ABSTRACTS OF RESEARCH AND DEVELOPMENT DOCUMENTS

Vol. 20, No. 7, 1st - 15th April, 1967

Introduction

1. R & D Abstracts is issued twice a month by Technical Information and Library Services, Ministry of Technology. It is intended primarily to serve Ministry of Technology branches and their contractors by abstracting, as promptly as possible classified and unclassified reports which are received from the Ministry, other government agencies, industry and universities.

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P 146159 FR N66-34316 UNLIMITED
NASA CR 65454
Computer Sciences Corp., El Segundo, Calif., U.S.A. 025.5 629.78 APOLLO NAS 9-3710
INFORMATION RETRIEVAL AND ENGINEERING AIDS SYSTEM
15.7.1966 15pp.
The IR and EA System was designed to process, catalogue, edit and report the immense volumes of engineering data generated in the development and construction of Manned Spacecraft Systems for the Apollo Spacecraft Programme. The data involved includes complete descriptive information of development, test, and flight models, as well as ground support equipment.
VJB

PSYCHOLOGY

NASA SP 128 UNLIMITED
National Aero & Space Admin., U.S.A.
SECOND ANNUAL NASA-UNIVERSITY CONFERENCE ON MANUAL CONTROL (28.2 - 2.3.1966) 061.3 "3.1966" 621-52 159.946
417pp.
Contains the proceedings of the Second Annual NASA-University Conference on Manual Control held February 28 to March 2, 1966, at Cambridge, Massachusetts. The programme was divided into the following nine sessions; discrete and continuous models, adaptive control, information theory, multivariable control, display, motion and stress, applications, optimal control, and analysis and design methods. Both formal and informal presentations were made. All of the formal and some of the informal papers are included.
VJB

OPERATIONS RESEARCH

AD 634310 R.R.73 UNLIMITED
Carnegie Inst. of Tech., Graduate School of Industrial Admin., U.S.A. 65.012.1 016
OPERATIONS RESEARCH IN THE DESIGN OF MANAGEMENT INFORMATION SYSTEMS NONR 760(24)
Kriebel, C.H.
April, 1966 25pp., 77ref.
Surveys a representative selection of the literature on management information systems in which mathematical models are employed as the basis for analysis and systems design.
VJB

P 146405 AFSC M 375-1 UNLIMITED
Air Force System Command, Washington, D.C., U.S.A. 65.012.4
SYSTEMS MANAGEMENT. CONFIGURATION MANAGEMENT DURING DEFINITION AND ACQUISITION PHASES
1.6.1964 356pp.
This manual establishes policy, provides guidance, and assigns responsibilities for configuration management of system/equipment programmes. It prescribes typical formats, authorizes certain forms for preparation and maintenance of system/equipment programme specifications. It provides for making concurrent decisions to approve or disapprove changes in specified requirements and to approve or disapprove the development, production, and retrofit requirements of engineering changes, and for implementing these decisions. It provides for configuration accounting of a given mission, design, series (M/D/S) of a system/equipment programme.
STB

P 146404 AFSCM 375-5 UNLIMITED
Air Force Systems Command, Washington, D.C., U.S.A.
65.012.4
SYSTEMS MANAGEMENT. SYSTEMS ENGINEERING MANAGEMENT PROCEDURES
10.3.1966 225pp.
Establishes the requirements, policies, and procedures for SPO management of the system engineering effort. It is the system engineering management standard for all future AFSC system acquisition programmes, and projects.
STB

P 146403 AFSCM 375-4 UNLIMITED
Air Force Systems Command, Washington, D.C., U.S.A.
65.012.4
SYSTEMS MANAGEMENT. SYSTEM PROGRAM MANAGEMENT PROCEDURES
31.5.1966 190pp.
Establishes the requirements, policies, and procedures for the conceptual, definition, acquisition, and operational phases of a system programme. It prescribes the significant management actions for integrating and fulfilling the responsibilities of the organisational elements involved in managing a system programme. It is the mandatory management standard for all future AFSC system programmes and projects.
STB

P 146218 UNLIMITED
Boeing Co., Aerospace Group, Seattle, Wash., U.S.A.
061.3 (3.1967)
65.012.4
PROJECT EXPERIENCE IN THE APPLICATION OF SYSTEM EFFECTIVENESS ASSURANCE MANAGEMENT PRINCIPLES. (PRESENTED AT THE 2nd EIA SYSTEM EFFECTIVENESS CONFERENCE, FEB.28-MARCH 1,1967, LOS ANGELES, CALIF.)
MacDonald, K.A.B., Ball, L.E.
13pp.
Successful programme managers in a wide variety of projects have recognised the need for their staff to include a technical assurance function as well as a cost assurance and a schedule assurance function. The titles for such positions are usually "System Effectiveness Assurance Manager" or "Product Assurance Manager", but other titles have been used. The duties of the position vary with the phase of the programme, but in all cases the result is to give the programme manager and his customer confidence that everything that should be done to achieve system effectiveness can be, will be, is being, or has been done. Tangible evidence that this is so is provided by identifying, requiring and validating or when necessary providing appropriate data.
VJB

AD 633939 P 3358 UNLIMITED
Rand Corp., Santa Monica, Calif, U.S.A.
658.5.01
TOWARDS AN IMPROVED BASIS OF ESTIMATING AND CONTROLLING R AND D TASKS
Hill, L.S.
May, 1966 19pp.,8ref.
Effective managerial control requires that planning at all stages be accepted by both researchers and management. Some of the traditional approaches to recording and analysis of technological development programmes are satisfactory if properly used, but complementary techniques are needed to accommodate the unique characteristics of research activities. In the technological development area, it is especially important for control purposes that the complex of programme objectives and sub-objectives be clearly identified and that uncertainty be dealt with in an explicit fashion. The techniques for management control suggested in this paper should not interfere with creative activity but, on the contrary, might help to direct the researcher in the conduct of his work.
LBT

[illegible] Rep. [illegible] [illegible]
Bureau [illegible] & Survey, Wash.,
U.S.A. 016:
HYPERBARIC OXYGENATION BIBLIOGRAPHY CURRENT 615.836
TO 1965
20.6.1965 21pp., c.250ref.
References, mainly to published literature, arranged in order of author.
MHR

HEALTH & SAFETY

UKSH Rep. 67/10 UNLIMITED
U.K. Scientific Mission, Washington, D.C.,
U.S.A. 614.77
THE SOUTHEAST WATER LABORATORY 532.95
Griffith, D.L. 597
Jun., 1967 6pp.
This laboratory is one of those under the Federal Water Pollution Control Administration. The field organization of FWPCA is described. Research projects at the laboratory include (a) biological effect of pesticides on fish (b) estimation of pesticides in water (c) Pearl River Reservoir project.
FAM

FIRES & FIREFIGHTING

P 146690 NRL Rep. 6499 UNLIMITED
Naval Res. Lab., Washington, D.C., U.S.A.
THE PERMEABILITY AND ELUTRIATION METHODS FOR 614.843
DETERMINING THE SPECIFIC SURFACE OF DRY 539.215.3
CHEMICAL [illegible] EXTINGUISHING POWDERS
Norris, W.P.
20.1.[illegible] 22pp.,7ref.
The air permeability (Blaine) method gives a direct measure of the total surface of a powder sample. The air elutriation (Roller) method gives the distribution of particle diameters in a sample, from which the surface can be found by [illegible] or graphical integration. Measurements of the specific surface by the permeability method of powders ranging from approximately 2600 to 5900 cm²/g were reproducible to within ±1.% when the test was carried out in a preferred manner. Samples which were frequently exposed to the atmosphere by repeated opening of their containers over a period of a few months suffered an apparent loss of specific surface which could be only partially restored by agitation. Samples which were stored in continuously closed containers showed no change over the same period of time. Mixtures of equal weights of two powders of different composition and different grain shapes gave experimentally determined values of specific surface in good agreement with the average calculated from the specific surfaces of the individual powders. The elutriation method appeared to be unsuitable for characterising dry chemical powder extinguishants. FAM

MATHEMATICS

AD 638656 MRC TSR 625 UNLIMITED
Wisconsin Univ., Mathematics Res. Center,
Madison, U.S.A. — 512.3
ON SPLINE FUNCTIONS -,WITH SUPPLEMENT DA 11-022 ORD 2059
Schoenberg, I.J., Greville, T.N.E.
May, 1966 52pp.,17ref.
It is shown how spline functions allow one to generalize the Bernstein polynomials, thereby also leading to variation diminishing approximation methods which converge faster than the Bernstein polynomials.
VJB

COMPUTERS & DATA PROCESSING

NASA TM X-57637 N66-27933 UNLIMITED
National Aero. & Space Admin., U.S.A.
DESIGN OF COUNTUP-COUNTDOWN MACHINES 681.3.042
Moshos, G.J. 511.1
1965 144pp.,19ref.

The design of a class of special purpose computing machines which compute by counting is systematically developed. The basis of the design philosophy is to limit the basic building elements to three fundamental units and to develop the method of synthesis such that these three building elements are represented as operational units. In particular, the three basic building elements are; (1) the binary rate multiplier which is a means of scaling down a pulse stream to some specified fraction; (2) the counter; and (3) the anti-coincidence circuit which is a means of separating pulses arriving at the counter simultaneously.

VJB

AD 636396 RAC-TP-196 UNLIMITED
Research Analysis Corp., McLean, Va., U.S.A.
7040 SIMSCRIPT: A CASE STUDY 681.3.06 SIMSCRIPT
Weinert, A.E., Bosserman, J.R. D. 44-188-ARO-1
Feb., 1966 117pp.,8ref.

Simscript is a computer language designed to aid in the preparation of computer programs for a specific type of problem. Comparisons are made in terms of a particular problem programmed both in Simscript and Fortran IV.

VJB

AD 636435 352.14-R-2 UNLIMITED
Keller, Raymond & Brown-Singer Inc. State College, Pa., U.S.A. 025.5
A GENERAL MODEL FOR SIMULATING INFORMATION STORAGE AND RETRIEVAL SYSTEMS 681.3.06 NONR 38 18(00)
Blunt, C.R., Duquet, R.T., et al.
April, 1966 184pp.,8ref.

Presents the results of a research effort to explore the use of computer simulation as a quantitative tool for planning, analyzing and evaluating Information Retrieval (IR) systems. A general time-flow model has been developed that enables a systems engineer to simulate the interactions among personnel, equipment and data at each step in an information processing effort. The input parameters for the simulation reflect the configuration of the system, the processing load of the system, the work schedule of the system, the work schedule of the personnel, equipment availability, the likelihood and effect of errors in processing and the location and availability of the system user.

VJB

AD 634371 MTP-33 ESD-TR-66-289 UNLIMITED
Mitre Corp., Bedford, Mass., U.S.A.
AESOP: A GENERAL PURPOSE APPROACH TO REAL-TIME, DIRECT ACCESS MANAGEMENT INFORMATION SYSTEMS 681.3.06 025.5 65.01
Spiegel, J., Summers, J.K., et al. AF 19(628)-5165
June, 1966 31pp.

AESOP, a laboratory-based prototype of a general purpose, on-line, visually-oriented information system, is used to investigate ways of handling many different types and levels of command and management problems spanning organizational levels from the executive suite down through the staff and operations analysts to the actual system designers and programmers. In particular, it deals with those organizational activities that require highly flexible, direct-access capabilities.

VJB

RAE TR 66255 SPACE 166 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K.
THE DYNAMIC MODEL OF PROP, A COMPUTER PROGRAM FOR THE REFINEMENT OF THE ORBITAL PARAMETERS OF AN EARTH SATELLITE (Presented at COSPAR 7th International Space Science Symposium, Vienna, May, 1966) 531.352 681.3.06 FORTRAN 061.3 * 5.1966*
Morson, R.H.
Aug., 1966 30pp.,9ref.

PROP is the code-name for a new orbit determination program written in FORTRAN for an ATLAS computer. With certain minor modifications the program can also handle certain tracking network assessment problems and prediction problems. PROP is similar, in many respects, to the D.O.I. programme of the Smithsonian Institution Astrophysical Observatory, which is based on the theory of Kozai. PROP, however, is capable of handling not only range and angle observations but also observations of range rate and angle rate, so that virtually all current types of ground-based satellite observations can be analysed.

(continued)

RAE TR 66255 (continued)

This paper is concerned mainly with extensions and modifications of Kozai's theory in respect of perturbations due to the gravity field of the earth. In particular, the long-periodic perturbation of the mean anomaly is derived, and compact formulae for perturbations due to zonal harmonics up to any order are presented in a form suitable for computation. Particular attention is paid to the removal of singularities at $e \approx 0$, $i \approx 0$ and to the pseudoresonance at $i \approx 63$deg.4.

VJB

AD 636738 NWL Rep. 2035 UNLIMITED
Naval Weapons Lab., Dahlgren, Va., U.S.A.
DA-MRCA: A FORTRAN IV PROGRAM FOR MULTIPLE LINEAR REGRESSION 519.653 681.3.06 FORTRAN 519.651.2
Att, K., Gemill, C., et al.
March, 1966 207pp.,12ref.

DAhlgren-Multiple Regression Comprehensive Analysis is partially based on the Tennessee Valley-MRCA. A multiple linear regression program is given for up to 50 independent variables written in Fortran IV for the IBM 7030 (STRETCH) computer. An outline of the applicability of program includes non-orthogonal analysis of variance.

VJB

NASA TN D-5523 N66-30346 UNLIMITED
National Aero. & Space Admin., U.S.A.
A COMPUTER PROGRAM FOR CALCULATING THE AERODYNAMIC CHARACTERISTICS OF FINS AT SUPERSONIC SPEEDS 533.694.541 681.3.06
Barrowman, J.S.
April, 1966 35pp.,6ref.

By numerical solution of Busemann's Second Order Aerofoil Theory and the spanwise summing of aerofoil strips, FIN determines the pressure coefficient distributed over a given fin configuration moving at supersonic speeds. In determining the distribution, the program can include the effect of a fin-tip Mach cone. From this basic calculation, FIN can determine as functions of angle of attack the lift coefficient, wave drag coefficient, pitching moment coefficient, and centre-of-pressure location, and as a function of fin cant angle the rolling moment coefficient.

VJB

AD 607408 — NL TDR 64-52 Vol.2. — UNLIMITED

International Business Machines Corp., Space Guidance Center, Oswego, N.Y., U.S.A.

AUTOMATED DIGITAL COMPUTER PROGRAM FOR DETERMINING RESPONSES OF ELECTRONIC SYSTEMS TO TRANSIENT NUCLEAR RADIATION. VOLUME II: PREDICT CIRCUIT ANALYSIS PROGRAM

681.3.06 PREDICT
539.1.044
U 03927: 10853
Proj.5776
AF 29(601)5399

Aug., 1964 152pp., 6ref.

PREDICT is an IBM 7090/7094 program which automatically solves, from a description of the network topology, built-in differential and algebraic matrix equations which completely characterize the behaviour of a complex network. The general approach in the PREDICT formulation does not limit it to radiation applications: the radiation problem is treated as a special case of the general circuit analysis problem. Contains information useful to circuit analysts and computer programmers for application of this program. A detailed description of PREDICT, a discussion of its use and operation, and example problems are included to demonstrate and verify its operation at other computing facilities. The last section contains information on machine requirements and off-line equipment necessary for the PREDICT system.

DMA

AD 630301 — RM 4782 PR — UNLIMITED

Rand Corp., Santa Monica, Calif., U.S.A.

A COMPUTER SIMULATION OF ADAPTIVE ROUTING TECHNIQUES FOR DISTRIBUTED COMMUNICATIONS SYSTEMS

681.3.06 FORTRAN
621.39
AF 49 (638)1700

Boehm, B.W., Mobley, R.L.

Feb., 1966 44pp., 2ref.

Describes a computer model of a distributed communications system, written in FORTRAN IV and designed to test various adaptive message routing techniques. The program simulates the progress of messages through the system and measures the effects of adaptation of the routing techniques to specified degrees of destruction of its links and nodes. Details of the program are given, plus a list of pitfalls to avoid in developing similar programs.

VJB

AD 635249 — Thesis — UNLIMITED

Texas Agricultural & Mechanical Univ., U.S.A.

PROBABILISTIC MANPOWER FORECASTING

681.3.06
658.5.01

Kuance, J.F.

May, 1966 71pp., 33ref.

A computer program is developed to build a cumulative probability table of all possible combinations of manpower requirements that may occur for a specified group of projects. It is assumed that a manpower array has previously been generated which contains the total manpower requirements, time adjusted, for all the projects to be considered; and the subjective probabilities are available for each project in the array.

LBT

AD 636419 — UNLIMITED

Carnegie Inst. of Tech., Pittsburgh, Pa., U.S.A.

A DEFINITION OF FORMULA ALGOL

681.31 CDC G-20
681.3.06 ALGOL
SD-146

Perlis, A.J., Iturriaga, R. et al.

29-31.3.1966 46pp.

Formula Algol is an extension of ALGOL 60 incorporating formula manipulation and list processing. A current version of the Formula Algol language which is implemented on the CDC G-20 is defined.

VJB

P 146342 AFCRL 66-695 PHSRP 275 UNLIMITED
Air Force Cambridge Res. Labs., Hanscom Field, Mass., U.S.A. 681.325.53
AVERAGE DIGIT ERROR PROBABILITY AFTER DECODING RANDOM LINEAR CODES
Pierce, J.N.
Oct., 1966 32pp.,3ref.

The post-decoding digit error probability averaged over all linear codes is compared with the average word error probability. It is shown that the ratio of these two averages approaches a nonzero limit with increasing code length at fixed code rate, and the value of the limit is determined.

VJB

ASTRONOMY & CARTOGRAPHY

NASA MISC 298 N63-19369 UNLIMITED
National Aero. & Space Admin., U.S.A.
THE ORBITING ASTRONOMICAL OBSERVATORY AND THE ORBITING SOLAR OBSERVATORY 522.15 629.783
Rosen, N.G.
14.8.1963 13pp.

The Orbiting Astronomical and the Orbiting Solar Observatories are designed to permit astronomers to observe the sun, planets, stars, and galaxies from outside the disturbing influences of the earth's atmospheres. To understand why such observations are important, the ways in which the atmosphere hinders observations are reviewed.

VJB

P 146445 Rep. 8346 (1) NASA CR 75299 N66-26819 FR UNLIMITED
Perkin-Elmer Corp., Electro-Optical Div., Norwalk, Conn., U.S.A. 522.15 629.783
PRINCETON ADVANCED SATELLITE STUDY, VOL. 1. SUMMARY (8.3.1965-15.5.1966) NGR 31-001-044
Loening, W.F., Hamstreet, H.S.
35pp.

Contains: General problems associated with spaceborne telescopes; 40-inch system description; OAO/APEP in association with AAP; Recommendations for additional effort; Selected design parameters.

VJB

RAE TR 66257 SPACE 167 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K. 531.352
SYMMETRY OF A GEOCENTRIC DUST BELT AND THE ZODIACAL LIGHT 523.161 523.59
Allan, R.R., Cook, G.E.
Aug., 1966 10pp.,7ref.

The behaviour of dust particles in geocentric orbits is discussed. An approximate analytical solution can be found for the motion under gravitational forces alone if the orbital eccentricity is small, and a plane of symmetry can be defined if the lunar orbit is assumed fixed. Solar radiation pressure is important for dust particles and its effect is to change the position of the plane of symmetry so that it lies more nearly in the ecliptic. If, as suggested by Peale, a substantial part of the zodiacal light is due to dust particles in geocentric orbits, they must be fairly distant, probably beyond about 12 earth radii.

VJB

R/E TR 66396 SPACE 184 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K.
523.3
THE ORBITS OF LUNAR SATELLITES: AN INTRODUCTION 531.352
Cook, G.E.
Dec., 1966 21pp.,20ref.

Present knowledge of the Moon's gravitational field is briefly reviewed. The report then describes the main perturbations of the orbit of a lunar satellite caused by low-order terms in the lunar gravitational potential and by the Earth. Techniques for investigating the lunar potential are outlined.

VJB

NASA TT F-394 UNLIMITED
National Aero. & Space Admin., U.S.A.
PROBLEMS IN ASTROPHYSICS: INVESTIGATION OF THE ATMOSPHERES OF VENUS AND MARS 061.3 "6,1964"
523.42
523.43
Koval', I.K.
Jan., 1967 148pp.,198ref.

A Conference of the Working Group on Investigation of Earth-type Planets was held in Kiev in June 1964 to discuss the results of these studies and to point out paths for future investigations. The complete contents of most of the many reports and lectures given at the conference are published in this collection.

VJB

NASA TTF-430 UNLIMITED
Academy of Sciences of the Ukrainian SSR, Ukrainian Interdepartmental Collection
Series, Astronomy and Astrophysics 523.5
523.6
PHYSICS OF COMETS AND METEORS
Konopleva, V.P.
1965 92pp.

Contents: Photometry of comets using 1963-1964 patrol photographs (Rozhkovskii, D.A.); Detailed photometry of comet Arend-Roland 1956 h (Nazarchuk, G.K.); The radius of existence of C_2 and C_3 molecules in comets (Cherednichenko, V.I.); Dissociation and ionization of water molecules in cometary atmospheres (Cherednichenko, V.I.); Intrinsic brightness of comet Ikeya 1963 a (Vsekhsvyatskii, S.K.); Visual observations of comet Alcock 1963 b (Vsekhsvyatskii, S.K.); Statistical characteristics of the meteor radio echo in the epoch of the 1963 Geminids (Fialko, E.I., Bairachenko, I.V. et al);

(continued)

NASA TTF-430 (continued)

Some results of the application of intermediate-type trains in measurements of electron line density (Fialko; E.I., Bairachenko, I.V. et al); Propagation of electromagnetic waves in a moving gyrotropic medium (Daryugin, I.A. and Vorontsov, V.I.); The drift of meteor trains (Kashcheev, B.L.); Some problems of the theory and new methods of observation of meteors (Kramer, E.N.); On the subject of the trajectory and the orbit of the Tunguska Comet (Astapovich, I.S.); Turbulent motions in the upper atmosphere at heights of 80 - 110 km according to radio observations of meteor trains (Delov, I.A.); The Kiev seminar on comet photometry.

LBT

NASA CR 672 UNLIMITED
Control Data Corp., Minneapolis, Minn., U.S.A.
A THEORETICAL INVESTIGATION OF INFORMATION LIMITS OF SCANNING OPTICAL SYSTEMS 523.8 621.397.331.2
Farrell, E.J., Zimmerman, C.D., et al.
Jan., 1967 352pp.,87ref.

The objectives described are: (1) to improve the accuracy of current methods of predicting system performance, and (2) to develop better techniques of signal processing. The first objective entails selecting models that are more complete than models currently used. With complete models, we can accurately predict system performance. The second objective entails developing processing techniques that efficiently use signals generated by the photodetector. With efficient techniques, the sensor size can be minimized or more accurate measurements obtained.

VJB

RAE TR 66279 SPACE 169 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K.
RESONANCE EFFECTS DUE TO THE LONGITUDE DEPENDENCE OF THE GRAVITATIONAL FIELD OF A ROTATING PRIMARY 523.838 534.242 629.783
Allan, R.R.
Aug., 1966 40pp.,21ref.

There will be long-period oscillations in the position of a satellite if its path is nearly repetitive relative to the rotating primary, and there is an infinite sequence of such resonances. The behaviour near resonance is governed by a pendulum equation and in the extreme case a satellite can be captured by the resonance and be stable against small drag forces. Moreover the presence of "drag" forces, which include a change in the primary's rotation, e.g. by tidal effects, gives a mechanism for permanent or semi-permanent capture, a positive real drag or its equivalent being the more favourable condition. If capture takes place, "drag" forces lead to secular changes in inclination; the sense depends on the sign of the drag, whether the resonance is above or below synchronous height, and on the inclination itself. The resonance effects are highly dependent on inclination, and all except the synchronous resonance become ineffective on the equatorial plane. This appears to give a partial explanation of the formation and structure of the rings of Saturn, and suggests that there could be similar but much less regular bands of dust around the earth.

RGF

P 146113 ESRO SR-59 UNLIMITED
European Space Organisation, Paris, France
OBSERVATION OF STELLAR X-RAY SOURCES 551.521.64 551.507.362.1 523.87
Rossi, B.
May, 1966 67pp.,5ref.

The limitations of X-ray astronomy due to absorption and production of secondary photons in the atmosphere are discussed. Almost all measurements have to be conducted from rockets or satellites. The experiments which have been carried out so far are mentioned. In the second chapter the detectors employed (gas counters, scintillation crystals and photoelectric devices) are described as well as ancillary instrumentation. The analysis of data obtained from rocket flights is extensively discussed. In the last chapter the results of the observations performed until now are presented and compared in detail. The present knowledge on extra-terrestrial non-solar X-ray sources is critically reviewed.

