TAKEN BY THE LOWER ORBITING SATELLITES OF THE 'METEOR' WEATHER SATELLITE SYSTEM TO OBTAIN A DETAILED AND COMPREHENSIVE VIEW OF GLOBAL WEATHER SYSTEMS. THE SATELLITE PROBABLY CEASED TRANSMITTING IN FEBRUARY 1970. HOWEVER, AS OF MAY 1972, IT REMAINED IN ORBIT.

REFERENCES

221, 266, 287, 560, 872, AND 879.



METEOR SERIES

3. Meteor Series

SPACECRAFT COMMON NAME- METEOR 1 NSSDC ID 69-029A
ALTERNATE NAMES- METEORA 1

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 03/30/69
APOGEE- 687.000 KM ALT
PERIGEE- 633.000 KM ALT
PERIOD- 97.96 MIN
INCLINATION- 81.2 DEG

OTHER INFORMATION
SPACECRAFT WT- 1400. KG
LAUNCH DATE- 03/26/69
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 070070

SPACECRAFT PERSONNEL
PM - UNKNOWN SOV. HYDROMET. SERVICE MOSCOW, USSR
PS - UNKNOWN SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 1 WAS THE FIRST FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE NINTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. METEOR 1 WAS EQUIPPED WITH TWO VIDICON CAMERAS FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AND AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 1 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH APPROXIMATELY EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED BY METEOR 1 WERE TRANSMITTED DIRECTLY TO THE GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, OR VLADIVOSTOK. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 1 RECORDED THE TV AND IR PICTURES AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. IT IS BELIEVED THE SATELLITE TERMINATED OPERATIONS IN JULY 1970 WHEN THE TRANSMISSIONS OF VIDEO AND IR DATA FROM MOSCOW TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK CEASED.

REFERENCES

222, 225, 375, 575, 634, 635, AND 830.

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EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 69-029A-01

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 070170

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 1 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 1 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 1 SATELLITE (659 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE RECEIVED AT NESS WITHOUT INTERRUPTION FROM MARCH 28, 1969, THROUGH FEBRUARY 12, 1970, AND THEN AGAIN ON JULY 1, 1970, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS WERE TERMINATED. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

199, 225, 339, 373, 375, 567, 575, 869, AND 942.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 69-029A-02

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 070070

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 1 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADON TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH THE PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE

(NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM LATE MARCH 1969 UNTIL MID-FEBRUARY 1970. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WERE DISCARDED. IT IS BELIEVED THAT THE INSTRUMENT TERMINATED OPERATIONS IN JULY 1970.

REFERENCES
199, 567, 575, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 69-029A-03

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 070C70

EXPERIMENT BRIEF DESCRIPTION
THE METEOR 1 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIOTELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO

PROVIDE A BACKUP CAPABILITY. ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD BE ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 1 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM LATE MARCH 1969 TO JULY 1970, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS WERE TERMINATED. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA.

REFERENCES
199, 356, 358, AND 575.

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SPACECRAFT COMMON NAME- METEOR 2 NSSDC ID 69-084A
ALTERNATE NAMES- METEORA 2

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 10/06/69
APOGEE- 681.000 KM ALT
PERIGEE- 613.000 KM ALT
PERIOD- 97.7 MIN
INCLINATION- 81.26 DEG

OTHER INFORMATION
SPACECRAFT WT- 1440. KG
LAUNCH DATE- 10/06/69
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 070070

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR
PS -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION
METEOR 2 WAS THE SECOND FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE TENTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. METEOR 2 WAS EQUIPPED WITH TWO VIDICON CAMERAS FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AND AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE

SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 2 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH APPROXIMATELY EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED BY METEOR 2 WERE TRANSMITTED DIRECTLY TO THE GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, OR VLADIVOSTOK. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 2 RECORDED THE TV AND IR PICTURES AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. IT IS BELIEVED THAT THE SATELLITE OPERATIONS ENDED IN JULY 1970 WHEN TRANSMISSIONS OF VIDEO AND IR DATA FROM MOSCOW TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK TERMINATED.

REFERENCES

267, 575, 634, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 69-084A-01

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 070170

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 2 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 2 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE

CARRIED ON THE ESSA SATELLITES. THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 2 SATELLITE (645 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM OCTOBER 9, 1969, UNTIL JULY 1, 1970, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS CEASED. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

199, 339, 567, 575, AND 942.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 69-084A-02

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 060070

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 2 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH THE PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE

SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM EARLY OCTOBER 1969 THROUGH JUNE 1970, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS CEASED. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WERE DISCARDED.

REFERENCES
199, 567, 575, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 69-084A-03

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 070C70

EXPERIMENT BRIEF DESCRIPTION
THE METEOR 2 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS, AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING

(KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD BE ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 2 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM EARLY OCTOBER 1969 TO JULY 1970, WHEN, IT IS BELIEVED, THE INSTRUMENT OPERATIONS TERMINATED. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA.

REFERENCES

199, 356, AND 575.

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SPACECRAFT COMMON NAME- METEOR 3 NSSDC ID 70-019A
ALTERNATE NAMES- METEORA 3

ORBITAL INFORMATION OTHER INFORMATION

ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 03/18/70
APOGEE- 635.000 KM ALT
PERIGEE- 537.000 KM ALT
PERIOD- 96.42 MIN
INCLINATION- 81.18 DEG

SPACECRAFT WT- 1440. KG
LAUNCH DATE- 03/17/70
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 070070

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR
PS -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 3 WAS THE THIRD FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE ELEVENTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. METEOR 3 WAS EQUIPPED WITH TWO VIDICON CAMERAS FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AND AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 3 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTIONS. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH APPROXIMATELY EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED BY METEOR 3 WERE TRANSMITTED DIRECTLY TO THE GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, OR VLADIVOSTOK. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 3 RECORDED THE TV AND IR PICTURES AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. IT IS BELIEVED THAT THE SATELLITE OPERATIONS TERMINATED IN JULY 1970, WHEN TRANSMISSIONS OF DATA TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW CEASED.

REFERENCES

207, 634, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS   NSSDC ID 70-019A-01

EXPERIMENT PERSONNEL

PI -	SHS STAFF	SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 061970

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 3 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 530 TO 630 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 3 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 3 SATELLITE (585 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM MARCH 18, 1970, UNTIL JUNE 19, 1970, WHEN, IT IS BELIEVED, INSTRUMENT OPERATIONS CEASED. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

199, 339, 567, 575, AND 942.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 70-019A-02

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 070070

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 3 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF

THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH THE PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM MID-MARCH 1970 THROUGH JULY 1970, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS CEASED. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WERE DISCARDED.

REFERENCES

199, 475, 567, 575, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 70-019A-03

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 070C70

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 3 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS, AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD BE ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 3 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE

VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM MID-MARCH 1970 TO JULY 1970, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS CEASED. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER, ASHEVILLE, NORTH CAROLINA. THE ACTINOMETRIC INSTRUMENT TERMINATED OPERATIONS IN JULY 1970.

REFERENCES

199, AND 575.

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SPACECRAFT COMMON NAME- METEOR 4 NSSDC ID 70-037A

ALTERNATE NAMES- METEORA 4

ORBITAL INFORMATION

ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/29/70
APOGEE- 710.000 KM ALT
PERIGEE- 625.000 KM ALT
PERIOD- 98.12 MIN
INCLINATION- 81.23 DEG

OTHER INFORMATION

SPACECRAFT WT- 1440. KG
LAUNCH DATE- 04/28/70
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 060071

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR
PS -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 4 WAS THE FOURTH FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE TWELFTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. METEOR 4 WAS EQUIPPED WITH TWO VIDICON CAMERAS FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AND AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 4 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH APPROXIMATELY EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED

BY METEOR 4 WERE TRANSMITTED DIRECTLY TO THE GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, OR VLADIVOSTOK. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 4 RECORDED THE TV AND IR PICTURES AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. IT IS BELIEVED THAT THE SATELLITE OPERATIONS TERMINATED IN JUNE 1971, WHEN DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW CEASED.

REFERENCES
575, 634, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 70-037A-01

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 041971

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 4 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 4 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 4 SATELLITE (650 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA

THE 'COLD LINE' FACSIMILE LINK WITH MOSCCW. PICTURES WERE TRANSMITTED TO NESS FROM MAY 1, 1970, UNTIL APRIL 19, 1971, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS TERMINATED. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES
199, 339, 567, 575, AND 942.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 70-037A-02

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDRCMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 060C71

EXPERIMENT BRIEF DESCRIPTION
THE METEOR 4 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNCW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRCN ATMCSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CCNSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATICN BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADICMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THRCUGH AN ANGLE OF PLUS CR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATICNARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH THE PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND

RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM EARLY MAY 1970 UNTIL JUNE 1971, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS TERMINATED. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WERE DISCARDED.

REFERENCES

199, 567, 575, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 70-037A-03

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 060071

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 4 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS, AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER

SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD BE ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 4 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM LATE APRIL 1970 TO MID-FEBRUARY 1971. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA. IT IS BELIEVED THAT THE ACTINOMETRIC INSTRUMENT OPERATIONS TERMINATED IN JUNE 1971.

REFERENCES
    199, AND 575.

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SPACECRAFT COMMON NAME- METEOR 5 | NSSDC ID 70-047A
ALTERNATE NAMES- METEORA 5

ORBITAL INFORMATION
- ORBIT TYPE- GEOCENTRIC
- EPOCH DATE- 06/25/70
- APOGEE- 888.000 KM ALT
- PERIGEE- 831.000 KM ALT
- PERIOD- 102.2 MIN
- INCLINATION- 81.23 DEG

OTHER INFORMATION
- SPACECRAFT WT- 1440. KG
- LAUNCH DATE- 06/23/70
- OPERATING STATUS- INOPERABLE
- DATE LAST USABLE
  - DATA RECORDED- 040072

SPACECRAFT PERSONNEL
PM - UNKNOWN SOV. HYDROMET. SERVICE MOSCOW, USSR
PS - UNKNOWN SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 5 WAS THE FIFTH FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE THIRTEENTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THIS WAS THE FIRST SATELLITE OF THE METEOR SERIES TO BE PLACED IN A HIGH ORBIT -- ABOUT 240 KM HIGHER THAN MOST OTHER METEOR LAUNCHES. OTHER HIGH-ORBIT FLIGHTS WERE MADE BY METEOR 10, 11, AND 12. METEOR 5 WAS EQUIPPED WITH TWO VIDICON CAMERAS FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AND AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 5 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH APPROXIMATELY EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED BY METEOR 5 WERE TRANSMITTED DIRECTLY TO GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, OR VLADIVOSTOK. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 5 RECORDED THE TV AND IR PICTURES AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. IT IS BELIEVED THAT THE SATELLITE OPERATIONS TERMINATED IN APRIL 1972, WHEN DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW CEASED.

REFERENCES

124, 273, 575, 634, 635, AND 830.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 70-047A-01

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 091971

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 5 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. METEOR 5 HAD

SLIGHTLY MODIFIED EQUIPMENT WITH A WIDER VISION BANDWIDTH THAN THE LOWER ORBITING SATELLITES OF THE METEOR SERIES. EACH CAMERA VIEWED A 730- BY 730-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF ABOUT 850 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 5 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 5 SATELLITE (854 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM JULY 1, 1970, TO SEPTEMBER 19, 1971, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS CEASED. THE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES
208, 339, 567, 575, AND 942.

EXPERIMENT NAME- SCANNING HRIR　　　　NSSDC ID 70-047A-02

EXPERIMENT PERSONNEL
PI - SHS STAFF　　SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 040C72

EXPERIMENT BRIEF DESCRIPTION
THE METEOR 5 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE

RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH THE PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM EARLY JULY 1970 THROUGH APRIL 1972, WHEN, IT IS BELIEVED, THE EXPERIMENT OPERATIONS CEASED. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WERE DISCARDED.

REFERENCES

567, 575, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT   NSSDC ID 70-047A-03

EXPERIMENT PERSONNEL

PI - SHS STAFF   SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 040072

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 5 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS, AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3.0-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD BE ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 5 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 3500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK

WITH MOSCOW FROM LATE JUNE 1970 TO MID-FEBRUARY 1971. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA. IT IS BELIEVED THAT THE ACTINOMETRIC INSTRUMENT OPERATIONS TERMINATED IN APRIL 1972.

REFERENCES

575.

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SPACECRAFT COMMON NAME- METEOR 6 NSSDC ID 70-085A

ALTERNATE NAMES- METEORA 6

ORBITAL INFORMATION

ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 10/25/70
APOGEE- 648.000 KM ALT
PERIGEE- 626.000 KM ALT
PERIOD- 97.49 MIN
INCLINATION- 81.21 DEG

OTHER INFORMATION

SPACECRAFT WT- 1440. KG
LAUNCH DATE- 10/15/70
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 020071

SPACECRAFT PERSONNEL

PM - UNKNOWN SOV. HYDROMET. SERVICE MOSCOW, USSR
PS - UNKNOWN SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 6 WAS THE SIXTH FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE FOURTEENTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. METEOR 6 WAS EQUIPPED WITH TWO VIDICON CAMERAS FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AND AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 6 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH APPROXIMATELY EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED BY METEOR 6 WERE TRANSMITTED DIRECTLY TO GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, OR VLADIVOSTOK. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 6 RECORDED THE TV AND IR PICTURES AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED

AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. IT IS BELIEVED THAT THE SATELLITE OPERATIONS TERMINATED IN FEBRUARY 1971 WHEN DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW CEASED.

