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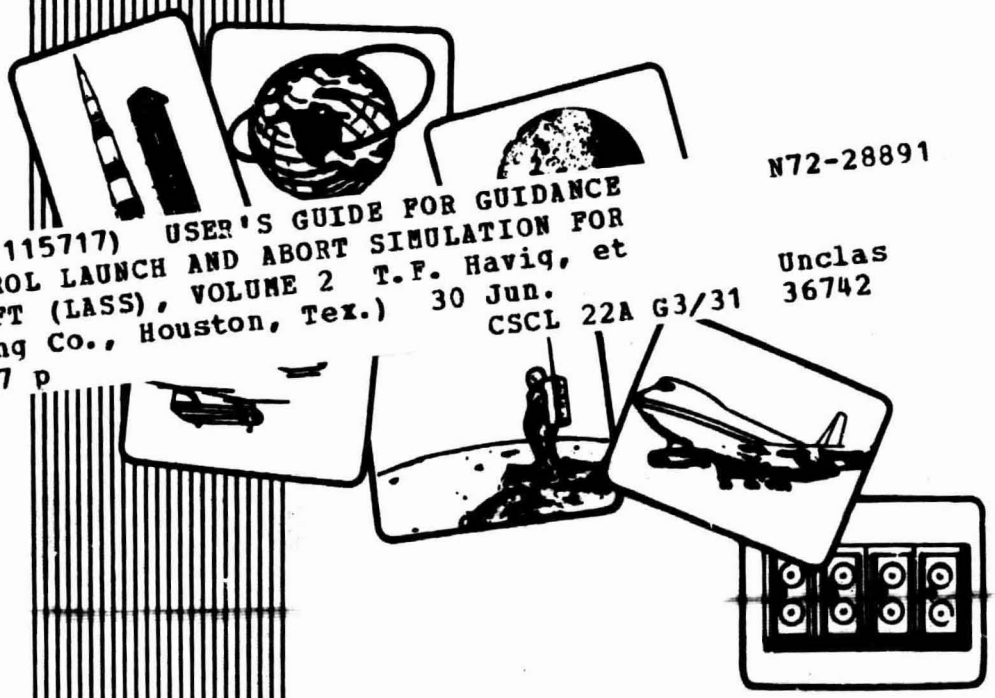
USERS GUIDE FOR GUIDANCE AND CONTROL LAUNCH AND ABORT SIMULATION FOR SPACECRAFT (LASS)

VOLUME II



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USERS GUIDE FOR GUIDANCE AND CONTROL LAUNCH AND ABORT SIMULATION FOR SPACECRAFT (LASS)

VOLUME II

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June 30, 1972

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USERS GUIDE FOR GUIDANCE AND CONTROL LAUNCH AND ABORT SIMULATION FOR SPACECRAFT (LASS)

VOLUME II

June 30, 1972

TABLE OF CONTENTS

VOLUME I

PARAGRAPH		Page
	REVISIONS	ii
	ABSTRACT AND LIST OF KEY WORDS	iii
	TABLE OF CONTENTS	v
	LIST OF FIGURES	vii
	LIST OF TABLES	ix
	REFERENCES	xi
1.0	INTRODUCTION	1
2.0	OBJECTIVES	4
2.1	OBJECTIVE OF THE SIMULATION	4
2.2	STUDY OBJECTIVES	4
3.0	SCOPE	5
4.0	SUMMARY	6
5.0	SIMULATION DESCRIPTION	9
5.1	MASTER SIMULATION CONTROL	11
5.2	INITIALIZATION MATH MODEL	13
5.3	LAUNCH GUIDANCE MATH MODEL (GUIDAN)	27
5.4	EQUATIONS OF MOTION	44
5.5	AERODYNAMICS SUBROUTINE (AERO)	59
5.6	MASS CHARACTERISTICS MATH MODEL	89
5.7	IDEAL AUTOPILOT MATH MODEL (AUTOPI)	92
5.8	CONVENTIONAL AUTOPILOT MATH MODEL (AUTOP2)	129
5.9	ABORT GUIDANCE	138
5.10	LASS OUTPUT SUBROUTINE (READO)	166
5.11	UTILITY MATH MODELS	178

TABLE OF CONTENTS

VOLUME II

	Page
TABLE OF CONTENTS	ii
LIST OF FIGURES	v
LIST OF TABLES	vii
INTRODUCTION	1
LASS Program Input	1
LASS Program Output	2
APPENDIX A - FLOW CHARTS, SYMBOL DEFINITIONS AND INITIALIZATION DATA	A-1
MASTER SIMULATION CONTROL	A-6
INITIALIZATION	A-13
LAUNCH GUIDANC	A-26
EQUATIONS OF .JTION	A-36
AERODYNAMICS MATH MODEL	A-48
COEFFICIENT MODEL (BOOSTER)	A-55
COEFFICIENT MODEL (ORBITER)	A-58
ATMOSPHERE MODEL	A-62
MASS CHARACTERISTICS MATH MODEL	A-67
AUTOPILOT MODEL (IDEAL)	A-71
ANGULAR ACCELERATION MODEL	A-81
AUTOPILOT MODEL (CONVENTIONAL)	A-95
ABORT GUIDANCE MODEL	A-110
ABORT TARGET MODEL	A-124
POST BURNOUT CONTROL MODEL	A-131
OUTPUT COMPUTATION (READO)	A-138

TABLE OF CONTENTS

VOLUME II (Continued)

	Page
APPENDIX B - PROGRAM LISTINGS	B-1
MASTER CONTROL (FUN)	B-2
RECOVERY CONTROL (RECOV AND QZKILL)	B-6
INITIALIZATION AND DATA BLOCK (INITIA)	B-7
LAUNCH GUIDANCE (GUIDAN)	B-14
EQUATIONS OF MOTION (EOM)	B-18
AERODYNAMICS (AERO)	B-23
COEFFICIENT MODEL - BOOSTER (COEF)	B-26
COEEFICIENT MODEL - ORBITER (COEFO)	B-28
ATMOSPHERE MODEL (ATMOS3)	B-34
MASS CHARACTERISTICS MATH MODELS	B-37
IDEAL AUTOPILOT MODEL (AUTOPI)	B-45
ANGULAR ACCELERATION (ACC)	B-50
CONVENTIONAL AUTOPILOT MODEL (AUTOP2)	B-54
AUTOPILOT GAIN TABLE (Z2)	B-58
ABORT GUIDANCE MODEL (ABGUID)	B-59
ABORT TARGET MODEL (TARGET)	B-65
POST BURNOUT CONTROL MODEL (PBC)	B-68
OUTPUT COMPUTATION (READO)	B-72
UTILITY SUBROUTINES	B-85

LIST OF FIGURES
VOLUME I

FIGURE		Page
1	Basic Format of LASS	10
2	Functional Description of the INITIA Subroutine	14
3	Development of Unit Vector Normal to Orbit Plane	20
4	Coordinate Systems Used in INITIA Subroutine	24
5	Rotations Involved in the TIP Coordinate Transformation	25
6	Functional Flow Chart of GUIDAN Subroutine	29
7	Launch Guidance Plumbline Coordinate System	31
8	Sense of Desired Inertial Attitude Angles	31
9	Desired Acceleration Components in Plumbline Launch Coordinates	38
10	Function Flow Chart of EOM Subroutine	45
11	Relation Between Body and Platform Coordinates	50
12	Trapazoidal Integration	56
13	Functional Description of AERO Subroutine	60
14	Functional Description of ATMOS3 Subroutine	86
15	Functional Flow Chart for AUTOPI Subroutine	94
16	Functional Flow Chart for ACC Subroutine	96
17	Functional Flow Chart for AUTOP2 Subroutine	130
18	Functional Flow Chart for ABGUID Subroutine	143
19	VC Rotation Algorithm for Abort Guidance	152
20	Functional Flow Chart of TARGET Subroutine	154
21	Unit Vectors Describing Abort Guidance Coordinate System	154
22	Relation Between Coast Angle and Burnout Velocity	157
23	Functional Flow Chart of PBC Subroutine	161
24	Functional Flow Chart of READO Subroutine	167

LIST OF FIGURES (Continued)

VOLUME II

FIGURE		Page
A-1	Flow Chart of Main Subroutine	A-6
A-2	Flow Chart of INITIA Subroutine	A-13
A-3	Flow Chart of GUIDAN Subroutine	A-26
A-4	Flow Chart of EOM Subroutine	A-36
A-5	Flow Chart of AERO Subroutine	A-48
A-6	Flow Chart of COEF Subroutine	A-55
A-7	Flow Chart of COEFO Subroutine	A-58
A-8	Flow Chart of Z1 FUNCTION Subroutine	A-59
A-9	Flow Chart of ATMOS3 Subroutine	A-62
A-10	Flow Chart of Mass Properties Math Model	A-67
A-11	Flow Chart AUTOPI (Ideal Autopilot) Subroutine	A-71
A-12	Flow Chart of ACC Subroutine	A-86
A-13	Flow Chart of AUTOP2 (Conventional Autopilot) Subroutine	A-95
A-14	Flow Chart of Z2 FUNCTION Subroutine	A-101
A-15	Flow Chart of ABGUID (Abort Guidance) Subroutine	A-110
A-16	Flow Chart of TARGET Subroutine	A-124
A-17	Flow Chart of PBC (Post Burnout Control) Subroutine	A-131
A-18	Flow Chart of READO (Output) Subroutine	A-138

LIST OF TABLES

VOLUME I

TABLE		Page
I	Sumbol Code Assignment Philosophy	9
II	Inputs Required to Initialize INITIA Subroutine	15
III	Cross Reference of Data Tables in the Data Block	16
IV	Input Data Required by GUIDAN Subroutine	28
V	Inertial Pitch Profile Table	33
VI	Input Information Required by the EOM Subroutine	46
VII	Output of EOM Subroutine	48
VIII	Inputs to AERO Subroutine	61
IX	AERO Subroutine Outputs	62
X	Aerodynamics for Booster/Orbiter Vehicle	72
XI	161-C Orbiter AERO Coefficients	76
XII	ATMOS3 Subroutine Outputs	87
XIII	Mass Characteristic Data Used in LASS	90
XIV	Inputs to AUTOPI Subroutine	99
XV	AUTOPI Subroutine Outputs	101
XVI	Inputs to ACC Subroutine	104
XVII	ACC Subroutine Outputs	109
XVIII	AUTOP2 Subroutine Inputs	134
XIX	AUTOP2 Subroutine Outputs	135
XX	Conventional Autopilot Gains (w = 1.5)	137
XXI	Input to Abort Guidance ABGUID or TARGET Subroutine	139
XXII	Input Information Required by the PBC Subroutine	140
XXIII	Input Information Required by READO Subroutine	168

LIST OF TABLES (Continued)

VOLUME II

TABLE		Page
I	Data Run Title Block	3
II	Format for Tabular Data Output	4
A-I	Matrix Correlating Subroutines and Common Statements	A-3
A-II	Symbol Definitions for FUN Subroutine	A-10
A-III	Data Block Used in LASS	A-15
A-IV	Symbol Definitions for INITIA Subroutine	A-17
A-V	Symbol Definitions for GUIDAN Subroutine	A-30
A-VI	Symbol Definitions for EOM Subroutine	A-40
A-VII	Symbol Definitions for AERO Subroutine	A-50
A-VIII	Symbol Definitions for COEF Subroutine	A-56
A-IX	Symbol Definitions for COEFO Subroutine	A-60
A-X	Symbol Definitions for ATMOS3 Subroutine	A-65
A-XI	Symbol Definitions for Mass Properties Math Model	A-69
A-XII	Symbol Definitions for AUTOPI (IDEAL Autopilot) Subroutine	A-77
A-XIII	Symbol Definitions for ACC Subroutine	A-91
A-XIV	Symbol Definitions for AUTOP2 (Conventional Autopilot) Subroutine	A-102
A-XV	Symbol Definitions for ABGUID (Abort Guidance) Subroutine	A-116
A-XVI	Symbol Definitions for TARGET Subroutine	A-126
A-XVII	Symbol Definitions for PBC Subroutine	A-134
A-XVIII	Symbol Definitions for READO Subroutine	A-151

1.0 INTRODUCTION

This document constitutes Volume 2 to D2-118387-1A,"Users Guide for Guidance and Control Launch and Abort Simulation for Spacecraft (LASS) Volume I." Volume I, D2-118387-1A, provides descriptions of engineering math models used in the development of LASS. Volume II contains flow charts, symbol dictionaries, and computer program listings that supplement the discussions contained in Volume I. The supplement information is divided into Appendix A, which contains flow charts and symbol dictionaries, and Appendix B, which contains computer program listings currently used in LASS.

1.1 LASS PROGRAM INPUT

Data is input to LASS by two means. The first is by four input data cards that are read by the FUN master program. The second is by changes in data arrays housed in INITIA subroutine and additional data array located in some of the other subroutines. However, those parameters that control an abort are input via the data cards. The first data card contains a field of 50 columns in width. These first 50 columns are used to input titles that are put at the top of each of the output plots. The title is common to all output plots in any particular run. The second card contains five F format fields each are 14 columns wide. The variables contained on this card are in order:

ABTT Time of abort in GET

TTD1 Time delay desired between abort initiation and start of closed loop abort guidance

TLAT1 Latitude of launch PAD in degrees

TLONG1 Longitude of launch PAD in degrees

AALIM Thrust limit of orbiter in gees

The third card contains four integer format fields each three columns wide and four F format fields each 14 columns wide. The variables contained on this card are in order:

KAUT If KAUT = 1 the Ideal autopilot is used during powered flight. If KAUT = 0 the conventional autopilot is used during powered flight.

KLPDR If KLPDR = 1 the orbiter returns to the launch site after abort. If KLPDR = 0 the orbiter continues downrange for landing after abort.

1.1 LASS PROGRAM INPUT (Continued)

KACØTC Not presently used

IRERUN Not presently used

SINCI Orbit plane inclination angle in degrees

SLAZI Lanuch azimuth in degrees

THBØ Abort target altitude in feet

TPPCØ Time in seconds that the orbiter pitch profile is used. This variable is used for PAD aborts.

The fourth card contains two F format fields each 10 columns wide. The variables contained on this card are in order:

GTDM Limiting rate at which the orbiter is allowed to rotate when using conventional autopilot

THELIM Limiting rate at which the desired inertial pitch angle is allowed to change when the orbiter is maneuvering during an abort.

1.2 LASS PROGRAM OUTPUT

All output from LASS is provided by the INITIA and READO subroutines. The INITIA subroutine outputs constant data that is used to identify the run and provide some of the more pertinent constants that are used in LASS. The READO subroutine loads data into either or both output data arrays or output plot arrays every other second of ground elapsed time from launch to LASS program termination.

1.2.1 Data Run Title Block

The data run title block is shown in Table I - VOL. 2. This data provides the identification of the abort run and is written by the INITIA subroutine. Specific data format is shown in the listings of Appendix B. Symbols are defined in the symbol definitions for INITIA subroutine provided in Appendix A.

1.2.2 Tabular Data Output

An example of the tabular data output array is shown in Table II - VOL. 2. This represents 16 seconds of data taken every other second. Data from each variable is put in the array by the READO subroutine and held in the array until it is full. When

TABLE I-VOL 2 DATA RUN TITLE BLOCK

ABORT PARAMETERS

ABORT TIME= 7.400000+01 L.S. LATITUDE= 3.220000+01 L.S. LONGITUDE= -6.480000+01 ABORT TARGET ALTITUDE= 2.500000+05
T DELAY ABORT 1.460000+02 ABORT ACCEL THROTTLE 3.000000+00 RETURN TO LP 0 IDEAL A. P. ABORT 0
ABORT PITCH PROFILE CUTTOFF 2.000000+01 TVC ROTATION RATE 6.000000+00 THETA ROTATION RATE 6.000000+00

LAUNCH PARAMETERS

LAUNCH LATITUDE= 2.853200+01 LAUNCH LONGITUDE= -8.056500+01 LAUNCH AZIMUTH= 3.844000+01 BETA ANGLE= -1.700000+01

ORBIT PARAMETERS

ORBIT INC. DESIRED= 5.500000+01 ORBIT INC. ACTUAL= 5.499999+01 PERIGEE= 3.098819+05 APOGEE= 6.076115+05

LAUNCH TARGET PARAMETERS

SRD= 2.121962+07 SYD= 0.000000 SRDOTD= 2.928427+00 SYDOTD= 0.000000 SZDOTD= 2.584560+04
SUQ -1.0158271-02 9.9939623-01 -3.3226212-02 9.9999999-01

UTILITY PARAMETERS

SRMEAN= 2.090974+07 SGRAV= 3.217404+01 SEROT= 7.292115-05 SMU= 1.407654+16

D2-118287-2A

TABLE II-VOL 2 FORMAT FOR TABULAR DATA OUTPUT

PILOT DISPLAY PARAMETERS

TIME FROM LAUNCH (SEC)	1.3000+02	1.3200+02	1.3400+02	1.3600+02	1.3800+02	1.4000+02	1.4200+02	1.4400+02
ALTITUDE (FEET)	9.6734+04	9.9088+04	1.0145+05	1.0381+05	1.0619+05	1.0856+05	1.1094+05	1.1332+05
ALTITUDE RATE (FT/SEC)	1.1756+03	1.1793+03	1.1822+03	1.1846+03	1.1869+03	1.1885+03	1.1897+03	1.1904+03
REL. FLT. PATH ANGLE (DEG)	2.8731+01	2.7156+01	2.6308+01	2.5490+01	2.4699+01	2.3934+01	2.3193+01	2.2476+01
DYNAMIC PRESS. (LBS/FT2)	1.2105+02	1.1960+02	1.1033+02	1.0526+02	1.0021+02	9.5022+01	9.0129+01	8.5511+01
MACH NUMBER	2.5305+00	2.6091+00	2.6894+00	2.7713+00	2.8526+00	2.9294+00	3.0075+00	3.0868+00
GROUNDSPEED (FT/SEC)	2.7885+03	2.2990+03	2.3912+03	2.4850+03	2.5806+03	2.6778+03	2.7767+03	2.8772+03
FUEL REMAINING (LBS)	4.3152+05	4.2502+05	4.1952+05	4.1402+05	4.0852+05	4.0302+05	3.9752+05	3.9202+05
THRUST ACCEL. (FT/SEC2)	5.7457+01	5.7926+01	5.8399+01	5.8879+01	5.9366+01	5.9858+01	6.0358+01	6.0865+01
THROTTLE	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00
VEHICLE LATITUDE (DEG)	2.8696+01	2.8706+01	2.8716+01	2.8727+01	2.8737+01	2.8749+01	2.8760+01	2.8772+01
VEHICLE LONGITUDE (DEG)	-8.0417+01	-8.0408+01	-8.0399+01	-8.0390+01	-8.0380+01	-8.0370+01	-8.0359+01	-8.0348+01
TIME TO GO (SEC)	1.2539+02	1.2494+02	1.2349+02	1.2209+02	1.2059+02	1.1914+02	1.1770+02	1.1626+02
BANK ANGLE (DEG)	-4.3194-01	-4.3535-01	-4.3925-01	-4.4310-01	-4.4720-01	-4.5158-01	-4.5603-01	-4.5976-01
COMPASS HEADING (DEG)	3.9372+01	3.8387+01	3.8403+01	3.8418+01	3.8434+01	3.8449+01	3.8465+01	3.8481+01
RANGE HEADING ANGLE	3.3154+01	3.3170+01	3.3187+01	3.3205+01	3.3225+01	3.3247+01	3.3269+01	3.3294+01
RANGE FROM L.S. (N.MI.)	9.6307+02	9.5944+02	9.5878+02	9.5809+02	9.5738+02	9.5664+02	9.5587+02	9.5507+02
RANGE ALONG VEL. (N.MI.)	8.0378+02	8.0310+02	8.0239+02	8.0165+02	8.0087+02	8.0005+02	7.9920+02	7.9832+02
RANGE NORMAL VEL. (N.MI.)	5.2525+02	5.2493+02	5.2481+02	5.2469+02	5.2458+02	5.2447+02	5.2437+02	5.2427+02
PILOTS PITCH ANGLE (DEG)	3.4622+01	3.3893+01	3.3259+01	3.2645+01	3.2050+01	3.1470+01	3.0907+01	3.0341+01
PILOTS YAW ANGLE (DEG)	3.8509+01	3.8522+01	3.8535+01	3.8548+01	3.8560+01	3.8573+01	3.8585+01	3.8597+01
PILOTS ROLL ANGLE (DEG)	-3.6997-01	-3.7638-01	-3.8359-01	-3.9062-01	-3.9781-01	-4.0522-01	-4.1262-01	-4.1922-01
BODY ATT. RATE (D/S) PITCH	-3.8299-01	-3.3016-01	-3.0964-01	-3.0174-01	-2.9254-01	-2.8580-01	-2.7812-01	-2.8546-01
YAW	1.5277-03	1.1479-03	1.1395-03	1.0447-03	9.4362-04	6.2162-04	7.3236-04	4.0607-04
ROLL	-1.5313-03	-2.5566-03	-2.2344-03	-2.2054-03	-2.1889-03	-2.1725-03	-1.9600-03	-1.4379-03
BODY ATT ERROR (DEG) PITCH	-1.0931-01	-3.0186-02	-2.6176-02	-2.6411-02	-3.0109-02	-3.4333-02	-3.9580-02	-2.7053-02
YAW	5.3997-03	4.2809-03	2.8239-03	1.4123-03	1.2615-04	-9.7677-04	-1.9531-03	-2.4958-03
ROLL	-8.4856-02	-8.0180-02	-7.5359-02	-7.0896-02	-6.6486-02	-6.2090-02	-5.7891-02	-5.4756-02

ADDITIONAL STUDY PARAMETERS

TIME FROM LAUNCH (SEC)	1.3000+02	1.3200+02	1.3400+02	1.3600+02	1.3800+02	1.4000+02	1.4200+02	1.4400+02
ENGINES ON	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00
RANGE FROM L.P. (N.MI.)	1.3275+01	1.4055+01	1.4872+01	1.5718+01	1.6596+01	1.7511+01	1.8457+01	1.9433+01
ANGLE OF ATTACK (DEG)	6.6689+00	6.8045+00	7.0131+00	7.2158+00	7.4098+00	7.5941+00	7.7699+00	7.9224+00
ANGLE OF SIDESLIP (DEG)	-1.6345-01	-1.6418-01	-1.6469-01	-1.6511-01	-1.6537-01	-1.6547-01	-1.6542-01	-1.6490-01
INT. FLIGHT PATH ANGLE (D)	2.0016+01	1.9588+01	1.9163+01	1.8742+01	1.8325+01	1.7912+01	1.7503+01	1.7098+01
BURNOUT VEL. (FT/SEC)	1.1676+04	1.1679+04	1.1682+04	1.1685+04	1.1687+04	1.1690+04	1.1693+04	1.1695+04
TIME TO THRUST LIMIT (SEC)	1.0516+02	1.0307+02	1.0099+02	9.8927+01	9.6867+01	9.4814+01	9.2768+01	9.0726+01
ABORT TAR.VEL.(F/S) TVDG(1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TVDG(2)	2.3583+02	2.3522+02	2.3458+02	2.3392+02	2.3323+02	2.3252+02	2.3177+02	2.3100+02
TVDG(3)	1.2907+04	1.2910+04	1.2913+04	1.2916+04	1.2919+04	1.2922+04	1.2925+04	1.2927+04
TVDG(4)	1.2909+04	1.2912+04	1.2915+04	1.2918+04	1.2921+04	1.2924+04	1.2927+04	1.2929+04
VEL. LV COORD (F/S) TVG(1)	1.1742+03	1.1780+03	1.1811+03	1.1838+03	1.1861+03	1.1879+03	1.1893+03	1.1902+03
TVG(2)	-7.6193+02	-8.1216+02	-8.6351+02	-9.1589+02	-9.6931+02	-1.0238+03	-1.0793+03	-1.1360+03
TVG(3)	3.0937+03	3.1687+03	3.2452+03	3.3231+03	3.4023+03	3.4828+03	3.5646+03	3.6478+03
TVG(4)	3.3956+03	3.4768+03	3.5598+03	3.6446+03	3.7312+03	3.8196+03	3.9097+03	4.0017+03
VEL TO GAIN (F/S) TDVG(1)	2.3196+03	2.2737+03	2.2284+03	2.1834+03	2.1390+03	2.0949+03	2.0514+03	2.0084+03
TDVG(2)	9.9776+02	1.0474+03	1.0981+03	1.1498+03	1.2025+03	1.2563+03	1.3111+03	1.3670+03
TDVG(3)	9.0132+03	9.7414+03	9.6681+03	9.5933+03	9.5170+03	9.4393+03	9.3601+03	9.2794+03
TDVG(4)	1.0133+04	1.0058+04	9.9822+03	9.9056+03	9.8283+03	9.7502+03	9.6715+03	9.5922+03
DESIRED ACCEL. TAG(1)	2.9838+01	2.9516+01	2.9202+01	2.8891+01	2.8585+01	2.8283+01	2.7986+01	2.7694+01
LV COORD. (FT/SEC2) TAG(2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TAG(3)	4.8831+01	4.9566+01	5.0299+01	5.1027+01	5.1752+01	5.2475+01	5.3195+01	5.3914+01

TABLE II VOL CONT'D

	TAG(4)	5.7225+01	5.7690+01	5.8162+01	5.8639+01	5.9122+01	5.9611+01	6.0107+01	6.0611+01
DESIRED ACCEL P.	GADP(1)	2.9838+01	2.9516+01	2.9202+01	2.8891+01	2.8585+01	2.8283+01	2.7986+01	2.7694+01
COORD. (FT/SEC2)	GADP(2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	GADP(3)	4.0830+01	4.9568+01	5.0299+01	5.1027+01	5.1752+01	5.2475+01	5.3195+01	5.3914+01
	GADP(4)	5.7225+01	5.7690+01	5.8162+01	5.8639+01	5.9122+01	5.9611+01	6.0107+01	6.0611+01
TIME FROM LAUNCH (SEC)		1.3000+02	1.3200+02	1.3400+02	1.3600+02	1.3800+02	1.4000+02	1.4200+02	1.4400+02
INERTIAL VEL. P.	EVP(1)	1.1424+03	1.1439+03	1.1449+03	1.1454+03	1.1453+03	1.1446+03	1.1434+03	1.1415+03
COORD. (FT/SEC)	EVP(2)	1.0397+03	1.0394+03	1.0391+03	1.0388+03	1.0385+03	1.0381+03	1.0378+03	1.0375+03
	EVP(3)	3.0691+03	3.1603+03	3.2532+03	3.3478+03	3.4441+03	3.5420+03	3.6416+03	3.7429+03
	EVP(4)	3.4359+03	3.5180+03	3.6020+03	3.6877+03	3.7751+03	3.8644+03	3.9555+03	4.0483+03
REL. VEL. PLAT.	VA(1)	1.1564+03	1.1584+03	1.1598+03	1.1606+03	1.1610+03	1.1608+03	1.1600+03	1.1586+03
COORD. (FT/SEC)	VA(2)	-7.9267+00	-8.0309+00	-8.2343+00	-8.4361+00	-8.6369+00	-8.8373+00	-9.0378+00	-9.2396+00
	VA(3)	2.2188+03	2.3096+03	2.4022+03	2.4964+03	2.5924+03	2.6900+03	2.7892+03	2.8902+03
	VA(4)	2.5020+03	2.5835+03	2.6675+03	2.7531+03	2.8405+03	2.9297+03	3.0208+03	3.1138+03
REL. VEL. BODY	VAB(1)	2.4851+03	2.5656+03	2.6475+03	2.7312+03	2.8167+03	2.9040+03	2.9931+03	3.0841+03
COORD. (FT/SEC)	VAB(2)	-7.1375+00	-7.4038+00	-7.6676+00	-7.9334+00	-8.1965+00	-8.4609+00	-8.7216+00	-8.9616+00
	VAB(3)	2.9654+02	3.0614+02	3.2569+02	3.4580+02	3.6632+02	3.8718+02	4.0840+02	4.2917+02
INERTIAL POS. (FT)	ERP(1)	2.1005+07	2.1008+07	2.1010+07	2.1012+07	2.1015+07	2.1017+07	2.1019+07	2.1021+07
	ERP(2)	1.3602+05	1.3810+05	1.4017+05	1.4225+05	1.4433+05	1.4641+05	1.4848+05	1.5056+05
	ERP(3)	1.8571+05	1.9194+05	1.9836+05	2.0496+05	2.1175+05	2.1874+05	2.2592+05	2.3330+05
	ERP(4)	2.1007+07	2.1009+07	2.1011+07	2.1014+07	2.1016+07	2.1019+07	2.1021+07	2.1023+07
ATTITUDE (ACT) (DEG)	PITCH	-5.5883+01	-5.6630+01	-5.7281+01	-5.7913+01	-5.8527+01	-5.9125+01	-5.9708+01	-6.0294+01
	YAW	-5.7379-03	-4.2387-03	-2.7894-03	-1.3797-03	-9.1216-05	1.0140-03	.9931-03	2.5217-03
	ROLL	8.4817-02	8.0183-02	7.5361-02	7.0896-02	6.6486-02	6.2089-02	5.7889-02	5.4754-02
ATTITUDE (DES) (DEG)	PITCH	-5.5993+01	-5.6669+01	-5.7308+01	-5.7940+01	-5.8557+01	-5.9160+01	-5.9747+01	-6.0321+01
	YAW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	ROLL	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TIME FROM LAUNCH (SEC)		1.3000+02	1.3200+02	1.3400+02	1.3600+02	1.3800+02	1.4000+02	1.4200+02	1.4400+02
ANGULAR BODY ACCEL.	PITCH	1.2242-01	1.8977-01	1.6427-01	1.6686-01	1.6572-01	1.6587-01	1.5723-01	1.5774-01
(DEG/SEC2)	YAW	-6.4310-04	-3.0082-04	-2.9237-04	-2.8769-04	-2.9432-04	-2.4512-04	-3.0451-04	-2.3235-04
	ROLL	-1.0069-03	1.0534-04	1.0893-04	2.8585-05	-2.9765-06	5.5706-05	4.0792-04	-1.9166-05
TRANSLATIONAL	EAVP(1)	3.2869+01	3.2459+01	3.2200+01	3.1924+01	3.1640+01	3.1340+01	3.1038+01	3.0685+01
ACCEL. P. COORD.	EAVP(2)	5.4569-02	5.4943-02	5.5547-02	5.6020-02	5.6175-02	5.5765-02	5.5210-02	5.3289-02
(FT/SEC2)	EAVP(3)	4.5339+01	4.6288+01	4.7131+01	4.7977+01	4.8823+01	4.9676+01	5.0542+01	5.1386+01
	EAVP(4)	5.5999+01	5.6535+01	5.7081+01	5.7628+01	5.8179+01	5.8736+01	5.9294+01	5.9851+01
AERO MOMENT ABOUT	X-AXIS	1.6888+04	1.5776+04	1.4761+04	1.3780+04	1.2820+04	1.1683+04	1.1018+04	1.0399+04
BODY (FT/LBS)	Y-AXIS	-7.5522+05	-6.8928+05	-6.3057+05	-5.7454+05	-5.1336+05	-4.5242+05	-3.9463+05	-3.6443+05
	Z-AXIS	-5.1192+03	-3.5109+03	-1.9358+03	-4.9065+02	7.9709+02	1.8836+03	2.7966+03	3.1208+03
AERO FORCES BODY	DFAB(1)	-3.0497+04	-2.6735+04	-2.7008+04	-2.5384+04	-2.3828+04	-2.2305+04	-2.0903+04	-1.9677+04
COORD. (LBS)	DFAB(2)	1.3737+03	1.3195+03	1.2643+03	1.2096+03	1.1535+03	1.0940+03	1.0361+03	9.7312+02
	DFAB(3)	-1.1174+05	-1.0768+05	-1.0512+05	-1.0232+05	-9.9155+04	-9.5572+04	-9.1939+04	-8.8201+04
	DFAB(4)	1.1584+05	1.1145+05	1.0854+05	1.0542+05	1.0198+05	9.8146+04	9.4291+04	9.0374+04
ALPHA-QUE (DEG-LBS/FT2)		8.0721+02	7.8657+02	7.7378+02	7.5951+02	7.4251+02	7.2161+02	7.0029+02	6.7745+02
BETA-QUE (DEG-LBS/FT2)		-1.9785+01	-1.8978+01	-1.8171+01	-1.7378+01	-1.6572+01	-1.5723+01	-1.4909+01	-1.4101+01
VEHICLE WEIGHT (LBS)		7.0524+05	6.9974+05	6.9424+05	6.8874+05	6.8324+05	6.7774+05	6.7224+05	6.6674+05
AERO DECELERATION (GEES)		1.6425-01	1.5928-01	1.5634-01	1.5307-01	1.4927-01	1.4481-01	1.4027-01	1.3555-01
HEAT RATE (BTU/FT2/SEC)		1.4082+00	1.4747+00	1.5429+00	1.6128+00	1.6830+00	1.7517+00	1.8221+00	1.8943+00
TOTAL AXIAL ACCEL. (GEES)		1.7396+00	1.7564+00	1.7734+00	1.7904+00	1.8076+00	1.8250+00	1.8424+00	1.8598+00
TOTAL OUT OF PL. ACC. (GS)		1.7898-03	1.7674-03	1.7482-03	1.7256-03	1.6963-03	1.6549-03	1.6118-03	1.5403-03
TOTAL NORMAL ACCEL. (GEES)		-5.5516-02	-5.1322-02	-5.0345-02	-4.8681-02	-4.6595-02	-4.3834-02	-4.1010-02	-3.7046-02
TOTAL HORIZ ACCEL. (GEES)		5.5544-02	5.1352-02	5.0376-02	4.8711-02	4.6626-02	4.3866-02	4.1042-02	3.7078-02
ENG1 PITCH ANGLE (DEG.)		-3.4581+00	-3.3971+00	-3.3191+00	-3.2486+00	-3.1748+00	-3.1016+00	-3.0273+00	-2.9849+00
ENG1 YAW ANGLE (DEG.)		4.6739-03	3.5871-03	2.1287-03	8.0392-04	-3.8574-04	-1.3725-03	-2.2483-03	-2.4867-03
ENG2 PITCH ANGLE (DEG.)		-3.2253+00	-3.1804+00	-3.1154+00	-3.0578+00	-2.9965+00	-2.9358+00	-2.8732+00	-2.8387+00
ENG2 YAW ANGLE (DEG.)		4.6739-03	3.5871-03	2.1287-03	8.0392-04	-3.8574-04	-1.3725-03	-2.2483-03	-2.4867-03
ENG1 PITCH RATE (DEG/S)		-2.3801-02	2.2228-02	1.7962-02	1.7885-02	1.8570-02	1.8281-02	1.8665-02	9.9508-03