VJB

METEOROLOGY

P 146463 ESRO SR-59 ESLAB UNLIMITED
European Space Res. Organisation, Paris, France
DESCRIPTION OF EXPERIMENT R-74 SARDINIA, JULY 1966 INVESTIGATION OF NEUTRON ALBEDO 551.507.321 551.521.14 539.125.5
Page, D.E.
Aug. 1966 9pp.,6ref.

The aim of this experiment is to determine the densities of atmospheric neutrons with energies from thermal (about 0.04 eV) up to about 20 MeV in a height band between 40 and 60 km. Brief mention is made of the scientific reasons for the experiment and of previous measurements from balloons at heights approaching 40 km. The method to be used in the present experiment is to carry the detector up to about 60 km by means of a Bellor rocket and then to eject it attached to a parachute.

VJB

P 146347 AFCRL 66-706 AFSG-187 UNLIMITED
Air Force Cambridge Res. Labs., Hanscom Field, Mass., U.S.A. 551.507.321.2
METEOROLOGICAL ASPECTS OF CONSTANT-LEVEL BALLOON OPERATIONS IN THE SOUTHWESTERN UNITED STATES 629.733.33
Gildenberg, N.D.
Oct., 1966 42pp.,3ref.

A summary of experience in furnishing meteorological support for constant-level balloon operations conducted primarily in the South-western United States. Important meteorological parameters are discussed in detail and related to operational factors. Objective and subjective information and procedures are given for forecasting surface and in-flight weather, balloon trajectories, and other pertinent meteorological phenomena. The role of the meteorologist during all phases of a balloon operation is described.

LBT

UKSM Rep. 67/9 UNLIMITED
U.K. Scientific Mission, Washington, D.C., U.S.A. 551.509.3
THE WORLD WEATHER WATCH
Bourne, H.R.
Jan., 1967 8pp.

Weather forecasters have for long been handicapped by a deficiency in meteorological observations, especially over the oceans and over sparsely populated land masses. The International project of the World Weather Watch will make good this deficiency by providing meteorological data on a daily global basis which should enable the weather to be forecast more accurately for a longer period ahead. A pre-requisite to the World Weather Watch is for a better understanding of atmospheric circulation, which should be obtained as a result of measurements made in the Global Atmospheric Research Project planned for 1972 and on which work has already started.

LBT

P 146161 RM 1788 P 12 N66-27955 UNLIMITED
NASA CR 75518 QPR
Cornell Aeronautical Lab. Inc., Buffalo, N.Y., U.S.A. 551.509.325
NASR-156
PROJECT FOG DROPS INVESTIGATION OF WARM FOG PROPERTIES AND FOG MODIFICATION CONCEPTS
Kocmond, W.C.
15.5.1966 7pp.

A fog is produced on natural condensation nuclei drawn into the test chamber from outside of the laboratory. Moisture is supplied by wet blotting paper that lines the test chamber walls. The transmissivity of the natural fog is measured as a function of time, and the extinction coefficient and visibility are computed. The natural fog is then flushed from the chamber and a new sample of outside air, into which nuclei of controlled size have been introduced, is placed in the chamber. The visibility of the fog forming in the seeded air is then determined and compared with that previously determined for the unseeded fog.

VJB

UKSM Rep. 67/11 UNLIMITED
U.K. Scientific Mission, Washington, D.C., U.S.A. 551.509.61
IMPLICATIONS OF THE NEW HORIZONS IN RESEARCH ON WEATHER MODIFICATION
Bourne, H.K.
Jan., 1967 4pp.

The chances of achieving some degree of weather modification are improving as a result of modern methods of research and technological advances. A considerable increase in effort in this field on a national scale is expected in the next few years. This report discusses the possibilities of being able to modify the weather, and the implications if this is achieved.

LBT

RAE TR 66370 SPACE 181 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K.
551.510.3
COMPARISON OF AIR DENSITIES OBTAINED FROM ORBITAL DECAY AND INSTRUMENTS 531.352
Cook, G.E.
Nov., 1966 23pp.,33ref.

Methods for determining upper-atmosphere density are briefly reviewed. Values of air density derived from orbital decay are compared with those obtained from instruments and shown to be systematically higher. The difference is too large to be due entirely to errors in the drag-derived values and cannot be explained at present if the absolute accuracy claimed for the gauges is realistic. This paper was presented at a Discussion Meeting on Orbital Analysis at the Royal Society, London, 17-18 October, 1966.

VJB

P 146464 ESRO SR-63 UNLIMITED
European Space Res. Organisation, Paris, France.
551.521.1
OBSERVATIONS OF SOLAR X-RAYS 551.507.3
Labeyrie, J. 537.531
April, 1966 62pp.,42ref.

A comprehensive review of the measurements of X-rays emitted by the quiet as well as the active sun is presented. Starting with the historic sounding rocket flight by Burnight in 1948 these observations were carried out by means of balloons, sounding rockets and satellites, covering more than one solar cycle. The instruments used as well as the experimental results are discussed in detail.

VJB

P 146195 TP 72 N66-16687 UNLIMITED
Sem.Ann.Prog.Rep.2 NASA CR 70053
Colorado State Univ., Atmospheric Science Dept., Fort Collins, U.S.A.
551.521.14
551.521.2
THE INVESTIGATIONS OF THE TEMPERATURE AND SPECTRAL EMISSIVITY CHARACTERISTICS OF CLOUD TOPS AND OF THE EARTH'S SURFACE (Feb.-Sept., 1964) NASr-147
Marlatt, W.E.
Dec., 1965 26pp.

During the period measurements of surface temperatures over the Pawnee National Grassland were continued using thermistors, and ground-based and airborne radiometers. Measurements of albedo and of clouds, ocean surfaces and various earth surfaces were obtained using the TIROS radiometer (channel 3 and channel 5) and the sol-a-meters. Measurements of desert ground radiation and temperatures were obtained near Edwards Air Force Base, California, in conjunction with flights conducted by the CARIE Project and the University of Michigan. Measurements of ocean and grassland-surface temperatures were obtained for several orbits immediately following the launching of NIMBUS I. A few measurements of cloud-top radiation temperatures were obtained for comparison with air temperatures.

LBT

P 146351 Sci.Rep.4 AFCRL 66-812 UNLIMITED
Denver Univ., Physics Dept., Col., U.S.A.
ATMOSPHERIC ABSORPTIONS OVER LONG SLANT PATHS IN THE STRATOSPHERE 551.521.18
551.507.321.2
Murcray, D.G., Murcray, F.H., et al. AF 19(628)5202
Oct., 1966 57pp.,5ref.

The variation of the infrared solar spectrum with altitude was observed during a series of balloon flights made from Fairbanks, Alaska. Spectra were obtained at various altitudes with solar zenith angles ranging from 49 to 92 deg. These spectra were used to determine the atmospheric transmittance to be expected at high altitudes and particularly over very long slant paths in the stratosphere. The transmittance data are presented.

VJB

N/SA TM X-51611 — UNLIMITED
National Aero. & Space Admin., U.S.A.
THE LATITUDINAL DISTRIBUTION OF CLOUD COVER FROM TIROS III PHOTOGRAPHS — 629.78 TIROS 551.576
Arking, A.
July, 1965 16pp.,6ref.
Television pictures from the TIROS III satellite have been analyzed on a computer to give the latitudinal distribution of cloud cover during the summer of 1961. The results, which will be useful in studying the heat balance of the atmosphere, and in the determination of vertical motion, show good agreement with the long term average cloudiness derived from data accumulated during a half century of ground observations.

LBT

GEOLOGY & GEOPHYSICS

AD 638301 NEL Rep. 1374 — UNLIMITED
Navy Electronics Lab., San Diego, Calif., U.S.A. — 551.462
PHOTO ANALYSIS OF SEA FLOOR MICRORELIEF
Shipek, C.J.
26.4.1966 70pp.,36ref.
Over 700 NEL sea floor photographs, obtained intermittently over a 10-year period, in a wide variety of environments, have been analyzed. Five major types of bottom microrelief, on the basis of origin, have been defined, a numerical scale of microroughness has been developed and ratings predicted for normal bottom environment and zones of isoroughness have been delineated for large portions of the Pacific and adjacent ocean areas.

LBT

AD 639101 SN 134-12 — UNLIMITED
National Engineering Science Co., Pasadena, Calif., U.S.A. — 016: 551.466 NONR 4177(00)
A BIBLIOGRAPHY ON STORM SURGES AND RELATED SUBJECTS
Bretschneider, C.L., Pick, G.S.
1.8.1966 48pp.
Work began on this bibliography in 1960, using the library of the Coastal Engineering Research Center (formerly Beach Erosion Board) of the U.S. Army Corps of Engineers. It was continued and brought up to date under ONR sponsorship under Contract NONR-4177(00), "Modification of Wave Spectra over the Continental Shelf". A report is under preparation on "Storm Surges: Theory, Measurements and Data Collection". This will discuss the effects of the continental shelf on waves.

LBT

FLUID DYNAMICS

P 146194 N66-27079 NASA CR 64421 — UNLIMITED
California Inst. of Tech., Jet Propulsion Lab., Pasadena, U.S.A. — 532.517.4 532.542.2 532.527.2
EXPLORATORY MEASUREMENTS IN SPIRAL TURBULENCE
Van-Atta, C.
c.1965 38pp.,5ref. — NAS7-100
These experiments lay a foundation for a study of interface propagation in a mixed laminar-turbulent flow between counter-rotating concentric cylinders. Such mixed flows, including one particularly well-organized pattern called spiral turbulence, are found to be a dominant feature of transition in Couette flow. In spiral turbulence, the laminar and turbulent regions of the flow form an alternating pattern of helical stripes, rotating with approximately the mean angular velocity of the two cylinders. Stable right- and left-handed spirals occur with equal probability when the flow is established from rest. Hot-wire measurements have been made of the mean cross-sectional shape of the interfaces in the axial mid-plane for a spiral-turbulent flow having low dispersion in interface position.

VJB

P 146442 LMSC/HREC A 702436 FR UNLIMITED
HREC 11924-1
NASA CR 77547
N66-35232 532.525 AMPLIFICATION
NAS 8-11924
Lockheed Missiles & Space Co., Huntsville Res. & Engineering Center, Ala., U.S.A.
ELECTROFLUID CONVERTER (25.6.1965-25.3.1966)
Chang, C.S., Trautwein, W., et al.
23.3.1966 50pp.,6ref.
Four electrofluid converter concepts were considered and investigated: (1) deflectable splitter; (2) flapper valve; (3) acoustic driver; and (4) movable nozzle. Models of each were built, compared and evaluated. The most promising one, the flapper valve concept, was selected and development work was continued to improve the performance characteristics of this selected model.

VJB

AD 631561 FR UNLIMITED
Johnson Service Co., Milwaukee, Wis., U.S.A.
IMPACT MODULATOR, IMPACT MODULATOR AMPLIFIERS WITH FEEDBACK, AND SYSTEMS APPLICATIONS (15.5.1963 - 30.6.1964) 532.525 AMPLIFICATION
DA 49-186-AMC-28(X)
15.7.1964 46pp.
The primary objective of this work is to develop and test pure fluid (pneumatic) circuits that perform as operational amplifiers and integrators. The active fluid component is the transverse impact modulator. The basic circuit diagram for the operational amplifier is essentially the same as an electronic operational amplifier. The difference being that the pneumatic DC amplifier has a low input impedance which has to be considered in the analysis. Two operational amplifiers in series are used to attain a positive gain package which is used to form a bootstrap integrator. When properly adjusted this device performs a true integration. The governing equations are presented which describe the resistance values necessary to obtain desired integration rates.

DMA

P 146204 CAL-AD-1672-A-2 ARL 66-0190 UNLIMITED
Cornell Aeronautical Lab Inc., Buffalo, N.Y., U.S.A. 536.423
AN ANALYSIS OF THERMAL AND DIFFUSION EFFECTS ON DROPLET GROWTH RATES 532.529
AF 33(657)-8302
King, C-W., Weatherson, R.C.
Sept., 1966 62pp.,6ref.
The effects of thermal and diffusion limitations on growth rates and temperature history of small droplets are analyzed for a supersaturated vapour in an inert carrier gas. The growth rates are determined for the cases of (1) constant field conditions, and (2) changing fluid conditions due to vapour deposition on droplets. The analysis is so formulated as to describe the growth process as the droplet size increases from microscopic (free-molecular) to macroscopic (continuum).

VJB

P 146191 03424-18-T TR-18 UNLIMITED
NASA CR 75127
N66-26659 532.529.5
Michigan Univ., Coll. of Engineering, Ann Arbor, U.S.A. 532.528
Grant NsG-39-60
CHOKED FLOW ANALOGY FOR VERY LOW TWO-PHASE FLOWS
Hamrit, F.G., Robinson, M.J.
March, 1966 40pp.,22ref.
Two theoretical models to predict axial pressure distribution, void fraction, and velocity in a cavitating venturi are applied. The theoretical predictions are compared with experimental data from cold water and mercury tests, and good agreement for the pressure profiles is found. The predicted void fractions are found to be too high, probably because the models assume zero slip or negative slip between the vapour and liquid phases.

VJB

AD 633612 GEL TR 66-6 UNLIMITED

New York Univ., Geophysical Sciences Lab., Bronx, U.S.A. 532.593.4

ON THE GROWTH OF THE SPECTRUM OF A WIND GENERATED SEA ACCORDING TO A MODIFIED MILES-PHILLIPS MECHANISM 551.46.018 535.33 N 62306-1589

Inoue, T.

April, 1966 64pp.,26ref.

The need for the study of ocean waves has increased rapidly owing to increased needs in fields like naval architecture, optimum ship routing and coastal engineering. One of the most important problems is the forecasting of sea surface conditions. Ocean wave problems are not simple, mainly because of the complexity of the turbulence at the interface of the atmosphere and the ocean. Since the introduction of the wave spectrum concept, ocean wave studies have made remarkable progress. Wave forecasting had been done by using an empirical spectral growth relationship. In the late 1950's, two kinds of wave generation mechanisms were proposed. In this paper, an attempt to determine spectral wave growth is reported by the application of two modified wave generation mechanisms based on the theories of Miles and Phillips.

STB

P 146439 QPR 15 N66-34071 NASA CR 77093 UNLIMITED

Southwest Res. Inst., San Antonio, Tex., U.S.A. 532.595 Proj. 02-1072 NAS 8-1555

FUEL SLOSHING STUDIES (1.10-31.12.1964)

8.1.1965 7pp.

Tests for determining pressure distributions on a single solid ring baffle have been completed, and the data from these tests are in the final stages of being reduced to an appropriate form for presentation. The experimental apparatus devised for measuring torque, as well as the phase angle between torque and displacement, in a pitching cylindrical tank has now been essentially completed.

VJB

AERODYNAMICS

P 146189 CR-332-761-001 FR N66-39999 NASA CR 79095 UNLIMITED

General Dynamics, Pomona Div., Calif., U.S.A. 532.526.4

DIRECT MEASUREMENT OF COMPRESSIBLE TURBULENT BOUNDARY LAYER SKIN FRICTION ON A POROUS FLAT PLATE WITH MASS INJECTION 532.526.7 NAS 7-294

Dershin, H., Leonard, C.A., et al.

July, 1966 46pp.,19ref.

An experimental investigation of skin friction on a porous flat plate in supersonic turbulent flow has been carried out. Useful data has been obtained at 3.2 (nominal) and at two of the order of 10^7. Measurements were made with a skin friction balance which permitted mass injection through its friction surface. The injectant gas was nitrogen. The results of the experiments are in essential agreement with the theory of Rubesin as regards skin friction reduction with mass injection. In addition, correlation of the skin friction data with heat transfer measurements, conducted previously by Bartle and Leadon, tend to verify the "Reynolds analogy" between skin friction and heat transfer developed by Rubesin.

VJB

NASA SP 106 UNLIMITED

National Aero & Space Admin., U.S.A.

THE DYNAMIC BEHAVIOR OF LIQUIDS IN MOVING CONTAINERS 532.595

Abramson, H.N.

1966 467pp.

Contents:- Introduction (Abramson, H.N.); Lateral sloshing in moving containers (Silverman, S., Abramson, H.N.); Nonlinear effects in lateral sloshing (Abramson, H.N., Chu, W.H., Dodge, F.T.); Damping of liquid motions and lateral sloshing (Silverman, S., Abramson, H.N.); Simulation and experimental techniques Part I: Simulation of liquid sloshing (Dalzell, J.F.); Part II: Experimental techniques and apparatus (Brooks, G.W.); Analytical representation of lateral sloshing by equivalent mechanical models (Dodge, F.T.); Vehicle stability and control (Bauer, H.F.); Vertical excitation of propellant tanks (Dodge, F.T.); Interaction between liquid propellants and the elastic structure (Kana, D.D.); Special topics Part I: Liquid impact on tank bulkheads (Dalzell, J.F.), Part II: Liquid rotation and vortexing during draining (Dodge, F.T.); Part III: Longitudinal oscillations of flight vehicles (Kana, D.D.); Liquid propellant behaviour at low and zero g (Reynolds, W.C., Satterlee, H.M.)

VJB

NASA TM X-53501 N66-38487 UNLIMITED
National Aero. & Space Admin., U.S.A.
RESEARCH ACHIEVEMENTS REVIEW, SERIES NO. 12 047.1
1965 35pp.,7ref. 532.5
533.6

Contains the following articles:- Subsonic Flow, Jet impact in water, Base flow investigation, Effect of Wall-to-total temperature ratio on hypersonic flow detachment, Variable Porosity Walls, Dynamic balance for Saturn Forebody, Panel Flutter, Aerodynamic-Damping studies, Buffeting, Engine Generated Noise, Ground-Winds problem, Short duration technique in Base-heating, External-flow Reynolds number program, Flow field visualization, Radiation, Investigation of Combustion of hydrogen in a hypersonic air stream, Rarefied Gas Dynamics and Turbulent fluctuation measurements with the Crossed-Beam method.

RGP

NASA TM X-56865 N66-29374 UNLIMITED
National Aero. & Space Admin., U.S.A.
RECENT RESEARCH RESULTS IN THE AERODYNAMICS 533.6.011.5
OF SUPERSONIC VEHICLES 629.73 SCAT 15-F
Robins, A., Morris, O.A., et al.
Nov., 1965 22pp.,3ref.

The continuing aerodynamic-research effort aimed at improving the design of supersonic-cruise vehicles has recently produced some significant results. Research by both government and industry has provided, in addition to a better understanding of the design problem itself, some new and very useful design tools and concepts. Some of the advantages of these methods in the treatment of wave drag and drag due to lift are briefly discussed. Also presented are some new considerations of aerodynamic interference and its effect on the aerodynamic efficiency of the trimmed vehicle. An illustrative example of the application of these design tools and concepts to the aerodynamic design of a supersonic-cruise vehicle (SCAT 15-F) is made.

VJB

P 146203 ARL 66-0186 UNLIMITED
Aerospace Res. Labs., Wright Patterson AFB,
Ohio, U.S.A. 533.6.011.8
THE LINEARIZED RAYLEIGH PROBLEM IN A 533.5
RAREFIED GAS FLOW ACCORDING TO THE BGK MODEL 533.73
Nagaraja, K.S.
Sept., 1966 98pp.,39ref.

The classical Rayleigh problem has been formulated using the BGK kinetic equation, and the numerical evaluation is carried out on an IBM 7094. The results describe the macroscopic velocity qx, the shear stress Pxy, the tangential heat flux Qx, and the temperature field T' in the near-free-molecule flow. These results are obtained for a wide range of values of λt (the number of inter-molecular collisions in a time t).

VJB

NASA TM X-1198 N66-17888 UNLIMITED
National Aero & Space Admin., Washington, D.C.,
U.S.A. 629.73 X-15A-2
AERODYNAMIC CHARACTERISTICS OF A 0.0667-SCALE 533.6.013.4
MODEL OF THE X-15A-2 RESEARCH AIRPLANE AT
TRANSONIC SPEEDS
Patterson, J.C.
63pp.

The Mach. number varied from 0.60 to 1.20. Angle of attack range -4 deg. to 20 deg. Reynolds numbers 2.074 x 106 to 2.172 x 10^6. Static longitudinal, directional, and lateral stability has been reduced at lifting conditions compared with that of the X-15 research aircraft, when the external fuel tanks are absent.

RGP

NASA TIL 6803 N66-31728 UNLIMITED
NASA MEMO 2-3-59L
National Aero. & Space Admin., U.S.A. 533.6.013.4
COMPARISON OF CONTROL-FIXED STABILITY 629.735.33
DERIVATIVES FOR TWO SUPERSONIC FIGHTER AIRPLANES
AS DETERMINED FROM FLIGHT AND WIND-TUNNEL TESTS
Crane, H.L., McLaughlin, M.D., et al.
April, 1959 33pp., 8ref.

The principal control-fixed stability derivatives of two fighter aircraft operating in the clean condition have been obtained from flight tests at an altitude of 35,000 feet at M up to 1.44 for one aircraft and up to 1.25 for the other aircraft. The static derivatives were compared with those determined from wind-tunnel results after the tunnel data were adjusted for the effects of differences in configuration, aeroelastic distortion, and mass flow through the engine. After these adjustments were made, the static derivatives determined from the wind-tunnel results usually proved to be an adequate indication of the derivatives of the full-scale aircraft.

VJB

NASA TT F-10204 N66-29728 UNLIMITED
National Aero & Space Admin., Washington, D.C.
U.S.A. 629.7.025.4
FLIGHT HANDLING QUALITY PROBLEMS POSED BY 629.734.3
SWEPT-WING TRANSPORT PLANES WITHOUT TAIL UNITS 629.7.072
Lecomte, P., Page, E. 533.6.015
June, 1966 59pp., 22ref.

Analyses the unusual features of swept-wing tail-less, heavy aircraft, from the pilots viewpoint. Emphasis is put on the special low velocity type of behaviour, in connection with the longitudinal flight qualities.

ROF

S & T Memo 9/66 UNLIMITED
Technical Information & Library Services,
Min. of Aviation, U.K. 533.6.015.1
THE DRAG OF A LARGE AND SMALL PNEUMATIC TYRE 656.71:551.578.1
TRAVELLING THROUGH WATER, SLUSH AND SNOW 539.622
Sugg, R.W. 629.7.027.23
Oct., 1966 8pp., 1ref.

Tests were made with a 35 x 10 - 17 aircraft tyre using the heavy load test which described in S & T Memo 8/63 and results were compared with those from a 13 in. diameter, 3 in. wide tyre in trials of a recently developed device, a slush drag meter to measure the water equivalent depth of runway contamination. Trials were conducted at Bromma, Sweden, on natural snow and at Road Research Laboratory, Crowthorne and Bristol University on water and ground ice with the small tyre and slush drag meter, and at Crowthorne only with the aircraft tyre. Within the speed range of the tests (up to 90 ft/sec.) it was found that drag varied linearly with velocity squared in water and ground ice with both tyres and with the small tyre in Swedish snow. With the small tyre drag per inch increased with depth but was constant with the large tyre.

RHH

RAE TR 66356 AERO 2856 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K.
CALCULATION OF THE LOAD DISTRIBUTION, AT 533.6.048.1
SUPERSONIC SPEEDS, ON A SWEPTBACK WING OF 533.693.1
ARBITRARY PLANFORM 533.6.048.3
Roper, O.M.
Nov., 1966 49pp., 37ref.

The swept back wing can be cambered or uncambered, with subsonic leading edges and supersonic or subsonic trailing edges. Evvards method is used for the part of the wing ahead of the trailing edge disturbances, and a lift cancellation method for the part affected by the wake. The formulae derived are put into forms suitable for calculations on a high speed digital computer.

ROF

AD 636392 AFTR 6273 UNLIMITED
Air Force Systems Command, Flight Test Center, Edwards AFB., Calif., U.S.A. 533.6.053
FLIGHT TEST ENGINEERING HANDBOOK. 083
CORRECTED AND REVISED JUNE 1964-Jan. 1966
Herrington, R.M., Shoemacher, P.E., et al.
May, 1951 660pp.

Methods of obtaining flight test data for reciprocating engine aircraft (including helicopters) and turbojet aircraft are presented together with various methods of data analysis and data presentation. Correction of aircraft performance to standard conditions is included, as are detailed derivations of correction factors and performance parameters. Numerous graphs and charts containing information required by and useful to the flight test engineer are presented, together with sample data reduction forms and sample flight test programmes.

VJB

NASA TM X-1278 N66-34426 UNLIMITED
National Aero. & Space Admin., U.S.A.
CHARACTERISTICS OF A NEW TYPE BALANCE FOR WIND-TUNNEL MODELS 533.6.071.3
Dimoff, J., McFarland, K., et al.
15.6.1966 24pp.