REFERENCES

575, 634, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 70-085A-01

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 122870

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 6 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 6 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 6 SATELLITE (637 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM OCTOBER 15, 1970, UNTIL DECEMBER 28, 1970, WHEN, IT IS BELIEVED, THE INSTRUMENT OPERATIONS CEASED. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES

199, 339, 567, 575, AND 942.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 70-085A-02

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 100C70

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 6 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH THE PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO

PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS ONLY FROM MID-OCTOBER THROUGH LATE OCTOBER 1970. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WERE DISCARDED. IT IS BELIEVED THAT THE INSTRUMENT OPERATIONS TERMINATED IN OCTOBER 1970.

REFERENCES
199, 575, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT   NSSDC ID 70-085A-03

EXPERIMENT PERSONNEL
PI - SHS STAFF   SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 020C71

EXPERIMENT BRIEF DESCRIPTION
THE METEOR 6 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS, AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A

COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD HAVE BEEN ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 6 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM OCTOBER 1970 TO MID-FEBRUARY 1971. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA. IT IS BELIEVED THAT THE ACTINOMETRIC INSTRUMENT OPERATIONS TERMINATED IN FEBRUARY 1971.

REFERENCES

199, AND 575.

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SPACECRAFT COMMON NAME- METEOR 7 NSSDC ID 71-003A
ALTERNATE NAMES- METEORA 7

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 02/01/71
APOGEE- 636.000 KM ALT
PERIGEE- 629.000 KM ALT
PERIOD- 97.6 MIN
INCLINATION- 81.21 DEG

OTHER INFORMATION
SPACECRAFT WT- 1440. KG
LAUNCH DATE- 01/20/71
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 050071

SPACECRAFT PERSONNEL
PM - UNKNOWN SOV. HYDROMET. SERVICE MOSCOW, USSR
PS - UNKNOWN SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 7 WAS THE SEVENTH FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE SIXTEENTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER

SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. METEOR 7 WAS EQUIPPED WITH TWO VIDICON CAMERAS FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AND A SET OF ACTINOMETRIC INSTRUMENTS FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 7 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH APPROXIMATELY EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED BY METEOR 7 WERE TRANSMITTED DIRECTLY TO THE GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, OR VLADIVOSTOK. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 7 RECORDED THE TV AND IR PICTURES AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. IT IS BELIEVED THAT THE SATELLITE OPERATIONS TERMINATED IN MAY 1971, WHEN DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW CEASED.

REFERENCES
575, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS　　　　NSSDC ID 71-003A-01

EXPERIMENT PERSONNEL
PI - SHS STAFF　　SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 021771

EXPERIMENT BRIEF DESCRIPTION
THE METEOR 7 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE

EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 7 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 7 SATELLITE (642 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM JANUARY 31, 1971, UNTIL FEBRUARY 17, 1971. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED. IT IS BELIEVED THAT THE INSTRUMENT OPERATIONS TERMINATED IN APRIL 1971.

REFERENCES

199, 208, 339, AND 575.

EXPERIMENT NAME- SCANNING HRIR   NSSDC ID 71-003A-02

EXPERIMENT PERSONNEL

PI - SHS STAFF   SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 040C71

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 7 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN

THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH THE PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM LATE JANUARY 1971 THROUGH APRIL 1971. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WERE DISCARDED. IT IS BELIEVED THAT THE INSTRUMENT OPERATIONS TERMINATED IN MAY 1971.

REFERENCES

199, 575, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 71-003A-03

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 020C71

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 7 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS, AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF

VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIOTELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD BE ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 7 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM LATE JANUARY 1971 TO MID-FEBRUARY 1971. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA. IT IS BELIEVED THAT THE ACTINOMETRIC INSTRUMENT OPERATIONS TERMINATED IN APRIL 1971.

REFERENCES

199, AND 575.

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SPACECRAFT COMMON NAME- METEOR 8 NSSDC ID 71-031A
ALTERNATE NAMES- METEORA 8

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/18/71
APOGEE- 633.000 KM ALT
PERIGEE- 610.000 KM ALT
PERIOD- 97.17 MIN
INCLINATION- 81.24 DEG

OTHER INFORMATION
SPACECRAFT WT- 1440. KG
LAUNCH DATE- 04/17/71
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 062972

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR
PS -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 8 WAS THE EIGHTH FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE SEVENTEENTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, VERTICAL PROFILES OF TEMPERATURE AND MOISTURE, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. METEOR 8 WAS EQUIPPED WITH TWO VIDICON CAMERAS FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS, AND A MEDIUM-RESOLUTION SCANNING DIFFRACTION SPECTROMETER FOR DETERMINING INDIRECTLY THE VERTICAL PROFILES OF ATMOSPHERIC TEMPERATURE AND HUMIDITY. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 8 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH APPROXIMATELY EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED BY METEOR 8 WERE TRANSMITTED DIRECTLY TO THE GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, AND VLADIVOSTOK. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 8 RECORDED THE TV AND IR PICTURES, SPECTROMETER DATA, AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. IT IS BELIEVED THAT THE SATELLITE CEASED OPERATIONS IN JUNE 1972, WHEN DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK FROM MOSCOW CEASED.

REFERENCES
224, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 71-031A-01

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 062972

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 8 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 8 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 8 SATELLITE (621 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM APRIL 21, 1971, UNTIL MARCH 1, 1972, AND AGAIN AROUND MID-YEAR. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED. THE INSTRUMENT PROBABLY CEASED OPERATIONS IN JUNE 1972.

REFERENCES
199, 208, AND 339.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 71-031A-02

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 8 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH THE PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES IS

RECEIVING THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES HAVE BEEN TRANSMITTED TO NESS FROM LATE APRIL 1971 UNTIL JUNE 1972, WHEN IT IS BELIEVED THAT THE INSTRUMENT OPERATIONS CEASED. THESE IR PICTURES ARE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY ARE DISCARDED.

REFERENCES

199, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 71-031A-03

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 062972

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 8 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS, AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3.0-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS

MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD BE ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 8 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. THE ACTINOMETRIC INSTRUMENT PROBABLY CEASED OPERATIONS IN LATE JUNE 1972.

REFERENCES

199.

EXPERIMENT NAME- ATMOSPHERIC THERMAL SOUNDER NSSDC ID 71-031A-04

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 062972

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 8 ATMOSPHERIC TEMPERATURE SOUNDER WAS AN OPERATIONAL EXPERIMENT DESIGNED TO OBTAIN VERTICAL PROFILES OF TEMPERATURE AND ATMOSPHERIC HUMIDITY BY INDIRECT MEANS UNDER A VARIETY OF CLOUDCOVER CONDITIONS. THE INSTRUMENTATION CONSISTED OF A MEDIUM-RESOLUTION DIFFRACTION SPECTROMETER THAT SCANNED CONTINUOUSLY OVER A 20-SEC OBSERVING CYCLE IN THE 10.5- TO 15-MICRON BAND. THE RESOLVING POWER OF THE SPECTROMETER IN THIS SPECTRAL RANGE WAS WITHIN 4 TO 5 MILLIMICRONS. FROM AN AVERAGE SATELLITE ALTITUDE OF ABOUT 620 KM, THE INSTRUMENT'S FIELD OF VIEW COVERED A 53- BY 13-KM AREA ON THE EARTH'S SURFACE WITH THE LONG SIDE ORIENTED PARALLEL TO THE SATELLITE TRAJECTORY. THE DATA WERE STORED ON BOARD THE SPACECRAFT UNTIL A GROUND ACQUISITION STATION CAME WITHIN COMMUNICATION RANGE. THE DATA WERE THEN RELAYED TO THE GROUND STATION, REDUCED AND PROCESSED, AND TRANSMITTED DIRECTLY TO THE SOVIET HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED. TEMPERATURE PROFILES WERE CONSTRUCTED FROM THE SPECTRAL RADIATION DATA BY MEANS OF MATHEMATICAL INVERSION TECHNIQUES FOR CLEAR AND OVERCAST CLOUDCOVER CONDITIONS. THE AVERAGE ERROR FOR THESE PROFILES WAS 2 TO 4 DEG K. TEMPERATURE PROFILES WERE ALSO CONSTRUCTED FOR PARTLY CLOUDY CONDITIONS AND, WHILE NOT AS ACCURATE AS THE CLEAR AND OVERCAST RESULTS, PROVED PROMISING. ATMOSPHERIC HUMIDITY PROFILES WERE STATISTICALLY DERIVED USING MEASUREMENTS OF THE OUTGOING RADIATION IN THE 15-MICRON BAND. THE EXPERIMENT PROBABLY CEASED OPERATIONS IN LATE JUNE 1972.

REFERENCES

704.

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SPACECRAFT COMMON NAME- METEOR 9 NSSDC ID 71-059A
ALTERNATE NAMES- METEORA 9

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 07/20/71
APOGEE- 642.000 KM ALT
PERIGEE- 619.000 KM ALT
PERIOD- 97.31 MIN
INCLINATION- 81.2 DEG

OTHER INFORMATION
SPACECRAFT WT- 1440. KG
LAUNCH DATE- 07/16/71
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 010072

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR
PS -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 9 WAS THE NINTH FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE EIGHTEENTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, VERTICAL PROFILES OF TEMPERATURE AND MOISTURE, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. METEOR 9 WAS EQUIPPED WITH TWO VIDICON CAMERAS FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS, AND A MEDIUM-RESOLUTION SCANNING DIFFRACTION SPECTROMETER FOR DETERMINING INDIRECTLY THE VERTICAL PROFILES OF ATMOSPHERIC TEMPERATURE AND HUMIDITY. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 9 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH APPROXIMATELY EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED BY METEOR 9 WERE TRANSMITTED DIRECTLY TO THE GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, OR VLADIVOSTOK. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 9 RECORDED THE TV AND IR PICTURES, SPECTROMETER DATA, AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. IT IS BELIEVED THAT THE SATELLITE WAS DEACTIVATED IN JANUARY 1972, WHEN IR AND VIDEO DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW CEASED.

REFERENCES
224, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 71-059A-01

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 011672

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 9 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. EACH CAMERA VIEWED A 500- BY 500-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF 600 TO 700 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 9 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 9 SATELLITE (628 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM JULY 23, 1971, UNTIL JANUARY 16, 1972, WHEN, IT IS BELIEVED, THE EXPERIMENT WAS DEACTIVATED. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED.

REFERENCES
199, AND 208.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 71-059A-02

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 010C72

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 9 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION, RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES

RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES WERE TRANSMITTED TO NESS FROM LATE JULY 1971 UNTIL EARLY JANUARY 1972. THESE IR PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WERE DISCARDED. IT IS BELIEVED THAT THE INSTRUMENT WAS DEACTIVATED IN JANUARY 1972.

REFERENCES
199, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 71-059A-03

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 010072

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 9 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS, AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS

MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD HAVE BEEN ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 9 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 2500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. IT IS BELIEVED THAT THE ACTINOMETRIC INSTRUMENT TERMINATED OPERATIONS IN JANUARY 1972.

REFERENCES

199.

EXPERIMENT NAME- ATMOSPHERIC THERMAL SOUNDER　　　　NSSDC ID 71-059A-04

EXPERIMENT PERSONNEL

PI - SHS STAFF　　　SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 010072

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 9 ATMOSPHERIC TEMPERATURE SOUNDER WAS AN OPERATIONAL EXPERIMENT DESIGNED TO OBTAIN VERTICAL PROFILES OF TEMPERATURE AND ATMOSPHERIC HUMIDITY BY INDIRECT MEANS UNDER A VARIETY OF CLOUDCOVER CONDITIONS. THE INSTRUMENTATION CONSISTED OF A MEDIUM-RESOLUTION DIFFRACTION SPECTROMETER THAT SCANNED CONTINUOUSLY OVER A 20-SEC OBSERVING CYCLE IN THE 10.5- TO 15-MICRON BAND. THE RESOLVING POWER OF THE SPECTROMETER IN THIS SPECTRAL RANGE WAS WITHIN 4 TO 5 MILLIMICRONS. FROM AN AVERAGE SATELLITE ALTITUDE OF ABOUT 625 KM, THE INSTRUMENT'S FIELD OF VIEW COVERED A 53- BY 13-KM AREA ON THE EARTH'S SURFACE WITH THE LONG SIDE ORIENTED PARALLEL TO THE SATELLITE TRAJECTORY. THE DATA WERE STORED ON BOARD THE SPACECRAFT UNTIL A GROUND ACQUISITION STATION CAME WITHIN COMMUNICATION RANGE. THE DATA WERE THEN RELAYED TO THE GROUND STATION, REDUCED AND PROCESSED, AND TRANSMITTED DIRECTLY TO THE SOVIET HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED. TEMPERATURE PROFILES WERE CONSTRUCTED FROM THE SPECTRAL RADIATION DATA BY MEANS OF MATHEMATICAL INVERSION TECHNIQUES FOR CLEAR AND OVERCAST CLOUDCOVER CONDITIONS. THE AVERAGE ERROR FOR THESE PROFILES WAS 2 TO 4 DEG K. TEMPERATURE PROFILES WERE ALSO CONSTRUCTED FOR PARTLY CLOUDY CONDITIONS AND, WHILE NOT AS ACCURATE AS THE CLEAR AND OVERCAST RESULTS, PROVED PROMISING. ATMOSPHERIC HUMIDITY PROFILES WERE STATISTICALLY DERIVED USING MEASUREMENTS OF THE OUTGOING RADIATION IN THE 15-MICRON BAND. IT IS BELIEVED THAT THE EXPERIMENT TERMINATED OPERATIONS IN JANUARY 1972.