D2-18871-2

TABLE II -2 CONT'D

ENG1 YAW RATE (DEG/S)	-5.0868-04	-3.2773-04	-3.6286-04	-3.2179-04	-2.8691-04	-2.3966-04	-2.0931-04	-3.8879-05
ENG2 PITCH RATE (DEG/S)	-2.6327-02	1.8321-02	1.4792-02	1.4686-02	1.5428-02	1.5189-02	1.5857-02	7.8919-03
ENG2 YAW RATE (DEG/S)	-5.0868-04	-3.2773-04	-3.6286-04	-3.2179-04	-2.8691-04	-2.3966-04	-2.0931-04	-3.8879-05

PILOT DISPLAY PARAMETERS

TIME FROM LAUNCH (SEC)	1.4600+02	1.4800+02	1.5000+02	1.5200+02	1.5400+02	1.5600+02	1.5800+02	1.6000+02
ALTITUDE (FEET)	1.1578+05	1.1807+05	1.2045+05	1.2283+05	1.2520+05	1.2757+05	1.2993+05	1.3228+05
ALTITUDE RATE (FT/SEC)	1.1934+03	1.1930+03	1.1889+03	1.1874+03	1.1854+03	1.1829+03	1.1799+03	1.1765+03
REL. FLT. PATH ANGLE (DEG)	2.1779+01	2.1102+01	2.0446+01	1.9810+01	1.9193+01	1.8595+01	1.8015+01	1.7453+01
DYNAMIC PRESS. (LBS/FT2)	8.1155+01	7.7047+01	7.3175+01	6.9526+01	6.6089+01	6.2852+01	5.9804+01	5.6933+01
MACH NUMBER	3.1672+00	3.2489+00	3.3317+00	3.4156+00	3.5007+00	3.5869+00	3.6743+00	3.7627+00
GROUNDSPEED (FT/SEC)	2.9795+03	3.0835+03	3.1891+03	3.2964+03	3.4053+03	3.5159+03	3.6281+03	3.7419+03
FUEL REMAINING (LBS)	3.8652+05	3.8102+05	3.7552+05	3.7002+05	3.6452+05	3.5902+05	3.5352+05	3.4802+05
THRUST ACCEL. (FT/SEC2)	6.1379+01	6.1901+01	6.2431+01	6.2969+01	6.3516+01	6.4072+01	6.4637+01	6.5211+01
THROTTLE	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00
VEHICLE LATTITUDE (DEG)	2.0795+01	2.0798+01	2.0811+01	2.0825+01	2.0840+01	2.0854+01	2.0870+01	2.0885+01
VEHICLE LONGITUDE (DEG)	-8.0337+01	-8.0325+01	-8.0313+01	-8.0300+01	-8.0287+01	-8.0274+01	-8.0260+01	-8.0245+01
TIME TO GO (SEC)	1.1481+02	1.1337+02	1.1194+02	1.1051+02	1.0908+02	1.0765+02	1.0623+02	1.0482+02
BANK ANGLE (DEG)	-4.6350-01	-4.6730-01	-4.7118-01	-4.7514-01	-4.7918-01	-4.8329-01	-4.8747-01	-4.9171-01
COMPASS HEADING (DEG)	3.8496+01	3.8512+01	3.8527+01	3.8543+01	3.8559+01	3.8575+01	3.8591+01	3.8607+01
RANGE HEADING ANGLE	3.3319+01	3.3346+01	3.3375+01	3.3405+01	3.3437+01	3.3470+01	3.3505+01	3.3541+01
RANGE FROM L.S. (N.MI.)	9.5425+02	9.5340+02	9.5252+02	9.5160+02	9.5066+02	9.4969+02	9.4869+02	9.4765+02
RANGE ALONG VEL. (N.MI.)	7.9739+02	7.9643+02	7.9543+02	7.9440+02	7.9332+02	7.9221+02	7.9105+02	7.8985+02
RANGE NORMAL VEL. (N.MI.)	5.2417+02	5.2408+02	5.2399+02	5.2391+02	5.2383+02	5.2376+02	5.2368+02	5.2361+02
PILOTS PITCH ANGLE (DEG)	2.9786+01	2.9255+01	2.8742+01	2.8245+01	2.7762+01	2.7293+01	2.6836+01	2.6391+01
PILOTS YAW ANGLE (DEG)	3.8609+01	3.8621+01	3.8633+01	3.8646+01	3.8658+01	3.8671+01	3.8683+01	3.8696+01
PILOTS ROLL ANGLE (DEG)	-4.2579-01	-4.3232-01	-4.3880-01	-4.4525-01	-4.5166-01	-4.5804-01	-4.6438-01	-4.7067-01
BODY ATT. RATE (D/S) PITCH	-2.7218-01	-2.6287-01	-2.5322-01	-2.4822-01	-2.4193-01	-2.3599-01	-2.3047-01	-2.2529-01
YAW	3.8542-04	3.5612-04	3.2162-04	2.9159-04	2.6374-04	2.3816-04	2.1477-04	1.9346-04
ROLL	-1.4746-03	-1.3317-03	-1.2720-03	-1.2144-03	-1.1594-03	-1.1070-03	-1.0569-03	-1.0091-03
BODY ATT ERROR (DEG) PITCH	-1.0238-02	-2.7236-03	1.6869-03	4.0664-03	5.2787-03	5.8884-03	6.2325-03	6.4861-03
YAW	-2.7734-03	-3.0572-03	-3.3065-03	-3.5243-03	-3.7141-03	-3.8790-03	-4.0186-03	-4.1381-03
ROLL	-5.1866-02	-4.9136-02	-4.6551-02	-4.4086-02	-4.1736-02	-3.9493-02	-3.7354-02	-3.5314-02

ADDITIONAL STUDY PARAMETERS

TIME FROM LAUNCH (SEC)	1.4600+02	1.4800+02	1.5000+02	1.5200+02	1.5400+02	1.5600+02	1.5800+02	1.6000+02
ENGINES ON	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00	1.0000+00
RANGE FROM L. P. (N. MI.)	2.0454+01	2.1504+01	2.2591+01	2.3714+01	2.4878+01	2.6081+01	2.7316+01	2.8595+01
ANGLE OF ATTACK (DEG)	8.0615+00	8.2054+00	8.3469+00	8.4845+00	8.6172+00	8.7447+00	8.8664+00	8.9824+00
ANGLE OF SIDESLIP (DEG)	-1.6407-01	-1.6328-01	-1.6248-01	-1.6166-01	-1.6083-01	-1.5998-01	-1.5911-01	-1.5822-01
INT. FLIGHT PATH ANGLE (D)	1.6696+01	1.6298+01	1.5905+01	1.5516+01	1.5133+01	1.4755+01	1.4383+01	1.4017+01
BURNOUT VEL. (FT/SEC)	1.1697+04	1.1699+04	1.1701+04	1.1703+04	1.1704+04	1.1706+04	1.1707+04	1.1708+04
TIME TO THRUST LIMIT (SEC)	8.8693+01	8.6657+01	8.4629+01	8.2604+01	8.0581+01	7.8562+01	7.6545+01	7.4529+01
ABORT TAR.VEL.(F/S) TVDG(1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TVDG(2)	2.3028+02	2.2937+02	2.2851+02	2.2761+02	2.2669+02	2.2573+02	2.2474+02	2.2372+02
TVDG(3)	1.2930+04	1.2932+04	1.2934+04	1.2936+04	1.2938+04	1.2939+04	1.2941+04	1.2942+04
TVDG(4)	1.2932+04	1.2934+04	1.2936+04	1.2938+04	1.2940+04	1.2941+04	1.2943+04	1.2944+04
VEL. LV COORD (F/S) TVG(1)	1.1905+03	1.1902+03	1.1894+03	1.1881+03	1.1863+03	1.1839+03	1.1811+03	1.1779+03
TVG(2)	-1.1937+03	-1.2525+03	-1.3124+03	-1.3735+03	-1.4356+03	-1.4989+03	-1.5633+03	-1.6288+03
TVG(3)	3.7323+03	3.8182+03	3.9053+03	3.9936+03	4.0835+03	4.1745+03	4.2667+03	4.3601+03
TVG(4)	4.0954+03	4.1909+03	4.2882+03	4.3873+03	4.4881+03	4.5907+03	4.6951+03	4.8012+03
VEL TO GAIN (F/S) TDVG(1)	1.9663+03	1.9242+03	1.8830+03	1.8423+03	1.8023+03	1.7629+03	1.7241+03	1.6859+03
TDVG(2)	1.4239+03	1.4819+03	1.5409+03	1.6011+03	1.6623+03	1.7246+03	1.7880+03	1.8526+03
TDVG(3)	9.1973+03	9.1130+03	9.0286+03	8.9421+03	8.8542+03	8.7648+03	8.6741+03	8.5819+03

1.2.2 Tabular Data Output (Continued)

the array is full all data contained is written out. If the run terminates prior to completion of a full data array, the remaining part of the unfilled array is filled with zeros and written out. Lists of data variables that are output are shown in the description of READO subroutine provided in Appendix A.

1.2.3 Plotted Data Output

An example of LASS output plots are shown in reference 18. Values of selected variables to be plotted are loaded in data arrays every other second. These plot arrays are being filled and held in memory until the run reaches terminal end conditions. At this terminal point, the plots are made with ground elapsed time being the independent variable. A list of variables to be plotted, as time histories, are shown in the description of READO subroutine provided in Appendix A.

If LASS should terminate its run prior to attainment of simulation terminal conditions, provisions are made to plot that data which is contained in the plot data arrays. Two machine language subroutines are provided for this purpose. The RECOV subroutine is called up by the master FUN subroutine. It in turn uses the QZKILL subroutine to cause a program restart to be entered in the READO subroutine. Consequently, when a LASS run terminates before normal terminal conditions are reached, all data left in the plot arrays are plotted. The recovery subroutines are shown in Appendix B.

The plotting provisions use the standard MSC plot routines. The specific call statements and arguments are shown in the program listings for READO provided in Appendix B.

APPENDIX A

Appendix A contains flow charts of the more complicated subroutines used in LASS. The charts are detailed using coded symbol notation. Along with each flow chart is a symbol definition table. The symbol definitions are provided showing engineering symbols as defined in the respective discussions located in section 5 of Vol. I. The symbol dictionary is detailed from the coded listings in alphabetical order. The symbols that are provided in the common blocks of each subroutine are also included. This provides a focal point which defines input and output from the subroutine and provides a correspondence for use of the listing provided in Appendix B. The flag codes, used in the symbol dictionary, are:

1> Internally used parameter
2> Input parameter from another subroutine
3> Output parameter or available for output
4> Output print parameter
5> Contained in common block but not used in subroutine
6> Parameter not presently in use
7> Parameter initialized to zero
8> Parameter initialized to a value other than zero
9> Card input parameters

An attempt was made to code symbols such that they have identity to major subroutines. As noted in section 5.0 of Vol. I, the prefix letters are in general:

Subroutine	Symbol Prefix Letter
INITIA	S
GUIDAN	G
EOM & FUNCTIONS	E
AERO, ATMOS3, COEF	D
TARGET & ABGUID	T
AUTOPI & ACC, & AUTOP2	A
PBC	P
READO	R

Table A-I contains a matrix of the common blocks used in LASS correlated with the respective subroutines. This will provide visiability of communication between subroutines.

TABLE A-I MATRIX CORRELATING SUBROUTINES AND COMMON STATEMENTS

SUBROUTINE / COMMON BLOCK	Z2	EOM	GUIDAN	FUNCTØ*	Z1	AERØ	ATMØS3	CØEF	CØEFØ	MATH**	AUTØP2	AUTØPI	ACC	TARGET	PBC	ABGUID	READØ	INITIA	FUN
AD1											X	X				X		X	
AD2													X					X	
AR1											X	X						X	
CG				X														X	
CLA	X										X	X							
CØN		X	X			X					X	X		X	X	X	X	X	
DA1		X				X					X	X	X		X		X	X	
DP1						X									X				
DR1						X									X	X	X		
DR2						X									X	X	X		
EA1		X				X					X	X				X	X	X	
EA2		X	X			X					X	X	X			X	X	X	X
EG1		X	X													X	X		
FIRST						X		X	X										
GR1			X														X		
GT1			X													X			
IA1		X				X					X	X			X	X	X	X	X
IA2											X	X	X					X	
IA3											X	X						X	
IA4											X	X	X					X	

* FUNCTØ - REPRESENTS SEVERAL FUNCTION ROUTINES

** MATH - REPRESENTS SEVERAL MATH SUBROUTINES

TABLE A-I MATRIX CORRELATING SUBROUTINES AND COMMON STATEMENTS - (Continued)

SUBROUTINE / COMMON BLOCK	Z2	EOM	GUIDAN	FUNCTØ*	Z1	AERØ	ATMØS3	CØEF	CØEFØ	MATH**	AUTØP2	AUTØPI	ACC	TARGET	PBC	ABGUID	READØ	INITIA	FUN
IA5											X	X	X					X	
IA6											X	X	X					X	
IA7											X	X	X					X	
IA8											X	X	X					X	
IA9											X	X	X					X	
ID1						X												X	
ID2							X											X	
ID3																		X	
IE1		X							X		X	X					X	X	
IE2		X	X			X								X		X	X	X	
IE3		X																X	
IG1		X	X													X		X	
IG2			X															X	X
IG3		X	X			X								X	X	X	X	X	X
IG4			X								X	X		X	X	X	X	X	
IG6			X															X	
IT1		X												X	X	X		X	X
IT2		X												X		X	X	X	
MAN											X	X						X	X
MAI		X	X								X	X	X	X	X	X	X	X	X

* FUNCTØ - REPRESENTS SEVERAL FUNCTION ROUTINES

** MATH - REPRESENTS SEVERAL MATH SUBROUTINES

TABLE A-I MATRIX CORRELATING SUBROUTINES AND COMMON STATEMENTS - (Continued)

SUBROUTINE / COMMON BLOCK	Z2	EOM	GUIDAN	FUNCTØ*	Z1	AERØ	ATMØS3	CØEF	CØEFØ	MATH**	AUTØP2	AUTØPI	ACC	TARGET	PBC	ABGUID	READØ	INITIA	FUN
MA2																X		X	X
MA3																X	X		
MI1																		X	X
MP1															X			X	X
MP2																		X	X
MR1																	X		X
PAR																		X	
SR1		X												X			X	X	X
TA1														X		X	X		
TA3			X											X		X	X		
THIRD						X													
TP11														X					
TR1														X		X	X	X	
TR2														X			X		

* FUNCTØ - REPRESENTS SEVERAL FUNCTION ROUTINES

** MATH - REPRESENTS SEVERAL MATH SUBROUTINES

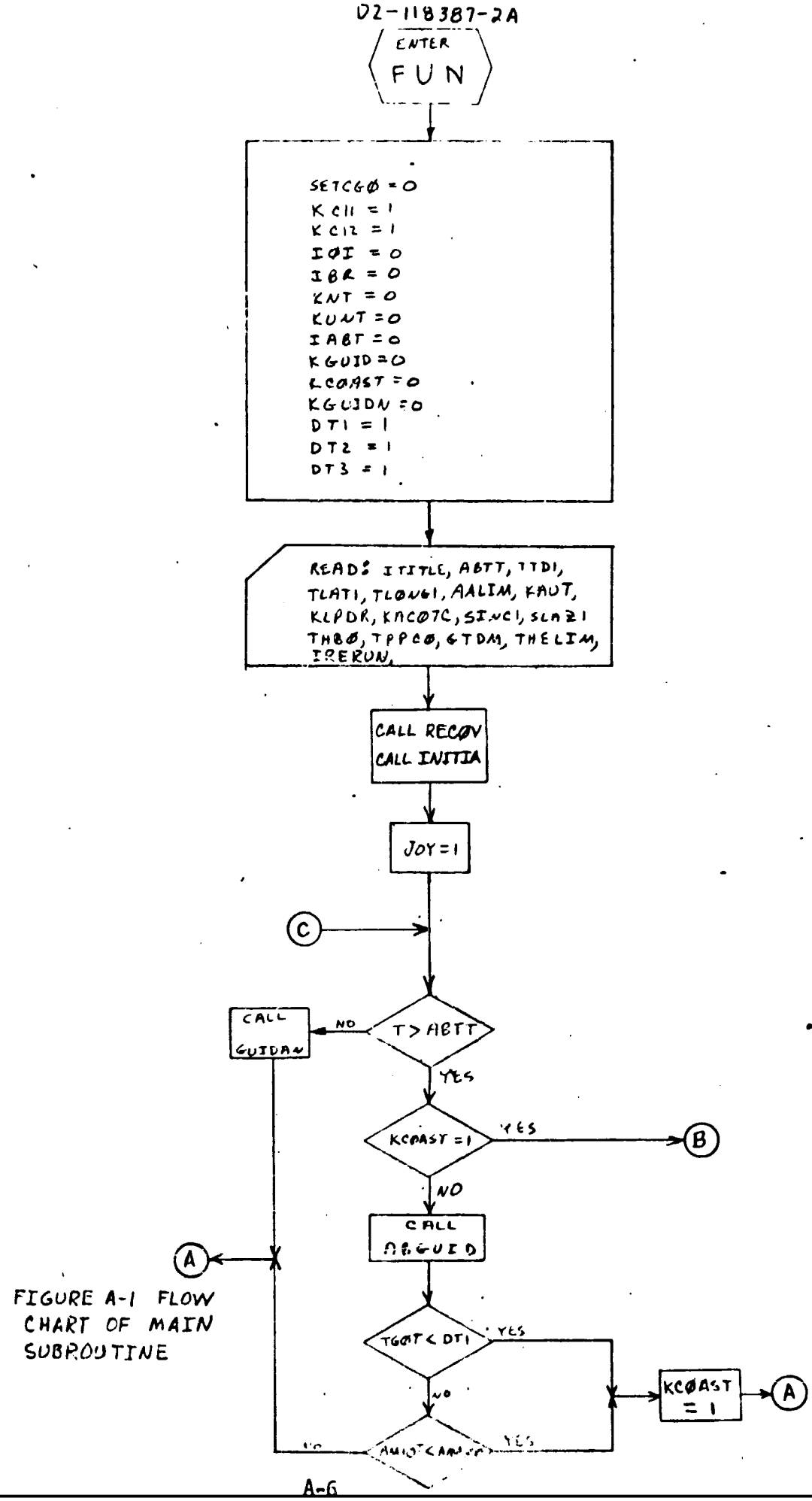


FIGURE A-1 FLOW CHART OF MAIN SUBROUTINE

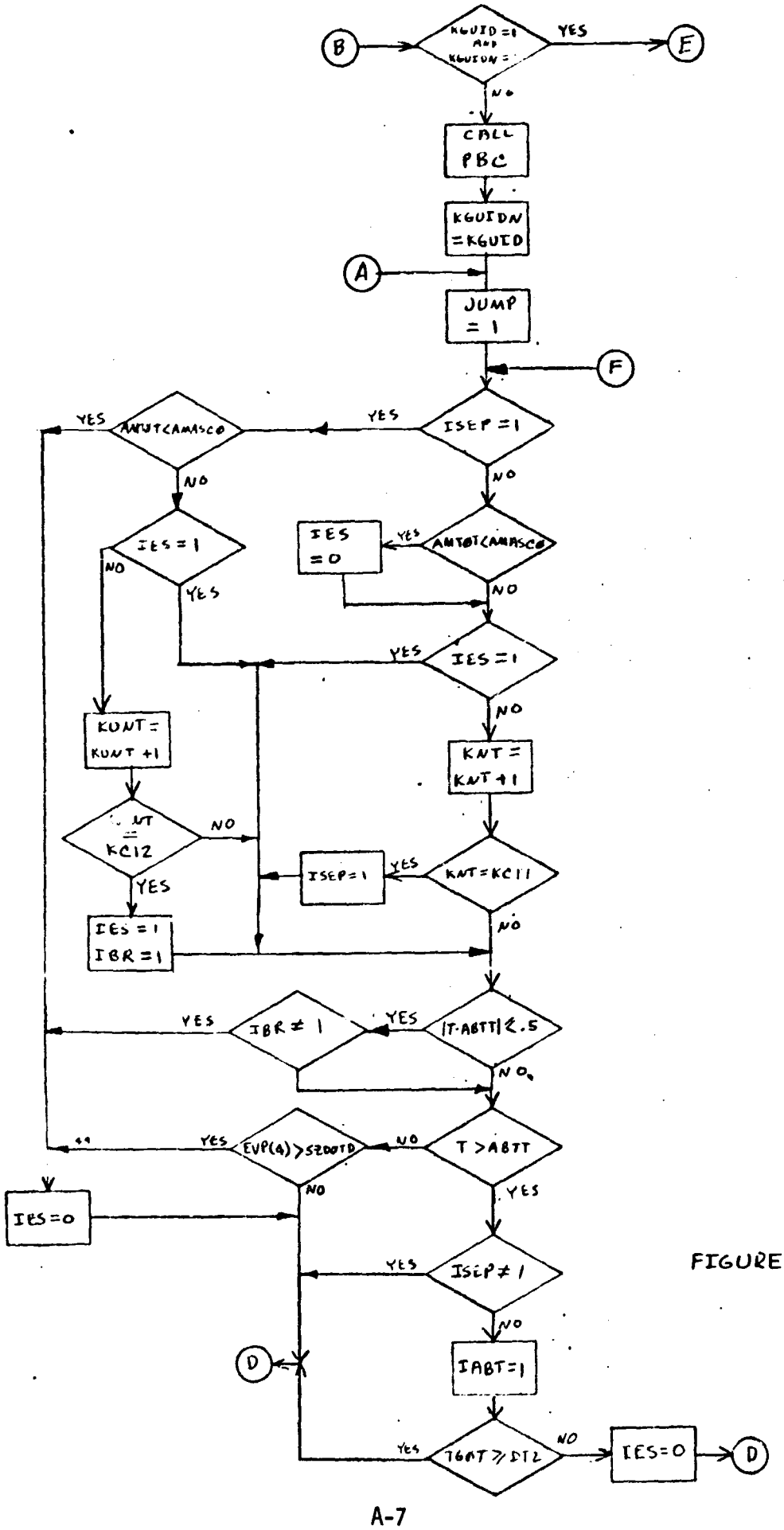


FIGURE A-1 CONT'D

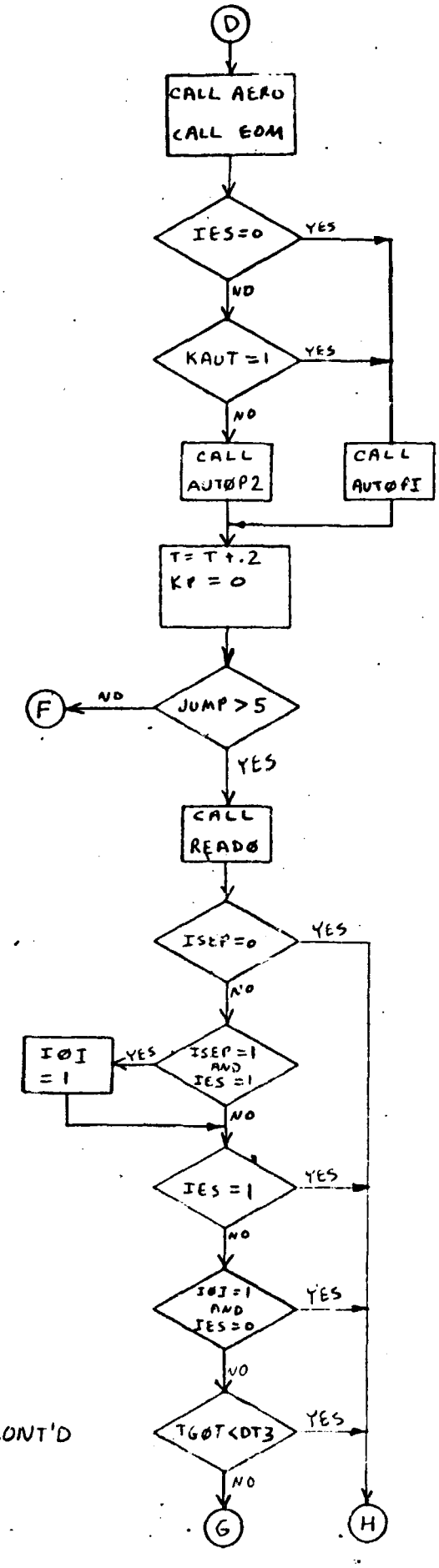


FIGURE A-1 CONT'D

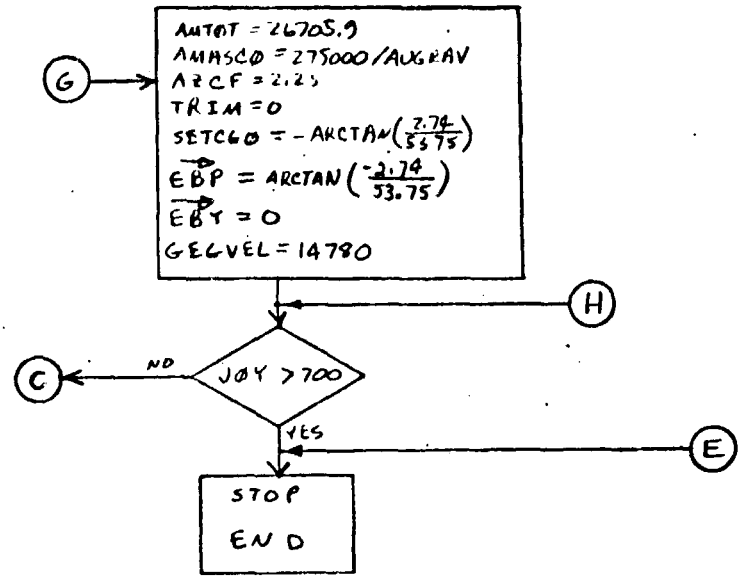


FIGURE A-1 CONT'D

TABLE A-II SYMBOL DEFINITIONS FOR MAIN PROGRAM

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
AALIM		Orbiter Maximum Linear Acceleration during abort 9 3	Gees
ABTT		Time selected for abort 9 3	sec.
ADMASS (12)		5	
ADMTØT		5	
AMASCØ		Payload mass of orbiter 8 3	slugs
AMDØTV		5	
AMTØT		Mass of orbiter plus fuel 8 3	slugs
APDET		5	
ARCSPM		Pitch Moment calculated by RCS model 5	Ft-Lbs
ARCSRM		Roll moment calculated by RCS model 5	FT-Lbs
ARCSYM		Yaw moment calculated by RCS model 5	Ft-Lbs
ARDET		5	
AUGRAV		5	
AYDET		5	
AZCF		Reference distance along body Z-axis used in orbiter moment calculations 8 3	Ft
DT1		Minimum Time to go which causes switching from Abort guidance to coast guidance 1	sec
DT2		Minimum time to go which causes orbiter engine shutdown 1	sec
DT3		Minimum time to go which causes switching from booster flight to orbiter flight 1	sec
EAVP		Vehicle acceleration in platform coordinates 5	Ft/sec^2
EBP(12)		5	
EBY(12)		5	
EG		Acceleration Due to Gravity 5	Ft/sec^2
EGEFF		5	
EL(12,3		5	
ELATC		Geocentric Latitude of vehicle 5	deg
ELØ (2, 3)		5	
ELONGD		Geodetic longitude of vehicle 5	deg
EPE (12)		5	
EPT		5	
ERP (4)		Present vehicle inertial position 2 5	Ft