A new type of internal-sting, six-component, strain-gauge balance has been developed and calibrated at Ames Research Center. The balance is used to measure the aerodynamic forces on wind-tunnel test models. A unique feature of the balance is a hollow cavity running the length of the balance, through which additional wires, linkages, hydraulic lines, etc., can be passed. Other attractive features include the ease of aligning the force elements, and the ability to fabricate the assembly with standard machine shop tooling. These features are made possible by the relatively simple geometry with all elements being machined in one piece.

VJB

AD 640945 Rep. 756 USAAVLABS TR 66-53 UNLIMITED
Princeton Univ., Aerospace & Mechanical Sciences Dept., N.J., U.S.A. 533.652.6
AN ANALYTICAL STUDY OF FACTORS INFLUENCING THE LONGITUDINAL STABILITY OF TILT-WING VTOL AIRCRAFT 533.6.013.412
629.735.3
629.73 XC-142A
DA 44-177 AMC-8(T)
Boppu, O., Curtiss, H.C.
July, 1966 90pp.,22ref.

An analytical method for predicting the stability characteristics of tilt-wing VTOL aircraft in the transition speed range is presented. Sample calculations based on an assumed tilt-wing VTOL transport configuration of the XC-142A class with double-slotted flaps are given. A limited comparison of the calculated results with experimental data obtained from a dynamic model of the XC-142A, which is somewhat dissimilar from the assumed configuration, is presented. This comparison indicates that the trends of the stability derivatives are correctly predicted. The agreement between theory and experiment is good in hovering; however, as the wing incidence is reduced, the difference between theory and experiment becomes quite large.

STB

NASA CR 713 UNLIMITED
Arizona State Univ., Tempe, U.S.A.
ON THE DYNAMIC CHARACTERISTICS OF A VARIABLE-MASS SLENDER ELASTIC BODY UNDER HIGH ACCELERATIONS 533.665
533.696.3
624.074.7
Meirovitch, L., Wesley, D.A.
Feb., 1967 76pp.,28ref.

The dynamic characteristics of a slender, elastic body of variable mass were investigated. The analysis is applicable to a solid-fuel missile which was envisioned as a slender, cylindrical body capable of both rigid-body motion as well as axial and transverse elastic deformation. During the powered flight of the vehicle, the mass was considered as a function of time with the products of combustion flowing relative to the missile structure and finally exhausting through a nozzle to the atmosphere.

MRC

AD 635468 DTMB Rep.2121B Rep.Aero 11008 UNLIMITED
David W.Taylor Model Basin, Aerodynamics Lab., Washington, D.C., U.S.A. 629.1.039
SOME DESIGN PRINCIPLES OF GROUND EFFECT MACHINES. SECTION B. AIR CUSHION MECHANICS 533.68
Chaplin, H.R., Ford, A.G.
Apr1., 1966 40pp.

The energy and momentum relationships governing air cushion performance are reviewed. The exponential-theory equations are recommended for calculation of cushion pressure and jet reaction, and a modified equation is proposed for calculation of the volume flow rate. The question of off-design cushion performance is discussed. It is pointed out that off-design performance is of paramount practical importance and that the widely held notion that peripheral jet cushions are more efficient than simple plenum cushions is not necessarily valid in this context. The danger of drawing erroneous conclusions from the cushion performance equations, which (except for the plenum) do not apply to off-design operation, is emphasized.

ZHR

NASA TM X-743 N66-34954 UNLIMITED
National Aero. & Space Admin., U.S.A. 533.693.49
SUBSONIC AND SUPERSONIC AERODYNAMIC CHARACTERISTICS OF AN AIRPLANE CONFIGURATION UTILIZING DOUBLE-PIVOT VARIABLE-SWEEP WINGS
Polhamus, E.C., Alford, W.J., et al.
Dec., 1962 53pp.,6ref.

A variable-wing-sweep aircraft having a double-inboard-pivot wing has been tested at low subsonic speeds and at a Mach number of 2.20 to determine the aerodynamic characteristics of this type of configuration. The double-pivot wing consists of a main wing and a fore wing, each pivoted within the fuselage in such a manner that unbroken leading and trailing edges are provided in both the low- and high-sweep positions. The results indicate that the variation of longitudinal stability with wing sweep angle for the double-pivot wing was similar to that of an outboard-pivot wing and considerably less than that of a single-inboard-pivot wing investigated in combination with the identical fuselage and tail arrangement.

VJB

P 146409 D6-19860 NASA CR 62037 UNLIMITED
N66-32623
Boeing Co., Renton, Wash., U.S.A. 533.693.49
367-80 VARIABLE STABILITY SIMULATION SYSTEM (NASA AMES LARGE TRANSPORT SIMULATION PROGRAM) 629.7.025.3
629.73 BOEING 707
Baska, G.W., Robbins, R.E. NAS2-3224
25.1.1966 161pp.,5ref.

Describes the simulation systems as used for the NASA Ames program and includes descriptions of the technique, hardware, operational procedure and the various configurations simulated.

VJB

P 146414 D6-19856 N66 31853 UNLIMITED
NASA CR-66126
Boeing Co., Renton, Wash., U.S.A. 533.693.49
367-80 AIRPLANE-VARIABLE STABILITY SIMULATION SYSTEM (NASA LANGLEY SUPERSONIC TRANSPORT SIMULATION PROGRAM) 629.735 ((629.7.016.54)) NAS1-4096
Robbins, R.E., Person, S.D.
10.2.1965 204pp.,2ref.

Describes the techniques, hardware and operational procedures involved in the variable stability programme. Also included is a description of the SST configurations that were simulated and flight tested and a discussion of some of the problems encountered.

VJB

P 146410 D6-10743 NASA CR 66125 N66-31854 UNLIMITED

Boeing Co., Renton, Wash., U.S.A. 533.693.49
SIMULATION OF THREE SUPERSONIC TRANSPORT CONFIGURATION: WITH THE BOEING 367-80 IN-FLIGHT DYNAMIC SIMULATION AIRPLANE 629.735((629.7.016.54)) NASI-4096

Eldridge, W.H., Condit, P.M., et al.
28.12.1965 202pp.

Three supersonic transport configurations were evaluated with the Boeing 367-80 in-flight dynamic simulation aircraft. Typical variable geometry and delta SST configurations in landing approach configuration were simulated and evaluated in detail. In addition a variable geometry aircraft in an emergency wings back configuration (72 deg. sweep) was briefly evaluated. In this programme the basic SST configurations were evaluated and systems of longitudinal and lateral-directional stability augmentation were developed and evaluated. (The 72 deg. sweep was tested in the basic configuration only). The effect of centre of gravity position was evaluated with and without longitudinal stability augmentation. Configurations with degraded lateral-directional stability were evaluated to anticipate the possible variations with SST configuration changes or inaccuracies in estimating the stability derivatives. VJB

NASA TM X-280 N66-21563 UNLIMITED

National Aero. & Space Admin., U.S.A.
TRANSONIC WIND-TUNNEL INVESTIGATION OF THE EFFECT OF CONTROL SPAN AND LARGE WING-TIP NACELLES ON EFFECTIVENESS OF SPOILER-SLOT-DEFLECTOR CONTROLS ON AN UNSWEPT-WING FIGHTER-TYPE AIRPLANE 533.694.27 533.6.013.153

Mormon, D.E.
May, 1960 29pp.,5ref.

An investigation was conducted in the Langley 8-foot transonic pressure tunnel to determine the effect of control span and large wing-tip nacelles on spoiler-slot-deflector effectiveness. Effect of control span on control characteristics was obtained by testing the outboard one-third, outboard two-thirds, and the complete control. The complete control extended from 29 to 86% of the wing semi-span and was located between the 80- and 94%-chord lines. The unswept wing of the fighter-type aircraft had an aspect ratio of 2.42, a taper ratio of 0.433, and a modified NACA 65A005 aerofoil section. Six-component force and moment data were obtained through an angle-of-attack range of approximately -6 to 16 deg. for Mach numbers from 0.60 to 1.20. The test Reynolds number varied from 1.42×10^6 to 1.90×10^6. VJB

AD 634562 DTMB Rep. 2201 Aero Rep. 1109 UNLIMITED

David W. Taylor Model Basin, Aerodynamics Lab., Washington, D.C., U.S.A. 533.695.12
LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF SEVERAL HYPERSONIC AIRCRAFT CONFIGURATIONS AT A MACH NUMBER OF 6.26 533.6.011.55 533.6.013.412

Krouse, J.R., Ellis, B.K.
May, 1966 33pp.,8ref.

Wind tunnel tests were conducted at M=6.26 on configurations consisting of various half-cone-cylinder bodies and double-delta wings. Effects of body volume, vehicle orientation, wing planform, and wing-tip dihedral were determined. In general, the lift-to-drag ratios of all high-wing configurations varied slightly over an angle-of-attack range of 0 to 12deg., reaching maximum values of about 3.2 near 6 deg. The lift-to-drag ratios of all low-wing configurations increased continuously with increasing angle of attack, eventually reaching maximum values of about 3.6 near 10deg. In all cases, fuselage base drag accounted for less than 10% of the total drag. For the arbitrarily chosen centre-of-gravity location, all low-wing configurations were stable but unbalanced whereas several high-wing configurations were both stable and balanced. EMR

P 146412 PWA FR 1669 NASA CR 54545 N66-39939 UNLIMITED

United Aircraft Corp., Pratt & Whitney Aircraft Div., West Palm Beach, Fla., U.S.A. 533.695.5 621.438.031
SINGLE STAGE EXPERIMENTAL EVALUATION OF SLOTTED ROTOR AND STATOR BLADING. PART 2: ANNULAR CASCADE INVESTIGATION OF SLOT LOCATION AND GEOMETRY 621.438-253.5 NAS 3-7603

31.10.1966 73pp.,87ref.

An annular cascade investigation was conducted to provide criteria for the design of slotted rotors and stators to be tested in a subsequent part of the overall programme. The test stators were 65-series aerofoils, having a chord length of 6.5 inches and a calculated midspan D-factor loading of 0.528 without slots. A slot located approximately midway between the point of minimum pressure and the point of separation produced the best performance, reducing the wake loss coefficient to about 17% of that for the unslotted vane and increasing the lift coefficient and air turning angle approximately 10% and 2 degrees, respectively. VJB

P 146174 SID 65-1353 NASA CR 65329 N66-21562 FR UNLIMITED

North American Aviation Inc., Space & Information Systems Div., Calif., U.S.A. 533.696.5 533.6.011((517.949.8)) 681.3.06 NAS 9-3159

STUDY OF FLOW FIELDS ABOUT AXISYMETRIC BLUNT BODIES AT LARGE ANGLE-OF-ATTACK

Webb, H.O.

29.10.1965 153pp.,23ref.

Presents a detailed theoretical formulation of the solution of real gas inviscid flow fields about axisymmetric blunt bodies at large angles-of-attack, travelling at supersonic speeds. An IBM 7094 computer program has been developed to do the calculation. Also, given are sample results of two cases and an explanation of the numerical procedures used in the finite difference solution.

RGF

NASA TM X-53156 N65-14934 UNLIMITED

National Aero & Space Admin., Washington, D.C. U.S.A. 533.697.3 533.6.011.6

A STUDY OF DENSITY VARIATIONS IN FREE MOLECULAR FLOW THROUGH CYLINDRICAL DUCTS DUE TO ACCOMMODATION COEFFICIENTS

Robertson, S.J.

46pp.,27ref.

Investigates theoretically free-molecule flow through a duct of circular cross-sections. The molecular flux to the duct wall and exit plane was calculated along with the total flow rate through the duct. The density field was calculated at the duct exit and along the centre line for various duct wall temperatures and thermal accommodation coefficients.

RGF

P 146556 DLR FB 67-04 , DVL Ber. 584 UNLIMITED

Deutsche Versuchsanstalt fur Luft-und Raumfahrt, Germany 533.697.4

THEORETICAL AND EXPERIMENTAL ANALYSIS OF THE STATIC PRESSURE IN A PLANE TURBULENT JET AT LOW MACH-NUMBER (THEORETISCHE UND EXPERIMENTELLE ANALYSE DES STATISCHEN DRUCKES IM EBENEN TURBULENTEN FREISTRAHL BEI KLEINER MACHZAHL)

Report in German

Fiedler, H.

Jan., 1967 114pp.,38ref.

A turbulent jet is considered. Theoretical pressure distributions were obtained with the aid of the complete Reynolds equation. For the purpose of experimental investigation, the influence of the turbulence on the static pressure reading was determined by dynamic calibration of the probe. A combination probe, consisting of Pitot tube and hot wire, was also developed for measuring the static pressure in a turbulent stream. The experimental results were in good agreement with the theory. Generally it was found that in the turbulent region of the jet the static pressure is negative with respect to the pressure of the ambient still air.

P 146201 ARL 66-0160 UNLIMITED

Aerospace Res. Labs., Wright Patterson AFB, Ohio, U.S.A. 532.529.3 533.697.5

ANALITICAL AND EXPERIMENTAL INVESTIGATION OF SUPERSONIC INJECTORS WITH LARGE SECONDARY MASS FLOWS

Pinchak, A.C., Stephen, B.O.

Aug., 1966 53pp.,5ref.

The results presented are for air-air constant area supersonic injectors. Data were taken with secondary mass flows, both larger and smaller in magnitude than primary mass flow. Both air-air and mercury-helium injectors were treated in the calculations.

RGF

PLASMA PHYSICS

P 146371 UNLIMITED
DLR-ForschBer., (FB 64-74), Germany
WORKING SHEETS FOR THE CALCULATION OF PLASMA ACCELERATION IN CROSSED FIELDS 533.95: 518.3
Stoffers, G.
June, 1966 30pp.,9ref.

For the plasma acceleration in crossed electromagnetic fields, the equation of motion is integrated for the case of constant flow area, constant electric field strength and constant magnetic induction, the flow being treated as a one-dimensional problem. From the integrated equation of motion, nomographs are derived for the graphical evaluation of the mutual relations between the velocity, the pressure, the electric field strength, the magnetic induction, and the employed electric work. The so-called velocity of momentum rate is used as an auxiliary quantity.

ACOUSTICS & VIBRATIONS

AD 638134 NOL TR 66-146 UNLIMITED
Naval Ordnance Lab., White Oak, Md., U.S.A.
ACOUSTIC IMPEDANCE OF SEA WATER AS A FUNCTION OF TEMPERATURE, PRESSURE AND SALINITY 551.48 534.231.3
Bradley, D.L., Wilson, W.D.
19.7.1966 14pp.,3ref.

The acoustic impedance (pc) of sea water is presented as a function of temperature, pressure and salinity. This acoustic impedance has been calculated from empirical equations developed at the Naval Ordnance Laboratory to represent the velocity of sound and density of sea water as functions of the parameters temperature, pressure, and salinity. Tables of the calculated data and graphs are given.

VJB

P 146110 UTIAS TN 110 UNLIMITED
Toronto Univ., Inst. for Aerospace Studies, Canada
REFRACTION OF SOUND BY JET FLOW AND JET TEMPERATURE, II 532.525.2 534.25 AFOSR 672-64
Grande, E.
51pp.,21ref.

The refraction of the sound field of an omnidirectional pure tone 'point' source of sound by the temperature and velocity fields of a 3/4 in.air or nitrogen jet was measured. Several different sound source positions were employed; one within the potential core of the jet, others off the axis, entirely outside the jet.

VJB

AD 635849 FTD TT 65-1851 UNLIMITED
Foreign Tech. Div., Wright-Patterson AFB, Ohio, U.S.A.
ON COGNITION OF SPEECH SOUNDS WITH THE AID OF SELF-ORGANIZING SYSTEMS WITH TWO POSITIVE FEEDBACKS (Transl. from: Avtomatika 9 (2), 59-70, 1964, U.S.S.R.) 534.785 621-52
Otkhmezuri, G.L.
25.5.1966 21pp.,4ref.

Discusses the use of self-organizing systems in the role of cognitive devices of second-degree speech. Shown are advantages of such systems in comparison with determinative systems. Block diagrams are proposed for the cognizance of sounds with the use of self-organizing systems. Given are methods of improving the cognizance part by the introduction of additional bonds. Also, given are certain experimental results with the use of self-organizing systems with one (basic) positive feedback.

VJB

P 146415 Rep.1272 NASA CR 74699 N66-21941 UNLIMITED
Bolt Beranek & Newman Inc., Cambridge, Mass., U.S.A. 534.836 ((629.737.45)) 532.525.2
STUDIES OF THE NEAR-FIELD NOISE PROPERTIES OF A SMALL AIR JET NAS1-4656
Keast, D.N., Maidanik, G.
Feb.,1966 97pp.
The spectral and spatial-correlation properties of the noise field in the immediate vicinity of a small air jet have been recorded and analysed over the frequency range from 1000 Hz to 60,000 Hz.
VJB

OPTICS & INFRA-RED SYSTEMS

P 146350 FR AFCRL 66-647 UNLIMITED
Idealab Inc., Franklin, Mass., U.S.A.
MOBIUS BAND INTERFEROMETER 535.411
(20.5.1965 - 19.5.1966) AF 19(628)5184
Bullard, A.H.
15.8.1966 38pp.,1ref.
The procedure, techniques, and precautions observed in the design and construction of the Mobius Band Interferometer structure are discussed. Next, a review of the system design covering the servo configuration and the electronic sweep circuit is presented. The final section of the report covers in detail the operating controls and the procedure for component selection for variation of the sweep time and forward to flyback ratio. The auxiliary output features provided in the Idealab Interferometer Control Unit are described.
VJB

P 146349 Sci. Rep.3 AFCRL 66-742 UNLIMITED
Brown Univ., Engineering Div., Providence, R.I., U.S.A. 535.421
SURFACE CURRENTS INDUCED ON WEDGES UNDER PLANE WAVE ILLUMINATION AF 19(628)5846
Romano, R., Bolle, D.M.
Sept.,1966 33pp.,9ref.
Magnitudes and phases of the surface currents induced on perfectly conducting infinite wedges are presented as a function of the distance from the wedge apex. Results are presented for wedges with interior angles of 60, 90 and 120 deg. for various angles of incidence. Results are given for the polarization of the incident plane both in and normal to the plane of incidence.
VJB

HEAT, THERMODYNAMICS, COMBUSTION

RAE TR 66328 CPM 89 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K.
THE DETERMINATION OF THERMAL CONDUCTIVITY BY MEANS OF MELTING PHENOMENA 536.2.022 536.421.1 547.916
Bishop, P.H.H., Rogers, K.F.
Oct.,1966 21pp.,3ref.
The property of melting is used to provide a cheap, quick and reasonably accurate determination of thermal conductivity, needing very little preparation or apparatus. The method is free from the need for constant ambient conditions, and can accommodate specimens of moderate flatness and any reasonable size and shape.
VJB

[illegible] T. X-56309 N66-37006 UNLIMITED
National Aero. & Space Admin., U.S.A.
PROCEEDINGS OF CONFERENCE ON THERMAL 061.3"2.1964"
JOINT CONDUCTANCE 536.21
19.2.1964 136pp. 621.08

Contains: Results of Contract NAS 8-5207 Thermal contact conductance in a vacuum and related parameter study (Atkins, H.L.); Measurements of thermal contact conductance in a vacuum (Kasparek, W.E., Daily, R.M.); Thermal joint conductance (Vickers, J.M.F.); Thermal conductance of molybdenum and stainless steel interfaces in a vacuum environment (Sommers, R.D., Coles W.D.)

VJB

NASA TN D-3741 UNLIMITED
National Aero. & Space Admin., U.S.A.
A SURVEY OF THERMAL RADIATION STUDIES OF 536.422.1
ABLATING BODIES IN THE BALLISTIC RANGE 629.7.023.225
(PRESENTED AT THE THIRTEENTH NATIONAL 536.33
INFRARED INFORMATION SYMPOSIUM, OCT., 26-
28, 1965, IN PASADENA, CALIF.)
Page, W.A.
Feb.,1967 19pp.,23ref.

Ames Research Centre has studied the radiative properties of the boundary layer and near wake of ablating bodies flying in ballistic ranges. The ablating materials investigated include polycarbonate, General Electric 124 resin, polyethylene, polyformaldehyde, Teflon, and cellulose nitrate. Both absolute radiometric and spectrographic data were obtained. The observed absolute amount of radiation varied greatly for the various materials. The chemical species responsible for the radiation in the spectral range from 0.2 to 1.1 μ were CN, C_2, NH, H, and solid carbon microparticles, or soot. The results of the tests indicate a strong correlation between the radiating species present and the carbon-oxygen ratio of the ablating material.

MHC

P 146503 QPR 11 NASA CR 54405 UNLIMITED
N65-20625
General Electric Co., Missile & Space Div., 669.832
Cincinnati, Ohio, U.S.A. 536.423
ALKALI METALS BOILING AND CONDENSING 532.5
INVESTIGATIONS (1.1-31.3.1965) NAS 3-2528
Tippets, F.E., Converse, G.L. (Editors)
23.4.1965 674pp.,16ref.

Experimentation to determine two-phase heat transfer and fluid flow data for potassium under conditions of boiling and condensing; approximating those anticipated in large space turbo-electric power systems is reported for the 50 kW, 100kW, and 300kW facilities. The results for the 300 kW project show the dependence of heat transfer performance on saturation temperature level, tube exit quality, mass velocity and heat flux, the difference in performance between co-current and counter-current flow, and the effect of the helical insert compared to performance with a plain tube without insert.

GH

P 146153 NBS 8750 N65-25244 UNLIMITED
NASA CR 63149
National Bureau of Standards, Dept., 536.48
of Commerce, Boulder, Col., U.S.A. 536.532
AVAILABLE LOW TEMPERATURE THERMOCOUPLE Proj. 31503-12-3150532
INFORMATION AND SERVICES
Sparks, L.L., Powell, R.L.
15.2.1965 17pp.,2ref.

The Cryogenic Data Centre of the National Bureau of Standards maintains "standard" tables of voltage vs. temperature for ten thermocouple pairs frequently used at low temperatures. These tables contain interim values which will be useful until national NBS, ASTM, and ASA tables are established for cryogenic temperatures. The "standard" tables now available are slightly different than the previously published tables. The differences are caused by adjusting the older tables to obtain smoother first and second differences of the voltages and sensitivities.

VJB

P 146197 Rep.66510A FR N66-37905 UNLIMITED
NASA CR 70446

Rosemount Engineering Co., 536.53
Minneapolis, Minn., U.S.A. 629.7.063
DEVELOPMENT OF A FAST RESPONSE TEMPERATURE GAGE FOR ROCKET VEHICLE PLUMBING SYSTEMS (24.6.1964 - 24.6.1965) NAS 8-11699
Stickney, T.M.
18.6.1965 55pp.,14ref.

Describes the development of a temperature gauge using a coaxial thermoelement, a platinum-rhodium multishield sensing head, and a one-piece superalloy mounting stem. The range of flow parameters and gas properties forwhich the temperature gauge was designed are noted, and the results of a materials survey and engineering analysis are presented. Proof test results are discussed and shown by graphical representations. Schematic diagrams and photographs of the gauge are included.

MHC

P 146144 FR 0700-1161 N66-31701 UNLIMITED
NASA CR 76417

Aerojet-General Corp., Aerometrics, 661.96
San Ramon, Calif., U.S.A. 661.96-404
DEVICE FOR MEASURING THE TEMPERATURE OF LIQUID AND GASEOUS HYDROGEN 536.53
621.317.39(536))
Chandon, H.C., Larson, A.R. NAS 8-11062
April, 1966 126pp.

A cryogenic temperature transducer was produced which is extremely fast in response to changing temperatures, is of medium accuracy and measures temperature over a wide range. The transducer will respond to a temperature change from-146 to -196 deg.C in 0.1 second. The range of the transducer is designed for -253 to +60 deg.C.

MHC

NUCLEAR, ATOMIC & MOLECULAR PHYSICS

NASA TN D-3548 UNLIMITED
National Aero. & Space Admin.,
Washington, D.C. 539.128.2:
INVESTIGATION OF THE (d,α) REACTION ON ALUMINUM 27 539.128.4
669.71
Priest, J.R., Vincent, J.S.
Feb.,1967 17pp.,16ref.

The angular distributions of seven alpha-particle groups from the (d, α) reaction on aluminium 27 (Al^{27}) were measured. The deuteron energy was 20.9 MeV in the laboratory system. The angular distributions are all peaked in the forward direction and have little structure. The integrated differential cross sections for those reactions that leave the Mg^{25} nucleus in the $K = 5/2^+$ rotational states are, in general, more than one order or magnitude larger than those that leave Mg^{25} in the $K = 1/2^+$ rotational states. The angular distributions corresponding to a given rotational band in Mg^{25} are strikingly similar both in magnitude and shape.