REFERENCES

704.

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SPACECRAFT COMMON NAME- METEOR 10 NSSDC ID 71-120A
ALTERNATE NAMES- METEORA 10

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 12/30/71
APOGEE- 880.000 KM ALT
PERIGEE- 860.000 KM ALT
PERIOD- 102.7 MIN
INCLINATION- 81.2 DEG

OTHER INFORMATION
SPACECRAFT WT- 1440. KG
LAUNCH DATE- 12/29/71
OPERATING STATUS- INOPERABLE
DATE LAST USABLE
DATA RECORDED- 060072

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR
PS -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 10 WAS THE TENTH FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE NINETEENTH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, VERTICAL PROFILES OF TEMPERATURE AND MOISTURE, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THIS WAS THE SECOND SATELLITE OF THE METEOR SERIES TO BE PLACED IN A HIGH ORBIT -- ABOUT 240 KM HIGHER THAN MOST OTHER METEOR LAUNCHES. OTHER HIGH-ORBIT FLIGHTS WERE MADE BY METEOR 5, 11, AND 12. METEOR 10 WAS EQUIPPED WITH TWO VIDICON CAMERAS AND APT CAMERA(S) FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER WITH APT CAPABILITY FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS, AND A MEDIUM-RESOLUTION SCANNING DIFFRACTION SPECTROMETER FOR DETERMINING INDIRECTLY THE VERTICAL PROFILES OF ATMOSPHERIC TEMPERATURE AND HUMIDITY. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 10 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM IDEALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LATITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH EVERY 6 HR. THIS ALLOWS THE MONITORING OF THE FORMATION, DEVELOPMENT, AND MOVEMENT OF MAJOR WEATHER SYSTEMS. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED BY METEOR 10 WERE TRANSMITTED DIRECTLY TO THE GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, AND VLADIVOSTOK OR TO APT-EQUIPPED STATIONS WITHIN THE U.S.S.R. OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 10 RECORDED THE TV AND IR PICTURES, SPECTROMETER DATA, AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED TO PREPARE VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS

METEOROLOGICAL CENTERS AROUND THE WORLD. SOME OF THESE DATA WERE TRANSMITTED FROM MOSCOW TO THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS). IT IS BELIEVED THAT METEOR 10 WAS DEACTIVATED IN JUNE 1972, AS INDICATED BY THE TERMINATION OF DATA BEING TRANSMITTED TO NESS.

REFERENCES

124, 224, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 71-120A-01

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 060072

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 10 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. METEOR 10 HAD SLIGHTLY MODIFIED EQUIPMENT WITH A VISION BANDWIDTH 50 PERCENT GREATER THAN THE LOWER ORBITING SATELLITES OF THE METEOR SERIES. EACH CAMERA VIEWED A 750- BY 750-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF ABOUT 870 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 10 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 10 SATELLITE (870 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUD MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. THESE PICTURES WERE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, WERE DISCARDED. THE SYSTEM HAD A SCAN RATE OF TWO LINES PER SECOND, OR HALF THE ESSA RATE, AND SCANNED FROM RIGHT TO LEFT INSTEAD OF LEFT TO RIGHT. THE EXPERIMENT WAS PROBABLY DEACTIVATED IN JUNE 1972, AS INDICATED BY THE TERMINATION OF DATA

TRANSMISSIONS TO NESS.

REFERENCES

199.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 71-120A-02

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE

DATE LAST USABLE DATA RECORDED- 060C72

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 10 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1650 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION OR AN APT-EQUIPPED STATION WITHIN THE U.S.S.R., RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE

FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES RECEIVED THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. THESE IR PICTURES ARE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY ARE DISCARDED. THE EXPERIMENT WAS PROBABLY DEACTIVATED IN JUNE 1972, AS INDICATED BY THE TERMINATION OF DATA TRANSMISSIONS TO NESS.

REFERENCES
199, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 71-120A-03

EXPERIMENT PERSONNEL
PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 060072

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 10 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS, AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP. THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL

SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD BE ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 10 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 3500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. THE EXPERIMENT WAS PROBABLY DEACTIVATED IN JUNE 1972, AS INDICATED BY THE TERMINATION OF VIDEO AND IR DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW.

REFERENCES
199.

EXPERIMENT NAME- ATMOSPHERIC THERMAL SOUNDER   NSSDC ID 71-120A-04

EXPERIMENT PERSONNEL

PI -	SHS STAFF	SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- INOPERABLE
DATE LAST USABLE DATA RECORDED- 060C72

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 10 ATMOSPHERIC TEMPERATURE SOUNDER WAS AN OPERATIONAL EXPERIMENT DESIGNED TO OBTAIN VERTICAL PROFILES OF TEMPERATURE AND ATMOSPHERIC HUMIDITY BY INDIRECT MEANS UNDER A VARIETY OF CLOUDCOVER CONDITIONS. THE INSTRUMENTATION CONSISTED OF A MEDIUM-RESOLUTION DIFFRACTION SPECTROMETER THAT SCANNED CONTINUOUSLY OVER A 20-SEC OBSERVING CYCLE IN THE 10.5- TO 15-MICRON BAND. THE RESOLVING POWER OF THE SPECTROMETER IN THIS SPECTRAL RANGE WAS WITHIN 4 TO 5 MILLIMICRONS. FROM AN AVERAGE SATELLITE ALTITUDE OF ABOUT 870 KM, THE INSTRUMENT'S FIELD OF VIEW COVERED A 53- BY 13-KM AREA ON THE EARTH'S SURFACE WITH THE LONG SIDE ORIENTED PARALLEL TO THE SATELLITE TRAJECTORY. THE DATA WERE STORED ON BOARD THE SPACECRAFT UNTIL A GROUND ACQUISITION STATION CAME WITHIN COMMUNICATION RANGE. THE DATA WERE THEN RELAYED TO THE GROUND STATION, REDUCED AND PROCESSED, AND TRANSMITTED DIRECTLY TO THE SOVIET HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED. TEMPERATURE PROFILES WERE CONSTRUCTED FROM THE SPECTRAL RADIATION DATA BY MEANS OF MATHEMATICAL INVERSION TECHNIQUES FOR CLEAR AND OVERCAST CLOUDCOVER CONDITIONS. THE AVERAGE ERROR FOR THESE PROFILES WAS 2 TO 4 DEG K. TEMPERATURE PROFILES WERE ALSO CONSTRUCTED FOR PARTLY CLOUDY CONDITIONS AND, WHILE NOT AS ACCURATE AS THE CLEAR AND OVERCAST RESULTS, PROVED PROMISING. ATMOSPHERIC HUMIDITY PROFILES WERE STATISTICALLY DERIVED USING

MEASUREMENTS OF THE OUTGOING RADIATION IN THE 15-MICRON BAND. THE EXPERIMENT WAS PROBABLY DEACTIVATED IN JUNE 1972 AS INDICATED BY THE TERMINATION OF IR AND VIDEO DATA TRANSMISSIONS TO THE UNITED STATES VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW.

REFERENCES

704.

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SPACECRAFT COMMON NAME- METEOR 11 NSSDC ID 72-022A
ALTERNATE NAMES- METEORA 11

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 04/01/72
APOGEE- 903.000 KM ALT
PERIGEE- 878.000 KM ALT
PERIOD- 102.6 MIN
INCLINATION- 81.23 DEG

OTHER INFORMATION
SPACECRAFT WT- 1440. KG
LAUNCH DATE- 03/30/72
OPERATING STATUS- NORMAL

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR
PS -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION

METEOR 11 WAS THE ELEVENTH FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE TWENTIETH METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, VERTICAL PROFILES OF TEMPERATURE AND MOISTURE, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THIS WAS THE THIRD SATELLITE OF THE METEOR SERIES TO BE PLACED IN A HIGH ORBIT -- ABOUT 240 KM HIGHER THAN THAT OF MOST OTHER METEOR LAUNCHES. OTHER HIGH-ORBIT FLIGHTS WERE MADE BY METEOR 5, 10, AND 12. METEOR 11 WAS EQUIPPED WITH TWO VIDICON CAMERAS AND APT CAMERA(S) FOR TAKING DAYSIDE PICTURES, A SCANNING HIGH-RESOLUTION IR RADIOMETER WITH APT CAPABILITY, FOR TAKING DAYSIDE AND NIGHTSIDE PICTURES, AN ACTINOMETRIC INSTRUMENT FOR MAKING MEASUREMENTS OF THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS, AND A MEDIUM-RESOLUTION SCANNING DIFFRACTION SPECTROMETER FOR DETERMINING INDIRECTLY THE VERTICAL PROFILES OF ATMOSPHERIC TEMPERATURE AND HUMIDITY. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN SO AS TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 11 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM USUALLY CONSISTS OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH EVERY 6 HR. WHEN WITHIN COMMUNICATION RANGE, THE DATA ACQUIRED WERE TRANSMITTED

DIRECTLY TO THE GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, OR VLADIVOSTOK OR TO APT-EQUIPPED STATIONS WITHIN THE U.S.S.R. DURING PASSES OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 11 RECORDED THE TV AND IR PICTURES, SPECTROMETER DATA, AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER ONE OF THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED FOR PREPARING VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES AND ANALYZED ACTINOMETRIC DATA WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. AS OF JULY 1972, THE SATELLITE WAS BELIEVED TO BE IN OPERATION.

REFERENCES

124, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 72-022A-01

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 11 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. METEOR 11 HAD SLIGHTLY MODIFIED EQUIPMENT WITH A VISION BANDWIDTH 50 PERCENT GREATER THAN THE LOWER ORBITING SATELLITES OF THE METEOR SERIES. EACH CAMERA VIEWED A 750- BY 750-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF ABOUT 890 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE GROUND STATIONS OR WITH AN APT-EQUIPPED STATION OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. ALTHOUGH THE METEOR 11 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 11 SATELLITE (890 KM COMPARED TO 1400 KM). THUS, TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. THE UNITED STATES NORMALLY RECEIVES SOME OF THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. HOWEVER,

AS OF JULY 1972, NO PICTURES HAVE BEEN TRANSMITTED TO NESS. IF ANY PICTURES ARE TRANSMITTED, THEY WILL BE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WILL BE DISCARDED. THE SYSTEM HAD A SCAN RATE OF TWO LINES PER SECOND, OR HALF THE ESSA RATE, AND SCANNED FROM RIGHT TO LEFT INSTEAD OF LEFT TO RIGHT. THE INSTRUMENT IS BELIEVED TO BE ACTIVE AS OF JULY 1972.

REFERENCES

199.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 72-022A-02

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 11 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1100 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO THE RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH DEPENDING ON WHETHER THE

SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION OR TO APT-EQUIPPED STATIONS WITHIN THE U.S.S.R., RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. THE UNITED STATES IS RECEIVING THESE PICTURES AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MD., VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. PICTURES HAVE BEEN TRANSMITTED TO NESS FROM EARLY APRIL 1972 UNTIL THE PRESENT. THESE IR PICTURES ARE KEPT AT NESS FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY ARE DISCARDED. THE INSTRUMENT WAS BELIEVED TO BE ACTIVE, AS OF JULY 1972.

REFERENCES

199, AND 874.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 72-022A-03

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 11 ACTINOMETRIC INSTRUMENT WAS DESIGNED TO MEASURE (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP.

THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD HAVE BEEN ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 11 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 3500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS ARE BEING TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS HAVE BEEN RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW FROM LATE MAY 1972 UNTIL THE PRESENT. THE CHARTS ARE BEING MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA. AS OF JUNE 1972, THE ACTINOMETRIC INSTRUMENT WAS BELIEVED TO BE ACTIVE.

REFERENCES

199.