TABLE A-II (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EVP(4)		Present vehicle inertial velocity [2]	Ft/sec
GDTV		[6]	
GEGVEL		Exhaust Gas velocity of orbiter [3] [8]	Ft/sec
GMT(12)		[5]	
GTA(12)		[5]	
GTDM		Abort pitchover pitch rate limit [9] [3]	deg/sec
GTPPCØ		[5]	
IABT		IABT = 1 After abort is begun [1]	discrete
IBØ		[6]	
IBR		IBR = 1 when orbiter engines are burning [1]	
IES		One indicates engine start [3]	discrete
IGMT		[6]	
IOI		Latching flag [1]	discrete
IRERUN		[9] [6]	
ISEP		One indicates vehicles have separated [3]	discrete
ITITLE		Run graph title [9] [3]	Alpha-numeric
JOY		Counter variable to determine the number of times LASS is executed [1]	
JUMP		Inner loop control for LASS execution (five passes for one of JOY) [1] [3]	
KACOTC		[9] [6]	
KAUT		KAUT = 1 when Ideal Autopilot is used [9] [1]	discrete
KCOAST		KCOAST = 1 when PBC subroutine is used [1]	discrete
KC11		Time delay after booster engine cutoff prior to vehicle separation [8]	sec
KC12		Time delay after vehicle separation prior to engine start [8]	sec
KGUID		Run termination flag [2]	discrete
KGUIDN		Past value of KGUID [2]	discrete
KLPDR		If KLPDR = 1, Abort Back to pad [9] [3]	discrete
KNT		Counter associated with KC11 [1]	
KP		[6]	
KUNT		Counter associated with KC12 [1]	
MANUAL		[6]	
SETCGO		Angle between body X and thrust vector at launch pad [8] [3]	
SINC1		Orbit inclination angle [9] [3]	degrees

TABLE A-II (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
SLAT1		Latitude of launch site [5]	degrees
SLAZ1		Launch azimuth [9] [3]	degrees
SLONG1		Launch longitude [5]	degrees
SRDØTD		[5]	
SYDØTD		[5]	
SZDØTD		Desired vehicle Z at orbit insertion [2]	Ft/sec
T		Ground elapsed time [3] [4]	sec
TF		Earth Flattening constant [5]	unitless
TGØT		Time to go during abort [2]	sec
THBO		Abort burnout altitude [9] [3]	
THELIM		Abort pitch rate limit [9] [3]	deg/sec
TLAT		Target latitude [5]	radians
TLAT1		Target longitude [9] [3]	degrees
TLONG		Target longitude [5]	radians
TLONG1		Target longitude [9] [3]	degrees
TPPCO		Time for flight on pitch profile during abort [9] [3]	seconds
TRIM		Engine turn for autopilot [7] [3]	
TT(6)		Conversion matrix relating coast angle, reentry angle of attack, and burnout velocity [5]	unitless
TTD1		Time for open loop guidance during abort [9] [3]	seconds
TWEP(3)		Angular rotation rate of earth [5]	rad/sec

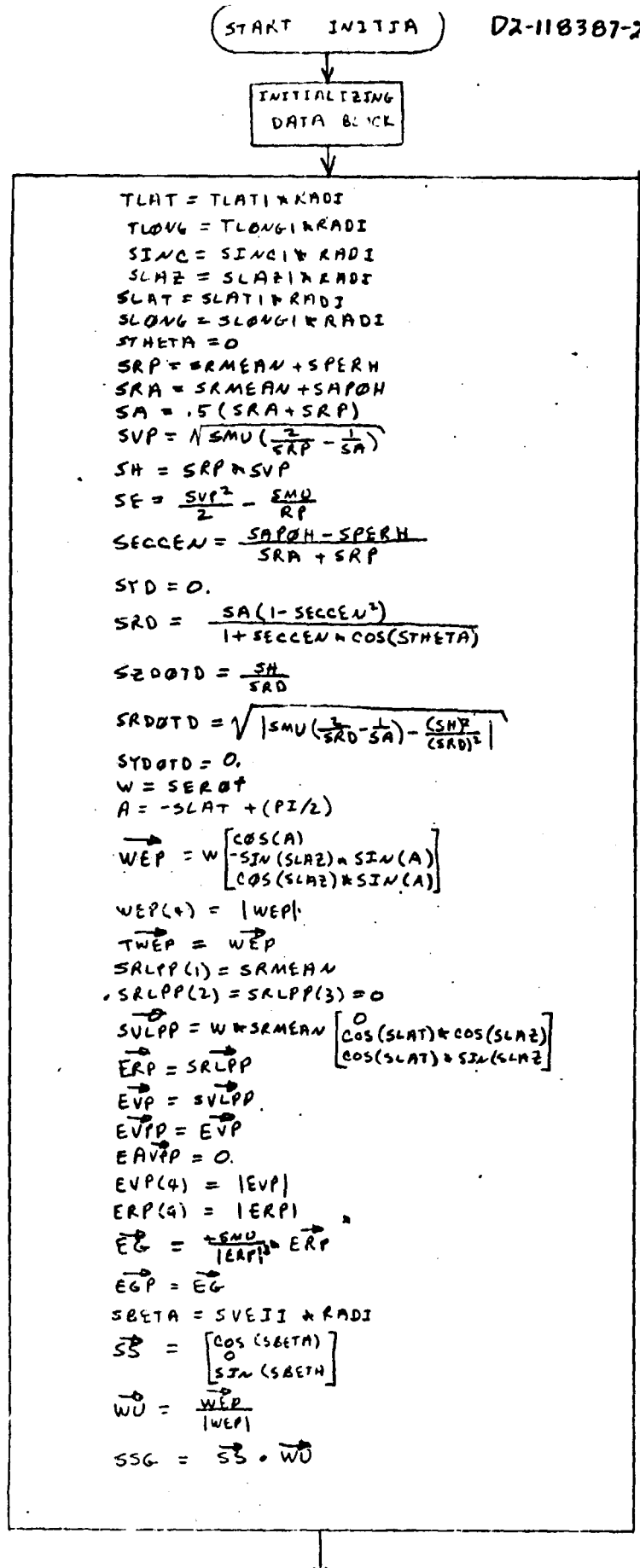


FIGURE A-Z FLOW CHART OF INITIA SUBROUTINE

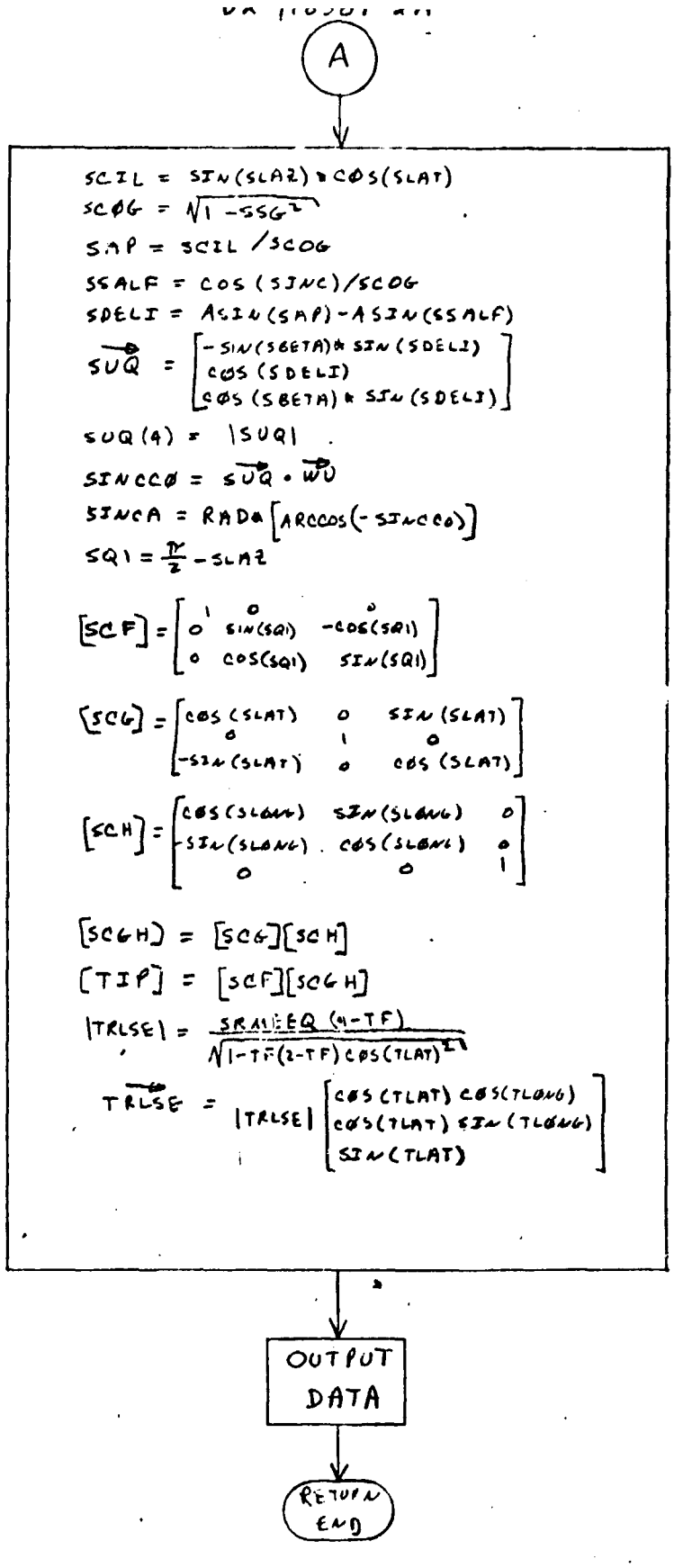


FIGURE A-2 CONT'D

TABLE A-III DATA BLOCK USED IN LASS

```
 DATA WT/9415.3,12297.1,15178.8,18060.6,20942.3,23824.1,26705.9,
•   51750.4,68417.5,85083.9,103033.1,120982.4,139553.3,156875.8/
 DATA XCG/  44.28,  45.85,  47.43,  49.01,  50.59,  52.17,  53.75,
•          106.96, 114.55, 118.88, 129.92, 134.23, 140.80, 147.48/
 DATA YCG/ 14*0./
 DATA ZCG/   3.40,   3.66,   3.93,   4.19,   4.46,   4.72,   4.99,
•          -11.32, -8.09,  -6.14,  -5.17,  -4.19,  -3.70,  -3.23/
 DATA MXX/  2.734,  3.230,  3.726,  4.221,  4.717,  5.212,  5.708,
•          29.170, 32.859, 34.852, 35.858, 36.794, 37.552, 38.310/
 DATA MYY/ 20.972, 23.156, 25.339, 27.522, 29.706, 32.889, 34.072,
•          241.190,304.817,363.439,423.213,483.008,542.822,602.627/
 DATA MZZ/ 22.756, 25.401, 28.047, 30.693, 33.339, 35.985, 38.631,
•          233.248,293.603,358.663,409.902,469.225,528.758,588.273/
 DATA MXZ/  0.080,  0.067,  0.055,  0.043,  0.030,  0.018,  0.006,
•          -37.336,-35.769,-32.867,-28.843,-25.054,-21.853,-18.652/
    INITIALIZATION
 DATA RAD,RADI,PI,SGRAV,SRMEAN,SEROT,SMU/57.29578,1.745329E-2,
•3.1415926536 ,32.17404,2.090974E7,7.292115E-5,1.407654E16/
 DATA SAPOH,SPERH,SLATI,SLONGI,SVEII,EC2/6.076115E5,3.098819E5,
128.532  , -80.565 ,-17.0,220./
 DATA SRMEEQ/2.09257382E7/
    EOM
 DATA  EL/12*0.,-4.7,4.7,-14.1,-4.7,4.7,14.1,-14.1,-4.7,4.7,14.1,
• -4.7,4.7,2*14.1,4*4.7,4*-4.7,2*-14.1/
 DATA EPE,EGEFF,EATI,ELO/12*1.,32.14655,40.,2*0.,-6.5,6.5,2*2.25/
 DATA ETSLB,EAEB,EBP,EPT/12*550000.,12*25.517,12*-.02189,1./
 DATA EPAI,EAEOI,EAEO2,EBPO,T/2116.8,61.903,68.046,5.565053E-2,0./
 DATA EATVPM,EATVPN,ETSLOI,ETSLO2,ETHETA/40.,41.,2*4.88ES,-.02189/
    GUIDANCE
 DATA GCO,GPHID,GEGVEL,AZCF,EPT/8.,80.4351.96.5221,0.,14136.,0.,1./
 DATA GMT /14.,20.,30.,40.,50.,60.,100.,120.,140.,180.,220.,240./
 DATA GTA/-.02189,-.06383,-.10598,-.15467,-.22454,-.31066,
1 -.81915,-1.04266,-1.21357,-1.41588,-1.56391,-1.59823/
 DATA GTPFCO,GDT,GCII,GURP,GUZP,GUYP,IES/212.,1.,4.,12*.5,1/
 DATA GTAU,GISOI,GISO2,GISO3,GTHEV,GVGVEC/290.,8*0./,ISEP/0/
 DATA IGMT/0/
    AUTOPILOT DATA
 DATA  ADMTOT,AMDOTV,ADMASS,AMTOT,AMASCO,AUGRAV,ATENG/14*0.,
• 156875.8,51933.48,32.17404,12*550000./
 DATA ANOAER,AMINGA,ACOMSM,ACCLIM,ARATLM,ANGLDB,ARATDB/.7,.35,
1 1.745329E-7,2.268928E-1,1.047197E-1,1.745329E-5,1.745329E-4/
 DATA  NOENGB,NOENGO,AFLOWB,AFLOWO/12,2,2*1375./
 DATA      AGAIN1,AGAIN2,AMAXGA,ANGMIN,ANGMAX,AMINOM,AREVRS/.9,.7,
1 1.3,.95,1.05,.99,1.20/
```

TABLE A-III (Continued)

```
    ABORT GUIDANCE
 DATA TT,TGCT/.06236,2,47813,-3,47331,.06236,2,47813,-3,4733,200./
 DATA TF      /.0C335233/
AERODYNAMICS DATA
 DATA /C/10.,9.8C665E-4/,HMAX/5.E5/
 DATA  SPAN,AREA,CHORD/150.,122.3,8308.,6484.,74.,70.6/
 DATA  XREF,YREF,ZREF/235.,46.58,4*0./
 DATA HB             /-5000.0,0.0,11000.0,20000.0,32000.0,47000.0,
152000.0,61000.0,79000.0,88743.0/
 DATA ZB       /9CCCO.0,100000.0,110000.0,120000.0,150000.0,16
10000C.C,170000.0,190000.0,230000.0,300000.0,400000.0,500000.0,60000
20.0,70000r.0/
 DATA TMB             /320.65,288.65,216.65,216.65,228.65,270.65,
1270.65,252.65,180.65,180.65,180.65,210.65,260.65,360.65,
2960.65,1110.65,1210.65,1350.65,1550.65,1830.65,2160.65,
32420.65,2590.65,2700.65/
 DATA ALP             /12.087778,11.526088,10.027120,8.6079235,
16.7662077,4.7086738,4.0775458,2.9019653,.37006732E-1,-1.8055744,
2-1.8055744,-3.5040610,-4.9124564,-5.9828218,-7.5886378,-7.9035491,
3-8.1833670,-8.6884559,-9.5726883,-10.879634,-12.421644,-13.724116,
4-14.879663,-15.942630/
 DATA XGB            /9.535,9.505,9.476,9.447,9.360,9.331,9.302,
19.246,9.134,8.942,8.679,8.428,8.187,7.956/
```

TABLE A-IV SYMBOL DEFINITION FOR INITIA SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
A		Complement of the launch pad latitude (1)	rad
AALIM		Orbiter maximum linear acceleration during abort (2) (4)	gees
ABETAP(5)		Engine gimbal angle computed for pitch (5)	rad
ABETAR(5)		Engine gimbal angle computed for roll (5)	rad
ABETAY(5)		Engine gimbal angle computed for yaw (5)	rad
ABPIT (12)		Pitch component of total pitch engine gimbal angle for booster (5)	rad
ABROLL (12)		Booster roll component of total pitch engine gimbal angle (5) or orbiter roll component of total yaw engine gimbal angle	
ABTOTP(12)		Total engine gimbal pitch angle (booster) (5)	rad
ABTOTY(2)		Total engine gimbal yaw angle (orbiter) (5)	rad
ABTT		Time selected for abort (2) (4)	sec
ABYAW(2)		Yaw component of total yaw engine gimbal angle for orbiter	rad
ACALMX(5)		Desired moment about X body axis (5)	Ft-lbs
ACALMY(5)		Desired moment about Y body axis (5)	Ft-lbs
ACALMZ(5)		Desired moment about Z body axis (5)	Ft-lbs
ACCLIM		Angular acceleration limit (8) (9)	rad/sec^2
ACOMSM		Constant for angular acceleration commanded equal to zero test (8) (3)	rad/sec^2
ACTALP(5)		Actual angular acceleration experienced (5)	rad/sec^2
ACTPAC(5)		Actual pitch angular acceleration experienced (5)	rad/sec^2
ACTRAC(5)		Actual roll angular acceleration experienced (5)	rad/sec^2
ACTYAC(5)		Actual yaw angular acceleration experienced (5)	rad/sec^2
ADESMX		(6)	
ADESMY		(6)	
ADESMZ		(6)	
ADMASS(12)		Mass depleted per engine per .2 sec (7) (3)	slugs
ADMTOT		Total Mass depleted per .2 sec (7) (3)	slugs
AFLØWB		Fuel flow rate of booster engines (8) (3)	Lbs/sec
AFLØWØ		Fuel flow rate for orbiter engines (8) (3)	Lbs/sec
AFYMX (5)		Moment about X-body axis due to Y-Body forces (5)	Ft-lbs
AFZMX (5)		Moment about X-body axis due to Z-body forces (5)	Ft-lbs
AGAIN1		Desired acceleration system Gain = .7 (8) (3)	Unitless
AGAIN2		Desired Acceleration System Gain = .9 (8) (3)	Unitless

TABLE A-IV SYMBOL DEFINITION FOR INITIA SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ALENGØ		Length of orbiter vehicle (8)	Ft
ALP(24)		Tables of natural log of pressures at the base layers (8)	Unitless
ALPHAC(24)		Angular acceleration commanded (5)	rad/sec^2
ALPHPI(5)		Pitch angular acceleration commanded (5)	rad/sec^2
ALPHRØ(5)		Roll angular acceleration commanded (5)	rad/sec^2
ALPHYA(5)		Yaw angular acceleration commanded (5)	rad/sec^2
AMASCØ		Mass cut-off for dry vehicle (8) (3)	slugs
AMAXGA		Upper Limit of AGAIN (8)	unitless
AMDOTV		Mass depletion rate (7) (8)	slugs/sec
AMINGA		Lower limit of gain = .35 (8) (3)	Unitless
AMINØM		Minimum percent of desired rotational rate = .99 (8) (3)	Unitless
AMINTB		Minimum total booster thrust (5)	pounds
AMINTØ		Minimum Total Orbiter thrust (5)	pounds
AMTØT		Total vehicle mass remaining. (8) (3)	slugs.
ANGLDB		Angle deadband = 1.745329 x 10^{-5} (8) (3)	radians
ANGMAX		Upper limit of percent desired angle change = 1.05 (8) (3)	Unitless
ANGMIN		Lower limit of percent desired angle change = .95 (8) (3)	Unitless
ANOAER		Percent of max acceleration with no aerodynamics (8) (3)	Unitless
APDET		(5)	
APDIFT		(5)	
APRATE(5)		Body pitch rate (5)	rad/sec
ARATDB		Residual rotational rate deadband (8) (3)	rad/sec
ARATE (5)		Rotational rate (5)	rad/sec
ARATLM		Angular rate limit = .05235987 (8) (3)	rad/sec
ARCSPM		Pitch moment commanded by RCS model (5)	Ft-lbs
ARCSRM		Roll moment commanded by RCS model (5)	Ft-lbs
ARCSYM		Yaw moment commanded by RCS model (5)	FT-lbs
ARDET		(5)	
ARDIFT		(5)	
AREA(2)		Aerodynamic surface area (8) (3)	Ft^2
AREVRS		Percent reversal of present rotational rate (8) (3)	Unitless
ARRATE(5)		Body roll rate (5)	rad/sec
ATENG(12)		Engine thrust magnitude (8) (3)	pounds
ATØTHR		Total engine thrust during present minor cycle (5)	Unitless

TABLE A-IV SYMBOL DEFINITION FOR INITIA SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ATØTPG(5)		Magnitude of total pitch and roll angles 5	radians
AUGRAV		Acceleration due to gravity at sea level 8 3	Ft/sec^2
AYDET		5	
AYDIFT		5	
AYRATE(5)		Body Y rate 5	rad/sec
AZCF		Distance between body X axis and the engine cluster centerline along the body Z axis 8 3	Ft
C(2)		5	
CHORD(2)		Aerodynamic chord 8 3	Ft
CM(40,2)		Table of pitching moment coefficients 8	Unitless
CN(40,2)		Table of yawing moment coefficients 8	Unitless
CX(20,2)		Table of coefficients for X body forces 8	Unitless
CY(40,2)		Table of coefficients for Y body forces 8	Unitless
CZ(40,2)		Table of coefficients for Z body forces 8	Unitless
DFAB (4)		5	
DMAXB		Aero moment about body X axis 5	Ft/lbs
DMAYB		Aero moment about body Y axis 5	Ft/lbs
DMAZB		Aero moment about body Z axis 5	Ft/lbs
EAEB		Booster engine nozzle area 8 3	Ft^2
EAEO1		Orbiter engine nozzle area 8 3	Ft^2
EAEO2		Orbiter engine extended nozzle area 8 3	Ft^2
EAIT		Vehicle acceleration due to thrust 8 3	
EATVPM		5	
EATVPN		5	
EAVP(3)		Vehicle acceleration expressed in platform coordinates 5	Ft/sec^2
EAVPP (3)		Acceleration of the vehicle just prior to launch 3	Ft/sec^2
EB(3,3)		Direction cosine matrix relating vehicle platform to vehicle body coordinates 5	Unitless
EBP(12)		Engine pitch gimbal angle 8 3	rad
EBPO		Engine pitch gimbal angle offset 8 3	rad
EBY(12)		Engine yaw gimbal angle 5	rad
EC 2		6	
EG(3)		Acceleration due to gravity 3	Ft/sec^2

TABLE A-1V SYMBOL DEFINITION FOR INITIA SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EGEFF		Effective gravity (8) (3)	Ft/sec^2
EGP(3)		Past value of EG(3) (3)	Ft/sec^2
EL(12,3)		Booster engine locations (8) (3)	Ft
ELATC		Geocentric latitude of vehicle (5)	deg
ELO(2,3)		Orbiter engine locations (8) (3)	Ft
ELONGD		Geodetic longitude of vehicle (5)	deg
EPA1		Sea level atmospheric pressure (8) (3)	Lb/Ft^2
EPB		Angular rate about body X axis (5)	rad/sec
EPBD		Angular acceleration about body x axis (5)	rad/sec^2
EPE(12)		Percent thrust due to engine out (6)	Unitless
EPHI		Outer gimbal angle (about X axis) (5)	radians
EPHID		EPHI rate (5)	rad/sec
EPSI		Middle gimbal angle (about Z axis) (5)	radians
EPSID		EPSI rate (5)	rad/sec
EPT		Fractional throttle setting (8) (3)	Unitless
EQB		Angular rate about body Y axis (5)	rad/sec
EQBD		Angular acceleration about body Y axis (5)	rad/sec^2
ERB		Angular rate about body Z axis (5)	rad/sec
ERBD		Angular acceleration about body Z axis	rad/sec^2
ERP(4)		Inertial vehicle position (8) (3)	Ft
ETHETA		Inner gimbal angle (about Y axis) (8) (3)	rad
ETHETD		ETHETA rate (5)	rad/sec
ETSLB		Booster sea level engine thrust (8) (3)	lbs
ETSLO1		Orbiter engine one sea level thrust (8) (3)	lbs
ETSLO2		Orbiter engine one sea level thrust (8) (3)	lbs
EVP(4)		Inertial vehicle velocity (8) (3)	Ft/sec
EVPP(3)		Past value EVP (8) (3)	Ft/sec
GCO(3)		Accleration limit. If KK = 2, limit is 2.5G (8) (3) If KK = 3, limit is 3G	Ft/sec^2
GC11		(6)	
GDT		Repetition rate of computing launch guidance (8) (3)	sec
GDTV		(6)	
GEGVEL		Engine exhaust gas velocity (8) (3)	ft/sec

TABLE A-IV SYMBOL DEFINITION FOR INITIA SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
GISO1		Guidance temporary variable 7 3	
GISO2		Guidance temporary variable 7 3	
GISO3		Guidance temporary variable 7 3	
GM(4)		Temporary variable used for GGEFF 5	
GMT(12)		Time parameter for pitch table look-up 1	sec
GPHID		Inertial roll angle desired 5	rad
GPSID		Inertial yaw angle desired 5	rad
GTA(12)		Pitch profile table 8 3	rad
GTAU		Parameter defined as ratio of GEGVEL/EATT 8 3	sec
GTDM		Abort pitchover pitch rate limit 2 4	deg/sec
GTHED		Inertial pitch angle desired 5	rad
GTHEV		Central angle traversed by the vehicle 7 3	rad
GTPPCO		Time for pitch profile cutoff 2 4	sec
GURP(4)		Unit radial position in platform coordinates 8 3	Unitless
GUYP(4)		Unit vecotr normal to GURP and GUZP 8 3	Unitless
GUZP(4)		Unit vector normal to SUQ and GURP 8 3	Unitless
GVGVEC(4)		Velocity to be gained in platform coordinates 7 3	Ft/sec
HB(10)		Table of geopotential altitude break points 8 3	Meters
HMAX		Maximum altitude for aero program 8 3	Feet
H1		Altitude 5	Feet
I		Integer count variable 1	Discrete
IABT		IABT = 1 after abort is begun 5	Discrete
IBO		6	
IES		A one indicates engines are on 8 3	Discrete
IGMT		6	
IPITCH		Pitch acceleration calculation flag 5	Discrete
IRESID		Residual rate calculation 5	
IROLL		Roll acceleration calculation flag 5	Discrete
ISEP		A one indicates vehicles are separated	Discrete
IYAW		Yaw acceleration calculation flag 5	Discrete
JUMP		5	
KACOTC		6	
KAUT		KAUT = 1 when ideal autopilot is used 2 4	Discrete

TABLE A-IV SYMBOL DEFINITION FOR INITIA SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
KGUID		Run terminate flag (5)	Discrete
KLPDR		KLPDR = 1 to abort to launch pad (2) (4)	Discrete
MANUAL		(6)	
MCH(20)		Table for Mach independent variable (8) (3)	Unitless
MXY(14)		Table of moments of inertia about body X-axis as a function of vehicle mass (8)	slug ft^2
MXZ(14)		Table of products of inertia in body XZ plane as a function of vehicle mass (8)	slug ft^2
MYY(14)		Table of moments of inertia about body Y-axis as a function of vehicle mass (8)	slug ft^2
MZZ(14)		Table of moments of inertia about body Z-axis as a function of vehicle mass (8)	slug ft^2
NOENGB		Number of booster engines (8)	
NOENGO		Number of orbiter engines (8)	
P		(5)	
PI		π radians or 180 degrees (8)	rad
RAD		RAD = 57.29578 (8)	deg/rad.
RADI		RADI = 1.745329×10^{-2} (8)	rad/deg.
SA	A	Semimajor axis of desired eliptical orbit (1)	Ft
SAP		Sine of angle between launch plane and earth sector plane containing intersection of orbit and launch planes (1)	
SAPØH	h_a	Apogee Altitude (4)	Ft
SBETA		SVEII expressed in radians (1) (4)	rad
SCF (3,3)		Transformation describing a rotation about the vehicle inertial or platform X-axis by an amount equal to the complement of the launch azimuth(SLAZ) (1)	
SCG (3,3)		Transformation describing a rotation about the line of nodes between earth fixed and vehicle inertial or platform coordinates by an amount equal to the launch pad latitude (SLAT) (1)	
SCGH (3, 3)		Matrix product [SCG] [SCH] (1)	
SCH (3, 3)		Transformation describing a rotation about earth fixed Z-axis coordinate by an amount equal to the launch pad longitude (SLØNG) (1)	
SCIL		Cosine of launch plane inclination angle (1)	

TABLE A-IV SYMBOL DEFINITION FOR INITIA SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
SCØG		Cosine of the arcsine of SAP (1)	
SDELI	Δi	Angle between desired orbit and launch planes (1)	
SE		Specify energy (1)	
SECCEN	ϵ	Orbit eccentricity (1)	
SERØT	W_e	Angular rotation velocity of the earth; SERØT = 7.292115 x 10^{-5} (2) (4) (5)	rad/sec
SETCGØ			
SGRAV		Acceleration due to gravity = 32.17404 (8) (4)	Ft/sec^2
SH	H	Specific angular momentum (1)	
SINC	A_L	Desired orbit inclination angle (1)	rad
SINCA		Orbit inclination angle achievable (4)	deg
SINCCØ		Negative of SINCA (1)	rad
SINC1		Orbit inclination angle (4)	degrees
SLAT	λL^*	Latitude of launch pad (2)	rad
SLAT1		Latitude of launch pad (4)	degrees
SLAZ	A_Z	Azimuth of launch plane (2)	rad
SLAZ1		Azimuth of launch plane (4)	degrees
SLØNG	θ_L	Longitude of launch pad (2)	rad
SLØNG1		Longitude of Launch pad (4)	degrees
SMU	μ	Gravitational constant; SMU = 14.07654 x 10^{15} (3) (4)	Ft^3/sec^2
SPAN		Aerodynamic wingspread normalizing coefficient	Unitless
SPERH	h_p	Perigee altitude (4)	Ft
SQ1		Complement of the launch azimuth (SLAZ) (1)	rad
SRA	R_A	Apogee radius (1)	Ft
SRD	R_D	Desired injection radius (3) (4)	Ft
SRDØTD	$\dot{R}_D$	Desired injection radial velocity (3) (4)	Ft/sec
SRLPP (3)		Vehicle position vector at time of launch (1) (3)	Ft
SRMEAN	r_a	Earth radius at launch pad; SRMEAN = 20, 909, 740 (3) (4)	Ft
SRMEEQ		Earth equatorial radius (3)	Ft
SRP	R_p	Perigee radius (1)	Ft
SS(3)	$\hat{S}$	(1)	