VJB

P 146206 FR ARL-66-0133 UNLIMITED
Brandeis Univ., Waltham, Mass., U.S.A.
ELECTRON PARAMAGNETIC RESONANCE AND OPTICAL STUDIES OF IMPURITY IONS IN SINGLE CRYSTAL HOSTS (15.4.1963 - 15.4.1966) 539.194((533.22))
535.333
U-10073:1051
AF 33(657)-11104
Dorian, P.B.
July,1966 108pp.,40ref.

The electron paramagnetic resonance and optical spectra of several systems is reported. These systems are Re^{+4} in K_2PtCl_6 single crystals and V^{+4} and Mn^{+4} in SnO_2 single crystals and S.C. gas.

DM

NASA TN D-3851 UNLIMITED
National Aero. & Space Admin., U.S.A.
CALCULATION OF THE CENTERED ONE-DIMENSIONAL UNSTEADY EXPANSION OF A REACTING GAS MIXTURE SUBJECT TO VIBRATIONAL AND CHEMICAL NON-EQUILIBRIUM 539.194 533.1
Connor, L.N.
Feb.,1967 42pp.,23ref.

A method of calculation based on a previously developed method-of-characteristics approach is presented for use in analysing the non-equilibrium one-dimensional unsteady expansion of a reacting mixture of gases. The characteristic equations are written in a general form which permits the consideration of a number of rate processes. A multi-component gas model with a number of simultaneous rate processes is used, and both chemical and vibrational non-equilibrium are permitted. A procedure which utilises the method of characteristics in a Lagrangian frame of reference is programmed to yield solutions on the IBM 7094 electronic data processing system. Calculations are presented for a typical unsteady expansion to demonstrate the use of the program. MHC

P 146156 WIS TCI 100 N66-25380 UNLIMITED
Wisconsin Univ., Theoretical Chemistry Inst., & Chemistry Dept., Madison, U.S.A. 539.198
THE EXTREMA-EFFECT IN TOTAL ELASTIC MOLECULAR BEAM SCATTERING CROSS SECTIONS FOR CHARACTERIZATION OF THE POTENTIAL WELL. Grant NsG 275-62
Bernstein, R.B., O'Brien, T.J.B.
14-16.9.1965 24pp.,17ref.

The theory of the extrema-effect in elastic impact spectra is reviewed and extended. It has been shown previously that for any realistic inter-particle potential (whose well has a capacity for one or more bound states), extrema in the total elastic molecular beam scattering cross sections are expected at certain characteristic velocities. The limiting high-velocity spacing of successive extrema on a 1/v plot is found to be inversely proportional to the product of the well depth times the inter-particle separation r_m at the potential minimum. It is shown that the constant of proportionality is closely related to the curvature of the well and thus to the force constant of the di-atom (or "complex" molecule). Methods are discussed for the extraction of the maximum amount of information on the shape of the potential well from measurements of the extrema-effect. FJM

CHEMISTRY

NASA TR R-254 UNLIMITED
National Aero. & Space Admin., U.S.A.
KINETIC THEORY OF BIMOLECULAR CHEMICAL REACTION, DIFFUSIVE DRAG, AND OTHER PROCESSES IN A GAS MIXTURE 533.1 533.7 541.12
Hord, R.A.
Feb.,1967 42pp.,14ref.

For two gas species with a temperature difference and a bulk velocity difference neither of which is necessarily small in magnitude, the kinetic theory of gases has been used to derive explicit expressions for the collision frequency, diffusive drag force, molecular translational energy transfer rate, and the bimolecular chemical reaction frequency. The derivations, which are based upon hypothesised mutual collision diameters, activation energies, and steric factors, are of interest in connection with theoretical studies of low-pressure gas mixtures with large departures from equilibrium. A binary temperature concept is introduced as an aid in condensing and interpreting the expressions derived from the kinetic theory. The expression derived for the diffusive drag force is used to give a more definite form to the equations of motion of the individual species in a mixture of several interdiffusing gases. MHC

RAE TR 66340 CPM 92 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K. 543.257.1 546.161 543.063
THE POTENTIOMETRIC DETERMINATION OF FLUORIDE WITH LANTHANUM NITRATE AND ITS APPLICATION TO THE MICRO-DETERMINATION OF FLUORINE IN ORGANIC COMPOUNDS
Cheeseman, G.F., Webb, J.R.
Oct.,1966 13pp.,4ref.

The unbuffered fluoride solution is adjusted to pH 6.3 and titrated with 0.05N lanthanum nitrate solution. A rapid decrease in pH at the end-point, due to hydrolysis of the excess of lanthanum ions, is followed with a quinhydrone indicator/calomel reference electrode system. Sulphate, phosphate, carbonate and silicate ions interfere. Methods for removal of all but the first of these are described. The method has been applied to the determination of fluorine in organic compounds. Results were within 0.5% absolute.

P 146343 AFCRL 66-652 PSRP 267 UNLIMITED

Air Force Cambridge Res. Labs.,
Hanscom Field, Mass., U.S.A. 546.273
A STUDY OF BORON HALIDE - GROUP V 546.851
HALIDE COMPLEXES

Armington, A.F., Weiner, J.R., et al.
Sept.,1966 10pp.,10ref.

Attempts were made to produce Lewis acid complexes of boron triiodide, tribromide and trichloride with the triiodides, tribromides and trichlorides of phosphorus, arsenic and antimony. The experimental method used involved the combining of the reagents in carbon disulphide at reduced temperatures. Of the 27 possible complexes, only 6 were formed. Of these only 4 complexes are stable. These are boron triiodide-phosphorus triiodide, boron triiodide-phosphorus bromide, boron-tribromide-phosphorus triiodide and boron tribromide-phosphorus triiodide and boron tribromide-phosphorus bromide. Boron triiodide-phosphorus trichloride and boron tribromide-phosphorus trichloride formed, were not stable, however, and did undergo cross halogenation and decomposition. Results of this are compared with other studies for these compounds which have been prepared in the literature. Some properties of the stable complexes are evaluated qualitatively. FJM

NASA TR R-253 UNLIMITED

National Aero. & Space Admin., U.S.A.
COUPLED VIBRATION AND DISSOCIATION RELAXATION 546.264-31
BEHIND STRONG SHOCK WAVES IN CARBON DIOXIDE 533.6.011.72
Hindelang, F.J. 539.194
Feb.,1967 34pp.,20ref.

The harmonic oscillator rigid-rotator model has been used to calculate the relaxation region behind a shock wave in carbon dioxide. Finite relaxation rates for the 3 different vibrational modes and 2 dissociation reactions are included. Models for the coupling between the vibrational relaxation and the dissociation process are based on the assumption that dissociation can proceed from any vibrational level with equal probability. Two different models for the vibrational excitation have been examined. Solutions have been obtained for the interdependent fluid flow, chemical rate, and vibrational relaxation-rate equations incorporating estimated rate coefficients. Results are presented in the form of flow-field profiles for density, pressure, translational and vibrational temperatures, and species concentrations. The effects of vibrational excitation, vibration-dissociation coupling, and energy exchange between the vibrational modes are investigated. The effect of vibrational relaxation and vibration-dissociation coupling is much stronger in CO_2 with three different vibrational modes than in diatomic cases with only a single mode. MHC

INSTRUMENTATION

AD 636940 E 1730 MDC TR 66-66 UNLIMITED

Massachusetts Inst. of Tech.,
Instrumentation Lab., Cambridge, U.S.A. 53.082.16
GYRO TEST STATION CHECKOUT AND EVALUATION 620.1.05
Gianoukos, W.A. AF 29(600) 5470
April,1966 50pp.,10ref.

A theoretical discussion of the procedures utilized to check out a gyro test station is presented. An analysis of test results which permits evaluation of the test station is described. The study also includes a brief description of the components involved and the techniques of testing as performed by the Massachusetts Institute of Technology, Instrumentation Laboratory.

VJB

NASA MISC 297 NGG-32057 UNLIMITED

National Aero. & Space Admin., U.S.A.
A LINEARIZED ANALYSIS AND DESIGN OF AN 531.31
AUTOMATIC BALANCING SYSTEM FOR THE THREE-AXIS 621-52
AIR BEARING TABLE 621.822-85

Zajac, F., Small, D.
10pp.

Presents the analysis and design of an automatic control system to reduce the mass unbalance to 5000 dyne-cms or less. To balance the table (eliminate the static mass unbalance) about three axes, the table is first balanced manually to within 200,000 dyne-cms of torque balance in the horizontal position. After this balancing the table should be penduluous, but with a period greater than 2.0 minutes. The table is then released from an appropriate initial position, and the automatic balancing system is activated. This system senses a positional error from the initial position, resulting from a torque unbalance, and corrects this unbalance by driving a weight along the appropriate axis.

R.E TR 66352 IR 79 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K. 531.787.9
A SEMI-AUTOMATIC EQUIPMENT FOR THE CALIBRATION OF PRESSURE TRANSDUCERS
Pole-Baker, P.C.
Nov.,1966 21pp.,1ref.

An equipment for the calibration of pressure transducers by a continuous sweep method is described which enables transducers having range maxima between 0.5 and 5000 lb/in^2 to be calibrated with an overall accuracy better than 0.1% of full scale. The system is shown to have certain advantages over the conventional point-by-point methods of calibration.

VJB

P 146177 NASA CR 74474. UNLIMITED
N66-29457
Research Triangle Inst., Durham, N.C., U.S.A. 621.382
SILICON NEEDLE TRANSDUCER 531.787.9
Stockard, R.R., Wortman, J.J. 061.3 "1966"
1966 6pp.,4ref. 537.220.1
NASr 222

Paper presented at the 1966 International Solid-State Circuits Conference, Philadelphia, Pa. Basically the silicon needle is a transducer of force and displacement. Its practical usefulness has been demonstrated by incorporating it into a laboratory accelerometer. The advantages of this transducer using the piezojunction effect include the elimination of critical alignment problems and the fact that it can be made more sensitive to stress.

VJB

P 146501 WA 7002-1 NASA CR 69543 UNLIMITED
N66-15704
Metrophysics Inc., Santa Barbara, 531.787.9
Calif., U.S.A. 681.3+132
ADVANCED TRANSDUCERS PHASE A: INVESTIGATION OF DIGITAL TRANSDUCERS AND DIGITAL COMPATIBILITY TECHNIQUE NAS 3-20515
Nov.,1965 200pp.,125ref.

This phase includes the following tasks: (1) Surveys present transducer and signal conditioning designs and automatic checkout techniques, with particular emphasis on digital compatibility. (2) Investigates conditioning and digital conversion requirements for both high-level (0-5 volt) and low-level (millivolt) output signals. (3) Investigates transducer "add-on" modules. (4) Studies long-term design approaches for physically integrating sensors and modules into new configurations.

VJB

NASA TN D-3811 UNLIMITED
National Aero. & Space Admin., U.S.A.
VARIATIONS IN GAGE CONSTANT AS A FUNCTION OF EMISSION CURRENT IN AN UNSHIELDED OPEN-END GRID BAYARD-ALPERT IONIZATION GAGE 531.738.7
Molfi, L.T., Kern, F.A.
Feb.,1967 19pp.,9ref.

A detailed laboratory study has revealed a gauge-constant-emission-current anomaly in the 1- to 10-milliampere emission-current range in an open-end grid Bayard-Alpert ionization gauge. This study was performed for the pressure range from 6×10^{-2} to 1×10^{-5} N/m^2 on an orifice-conductance calibration system with a computed pressure measurement uncertainty of ±5.5%.

VJB

AD 638449 P-3441 UNLIMITED
Rand Corp., Santa Monica, Calif., U.S.A.
INFORMATION THEORY AND ALTERNATE HYPOTHESIS TESTS 519.94 621.391
Bussgang, J.J., Marcus, M.B.
Sept.,1966 34pp.,6ref.

Lindley's (1956) concept of the information in an experiment is used to study alternate hypothesis statistical tests. A test is considered to be a combination of a sampling rule and a decision rule which is based on the samples taken. An information theoretic analysis of alternate hypothesis tests is developed. Using this approach new results on SPRT's and alternate hypothesis tests in general are obtained.

VJB

ELECTRICITY AND MAGNETISM

P 146199 ARL 66-0107 UNLIMITED
Aerospace Res. Labs., Wright Patterson AFB, Ohio, U.S.A. 537.523.3
THE EFFECTS OF PARTICLE CONDENSATION AROUND IONS IN ELECTRIC FLUID DYNAMIC ENERGY CONVERSION PROCESSES (OCT. 1963-MARCH 1964)
Decaire, J.A.
Sept.,1966 51pp.,34ref.

Fluid dynamic energy is converted directly into electrical energy - unipolar charges are seeded into a gas flow and are transported by viscous interaction with the gas molecules to an electrode of high potential. The effectiveness of the viscous coupling depends on the charge mobility being greatly increased when colloid sized particles rather than molecular ions are used as the charge carriers. The mobility of charged colloids is discussed theoretically.

VJB

P 146200 ARL 66-0184 UNLIMITED
Aerospace Res. Labs., Wright Patterson AFB, Ohio, U.S.A. 533.95 538.4
SURVEY OF INVESTIGATIONS OF ELECTRIC ARC INTERACTIONS WITH MAGNETIC AND AERODYNAMIC FIELDS
Myers, T.W., Roman, W.C.
Sept.,1966 115pp.,167ref.

Summarizes and evaluates the existing literature related to the interaction of an electric arc at pressure levels of one atmosphere or greater with magnetic fields and/or aerodynamic fields which are transverse to the arc column. The scope of this survey does not include the subject of retrograde motion. For the purposes of this survey, the subject is broken up accordingly to whether or not there is net arc motion with respect to the electrodes. When motion occurs, the arc is designated a travelling arc; this is the type of arc which occurs in rail acceleration, arc heaters utilizing magnetically rotated arcs and electric switchgear circuit breakers. When the arc undergoes no net motion with respect to the electrodes it is designated a stationary arc; this type occurs when the arc is balanced in a transverse gas flow by an appropriate transverse magnetic field. VJB

P 146202 ARL 66-0191 UNLIMITED
Aerospace Res. Labs., Wright Patterson AFB, Ohio, U.S.A. 533.95 538.4
INVESTIGATION OF ELECTRIC ARC INTERACTION WITH AERODYNAMIC AND MAGNETIC FIELDS
Roman, W.C., Myers, T.W.
Oct.,1966 59pp.,16ref.

An experimental study of a balanced electric arc of 200 to 400 amperes in an atmospheric pressure cross-flow air stream of velocities up to 60 ft/sec and transverse magnetic field strengths up to 50 gauss was made. An open jet type facility permitted the use of diagnostic techniques in the arc wake region. The arc's significant dimension transverse and parallel to the flow was measured. This dimension increased transverse to the flow and decreased parallel to the flow as the transverse blowing velocity was increased. Velocity profiles, energy flux distributions, relative turbulence levels and frequency measurements were obtained in the arc wake using miniaturized probe techniques. Flow visualization studies were performed using micron-sized particles. The input and output arc power distribution was obtained.

ELECTROMAGNETIC PROPAGATION

AD 639300 NEL Rep.1379 UNLIMITED
Navy Electronics Lab., San Diego, Calif., U.S.A. 621.3.013
ELF SURFACE ELECTRIC AND MAGNETIC FIELDS AND UNDER-WATER ELECTRIC FIELDS. SPECTRAL ESTIMATES OF FIELDS IN 4-25-C/S RANGE BASED ON SURFACE MEASUREMENTS AT BORDER FIELD AND UNDERWATER MEASUREMENTS AT 1000 FEET 621.319.7 538.562.2 U 1086:1226
Hughes, H.G.
27.5.1966 19pp.

Investigations into the electromagnetic environmental characteristics of the deep ocean in which present and future submarine communication systems must operate were conducted. (1) Surface measurements were made, consisting of simultaneous observations of the fluctuations in the vertical electric field and in the north-south magnetic field at NEL's Border Field Station. (2) Underwater horizontal electric-field fluctuations were recorded by measuring the voltage between probes on a boom mounted on the exterior of the Cousteau diving saucer. (3) Spectral analysis of the recordings was accomplished by computer and is presented in this report. (4) Significant peaks were found to occur in the underwater spectra in the region of the first resonant frequency of the earth-ionosphere cavity between 7 and 10 Hz. EMA

ELECTRICAL ENGINEERING - GENERAL

P 146225 FR NASA CR 65411 UNLIMITED
N66-30790
Union Carbide Corp., Carbon Products Div., Ohio, U.S.A. 621.3.036.61 546.26
CARBON ELECTRODE DEVELOPMENT PROGRAM (3.11.1964 - 3.5.1965) NAS 9-3699
24.5.1965 44pp.

Results are presented of a study conducted to improve 16 mm. solar positive carbon electrodes. Principal improvements sought were stronger more reliable carbon joints and the elimination or minimisation of arc sputtering. The development work on the electrode joints is summarised. The study of core formulations is discussed. The manufacture of a limited prediction run of carbon electrodes having the most improved composition is described. A process flow diagram showing the manufacturing operations involved in making solar arc carbons is included.

MHC

AD 636193 TR 1 UNLIMITED
Naval Applied Science Lab., Brooklyn, N.Y., U.S.A. 621.3.066.6
INVESTIGATION OF PLATINGS OF ELECTRICAL CONTACTS 669.056.9: 537.311.4
3.7.1966 31pp.,5ref.

MIL-C-26636 size no. 16 and no.20 pin and socket contacts were electroplated with gold over silver, gold over nickel, gold over copper, rhodium over nickel, and rhodium over silver. Plated contacts were wired and assembled in a modified louvred Stevenson Screen and installed at the NASL environmental site at Ft. Tilden, N.Y. mounted on a supporting structure facing the ocean without obstruction, approximately 500 feet from the shore line and 40 feet above M.L.W. Contact resistance measurements on contacts mated 100 times as compared to contacts mated once, prior to exposure, show no significant difference except for a 30% increase for those plated with rhodium over nickel.

GMH

USSR Rep.66/30 UNLIMITED
U.K. Scientific Mission, Washington, D.C.
1966 POWER SOURCES CONFERENCE. PART III: POWER CONDITIONING 061.3 "May 1966" 621.311.69
Griffiths, D.L. 621.314.5
Dec.,1966 5pp. U 0519:10379:10372

Topics discussed include modulation systems, current-fed and static inverters, manual generators and devices to protect solid-state electronics from surge damage.

PBP

P 146176 QR3 WGD 30531 UNLIMITED
Westinghouse Defense & Space Center,
Surface Div., Baltimore, Md., U.S.A. 621.38.004.6
RESEARCH ON FAILURE FREE SYSTEMS U 1613
(23.3 - 23.6.1966) N.Sw 572
1966 8pp.,1ref.
Research is being conducted to develop new techniques for increasing the reliability of vital electronic systems. The status and technical activities performed during this period on the current phase of the program are described. This phase provides for the documentation of a computer simulation program to perform reliability analyses of a wide variety of failure responsive redundant systems, and the development of computerised procedures for efficiently allocating a limited number of tests points within a redundant system and for estimating the system reliability when one or more components may have failed at the time of estimation.

PBP

ELECTRICAL POWER (INCLUDES BATTERIES & FUEL CELLS)

P 146413 FR NASA CR 69804 UNLIMITED
N66-16190
Radiation Applications Inc., L.I., 621.352.1
New York, U.S.A. 678.742.2
FABRICATION AND TEST OF BATTERY SEPARATOR NAS 7-100
MATERIALS RESISTANT TO THERMAL STERILIZATION
Wetherell, T.J., Scarsdville, P.A.
Dec.,1965 269pp.
Fifty-one materials were fabricated, using polyethylene as the base polymer, by crosslinking and grafting procedures. Each material was tested for its ability to withstand heat sterilization and to function as a battery separator in the silver-zinc alkaline system. Cells, constructed from seven materials which successfully withstood heat sterilization, retained greater than 9% of electrical capacity of control cells during five deep cycles of charge and discharge. The two materials described below are selected to be produced in 500 ft.^{2} quantities, which are to be used for further testing.

VJB

P 146160 EOS 4110 Pt. 20 N66-29761 UNLIMITED
NASA CR 76031
Electro-Optical Systems Inc., 621.352.6
Pasadena, Calif., U.S.A. N/S 3-2701
HYDROGEN-OXYGEN ELECTROLYTIC REGENERATIVE
FUEL CELLS (1.7-1.8.1965)
Klein, H.
10.9.1965 14pp.
Single cells with various electrode structures were tested to obtain a better understanding of cell performance controlling factors, and methods of improving the oxygen electrode. The first 500 watt, 34 series cell prototype was assembled and subjected to preliminary tests. It incorporated new insulators fabricated from glass epoxy sheet and platinized porous nickel plaque electrodes of the standard EOS type.

EHR

SEMI-CONDUCTORS, TRANSISTORS

P 146206 FR ARL 66-0071 UNLIMITED
Marquette Univ., Milwaukee,
Wisconsin, U.S.A. 548.52
RESEARCH ON DEFECT CONTROLLED ELECTRICAL 621.315.612
PROPERTIES OF RUTILE U 1044.103152
Hirthe, W.M. AF 33(615)-1244
April,1966 00pp.,22ref.
The electrical conductivity of single crystals of rutile was measured in the "C" direction over the temperature range 800 deg.C. to 1500 deg.C. and from 1 to 10-15 atm. of oxygen. The electrical conductivity of rutile in air below approximately 950 deg.C. appears, on the basis of this investigation to be impurity controlled due to the presence of aluminium rather than intrinsic conduction.

DMA

AD 635626 NAD Crane Rep. 66-284 Note Issue 16 UNLIMITED

Naval Ammunition Depot, Crane, Ind., U.S.A. 621.38.049.7 (S.I.C.)
INFORMATION ON MICROELECTRONICS FOR NAVY EQUIPMENTS U 156772:1691
1.4.1966 53pp.

The test data contained in this issue of μ -NOTES is data taken on units which were removed from life test. The life tests were conducted at 25 deg.C ambient temperature with nominal power supply voltage applied to the units while operating in ring counter configurations.

DMA

P 146358 AFCRL 66-641 FSRP 266 UNLIMITED

Air Force Cambridge Res. Labs., Hanscom Field, Mass., U.S.A. 548.52
SOME FACTORS AFFECTING THE GROWTH OF BETA SILICON CARBIDE 546.201'251
621.38.049.7(PEM)
Ryan, C.E., Berman, I., et al. U 1044:156713
17pp.,10ref.

Discusses the growth of beta silicon carbide by the hydrogen reduction of methyl trichlorine onto carbon substrates at 1500 deg.C. It is shown that alpha inclusions present are the rare 2H (Wurtzite) modification of silicon carbide and that their presence resulted from a vapour-liquid-solid growth mechanism which was dominated by impurities in the substrate. By carefully cleaning the substrate and purifying the methyltrichlorosilane, the alpha inclusions were eliminated. The 2H alpha crystals were then deliberately grown by introducing selected impurities locally on the substrate. Beta crystals were also intentionally grown by the vapour-liquid-solid technique by introducing appropriate impurities. Growth of beta silicon carbide from the melt is also briefly discussed.

PBP

P 146437 AFCRL 66-750 IP 121 UNLIMITED

Air Force Cambridge Res. Labs., Bedford, Mass., U.S.A. 537.312.62:
TECHNIQUE FOR FABRICATION OF Al-Al $_2O_3$-Pb SUPERCONDUCTING TUNNEL DIODES 621.302.23:
546.621'21'015
Silva, H.J. U 1004:156722
Nov.,1966 9pp.,6ref. Proj. 8603

This report describes an improved method of growing Al - Al_2O_3 - Pb superconducting tunnel diodes. Since the resistance of the diode is dependent upon the thickness of the oxide layer, this layer must be carefully controlled in order to fabricate diodes of the desired resistance in a reproducible manner. The key to this method is a substrate holder which allows the entire process to be completed under vacuum.

DMA

AD 629286 QPR 3 UNLIMITED

Fairchild Engine & Airplane Corp., Fairchild Semi-Conductor Div., U.S.A. 650.51
PRODUCTION ENGINEERING MEASURE FOR IMPROVEMENT OF PRODUCTION TECHNIQUE TO INCREASE THE RELIABILITY FOR PNP INTERMEDIATE POWER SILICON PLANAR SWITCHING TRANSISTORS INCLUDING 2N3502 (1.7. - 30.9.1965) 621.382.332
U 171:1617:156768
DA 36-039 AMC 06155(E)
McKeown, W., Walker, H.
27pp.

AD 630835 FR 66_17_105 TR Rep.1 TR ECOM 01541-1 UNLIMITED

Hughes Aircraft Co., Fullerton, Calif., U.S.A. 621.382.333: 539.1.044 U 156767:10051: DA-28-043-AMC-01541(E)

EFFECT OF TRANSISTOR DESIGN PARAMETERS ON RADIATION RESISTANCE (POWER TRANSISTORS) (1.7 - 30.9.1965)

Honnold, V.R., Thomas, G.D., et al.