EXPERIMENT NAME- ATMOSPHERIC THERMAL SOUNDER NSSDC ID 72-022A-04

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 11 ATMOSPHERIC TEMPERATURE SOUNDER WAS AN OPERATIONAL EXPERIMENT DESIGNED TO OBTAIN VERTICAL PROFILES OF TEMPERATURE AND ATMOSPHERIC HUMIDITY BY INDIRECT MEANS UNDER A VARIETY OF CLOUDCOVER CONDITIONS. THE INSTRUMENTATION CONSISTED OF A MEDIUM-RESOLUTION DIFFRACTION SPECTROMETER THAT SCANNED CONTINUOUSLY OVER A 20-SEC OBSERVING CYCLE IN THE 10.5- TO 15-MICRON BAND. THE RESOLVING POWER OF THE SPECTROMETER IN THIS SPECTRAL RANGE WAS WITHIN 4 TO 5 MILLIMICRONS. FROM AN AVERAGE SATELLITE ALTITUDE OF ABOUT 890 KM, THE INSTRUMENT'S FIELD OF VIEW COVERED A 53- BY 13-KM AREA ON THE EARTH'S SURFACE WITH THE LONG SIDE ORIENTED PARALLEL TO THE SATELLITE TRAJECTORY. THE DATA WERE STORED ON BOARD THE SPACECRAFT UNTIL A GROUND ACQUISITION STATION CAME WITHIN COMMUNICATION RANGE. THE DATA WERE

THEN RELAYED TO THE GROUND STATION, REDUCED AND PROCESSED, AND TRANSMITTED DIRECTLY TO THE SOVIET HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED. TEMPERATURE PROFILES WERE CONSTRUCTED FROM THE SPECTRAL RADIATION DATA BY MEANS OF MATHEMATICAL INVERSION TECHNIQUES FOR CLEAR AND OVERCAST CLOUDCOVER CONDITIONS. THE AVERAGE ERROR FOR THESE PROFILES WAS 2 TO 4 DEG K. TEMPERATURE PROFILES WERE ALSO CONSTRUCTED FOR PARTLY CLOUDY CONDITIONS AND, WHILE NOT AS ACCURATE AS THE CLEAR AND OVERCAST RESULTS, PROVED PROMISING. ATMOSPHERIC HUMIDITY PROFILES WERE STATISTICALLY DERIVED USING MEASUREMENTS OF THE OUTGOING RADIATION IN THE 15-MICRON BAND. THE EXPERIMENT WAS A SUCCESS AND, AS OF JUNE 1972, WAS BELIEVED TO BE ACTIVE.

REFERENCES
704.

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SPACECRAFT COMMON NAME- METEOR 12 NSSDC ID 72-049A
ALTERNATE NAMES- METEORA 12

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 07/01/72
APOGEE- 929.000 KM ALT
PERIGEE- 857.000 KM ALT
PERIOD- 103. MIN
INCLINATION- 81.2 DEG

OTHER INFORMATION
SPACECRAFT WT- 1440. KG
LAUNCH DATE- 06/30/72
OPERATING STATUS- NORMAL

SPACECRAFT PERSONNEL

PM -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR
PS -	UNKNOWN	SOV. HYDROMET. SERVICE MOSCOW, USSR

SPACECRAFT BRIEF DESCRIPTION
METEOR 12 WAS THE TWELFTH FULLY OPERATIONAL RUSSIAN METEOROLOGICAL SATELLITE AND THE TWENTY-FIRST METEOROLOGICAL SATELLITE LAUNCHED FROM THE PLESETSK SITE. THE SATELLITE WAS PLACED IN A NEAR-CIRCULAR, NEAR-POLAR PROGRADE ORBIT TO PROVIDE NEAR-GLOBAL OBSERVATIONS OF THE EARTH'S WEATHER SYSTEMS, CLOUD COVER, ICE AND SNOW FIELDS, VERTICAL PROFILES OF TEMPERATURE AND MOISTURE, AND REFLECTED AND EMITTED RADIATION FROM THE DAYSIDE AND NIGHTSIDE OF THE EARTH-ATMOSPHERE SYSTEM FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THIS WAS THE FOURTH SATELLITE OF THE METEOR SERIES TO BE PLACED IN A HIGH ORBIT -- ABOUT 240 KM HIGHER THAN MOST OTHER METEOR LAUNCHES. OTHER HIGH-ORBIT FLIGHTS WERE MADE BY METEOR 5, 10, AND 11. METEOR 12 WAS EQUIPPED WITH TWO VIDICON CAMERAS AND APT CAMERA(S) FOR DAYSIDE PHOTOGRAPHY, A SCANNING HIGH-RESOLUTION IR RADIOMETER FOR DAYSIDE AND NIGHTSIDE PHOTOGRAPHY, AN ACTINOMETRIC INSTRUMENT FOR MEASURING THE EARTH'S RADIATION FIELD IN THE VISIBLE AND INFRARED REGIONS, AND A MEDIUM-RESOLUTION SCANNING DIFFRACTION SPECTROMETER FOR DETERMINING INDIRECTLY THE VERTICAL PROFILES OF ATMOSPHERIC TEMPERATURE AND HUMIDITY. THE SATELLITE WAS IN THE FORM OF A CYLINDER 5 M LONG AND 1.5 M IN DIAMETER WITH TWO LARGE SOLAR PANELS ATTACHED TO THE SIDES. THE SOLAR PANELS WERE AUTOMATICALLY ORIENTED TOWARD THE SUN TO PROVIDE THE SPACECRAFT WITH THE MAXIMUM AMOUNT OF SOLAR POWER. METEOR 12 WAS ORIENTED TOWARD THE EARTH BY A GRAVITY-GRADIENT TRIAXIAL STABILIZATION SYSTEM CONSISTING OF FLYWHEELS WHOSE KINETIC ENERGY WAS DAMPENED BY THE USE OF CONTROLLED ELECTROMAGNETS ON BOARD THAT INTERACTED WITH THE MAGNETIC FIELD OF THE EARTH. THE INSTRUMENTS WERE

HOUSED IN THE BASE OF THE SATELLITE, WHICH POINTED TOWARD THE EARTH, WHILE THE SOLAR SENSORS WERE MOUNTED IN THE TOP SECTION. THE OPERATIONAL 'METEOR' WEATHER SATELLITE SYSTEM CONSISTS IDEALLY OF AT LEAST TWO SATELLITES SPACED AT 90-DEG INTERVALS IN LONGITUDE SO AS TO OBSERVE A GIVEN AREA OF THE EARTH EVERY 6 HR. THE DATA ACQUIRED WERE TRANSMITTED DIRECTLY TO GROUND RECEIVING CENTERS IN MOSCOW, NOVOSIBIRSK, VLADIVOSTOK, OR APT-EQUIPPED STATIONS WITHIN THE U.S.S.R. WHEN WITHIN COMMUNICATION RANGE. DURING ITS PASSES OVER REGIONS BEYOND COMMUNICATION RANGE, METEOR 12 RECORDED THE TV AND IR PICTURES, SPECTROMETER DATA, AND ACTINOMETRIC DATA AND STORED THEM ON BOARD UNTIL THE SATELLITE PASSED OVER ONE OF THE RECEIVING CENTERS. THE METEOROLOGICAL DATA RECEIVED AT THESE CENTERS WERE PROCESSED, REDUCED, AND SENT TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE ANALYZED AND USED FOR PREPARING VARIOUS FORECAST AND ANALYSIS PRODUCTS. SOME OF THE TV AND IR PICTURES WERE THEN DISTRIBUTED TO VARIOUS METEOROLOGICAL CENTERS AROUND THE WORLD. THE SATELLITE FUNCTIONED SUCCESSFULLY AFTER LAUNCH AND, AS OF JULY 1972, WAS BELIEVED TO BE ACTIVE.

REFERENCES

220, AND 635.

EXPERIMENT NAME- DUAL VIDICON CAMERAS NSSDC ID 72-049A-01

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 12 DUAL VIDICON CAMERA SYSTEM PROVIDED DAYTIME PICTURES OF THE EARTH'S CLOUDCOVER DISTRIBUTION, LOCAL STORMS, AND NEAR-GLOBAL WEATHER SYSTEMS FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF TWO IDENTICAL VIDICON CAMERAS THAT WERE MOUNTED IN THE SATELLITE BASE AND WERE DIRECTED TOWARD THE EARTH. METEOR 12 HAD SLIGHTLY MODIFIED EQUIPMENT WITH A VISION BANDWIDTH THAT WAS 50 PERCENT GREATER THAN THAT OF THE LOWER ORBITING SATELLITES OF THE METEOR SERIES. EACH CAMERA VIEWED A 750- BY 750-KM AREA -- ONE TO THE LEFT AND THE OTHER TO THE RIGHT OF NADIR -- WITH A RESOLUTION OF 1.25 KM AT NADIR FROM A SATELLITE ALTITUDE OF ABOUT 910 KM. THE CAMERAS TOOK A ONE-FRAME IMAGE OF THE EARTH'S CLOUD COVER WITH SLIGHT OVERLAPPING OF SUCCESSIVE FRAMES TO PROVIDE CONTINUOUS COVERAGE. THE CAMERAS SWITCHED ON AUTOMATICALLY ANY TIME THE SUN WAS MORE THAN 5 DEG ABOVE THE HORIZON. BECAUSE THE EARTH ILLUMINATION VARIED SO MUCH, AUTOMATIC SENSORS ADJUSTED THE CAMERA APERTURES TO PRODUCE HIGH-QUALITY PICTURES UNDER A VARIETY OF ILLUMINATION CONDITIONS. THE IMAGE FORMED BY EACH VIDICON TUBE EITHER WAS TRANSMITTED DIRECTLY TO THE GROUND IF THE SATELLITE WAS IN RADIO CONTACT WITH ONE OF THE THREE GROUND STATIONS OR WAS RECORDED ON MAGNETIC TAPE FOR LATER TRANSMISSION IF THE SATELLITE WAS BEYOND THE ZONE OF RADIO COMMUNICATION. THE TV IMAGES RECEIVED BY THESE GROUND STATIONS WERE PROCESSED AND TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW WHERE THEY WERE ANALYZED AND USED IN VARIOUS FORECAST AND ANALYSIS PRODUCTS. ALTHOUGH THE METEOR 12 CAMERAS HAD ABOUT FOUR TIMES THE RESOLUTION AT NADIR OF THOSE CARRIED ON THE ESSA SATELLITES, THEY COULD NOT PROVIDE CONTINUOUS OVERLAPPING GLOBAL COVERAGE AS DO THE ESSA CAMERAS OWING TO THE LOWER ORBIT OF THE METEOR 12 SATELLITE (ABOUT 910 KM COMPARED TO 1400 KM). TO CLOSE THE GAPS IN COVERAGE, AT LEAST TWO METEOR SATELLITES WERE REQUIRED IN THE WEATHER SATELLITE SYSTEM. IN ADDITION, CLOUDCOVER MOSAICS WERE PRODUCED FROM 10 OR MORE INDIVIDUAL CLOUDCOVER PICTURES AT THE

HYDROMETEOROLOGICAL CENTER TO PROVIDE A MORE COMPREHENSIVE VIEW OF NEAR-GLOBAL WEATHER SYSTEMS. SOME OF THE INDIVIDUAL PICTURES AND THE CLOUDCOVER MOSAICS WERE TRANSMITTED TO VARIOUS FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. HOWEVER, AS OF JULY 1972, NO PICTURES HAVE BEEN RECEIVED FROM METEOR 12 AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS) IN SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. THE METEOR 12 CAMERA SYSTEM WAS BELIEVED TO STILL BE ACTIVE AS OF JULY 1972.

REFERENCES

199.