TABLE A-IV SYMBOL DEFINITION FOR INITI.. SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
SSALF		Sine of angle between orbit plane and earth sector containing intersection of orbit and launch plane [1]	
SSG		Direction cosine of angle between $\overline{SS}$ and $\overline{WU}$ [1]	
STHETA	θ_{PA}	Perigee phase angle from insertion [1]	rad
STI		[6]	
SUQ(4)	$\hat{U}_q$	Unit vector normal to the desired orbit plane in vehicle inertial or platform coordinates [3] [4]	
SVEII	β	Central angle between a vector through the launch pad and the intersection between orbit plane, launch plane, and earth's surface [4]	deg
SVLPP (3)		Vehicle velocity vector at time of launch in vehicle inertial or platform coordinates [3]	Ft/sec
SVP	V_p	Velocity at Perigee [1]	Ft/sec
SYD	Y_D	Desired injection cross-range distance [3] [4]	Ft
SYDØTD	$\dot{Y}_D$	Desired injection cross-range velocity [3] [4]	Ft/sec
SZDØTD	$\dot{Z}_D$	Desired injection downrange velocity [3] [4]	Ft/sec
T		Ground elapsed time [2]	sec
TAE	E	Angle of attack desired to be used for reentry after an abort [6]	rad
TF		Earth flattening constant [8] [3]	Unitless
TGOT		Time to go to reach abort target [5]	sec
THBO		Target altitude desired for abort guidance [2] [4]	Ft
THELIM		Abort pitch rate limit [2] [4]	deg/sec
TIP (3,3)		Provides for the transformation between an earth fixed inertial coordinate system and the vehicle inertial or platform coordinate system [3]	
TLAT		Latitude of desired landing site after an abort [1]	rad
TLAT1		Latitude of landing site [2] [4]	degrees
TLØNG		Longitude of desired landing site after an abort [1]	rad
TLØNG1		Longitude of landing site [2] [4]	degrees
TMB(24)		Table of values of molecular scale temperatures at base layers [8]	^{o}KELVIN
TPPCO		Time for flight on pitch profile during abort [3] [4]	seconds
TRIM		[5]	

TABLE A-IV SYMBOL DEFINITION FOR INI IA SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TRLSE(4)		Landing site position in rotating earth coordinates 3	Ft
TRLSP(4)		Landing site position in platform coordinates 5	Ft
TT(6)		Conversion matrix relating coast angle, reentry angle of attack, and burnout velocity 8 3	Unitless
TTD1		Time for open loop guidance during abort 2 4	seconds
TTL		5	
TVBO		Burnout velocity during abort targeting 2 4	
TVBON		Past value of TVBO 5	
TWEP(4)		Angular rate of earth rotation in platform coordinates 3	rad/sec
W	W_e	Angular rotation velocity of the earth (same as SERØT) 3	rad/sec
WEP(4)	$\overline{W}_{ep}$	Same as TWEP(4) 1	rad/sec
WT(14)		Independent variable for mass in table look-up 8	slugs
WU(3)	$\hat{W}_u$	WEP(4) expressed as a unit vector 3	
XCG(14)		Table look-up for X center of mass 8	Ft
XGB(14)		Table of values for acceleration due to gravity at the the base layers above 90 KM. 8	meters/sec^2
XREF(2)		X coordinate of aero C.P. reference 8	Ft
YCG(14)		Table look-up for Y center of mass 8	Ft
YREF(2)		Y coordinate of aero C.P. reference 7	Ft
ZB(14)		Table of values of geometric altitudes 8	meters
ZCG(14)		Table look-up for center of mass 8	Ft
ZREF(2)		Z coordinate of aero C.P. reference 7	Ft

DATA STATEMENT:
GTDM = 2

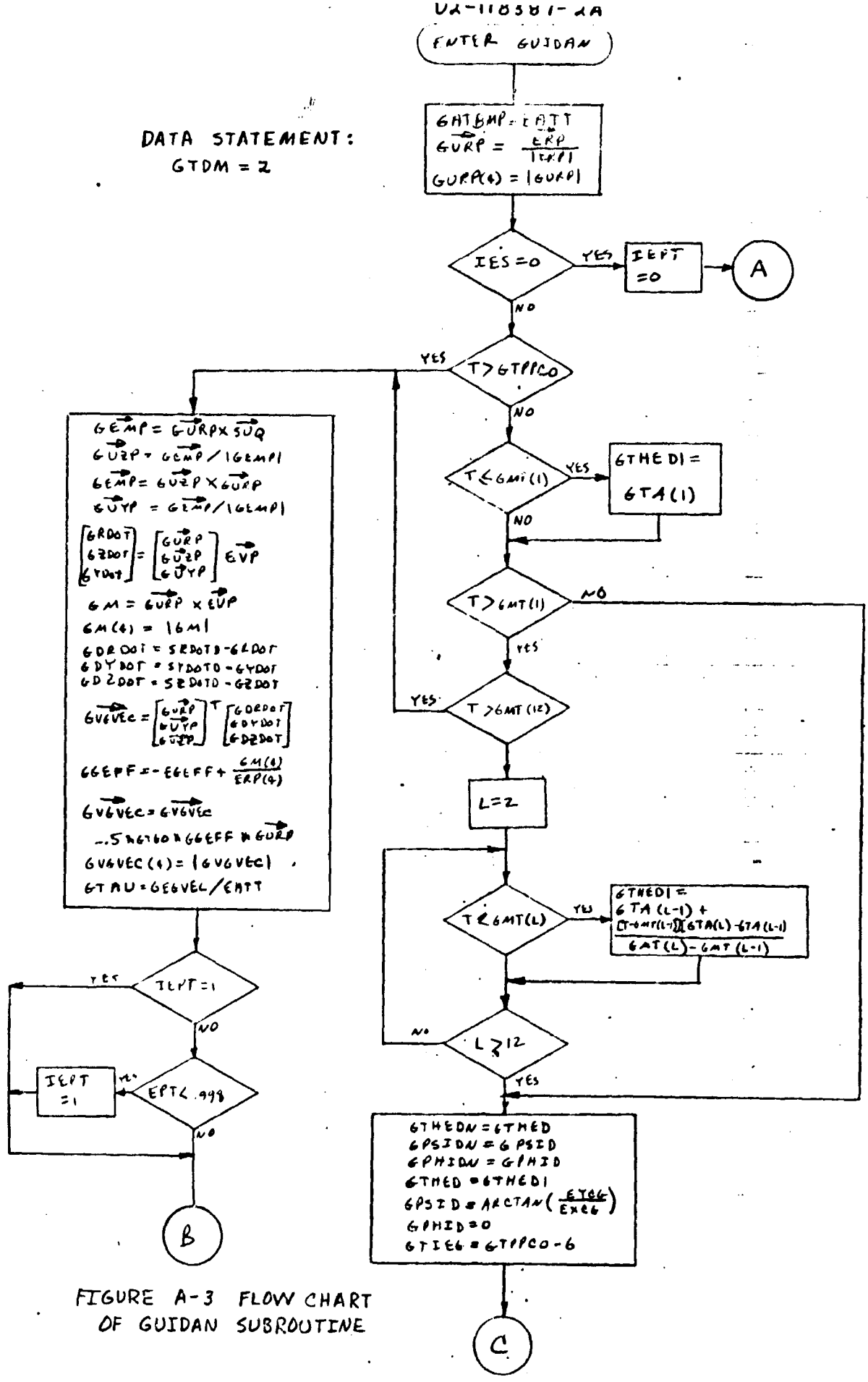


FIGURE A-3 FLOW CHART OF GUIDAN SUBROUTINE

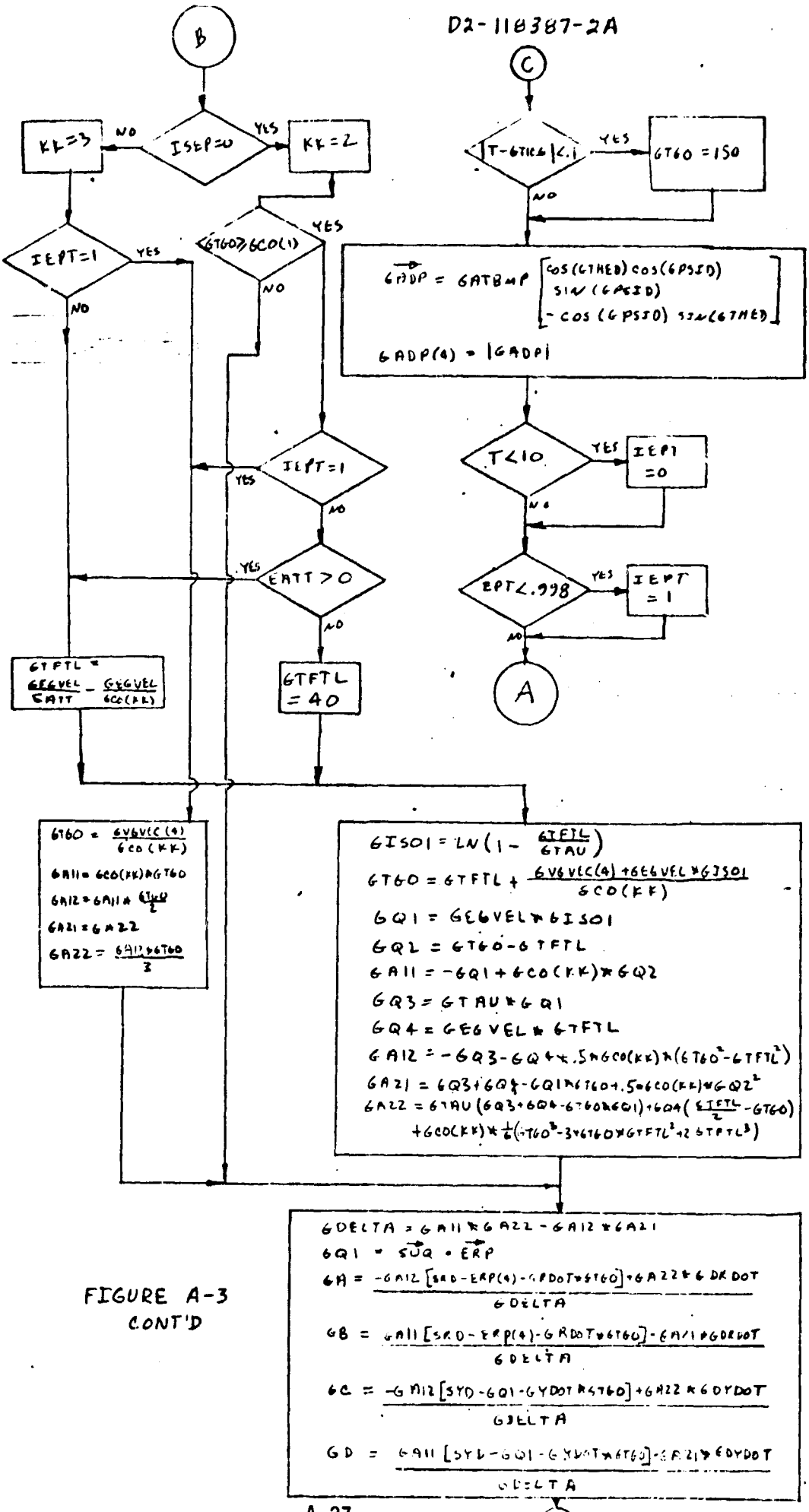


FIGURE A-3
CONT'D

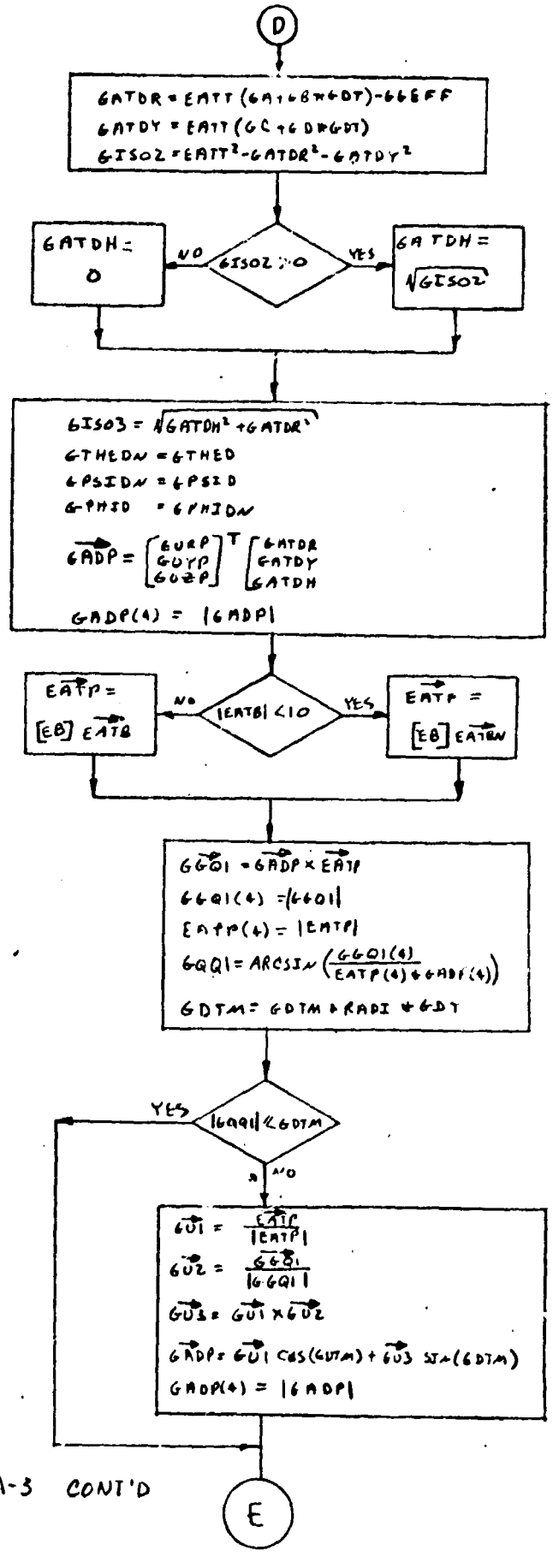


FIGURE A-3 CONT'D

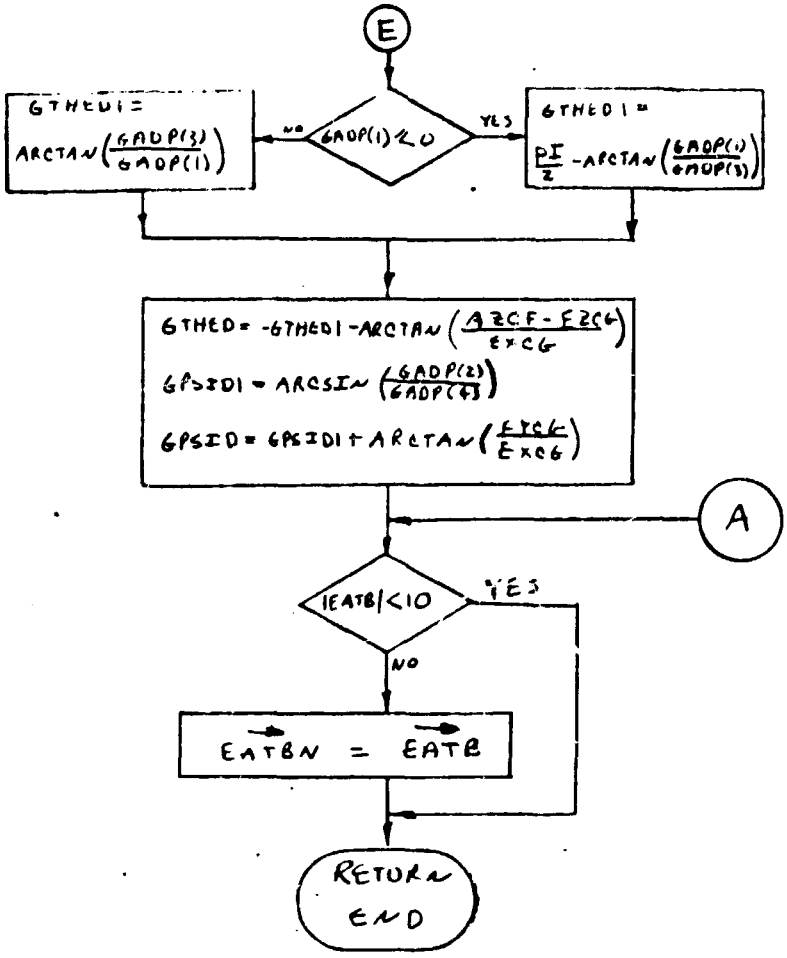


FIGURE A-3 CONT'D

TABLE A-V SYMBOL DEFINITION FOR GUINAN SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ABTT		Time selected for abort (2)	sec
AMTØT		Total remaining mass of the vehicle (same as AMT) (2)	slugs
ARCSPM		Pitch moment commanded by RCS model (5)	Ft-lbs
ARCSRM		Roll moment commanded by RCS model (5)	FT-lbs
ARCSYM		Yaw moment commanded as RCS model (5)	Ft-lbs
AZCF	Z_{CF}	Distance between body X-axis and the engine cluster center line along the body Z-axis (2)	Ft
EATB(4)		Acceleration due to thrust in body coordinates (2)	Ft/sec^2
EATBN(4)		Past value of EATB (1)	Ft/sec^2
EATP(4)		Acceleration due to thrust in platform coordinates (1)	Ft/sec^2
EATT	A_T	Total thrust acceleration (2)	Ft/sec^2
EB (3,3)		Direction cosine matrix relating vehicle platform to vehicle body coordinates (2)	
EBP (12)		(5)	
EBPØ		(5)	
EBY (12)		(5)	
EGEFF		Gravity acceleraiton as a function of distance from the earth's center directed towards that center (2)	Ft/sec^2
EL (12, 3)		(5)	
ELØ (2, 3)		(5)	
EPE (12)		(6)	
EPT		Fractional Throttle setting (2)	
ERP(4)	R_P	Present vehicle position vector expressed in vehicle inertial or platform coordinates (2)	Ft
ETSLB (12)		(5)	
ETSLØ1		(5)	
ETSLØ2		(5)	
EVP(4)	V_P	Present vehicle velocity vector expressed in vehicle inertia' or platform coordinates (2)	Ft/sec
EXCG (AMTØT)	X_{CG}	Center of gravity displacement along the body X-axis as a function of present vehicle mass (2)	Ft

TABLE A-V SYMBOL DEFINITION FOR GUINAN SUBROUTINE (Continued)

CODED SYM.	ENGR SYM.	SYMBOL DEFINITION OR USE	UNITS
EYCG (AMTØT)	Y_{CG}	Center of gravity displacement along the body Y-axis as a function of present vehicle mass [2]	Ft
EZCG (AMTØT)	Z_{CG}	Center of gravity displacement along the body Z-axis as a function of present vehicle mass [2]	Ft
GA	A	Linear coefficient for radial constraint [1]	
GADP (4)	A_{DP}	Desired vehicle acceleration vector expressed in vehicle inertial or platform coordinates [1]	Ft/sec^2
GATBMP	A_T	Total thrust acceleration (Same as EATT) [1]	Ft/sec^2
GATDH	A_H	Magnitude of thrust acceleration desired in downrange direction and indesired orbit plane [1]	Ft/sec^2
GATDR	A_R	Magnitude of thrust acceleration desired in the radial direction [1]	Ft/sec^2
GATDY	A_Y	Magnitude of thrust acceleration desired normal to the desired orbit plane [1]	Ft/sec^2
GA11	A_{11}	Guidance constraint integral [1]	
GA12	A_{12}	Guidance constraint integral [1]	
GA21	A_{21}	Guidance constraint integral [1]	
GA22	A_{22}	Guidance constraint integral [1]	
GB	B	Linear coefficient for radial constraint [1]	
GC	C	Linear coefficient for transverse constraint [1]	
GCØ(KK)	A_{LB}	Acceleration limit. If KK = 2, limit is set at 2.5 gees (80,366375). If KK = 3, limit is set at 3 gees (96,43965) [2]	Ft/sec^2
GCØ(1)		Limiting value set for time-to-go. If GTGØ is less than GCØ(1) the guidance constraint integrals are not recomputed. (GCØ(1) = 8) [2]	sec
GD	D	Linear coefficient for transverse constraing [1]	
GDELTA	Δ	Determinant of coefficients for linear constraint integral equations [1]	
GDRDOT	$\dot{R}_G$	Desired R to be gained [1]	Ft/sec
GDT	t	Repetition rate of computing launch guidance [2]	sec
GDTM		Abort pitchover pitch angular travel [2]	rad
GDTV		[6]	
GDYDØT	$\dot{Y}_G$	Desired $\dot{Y}$ to be gained [1]	Ft/sec

TABLE A-V (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
GDZDØT	$\dot{Z}_G$	Desired $\dot{Z}$ to be gained [1]	ft/sec
GEGVEL	V_e	Engine exhaust gas velocity (orbiter, GEGVEL = 14,514; booster, GEGVEL = 14,058) [2]	ft/sec.
GEMP(4)		Temporary vector used in computing guidance unit vectors [1]	
GGEFF	g_{eff}	Effective gravity acting on the vehicle [1]	ft/sec^2
GGQ1(4		Guidance scratch vector [1]	
GISØ1		Temporary variable used in guidance equation solutions [1]	
GISØ2		Temporary variable used in guidance equation solutions [1]	
GISØ3		Temporary variable used in guidance equation solutions [1]	
GM(4)		Temporary variable used in computing GGEFF [1]	
GMT(12)		Time parameter used in selecting values of pitch angle from pitch profile table [2]	sec.
GPHID	ϕ_D	Inertial roll angle desired [3]	rad.
GPHIDN		Past value of GPHID [1]	rad.
GPSID	ψ_D	Inertial yaw angle (angle between body X-axis and vehicle inertial or platform XZ plane) [3]	rad.
GPSIDN		Past value of GPSID [1]	rad.
GPSID1	ψ_{D1}	Angle between desired thrust acceleration vector and vehicle inertial or platform XZ plane [1]	rad.
GQQ1		Angle between thrust vector and desired acceleration vector [1]	rad.
GQ1		Temporary variable used in solution of guidance integrals [1]	

TABLE A-V (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
GQ2		Temporary variable used in solution of guidance integrals [1]	
GQ3		Temporary variable used in solution of guidance integrals [1]	
GQ4		Temporary variable used in solution of guidance integrals [1]	
GRDØT	$\dot{R}$	Present value of vehicle radial velocity [1]	ft/sec
GTA(12)	τ	Pitch angle taken from pitch profile tables [2]	rad.
GTAU		Parameter defined as the ratio of GEGVEL to EATT [1]	sec.
GTFTL	T_{FL}	Estimate of time remaining until vehicle thrust is limited to remain within thrust acceleration limits [1]	sec.
GTDM		Abort pitchover pitch rate limit [2]	deg/sec
GTGØ	T_{GO}	An estimate, based on present parameters, of time to reach orbit insertion [1]	sec.
GTHED	θ_D	Inertial pitch angle desired (angle between body X-axis and vehicle inertial or platform X-axis) [3]	rad.
GTHEDN		Past value of GTHED [1]	rad.
GTHED1	θ_{D1}	Angle between desired thrust acceleration vector and vehicle inertial or platform X-axis [1]	rad.
GTHEV		Central angle traversed by the vehicle [1]	rad.
GTIEG		Time used in branching to assure an initial value of GTGØ has been selected [1]	sec.
GTPPCØ		Time at which pitch angle selections from the pitch profile table are terminated (time for pitch profile cut off) [2]	sec.

TABLE A-V (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
GURP(4)	$\hat{U}_{RP}$	Unit vector of radial direction in vehicle inertial or platform coordinates [1]	
GUYP(4)	$\hat{U}_{YP}$	Unit vector normal to plane containing $\overline{GURP}$ and $\overline{GUZP}$ [1]	
GUZP(4)	$\hat{U}_{ZP}$	Unit vector normal to plane containing $\overline{GURP}$ and $\overline{SUQ}$ (unit vector normal to desired orbit plane) [1]	
GU1		Thrust unit vector in platform coordinates [1]	unitless
GU2		Unit vector perpendicular to intersection of thrust and desired acceleration vectors in platform coordinates [1]	unitless
GU3		GU3 = GU1 X GU2 [1]	unitless
GVGVEC (4)	V_G	Velocity to be gained vector expressed in vehicle inertial or platform coordinates [1]	ft/sec
GYDØT	$\dot{Y}$	Present value of vehicle $\dot{Y}$ [1]	ft/sec
GZDØT	$\dot{Z}$	Present value of vehicle $\dot{Z}$ [1]	ft/sec
IABT		[5]	
IBØ		[6]	
IEPT		A one indicates thrust is being limited [1]	discrete
IES		A one indicates engines are burning [2]	discrete
IGMT		[6]	
ISEP		A one indicates vehicles are separated [2]	discrete
JUMP		[5]	
K		Counter [1]	discrete
KGUID		Run Terminate Flag [2]	discrete
KK		Argument used in GCØ(KK) [1]	
L		Internal counter [1]	

TABLE A-V - (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
PI		Constant π radians (2)	
RAD		(5)	
RADI		(5)	
SERØT		(5)	
SGRAV		(5)	
SMU		(5)	
SRD	R_D	Targeted radial distance at orbit insertion (2)	ft
SRDØTD	$\dot{R}_D$	$\dot{R}$ desired at orbit insertion (2)	ft/sec
SRMEAN		(5)	
SUQ(4)	$\hat{U}_q$	Unit vector normal to desired orbit plane (2)	
SYD	Y_D	Targeted out of plane distance at orbit insertion (2)	ft
SYDØTD	$\dot{Y}_D$	$\dot{Y}$ desired at orbit insertion (2)	ft/sec
SZDØTD	$\dot{Z}_D$	$\dot{Z}$ desired at orbit insertion (2)	ft/sec
T		Ground elapsed time (2)	sec
TAG(4)		Desired vehicle acceleration in guidance coordinates (5)	ft/sec^2
TDVG(4)		Desired velocity vector to be gained in guidance coordinates (5)	ft/sec
TGOT		Time-to-go to reach abort target (5)	sec
TTL		Estimate of time to thrust limiting (5)	sec
TVG(4)		Present vehicle velocity in guidance coordinate (5)	ft/sec