March,1966 15pp.,11ref.

Work carried out consists of the formulation of physical design theory including the effects of injection level. In addition, the sequencing of the fabrication steps for the 2N2369 is laid out in accordance with statistical design principles, and transistor fabrication initiated. Instrumentation design is completed and construction started on the circuits.

DMA

ELECTRICAL TESTING & INSTRUMENTS

NASA TN X-53425 N66-31231 UNLIMITED

National Aero. & Space Admin., U.S.A.

THE DESIGN AND DEVELOPMENT OF A DYNAMIC BRUSH WEAR MEASUREMENT APPARATUS 621.3.047.4 621.3.083.6 620.178.16

Horton, J.C., Owens, J.E.

8.4.1966 25pp.,6ref.

An apparatus that permits the continual measurement of electrical brush wear in high vacuum is described. A linear voltage differential transformer is used as the sensing element and its output is displayed on a potentiometric recorder. Resolution may be obtained from 0.0001 inch to 0.025 inch total wear, thus permitting wear rate measurements from 10^{-7} inches/hour to one inch per hour to be made. Calibration curves are shown, and the results from several tests are plotted and analyzed. Accuracy is shown to be better than ±0.5%.

VJB

P 146235 TR 66-3-N N66-27231 UNLIMITED

G.C.A. Corp., Tech. Div., Bedford, Mass., U.S.A. 621.384.8 NAS 1-4927

DEVELOPMENT OF A MASS SPECTROMETER EMPLOYING A PHOTOIONIZATION SOURCE

Poshenrieder, W.P., Barrington, A.F.

Feb.,1966 57pp.,23ref.

Deals with the construction of a mass spectrometer that uses photoionization for the ion product. By the use of uv light and in particular with a uv vacuum monochromator to select the proper wavelength, simplified spectra generally are achieved, since in contrast to the commonly used electron impact ion source fragmentation of molecules can be suppressed. Additional advantages are the exclusion of chemical reactions with hot filaments and the elimination of outgassing from heated elements that are present in electron impact ion sources.

VJB

P 146272 FR N66-39930 N.S.A. CR 66201 UNLIMITED

National Res. Corp., Cambridge, Mass., U.S.A. 543.51 621.384.0

DEVELOPMENT OF A MASS SPECTROMETER DESIGN (1.6 - 31.12.1964)

Blum, P., Torney, F.L.

23.3.1965 60pp.,14ref.

Covers the second phase of a four phase programme to develop a cold cathode ion source mated to a quadrupole mass spectrometer. The completed unit is to be used as a residual gas analyzer. The cold cathode (magnetron) ion source was chosen because of lower background noise and higher sensitivities than the usual hot-filament types. This report describes the design of the ion source and the mass spectrometer and gives details of the construction and experiments with the ion source.

VJB

MAGNETIC DEVICES & MATERIALS

AD 624204 EES Rep. 4E(1)66904 EES Rep. 4F(1)66918 UNLIMITED

Naval Engineering Experiment Station, Annapolis, Md., U.S.A. 621.318.4 530.22

MAGNETIC CHARACTERISTICS OF "NON-MAGNETIC" METALLIC MATERIALS. PERMEABILITY AND COERCIVE FORCE IN STRONG FIELDS 100-200 OERSTEDS U 1005:1006

Gross, M.R., Ellinghausen, H.C.

6.4.1951 23pp.,10ref.

Contains data on a wide variety of materials such as brasses, bronzes, copper-nickel alloys, nickel base alloys, wrought and cast austenitic stainless steels, austenitic stainless steel weld metals, and austenitic manganese steels. Tabulations include chemical composition, mechanical properties, normal permeability, coercive force and resistivity data for the materials tested. The permeability and coercive force measurements were performed in strong magnetic field (100-200 oersteds). The effect of composition and cold deformation on the magnetic properties of the various materials is discussed and considerable attention is focused on the austenitic stainless steels. In addition to general conclusions, the report contains generalizations as to the expected magnetic behaviour of the various types of materials. DMA

AD 632340 TR ECOM 2672 UNLIMITED

Army Electronics Res. & Dev. Lab., Fort Monmouth, N.J., U.S.A. 620.169 621.313.56

LIFE EXPECTANCY OF A NEW MINIATURE POWER RELAY U 1616:10316

Fontana, W.J.

March,1966 47pp.,14ref.

In a laboratory study a new miniature power relay design was subjected to a series of life tests to develop its life expectancy profile under a broad range of electrical operating conditions. The principle of factorial experimentation was applied to develop a test programme which, over the relay's design range of resistive load conditions, operating temperatures, and operating rates, would provide useful data at minimum cost. From the resulting statistical analysis, a series of functional relationships between the relay life expectancy and the operating stress levels were developed. Mathematical and graphical representations of these relationships are given.

DMA

THERMO- & PHOTO ELECTRICITY

NASA TN D-3849 — UNLIMITED

National Aero. & Space Admin., U.S.A.

MECHANISM OF CADMIUM SULFIDE FILM CELL 621.352.1:539.23

Potter, A.E.Jr., Schalla, R.L. 546.322.21

Feb.,1967 12pp.,13ref. U 10321:156716

The cadmium sulphide film cell is a barrier-layer cell formed by a surface layer of chalcocite (Cu_2S) on cadmium sulphide (CdS). The chalcocite is a very degenerate p-type semiconductor with the Fermi level 1 to 3 electron volts below the valence band edge. The barrier height of the junction is about 0.85 electron volt. The spectral response of the cell in monochromatic light for photon energies greater than 2.4 electron volts (the blue response) is ascribed to direct excitation across the band gap of cadmium sulphide plus photoelectric emission from the barrier layer. The response for photon energies less than 2.4 electron volts (the red response) is ascribed solely to photoelectric emission from the chalcocite layer. The efficiency of this process is greatly affected by surface damage and surface impurities. After heat treatment, the spectral response can be altered by illuminating the cell with constant-intensity blue or red light during the spectral-response measurements. (This is not the case before heat treatment). This effect is ascribed to impurities in the cadmium sulphide introduced from the copper sulphide layer by the heat treatment. PP

P 146190 FR NASA CR 54959 N66-27741 UNLIMITED

Radio Corp. of America, RCA Labs., Princeton, N.J., U.S.A. 621.383((523.72)) 629.7.064.56

MATERIALS AND METHODS FOR LARGE-AREA SOLAR CELLS (17.121.1964-16.12.1965) NAS 3-6466

Ellis, S.G., Yohl, P., et al.

14.1.1966 25pp.,3ref.

GaAs/InAs/Al foil structures have been grown by oxide transport from the respective compounds. Preliminary studies have been made of the growth from the metallic elements using both halide transport and oxide transport. These latter methods have not yet been perfected. The light transmission of some cuprous selenide films on glass has dropped after a period of several months.

VJB

N/SA TN D-3703 — UNLIMITED
National Aero. & Space Admin., U.S.A.
COMPARISON OF SOLAR DIRECT-ENERGY CONVERSION SYSTEMS OPERATING BETWEEN 1.0 AND 0.1 ASTRONOMICAL UNIT — 629.7.064.56
Difano, W.J., Scudder, L.R.
Feb.,1967 30pp.,7ref.

Three solar direct-energy conversion systems for operation in the 1.0 to 0.1 AU range were compared: thermoelectric flat plates (employing either lead telluride or silicon-germanium semiconductors), thermionic systems (including the solar concentrator), and uncooled silicon solar cells. Systems specific weight and power output variation during flight were used as a basis of comparison by assuming that an output power of 200 watts was required at the design point. Tilting the thermoelectric and solar cell panels from 0 deg. (panel normal to the incident radiation) to 60 deg. was assumed a means of solar flux control; however, no solar flux control was assumed for the thermionic systems.

VJB

LINES, NETWORKS, FILTERS & WAVEGUIDES

P 146361 AFCRL 66-733 PSRP 202 — UNLIMITED
Air Force Cambridge Res. Labs.,
Hanscom Field, Mass., U.S.A. — 621.372.54
OPTIMUM DESIGN OF SYMMETRICAL PARALLEL-T R-C NETWORKS — U 12371
Purnhagen, T.G.
Oct.,1966 11pp.,5ref.

Presents the information necessary for the design of symmetrical parallel-T R-C networks with symmetrical frequency response such that the networks will have optimum characteristics subject to certain circuit or performance constraints. Three cases are considered: (1) design for maximum Q when source and load resistances are specified; (2) design for maximum Q when minimum acceptable gain is specified; (3) design for maximum gain-Q product when source and load resistance are specified. Data are presented showing the trade-off between gain and Q as circuit parameters are varied.

DMI

AD 632690 QR 12 — UNLIMITED
E.B. Lewis Co. Inc., East Hartford,
Conn., U.S.A. — 658.51
PRODUCTION ENGINEERING MEASURE. CRYSTAL UNIT — 621.372.612
CR = $(XM-46^{A})/u$ (1.11.1965 - 1.2.1966) — 621.315.613.7
Lewis, E.D. — U 171:1543
1966 14pp. — DA 36-039-SC-06737

The reasons for the failure of the 70 Mc/s preproduction samples are analyzed. The problem of the instrumentation limitations with particular reference to obtaining satisfactory values of C_1 are discussed. The redisign of the 70 Mc/s units with reference to flatness, plateback and spot size are explained and documented. The revised manufacturing and testing procedures now possible with the new design are presented.

DMI

AD 637100 QR 6 — UNLIMITED
Bliley Electric Co., Erie, Pa., U.S.A.
PRODUCTION ENGINEERING MEASURE. CR-(XM-53)/U — 047.1 BLILEY
QUARTZ CRYSTAL UNITS (FEB.-APRIL,1966) — 621.372.612
Wolfskill, J.M. — 621.3.032.53
19pp. — U 032:Bliley Electric
1543:103155
DA 36-039 AMC 03640(E)

Although sample crystal units have been able to meet the stated requirements, neither sealing yields nor reliability levels attain the values which we believe are possible. The difficulty has been that cracking and/or leaking of the glass holders detracts from the performance of the units. Investigations were made to find methods of reducing these losses, preferably without making changes in the designs of the crystal resonators or the holders.

DMI

AD 636007 Semi-Ann Tech.Summ.Rep.2 UNLIMITED

Lexington Labs., Inc. Cambridge, Mass., U.S.A. 621.3.038.8
548.5
VAPOR PHASE GROWTH OF RUBY MONOCRYSTALS 549.517.13
(2.1 - 1.7.1966) U 14032.1044
Scheffer, P.S. NONR-4574(00)-1
Aug.,1966 17pp.,5ref.

The techniques of preparing large, high perfection ruby monocrystals by vapour phase growth was investigated and developed. A device was incorporated into the system which increased control of total pressure during crystal growth. Ruby crystals were successfully grown using chromium chloride and chromium carbonyl as sources of chromium vapour. Oxidation potential was determined to be an important process variable affecting Cr_2O_3 concentration. Laser oscillation of a vapour-grown ruby compared to Verneuil and Czochralski-grown rubies showed it to be of high optical perfection.

DMA

P 146205 R.R.7-301-49 ARL-66-0131 UNLIMITED

RCA Victor Res. Labs., Montreal, Canada
NOISE CONSIDERATION FOR THE DETECTION OF 621.383.4((535.61-15))
WEAK LASER SIGNALS (1.3 - 1.6.1966) 621.375.826
Weksberg, A.L., Shkarofsky, I.P. U 10542:10027:156718
Sept.,1966 56pp.,25ref. AF 33(615)-2196

A study is made of the minimum laser signal that can be detected when it is embedded in a background of black body radiation and other sources of noise. In particular, the laser source is assumed to be modulated and a phase lock or pulse coincidence amplifier to be employed. General expressions are derived for the signal-to-noise ratio at the output of a phase lock(or pulse amplifier) for a signal immersed in noise. The types of modulation that are examined comprise sinusoidal, square wave and pulse modulation. The noise considered is that arising from black body and Bremsstrahlung radiation, thermal noise, generation-recombination noise etc. In particular, laser noise is discussed in some detail. Finally, a Thomson scattering experiment is considered as a special case. DMA

AD 637500 Rep.1405 AFOSR 66-0490 UNLIMITED

Stanford Univ., Microwave Lab., Calif., U.S.A.
THE MEASUREMENT OF SEVERAL OPTICAL NONLINEARI- 621.375.826
TIES USING FOCUSED GAUSSIAN LASER BEAMS 535.326
Bjorkholm, J.E. 535.561.1
Jan.,1966 122pp.,30ref. U 14034:1051
AF 49(638)-1525

The twofold purpose of this study was (1) to analyze optical second-harmonic generation (SHG) in the focus of the lowest order transverse mode of a cw gas laser beam; (2) to utilize the power enhancement available from focusing to measure smaller nonlinearities on a cw basis than previously had been done. The analysis is carried out for negatively birefringent index-matching crystals and the solution gives the dependence of the second-harmonic power upon the crystal length, the crystal double-refraction angle, and the laser beam focal spot size. The general case of a crystal anywhere along the focused beam is also presented. Interpretation of the results shows that the limiting of SHG by double refraction is determined by beam divergence, not beam radius. The second section of this study describes measurements of several optical nonlinearities in calcite which were made under conditions of optimum focusing using cw gas lasers. DMA

AD 640439 TR ECOM 2751 UNLIMITED

Army Electronics Command, Fort Monmouth, N.J., U.S.A. 621.375.826
INTERFEROMETRIC PHOTOGRAPHIC TECHNIQUES FOR 535.417.2
RECORDING OPTICAL PATH LENGTH VARIATIONS 621.3.038.84
IN PUMPED LASER RODS U 14036:14037.15646
Bickart, C.J.
Aug.,1966 20pp.,3ref.

Describes some unique photographic techniques developed during an investigation of thermal effects occurring in solid-state laser materials (Nd glass and ruby) during the pumping period. An experimental approach is described for the investigation of the interaction of a high-energy laser beam with the atmosphere. Two novel high-speed cameras designed specifically for these investigations are discussed in detail. Experimental results are shown from which conclusions concerning optimum pumping arrangements, rod characteristics, and doping concentrations can be drawn.

N 146411 Engng Rep.0307 NASA CR 77482 UNLIMITED
NGC-35245

Perkin-Elmer, Electro-Optical Div., 621.375.026
Norwalk, Conn., U.S.A. 654.1:
LASER/OPTICS TECHNIQUES 629.783
Lipsett, M.S. U 14036
29.4.1966 223pp.

The subject of the present programme is laser and optical techniques applicable to future deep space optical communication systems. Analysis and laboratory work have been conducted in the following areas: stability of laser beam intensity distribution in the far field; remote boresight alignment of receiving and transmitting optical channels; isolation of the transmitter channel from the receiver channel; determination of a rotational coordinate reference system about the line of sight; and ways of implementing fine guidance tracking and pointing offset capabilities. Laboratory breadboard equipment which was developed as building blocks for this programme is described, and a summary of project activities to date is presented.

DMA

AD 637231 TDR 2939-5 FR UNLIMITED
RADC TR 65-450

Hughes Aircraft Co., Fullerton, 621.376.3
Calif., U.S.A. 621.385.62
PHASE LOCKED MICROWAVE OSCILLATOR U 1431:106342
(FREQUENCY MODULATOR AND EXCITER) ITEM 6 Proj. 4519
(PARTIAL) AF 30(602)2939
Bennison, G.K.
July,1966 25pp.

Results of a technical study to design and supply an X-band exciter and modulator for the Passive Satellite Research Terminal (PSRT). This design supplies the necessary hardware to provide an exciter-modulator operating at 7.33 gc for X-band experiments with the PSRT.

DMA

CIRCUITS - PULSE, DIGITAL, PRINTED & POTTED

AD 628271 SJ 220-0059-1 CR 1 ECOM 01256-1 UNLIMITED

Sperry Microwave Electronics Co., 621.374.4
Clearwater, Fla., U.S.A. 621.302.23
BROADBAND HARMONIC GENERATORS U 145:150723
(21.6 - 21.9.1965) Proj.1 P 6-22001 A 056
Chambers, R.P. DA 28-043-AMC-01256(E)
Oct.,1965 29pp.

The design goals for a broadband, solid state, Ku band triplor and the general circuit requirements to obtain these goals are presented. Reasons for selecting the form of the first basic triplor are discussed as well as its utilization in an alternate approach which dispenses with the idler circuit as a distinct quantity. An output filter-transformer is described and equations are derived for the relationships between hardware parameters and prototype parameters. Design curves for a three-section Tchebycheff prototype filter are included. The theoretical curves of varactor parameters are applied to a particular varactor to obtain theoretical diode parameters.

DMA

N 146223 Sci.Rep.2 NASA CR 77002 UNLIMITED
U0-011500-8 N66-36057

Texas Instruments Inc., Dallas, U.S.A. 621.30.049.7.(S.I.C.)
STUDY OF SOLID-STATE INTEGRATED MICROWAVE 621.396.61
CIRCUITS 621.396.665.52
Mason, A.E., Farber, L.L. U 156772:2223:1236
31.3.1966 61pp.,9ref. NAS 12-75

A study of a basic frequency-modulation telemetry transmitter configurations suitable for use in the 1- to 2-GHz frequency range is presented. The purpose of this study is to establish the framework within which a detailed analysis of the system requirements in terms of components, techniques, and devices can be made with the objective of demonstrating the system performance when implemented in integrated circuitry. The study includes the objective specifications, bandwidth determination, AFC control system parameters, and a discussion of eleven basic configurations.

DMA

AD 636650 FTD TT 65-1617/1+2+4 UNLIMITED
Foreign Tech.Div.,Wright-Patterson AFB.,Ohio, U.S.A.
621.383.292
CHANNEL PICTURE AMPLIFIERS U 1 56846
(Transl. From: Slaboproudy Obzor,24(6),356-363, 1963, U.S.S.R.)
Jares, V.
25pp.,3ref.

Methods are described which enable images to be intensified making use of secondary emission multipliers.

DMA

AD 638447 ECOM-TR 2737 UNLIMITED
Army Electronics Command, Fort Monmouth, N.J.,U.S.A.
621.385.632
ULTRA-LOW-NOISE TRAVELING-WAVE TUBES 537.312.62
Zotter, B. 621.59
Aug.,1966 11pp.,2ref. U 1 56362:1 084:1 086

The influence of high magnetic fields in the gun region on the noise figure of travelling wave tubes was investigated experimentally and analytically. The experiments were performed with a superconducting magnet capable of fields up to 30,000 gauss. Noise reduction of over 2 dB was measured. The analytical work resulted in a model which attributes the dependence of noise figure on magnetic fields to the coupling of axially symmetric space charge and transverse modes. Enhancement of the coupling mechanism is predicted for annular beams and for beams in magnetic field gradients.

DMA

P 1 46207 FR ARL 65-186 UNLIMITED
ITT Industrial Labs.,Fort Wayne,Indiana,U.S.A. 621.385.832
REPORT ON DEMOUNTABLE VACUUM SCANNER AND VACUUM SEALED CRYSTAL SPECIMENS FOR ELECTRONIC SCANNING 621.383.4
546.48'22
U1 56843 15683
AF(33-601)-63-7819
Williams, R.O.
Sept.,1966 16pp.

Six specially processed crystals which had been prepared were mounted into sealed-off test envelopes and partially evaluated. A demountable vacuum test head was furnished which has been utilised for testing a considerable number of specially prepared crystals.

DMA

RADIO

NASA CR-682 UNLIMITED
Adcom,Inc.,Cambridge,Mass.,U.S.A.
ADVANCED THRESHOLD REDUCTION TECHNIQUES STUDY 621.376.9
Filippi, C.A. U1 479
Jan.,1967 132pp.,16ref.

The threshold improvement capabilities of feedback and band-dividing demodulation techniques are investigated for PM or FM signals having a large index and/or deviation. The threshold performance of phase-locked and frequency-compressive feedback demodulators is analysed and an optimum second-order phase locked demodulator having a sinusoidal phase detector is developed and tested along with a conventional FM demodulator. Their threshold improvement capabilities are established and a third-order loop is developed and tested. The cycle slippage with a sawtooth phase detector is also investigated. Finally, several band-dividing systems based on either direct demodulation or signal estimation techniques are analysed and compared to the phase-locked demodulator insofar as possible.

PBP

AD 606908 P-1353 UNLIMITED
Rand Corp., Santa Monica, Calif., U.S.A.
GENERAL DESCRIPTION OF A COOPERATIVE ANTI-COLLISION SYSTEM FOR AIRCRAFT 621.396.933.2 621.396.969.36 U 31.474
Early, L.E.
3.2.1950 4pp.
Some thoughts are noted on a workable, immediately available system for collision avoidance that is usable as an interim device until research can provide a better system.
DMA

RADAR

RAE Tn 66348 MATH 161 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K.
AN INTEGRAL EQUATION EIGENFUNCTION PROBLEM CONCERNING THE ABILITY OF A RADAR TO DISTINGUISH BETWEEN TWO TARGETS 621.396.96:535.312 621.371.332.3 621.396.969.11 B 12241:414
Muddle, R.P.
Nov.,1966 13pp.,1ref.
Once the required performance of a radar has been specified by its ambiguity function, there exists an optimum emitted signal which most closely satisfies this requirement. The signal is the eigenfunction corresponding to the dominant eigenvalue of an integral equation. A numerical method is used to determine this eigenfunction and to evaluate the actual ambiguity function of the system using this signal.
DMA

AD 635052 FTD MT 65-62 UNLIMITED
Foreign Tech. Div., Wright-Patterson AFB, Ohio, U.S.A. 621.396.969.3 621.391 R 413:212
CERTAIN QUESTIONS OF THE THEORY OF DETECTION OF SINGLE PULSES (Transl. from: Trudy Leningradskogo Korablestroitel'nogo Instituta Sudostroyeniye i Sudovoye Mashinostroyeniye 1962 (36), 121-133, U.S.S.R.)
Nesteruk, V.F., Porfir'yeva, N.N.
14.1.1966 14pp.,0ref.
The present article is devoted, mainly, to a detailed study of special cases of detection of single pulses encountered in practice. The greatest attention is paid to the asynchronous method of detection.
DMA

SPACE COMMUNICATION

NASA SP-69 Vol.5 — UNLIMITED
National Aero. & Space Admin., U.S.A.
SPACE TECHNOLOGY. VOLUME V: TELECOMMUNICATIONS 629.7.050.76 621.376.2:621.376.5 629.7.036 U 143:13211
Stiffler, J.J.
1966 139pp.,13ref.
Discusses (1) Fundamentals, (2) Amplifiers and antennas, (3) Modulation, (4) Data Compression, (5) Tracking, in so far as these subjects are related to space technology.
DMA

NASA SP 32 VOL.4 — UNLIMITED
National Aero. & Space Admin., U.S.A.
TELSTAR I WITH A SUPPLEMENT ON TELSTAR II — 629.78 TELSTAR
Dec., 1965 — 422pp., 35ref. — 629.783
629.7.036

Includes: Project Telstar - Fucino Earth station operation analysis; Description of the installations at the Pleumeur-Bodou space communications station (Boutry, M.J.); Results of tests performed with the Telstar I satellite at the Pleumeur-Bodou satellite communication station (Bourgeat, L., Dyevre, A., Houssin, J.P.); The Post Office satellite communication system ground station at Goonhilly, Cornwall (Bray, W.J., Taylor, F.J.D.); The Goonhilly 85-ft steerable dish aerial (Kingston, C.H.); Computing and data transmission for the prediction steering of the Goonhilly satellite-communication aerial (Seeman, E.C., Thompson, W.E.); Digital techniques used in the steering apparatus of the GPO steerable aerial at Goonhilly Downs (Marshall, J.E., Coulter, R.J., Binks, J.K.); Beam-swinging facilities for the Goonhilly satellite-communication aerial (Davidson, C.F., Rowlinson, W.A.); A 4/6 Gc/s circularly-polarised diplexer for the Goonhilly

(continued)

NASA SP 32 VOL.4 (continued)

satellite-communication aerial (Chakraborty, D., Millward, G.F.D.); Primary feeds for the Goonhilly satellite-communication aerial (Ravenscroft, L.A.); Waveguide feeder system for the Goonhilly satellite-communication earth station (Shedlarmid, I.F., Gordon, S.C.); The travelling wave maser amplifier in the Goonhilly radio station (Walling, J.C., Smith, F.W.); The helium system of the maser installation at the Goonhilly satellite-communication earth station (Daglish, H.N., Child, M.R.); A low-temperature thermal noise source for use at the Goonhilly satellite-communication earth station (Daglish, H.N.); Demodulation techniques for use at Goonhilly satellite-communication earth station (White, R.N., Westcott, R.J.); A high power travelling wave tube for satellite communications (Bryant, M.O., Thomas, A., Wells, P.N.); The output stage for the ground transmitter at Goonhilly (Petherham, A.R.); Results of tests at Goonhilly using the experimental communication satellites Telstar I and Telstar II (Bray, W.J., Taylor, F.J.D., White, R.W.); Communications and radiation experiments with Telstar II.