EXPERIMENT NAME- SCANNING HRIR NSSDC ID 72-049A-02

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 12 HIGH-RESOLUTION SCANNING IR RADIOMETER MADE OPERATIONAL MEASUREMENTS OF CLOUD DISTRIBUTION AND SNOW AND ICE COVER ON THE DAYSIDE AND NIGHTSIDE OF THE EARTH. THE RADIOMETER MEASURED THE OUTGOING RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM IN THE 8- TO 12-MICRON ATMOSPHERIC WINDOW. MEASUREMENTS MADE IN THIS SPECTRAL REGION PERMITTED BRIGHTNESS PATTERNS OF THE THERMAL RELIEF TO BE CONSTRUCTED AND EQUIVALENT RADIATION TEMPERATURES OF THE EARTH'S SURFACE AND CLOUD TOPS TO BE DETERMINED. THE INSTRUMENT WAS A NARROW-ANGLE SCANNING RADIOMETER WITH AN INSTANTANEOUS VIEWING ANGLE OF 1.5 BY 1.5 DEG. IT WAS MOUNTED IN THE BASE OF THE SATELLITE IN A SEALED INSTRUMENT COMPARTMENT WITH ITS OPTICAL AXIS DIRECTED ALONG THE LOCAL VERTICAL AND TOWARD NADIR. THE RADIOMETER MEASURED THE INTENSITY OF THE OUTGOING RADIATION BY COMPARING THE EARTH'S RADIATION FLUX WITH THE RADIATION FLUX FROM SPACE. EACH TYPE OF RADIATION ENTERED THE RADIOMETER THROUGH SEPARATE WINDOWS, WHICH WERE ORIENTED IN MUTUALLY PERPENDICULAR DIRECTIONS. THE RADIATION FROM THE EARTH-ATMOSPHERE SYSTEM FELL ON A PLANE SCANNING MIRROR THAT WAS MOUNTED AT AN ANGLE OF 45 DEG TO THE SATELLITE VELOCITY VECTOR AND SCANNED THROUGH AN ANGLE OF PLUS OR MINUS 50 DEG FROM NADIR. THE RADIATION WAS REFLECTED FROM THE SCANNING MIRROR THROUGH A STATIONARY MODULATING DISK AND FILTER WINDOW ONTO A PARABOLIC MIRROR, WHICH FOCUSED THE PARALLEL BEAM THROUGH A MOVABLE MODULATING DISK ONTO A THERMISTOR BOLOMETER. THE STATIONARY AND MOVABLE MODULATING DISKS PROVIDED THE CHANNEL SWITCHING, SENDING FIRST THE EARTH-ATMOSPHERE RADIATION AND THEN THE SPACE RADIATION TO THE PARABOLIC MIRROR AND FINALLY TO THE BOLOMETER. THE BOLOMETER CONVERTED THE RADIANT FLUX INTO VARIABLE ELECTRIC VOLTAGES (0 TO 6 V) WHOSE FREQUENCY WAS EQUAL TO THE MODULATOR FREQUENCY AND WHOSE MAGNITUDES WERE PROPORTIONAL TO THE DIFFERENCES IN THE RADIANT FLUX INTENSITIES BETWEEN EARTH AND SPACE DEVELOPED AT THE BOLOMETER OUTPUT. DURING THE MOVEMENT OF THE SCANNING MIRROR THROUGH A PLUS OR MINUS 40-DEG SECTOR, LINE SCANNING (40 LINES/MIN) OF THE TARGET AREA WAS ACCOMPLISHED IN A PLANE NORMAL TO THE ORBITAL PLANE USING A FORWARD AND BACK PATH, WHILE SCANNING ALONG THE FLIGHT PATH WAS PROVIDED BY THE RELATIVE MOTION OF THE SATELLITE WITH RESPECT TO THE EARTH. IN EACH SCAN, WITH THE INDICATED VIEWING AND SCANNING ANGLES FROM THE SATELLITE'S ORBITAL ALTITUDE, THE RADIOMETER RECORDED THE MEAN RADIATION INTENSITIES FROM A BAND ABOUT 1650 KM WIDE WITH A RESOLUTION OF ABOUT 15 KM AT NADIR TO ABOUT 24 TO 27 KM AT THE EDGES. THE RADIOMETER WAS CAPABLE OF MEASURING RADIATION TEMPERATURES WITHIN 0.5 TO 0.6 DEG FOR TEMPERATURES OF 293 TO 298 DEG K AND 1.5 TO 2 DEG FOR TEMPERATURES AROUND 223 DEG K. THE VIDEO SIGNALS WERE AMPLIFIED AND SENT

EITHER TO THE SATELLITE MEMORY UNIT FOR LATER TRANSMISSION OR TO A RADIO TELEMETRY UNIT FOR DIRECT TRANSMISSION TO EARTH. DEPENDING ON WHETHER THE SATELLITE WAS BEYOND OR WITHIN THE ZONE OF RADIO COMMUNICATION WITH A GROUND RECEIVING STATION OR APT-EQUIPPED STATIONS WITHIN THE U.S.S.R., RESPECTIVELY. THE GROUND RECEIVERS RECORDED THE TRANSMITTED DATA IN DIGITAL FORM ON MAGNETIC TAPE AND SIMULTANEOUSLY ON 80-MM PHOTOGRAPHIC FILM IN THE FORM OF A BRIGHTNESS IMAGE OF THE THERMAL RELIEF OF THE EARTH-ATMOSPHERE SYSTEM. THE DATA ON MAGNETIC TAPE WERE PROCESSED BY COMPUTERS AT THE HYDROMETEOROLOGICAL CENTER AND WERE USED TO PRODUCE A DIGITAL MAP OF THE EQUIVALENT RADIATION TEMPERATURE FIELD WITH A SUPERPOSED GEOGRAPHIC GRID. THE PHOTOGRAPHIC FILM WAS DEVELOPED AND PROCESSED INTO AN IR PICTURE ALSO WITH A SUPERPOSED GRID. THE PICTURES WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE PICTURES ARE BEING SENT TO FOREIGN METEOROLOGICAL CENTERS AS PART OF AN INTERNATIONAL METEOROLOGICAL DATA EXCHANGE PROGRAM. HOWEVER, AS OF JULY 1972, NO PICTURES HAVE BEEN RECEIVED AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND, VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW. IF ANY PICTURES ARE RECEIVED AT NESS, THEY WILL BE KEPT FOR 1 YR AND THEN, UNLESS OF UNUSUAL INTEREST, THEY WILL BE DISCARDED. THE RADIOMETER, AS OF JULY 1972, REMAINED ACTIVE.

REFERENCES

199.

EXPERIMENT NAME- ACTINOMETRIC INSTRUMENT NSSDC ID 72-049A-03

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE METEOR 12 ACTINOMETRIC INSTRUMENT MEASURED (1) THE OUTGOING LONGWAVE RADIATION (3 TO 30 MICRONS) FROM THE EARTH-ATMOSPHERE SYSTEM, (2) THE OUTGOING NEAR UV, VISIBLE, AND NEAR IR SOLAR RADIATION (0.3 TO 3 MICRONS) REFLECTED AND BACKSCATTERED BY THE EARTH-ATMOSPHERE SYSTEM, AND (3) THE EFFECTIVE RADIATION TEMPERATURE OF THE EARTH'S SURFACE AND CLOUD TOPS (8 TO 12 MICRONS) FOR OPERATIONAL USE BY THE SOVIET HYDROMETEOROLOGICAL SERVICE. THE INSTRUMENTATION CONSISTED OF FOUR RADIOMETERS -- A PAIR OF SCANNING, NARROW-ANGLE, TWO-CHANNEL RADIOMETERS AND A PAIR OF NONSCANNING, WIDE-ANGLE, TWO-CHANNEL RADIOMETERS. THE NARROW-ANGLE (4 BY 5 DEG FIELD OF VIEW) RADIOMETERS MEASURED RADIATION IN ALL THREE SPECTRAL BANDS, WHILE THE WIDE-ANGLE (136 TO 140 DEG FIELD OF VIEW) RADIOMETERS OPERATED ONLY IN THE 0.3- TO 3- AND 3- TO 30-MICRON BANDS. IN THE NARROW-ANGLE RADIOMETER, THE 0.3- TO 3-MICRON BAND WAS MEASURED IN ONE CHANNEL AND THE 8- TO 12- AND 3- TO 30-MICRON BANDS WERE COMBINED IN THE SECOND CHANNEL. IN THE SECOND CHANNEL, THE TWO BANDS WERE SEPARATED BY THE EXCHANGE OF CORRESPONDING FILTERS AS THE RADIOMETER SCANNED IN ALTERNATE DIRECTIONS. THE EARTH RADIATION ENTERED THE NARROW-ANGLE RADIOMETER THROUGH A CYLINDRICAL FAIRING (KRS-5 CRYSTAL) AND FELL ONTO A CONICAL SCANNING MIRROR. THE RADIATION WAS REFLECTED FROM THE MIRROR THROUGH A THREE-LOBED ROTATING MIRROR CHOPPER THAT MODULATED THE RADIATION FLUX AT A FREQUENCY OF 80 HZ. THE CHOPPER ALTERNATELY REFLECTED EARTH RADIATION AND SPACE RADIATION, WHICH ENTERED THROUGH A SEPARATE KRS-5 CRYSTAL WINDOW, ONTO ONE OF THREE OPENINGS IN A COLOR FILTER WHEEL -- ONE FILTER FOR EACH SPECTRAL BAND. THE PARTICULAR SPECTRAL BAND THAT WAS PASSED THROUGH THEN FELL ON AN OFF-AXIS PARABOLIC MIRROR THAT FOCUSED THE RADIATION FLUX ONTO A BOLOMETRIC RECEIVER. PERIODIC CALIBRATION WAS MADE WHEN THE SCANNING MIRROR MOVED TO A 90-DEG ANGLE FROM NADIR WITH SIMULTANEOUS TURNING ON AND VIEWING OF A SILICON STANDARD LAMP.

THE 0.3- TO 3-MICRON CHANNEL DID NOT USE THE TWO-BEAM SYSTEM OR FILTER SWITCHING. THE OUTPUT FROM THE MODULATED FLOW OF RADIATION ON THE BOLOMETER WAS AMPLIFIED, RECTIFIED, FILTERED, AND FED INTO THE RADIO TELEMETRY SYSTEM OVER EIGHT CHANNELS. THE WIDE-ANGLE RADIOMETERS HAD IDENTICAL OPTICAL SYSTEMS FOR BOTH CHANNELS. THE EARTH RADIATION ENTERED THE RADIOMETER THROUGH A HEMISPHERICAL SHELL COMPOSED OF QUARTZ OR KRS-5 CRYSTAL WITH A COATING THAT DETERMINED THE PASSBAND. THE RADIATION WAS THEN MODULATED WITH A FREQUENCY OF 64 HZ AND FELL ON A BOLOMETRIC RECEIVER. AS IN THE NARROW-ANGLE RADIOMETERS, THE BOLOMETER OUTPUT WAS PROCESSED AND FED INTO THE RADIO TELEMETRY SYSTEM. THE WIDE-ANGLE RADIOMETER WAS STANDARDIZED SIMULTANEOUSLY WITH THE NARROW-ANGLE RADIOMETER BY INPUTTING A STANDARD 64-HZ CALIBRATING FREQUENCY INTO THE AMPLIFICATION CIRCUIT. THE RELATIVE RMS MEASURING ERROR FOR BOTH TYPES OF RADIOMETERS WAS ABOUT 0.5 PERCENT. TO PROVIDE A BACKUP CAPABILITY, ONE WIDE-ANGLE AND ONE NARROW-ANGLE RADIOMETER WERE HELD IN RESERVE AND COULD BE ACTIVATED ON COMMAND FROM THE GROUND. THE ORIENTATION OF THE METEOR 12 SATELLITE INSURED THAT THE PRIMARY OPTICAL AXES OF THE RADIOMETERS WERE ORIENTED VERTICALLY DOWN TOWARD NADIR. THE SURVEY OF THE EARTH'S SURFACE BY BOTH RADIOMETERS WAS CARRIED OUT BY THE MOTION OF THE SATELLITE RELATIVE TO THE EARTH. IN ADDITION, THE NARROW-ANGLE RADIOMETER SCANNED 66 DEG TO EITHER SIDE OF NADIR IN A PLANE NORMAL TO THE ORBITAL PLANE BY ROCKING THE SCANNING MIRROR ABOUT THE OPTICAL AXIS. THE RADIOMETERS COVERED A STRIP ABOUT 3500 KM WIDE ON THE EARTH'S SURFACE AND HAD A GROUND RESOLUTION OF 50 KM AT NADIR. THE DATA WERE REDUCED AT THE GROUND STATIONS AND WERE TRANSMITTED TO THE HYDROMETEOROLOGICAL CENTER IN MOSCOW, WHERE THEY WERE RECORDED IN DIGITAL FORM ON MAGNETIC TAPE AND WERE USED TO PRODUCE VARIOUS ANALYSIS PRODUCTS SUCH AS EARTH-ATMOSPHERE ALBEDO CHARTS AND RADIATION TEMPERATURE MAPS. THE DATA WERE ARCHIVED AT THE HYDROMETEOROLOGICAL CENTER. SOME OF THESE CHARTS WERE TRANSMITTED IN GRAPHICAL FORM TO VARIOUS FOREIGN METEOROLOGICAL CENTERS, INCLUDING THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE (NESS), SUITLAND, MARYLAND. THESE ACTINOMETRIC CHARTS WERE RECEIVED AT NESS VIA THE 'COLD LINE' FACSIMILE LINK WITH MOSCOW BEGINNING IN JULY 1972. THE CHARTS WERE MICROFILMED AND ARCHIVED AT THE NATIONAL CLIMATIC CENTER (NCC), ASHEVILLE, NORTH CAROLINA. THE ACTINOMETRIC INSTRUMENT WAS BELIEVED TO BE ACTIVE AS OF JULY 1972.

REFERENCES

199.