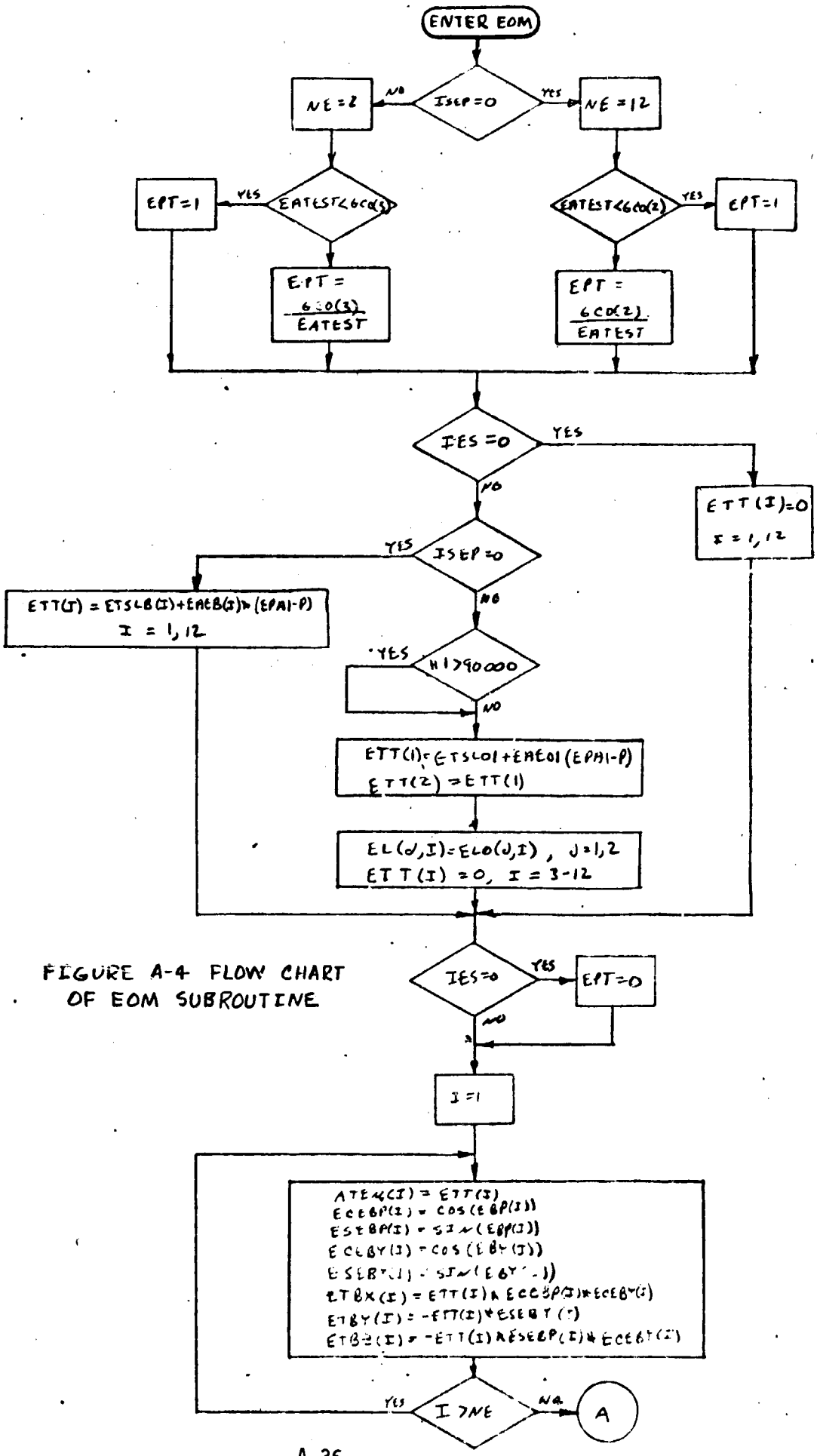


FIGURE A-4 FLOW CHART OF EOM SUBROUTINE

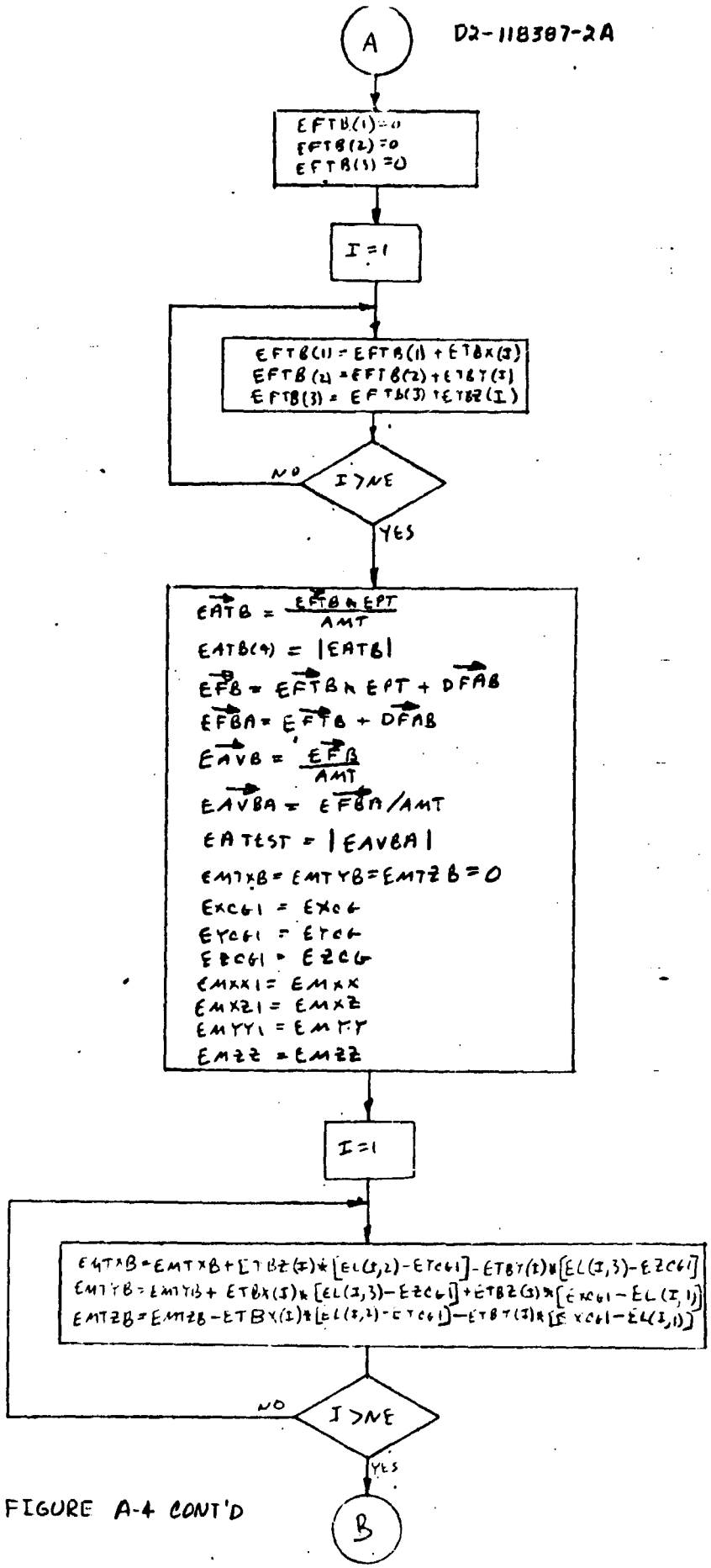


FIGURE A-4 CONT'D

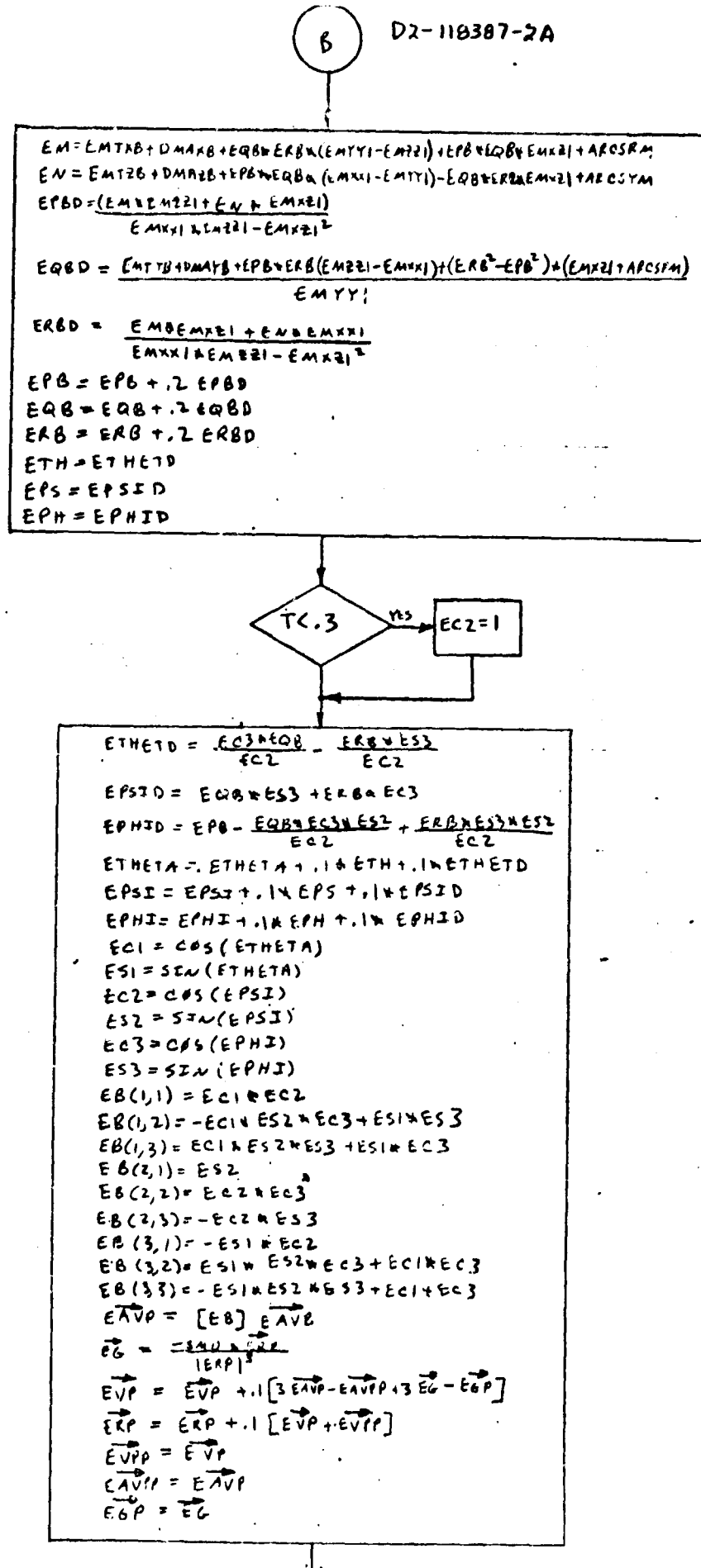


FIGURE A-4 CONT'D

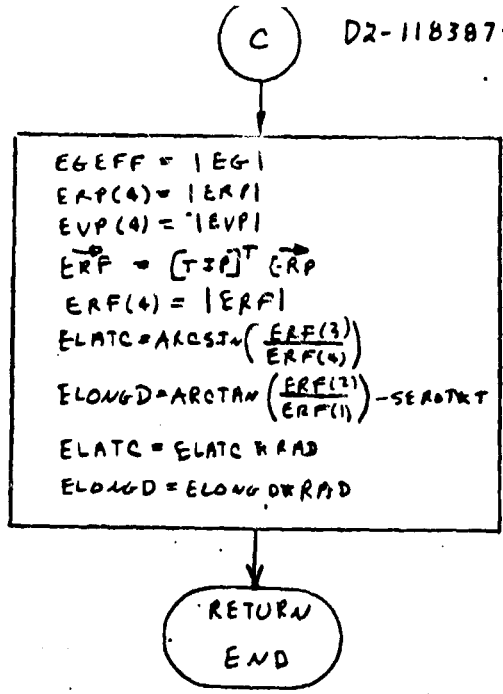


FIGURE A-4 CONT'D

TABLE A-VI SYMBOL DEFINITIONS FOR EOM SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ABTT		Time slected for abort [2]	seconds
ADMASS (12)		[5]	
ADMTØT		[5]	
AMASCØ		[5]	
AMDØTV		[5]	
AMT	M_T	Total remaining mass of vehicle [2] (Same as AMTØT)	slugs
ARCSPM		Pitch commanded by RCS model [2]	ft-lbs
ARCSRM		Roll commanded by RCS model [2]	ft-lbs
ARCSYM		Yaw commanded by RCS model [2]	ft-lbs
ATENG(12)	T_T	Engine thrust magnitude [3]	lbs
ATOTHR		Total engine thrust during present minor cicle [5]	lbs
AUGRAV	A_g	Acceleration due to gravity at sea level; AUGRAV = 32.17404 [2]	ft/sec^2
AZCF		[5]	
DFAB(4)	F_{AB}	Forces due to aerodynamics expressed in body coordinates [2]	lbs
DMAXB	M_{AXB}	Aerodynamic moment about body X-axis [2]	ft-lb
DMAYB	M_{AYB}	Aerodynamic moment about body Y-axis [2]	ft-lb
DMAZB	M_{AZB}	Aerodynamic moment about body Z-axis [2]	ft-lb
EAEB (12)	A_{EB}	Booster engine nozzle area [2]	ft^2
EAEØ1	A_{EO}	Orbiter engine nozzle area [2]	ft^2
EAEØ2	A_{EO}	Orbiter engine extended nozzle area [2]	ft^2
EATB(4)	A_T	Booster engine acceleration due to thrust [1]	ft/sec^2

TABLE A-VI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EATEST		Total vehicle acceleration achievable if there were no thrust limiting (1)	Gees
EATT	A_T	Same as |EATB| (3)	ft/sec^2
EAVB(4)	A_B	Vehicle acceleration vector expressed body coordinates (1)	ft/sec^2
EAVBA(4)	A_{BA}	Same as DAVB except EAVBA is the result without thrust limiting (1)	ft/sec^2
EAVP (4)	A_{VP}	Vehicle acceleration expressed vehicle inertial or platform coordinates (1)	ft/sec^2
EAVPP(3)		Previous value of EAVP (3)	ft/sec^2
EB (3, 3)	$\beta_{(3,3)}$	Direction cosine matrix relating vehicle inertial or platform to vehicle body cooridnates (1)	
EBP(12)	β_p	Engine pitch gimbal angles (2)	rad.
EBPØ	β_{PO}	Engine pitch gimbal angle offset (2)	rad.
EBY(12)	β_y	Engine yaw gimbal angles (2)	rad.
ECEBP		Cosine of engine pitch gimbal angle (1)	unitless
ECEBY		Cosine of engine yaw gimbal angle (1)	unitless
EC1		Cosine of euler pitch angle (1)	unitless
EC2		Cosine of euler yaw angle (1)	unitless
EC3		Cosine of euler roll angle (1)	unitless
EFB(4)	F_B	Total body forces acting on vehicle in body coordinates (1)	lbs
EFBA(4)	F_{BA}	Same as EFB except EFBA is the result without thrust limiting (1)	lbs

TABLE A-VI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EFTB (4)	F_{TB}	Forces acting on vehicle due to thrust in body coordinates [1]	lbs
EG(3)		Acceleration due gravity [1] [3]	ft/sec^2
EGEFF		Magnitude of EG [3] [1]	ft/sec^2
EGF(3)		Past value of EG [3]	ft/sec^2
EL(12,3)	L(I,J)	Booster engine locations [2]	ft
ELATC	λ_v	Geocentric latitude of vehicle [3]	deg.
ELØ(2,3)	L(I,J)	Orbiter engine locations [2]	ft.
ELØNGD	ϕ_v	Godetic longitude of vehicle [3]	deg.
EM	M	Temporary variable used in moment equations [1]	
EMTXB	M_{TXB}	Moment due to thrust about body X axis [1]	ft-lb
EMTYB	M_{TYB}	Moment due to thrust about body Y axis [1]	ft-lb
EMTZB	M_{TZB}	Moment due to thrust about body Z axis [1]	ft-lb
EMXX (AMT)	I_{XX}	Moment of inertia about body X-axis [2]	slug ft^2
EMXX1		Moment of inertia about body X-axis [1]	slug ft^2
EMXZ (AMT)	I_{XZ}	Moment of inertia about body XZ-plane [2]	slug ft^2
EMXZ1		Moment of inertia about body XZ-plane [1]	slug ft^2
EMYY (AMT)	I_{YY}	Moment of inertia about body Y-axis [2]	slug ft^2
EMYY1		Moment of inertia about body Y-axis [1]	slug ft^2

TABLE A-VI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EMZZ (AMT)	I_{ZZ}	Moment of inertia about body Z-axis [2]	slug ft^2
EMZZ1		Moment of inertia about body Z-axis [1]	slug ft^2
EN	N	Temporary variable used in moment equations [1]	
EPAI	P_{SL}	Sea level atmospheric pressure [2]	lb/ft^2
EPB	P_b or $\dot{\phi}_B$	Angular rate about body X-axis [1] [3]	rad/sec
EPBD	$\dot{P}_b$	Angular acceleration about X-axis [1] [3]	rad/sec^2
EPE(12)		[6]	
EPH		Past value of EPHID [1]	rad
EPHI	ϕ or ϕ_E	Rotation about X body axis [3]	rad.
EPHID	$\dot{\phi}$	Rotation rate about body X-axis [3]	rad/sec.
EPS		Past value of EPSID [1]	rad.
EPSI	ψ or ψ_E	Rotation about Z line of nodes [3]	rad.
EPSID	$\dot{\psi}$	Rotation rate about Z line of nodes [3]	rad/sec
EPT		Fractional throttle setting [3]	
EQB	Q_b or $\dot{\theta}_B$	Angular rate about body Y axis [1] [3]	rad/sec
EQBD	$\dot{Q}_b$	Angular acceleration about body Y axis [1] [3]	rad/sec^2
ERB	R_b or $\dot{\psi}_B$	Angular rate about body Z-axis [1] [3]	rad/sec
ERBD	$\dot{R}_B$	Angular acceleration about body Z-axis [1] [3]	rad/sec^2
ERF(4)		Position in earth-equatorial coordinate [1]	ft

C2

TABLE A-VI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ERP(4)	R_P	Present position of the vehicle in vehicle inertial or platform coordinates (3)	ft
ESEBP		Sine of engine pitch gimbal angle (1)	unitless
ESEBY		Sine of engine yaw gimbal angle (1)	unitless
ES1		Sine of euler pitch angle (1)	unitless
ES2		Sine of euler yaw angle (1)	unitless
ES3		Sine of euler roll angle (1)	unitless
ETBX(12)	T_{BX}	Thrust components in body X direction (1)	lbs
ETBY(12)	T_{BY}	Thrust components in body Y direction (1)	lbs
ETBZ(12)	T_{BZ}	Thrust components in body Z direction (1)	lbs
ETH		Past value of ETHETD (1)	rad
ETHETA	θ or θ_E	Rotation about vehicle inertial or platform Y-axis (3)	rad
ETHETD	$\dot{\theta}$	ETHETA rate (3)	rad/sec
ETSLB(12)	T_{SLB}	Booster engine thrust at sea level (2)	lbs
ETSLØ1	T_{SLO}	Orbiter engine one thrust at sea level (2)	lbs
ETSLØ2	T_{SLO}	Orbiter engine two thrust at sea level (2)	lbs
ETT(12)	T_T	Engine thrust magnitude (1)	lbs

TABLE A-VI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EVP(4)	V_p	Vehicle velocity expressed in vehicle inertial or platform coordinates (3)	ft/sec
EVPP(3)		Past value of EVP (3)	ft/sec
EXCG (AMT)	X_{CG}	Body X-axis center of gravity position (2)	ft
EXCG1		Body X-axis center of gravity position (1)	ft
ETCG		Body Y-axis center of gravity position (2)	ft
EYCG1		Body Y-axis center of gravity position (1)	ft
EZCG (AMT)	Z_{CG}	Body Z-axis center of gravity position (2)	ft
EZCG1		Body Z-axis center of gravity position (1)	ft
GCO(3)		Branching discrete and acceleration limits (2)	rad
GDT		Independent argument of GCO (5)	sec
GDTV		(6)	
GEGVEL		(5)	
HI		Altitude (5)	ft
I		Integer counter variable (1)	
IABT		IABT = 1 after abort is begun (5)	discrete
IBØ		(6)	
IES		A one indicates engines are on (2)	
IGMT		(6)	
ISEP		A one indicates vehicles are separated (2)	
JUMP		(5)	
KGUID		Run terminate flag (5)	discrete
KLPDR		Selection of orbiter abort downrange or return (2)	
NE		Number of engines in vehicle configuration (1) (2)	
P	P_a	Ambient atmospheric pressure (2)	lb/ft^2
PI		Constant π radians (2)	
RAD		Constant (2)	deg/rad
RADI		Constant (2)	rad/deg
SERØT		Angular rotation rate of the earth (2)	rad/sec

TABLE A-VI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
SGRAV		Acceleration due to gravity (2)	ft/sec^2
SLAT1		Latitude of Launch pad (5)	degrees
SLONG1		Longitude of launch pad (5)	degrees
SMU		Universal gravitation constant (2)	ft^3/sec^2
SRD		Desired radial position for orbit insertion (5)	ft
SRMEAN	R_a	Distance from earth's center to launch pad (2)	ft
SUQ(4)		Unit vector normal to orbit plane (5)	unitless
SYD		Desired lateral position for orbit insertion (5)	
T		Ground elapsed time (2)	
TAE		(6)	
TF		Earth oblateness factor (2)	
TGØT		Estimate of time to go to reach abort target (5)	sec
THBØ		(5)	
TIP(3,3)		Matrix relating earth inertial with vehicle inertial or platform coordinates (2)	
TLAT		(5)	
TLAT1		Latitude of landing site (5)	degrees
TLØNG		(5)	
TLONG1		Latitude of landing site (5)	degrees
TT(6)		(5)	
TTL		Time to thrust limit (5)	sec
TVBØN		(5)	

TABLE A-VI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TWEP(3)		(5)	
WEP(4)		(5)	

DATA STATEMENT:
CONF1 = 57.29578
CONF2 = .3048
ZETA = .7

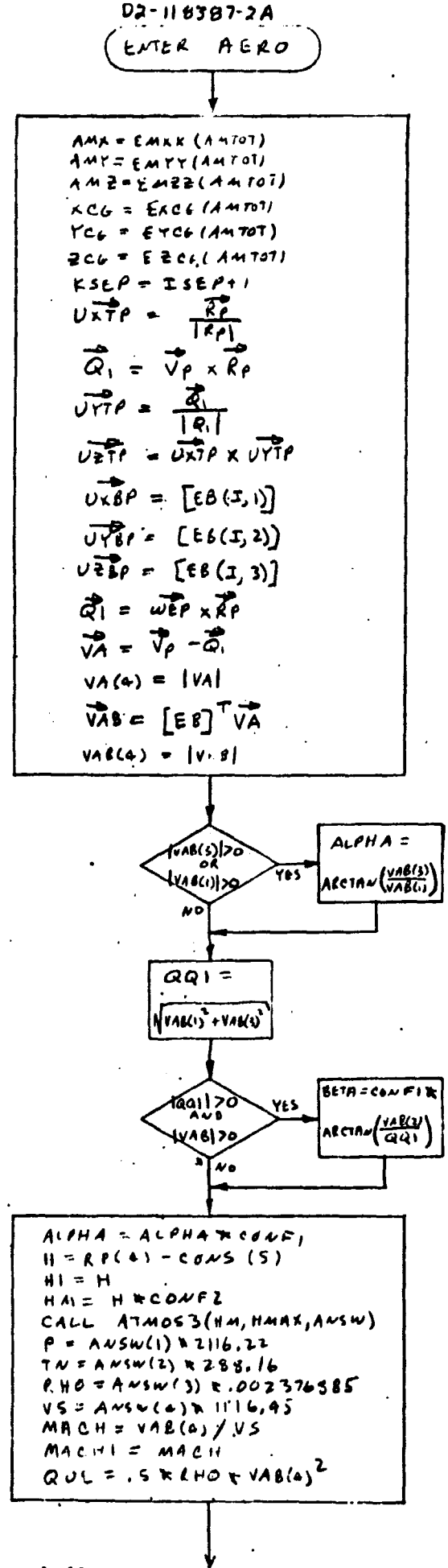


FIGURE A-5 FLOW CHART OF AERO SUBROUTINE

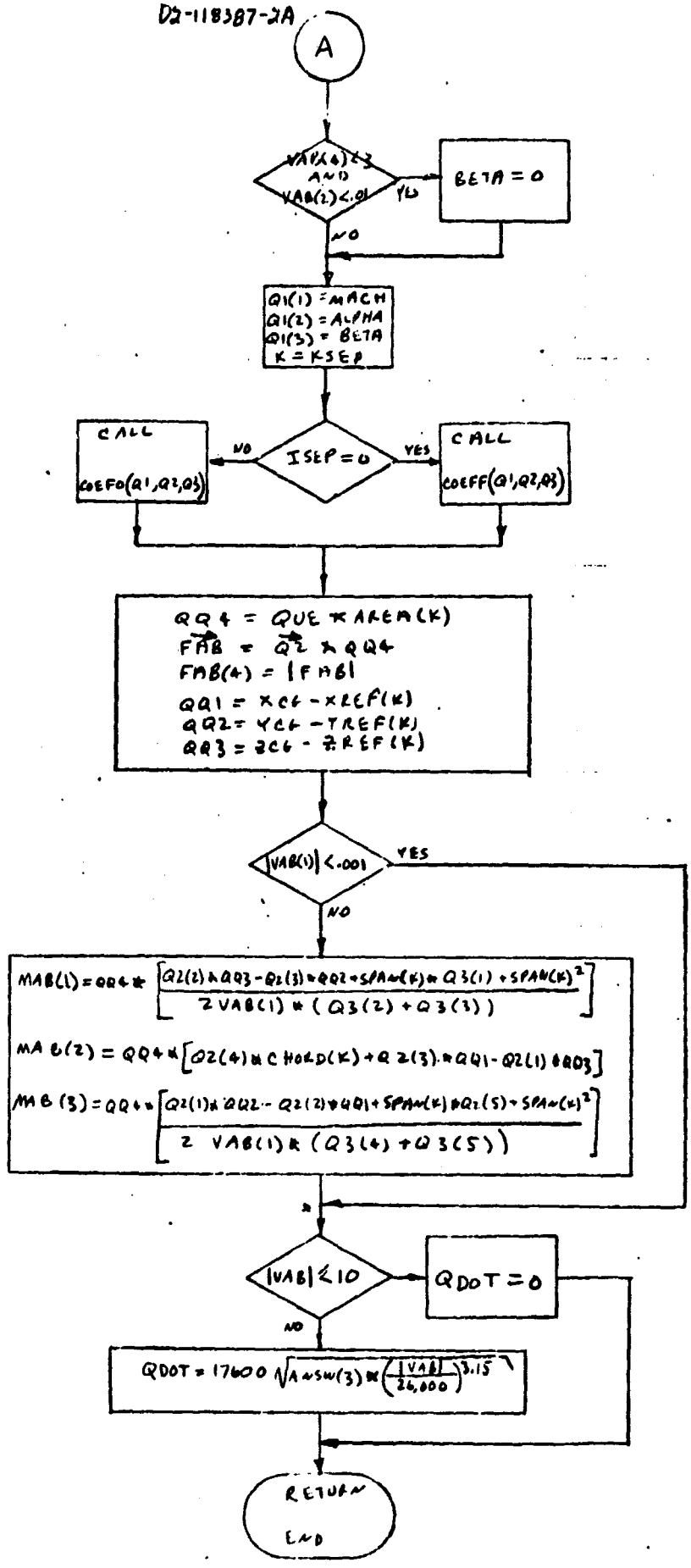


FIGURE A-5 CONT'D

TABLE A-VII - SYMBOL DEFINITIONS FOR AERO SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ADMASS(12)		(5)	
ADMTOT		(5)	
ALPHA	α	Angle of Attack (3)	degrees
AMASCO		(5)	
AMDOTV		(5)	
AMTOT	M_{TOT}	Total mass remaining (2)	slugs
AMX		Moment of inertia about X-axis (1)	slug ft^2
AMY		Moment of inertia about Y-axis (1)	slug ft^2
AMZ		Moment of inertia about Z-axis (1)	slug ft^2
ANSW(8)	$AN_{(I)}$	Input parameter scale factors (2)	unitless
ARCSPM		Pitch moment commanded by RCS model (5)	ft lbs
ARCSRM		Roll moment commanded by RCS model (5)	ft lbs
ARCSYM		Yaw moment commanded by RCS model (5)	ft lbs
AREA(2)	S	Aerodynamic surface area (1)	ft^2
ATENG(12)		(5)	
ATOTHR		Total engine thrust during present minor cycle (5)	lbs
AUGRAV		(5)	
AZCF		(5)	
BETA	β	Sideslip angle (3)	degrees
C(2)		(6)	
CHORD(2)	$\bar{c}$	Aerodynamic chord (1)	ft
CMA	C_{ma}	(5)	

TABLE A-VII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
CNB	C_{nb}	[5]	
CONF1	F_1	Deg-rad conversion constant; 57.29578 [1]	deg/rad
CONF2	F_2	Feet-meters conversion constant; .3048	meters/ft
CONS(7)	$K_{(I)}$	Constants [2]	varied
CYB		[5]	
CZA		[5]	
EATT		Vehicle acceleration due to thrust [5]	ft/sec^2
EB(3,3)		Direction cosine matrix relating vehicle platform to vehicle body coordinates [5]	
EBP(12)		[5]	
EBPO		Pitch gimbal offset angle	radians
EBY(12)		[5]	
EGEFF		[5]	
EL(12,3)		[5]	
ELO(2,3)		[5]	
EMXX		Table lookup for X moment of inertia [2]	slug ft^2
EMYY		Table lookup for Y moment of inertia [2]	slug ft^2
EMZZ		Table lookup for Z moment of inertia [2]	slug ft^2
EPE(12)		[6]	
ETHETD		[5]	
ETSLB(12)		Sea level booster thrust [5]	lbs
ETSLO1		Orbiter engine one sea level thrust [5]	lbs
ETSLO2		Orbiter engine two sea level thrust [5]	lbs
EXCG	X_{cg}	X-body c.g. location [2]	ft
EYCG	Y_{cg}	Y-body c.g. location [2]	ft
EZCG	Z_{cg}	Z-body c.g. location [2]	ft

TABLE A-VII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
FAB(4)	$F_{AB(I)}$	Aerodynamic body forces (1) (3)	lb
GDTV		(5)	
GEGVEL		(5)	
H	h	Altitude (2)	feet
HM	h_m	Altitude (1) (3)	meters
HMAX	h_{MAX}	Maximum altitude for ATMOS3 (3)	meters
HI		Altitude (3)	ft
I	I	Parameter subscript (1)	
IBO		(5)	
IES		(5)	
IGMT		(5)	
ISEP	I_{sep}	Separation discrete (2)	discrete
K	K	Separation subscript (1) (3)	unitless
KP	KP	(6)	
KSEP	K_{sep}	Separation subscript (1)	unitless
MAB(4)	$M_{AB(I)}$	Aerodynamic moments (3)	ft-lb
MACH	M	Mach number (1) (3)	unitless
MACH1		Mach number (3)	unitless
P	P	Atmospheric pressure (1) (3)	lb/ft^2
Pitch	θ	Inertial pitch angle (2)	rad
QDOT	$\dot{Q}$	(6)	
QQ1		Erasable scratch-pad (1)	
QQ2		Erasable scratch-pad (1)	
QQ3		Erasable scratch-pad (1)	

TABLE A-VII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
QQ4		Erasable scratch-pad [1]	
QUE	q	Dyanmic pressure [1]	lb/ft^2
Q1(3)	M, α, β	Erasable scratch pad [1] [3]	
Q2(3)	C_{xo}, C_{yo}, C_{zo}	Aerodynamic force coefficients [1] [2]	lbs
Q3(3)	C_{mo}, C_{no}	Aerodynamic moment coefficients [1] [2]	ft/lbs
RHO	p	Density of air [1]	$slugs/ft^3$
ROLL	ϕ	Inertial roll angle [2]	rad
RP(4)	$\bar{R}_p$	Platform radius vector [2]	ft
SPAN(2)	b	Aerodynamic wingspread normalizing coefficient [1]	ft
TN	T_n	Molecular temperature of air [1]	^oK
TTL		Time to thrust limit [5]	seconds
UXBP(3)	$\hat{U}_{XBP(I)}$	Direction cosines for transformation to body angle [1]	unitless
UXTP(3)	$\hat{U}_{XTP}$	Unit vector along $\bar{R}_p$ [1] [3]	unitless
UYBP(3)	$\hat{U}_{YBP(I)}$	Direction cosines for transformation to body angles [1]	unitless
UYTP(3)	$\hat{U}_{YTP}$	Unit vector along ($\bar{V}_p$ X $\bar{R}_p$) [1] [3]	unitless
UZBP(3)	$\hat{U}_{ZBP(I)}$	Direction cosines for transformation to body angles [1]	
UZTP(3)	$\hat{U}_{ZTP}$	Unit vector ($\hat{U}_{XTP}$ X $\hat{U}_{YTP}$) [1] [3]	
VA(4)	$\bar{V}_A$	Inertial velocity vector relative to the earth [3]	ft/sec
VAB(4)	$\bar{V}_{AB}$	Body velocity relative to air [1]	ft/sec

TABLE A-VII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
VP (4)	$\overline{V}_p$	Inertial platform velocity [2]	ft/sec
VS	V_S	Speed of sound [1]	ft/sec
WEP (4)	$\overline{W}_{ep}$	Earth's rotation vector [2]	ft/sec
XCG	X_{CG}	X-body location of c.g. [2]	ft
XREF (2)	X_{REF}	X-coordinate of aerodynamic c.g. ref. [2]	ft
YAW	ψ	Inertial yaw angle [2]	rad
YCG	Y_{CG}	Y-body location of c.g. [2]	ft
YREF (2)	Y_{REF}	Y-coordinate of aerodynamic c.g. ref. [2]	ft
ZCG	Z_{CG}	Z-body location of c.g. [2]	ft
ZETA		[5]	
ZREF (2)	Z_{REF}	Z-coordinate of aerodynamic c.g. ref [2]	ft