EMA

MECHANICAL ENGINEERING - GENERAL

AD 639953 — MEL Rep. 412/66 — UNLIMITED
Navy Marine Engineering Lab.,
Annapolis, Md., U.S.A. — 621.882
MECHANICAL SHOCK RESISTANCE OF THREADED FASTENERS
Braden, J.R., Heise, R.E.
Oct., 1966 — 28pp., 25ref.

An investigation was made of the mechanical shock resistance of K-Monel full-body studs set in HY-80 steel under various conditions. Strain gauges mounted on the stud shanks were used to measure dynamic loading. Elastic nylon-insert monel stop nuts were used throughout the test. The data indicated that for the conditions of the test Locktite-coated 3A-3B threads are equal in shock resistance to uncoated 5A-5B threads, and that the elastic stop nuts are reusable after repeated shock.

STB

ENGINES - PISTON, TURBINE, R/JET

AD 637992 — UNLIMITED
Boeing Airplane Co., Vertol Div.,
Morton, Pa., U.S.A. — 621.438
DESIGN HANDBOOK FOR SUBMERGED ENGINE COOLING SYSTEMS AND DUCT SYSTEMS — 621-71 — 629.735.45
Jan., 1953 — 600pp. — NOAS 56-800-F

This handbook has been prepared to provide aerodynamic and thermodynamic data required in the design of helicopter or airship cooling and induction airflow systems. In addition, considerable data have been provided to assist in the physical design of the various internal flow components. A rather extensive bibliography has been presented: the most apparently useful works are catalogued with each appropriate chapter, while an additional extensive bibliography is presented as an entity.

STB

NASA TN D-3035 UNLIMITED
National Aero. & Space Admin., U.S.A.
EXPERIMENTAL PERFORMANCE EVALUATION OF A 4.59-INCH RADIAL-INFLOW TURBINE OVER A RANGE OF REYNOLDS NUMBER 621.438.1 629.7.044.53
Nusbaum, W.J., Wasserbauer, C.A.
Feb.,1967 15pp.,9ref.

An experimental investigation of a 4.59-inch-tip-diameter radial-inflow turbine was conducted to determine the effect of a change in Re on the performance of this size and type of turbine. The investigation was conducted with cold argon over a range of inlet pressures from 4.4 to 24.0 lb/^{2}in.abs, corresponding to a range of Re from 64 000 to 352 000, at equivalent design speed and pressure ratio. Re as used herein is defined as weight flow divided by the product of viscosity and rotor tip radius. At each value of turbine inlet pressure, data were taken at equivalent design speed over a range of pressure ratios.

VJB

LUBRICATION & BEARINGS

P 146196 MTI-65 TR 49 N66-23515 NASA CR 74401 UNLIMITED
Mechanical Tech. Inc., Latham, N.Y., U.S.A. 621.822-05
DISTORTION OF GAS THRUST BEARING DUE TO VISCOUS SHEAR NONR 3730(00)
Pan, C.H.T., Sternlicht, B., et al.
Dec.,1965 26pp.,7ref.

This paper presents an analysis of thermal distortion of a gas lubricated spiral-grooved thrust bearing resulting from viscous shear. It is concluded that: (1) friction heat generated in the fluid film can distort the thrust surface and cause considerable reduction in load carrying capacity, (2) in order to minimize the frictional power losses the bearing distortion must be minimized, (3) the degree of distortion does not directly depend on the temperature level, (4) the amount of distortion is increased by a large coefficient of thermal expansion and reduced by a large coefficient of thermal conductivity, (5) large radius ratio bearings and high speed rotors are more sensitive to this type of thermal distortion, (6) analysis of a typical bearing design shows that the effects of thermal distortion can be significant for most structural materials and (7) materials giving minimum thermal distortion are often unsatisfactory otherwise. In such cases a surface coating may be applied to reduce friction and improve resistance to wear.

LDT

NASA SP 113 UNLIMITED
National Aero. & Space Admin., U.S.A.
DYNAMIC STABILITY OF ROTOR-BEARING SYSTEMS 629.7.035.6 621.822
Gunter, E.J.
1966 220pp.,11ref.

The objective of this investigation has been to examine in general the conditions which can lead to nonsynchronous precession in a rotor system. Nonsynchronous precession, which has often been referred to as shaft whirling, oil film whirl, resonance whip, half-frequency whirl, is a self-excited motion which can be caused by several factors such as internal rotor friction and fluid film bearings. In the analysis, general equations of motion of the extended Jeffcott rotor are developed to include rotor and foundation flexibility, internal and external damping, rotor and bearing mass, and fluid film bearings.

STB

NASA TN D-3821 UNLIMITED
National Aero. & Space Admin., U.S.A.
EVALUATION OF HIGH-TEMPERATURE BEARING CAGE MATERIALS 621.822.7
Zaretsky, E.V., Anderson, W.J.
Jan.,1967 15pp.,3ref.

A cage compatibility tester was used to determine the relative wear characteristics of six cage materials with four lubricants of practical interest. Test conditions were ambient temperatures of 500 and 700 deg.F (260 and 371 deg.C) a-shaft speed of 1200 rpm, and test durations of from 30 to 120 minutes. Measurements of the wear scar in the cage pocket were used to determine the effect of cage material, temperature, lubricant, and material hardness on cage wear. For the temperature range of 500 to 700 deg.F, S-Monel and M-1 materials gave the least wear. Additionally, at 500 deg.F, 400C (modified) stainless steel and a polyimide polymer indicated low wear.

GTH

NASA TN D-3032 UNLIMITED
National Aero. & Space Admin., U.S.A.
ROLLING-ELEMENT FATIGUE LIFE OF SAE 52100 STEEL HOLLOW BALLS 621.822.7: 669.14.018.24: 539.431
Scibbe, H.W., Parker, R.J., et al.
Feb.,1967 15pp.,11ref.

The NASA five-ball fatigue tester was used to determine the rolling-element fatigue lives of hollow and solid 1/2-inch-diameter (12.7 mm) balls. The upper test balls fabricated from consumable vacuum melt SAE 52100 steel (Cr 1.0%, C 1.0% approx.) were run against SAE 52100 steel lower support balls. Tests were conducted at a maximum Hertz stress of 800,000 lb/in^2. (5.52×10^9 N/m^2) with no heat added and with a super-refined naphthenic mineral oil as the lubricant. The hollow balls were fabricated by a technique that included rough-forming hemispherical shells, joining them together by electron-beam welding, heat treating, and finishing to an Anti-Friction Bearing Manufacturers Association 10 specification.

CMH

P 146173 AIL 66 to 32 Semi Ann Rep 3 UNLIMITED
NASA CR 54313
N66-32922 629.7.063.7
SKF Industries Inc., Res. Lab., 621.892
King of Prussia, Pa., U.S.A. 629.735((629.7.076.54))
SUPERSONIC TRANSPORT LUBRICATION SYSTEM INVESTIGATION NAS 3-6267
Rhoads, W.L., Sibley, L.B.
20.5.1966 120pp.,8ref.

The performance of aircraft gas turbine mainshaft ball bearings, seals, and lubricants under simulated supersonic transport engine conditions (Mach 3) is being studied using the most advanced materials, designs, and manufacturing techniques avaible. Both an oil circulating system and a once-through oil-mist system are under investigation, each with inert gas blanketing for high-temperature operation. Five candidate lubricants for each of the two systems are being used in screening evaluations, and a 1000-hour endurance test will be conducted with the two best oils in each system.

STB

P 146333 NRL REP.6463 UNLIMITED
Naval Res. Lab., Washington, D.C., U.S.A.
DRY-FILM LUBRICANTS FROM MOLYBDENUM DISULFIDE BONDED WITH MICROFIBROUS BOEHMITE 621.892.7 546.774'222.2
Fitzsimmons, V.G., Zisman, W.A.
22.12.1966 16pp.,14ref.

Binders that have been tried for powdered lamellar dry lubricants have shortcomings such as hindering the realignment of the lubricant particles or encapsulating the lubricant, making a wearing-in process necessary. A microfibrous form the colloidal alumina (boehmite) is shown to act as a superior nonencapsulating binder for molybdenum disulphide in the formation of dry lubricant films. Such films exhibit lower coefficients of friction than have been reported for molybdenum disulphide or graphite films bonded with any other material. These new lubricating coatings have good load-carrying ability and durability at any temperature below the decomposition temperature of molybdenum disulphide (700 deg.F). Optimum performance of these boehmite-bonded films is obtained when (a) the ratio of fibrillar boehmite to MoS_2 is near 0.20, (b) the film is 0.2 to 0.5 mil thick, (c) the substrate is hard and highly polished, and (d) the film is applied as an alkaline dispersion (pH = 10) and then dehydrated by baking at 550 deg.F.

FJM

WORKSHOP PRACTICE

NASA TN D-3434 UNLIMITED
National Aero. & Space Admin.,
Washington, D.C., U.S.A. 621.762.34: 621.929.1
COMPARISON OF SELECTED SUBMICRON POWDER BLENDING METHODS FOR DISPERSION ALLOYS
Norris, L.F., Reinhardt, G., et al.
Feb.,1967 27pp.,10ref.

In this investigation, a newly developed cartridge, actuated press was used to compact blended powder specimens to densities adequate for examination with the electron microscope while avoiding agglomeration due to prolonged heating at high temperatures. An automatic film scanner developed specifically for lineal analysis of dispersion microstructures was used to obtain microstructural parameters that were based on much more extensive and intensive examination than had previously been feasible. Blends consisting of 0.05-micro nickel powder with 5.4-volume-% 0.025-micron aluminium oxide were prepared by various wet and dry methods.

CMH

MILITARY SCIENCE

AD 640057 R-102-4 FR UNLIMITED
Computer R-s.Corp.,Newton,Mass.,U.S.A.
A STUDY OF CONVERSATIONAL ON-LINE INTERACTION IN MAN-MACHINE WAR GAMING 519.283((355.4)) 681.3.06 JOSL NONR 4861(00)
Clapp, L.C., Jacobson, R.V. et al.
Aug.,1966 64pp.,13ref.

Describes a study of war gaming using on-line interaction between man and computer. It is concluded that analysis and war gaming capabilities can be increased significantly using a time-sharing computer system with appropriate software and remote-access terminals. A system concept called CONSORT (CONversational System with On-line Remote Terminals) is described, and specifications are given for a user-oriented, conversational language, JOSL, which is designed specifically for simulation and analysis applications. CONSORT includes an automated data library, computer programming management features, and the capability to operate computer programs written in languages other than JOSL. Computer-aided manual gaming using CONSORT is described.

LBT

P 146321 Study UNLIMITED
ABT Associates Inc.,Cambridge,Mass.,U.S.A. 355.425
THE URB-COIN GAME 519.283((355.4)) DA 49-083-OSA-3062
Oct.,1966 135pp.

This report presents the results of a six-month effort by ABT Associates,Inc., to develop a game to simulate some of the major aspects of the terror phase of developing a computer model of urban insurgency based on game findings. Research on twenty selected cases of urban insurgency preceded development of the game, which has been played eight times to date; five times in developmental test versions, and three times in its current operational form. It has not yet been played a sufficient number of times to provide a data base for quantitative research findings.

LBT

MILITARY ENGINEERING - GENERAL

P 146787 TR 64-58 N66 37523 UNLIMITED
General Motors Corp.,G.M. Defense Res.Labs.,
Santa Barbara,Calif.,U.S.A. 531.58
MEASUREMENTS OF SHOCK WAVE PRESSURES GENERATED BY HYPERVELOCITY IMPACTS IN ALUMINUM 623.562.3 669.715 NAS 1-1118
Charest, J.A.
Nov.,1964 22pp.,11ref.

This paper presents and discusses the results of an experimental technique which has been used for determining maximum shock wave pressures generated by hypervelocity impacts of 0.476-cm aluminium spheres on 1100-0 aluminium targets. Shock wave pressures were calculated from available shock-wave data for aluminium using the approximation that free-surface particle velocity is twice the particle velocity behind the shock inside the targets. Measurements were made for various thicknesses of target and compared with values predicted from hydrodynamic calculations. The experimental results, which were obtained at an impact velocity of 7.32 km/sec, show a very close agreement above 100 kilobars with values calculated at 7.32 and 7.62 km/sec. From the calculated and measured values of peak shock wave amplitude, the pressure is found to decay as the inverse of the 1.6-power dependence of the distance from the impact point.

LBT

P 146514 TR 151 UNLIMITED
Army Cold Regions Res. & Engineering Lab.,
Hanover,N.H.,U.S.A. 624.139
A STRAIGHT-WALL CUT-AND-COVER SNOW TRENCH
Tobiasson, W., Rissling, D.L.
Oct.,1966 39pp.,17ref.

During the summer of 1962, a straight-wall cut-and-cover snow trench was constructed at Camp Century, Greenland, to house tests performed by USA CRREL Project 33, Feasibility Study of Pile Foundations in Snow. In this report, the parameters used to design the trench and the equipment and methods used in the construction are presented and evaluated. Time-motion studies covering all phases of contruction are included as a guide for the planning and evaluation of similar construction.

LBT

CHEMICAL, BIOLOGICAL & RADIOLOGICAL WARFARE

AD 622333 SRM-65-1 Addendum to Final Rep. P 125060 UNLIMITED

623.454.8 EFFECTS
355.58

IIT Res. Inst. Tech. Center, Chicago, Ill., U.S.A.

TRAJECTORY ANALYSIS FOR STRUCTURAL FRAGMENTS

Ahlers, E.E.

1.8.1965 94pp.

An addendum to the Final Report on the Debris Clearance Study (P125 060). It contains computations of the trajectories of typical fragments subject to nuclear blast winds and also amended versions of certain sections of the Final Report.

LDT

ROCKETS (INCLUDES ROCKET ENGINES)

P 146540 VIDYA NO.201(F) N66-20545 NASA CR 54757 UNLIMITED

Itek Corp., Vidya Res. & Dev., Palo Alto, Calif., U.S.A.

621.455((662.3-404))
536.422.1
NAS 7-210

ANALYTICAL AND EXPERIMENTAL STUDY OF ABLATION MATERIAL FOR ROCKET-ENGINE APPLICATION

Rindal, R.A., Flood, D.T., et al.

15.5.1966 242pp.,44ref.

A combined theoretical-experimental programme was conducted for developing techniques for rating the performance of ablative materials in liquid-propellant rocket engines. The theoretical studies resulted in the development of a computer program for characterising the response of charring ablation materials in high temperature, chemically reactive environments of arbitrary chemical composition. The experimental investigations resulted in the successful modification of an arc-plasma generator so that it would operate with the necessary gases and at the conditions requisite to achieving simulation of ablative-material response in two liquid-propellant environments, namely, O_2-H_2 and N_2O_4-N_2H_4/UDMH.

NHC

NASA TN D-3810 UNLIMITED

National Aero. & Space Admin., U.S.A.

OXIDE-CATHODE DURABILITY IN MERCURY ELECTRON-BOMBARDMENT ION THRUSTOR

621.455. ION
621.3.035.222.4

Kerslake, W.R.

Feb.,1967 25pp.,9ref.

The results of lifetime testing of oxide cathodes in mercury discharge chambers at emissions of 0.3 to 0.5 ampere per square centimeter are presented. High cathode erosion rates, probably due to ion sputtering, necessitated the construction of heavy layers of wire-reinforced oxide to provide lifetimes up to 5000 hours. An oxide-coated brush cathode gave the best lifetime of any cathode operated in an actual thrustor. Operation at low discharge voltages greatly extended the lifetime of cathodes. Calculated and measured losses of the oxide coating are compared.

VJB

NASA TN D-3022 UNLIMITED

National Aero. & Space Admin., U.S.A.

EXPERIMENTAL INVESTIGATION OF ACOUSTIC LINERS TO SUPPRESS SCREECH IN HYDROGEN-OXYGEN ROCKETS

621.455.015.2

Wanhainen, J.P., Bloomer, H.E., et al.

Feb.,1967 41pp.,16ref.

An investigation of suppression of high-frequency combustion instability using Helmholtz type acoustic damping devices was conducted at the Lewis Research Centre in a hydrogen-oxygen rocket of nominally 20,000-pound thrust size. Acoustic liner design variables investigated include the number and the diameter of the apertures, the thickness of the liner, the length of the liner, and the gap height behind the liner. The tests were conducted at a chamber pressure (nominal) of 300 pounds per square inch absolute and a range of oxidant-fuel ratios from 4 to 6. Hydrogen injection temperature was used to rate the stability of the various liners. The liner with the lowest self-triggering temperature was considered to be the most stable design.

VJB

NASA TN D-3359 UNLIMITED
National Aero. & Space Admin., U.S.A.
AEROBEE 150 PROPULSION FAILURE 629.76 AEROBEE
Busse, J.R., Bushnell, P.S. 551.507.362.1
Feb.,1967 37pp.,10ref.

NASA vehicle 4.113 GA-GI, an Aerobee 150 launched from the White Sands Missile Range, New Mexico, in April 1964, experienced a "hard" start (an explosive initial combustion generating high chamber pressures) which resulted in other anomalies, including a tail can explosion after 27 seconds of flight. The most probable cause of the hard start was an improper rupture sequence of the fuel and oxidiser diaphragms which could have resulted from an improper fuel bleed or manufacturing discrepancies. As a result of corrective measures, no hard starts occurred in 10 later Aerobee flights in 1964.

MHC

EXPLOSIVES & PROPELLANTS

AD 632461 NRDL-TR-1002 UNLIMITED
Naval Radiological Defense Lab.,
San Francisco, Calif., U.S.A. 546.171.5
THE RADIOLYTIC DECOMPOSITION OF 539.1.04
HYDRAZINE, RP-1 AND HYDYNE ROCKET 662.3-404 FUELS
FUELS
Shelberg, W.E.
6.3.1966 11pp.,6ref.

100-ml. Samples of the storable liquid rocket fuels hydrazine, RP-1 and Hydyne generate, respectively, 39.1, 50.3 and 149.4 Ml. of radiolytic off-gas (measured at 25 deg.C and 1 atm) when irradiated to 0.5×10^6 rads with gamma rays. When approximately 5 wt.% of an efficient olefinic free-radical scavenger is added to the samples, the off-gas volume produced by RP-1 fuel is reduced by 18.7% while those of hydrazine and Hydyne fuels are not reduced. These scavenging effects show that RP-1 fuel decomposes radiolytically by both free-radical (18.7%) and molecular mechanisms, and that hydrazine and Hydyne fuels decompose entirely by a molecular or ionic mechanism.

MHC

STRUCTURAL ENGINEERING

AD 646300 AFFDL TR 66-80 UNLIMITED
Air Force Systems Command, Flight
Dynamics Lab., Wright-Patterson AFB., U.S.A. 051.3 OCT.1965
MATRIX METHODS IN STRUCTURAL MECHANICS. 624.07
(PROCEEDINGS OF THE CONFERENCE HELD AT 629.7.02
WRIGHT-PATTERSON AIR FORCE BASE, OHIO,
26-28 OCTOBER, 1965)
Przemieniecki, J.S., Bader, R.M., et al.
Nov.,1966 973pp.

The purpose of the conference was to discuss the recent developments in the field of matrix methods of structural analysis and design of aerospace vehicles. The thirty-six papers presented were arranged into six sessions under five different themes: General Matrix Methods, Finite Element Properties, Nonlinear Effects, Dynamics, and Applications. The papers cover practically all major aspects of recent research and development work in the field of matrix methods of structural analysis and design.

NASA CR 705 UNLIMITED
Massachusetts Inst. of Tech.,
Cambridge, U.S.A. 624.073.1
ON THE DUALITY BETWEEN THE PROBLEMS OF 539.385
STRETCHING AND OF BENDING OF PLATES 539.384
Elias, Z.M.
Jan.,1967 60pp.,5ref.

The analogy between the problems of stretching and of bending of plates has been known for more than half a century. A general analogy exists between the two problems and is a particular case of the static geometric analogy in shell theory. It takes the form of a complete duality between the basic equations of the two problems whereby one set of equations is transformed into the other set by interchanging according to a certain correspondence the dependent variables of the two problems. The purpose of this paper is to present this duality in its totality including in the stretching problem displacements, strains, and in-plane changes of curvature and in the bending problem stress functions, stress couples and transverse shears. In both problems, the displacement and the stress function methods of solution, displacement and force boundary conditions and simply and multiplieonnected plates are considered.

STD

NASA TTF-284 IICT 1402 UNLIMITED
National Aero. & Space Admin., U.S.A.
DYNAMICS AND STRENGTH OF SHELLS 624.074.4
(Transl. From: Russian Book published 533.6.013.422
by Moscow Univ., 1963)
Ogibalov, P.M.
1963 319pp.,100ref.
Contents: Fundamental information on shells. Elastic vibrations of shells. Flutter in panels and shells. Some other dynamic problems of shells. Stability of shells in the range of elasticity. The stability of shells beyond the elastic limit. Special problems in calculation of shells.
VJD

F 146147 ONERA UNLIMITED
Note Technique 102
Office National D'Etudes et de Recherches 624.074.4:
Aérospatiales, France 539.371
ON THE DETERMINATION OF SHELLS BEYOND THE
ELASTIC RANGE (IN FRENCH)
Valid, R.
1966 116pp.,29ref.
A general shell theory, including all shapes and loads, is developed, using the principle of virtual displacements where they are compatible with the Kirchhoff-Love assumptions extended to take account of the thickness variation. This has the advantage of giving directly the necessary and sufficient conditions for equilibrium as well as the boundary-conditions concerning the above assumptions. The equations are first written in their intrinsic form and then developed in a local reference system. A general law applicable to the behaviour of the material is proposed and introduced in a step-by-step method permitting the calculation for large deformations and beyond the elastic range (plasticity and creep).

AIRCRAFT EQUIPMENT & FLIGHT CONTROL SYSTEMS

AD 625216 Rep.101 NLDC-NR-6522 UNLIMITED
Barry Controls Inc., Watertown, U.S.A.
DESIGN GUIDE FOR POLYURETHANE FOAM 621-752
ISOLATION SYSTEMS 629.664-496
Calcaterra, P.C. N600(19)59390
2.12.1965 120pp.,7ref.
The advantages of buckling isolators over presently used military standard isolators for the protection of equipment aboard high performance jet aircraft are discussed. The dynamic performance of various forms is compared to the theoretical behaviour of buckling isolators based on the experimental results obtained with polyurethane foams. Design guides are presented for the use of polyurethane foams in multifunctional vibration and shock isolation systems based on the experimentally determined dynamic properties of the foam material.
STD

AIRCRAFT INSTRUMENTS

RAE TR 66316 BLEU 74 UNLIMITED
Royal Aircraft Est., Ministry of
Aviation, U.K. 621.396.933.23
AUTOMATIC LANDING - RECENT R.A.E. 629.7.051.83
CONTRIBUTIONS D 554
Armstrong, D.D.
Oct.,1966 12pp.,4ref.
Presents a brief review of the more important R.A.E. work on automatic landing during the last four years. Work on roll-out and taxiing problems in low visibility and on the pilot's rôle in an automatic landing are mentioned briefly; but the paper dwells particularly on some lessons learnt while verifying that the I.L.S. could be used for landing, and on the implications of the safety target that must be met before blind automatic landing becomes a commercial reality.
DMC

AIRCRAFT

AD 635568 FSTC-HT-23-104-66 UNLIMITED
Army Foreign Science & Tech. Center,
Munitions Building Washington, D.C., U.S.A. 629.73 ANTONOV 22
WINGED GIANT. (Transl. from; Nauk i Zhizn 623.746.5
1965 (10), U.S.S.R.)
Pipko, A.
1965 11pp.

A general description is presented together with some of the rationale behind its arrangement of the Antonov 22 turboprop military transport. Particular emphasis is placed on the twin-tail, high wing location, fuselage mounting of gear, variable tyre pressure and ramp geometry. The aircraft was first shown to the western world at the Paris Air Show in 1966.

STD

AIR TRANSPORT (INCLUDES AIR TRAFFIC CONTROL)

NASA TT F-0369 N66-29403 UNLIMITED
National Aero. & Space Admin., U.S.A.
PROBLEMS OF APPROACH DURING POOR VISIBILITY 621.396.933.23
Gremillet, M.J. 629.7.051.83
Feb.,1963 9pp. U 554

Although many blind landings have been made so far in various countries, there has never been any system safe enough to permit all-weather landings of airline planes. A first step towards a solution of the problem has been taken by the use of the ILS system. The ILS system defines the localizer axis to within $\pm$ 1/3 of a degree with respect to the runway axis, which leads to too great a tolerance on the lateral error. It therefore appears logical to try to improve the ILS azimuthal precision, and tests along these lines have led to the conclusion that such improvement is possible.