EXPERIMENT NAME- ATMOSPHERIC THERMAL SOUNDER NSSDC ID 72-049A-04

EXPERIMENT PERSONNEL

PI - SHS STAFF SOV. HYDROMET. SERVICE MOSCOW, USSR

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

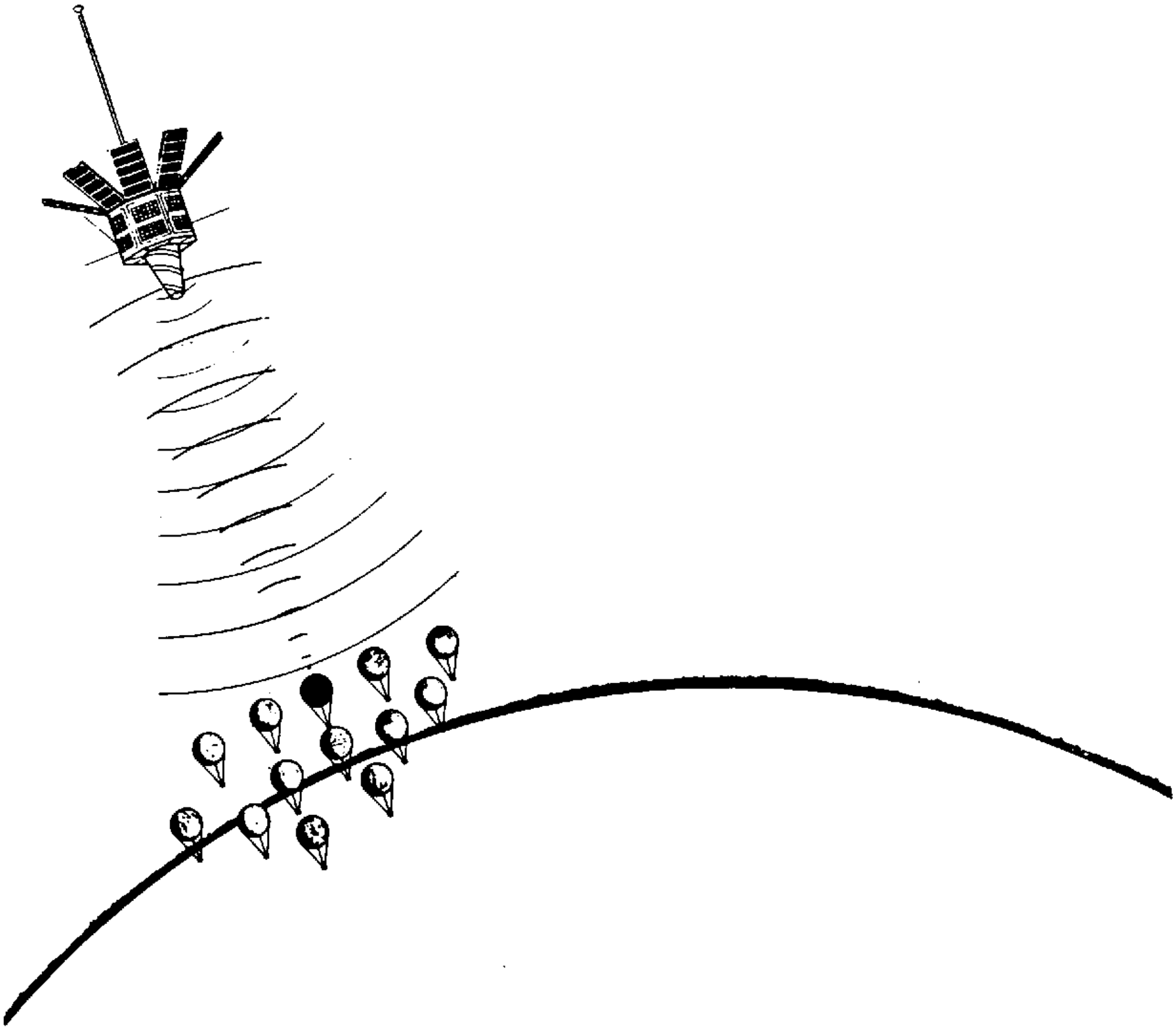
THE METEOR 12 ATMOSPHERIC THERMAL SOUNDER WAS AN OPERATIONAL EXPERIMENT DESIGNED TO OBTAIN VERTICAL PROFILES OF TEMPERATURE AND EARTH ATMOSPHERE HUMIDITY BY INDIRECT MEANS UNDER A VARIETY OF CLOUDCOVER CONDITIONS. THE INSTRUMENTATION CONSISTED OF A MEDIUM-RESOLUTION DIFFRACTION SPECTROMETER, WHICH SCANNED CONTINUOUSLY OVER A 20-SEC OBSERVING CYCLE IN THE 10.5- TO 15-MICRON BAND. THE RESOLVING POWER OF THE SPECTROMETER IN THE OPERATIONAL SPECTRAL RANGE WAS WITHIN 4 TO 5 MILLIMICRONS. FROM AN AVERAGE SATELLITE ALTITUDE OF ABOUT 910 KM, THE INSTRUMENT'S FIELD OF VIEW COVERED A 78- BY 39-KM AREA ON THE EARTH'S SURFACE WITH THE LONG SIDE ORIENTED PARALLEL TO THE SATELLITE TRAJECTORY. TEMPERATURE PROFILES WERE CONSTRUCTED AT THE HYDROMETEOROLOGICAL CENTER FROM THE SPECTRAL RADIATION DATA BY MEANS OF MATHEMATICAL INVERSION TECHNIQUES FOR CLEAR AND OVERCAST CLOUDCOVER

CONDITIONS. THE AVERAGE ERROR FOR THESE PROFILES WAS 2 TO 4 DEG K. TEMPERATURE PROFILES WERE ALSO CONSTRUCTED FOR PARTLY CLOUDY CONDITIONS. ATMOSPHERIC HUMIDITY PROFILES WERE STATISTICALLY DERIVED USING MEASUREMENTS OF THE OUTGOING RADIATION IN THE 15-MICRON BAND. THE EXPERIMENT WAS BELIEVED TO BE ACTIVE AS OF JULY 1972.

REFERENCES

704.

The Program of France



PEOLE AND EOLE

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C. THE PROGRAM OF FRANCE

PEOLE and EOLE

SPACECRAFT COMMON NAME- PEOLE 1 NSSDC ID 70-109A
ALTERNATE NAMES- PEOLE, PRELIMINAIRE EOLE

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 12/24/70
APOGEE- 749.000 KM ALT
PERIGEE- 635.000 KM ALT
PERIOD- 98.43 MIN
INCLINATION- 15.00 DEG

OTHER INFORMATION
SPACECRAFT WT- 70. KG
LAUNCH DATE- 12/24/70
OPERATING STATUS- NORMAL

SPACECRAFT PERSONNEL
PM - UNKNOWN UNKNOWN
PS - UNKNOWN UNKNOWN

SPACECRAFT BRIEF DESCRIPTION
PEOLE 1 (PRELIMINAIRE EOLE) WAS THE FIRST FRENCH EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE FIRST LAUNCHED BY THE CENTRE NATIONAL D'ETUDES SPATIALES (CNES) FROM THE CENTRE SPATIAL GUYANAIS NEAR KOUROU, FRENCH GUIANA. THE SATELLITE WAS PLACED INTO A NEAR-CIRCULAR, NEAR-EQUATORIAL ORBIT BY A DIAMANT B LAUNCH VEHICLE. LAUNCHED BEFORE THE INITIATION OF FRANCE'S OPERATIONAL METEOROLOGICAL SATELLITE PROGRAM, PEOLE 1 WAS DESIGNED TO TEST THE FEASIBILITY OF ACQUIRING DATA, INCLUDING WIND VELOCITY, BY RECEPTION OF TELEMETRY AND TRACKING DATA FROM INDEPENDENT EARTH-CIRCLING, CONSTANT-ALTITUDE, METEOROLOGICAL BALLOONS. QUALIFYING TESTS WERE MADE OF A GRAVITY-GRADIENT STABILIZATION AND ATTITUDE SYSTEM, ONBOARD ENGINEERING, AND METEOROLOGICAL EXPERIMENTAL EQUIPMENT THAT WERE LATER USED ON THE EOLE METEOROLOGICAL SATELLITE. IN ADDITION, STUDIES WERE MADE OF THE EFFECTS OF THE SPACE RADIATION ENVIRONMENT ON SOLAR CELLS COMPOSED OF THIN LAYERS OF CADMIUM SULFIDE AND CADMIUM TELLURIDE. THE SATELLITE WAS IN THE FORM OF A REGULAR OCTAHEDRON 0.70 M ACROSS OPPOSITE CORNERS AND 0.55 M LONG WITH EIGHT SOLAR PANELS CONTAINING 5920 SOLAR CELLS, WHICH WERE DEPLOYED 45 DEG FROM THE SPACECRAFT'S UPPER OCTAGONAL STRUCTURE AFTER ORBITAL INSERTION. A 136.350-MHZ (1-W) COMMAND RECEIVER HANDLED THE COMMAND AND PROGRAMMING TELEMETRY. THE SATELLITE-BALLOON AND SATELLITE-EARTH INTERROGATION SYSTEMS WERE TESTED WITH A 400.190-MHZ (4-W) TRANSMITTER THAT OPERATED THROUGH AN EARTH-ORIENTED CANTED TURNSTILE ANTENNA MOUNTED ON THE SATELLITE BASE. PEOLE 1 WAS A SUCCESS, AND NEARLY ALL OF ITS SYSTEMS WERE INCORPORATED INTO THE DESIGN OF EOLE 1.

REFERENCES
62, 70, 86, 192, 210, AND 216.

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SPACECRAFT COMMON NAME- EOLE NSSDC ID 71-071A
ALTERNATE NAMES- CAS-A

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ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 08/16/71
APOGEE- 906.000 KM ALT
PERIGEE- 678.000 KM ALT
PERIOD- 100.7 MIN
INCLINATION- 50.153 DEG

OTHER INFORMATION
SPACECRAFT WT- 84.7 KG
LAUNCH DATE- 08/16/71
OPERATING STATUS- NORMAL

SPACECRAFT PERSONNEL

PM - S.R.	STEVENS	NASA-GSFC	GREENBELT, MD.
PS - W.R.	BANDEEN	NASA-GSFC	GREENBELT, MD.

SPACECRAFT BRIEF DESCRIPTION

EOLE 1, THE SECOND FRENCH EXPERIMENTAL METEOROLOGICAL SATELLITE AND THE FIRST LAUNCHED BY NASA UNDER A COOPERATIVE AGREEMENT WITH THE CENTRE NATIONAL D'ETUDES SPATIALES (CNES), WAS DESIGNED TO FUNCTION PRIMARILY AS A COMMUNICATIONS SATELLITE TO ACQUIRE AND RELAY TELEMETERED DATA ON ALTITUDE, PRESSURE, TEMPERATURE, MOISTURE, AND UPPER ATMOSPHERIC WIND VELOCITIES FROM INSTRUMENTED EARTH-CIRCLING CONSTANT DENSITY METEOROLOGICAL BALLOONS. THE OCTAGONALLY SHAPED SATELLITE MEASURED 0.71 M ACROSS OPPOSITE CORNERS AND WAS 0.58 M LONG. ELECTRICAL POWER (20 W AVERAGE) WAS SUPPLIED BY EIGHT RECTANGULAR SOLAR PANELS DEPLOYED 45 DEG FROM THE EOLE 1 UPPER OCTAGONAL STRUCTURE AFTER ORBITAL INSERTION AND BY 15 RECHARGEABLE SILVER-CADMIUM BATTERIES. CONSTANT EARTH ORIENTATION WAS MAINTAINED BY A DEPLOYABLE 10.06-M-LONG GRAVITY GRADIENT BOOM. SATELLITE SPIN WAS EXPECTED TO BE NEAR ZERO RPM IN ORBIT, AND THE ATTITUDE WAS PROGRAMMED TO REMAIN STABLE WITHIN 9 DEG OF LOCAL VERTICAL. THE DATA WERE STORED ON BOARD THE SPACECRAFT AND UNLOADED ON COMMAND WHEN THE SPACECRAFT WAS IN RANGE OF THE GROUND STATION. THE ONBOARD TELEMETRY CONSISTED OF (1) A 136.350-MHZ DOWNLINK TRANSMITTER (250 MW) FOR RELAYING BALLOON TELEMETRY TO GROUND STATIONS AND ALSO SERVING AS A TRACKING BEACON, (2) A 148.25-MHZ RECEIVER FOR RECEIVING SPACECRAFT COMMANDS AND TELEMETRY PROGRAMS FOR BALLOON OPERATIONS, AND (3) A SPACECRAFT-TO-BALLOON TRANSMITTER (464.84 MHZ) AND RECEIVER (401.7196 MHZ). WITH THE EXCEPTION OF THE INADVERTENT DESTRUCTION OF 71 BALLOONS BY AN ERRONEOUS GROUND COMMAND, THE SATELLITE AND ITS SUBSYSTEMS HAVE PERFORMED NORMALLY SINCE LAUNCH (JULY 1972).

REFERENCES

55, 70, 87, 142, 194, 201, 272, 281, 655, 660, 670, AND 759.

EXPERIMENT NAME- UPPER ATMOSPHERE WINDS AND WEATHER DATA RELAY   NSSDC ID 71-071A-01

EXPERIMENT PERSONNEL

PI - W.R.	BANDEEN	NASA-GSFC	GREENBELT, MD.
OI - A.	KASAHARA	NCAR	BOULDER, COLO.
OI - J.	ANGELL	NOAA	SUITLAND, MD.
OI - Y.	MINTZ	U OF CALIFORNIA, LA	LOS ANGELES, CA.