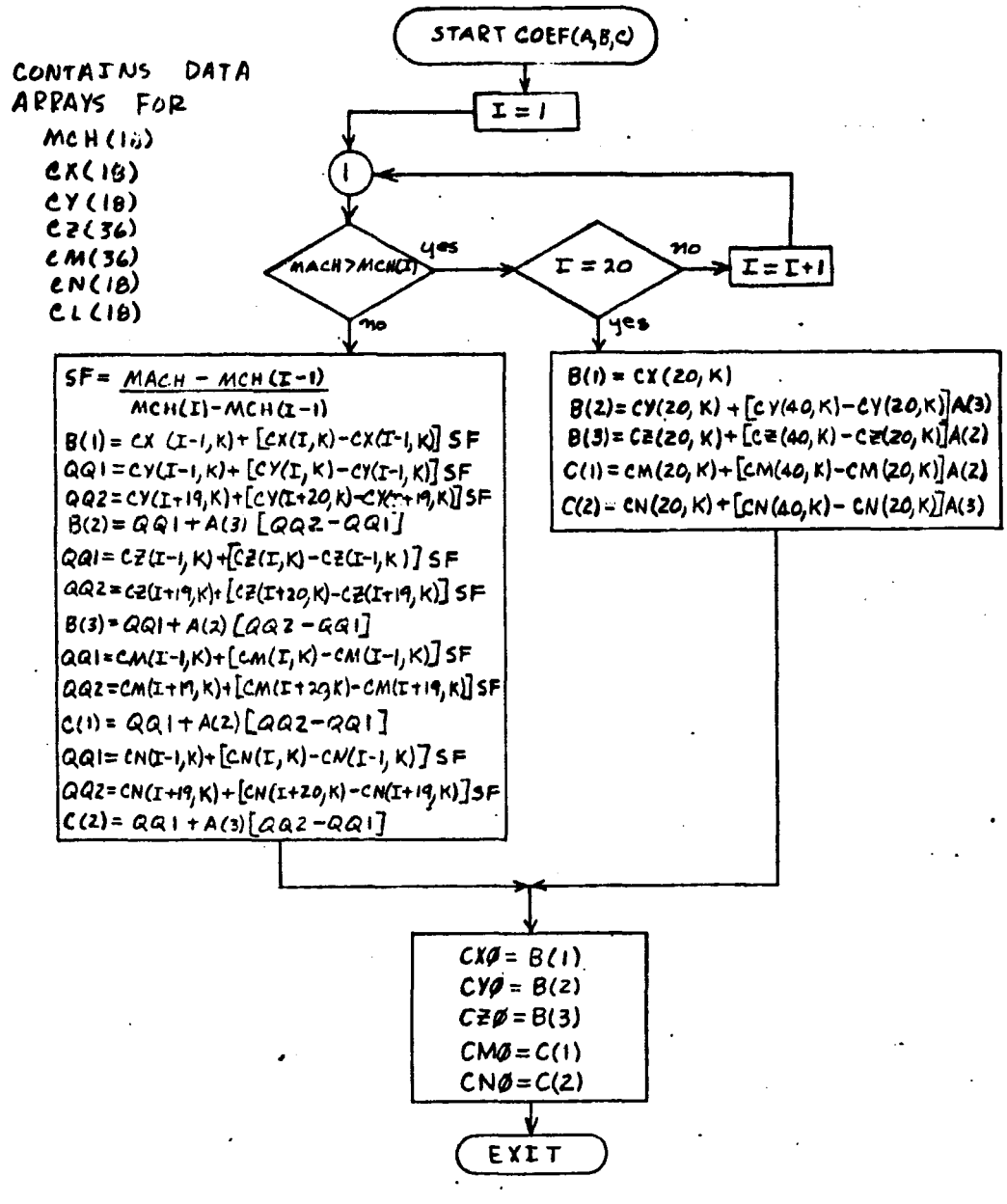


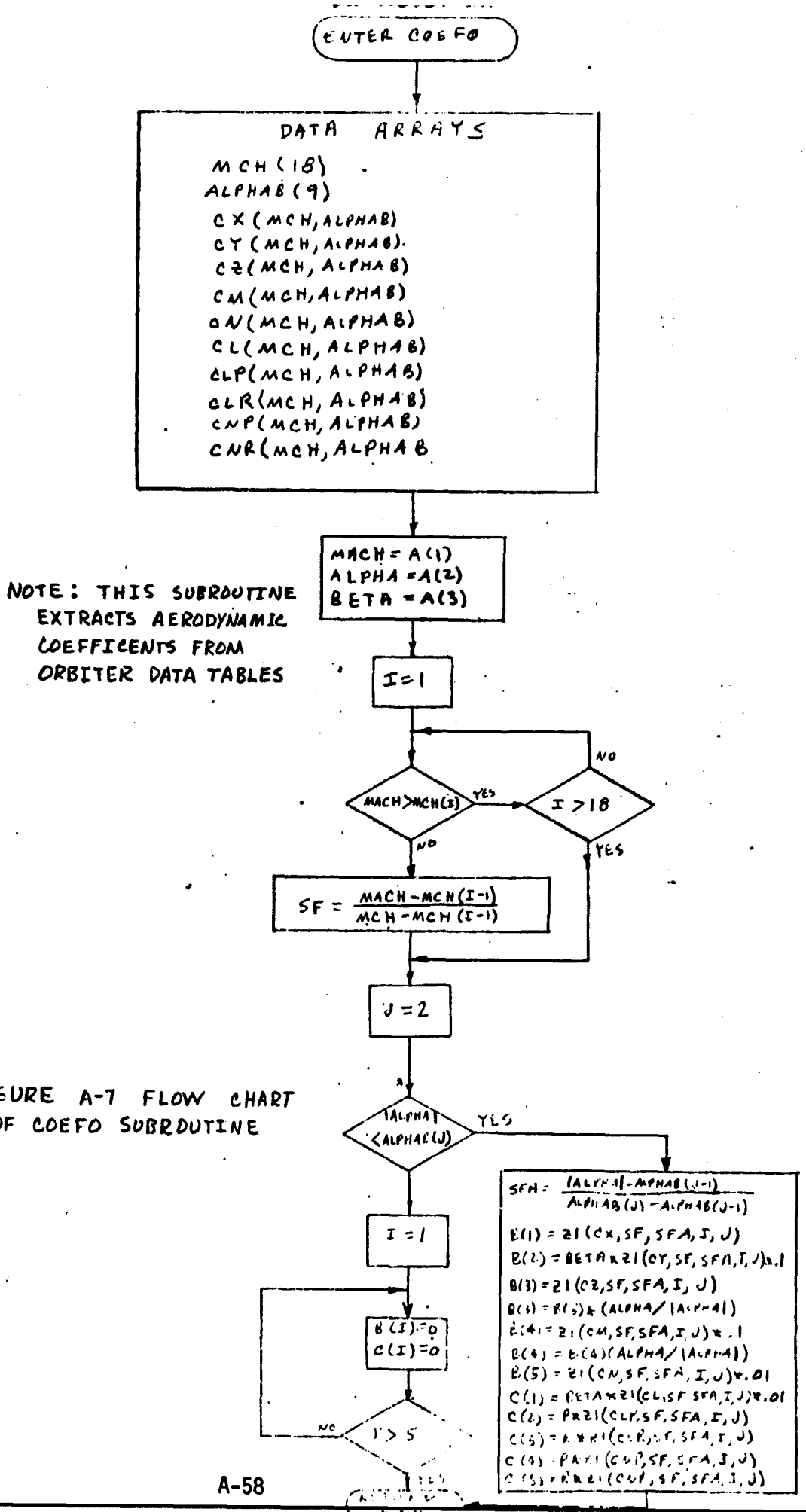
FIGURE A-6 FLOW CHART OF COEF SUBROUTINE

TABLE A-VIII SYMBOL DEFINITIONS OF COEF SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
A(3)		Argument of subroutine	
	M	A(1) = MACH (Mach number) [2]	
	α	A(2) = ALPHA (angle of attack) [2]	deg.
	β	A(3) = BETA (angle of sideslip) [2]	deg.
B(3)		Argument of subroutine	
	B_1	B(1) - Coefficient for body X force [3]	
	B_2	B(2) - Coefficient for body Y force [3]	
	B_3	B(3) - Coefficient for body Z force [3]	
C(3)		Argument of subroutine	
		C(1) - Coefficient for body pitching moment [3]	
		C(2) - Coefficient for body yawing moment [3]	
CL(18)		Table of rolling moment coefficient [2]	
CM(36)	C_M	Table of pitching moment coefficients [2]	
CMA	C_{MO}	Coefficient for body pitching moment (same as C(1)) [3]	
CN(18)	C_N	Table of yawing moment coefficients [2]	
CNB	C_{NO}	Coefficient for body yawing moment (same as C(2)) [3]	
CX(18)	C_X	Table of coefficients for body X forces [2]	
CY(18)	C_Y	Table of coefficients for body Y forces [2]	
CYB	C_{YO}	Coefficient for body Y force (same as B(2)) [3]	

TABLE A-VIII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
CZ(36)	C_Z	Table of coefficients for body Z forces 2	
CZA	C_{Z0}	Coefficient for body Z force 3 (Same as B(3,))	
I		Internal counter 1	
MACH	M	Actual vehicle mach number 2 (same as A(1))	
MCH(18)		Table of mach numbers used in table lookup 2	
SF		Internally used scale factor 1	
S1		Scratch variable 1	
S2		Scratch variable 1	



NOTE: THIS SUBROUTINE EXTRACTS AERODYNAMIC COEFFICENTS FROM ORBITER DATA TABLES

FIGURE A-7 FLOW CHART OF COEFO SUBROUTINE

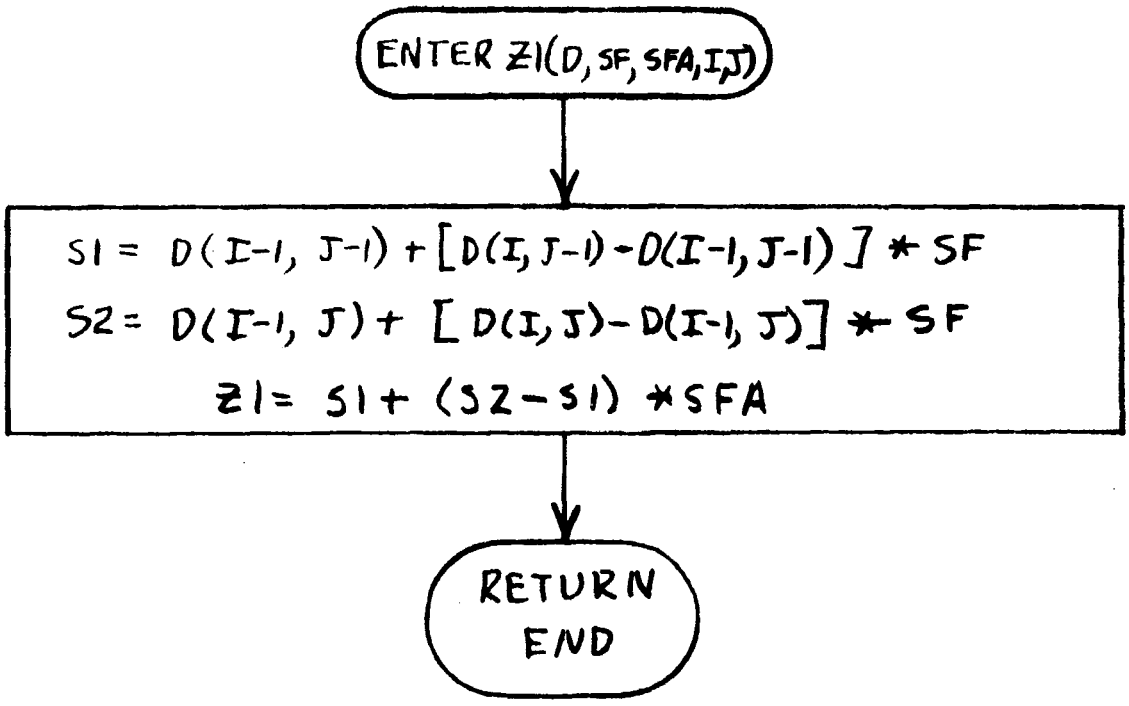


FIGURE A-8 FLOW CHART OF ZI FUNCTION SUBROUTINE

TABLE A-IX - SYMBOL DEFINITIONS FOR CØEFØ SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ALPHA		Angle of attack (independent variable) 2	degrees
ALPHAB(9)		Table of angles of attack used in table lookup 1	degrees
BETA		Sideslip angle 2	degrees
CL(18,9)		Table of rolling moment coefficients 1	unitless
CLP(18,9)		Axial force coefficient for roll rate 1	unitless
CLR(18,9)		Axial force coefficient for Yaw rate 1	
CM(18,9)		Table of pitching moment coefficients 1	unitless
CMA		Coefficient for body pitching moment 3	unitless
CN(18,9)		Table of yawing moment coefficients 3	unitless
CNB		Coefficient for body yawing moment	unitless
CNP(18,9)		Normal force coefficient for roll rate 1	
CNR(18,9)		Normal force coefficient for yaw rate 1	
CX(18,9)		Table of coefficients for body X-forces 1	unitless
CY(18,9)		Table of coefficients for body Y-forces 1	unitless
CYB		Coefficient for body Y-force 3	unitless
CZ(18,9)		Table of coefficients for body Z-forces	unitless
CZA		Coefficient for body Z-force 3	unitless
EAVPP(3)		Past value of vehicle acceleration in platform coordinates 5	ft/sec^2
EPA1		Sea level atmospheric pressure 5	lb/ft^2
EPBD		Angular acceleration about body X-axis 2	rad/sec^2
EQBD		Angular acceleration about body Y-axis 2	
ERBD		Angular acceleration about body Z-axis 2	rad/sec^2

TABLE A-IX (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EVPP(3)		Past value of platform velocity [5]	ft/sec
I		Pass counter [1]	
J		Pass counter [1]	
MACH		Actual vehicle mach number [3]	unitless
MCH(18)		Table of mach numbers used in table lookup [1]	unitless
P		Body roll rate [2]	rad/sec
Q		Body pitch rate [2]	rad/sec
R		Body yaw rate [2]	rad/sec
SF		Mach number interpolation scale factor [1]	unitless
SFA		Angle of attack interpolation scale factor [1]	unitless
Z1		Interpolation function subroutine	

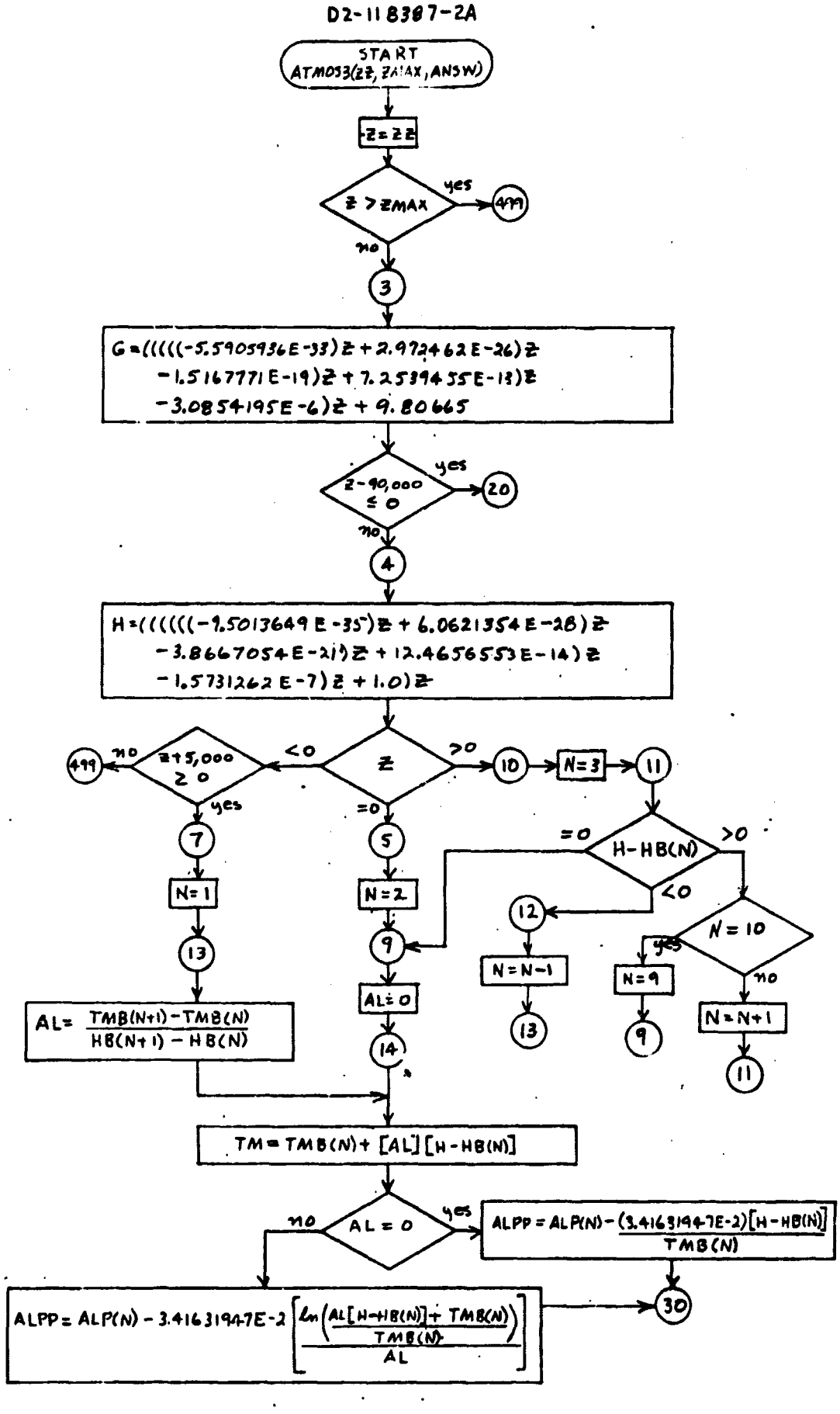


FIGURE A-9 FLOW CHART OF ATMOS3 SUBROUTINE

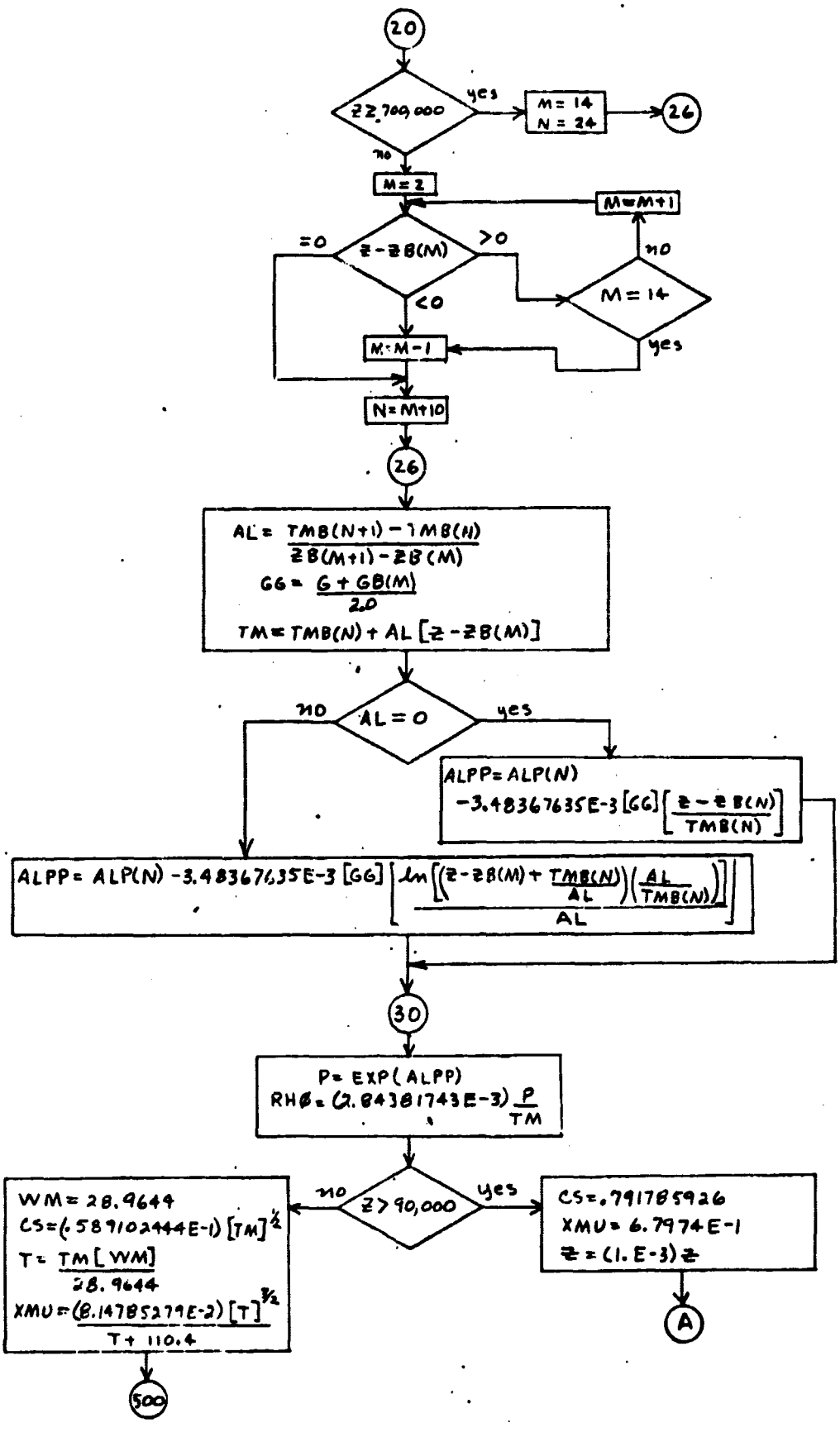


FIGURE A-9 CONT'D

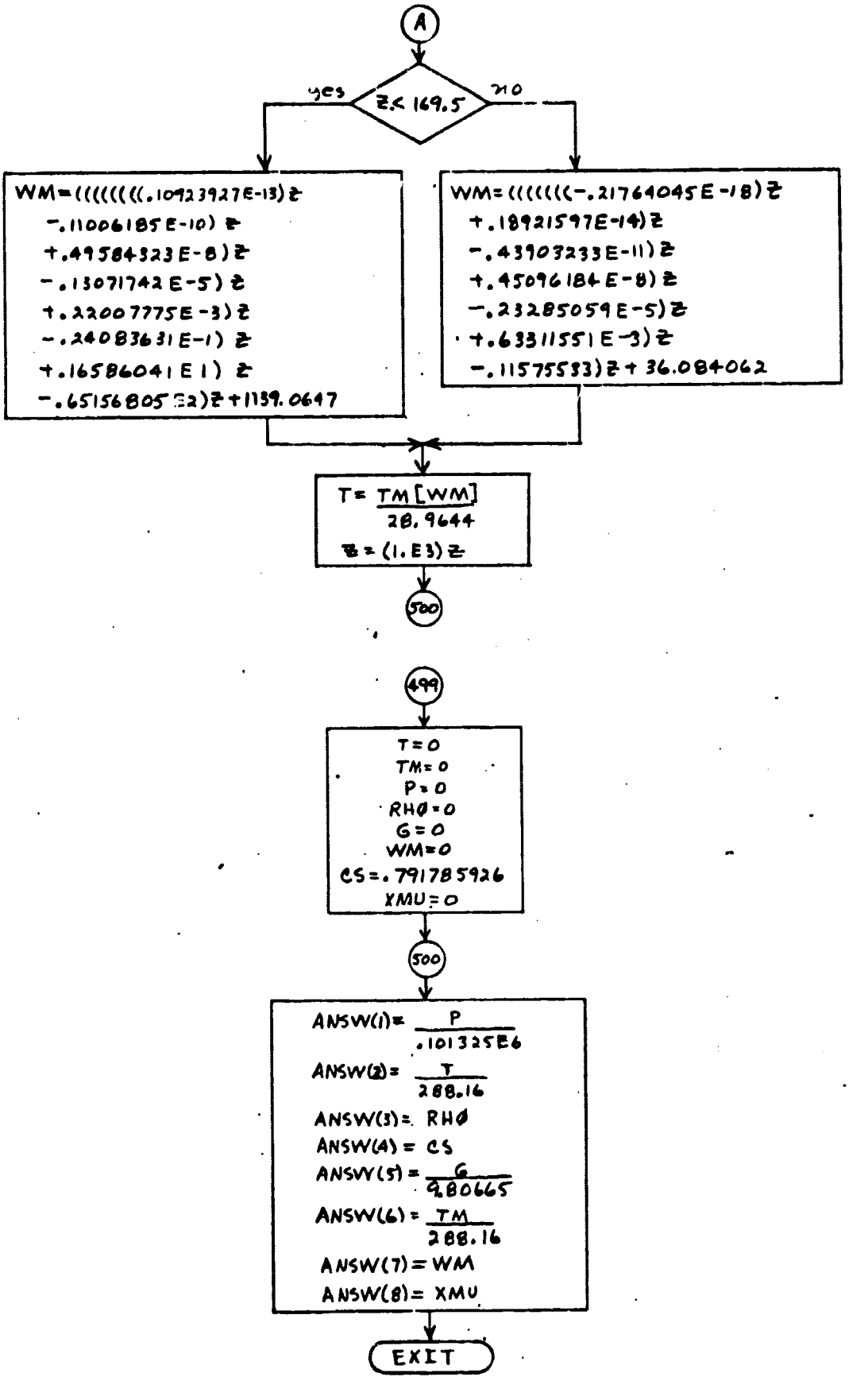


FIGURE A-9 CONT'D

TABLE A- X SYMBOL DEFINITIONS FOR ATMOS3 SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
AL	L'_M	Gradient of molecular-scale temperature with geopotential altitude [1]	$\frac{^oK}{m}$
ALP (24)	$\ln p_b$	Table values for the natural logs (ln) of the pressures at the base layers [1]	unitless
ALPP	$\ln p'$	Sum of the natural logs of the pressure at the base layer and the interpolated pressure within a layer [1]	unitless
ANSW (8)	$AN_{(I)}$	Output scale factor ratios [3]	unitless
CS	C_S	Ratio of speed of sound to sea level value [1] [3]	unitless
G	g	Compensated acceleration due to gravity as a function of geometric altitude [1] [3]	meters/sec sec^2
GB (14)	g_b	Table values for acceleration due to gravity at the base layers above $90K_m$ [1]	meters/ sec^2
GG	gg	Average of g and g_b above $90K_m$ [1]	meters/ sec^2
H	H	Geopotential altitude [1]	meters
HB (10)	H_b	Table values of geopotential altitudes [1]	meters
M	M	Parameter subscript [1]	
N	N	Parameter subscript [1]	
P	p	Atmospheric pressure or ratio of pressure to sea level value [1] [3]	newtons/ m^2
RHO	p	Ratio of atmospheric density to sea level value [1] [3]	unitless

TABLE A- X (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
T	T	Temperature or ratio of temperature to sea level value [1] [3]	^{o}K or unitless
TM	T_M	Molecular scale temperature or its ratio to sea level value [1] [3]	^{o}K or unitless
TMB (24)	T_{Mb}	Table values of molecular scale temperatures at base layers [1]	^{o}K or unitless
WM	M_0	Molecular weight [1]	unitless
XMU	μ	ratio of coefficient of viscosity to sea level value [1] [3]	unitless
Z	z	Geometric altitude [1]	meters
ZB (14)	z_b	Table values of geometric altitudes [1]	meters
ZMAX	z_{max}	Maximum altitude for ATMOS3 subroutine [2]	meters
Z Z	zz	Altitude in meters [2]	meters