DM

SPACE SCIENCE

NASA TN D-3850 UNLIMITED
National Aero. & Space Admin., U.S.A.
PREDICTIONS OF SHOCK-LAYER RADIATION FROM 533.6.011.72
MOLECULAR BAND SYSTEMS IN PROPOSED 523.42
PLANETARY ATMOSPHERES 523.43
Woodward, H.T.
Feb.,1967 47pp.,31ref.

Concentrations of radiating molecules and radiation from a number of band systems are presented for equilibrium shock-layer temperatures and densities of vehicles entering proposed Martian and Venusian atmospheres. The atmospheres selected consist of various proportions of CO_2, N_2, and A. Charts are also presented which relate these equilibrium shock-layer properties to flight velocity and ambient density through the normal shock conservation equations. These data can be used to estimate stagnation-point radiative heat transfer for entry trajectories. Estimates for a few selected flight conditions are discussed and compared.

VJB

AD 604416 R 64 SD 50 UNLIMITED
General Electric Co., Missile & Space Div.,
Philadelphia, Pa., U.S.A. 620.162((523.162))
PARAMETERS, TECHNIQUES AND SIGNIFICANCE OF
SOLAR SIMULATION IN SPACE SIMULATION TEST
CHAMBERS
Lee, D.E., Steg, L.
Aug.,1964 45pp.,5ref.

A review of the significance of solar simulation (collimation, spectrum, etc). on a typical satellite is given. Parameters affecting construction and performance of the solar simulation system and its relationship to a large (32 ft. x 54 ft.) space chamber located at the General Electric Valley Forge Space Technology Center are presented. Performance data of the complete chamber and sun system and early test results of typical satellite systems are reviewed.

VJB

NASA TN X-56144 N65-19764 UNLIMITED
National Aero. & Space Admin., Washington, D.C. U.S.A.
THE ROLE OF RESEARCH IN MANNED SPACE FLIGHT 629.7.014.18
Sloop, J.L. 5.001.5
22.10.1964 35pp. 629.78

The rapid growth of science and technology in recent years with its resulting impact on lives of all Americans was the basis of the lecture presented. Energy conversion, materials, structures, guidance, navigation, communications, life support systems, human factors, and other aeronautical areas are mentioned. The transfer of information and education is also highlighted.

STB

NASA CR 600 UNLIMITED
Lockheed Missiles & Space Co., Palo Alto, Calif., U.S.A. 629.7.043.4
STUDY OF ELECTROLYTIC DISSOCIATION OF CO_2-H_2O USING A SOLID OXIDE ELECTROLYTE 541.135
Weissbart, J., Smart, W.H.
Feb.,1967 88pp.,36ref.

An important problem in a space vehicle is the removal of respiratory CO_2 and the regeneration of its oxygen content. One method is that of electrolysis of the CO_2 in a solid oxide electrolyte cell. At present such cells all require an operating temperature of around 1000 deg.C and it is therefore important for the success of this method to lower the operating temperature. This programme consists of a study of the electrochemical properties of oxygen ion solid electrolytes having the imperfect fluorite structure within the temperature range 500-1000 deg.C, the aim being to operate cells made from these electrolytes for the electrolytic dissociation of CO_2-H_2O at temperatures below 1000 deg.C, preferably in the region 600-750 deg.C, at high energy efficiencies.

FAM

P 146193 FR N66-24583 UNLIMITED
NASA CR 74611
Vanderbilt Univ., Mathematics Dept., 629.7.052
Nashville, Tenn, U.S.A. 531.55
APPLICATIONS OF CALCULUS OF VARIATIONS TO TRAJECTORY ANALYSIS NAS 8-2619
Boyce, W.C., Linnstaedter, J.L., et al.
March,1966 47pp.,

This report describes in the introduction the general nature of the work done on Contract NAS 8-2619, and the numbered sections include in shortened form the principal contributions that were made. Section I extends the classical calculus of variations theory to include control variables. Section II is a treatment of a special multistage fuel minimization trajectory problem in which the lengths of the time intervals of the several stages are known. Section III is a simplified example of such a multistage problem. Section IV extends the Denbow multistage theory to allow discontinuities in variables and functions at stage boundaries, and in Section V further extensions are made to include control variables and inequality and finite equation constraints. Section VI gives an application of the theory of Section V to a three stage re-entry problem, and Section VII is an application to a six stage earth-moon problem for which partial results are obtained.

LBT

NASA TN D-3784 UNLIMITED
National Aero. & Space Admin., Washington, D.C. U.S.A. 629.7.064.53
ANALOG-COMPUTER STUDY OF PARASITIC-LOAD SPEED CONTROL FOR SOLAR-BRAYTON SYSTEM TURBOALTERNATOR 621-58
Tew, R.C., Gerchman, R.D., Hurrell, H.G.
Jan.,1967 38pp.,2ref.

The control studied is of the type being designed for a 10-kilowatt turboalternator of a Brayton-cycle space power system. The steady-state performance, transient response, and stability of the control system were investigated. Transients were introduced by stepping the alternator vehicle load off, allowing the system to reach steady state, and then stepping the vehicle load on. Ranges of controller parasitic-load capacity, overall gain, Ranges of controller parasitic-load capacity, overall gain, and time constants were studied.

STB

NASA TMX-56149 N65-19695 UNLIMITED
National Aero. & Space Admin., U.S.A.
SCIENTIFIC EXPLORATION OF SPACE AND ITS CHALLENGE TO EDUCATION 629.78 910
Oct.,1964 30pp.

A talk commemorating the founding of Worcester Polytechnic Inst., 100 years ago. Space research is characterised by the general spirit of inquiry into the nature of the external physical world and shows the scientist using hardware developed by the engineer. The most imposing challenge of the space age is the potential feed back of its developments into the civilian economy.

VJB

NASA SP 108 UNLIMITED
National Aero. & Space Admin., U.S.A.
CONFERENCE ON SPACECRAFT STERILIZATION TECHNOLOGY, BECKMAN AUDITORIUM, PASADENA, CALIFORNIA, NOV. 16-18, 1965 614.48 629.78 061
630pp.

This conference was convened to bring together scientists, engineers and administrators concerned with spacecraft sterilization technique. The seven sessions were entitled respectively (1) Sterilization requirements (2) Microbiological contamination control, microbiological monitoring and visual monitoring (3) Microbiological decontamination and sterilization (4) Bioengineering (5) Sterilizable capsule components and subsystems (6) Capsule structures and payloads, procedures and facilities (7) General Summary and panel discussion.

FJM

NASA TT F-429 IPST 1015 UNLIMITED
National Aero. & Space Admin., U.S.A.
MOTION OF AN ARTIFICIAL SATELLITE ABOUT ITS CENTER OF MASS (Transl. from: Russian Book published in Moscow, 1965) 629.783 531.352
Beletskii, V.V.
1966 261pp.,96ref.

Contents: Analysis of torques on a satellite; Stabilization and libration of the satellite in a Newtonian force field; Additional factors influencing stabilization and libration of a satellite; The relations between translational and rotational motions of a rigid body in a Newtonian force field; Perturbed rotational motions of a satellite and equations in osculating elements; Gravitational perturbations in rotational motion; Aerodynamic perturbations in rotational motion; Analysis of secular perturbations under the combined influence of gravity and aerodynamic torques and orbit evolution; The influence of magnetic fields and of solar radiation torques on satellite spin and attitude; The motion of some orbited artificial earth satellites around the centre of mass; Uses of an earth-oriented satellite in solar research; Motion of a rigid body about a fixed point in a Newtonian force field; The orbit of an equatorial earth satellite.

VJB

P 146115 ESRO TM-21 UNLIMITED
European Space Res. Organisation, Paris, France
THE ACCURACY OF MAGNETIC ASPECT MEASUREMENTS ABOARD A SATELLITE: GEOMETRICAL CONSIDERATIONS 629.783 550.38
Kalweit, C.C.
Nov.,1966 30pp.,2ref.

In the determination of the magnetic aspect aboard a satellite, errors occur due to inaccuracies of the measurement and also to the noninstantaneous sampling of the instrument outputs. The angular aspect errors resulting from these system errors are studied without discussing the measurement errors themselves. General formulae and numerical examples are given for the relation between error-angles, system errors and attitudes.

VJB

N.S. CR 665 — UNLIMITED
Arizona State Univ., Tempe, U.S.A.
ATTITUDE STABILITY OF A SPINNING PASSIVE ORBITING SATELLITE — 533.6.013.7, 629.783, 629.7.062.2
Meirovitch, L., Wallace, F.B.
Jan.,1967 216pp.,36ref.

Mathematical techniques for the stability investigation of the motion of satellites described by nonautonomous systems of equations, and in particular systems with periodic coefficients are considered. The methods of analysis have been applied to the problem of a slightly asymmetric satellite with arbitrary spin confined to a circular orbit and the problem of a spinning symmetric satellite moving in an elliptic orbit of low eccentricity.

VJB

R.A.E. TR 66360 — SPACE 178 — UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K.
ORBIT DETERMINATION FROM MINITRACK OBSERVATIONS — 531.352, 629.783, 629.7.086
Gooding, R.H.
Nov.,1966 17pp.,16ref.

Although Minitrack observations are only accurate to about 1 minute of arc, accurate orbits have been obtained for a number of satellites. This is due to the excellent global coverage of the NASA Minitrack network. The accuracy obtained for eccentricity is typically about 10^{-5}, and comparable values are obtained for the other orbital elements. The main source of observational error is thought to be inadequate correction for ionospheric refraction. Apparent error arises through deficiencies in the orbital model, namely, inadequate representation of satellite perturbations due to the Earth's tesseral harmonics and to atmospheric drag.

VJB

N.A.S.A. TN D-3873 — UNLIMITED
National Aero. & Space Admin., U.S.A.
ANALYSIS OF SEXTANT NAVIGATION MEASUREMENTS DURING LUNAR MODULE RENDEZVOUS — 522.41, 629.787, 523.3
Murtagh, T.B.
Feb.,1967 50pp.,3ref.

Two methods are presented for optimising individual spacecraft-star navigation measurements along the nominal concentric flight plan rendezvous trajectory for the Apollo programme. In the first method, a star is selected which will minimize the relative root-mean-square position errors at the measurement time. In the second method, a star is selected which will lie closest to the measurement plane defined by the inertial position vectors of the Command Service Module and the Lunar Module.

VJB

SPACECRAFT

P 146112 — ESRO TT-76 — UNLIMITED
European Space Res. Organisation, Paris, France
ATTITUDE CONTROL BY PURE JET SYSTEMS — 629.7.062.2, 533.694.6
O'Mahony, K.J.
April,1966 27pp.,6ref.

Investigation of satellite attitude control systems using gas jets by the phase plane, describing functions and other techniques is described. Brief mention is made of the acquisition problems and of the electronic circuits associated with the jet valves.

VJB

NASA TN D-3854 UNLIMITED
National Aero. & Space Admin., U.S.A.
A DESIGN METHOD FOR AN OPTIMAL ATTITUDE REGULATOR FOR A SPINNING SPACE STATION 629.7.062.2 629.786.2
Rempfer, P.S.
Feb.,1967 38pp.,7ref.

A study was made to show how a method in optimal control could be used in the design of a linear-feedback attitude regulator for a spinning space station. The design method is for linear systems, and the regulator, operating cyclically, minimizes a final error and uses a fixed amount of control effort in each cycle of operation. The resulting optimal feedback gains for the optimal regulator are computed and presented.

VJB

P 14644 Rep.3792009 IAC Paper N32 NG4-11892 UNLIMITED
Grumman Aircraft Engineering Corp., N.Y., U.S.A. 522.15 629.783
MOMENTUM CONTROL OF THE OAO SPACECRAFT UTILIZING THE EARTH'S MAGNETIC FIELD (25.9-1.10.1963) 629.7.062.2 NAS 5-814
Paiken, N., Fleizig, R.
1963 42pp.,16ref.

The analysis and preliminary design of an advanced control technique which is incorporated in the Orbiting Astronomical Observatory (OAO) are presented. In this technique the moments of inertia wheels, which provide the basic control torques, are regulated by torques created by the interaction of current-carrying coils with the earth's magnetic field. Operation of momentum control in this way permits an extremely accurate spacecraft pointing capability for long periods of time. This technique is applicable to any inertia wheel attitude control system for spacecraft which operate in ambient magnetic fields.

VJB

NASA SP 119 UNLIMITED
National Aero. & Space Admin., U.S.A.
ARIEL I: THE FIRST INTERNATIONAL SATELLITE EXPERIMENTAL RESULTS 629.78 ARIEL I
1966 158pp.,71ref.

The emphasis is on outlining the events that occurred during the period from launch to the end of the useful life of the satellite in November, 1964, and on documenting the results of the experiments carried aboard the satellite.

VJB

NASA MISC 295 N63-13738 UNLIMITED
National Aero. & Space Admin., U.S.A.
S-6, AN AERONOMY SATELLITE 629.78 S-6 551.507.362.2
Horowitz, R.
27.12.1962 22pp.

The S-6 satellite is one of the NASA Goddard Space Flight Centre's scientific earth satellites, instrumented to obtain data which will improve our understanding of the physical and chemical processes occurring in the upper atmosphere between 250 to 900 kilometres. This spherically shaped spacecraft, made from 0.025 inch thick stainless steel, is 35 inches in diameter, weights 400 pounds, and will be launched by a Delta vehicle in the first quarter of 1963 from the Atlantic Missile Range. The satellite will be placed into a 60 degree orbit, and it will be spin stabilized at 1.5 cycles per second. A three month useful life is anticipated.

VJB

NAS. SP-68 Vol.4 UNLIMITED
National Aero. & Space Admin., U.S.A.
SPACECRAFT GUIDANCE AND CONTROL 629.70
Scull, J.R. 629.7.05
1966 143pp.,12ref. 629.7.026.5
Contents: Spacecraft guidance philosophy; Optical sensors; Gyroscopes; Accelerometers; Servomechanisms; Analog computers; Digital computers; Spacecraft power; Spacecraft control systems; Inertial guidance; Earth-based midcourse guidance; Celestial navigation; Lunar-landing guidance; Planetary approach guidance; Capsule control.

VJB

NASA TM X-56997 N66-12973 UNLIMITED
National Aero. & Space Admin., U.S.A.
SATELLITE SITUATION REPORT 531.352
(Goddard Space Flight Center, Space 629.78
Operations Control Center, Vol.5, No.20)
31.10.1965 53pp.,of tables
This report reflects data computed and compiled by the Goddard Space Flight Centre, Norad, and Smithsonian Astrophysical Observatory as of 1200Z on October 31, 1965.

VJB

NASA MIGC 296 N66-32051 UNLIMITED
National Aero. & Space Admin., U.S.A.
FINE POINTING CONTROL FOR THE ORBITING 522.15
ASTRONOMICAL OBSERVATORY (OAO) 629.783
Graham, G.E.
4pp.,3ref.
High pointing accuracy requirements are imposed on the control system of the OAO. One tenth arcsec angular accuracy can be achieved in orbiting spacecraft using star references, long focal length optical systems, and relatively small torquing devices. Noise problems are introduced when a single error sensor is required to track stars with greatly different magnitudes. As star magnitude decreases, the compensating increase in the gain by the automatic gain control decreases the signal-to-noise ratio and degrades the pointing accuracy.

VJB

P 146228 LR 17516 NAS CR 60623 UNLIMITED
Lockheed California Co., Burbank,
Calif., U.S.A. 629.786
STUDY OF A ROTATING MANNED ORBITAL SPACE STATION NAS 9-1665
4.2.1964 153pp.
Contains the visual data used by the Lockheed-California Company at the Final Oral Presentation for the study of a rotating, manned, orbital space station. The design of the station has been accomplished. The configuration on which the study was based has three modules arranged radially around a central hub. Comparisons are drawn between this configuration and two others.

VJB

N65-12610 UNLIMITED
NAS. TM X-55114
National Aero. & Space Admin., U.S.A.
ADVANCED ORBITING SOLAR OBSERVATORY 629.786
DEVELOPMENT TASKS 522.15
2.12.1964 40pp.

The major objectives of the effort outlined are: Concentrate on the solution of critical problems, for example Fine Sun Sensor, and in-orbit alignment stability; Hold intact key members of the development teams which have been established at both the contractor's and major sub-contractors' facilities; Further define the observatory requirements; Prepare for system breadboard integration tests; Develop an observatory design configuration which provides the best compromise between performance, reliability, cost, and development schedule; and Minimize the number of alternate approaches or design changes for consideration in the Phase II programme should it be authorized.

VJB

P 146395 UNLIMITED
Air Force Systems Command, Aero
Propulsion Lab., Wright-Patterson AFB, 629.736
Ohio, U.S.A. 629.7.021.5
EXPENDABLE AND MODULAR STRUCTURES TECHNOLOGY 061.3 "10.1966"
FOR SUPPORT OF MANNED MISSIONS, PRESENTED AT
THE 17TH INTERNATIONAL ASTRONAUTICAL
FEDERATION CONGRESS OCTOBER 10-15,1966,
MADRID, SPAIN
Forbes, F.W., Yarymovych, M.I.
1966 14pp.

Describes up-to-date expendable and modular structures technology and its application to space missions. Historical accomplishments are reviewed, major research results are given, and immediate and longer range manned applications are included.

VJB

P 146114 ESRO SP-15 UNLIMITED
European Space Res. Organisation,
Paris, France 629.786.2
SPACECRAFT TECHNOLOGY. VOL.VIII: THE
ORBITING ASTRONOMICAL OBSERVATORY
Oct.,1966 25pp.

Deals primarily with the areas of satellite design in which difficulties arose in the development of the Orbiting Astronomical Observatory (OAO). A brief account is given of the history of the project, followed by a description of the OAO and its command and data handling system. The scientific experiments selected for the first three OAO spacecraft are described.

VJB

MECHANICAL PROPERTIES OF MATERIALS

AD 639314 FR UNLIMITED
Massachusetts Inst. of Tech.,
Metals Processing Labs., Cambridge, U.S.A. 539.374
DEFORMATION PROCESSING OF ANISOTROPIC METALS NOW 66-0068-d
(1.7.1965 - 30.6.1966)
Backofen, W.A., Holt, D.L., et al.
July,1966 100pp.

Contents: Superplasticity in the Al-Cu eutectic alloy; Superplasticity in some titanium and zirconium alloys; Superplasticity in some electroplated composites of lead and tin; Superplasticity in pellet - and ingot-extrusion of the magnesium alloy ZK60.

GH

P 146468 N66-33404 UNLIMITED
N.S. CR 77030

William Marsh Rice Univ., Houston, Tex., U.S.A. 669.28-172: 539.356
EASY GLIDE IN MOLYBDENUM CRYSTALS Grant NS G 6-59
Whitmire, L.D., Brotzen, F.R.
1966 5pp.,5ref.

By using direct shear on the (110) [$\bar{1}$11] system of 0.125 in. dia., electron-beam zone-refined molybdenum crystals, easy glide was observed at temperatures greater than 300 deg.K for a shear-strain rate of 4×10^{-5} sec^{-1}. It is noted that at higher strain rates a greater temperature is necessary for the observation of easy glide. The extent of the easy glide was dependent on the purity of the crystals, and slope of the stress-strain curves in the easy-glide region depended upon temperature and strain rate. The sensitivity of easy glide to impurities might be related to increased flow stresses in the impure material which enhance secondary slip.

GH

AD 640180 FR AROD 4266:4 UNLIMITED

Massachusetts Inst. of Tech., Mechanical Engineering Lab., Cambridge, U.S.A. 531.44 539.621 539.211
SURFACE ENERGY EFFECTS IN SLIDING Dr. 31-124 ARO(D) 143
THEMCHEL (1.7.1963 - 30.6.1966)
Rabinowicz, E.
12.9.1966 91pp.,33ref.

It has been proposed that surface energy manifests itself in a sliding system through a characteristic distance, equal to the size of wear particles for that system. This hypothesis was tested in systems in which other distance parameters were introduced, namely abrasive particles of varying sizes, solid films of varying thickness, and sliding surfaces of varying roughness. A minimum load was postulated below which low wear rates would prevail, and a number of experiments were carried out to test this prediction. The effect of material compatibility on friction and wear were evaluated. The experimental results either agreed with the predictions of the surface energy model, or at any rate were not inconsistent with them.

STB

TESTING OF MATERIALS

P 146471 TR 65-359-6 Index No. Rept. CR 75505 NGG-27962 UNLIMITED

Avco Corp., Tulsa Div., Okla., U.S.A. 620.162((523.152))
EVALUATION OF THERMAL CONTROL COATINGS IN THE SPACE ENVIRONMENT NASw 1162
Cooley, J.A.
1.11.1965 13pp.,2ref.

A space environment simulation facility and equipment used for the facility space programme are described, and the methods used in the calibration and monitoring of the various parameters are discussed. Space environment simulator test equipment described are:- (1) a Van de Graaff accelerator; (2) ultra high vacuum chambers; (3) the transition section and beam scanner; (4) the solar simulator; (5) the vacuum ultraviolet source; (6) the sample holder. The reflectance measuring apparatus and the temperature control unit are also described. Schematic diagrams of the simulator and the ultra high vacuum system are given, along with a photograph of the sample holder.

MKC

AD 631342 TDR ML-TDR-64-97 UNLIMITED

Rensselaer Polytechnic Inst., Troy, N.Y., U.S.A. 620.178.16: 539.538: 539.61
SURFACE TEMPERATURES AT SLIDING INTERFACES IN VACUA AND METAL ADHESION (15.11.1963-15.2.1964) AF 33(657)-10058
Ling, F.F.
March,1964 52pp.,38ref.

A friction and wear apparatus is described for use in vacuo which has no supporting bearings other than the sliding surfaces whose friction and wear characteristics are to be investigated. The moving specimen is suspended and rotated magnetically, external to a vacuum chamber enclosing the test section. The apparatus is suitable for both steady operation and coast-down operation. The geometries of specimens are kept simple. Surface temperatures on both sides of the interface are measured indirectly. Temperatures on the stationary specimen are measured by thermocouples while the temperature on the moving specimen is measured by a thermistor and the associated signal telemetered out from the test chamber.

GH

NASA TN D-3820 — UNLIMITED
National Aero. & Space Admin., U.S.A.
STRESS INTENSITY FACTORS FOR CRACKLINE-LOADED EDGE-CRACK SPECIMENS — 620.178.2: 539.56: 539.319
Srawley, J.E., Gross, B.
Feb.,1967 19pp.,17ref.

Crackline-loaded edge-crack specimens are flat plate specimens which have a single crack notch extending normally from one edge and which are loaded in tension at positions close to the intersection of the crack with that edge. Stress intensity factors were determined for a variety of these specimens, all with straight boundaries, by boundary collocation of the Williams form of stress function. The boundary conditions were determined with the aid of another stress function due to Filon. The results presented are considered to be comprehensive enough for a wide variety of applications of these specimens.

GMH

P 146477 C 68253 — NASA CR 77395 — UNLIMITED
CR
NGG-34804 — 661.877.651: 620.194.8
Arthur D. Little, Cambridge, Mass., U.S.A. — NASW 1403
THE PEST PHENOMENON IN INTERMETALLICS
Berkowitz, J., Rossetti, M.
28.7.1966 9pp.,2ref.

Single crystal boules of molybdenum disilicide were prepared to perform static fatigue tests in order to correlate failure measurements in the so-called pest range with classical chemical kinetic measurements. The pest phenomenon refers to the powdery yellow oxide, a mixture of SiO_2 and MoO_3 which is observed on fracture surfaces. Since static fatigue curves must be obtained as a function of temperature, particular attention was given to controlling the base level strength of the crystals; and measurements made on four samples cut at random found this strength to be 51,000 ± 3500 lb/in^2.

GMH

MATERIALS (NON-METALLIC)

AD 630299 AFML-TR-66-131 — UNLIMITED
Air Force Materials Lab., Wright-Patterson AFB, Ohio, U.S.A. — 661.666.2 673.046 Proj. 7340
GEOMETRICAL EFFECTS OF FILAMENT TWIST ON THE MODULUS AND STRENGTH OF GRAPHITE FIBER REINFORCED COMPOSITES (OCT.,1965-JAN.,1966)
Whitney, J.M.
May,1966 12pp.,4ref.

Using basic theory previously appearing in the literature, equations are derived for determining the effects of yarn twist on the modulus and strength of graphite reinforced composites. In the strength analysis the variation of individual filament properties is considered. Results show that a few turns of twist per inch have little effect on either modulus or strength. However, these properties decrease in value rapidly beyond seven turns per inch. The theory was checked using data from a unidirectional composite reinforced with graphite yarns having approximately five turns of twist per inch.