OPERATING STATUS- NORMAL

EXPERIMENT BRIEF DESCRIPTION

THE EOLE 1 UPPER ATMOSPHERIC WINDS AND WEATHER DATA RELAY SYSTEM CONSISTED OF EQUIPMENT DESIGNED PRIMARILY TO COLLECT VARIOUS METEOROLOGICAL DATA FROM BALLOONS IN THE SOUTHERN HEMISPHERE FLOATING AT PRESSURE ALTITUDES OF ABOUT 200 MB. A SECONDARY OBJECTIVE WAS TO DEVELOP TECHNIQUES FOR ACCURATELY DETERMINING BALLOON POSITIONS FROM AN ORBITING SPACECRAFT. THE

SATELLITE CARRIED A MODIFIED DOPPLER SYSTEM ON BOARD, WHICH, WHEN COMBINED WITH SATELLITE-ACQUIRED RANGE MEASUREMENTS, COULD LOCATE A BALLOON'S HORIZONTAL POSITION TO WITHIN PLUS OR MINUS 3 KM. AS MANY AS 500 3.66-M-DIAMETER, HELIUM-FILLED, 30-DAY-LIFETIME CONSTANT DENSITY BALLOONS WERE LAUNCHED AT THE RATE OF THREE PER DAY FROM THREE SITES IN ARGENTINA, WITH AN ADDITIONAL 250 HELD IN RESERVE TO REPLACE THOSE THAT FAILED. EACH BALLOON HAD A FRANGIBLE 9.75-M-LONG INSTRUMENTATION LINE CARRYING TEMPERATURE AND PRESSURE SENSORS, SOLAR CELLS AND BATTERIES FOR POWER SUPPLIES, A TELEMETRY RECEIVER OPERATING AT 464.4864 MHZ, AND A 4-W, 401.71796-MHZ TRANSMITTER USING A LINEAR SLEEVE ANTENNA. THE SPACECRAFT INTERROGATED THE BALLOONS BOTH DAY AND NIGHT, INDIVIDUALLY, IN SEQUENCE, OR IN A PROGRAMMED GROUP (UP TO 64 AT A TIME). THE BALLOON POSITION AND SENSOR DATA WERE RELAYED TO THE GROUND AND WERE FED INTO A COMPUTER PROGRAM THAT PROVIDED, FOR OPERATIONAL USE, WIND SPEED AND DIRECTION, AMBIENT TEMPERATURE AND PRESSURE, AND BALLOON SUPERPRESSURE. EACH BALLOON WAS ALSO EQUIPPED WITH AN EXPLOSIVE CHARGE FOR SELF-DESTRUCTION, WHICH COULD BE TRIGGERED BY GROUND COMMAND IF THE BALLOON DRIFTED BEYOND THE EXPERIMENT'S LATITUDINAL LIMITS (30 DEG S TO 60 DEG S). ON SEPTEMBER 11, 1971, 72 OF THE 115 BALLOONS IN OPERATION WERE ACCIDENTLY DESTROYED WHEN GROUND PERSONNEL INADVERTENTLY SENT UP A GENERAL DESTRUCT COMMAND INSTEAD OF THE INTERROGATION COMMAND. OTHERWISE, AS OF MAY 1972, THE EXPERIMENT HAS FUNCTIONED NORMALLY SINCE LAUNCH.

REFERENCES

55, 70, 87, 195, 201, 212, 281, 636, 660, 670, AND 759.

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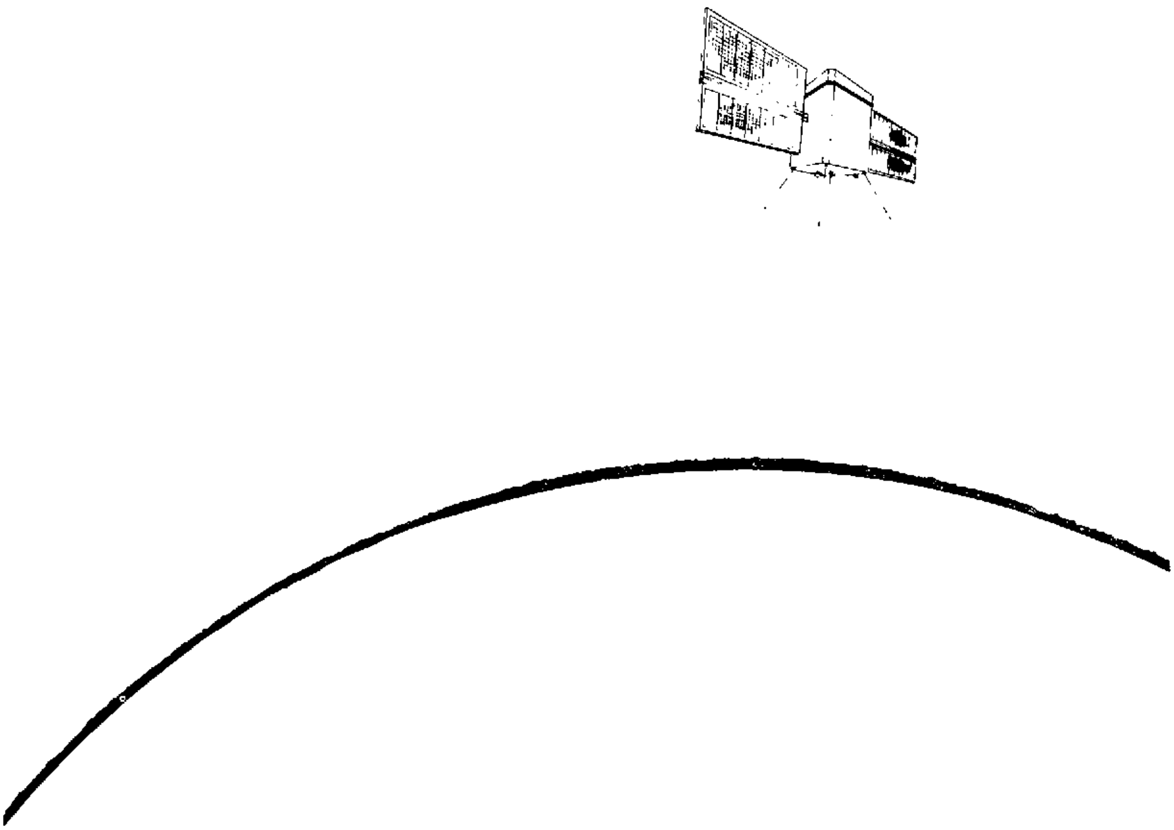
The Program of the United Kingdom



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D. THE PROGRAM OF THE UNITED KINGDOM

X-4

SPACECRAFT COMMON NAME- X-4 NSSDC ID X-4
ALTERNATE NAMES-

ORBITAL INFORMATION
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- / /
APOGEE- 500.000 KM ALT
PERIGEE- 500.000 KM ALT
PERIOD- MIN
INCLINATION- DEG

OTHER INFORMATION
SPACECRAFT WT- UNKNOWN KG
LAUNCH DATE- 05/00/74
OPERATING STATUS- PLANNED

SPACECRAFT PERSONNEL

PM -	UNKNOWN	UNKNOWN
PS -	UNKNOWN	UNKNOWN

SPACECRAFT BRIEF DESCRIPTION

THE X-4 SATELLITE WILL BE THE SECOND TECHNOLOGICAL SATELLITE OF THE BRITISH SPACE PROGRAM WHEN IT IS PLACED IN A LOW (500 KM), CIRCULAR, SUN-SYNCHRONOUS ORBIT IN 1974 BY A NASA SCOUT LAUNCH VEHICLE. THE SPACECRAFT WILL BE PART OF BRITIAN'S CONTRIBUTION TO GARP AND THE WORLD WEATHER WATCH PROGRAM FOR THE 1970'S. PRIMARILY AN EXPERIMENTAL METEOROLOGICAL SATELLITE, THE X-4 SPACECRAFT WILL ALSO TEST THE FEASIBILITY OF USING A PROPANE GAS JET SYSTEM FOR HIGH ACCURACY (0.02 TO 0.1 DEG) TRIAXIAL ATTITUDE CONTROL. THE SPACECRAFT WILL TENTATIVELY CARRY TWO METEOROLOGICAL EXPERIMENTS -- A HIGH-RESOLUTION MULTICHANNEL INFRARED RADIOMETER AND A LOW-RESOLUTION EARTH ALBEDO RADIOMETER. THE SATELLITE WILL BE IN THE FORM OF A BOX, 80.5 CM HIGH WITH A SQUARE BASE 65.0 CM ON A SIDE. MOUNTED ON THE SATELLITE BASE FACING EARTHWARD WILL BE (1) THE IR RADIOMETER, (2) THE EARTH ALBEDO SENSOR, (3) THE ALBEDO HORIZON DETECTORS, (4) A LIGHT, INEXPENSIVE CANOPUS STAR SENSOR, (5) A COARSE SUN SENSOR ARRAY, (6) A TWO-AXIS FINE SUN SENSOR, AND (7) FOUR VHF AERIALS. ATTACHED TO EITHER SIDE OF THE BOX STRUCTURE ARE FLEXIBLE DEPLOYABLE SOLAR PANELS WITH WRAPAROUND CONTACT SOLAR CELLS. THESE PANELS, WHICH HAVE CONSIDERABLE STRETCH CAPABILITY, WILL BE STOWED IN CONCERTINA FASHION WITH INTERLEAVING STRIPS TO AVOID VIBRATIONAL DAMAGE DURING LAUNCH. THEY WILL BE DEPLOYED AFTER LAUNCH AND WILL MEASURE 256 CM FROM ONE PANEL TO THE OTHER. LOCATED WITHIN THE BOX-SHAPED SPACECRAFT ARE -- (1) A FOUR-TRACK TAPE RECORDER WITH 1.6 MEGABITS OF STORAGE CAPACITY, (2) STRAPPED-DOWN INTEGRATING GYROS, (3) A BATTERY, (4) A DATA ENCODER AND PROGRAMMER/ROUTER, AND (5) VARIOUS SENSOR AND ATTITUDE CONTROL ELECTRONICS. THE X-4 SATELLITE WILL GENERATE ABOUT 400 KILOBITS OF INFORMATION/ORBIT. DATA WILL BE RECORDED ON THE ONBOARD TAPE RECORDER AT 64 BITS/SEC AND REPLAYED FROM THE RECORDER OR TRANSMITTED DIRECTLY AT 2048 BITS/SEC AT 137 MHZ. THE SATELLITE SPIN RATE WILL BE LOWERED AFTER SEPARATION BY CONVENTIONAL YO-YO TECHNIQUES AND THEN BROUGHT TO NEAR ZERO BY THE PRIME GAS JET SYSTEM.

REFERENCES

450, 809, AND 829.

EXPERIMENT NAME- HIGH-RESOLUTION MULTICHANNEL INFRARED RADIOMETER   NSSDC ID X-4 -01

EXPERIMENT PERSONNEL
PI - UNKNOWN   UNKNOWN

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION
THE HIGH-RESOLUTION MULTICHANNEL INFRARED RADIOMETER BEING PLANNED FOR THE X-4 SATELLITE WILL BE SIMILAR TO THE OXFORD/HERIOT-WATT TYPE RADIOMETER USED IN THE NIMBUS PROGRAM.

REFERENCES
450, 809, AND 829.

EXPERIMENT NAME- EARTH ALBEDO RADIOMETER   NSSDC ID X-4 -02

EXPERIMENT PERSONNEL
PI - UNKNOWN   UNKNOWN

OPERATING STATUS- PLANNED

EXPERIMENT BRIEF DESCRIPTION
THE EARTH ALBEDO RADIOMETER DESIGNED FOR THE X-4 SATELLITE WILL BE A LOW-RESOLUTION INFRARED SENSOR CAPABLE OF MEASURING THE GLOBAL DISTRIBUTION OF REFLECTED SOLAR AND LONGWAVE RADIATION LEAVING THE EARTH'S ATMOSPHERE.

REFERENCES
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APPENDIX

Availability of Satellite Meteorological Data

SOURCES[1] FOR METEOROLOGICAL SATELLITE DATA
(July 1972)

Satellite	Sensor[1]	Photographic: Film Strips	Photographic: Paper Prints	Magnetic Tape: Digital	Magnetic Tape: Analog	Grid Print Maps	Nonstandard Format
ATS 1	SSCC	NCC	NCC	NCC,UW	UW		UW (See pp. A.5 to A.13)
ATS 2	AVCS	NADUC					
ATS 3	MSSCC	NCC,NADUC[2]	NCC,NADUC[2]	NCC,UW	UW		UW,NAC (See pp. A.5 to A.13)
ATS 3	IDC	NCC	NCC				
Cosmos 144, 156,189,206 and 226	Dual Vidicon	SHC					SHC,NESS[3],NCC[4]
	Scanning HRIR	SHC		SHC			SHC,NESS[3],NCC[4]
	Actinometer			SHC			SHC,NCC[4]
Dodge	Dual Vidicon	APL		APL			
ERTS 1	MSS	ERDC[8]	ERDC[8]				
	RBV	ERDC[8]	ERDC[8]				
ESSA 1	Vidicon Camera	NCC	NCC				
ESSA 2,4,6,8	APT		NESS[5]				
ESSA 3,5,7,9	FPR			NESS			
ESSA 3,5,7,9	AVCS	NCC	NCC	NCC			NCC[6],WAB (See pp. A.5 to A.13)
Explorer 7	Thermal Radiation			NSSDC			
ITOS 1 NOAA 1	FPR			NESS			
	AVCS	NCC		NCC			
	SR			NCC		NCC	
Meteor 1 through 12	Dual Vidicon	SHC					SHC,NESS[3],NCC[4]
	Scanning HRIR	SHC		SHC			SHC,NESS[3],NCC[4]
	Actinometer			SHC			SHC,NCC[4]
Nimbus 1,2	AVCS	NCC	NCC				
Nimbus 3,4	IDCS	NCC	NCC	NCC			
Nimbus 1,2,3	HRIR	NSSDC	NSSDC	NSSDC		NSSDC	
Nimbus 2,3	MRIR	NSSDC	NSSDC	NSSDC		NSSDC	
Nimbus 4	THIR	NSSDC	NSSDC	NSSDC		NSSDC	
Nimbus 3,4	SIRS			NESS,NSSDC[7]			
Nimbus 3,4	IRLS						NADUC (printouts from individual experiments)
Nimbus 3,4	IRIS			NSSDC			
Tiros 1 through 10	TV Camera	NCC	NCC				
Tiros 2,3,4,7	Scanning Radiometer			NSSDC		NSSDC	
Tiros 3,4,7	Low-Resolution Omni-directional Radiometer			NSSDC		NSSDC	

1 See glossary for an explanation of acronyms and abbreviations.
2 Color only.
3 Paper prints are maintained for one year then discarded unless of unusual interest.
4 Derived products, nephanalyses, composites, etc.
5 Photographs taken over the United States only.
6 5-, 30-, and 90-day average brightness charts.
7 Radiances at NSSDC; deduced temperature profiles at NESS.
8 Primary source for the general public.