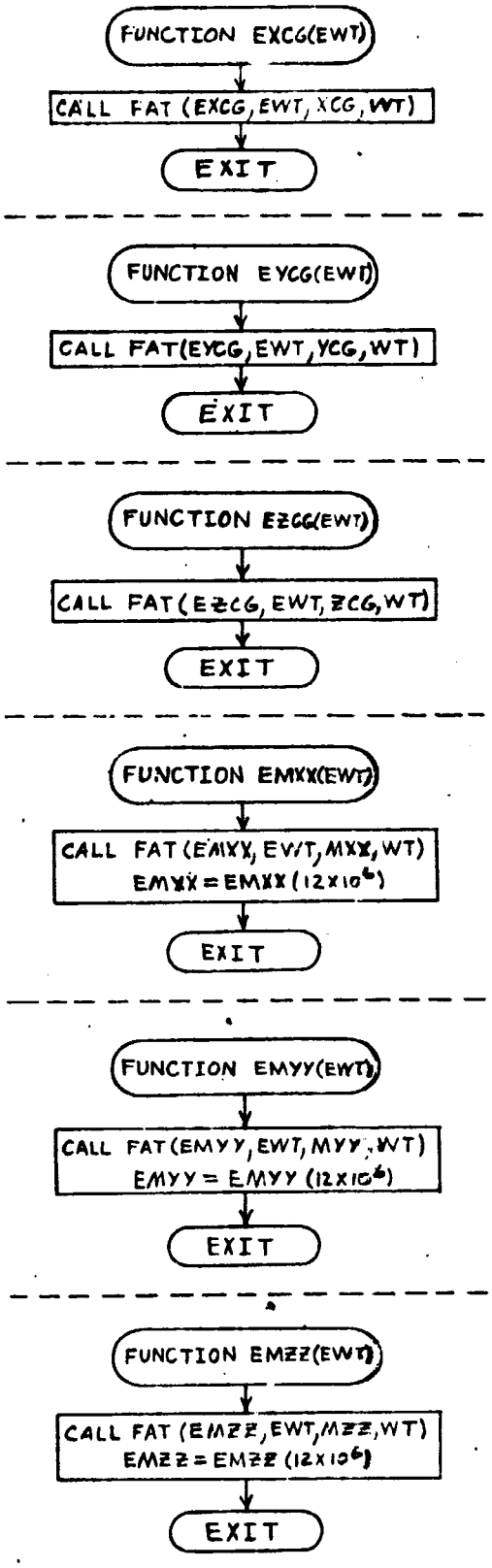


FIGURE A-10 FLOW CHART OF MASS PROPERTIES MATH MODEL

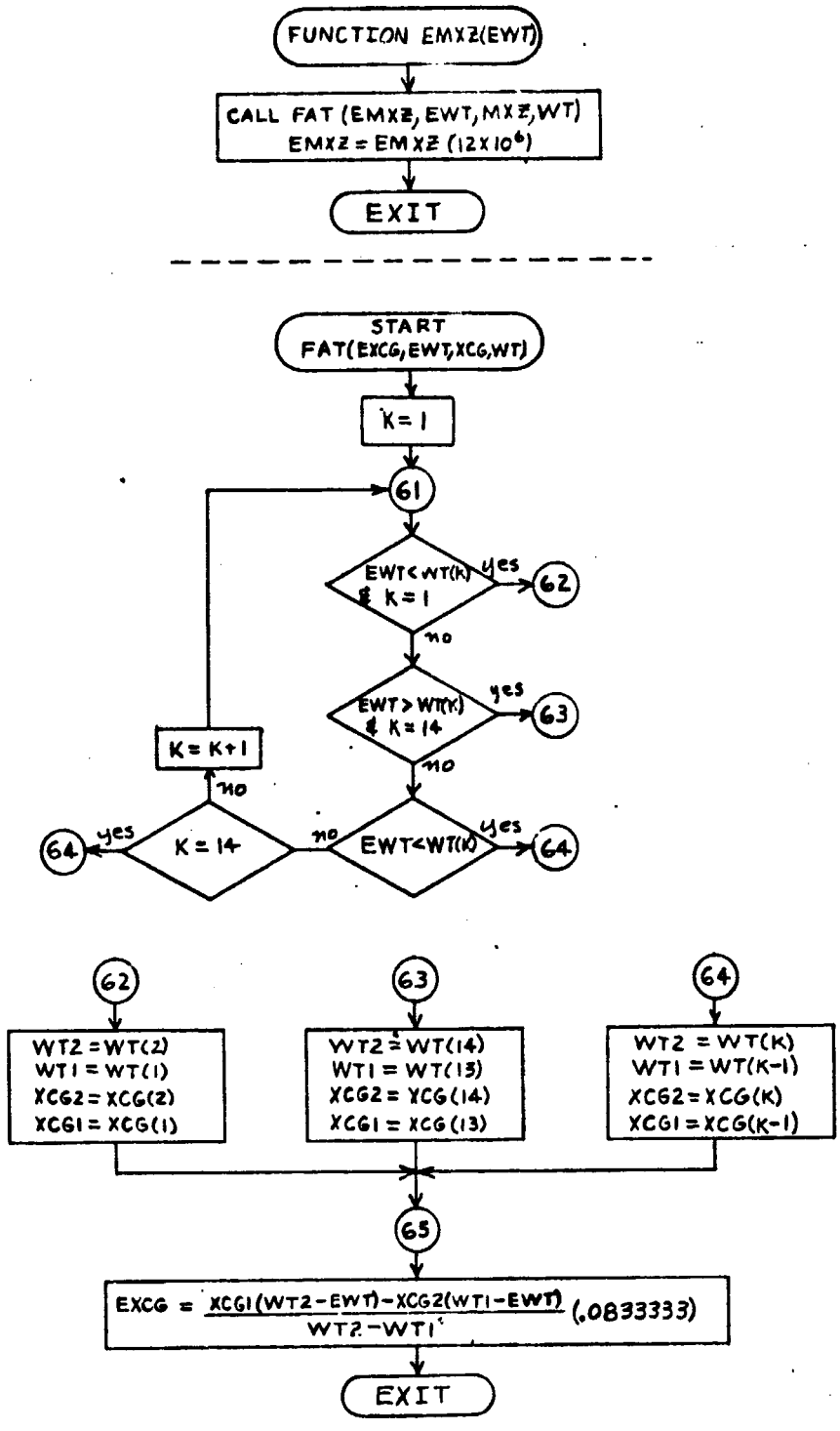


FIGURE A-10 CONT'D

TABLE A-XI SYMBOL DEFINITIONS FOR MASS PROPERTIES MATH MODEL

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EMXX (EWT)		Moments of inertia about the body X axis at present vehicle mass returned to calling subroutine [3]	slug -ft^2
EMXZ (EWT)		Product of inertia about body XZ plane at present vehicle mass returned to calling subroutine [3]	slug-ft^2
EMYY (EWT)		Moment of inertia about the body Y axis at present vehicle mass returned to calling subroutine [3]	slug-ft^2
EMZZ (EWT)		Moment of inertia about the body Z axis at present vehicle mass returned to calling subroutine [3]	slug-ft^2
EXCG (EWT)		Center of gravity displacement along body X-axis at present vehicle mass returned calling subroutine [3]	ft.
EXCG		Argument of the FAT subroutine, used to return the desired mass data to the function statement [1]	
EYCG (EWT)		Center of gravity displacement along body Y-axis at present vehicle mass returned to calling subroutine [3]	ft.
EZCG (EWT)		Center of gravity displacement along body Z-axis at present vehicle mass returned to calling subroutine [3]	ft.
EWT		Present vehicle mass, used as arguments of the function statements and FAT subroutine (same as AMT, in EOM and AMTOT in GUIDAN; ABGUID, and AUTOPI) [2]	slugs
K		Internal counter to FAT [1]	
MXX(14)	I_{XX}	Table of moments of inertia about body X-axis as a function of vehicle mass [2] [8]	slug-ft^2
MXZ(14)	I_{XZ}	Table of products of inertia about body XZ plane as a function of vehicle mass [2] [8]	slug-ft^2
MYY(14)	I_{YY}	Table of moments of inertia about body Y-axis as a function of vehicle mass [2] [8]	slug-ft^2
MZZ(14)	I_{ZZ}	Table of moments of inertia about body Z-axis as a function of vehicle mass [2] [8]	slug-ft^2

TABLE A-XI(Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
XCG(14)	X_{CG}	Table of center of gravity displacements along body X-axis as a function of vehicle mass. Also used as an argument of FAT subroutine to bring in the required mass characteristic table [2] [8]	in.
XCG1		Used in interpolation formula in FAT subroutine [1]	
XCG2		Used in interpolation formula in FAT subroutine [1]	
YCG(14)	Y_{CG}	Table of center of gravity displacements along body Y-axis as a function of vehicle mass [2] [7]	in.
ZCG(14)	Z_{CG}	Table of center of gravity displacements along body Z-axis as a function of vehicle mass [2] [7]	in.
WT(14)		Table of vehicle weights used in determining mass characteristics. Also used as an argument of the FAT subroutine to bring in vehicle weight table [2] [8]	slugs
WT1		Used in interpolation formula in FAT subroutine [1]	
WT2		Used in interpolation formula in FAT subroutine [1]	

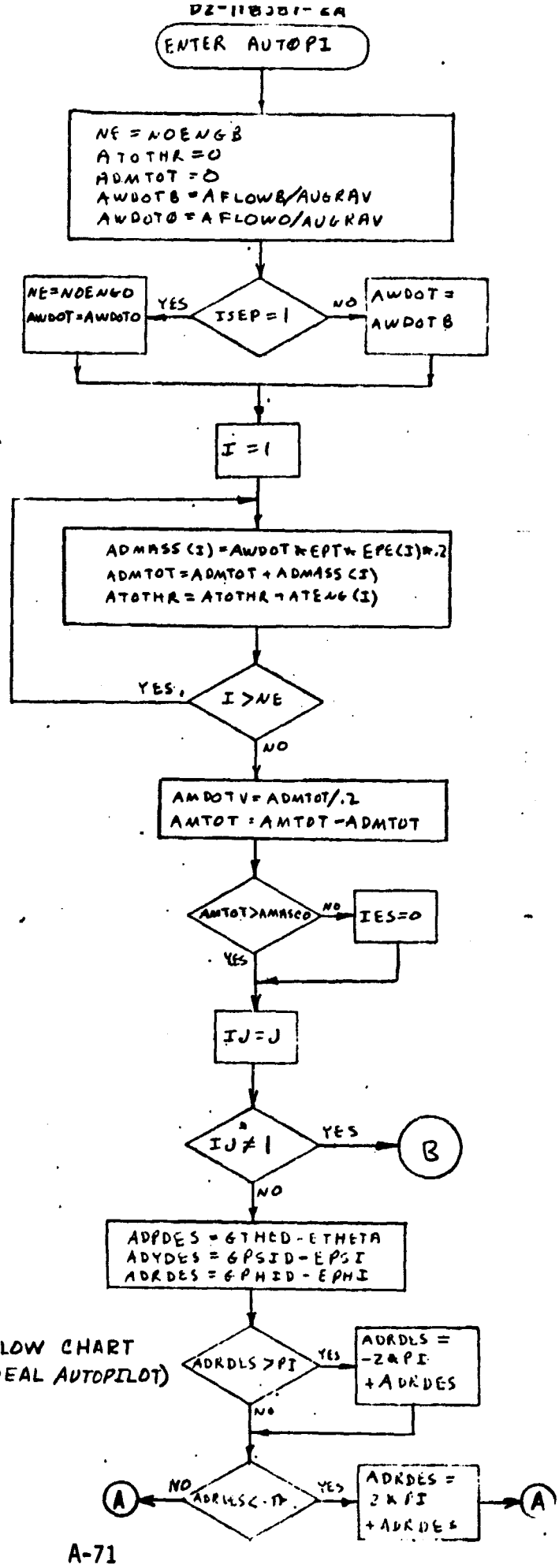


FIGURE A-11 FLOW CHART OF AUTOPI (IDEAL AUTOPILOT) SUBROUTINE

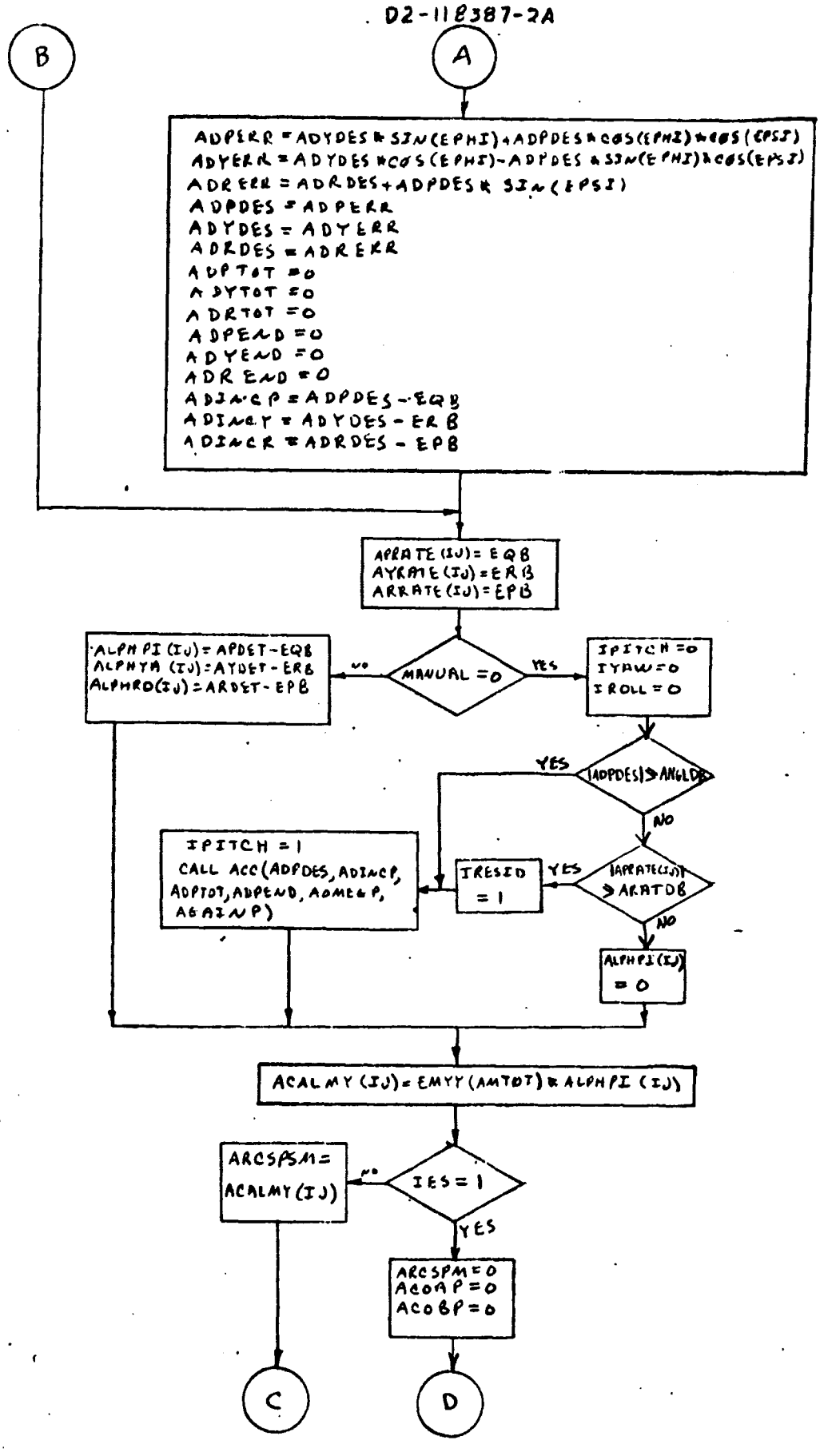


FIGURE A-11 CONT'D

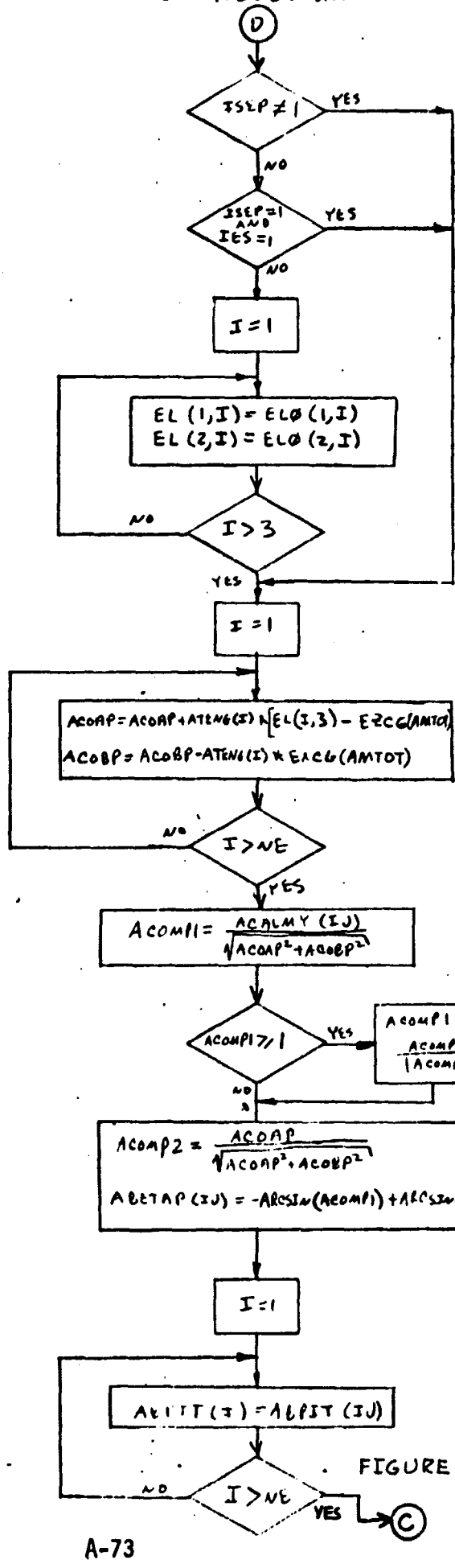


FIGURE A-11 CONT'D

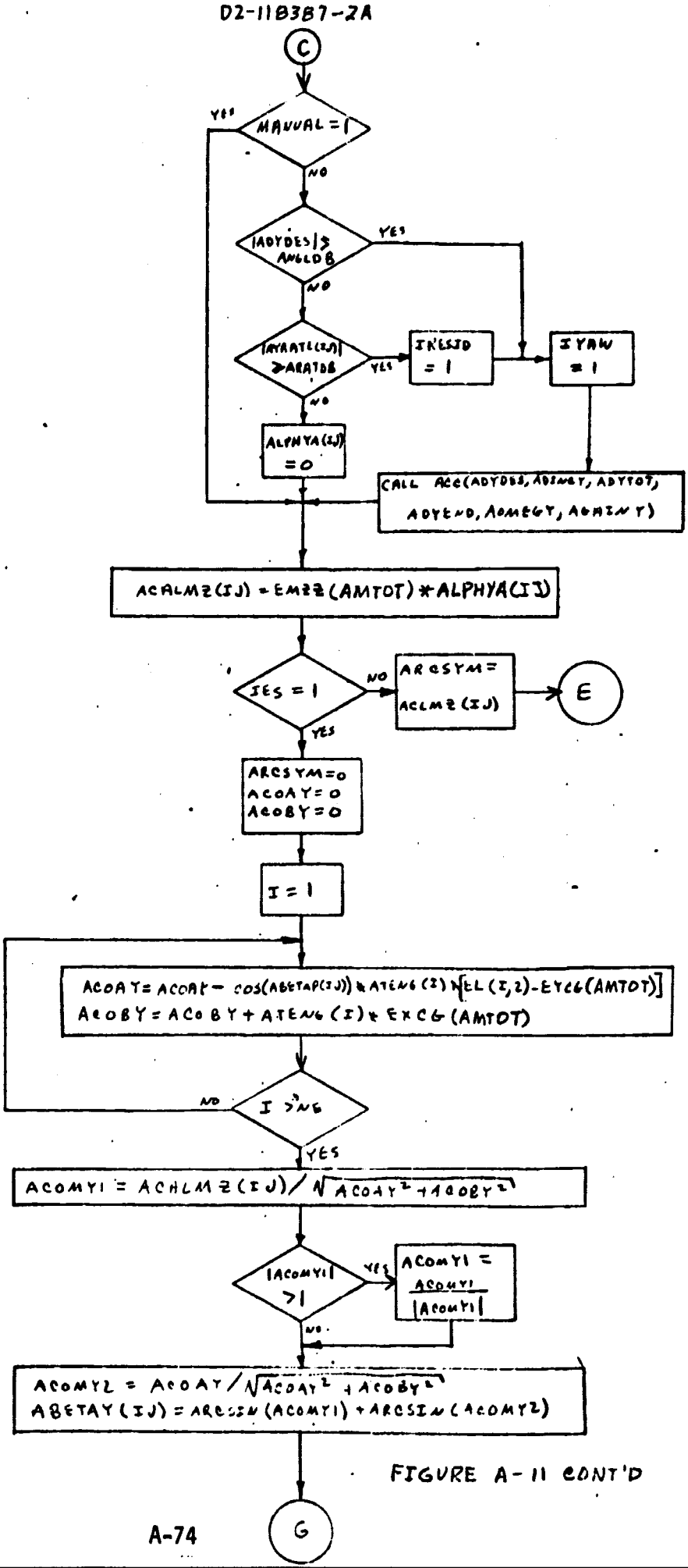


FIGURE A-11 CONT'D

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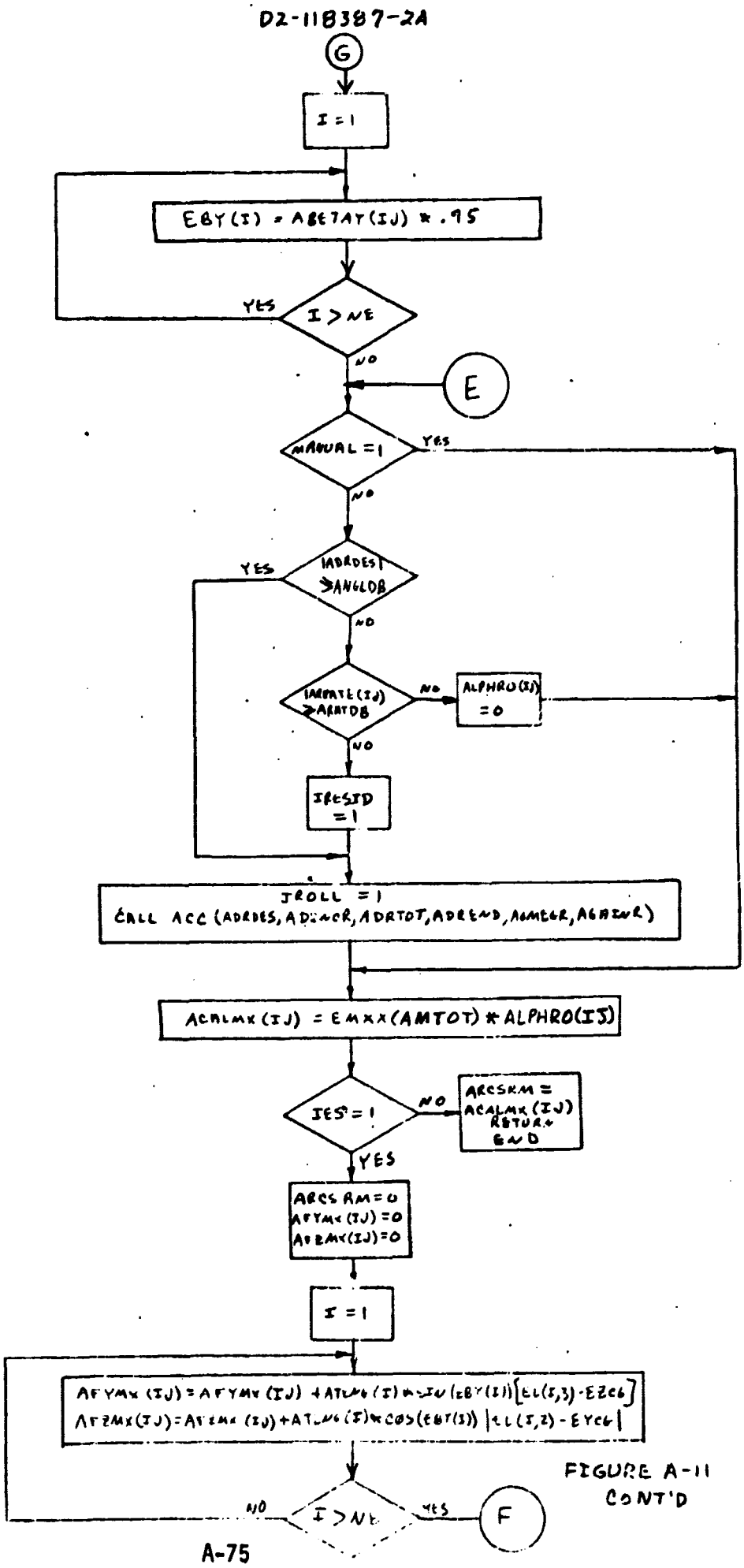


FIGURE A-11
CONT'D

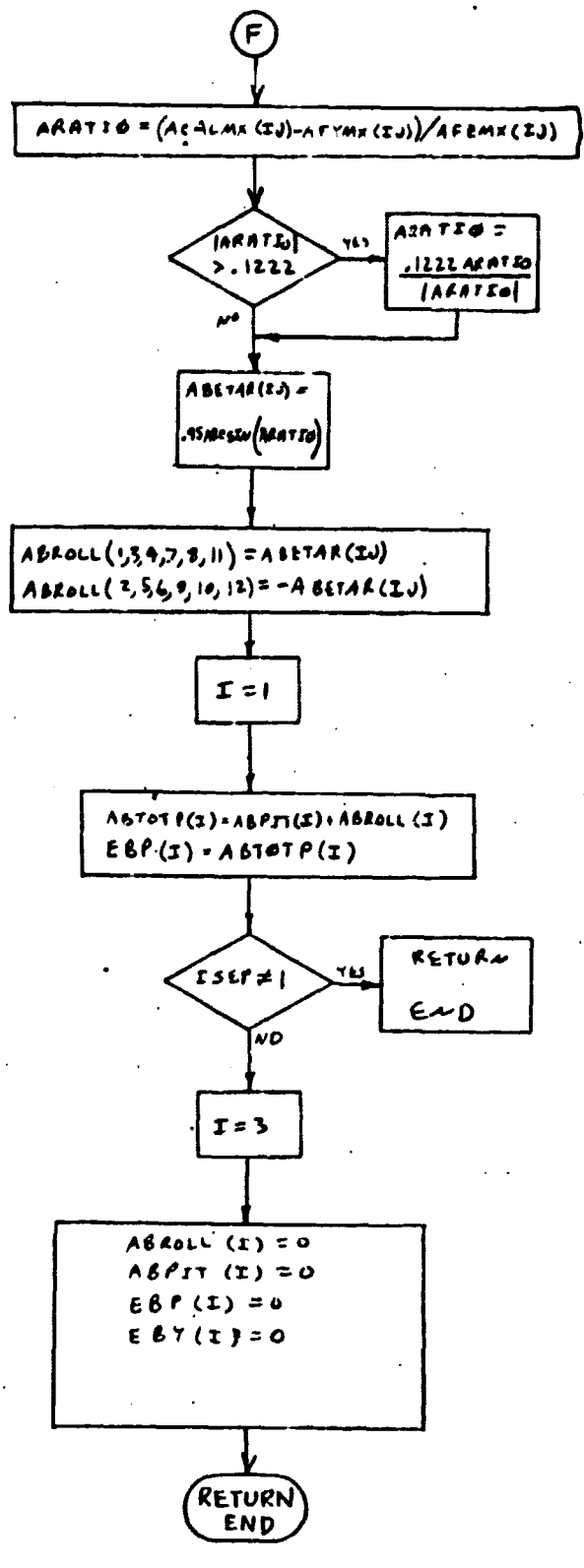


FIGURE A-11 CONT'D

TABLE A-XII SYMBOL DEFINITION FOR AUTOPI (IDEAL AUTOPILOT) SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ABETAP (5)	B_P	Engine gimbal angle computed for pitch [1, 3]	rad
ABETAR (5)	B_R	Engine gimbal angle computed for roll [1]	rad
ABETAY (5)	B_Y	Engine gimbal angle computed for yaw [1, 3]	rad
ABPIT (12)	θ_P	Pitch component of total pitch engine gimbal angle for Booster [1]	rad
ABROLL (12)	θ_R, ψ_R	Booster roll component of total pitch engine gimbal angle or Orbiter roll component of total yaw engine gimbal angle [1]	rad
ABTOTP (12)	θ_T	Total engine gimbal pitch angle (Booster) [3]	rad
ABTOTY (2)	ψ_T	Total engine gimbal yaw angle (Orbiter) [3]	rad
ABTT		Time selected for abort [2]	sec.
ABYAW (2)	ψ_Y	Yaw component of total yaw engine gimbal angle for Orbiter [1]	rad
ACALMX (5)	M_X	Desired moment about X-body axis [1, 4]	ft-lbs
ACALMY (5)	M_Y	Desired moment about Y-body axis [1, 4]	ft-lbs
ACALMZ (5)	M_Z	Desired moment about Z-body axis [1, 4]	ft-lbs
ACCLIM	α_{LIM}	Angular acceleration limit; 1.745329 E-1 [5, 8]	rad/sec^2
ACOAP	A_θ	Moment about Y-body axis due to forces in X-body direction [1]	ft-lbs
ACOAY	A_ψ	Moment about Z-body axis due to forces in X-body direction [1]	ft-lbs
ACOBP	B_θ	Moment about Y-body axis due to forces in Z-body direction [1]	ft-lbs

TABLE A-XII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ACOBY	B_ψ	Moment about Z-body axis due to forces in Z-body direction [1]	ft-lbs
ACOMP1	P_1	Ratio of M_y to $\left[A_\theta^2 + B_\theta^2\right]^{1/2}$ [1]	unitless
ACOMP2	P_2	Ratio of A_θ to $\left[A_\theta^2 + B_\theta^2\right]^{1/2}$ [1]	unitless
ACOMSM	α_{CSM}	[5]	rad/sec^2
ACOMY1	Y_1	Ratio of M_Z to $\left[A_\psi^2 + B_\psi^2\right]^{1/2}$ [1]	unitless
ACOMY2	Y_2	Ratio of A_ψ to $\left[A_\psi^2 + B_\psi^2\right]^{1/2}$ [1]	unitless
ACTALP (5)	α_{ACT}	Actual angular acceleration experienced [1]	rad/sec^2
ACTPAC (5)	$\alpha_{\theta ACT}$	Actual pitch angular acceleration experienced [1]	rad/sec^2
ACTRAC (5)	$\alpha_{\phi ACT}$	Actual roll angular acceleration experienced [1]	rad/sec^2
ACTYAC (5)	$\alpha_{\psi ACT}$	Actual yaw angular acceleration experienced [1]	rad/sec^2
ADESMX		[6]	
ADESMY		[6]	
ADESMZ		[6]	
ADINCP	$\Delta\theta$	Impending incrementatl pitch angle error due to pitch rate on first pass [3]	rad.
ADINCR	$\Delta\phi$	Impending incremental roll angle error due to roll rate on first pass [3]	rad.
ADINCY	$\Delta\psi$	Impending incremental yaw angle error due to yaw rate on first pass [3]	rad.
ADMASS (12)	ΔM	Mass depleted per engine per 0.2 sec [1] [4]	slugs

TABLE A-XII (Continue1)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ADMTOT	ΔM_{TOT}	Total mass depleted per 0.2 sec [1]	slugs
ADPDES	$\Delta\theta_D$	Desired change in body pitch angle [3]	rad
ADPEND	$\Delta\theta_{END}$	Total pitch angle accumulated if the vehicle pitch rate is stopped at the end of present minor cycle [5]	rad
ADPERR	θ_{ERR}	Desired body pitch angle change transformed from inertial angles [1]	rad
ADPTOT	$\Delta\theta_{TOT}$	Total pitch angle accumulated since the start of the major cycle [3]	rad
ADRDES	$\Delta\phi_D$	Desired change in body roll angle [3]	rad
ADREND	$\Delta\phi_{END}$	Total roll angle accumulated if the vehicle roll rate is stopped at the end of present minor cycle [5]	rad
ADRERR	ϕ_{ERR}	Desired body roll angle change transformed from inertial angles [1]	rad
ADRTOT	$\Delta\phi_{TOT}$	Total roll angle accumulated since the start of the major cycle [3]	rad
ADYDES	$\Delta\psi_D$	Desired change in body yaw angle [3]	rad
ADYEND	$\Delta\psi_{END}$	Total yaw angle accumulated if the vehicle yaw rate is stopped at the end of present minor cycle [5]	rad
ADYERR	ψ_{ERR}	Desired body yaw angle change transformed from inertial angles [1]	rad
ADYTOT	$\Delta\psi_{TOT}$	Total yaw angle accumulated since the start of the major cycle [3]	rad
AFLOWB	$\dot{F}_B$	Fuel flow rate of Booster engines; 1021.27 [1]	lbs/sec
AFLOWO	$\dot{F}_O$	Fuel flow rate of orbiter engines; 1021.27 [1]	lbs/sec
AFYMX (5)	M_{XFY}	Moment about X-body axis due to Y-body forces [1]	ft-lbs