GMH

P 146283 — UNLIMITED
Harbison-Walker Refractories Co., Pittsburgh, Pa., U.S.A. — 666.763/764 621-982
STABILITY OF COMMERCIAL REFRACTORIES IN VACUUM
Bonar, K.M., Cunningham, J.L., et al.
3.11.1966 25pp.,3ref.

A study has been made of the behaviour of a number of commercially available refractory materials in vacuum at temperatures to 3000 deg.F (1649 deg.C). Weight loss data on ten refractories are reported along with chemical analyses and petrographic observations. High alumina, magnesia, magnesia-chrome, dolomite, and stabilized zirconia type materials were included.

GMH

AD 628194 Transl. 2059 UNLIMITED
Dept. of the Navy, Washington, D.C., U.S.A. 667.637
RAPID METHODS OF TESTING ANTIFOULING PAINTS FOR OCEAN GOING SHIPS (Transl.from: OB USKORENNYKH METODAKH ISPYTANIY NEOBRASTAYUSHCHIKH KRASOK DLYA MORSKIKH SUDOV. Lakokrasochnye Materialy i Ikh Primenenlye 1964,(6) 53-56, U.S.S.R.)
Glotov, V.N., Gurevich, Ye.S., et al.
11pp.
The Kinetics of the process whereby copper ions, toxic to marine organisms are leached from anti-fouling coating of KAV-53 and KNS-79 has been studied. It is shown that the process taking place at different temperatures, chloride concentrations and pH values of leaching media follows a similar pattern for both paints, although temperature is the most important factor. It is recommended that the glycine method be used for the rapid determination of the speed of leaching out of copper from anti-fouling paints.
FAM

RAE TR 66299 CPM 87 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K. 539.42:
SNATCH-TEARING OF FABRICS: COMPARISON OF SIX FABRICS 677.015
Swallow, J.E., Mikolajewski, E.
Sept.,1966 25pp.,1fig.,2ref.
The snatch-tearing method developed by Swallow and Mikolajewski has been used to compare the response to a tearing agency of six biaxially-tensioned fabrics. The sum of the warpwise and weftwise torn lengths has been taken as the criterion of tear. Analysis of variance has been made and response equations determined, characterising the length of tear in terms of the significant factors. The dependence of tear length on energy input is closely linked with the breaking strength of the fabric. The relationship for the six fabrics is very close to the hyperbolic form.

P 146120 Plastec Note 14 UNLIMITED
Picatinny Arsenal, Plastics Tech., Evaluation Center, Dover, N.J., U.S.A. 678
GLOSSARY OF PLASTICS TERMS: A CONSENSUS 083.7
Beach, N.E.
Dec.,1966 88pp.,21ref.
Presents a glossary of terms relating to plastics, adhesives and elastomers; materials and techniques. It represents a consensus of opinion from various general and specific glossaries available. Terms defined are thus general or esoteric. Definitions which tie-in with plastics and the related materials are included only; available dictionary definitions are not used. 21 lists were consulted and the terms defined number over 1,800.
MHC

P 146121 Plastec Note 15 UNLIMITED
Picatinny Arsenal, Plastics Tech. Evaluation Center, Dover, N.J., U.S.A. 016:
FERROCENE POLYMERS: AN ANNOTATED 678
BIBLIOGRAPHY 547.514.721'172
Levi, D.W.
Sept.,1966 24pp.,46ref.
An annotated bibliography of 46 items is reported on ferrocene polymers. It is limited to the references in the author's personal file. However, these cover the significant journals in the field, for the period 1956-1966. Complete subject and author indexes are included for the convenience of the user.
MHC

P 146118 Plastec Rep.56 UNLIMITED
Picatinny Arsenal, Plastics Tech.,
Evaluation Center, Dover, N.J., U.S.A. 678
DIRECTORY IN PLASTICS-KNOWLEDGEABLE 059.7
GOVERNMENT PERSONNEL (REVISED) 5.007
Leach, N.E.
Sept.,1966 144pp.

The revision has been expanded beyond the Departments of the Army, Navy and Air Force, to include the Departments of the Treasury; Commerce; Agriculture; the Interior; Health, Education and Welfare; and Housing and Urban Development. Included also are Government-funded information agencies, and the National Aeronautics and Space Administration. Contributions from 88 activities are presented, covering over 500 persons who are variously specialised in subjects pertaining to the plastics field. An index of personnel is included for use in the location of a person known by name only. A list of subjects, cross-referenced to the specialising activity, is provided for the rapid location of personnel knowledgeable in a particular matter. This listing covers 524 primary subjects, many of which are further augmented.

MHC

P 146119 Plastec Note 13 UNLIMITED
Picatinny Arsenal, Plastics Tech.
Evaluation Center, Dover, N.J., U.S.A. 061.3 "6.1966"
PLASTICS IN GOVERNMENT: A REPRINTING OF 678.6
FOUR CONFERENCE PAPERS, 1966 ANNUAL CONFERENCE,
SOCIETY OF THE PLASTICS INDUSTRY
(JUNE 7-9, NEW YORK CITY)
Pobly, H.E.
July,1966 46pp.,7ref.

The papers are:- Plastics in ammunition (Matlack, J.D.); Plastics development in ships (Alfers, J.B.); Applications of plastics for aerospace use (Fostolnek, W.); Needs for characterization and process control of low-density composites for aerospace application (Parker, J.A.).

MHC

NASA TT F-10174 NGS-28370 UNLIMITED
National Aero. & Space Admin., U.S.A.
STUDY OF THE FORMATION REACTION OF 678.746.52
POLYBENZIMIDOZOLES
Korshak, V.V., Frunze, T.M., et al.
May,1966 9pp.,4ref.

The mechanism of the synthesis of polybenzimidazoles is investigated on the example of the polycondensation reaction of 3,3'-diaminobenzidine with the diphenyl ester of sebacic acid. Thermographic analyses showed the reaction temperature to be of major significance. An increase led to a sharp rise in molecular weight of the polymer and shortening of the reaction time. During the first stages, the reaction is of the equilibrium kind, accompanied by cessation of chain growth; during later stages, the equilibrium character is lost due to the presence of extremely stable benzimidazole rings in the macromolecules.

FSH

METALLURGY

P 146504 FR NASA CR 76061 UNLIMITED
N66-29907
Ipsen Industries Inc., Rockford, Ill., U.S.A. 669-405.8
INVESTIGATION OF FORMED METALS FOR LAUNCH AND NAS 8-11048
SPACE VEHICLE APPLICATION (29.6.1963-30.11.1965)
Byrnes, E.R., Twine, C.J.
May,1966 110pp.,13ref.

Investigations of methods for manufacturing porous metals are reported. Effects of variables in processing and fabrication on the ultimate strength and integrity of form metals are discussed. The formed metals studied were aluminium, titanium, nickel, 316 stainless steel, H-11 tool steel, and molybdenum. No unusual difficulties were encountered in preparing form metals of molybdenum, H-11 tool steel, 316 stainless steel and nickel; however, at densities less than 15% of theoretical, the form metals exhibited brittle fracture characteristics. Since no practical mechanical or chemical method was discovered to prevent or remove the formation of oxide film around the aluminium metal particles, useable formed aluminium was not produced.

GTH

S & T Memo 1/67 — UNLIMITED
Technical Information & Library Services, Ministry of Aviation, U.K.
STRETCH FORMING OF VERY LONG STAINLESS STEEL SKINS (Report of work by Hawker Siddeley Aviation Ltd., under Ministry of Aviation Contract) — 621.983.7; 669.14.018.8; 669.146; KB/1/0135/CB.43(a)(2)
Padley, N., Frny, J.
Feb.,1967 11pp.
Precipitation hardening FV 520 stainless steel was stretch formed in the fully softened (austenitic) and the cold rolled and transformed (martensitic) conditions using the H.S.A. 250t stretching machine; the skins were subjected to various heat treatments after forming. It was shown that FV520 skins up to at least 45 ft long can be stretch formed satisfactorily in the soft condition only. Forming in the harder condition gave rise to considerable springback. Long skins of FV520 could be heat treated satisfactorily after stretch forming, but low temperature transformation was impractical due to problems of distortion.
CMH

P 146192 AR-592-1-365 N66-22934 NASA CR 54614 — UNLIMITED
General Dynamics Corp., Astronautics Div., San Diego, Calif., U.S.A. — 669.14.018.85; 539.3.096
THE EFFECTS OF COLD ROLLING ON THE MECHANICAL PROPERTIES OF TYPE 310 STAINLESS STEEL AT ROOM AND CRYOGENIC TEMPERATURES
Christian, J.L., Gruner, J.D., et al.
27.11.1962 23pp.,16ref.
The purpose of this investigation was to determine the applicability of cold rolled type 310 stainless steel (Cr 25%, Ni 20% approx.) for structural uses at cryogenic temperatures. Yield and tensile strengths, elongation and notched toughness were determined as a function of cold rolling from 0 to 92% reduction and of temperature from 78 deg. to -423 deg.F(26 to -253 deg.C). The results indicate that high strengths may be achieved by cold rolling and that the toughness is adequate for structural applications at -423 deg.F for the 0 - 85% cold rolled tempers. An evaluation was also made of the room temperature formability of annealed and cold rolled 310 stainless steel.
CMH

F 146175 NRC-293 NASA CR 54747 N66-22932 — UNLIMITED
General Dynamics Corp., Convair Div., San Diego, Calif., U.S.A. — 669.14.018.85; 539.3.096; 539.4.016.2
THE EFFECTS OF COLD ROLLING ON THE NOTCHED AND UNNOTCHED TENSILE PROPERTIES OF TYPE 310 STAINLESS STEEL AT + 75 DEG.F, - 320 DEG.F, AND - 423 DEG.F
Gruner, J.D.
2.2.1962 15pp.
The effects of various degrees of cold rolling on the notched and unnotched longitudinal and transverse tensile properties of Type 310 stainless steel sheet (Cr 25%, Ni 20% approx.) were determined at +75, -320 and -423 deg.F (+24, -196 and -253 deg.C). Tests results showed that this material exhibits good notched toughness at cryogenic temperatures. The notch toughness at -320 and -423 deg.F improved with increased cold rolling until a maximum was reached at approximately 60% reduction. Further cold working decreased the low temperature notched toughness.
CMH

AD 639619 SSC-174 FR — UNLIMITED
National Res. Council, Ship Structure Committee, Washington, D.C., U.S.A. — 669.146; 669.738; 539.319; 621.791; 539.56; Nobs 92521
INVESTIGATION OF RESIDUAL STRESSES IN STEEL WELDMENTS
Masubuchi, K., Martin, D.C.
Sept.,1966 103pp.,26ref.
Experimental hydrogen-induced-cracking tests were made on 45 weldments in mild steel HY-80 steel, a commercial high-strength structural steel, and SAE 4340 steel. Extensive cracks were found in weldments made in SAE 4340 steel (oil quenched and tempered at 500 deg.F) after hydrogen charging for relatively short times. Systematic crack patterns that could be related to residual stress distributions were obtained on various complex weldments. When steels of lower strengths were used, longer charging time was required to produce cracks, and crack patterns were less pronounced. The hydrogen-induced-cracking technique does not seem to work on mild-steel weldments.
CMH

P 146461 ER-6373 Intm Engng Rep.2 UNLIMITED
NASA CR 72011
NGG-33504 669.245
TRW Inc., Equipment Labs., 621.438-253.5
Cleveland, Ohio, U.S.A. AD53-7267
TASK 1, CONCLUDING REPORT. DEVELOPMENT OF HIGH TEMPERATURE NICKEL-BASE ALLOYS FOR JET ENGINE TURBINE BUCKET APPLICATIONS (1.10.1965 - 31.5.1966)
Collins, H.E.
20.6.1966 145pp.,12ref.

A screening study was conducted in which 75 experimental compositions were melted, cast and evaluated on the basis of mechanical property, microstructure and workability results. From this study, three promising cast and five promising wrought alloys were established and recommended for a more complete property evaluation. The elements most influential in improving stress rupture life were Ta, W, Hf, Al, and Cr. It is stated that these elements, in the percentages suggested, generally increase life and tensile strength, but they normally decreased ductility and workability. The data obtained from these investigations are given, and the alloy candidates recommended for further evaluation are identified. GMH

NASA TT F-10156 UNLIMITED
National Aero. & Space Admin., U.S.A.
ELECTRON DIFFRACTION STUDY OF THE OXIDATION PROCESS OF THIN FILMS OF INTERMETALLIC COMPOUNDS OF THE SYSTEM NICKEL-ALUMINUM 669.248.61:669.718.61:669.715'24:669.243'71
Nazarova, R.I. 621.793.14
May,1965 7pp.,11ref.

A method for preparing intermetallic compounds of the nickel-aluminium system in the form of thin films, by vacuum evaporation and condensation of the metal vapour until the percentage composition of the alloy corresponded to a given point of the phase diagram, is described. Electron diffraction studies were used for determining the heat resistance of the alloys and the structure of the oxide films. Simultaneous deposition of aluminium and nickel from two different evaporators on a liquid-nitrogen cooled base resulted not only in reflections characteristic of the two metals but also in reflections characteristic of the compound NiAl.

GMH

NASA TN D-3825 UNLIMITED
National Aero & Space Admin., Washington, D.C. U.S.A.
CRACK PROPAGATION, DELAYED FAILURE, AND RESIDUAL STATIC STRENGTH OF TITANIUM, ALUMINUM, AND STAINLESS STEEL ALLOYS IN AQUEOUS ENVIRONMENTS 620.193.27:669.295.5'71'28'292:669.715'5'721:669.715'3'721
Figge, I.E., Hudson, C.M.
Feb.,1967 41pp.,11ref.

An investigation of crack propagation, delayed failure, and residual static strength was conducted on titanium, aluminium, and stainless steel alloys in air in a 3% salt solution, and in sea water. Fatigue cracks grew approximately 2 to 3 times faster in the aqueous environment than in air in Ti-8Al-1Mo-1V (duplex annealed) titanium alloy and 7075-T6 aluminium alloy. In the 2024-T3 aluminium alloy, the aqueous environment had a deleterious effect on the crack growth rate at the lower stress levels and a beneficial effect at the high stress levels. In general, the delayed failure strengths of the aluminium and stainless steel alloys were essentially the same as their residual static strengths in air.

GMH

AD 630523 AMRA TR 66-19 UNLIMITED
Army Materials Res. Agency, Watertown, Mass., U.S.A. 669.715:661.862.22:532.696.1
WETTING AND BONDING BETWEEN ALUMINUM ALLOYS AND SAPPHIRE
Wolf, S.M., Levitt, A.P., et al.
July,1966 12pp.,9ref.

Wetting and bonding between the basal plane of single crystal sapphire and several aluminium alloys were investigated by the sessile drop technique at 1300 and 1600 deg.F (704 and 871 deg.C) in vacuo of 10^{-4} Torr. The alloys were commercially pure (99.5%) aluminium, commercially pure aluminium with small additions of each of eleven elements, and three commercial aluminium alloys. Additions of zirconium, magnesium, and copper lowered the aluminium-sapphire equilibrium contact angle; the lowest contact angle observed was 94 deg. and was obtained with 0.94 atomic % addition of magnesium to pure aluminium.

GMH

P 146508 Summary Rep. N66-23655 UNLIMITED
NASA CR 74443
Aluminum Co. of America, Alcoa Res. Labs., 620.194.2:
New Kensington, Pa., U.S.A. 669.715:
INVESTIGATION OF THE STRESS-CORROSION CRACKING 621.791
OF HIGH STRENGTH ALUMINUM ALLOYS NAS 8-5340
(6.5.1963 - 6.7.1965)
Lifka, B.J., King, W., et al.
1.8.1965 158pp.,19ref.

Stress corrosion cracking of several high-strength aluminium alloys was tested in various environments, after protective surface treatments and coatings, and after tempering and weldings. Parent Al-Zn-Mg alloys were little affected; but in the as-welded condition, all investigated Al alloys suffered severe localized corrosions of the heat affected zones. Post-weld ageing eliminated this effect greatly. Good stress-corrosion cracking resistance was obtained for all alloys when they were welded and stressed either in bending, or in tension as high as 75% of their weldment strength. Post-weld ageing decreased weld-strength to corrosion cracking markedly.

CMH

P 146470 FR NASA CR 77778 UNLIMITED
N66-35982
West Virginia Univ., Chemical Engineering Dept., 669.715.018.95:
Morgantown, U.S.A. 669.13
PRODUCTION OF DISPERSION ALLOYS WITH THE AID OF 534.321.9
ULTRASONICS Ns 0-533
Fairbanks, H.V.
June,1966 10pp.,3ref.

The results are summarised from research on the dispersion of inerts in a molten matrix by ultrasonic energy, and the ultrasonic treatment of alloys to produce dispersion strengthening. Mixing an inert material into molten aluminium indicated that a nearly uniform dispersion by the use of ultrasonics could be obtained. It is also reported that insonation during the solidification of gray cast iron produced more ferrite and less pearlite than the non-insonated reference specimen. Additional results are given and recommendations for further study are made.

CMH

P 146505 D2-20478-1 NASA CR 54837 UNLIMITED
N66-19586
Boeing Co., Seattle, Wash., U.S.A. 669.715'3:
INVESTIGATION OF PLANE-STRAIN FLAW GROWTH IN 669.295.5'71'16:
THICK-WALLED TANKS (26.6.1964 - 26.10.1965 539.56
Tiffany, C.F., Lorens, P.M., et al. NAS3-4194
Feb.,1966 164pp.,23ref.

Plane-strain cyclic flaw-growth rates and fracture-toughness values were obtained for 2219-T87 aluminium and 5Al-2.5Sn (ELI) titanium. Investigations were conducted at room temperature, -320 and -423 deg.F (-196 and -253 deg.C) and under zero-to-tension and half-tension-to-tension loading profiles. The experimental approach used linear elastic fractures mechanics. Results from surface-flawed uniaxial specimens and cylindrical tanks were obtained and compared. It was concluded that, within limitations, the uniaxial data can be usefully applied in the design of cryogenic pressure vessels.

CMH

RAE TR 66201 CPM 77 UNLIMITED
Royal Aircraft Est., Ministry of Aviation, U.K.
A COMPARISON OF THE FATIGUE BEHAVIOUR OF TWO 669.715'5'72
ALUMINIUM-ZINC-MAGNESIUM ALLOYS 539.431.4
Stubbington, C.A., Forsyth, P.J.E.
June,1966 30pp.,5ref.

The torsional fatigue deformation of two aluminium alloys, Al-7.5Zn-2.5Mg and Al-4Zn-5Mg, has been examined in various conditions of heat treatment. Two well defined deformation modes were observed, one in which localised transcrystalline slip produced narrow zones of precipitate re-solution, and another in which localised deformation occurred in the precipitate depleted zones at the grain boundaries. An attempt was made to correlate the torsional deformation modes of the two alloys with the fracture modes observed on rotating bending corrosion fatigue test pieces.

CMH

P 146172 FR NASA CR 77511 UNLIMITED
N66-35177

Southwest Res. Inst., San Antonio, U.S.A. 669.716:
DEVELOPMENT OF WELDING TECHNIQUES AND FILLER METALS FOR HIGH STRENGTH ALUMINUM ALLOYS 621.791.75
NAS8-1529
NAS8-20160

Burghard, H.C., Norris, E.B.
27.5.1966 269pp.,25ref.

Possible means of improving the strength of welded aluminium alloys were investigated, and the mechanical and metallurgical characteristics of these types of weldments were better defined. The programme included: (1) development of welding techniques and filler metal alloys, and (2) evaluation of the uniaxial and biaxial mechanical properties of aluminium alloy weldments. Metal inert gas, and tungsten inert gas weldments of various aluminium alloys were studied. It was established that joint preparation methods (machining, cleaning, etc.) exert a strong influence on the soundness of the welds for all material process combination included in the study.

GMH

AD 640437 NAEC AML 2478 UNLIMITED

Naval Air Engineering Center, Aeronautical Materials Lab., Philadelphia, Pa., U.S.A. 669.716.9:
A RADIOCHEMICAL INVESTIGATION OF THE LEACHING OF CHROMIUM FROM CHEMICALLY CHROMATED ALUMINUM SURFACES 621.794.6

Glass, A.L.
19.7.1966 23pp.,6ref.

A reproducible and accurate radioactive tracer procedure using the isotope chromium-51 has been developed to measure the "leaching" rates, in situ, of chromium from chemically chromated aluminium surfaces. Studies of the rates of solution are reported and an interpretation of these results is presented.

GMH

P 146143 Special Rep. NASA CR 74034 UNLIMITED
N66-23505

Battelle Memorial Inst., Columbus Labs., Ohio, U.S.A. 539.56:
669.788
REVIEW OF LITERATURE ON HYDROGEN EMBRITTLEMENT NAS 8-20029

Groeneveld, T.P., Fletcher, E.E., et al.
12.1.1966 76pp.,98ref.

Deals primarily with the loss in mechanical properties experienced by high strength iron-base and nickel-base alloys and by titanium as a result of hydrogen introduced into the material during manufacturing and processing of the alloy, or in service. The programme was conducted to determine the susceptibility of specified materials to hydrogen stress cracking, with particular attention being given to the susceptibility to hydrogen stress cracking induced by various commonly used cleaning, pickling, and electroplating processes, and to determine the effectiveness of various hydrogen embrittlement relief treatments.

GMH

MISCELLANEOUS

UKSM Rep.66/76 OPEN DISTRIBUTION
UNLIMITED

U.K. Scientific Mission, Washington, D.C., U.S.A. 061.3 "11.1966"
NOTES ON A SYMPOSIUM OF TECHNOLOGY AND WORLD TRADE SPONSORED BY THE SECRETARY OF COMMERCE OF THE UNITED STATES: NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MARYLAND, NOVEMBER 16-17, 1966 389.6:
382

Voysey, R.O.
Dec.,1966 16pp.

The symposium, besides presenting a plea for more extensive standardisation and a little material on world trade, gave some recent findings on the problem of stimulating technology and innovation. The scrutiny of this problem has grown steadily in the U.S., particularly in this decade, because of its obvious importance for sustained economic growth at a time when American policy commitments, external and internal, continue to grow and there is some disappointment at signs of slackening of the rate of growth of technological and trade achievement.

LBT

AD 640619 P-3462 UNLIMITED

Rand Corp., Santa Monica, Calif., U.S.A.

REVIEW OF "THE POLITICS OF THE CHINESE RED ARMY" EDITED BY CHESTER CHENG, THE HOOVER INSTITUTE, 1966 355.3(510)

Hsieh, A.L.

Aug., 1966 3pp.

"The Politics of the Chinese Red Army" is a volume of some 800 pages, containing a translation of 29 issues of a secret military journal covering the period 1 Jan. to 26 Aug. 1964. The reviewer considers that it is a very valuable contribution to Western knowledge of communist China, but points out some mistranslations.

LBT

P 146432 Monograph 13 UNLIMITED

Bureau of Mines, Washington, D.C., U.S.A.

OIL RECOVERY FROM GAS-CAP RESERVOIRS: AN ENGINEERING EVALUATION OF CONSERVATION PRACTICES IN SIX RESERVOIRS 622.323 622.276.23

Weaver, L.K., Anderson, K.E.

1966 106pp., 17ref.

This report describes the performance of six gas-cap reservoirs that are examples of both good engineering and good regulatory practices. Operations presented show: (1) water injection at the gas-oil contact to isolate the gas cap and maintain the reservoir pressure, (2) return gas produced with the oil to the gas cap while using the recovery mechanism of gravity drainage and natural-water influx to produce the oil zone, (3) cycling the gas-cap supplemented with extraneous gas to maintain the reservoir pressure while utilising the natural water influx to produce the oil zone: the condensate is recovered with minimum retrograde losses, (4) in the early stages of production, injecting water below the water-oil contact

(continued)

P 146432 (continued)

to maintain the reservoir pressure to prevent excessive gas-cap expansion and retrograde condensation; in the latter stages of production the gas-cap gas is cycled to recover the condensate without retrograde losses, (5) initially returning gas produced with the oil to the cap and simultaneously injecting water below the water-oil contact to prevent movement of the gas-oil contact and maintain reservoir pressure, and (6) controlling withdrawals from the gas cap and the oil zone and not using pressure maintenance.

PAM

UKSM Rep. 67/8 OPEN DISTRIBUTION UNLIMITED

U.K. Scientific Mission, Washington, D.C., U.S.A.

THE ADVANCED WASTE TREATMENT RESEARCH PROGRAMME 628.54 661.183.2 66.064

Griffiths, D.L.

Jan., 1967 5pp.

This report covers visits to the Robert A. Taft Sanitary Engineering Centre, Cincinnati and the Lebanon Pilot Plant Facility, Lebanon, Ohio. Themes described include (a) Lebanon sewage effluent (b) the activated carbon adsorption method (c) electrodialysis in waste water renovation (d) Pretreatment in the electrodialysis system etc., etc.

PAM