FILM LOOPS AND MOVIE DATA AVAILABLE FROM SELECTED SATELLITES

IDENTIFICATION	DATE	REMARKS
1. ATS 1 Film Loops from University of Wisconsin*		
CD-1	Jan. 7-8, 1967	Complete day
CD-2	Feb. 18-19, 1967	Complete day
CD-3	Feb. 19-20, 1967	Complete day
CD-3.1	Apr. 13-14, 1967	Complete day
CD-3.2	Apr. 14-15, 1967	Complete day
CD-3.3	Apr. 15-16, 1967	Complete day
CD-4	Apr. 16-17, 1967	Complete day
CD-4.1	Apr. 17-18, 1967	Complete day
CD-5	Apr. 18-19, 1967	Complete day
CD-6	Apr. 19-20, 1967	Complete day
CD-7	Apr. 20-21, 1967	Complete day
CD-8	Apr. 21-22, 1967	Complete day
CD-9	Apr. 22-23, 1967	Complete day
CD-10	Apr. 23-24, 1967	Complete day
CD-16	June 21-22, 1967	Complete day
CD-17	July 15-16, 1967	Complete day
CD-21	Sept. 16-17, 1967	Complete day
CD-22	Sept. 17-18, 1967	Complete day
CD-12.15-69	Dec. 15, 1969	Complete day
CD-12.16-69	Dec. 16, 1969	Complete day
CD-12.17-69	Dec. 17, 1969	Complete day
CD-1.18-70	Jan. 18, 1970	Complete day
CD-1.19-70	Jan. 19, 1970	Complete day
CD-1.20-70	Jan. 20, 1970	Complete day
CD-1.21-70	Jan. 21, 1970	Complete day
CD-3.27-70	Mar. 27, 1970	Complete day
CD-3.28-70	Mar. 28, 1970	Complete day
CD-3.29-70	Mar. 29, 1970	Complete day
CD-5.5-70	May 5, 1970	Complete day
CD-5.6-70	May 6, 1970	Complete day
CD-5.7-70	May 7, 1970	Complete day
2CD-1	Feb. 18-20, 1967	Two complete days
DS-2	Jan. 21 - Feb. 28 1967	Daily series, 35 pictures at approximately local noon

*For address see page A.15.

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IDENTIFICATION	DATE	REMARKS
1. ATS 1 Film Loops from University of Wisconsin (continued)		
CU-1	Feb. 19-20, 1967	Close-up of cloud wave in a polar jet
CU-3	June 21-22, 1967	Close-up of easterly waves, Southeast Pacific
STS-CU-2	Apr. 6-15, 1967	Special time series of the birth and death of a hurricane
2. ATS 1 Short Movies from University of Wisconsin		
12CD-1	Apr. 13-24, 1967	
12CD-1 W/CU	Apr. 13-24, 1967	Close-up of a cyclone
DS-1967	1967	Five frames per day (300 taken at approximately local noon)
STS-6	1967	Five frames per day (one per week taken at approximately local noon)
STS-5	Aug. 31 - Sept. 22, 1967	Life history of Typhoon Sarah

IDENTIFICATION	DATE	REMARKS

3. ATS 1 Movies from University of Wisconsin

IDENTIFICATION	DATE	REMARKS
"Weather in Motion"		Consists of CD-1, CD-3, CD-4, DS-2, STS-CU-2, and CU-1
"Mesoscale Cloud Motions from ATS Synchronous Satellites"		Consists of ATS 1 (CD-3, CU-1, CD-16, CU-3, 12CD-1 W/CU) and parts of ATS 3 movie

4. ATS 1 Films from Walter A. Bohan Co.*

IDENTIFICATION	DATE	REMARKS
WAB 102 "Detailed Views of Mesoscale Cloud Patterns"	Jan. 7-8, 1967	50°N to 50°S, 140°E to 80°W (Fujita/Bohan)
WAB 223 "The Use of Clouds in Motion for Teaching Synoptic Meteorology"	1969 - 1970	Selected synoptic scale sequence
WAB 334 "Barrier Effects of Mountains on Cloud Patterns"	1970 - 1971	Selected sequences ATS 1 and ATS 3; jet stream cirrus, mountain waves, and mountain gap streamers

5. ATS 3 Film Loops from University of Wisconsin

IDENTIFICATION	DATE	REMARKS
CD-C-1	Nov. 18, 1967	Complete day
CD-4.22-23.8	Apr. 22-23, 1968	Complete day
CD-5.6-9	May 6, 1969	Complete day
CD-7.27-69	July 26, 1969	Complete day

*For address see page A.15.

IDENTIFICATION	DATE	REMARKS
5. ATS 3 Film Loops from University of Wisconsin (continued)		
CD-7.27-69	July 27, 1969	Complete day
CD-7.28-69	July 28, 1969	Complete day
ATS-3-STS-CU1	Apr. 19, 1968	Close-up of tornado watch
6. ATS 3 Movies from University of Wisconsin		
"Weather in Motion and in Color"	Nov. 18, 1967	Selected close-ups
"Mesoscale Cloud Motions from ATS Synchronous Satellites"		ATS 1 (CD-3, CU-1, CD-16, CU-3, 12CD-1 with CU) and parts of ATS 3 movie
"The 1968 Barbados Experiment"	May 1-11, 15-17, 23-25, 29-30, 1968, and June 1, 5, 6, 9, 16, 20-24, 1968	Close-ups of Barbados area
"Solar Eclipse"	Mar. 7, 1970	Path of totality and selected close-ups of U.S.
"Weather Patterns"	July 18, 1969	Precision display negatives with close-ups of the Caribbean and Barbados
"Cloud Cluster and Meso-Convective Cloud Development"	July 24 and 26, 1969	Precision display enhanced negatives with close-ups of the Caribbean and Atlantic near African Coast

IDENTIFICATION	DATE	REMARKS
6. ATS 3 Movies from University of Wisconsin (continued)		
"Nicholson Movie" (special movie for Frank Nicholson's Preliminary Doctoral Thesis)		Includes Hurricanes Camille and Debby, Nicholson's dishpa[n] experiment on hurricane model, and tornado model experiments
7. ATS 3 Films from Walter A. Bohan Co.		
WAB 273 "Convective Cloud Patterns"	Aug. 13-15, 1970	Convective cloud patterns over western Tropical Atlantic, SE U.S., and the Caribbean Sea
WAB 334 "Barrier Effects of Mountains on Cloud Patterns"	1970 - 1971	Selected sequences ATS 1 and ATS 3; jet stream cirrus, mountain waves, and mountain gap streamers

IDENTIFICATION	DATE	REMARKS
8. ATS 3 16-mm Films from National Audiovisual Center*		
NASA Release No. 68-713	Nov. 18, 1967	Color time-lapse of cloud motions
NASA Index No. 04112	Apr. 19, 1968	Development of tornadic situations over Eastern U.S.
NASA Index No. 04113	Apr. 23, 1968	Time and location correlated tornadic and severe hail storm conditions over the Eastern U.S.
NASA Release No. 69-812	1968	Lives of Hurricanes Abby and Brenda; birth of Hurricane Candy
NASA Release No. 895 "ATS-III Views the March 7, 1970, Solar Eclipse"	Mar. 7, 1970	Color time-lapse from the MSSCC of umbra progression from South Pacific to Iceland
NASA Release No. 70-903 "Lubbock Tornadoes of May 11, 1970"	May 11, 1970	Cloud development, radar echoes alone and superposed upon cloud imagery; color aerial photographs of Lubbock damage and storm track data

*For address see page A.15.

IDENTIFICATION	DATE	REMARKS

9. ESSA Time-Lapse Movies from Walter A. Bohan Co.

IDENTIFICATION	DATE	REMARKS
WAB 195 "Indian Ocean Cloud Patterns"	1967	ESSA 3 and 5 tropical storm tracks 40°N to 30°S; 30°E to 160°E, Mercator Projection
WAB 196 "Tropical Pacific Cloud Patterns"	1967	ESSA 3 and 5 tropical storm tracks 40°N to 30°S; 150°E to 80°W, Mercator Projection
WAB 197 "Tropical Atlantic Cloud Patterns"	1967	ESSA 3 and 5 tropical storm tracks 40°N to 30°S; 90°W to 20°E, Mercator Projection
WAB 186 "Southern Hemisphere Cloud Patterns"	Sept. 16, 1967, - March 31, 1968	ESSA 3 and 5 Polar Stereographic Projection; 0° to 90°S
WAB 187 "South Pacific Cloud Patterns"	Sept. 16, 1967, - March 31, 1968	ESSA 3 and 5 Polar Stereographic Projection; South Pacific Ocean centered on 180°
WAB 191 "Northern Hemisphere Cloud Patterns"	1968	ESSA 3, 5, and 7 Polar Stereographic Projection; 0° to 90°N

IDENTIFICATION	DATE	REMARKS
9. ESSA Time-Lapse Movies from Walter A. Bohan Co. (continued)		
WAB 193 "North America Cloud Patterns"	1968	ESSA 3, 5, and 7 Polar Stereographic Projection
WAB 209 "Tropical Atlantic Cloud Patterns"	1968	ESSA 3, 5, and 7 tropical storm tracks 40°N to 30°S; 90°W to 40°E, Mercator Projection
WAB 226 "Tropical Pacific Cloud Patterns"	1968	ESSA 3, 5, and 7 tropical storm tracks 40°N to 30°S; 150°E to 80°W, Mercator Projection
10. ESSA Film Loops (from computer composite pictures) from University of Wisconsin		
OS-1	Jan. 21 - Feb. 25, 1967	Mercator Projection, Pacific Ocean (daily photographs, three frames per day)
OS-2	Jan. 26 - Mar. 25, 1967	North Polar Projection (daily photographs, three frames per day)
OS-5	Jan. 10 - May 31, 1967	North Polar Projection (daily photographs, three frames per day)

IDENTIFICATION	DATE	REMARKS
	10. ESSA Film Loops (from computer composite pictures) from University of Wisconsin (continued)	
OS-6	Jan. 10 - May 31, 1967	South Polar Projection (daily photographs, three frames per day)
OS-A-1	1967	Monthly averages; Mercator Projection; Pacific Ocean (five frames per month)
OS-A-2	1967	Monthly averages; Mercator Projection; Atlantic and Indian Oceans (five frames per month)
OS-A-3	1967	Fifteen-day averages; Mercator Projection; Pacific Ocean (five frames per photograph)
OS-A-4	1967	Fifteen-day averages; Mercator Projection; Atlantic and Indian Oceans (five frames per photograph)
OS-A-1967	1967	Short film, ESSA Mercator; monthly and 15-day averages, (OS-A-1 through OS-A-4)

LOCATIONS OF DATA SOURCES

APL	Applied Physics Laboratory of Johns Hopkins University 8621 Georgia Avenue Silver Spring, Maryland 20910
ERDC	Earth Resources Data Center Department of the Interior Sioux Falls, South Dakota 57189
NAC	National Audiovisual Center (GSA) Washington, D.C. 20409
NADUC	Nimbus/ATS Data Utilization Center NASA-GSFC Greenbelt, Maryland 20771
NCC	National Climatic Center NOAA Asheville, North Carolina 28801
NESS	National Environmental Satellite Service NOAA Suitland, Maryland 20233
NSSDC	National Space Science Data Center Code 601 NASA-GSFC Greenbelt, Maryland 20771
SHC	Soviet Hydrometeorological Center Moscow, U.S.S.R.
UW	University of Wisconsin Space and Earth Sciences Department Madison, Wisconsin 53706
WAB	Walter A. Bohan Co. 2026 Oakton Avenue Park Ridge, Illinois 60068

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