TABLE A-XII(Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
AFZMX (5)	M_{XFZ}	Moment about X-body axis due to Z-body forces [1]	ft-lbs
AGAINP	G_P	Pitch acceleration system gain [5]	unitless
AGAINR	G_R	Roll acceleration system gain [5]	unitless
AGAINY	G_Y	Yaw acceleration system gain [5]	unitless
ALENGO	L_O	Length of orbiter vehicle; 148.0 [1]	ft
ALPHAC	α_{COM}	Angular acceleration commanded [5]	rad/sec^2
ALPHPI	$\alpha_{\theta COM}$	Pitch angular acceleration commanded [1] [2]	rad/sec^2
ALPHRO	$\alpha_{\phi COM}$	Roll angular acceleration commanded [1] [2]	rad/sec^2
ALPHYA	$\alpha_{\psi COM}$	Yaw angular acceleration commanded [1] [2]	rad/sec^2
AMASCO	M_{CO}	Mass cut-off value for dry vehicle 33,719.51 [2]	slugs
AMDOTV	$\dot{V}_M$	Mass depletion rate [3]	slugs/sec
AMINGA	G_{MIN}	Lower limit of AGAIN; 0.35 [5]	unitless
AMINTB	$T_{MIN\ B}$	Minimum total booster thrust; 44,000. [1]	lbs
AMINTO	$T_{MIN\ O}$	Minimum total orbiter thrust; 8000. [1]	lbs
AMTOT	M_{TOT}	Total vehicle mass remaining; [1] [3]	slugs
ANGLDB	θ_{DB}, ψ_{DB} ϕ_{DB}	Angle deadband; 1.745329 E-5 [1]	rad
ANOAER	C_p	Percent of max acceleration with no aerodynamics 0.7 [5]	unitless
AOMEGP	ω_P	Desired pitch rotational rate [5]	rad/sec
AOMEGR	ω_R	Desired roll rotational rate [5]	rad/sec

TABLE A-XII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
AOMEGY	ω_Y	Desired yaw rotational rate [5]	rad/sec
APDET		[6]	
APDIFT		[6]	
APRATE(5)	B	Body pitch rate [1] [3]	rad/sec
ARATDB	$\dot{\theta}_{DB}$, $\dot{\psi}_D$ ϕDB	Residual rotational rate deadband [1]	rad/sec
ARATE(5)	$\dot{\Delta}$	Rotational rate [5]	rad/sec
ARATIO	ARATIO	SIN of desired roll angle [1]	unitless
ARATLM	ω_{LIM}	Angular rate limit; [5] 5.235987E-2 [8]	rad/sec
ARCSPM		Pitch moment commanded by RCS model	
ARCSRM		Roll moment commanded by RCS model	
ARCSYM		Yaw moment commanded by RCS model	
ARDET		[6]	
ARDIFT		[6]	
ARRATE(5)	$\dot{\phi}_B$	Body roll rate [1] [3]	rad/sec
ATENG(12)	T	Engine thrust magnitude; [1] [2] 400,000 [8]	lbs
ATOTHR	T_T	Total engine thrust during present minor cycle [1]	lbs
ATOTPG(5)		Magnitude of total pitch and roll angles [5]	radians
AUGRAV	C_{GRAV}	Acceleration due to gravity at sea level, [1] 32,17404 [8]	ft/sec^2
AWDOT	$\dot{W}$	Mass flow rate [1] [3]	slugs/sec
AWDOTB	$\dot{W}_B$	Mass flow rate of booster engines [1]	slugs/sec
AWDOTO	$\dot{W}_O$	Mass flow rate of orbiter engines [1]	slugs/sec
AYDET		[6]	
AYDIFT		[6]	
AYRATE(5)	$\dot{\psi}_B$	Body yaw rate [1] [3]	rad/sec
DFAB(4)		Aero forces in body coordinates [5]	lbs
DMAXB		Aero moment about body X-axis [5]	ft-lbs
DMATB		Aero moment about body Y-axis [5]	ft-lbs
DMAZB		Aero moment about body Z-axis [5]	ft-lbs

TABLE A-XII(Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EAVPP (3)		5	
EBP (12)	Θ_{GIM}	Engine gimbal pitch angle 3	rad
EBY (12)	Ψ_{BIM}	Engine gimbal yaw angle 3	rad
EL (12)	EL	Booster engine locations 2	ft
ELO (2, 3)	ELO	Orbiter engine locations 2	ft
EMXX (14)	I_{XX}	Moment of inertia about X-body axis 2	slug-ft^2
EMYY (14)	I_{YY}	Moment of inertia about Y-body axis 2	slug-ft^2
EMZZ (14)	I_{ZZ}	Moment of inertia about Z-body axis 2	slug-ft^2
EPA1		5	
EPB	$\dot{\phi}_E$	Body roll rate 2	rad/sec
EPBD		5	
EPE (12)	P_{Ei}	Percent thrust due to engine out 2	unitless
EPHI	ϕ_E	Inertial roll angle 2	rad
EPHID		5	
EPSI	ψ_E	Inertial yaw angle 2	rad
EPSID		5	

TABLE A-XII(Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EPT	P_{Ti}	Percent engine thrust [2]	unitless
EQB	$\dot{\theta}_E$	Body pitch rate [2]	rad/sec
EQBD		[5]	
ERB	$\dot{\psi}_E$	Body yaw rate [2]	rad/sec
ERBD		[5]	
ETHETA	θ_E	Inertial pitch angle [2]	rad
ETHETD		[5]	
EVPP (3)		[5]	
EXCG (14)	X_{CG}	Body X_{CG} [2]	ft
EYCG (14)	Y_{CG}	Body Y_{CG} [2]	ft
EZCG (14)	Z_{CG}	Body Z_{CG} [2]	ft
GM (4)		[5]	
GPHID	ϕ_G or ϕ_D	Inertial roll angle requested from Guidance [2]	rad
GPSID	ψ_G or ψ_D	Inertial yaw angle requested from Guidance [2]	rad
GTHED	θ_G or θ_D	Inertial pitch angle requested from Guidance [2]	rad
GURP (4)		[5]	
GUYP (4)		[5]	

TABLE A-XII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
GUZP(4)		[5]	
H1		Altitude [2]	feet
I	I	Do loop counter	
IABT		IABT = 1 after abort is begun [5]	discrete
IBO	I_B	[6]	
IES	I_{ES}	Engine start flag [2] [3]	discrete
IJ	IJ	Autopilot pass counter [1]	1-5
IPITCH	I_θ	Pitch acceleration calculation flag [1] [2] [3]	discrete
IRESID	I_R	Residual rate calculation [1] [2] [3]	discrete
IROLL	I_ϕ	Roll acceleration calculation discrete [1] [2] [3]	discrete
ISEP	I_{SEP}	Vehicle separation flag [2]	discrete
IYAW	I_ψ	Yaw acceleration calculation flag [1] [2] [3]	discrete
J	J	Pass counter [2]	1-5
KGUID		Run terminate flag [5]	discrete
KP	KP	Output print flag [6]	
MANUAL		Manual operation [1]	discrete
NE	i	Number of vehicle engines [1]	
NOENGB	i_B	Number of booster engines [1] $i_B = 12$	
NOENGO	i_O	Number of orbiter engines [1] $i_O = 2$	
P	P	Atmospheric pressure [5]	
PAO(10)		Pitch attitude gain [5]	unitless
PAI (10)		Pitch rate gain [5]	unitless

TABLE A-XII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
PI		π = 3.141592653 (8)	
RAD		RAD = 57.29578 (8)	deg/rad
RADI		RADI = 1.745329 X 10^{-2} (8)	rad/deg
RAO(10)		Roll attitude gain (5)	unitless
RA1(10)		Roll rate gain (5)	unitless
SEROT		Angular rate of earths rotation (8)	rad/sec
SETCGO		(5)	
SGRAV		Acceleration due to gravity - 32.17404 (8)	ft/sec^2
SMU		Gravitation constant = 14.07654 X 10^{15} (8)	ft^3/sec^2
SRMEAN		Earth radius at launch pad = 20,909,740 (8)	ft
T		(5)	
TGOT		Time to go to reach abort target (8)	sec
TRIM		(5)	
WEP(4)		(5)	
YAO(10)		Yaw attitude gain (5)	
YA1(10)		Yaw rate gain (5)	

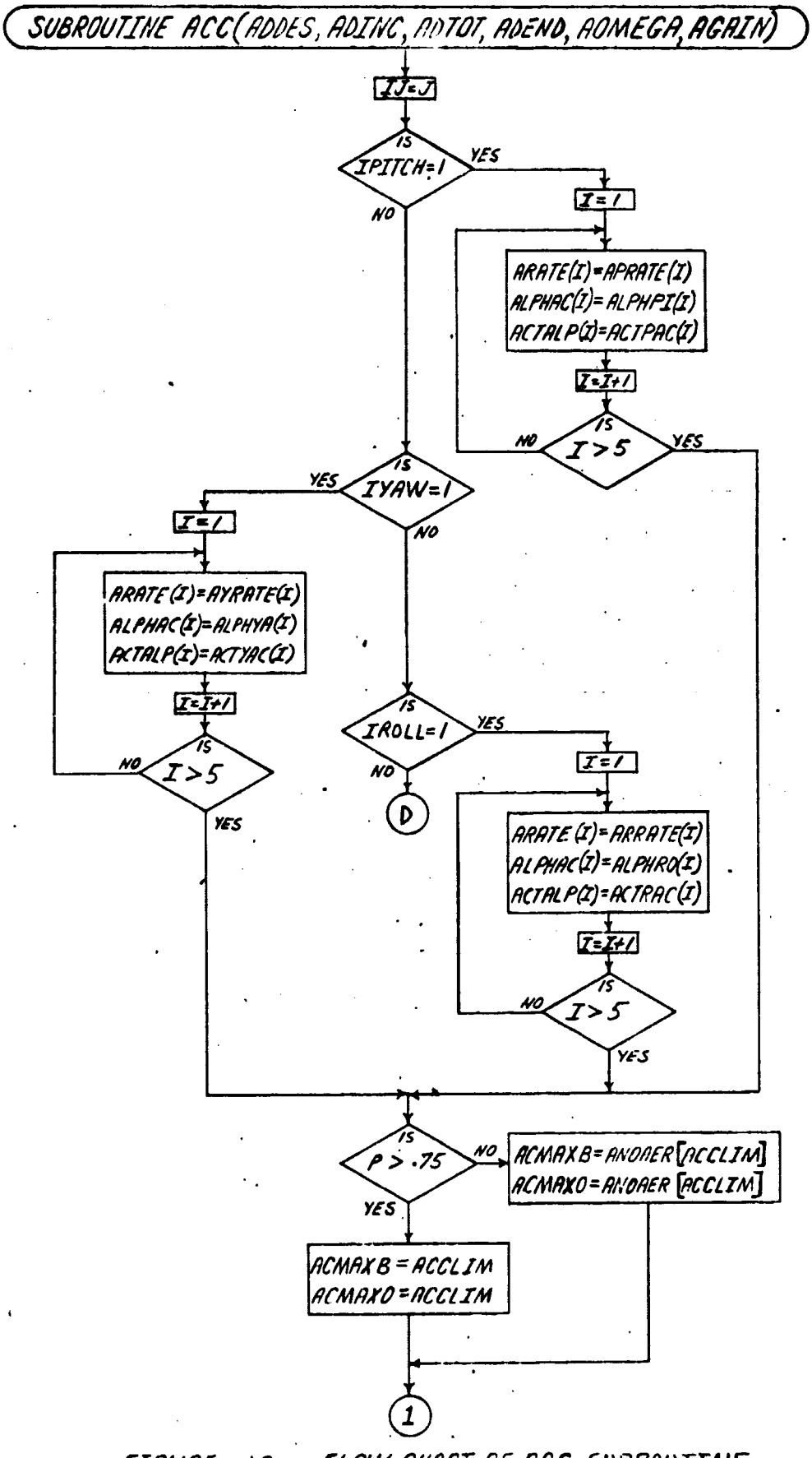


FIGURE 12 FLOW CHART OF ACC SUBROUTINE

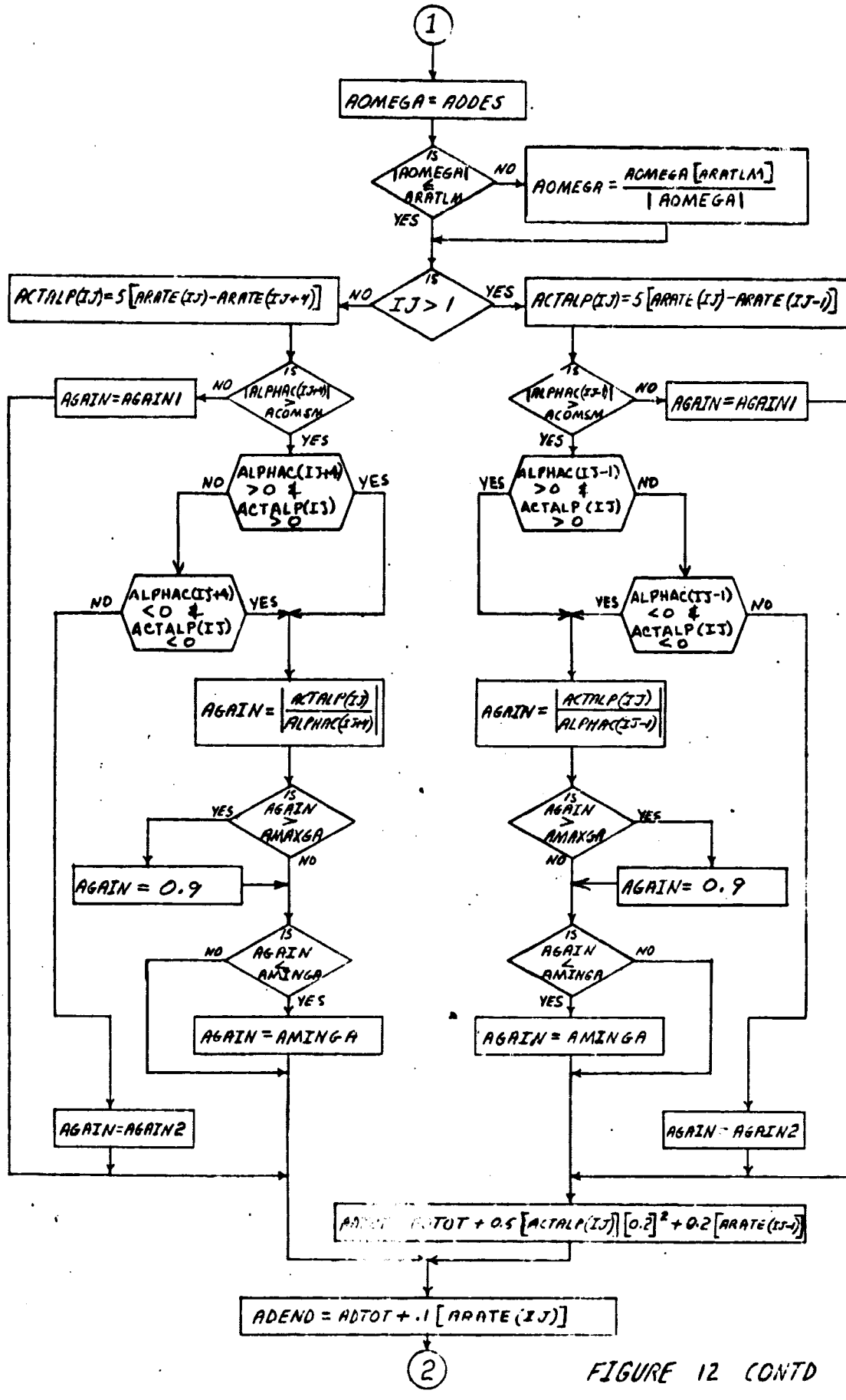


FIGURE 12 CONTD

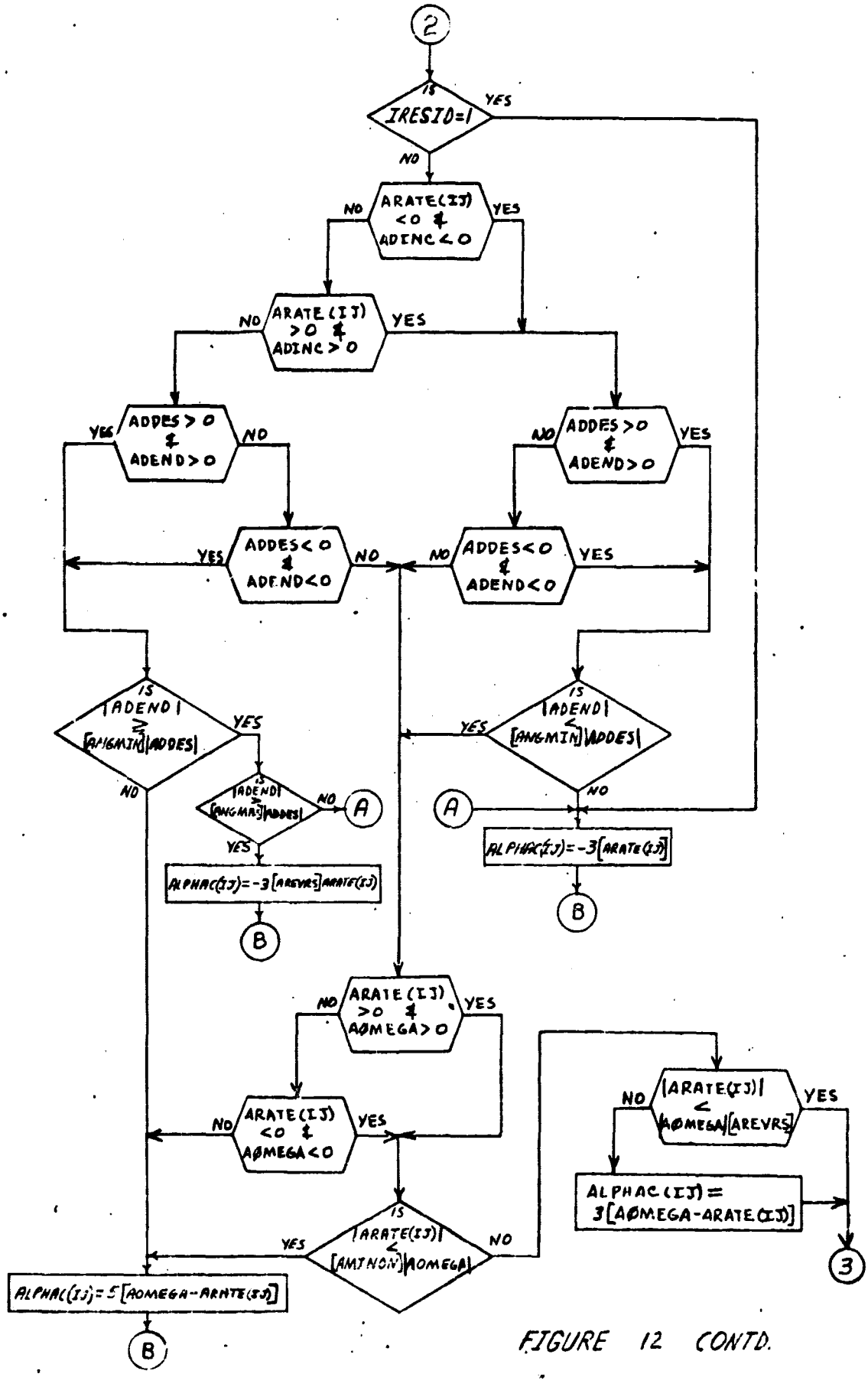


FIGURE 12 CONTD.

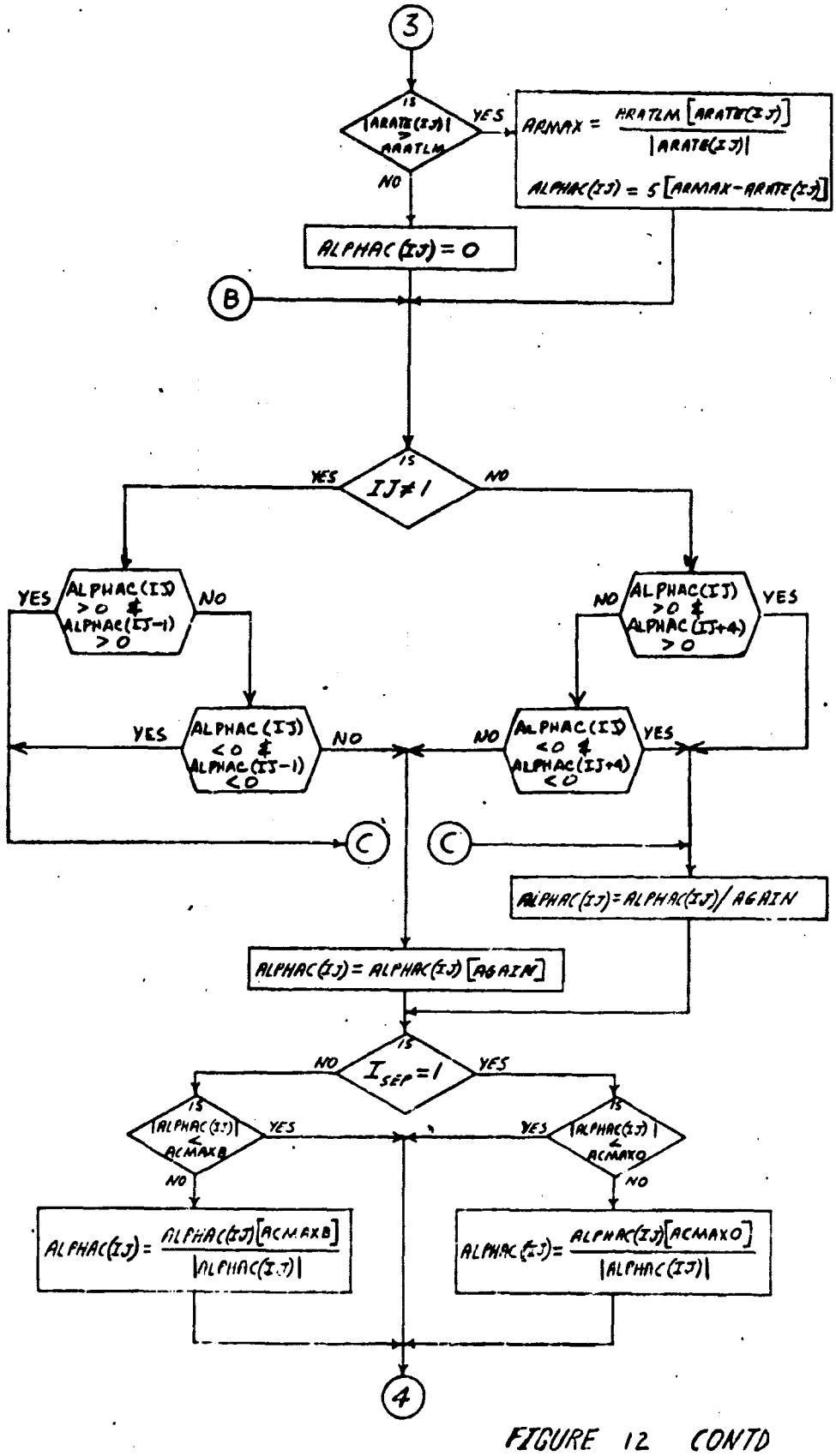


FIGURE 12 CONTD

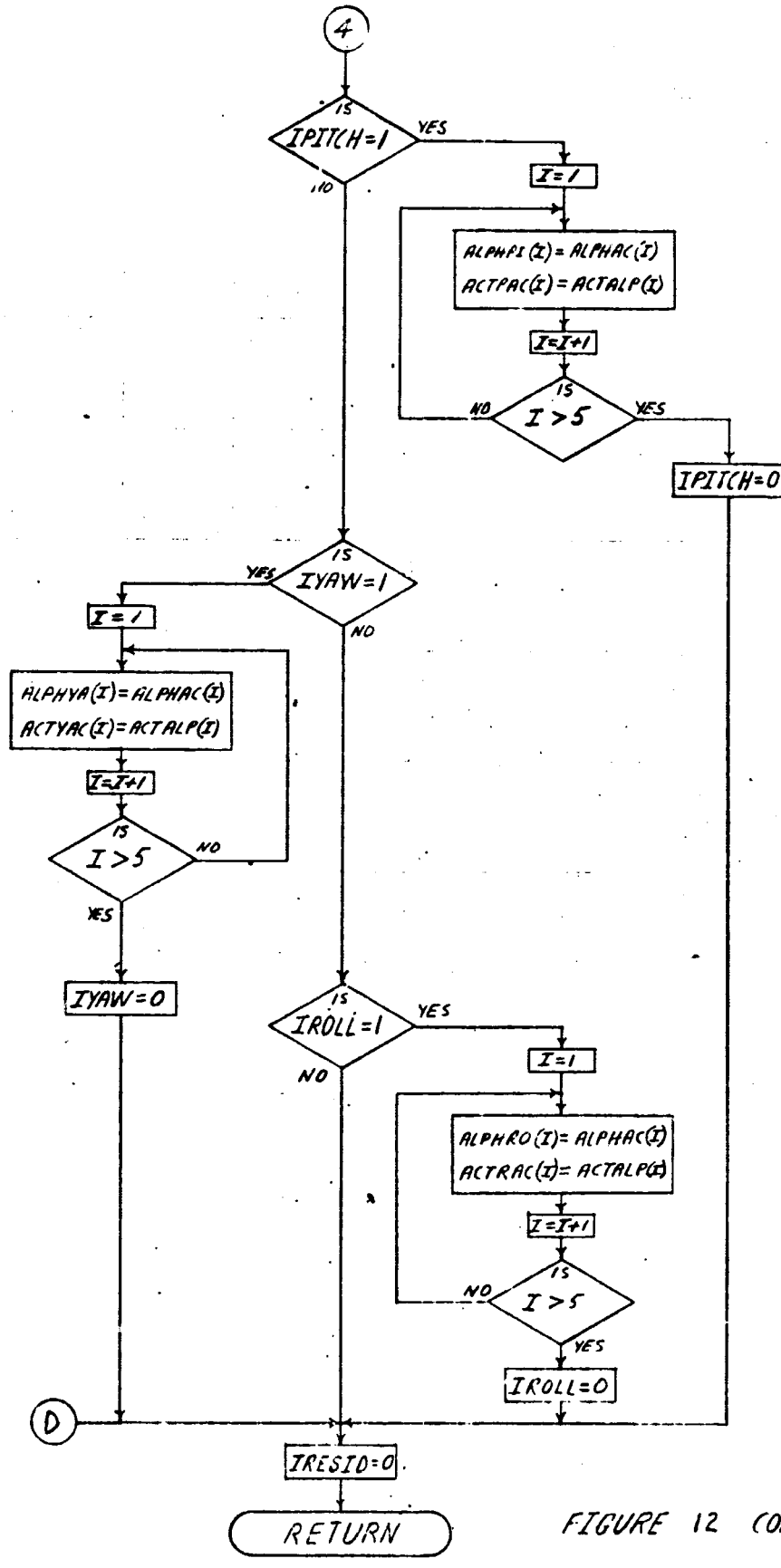


FIGURE 12 CONTD.

TABLE A-XIII SYMBOL DEFINITION FOR ACC SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ABETAP (5)	β_P	5	
ABETAR (5)	β_R	5	
ABETAY (5)	β_Y	5	
ABPIT (12)	θ_P	5	
ABROLL (12)	θ_R, ψ_R	5	
ABTOTP (12)	θ_T	5	
ABTT		Time selected for abort 5	seconds
ACALMX (5)	M_X	5	
ACALMY (5)	M_Y	5	
ACALMZ (5)	M_Z	5	
ACCLIM	α_{LIM}	Angular acceleration limit; 1.745329 E-1 1, 8	rad/sec^2
ACMAXB	α_{MAXB}	Maximum Booster angular acceleration 1	rad/sec^2
ACMAXO	α_{MAXO}	Maximum Orbiter angular acceleration 1	rad/sec^2
ACOMSM	α_{CSM}	Constant for angular acceleration commanded equal to zero test; 1.745329E-7 1, 8	rad/sec^2
ACTALP (5)	α_{ACT}	Actual angular acceleration experienced 1	rad/sec^2
ACTPAC (5)	$\alpha_{\theta ACT}$	Actual pitch angular acceleration experienced 3	rad/sec^2

TABLE A-XIII(Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ACTRAC (5)	$\alpha_{\phi ACT}$	Actual roll angular acceleration experienced [3]	rad/sec^2
ACTYAC (5)	$\alpha_{\psi ACT}$	Actual yaw angular acceleration experienced [3]	rad/sec^2
ADDES	Δ_D	Desired change in body angle ($\Delta\theta_D$, $\Delta\psi_D$, $\Delta\phi_D$); [2]	rad
ADEND	Δ_{END}	Total angle accumulated ($\Delta\theta_{END}$, $\Delta\psi_{END}$, $\Delta\phi_{END}$) if vehicle rate is stopped at the end of present minor cycle; [1] [2] [3]	rad
ADINC	Δ	Impending incremental angle ($\Delta\theta$, $\Delta\psi$, $\Delta\phi$) due to body rate on first pass; [2]	rad
ADTOT	Δ_{TOT}	Total angle accumulated ($\Delta\theta_{TOT}$, $\Delta\psi_{TOT}$, $\Delta\phi_{TOT}$) since the start of the major cycle; [1] [2] [3]	rad
AFYMX(5)		[5]	
AFZMX(5)		[5]	
AGAIN	G	Desired or computed system gain (G_P, G_R, G_Y); [1] [3]	unitless
AGAIN 1	G_1	Desired acceleration system gain; 0.9 [1]	unitless
AGAIN 2	G_2	Desired acceleration system gain; 0.7 [1]	unitless
ALPHAC (5)	α_{COM}	Angular acceleration commanded [1]	rad/sec^2
ALPHPI (5)	$\alpha_{\theta COM}$	Pitch angular acceleration commanded [3]	rad/sec^2
ALPHRO (5)	$\alpha_{\phi COM}$	Roll angular acceleration commanded [3]	rad/sec^2
ALPHYA (5)	$\alpha_{\psi COM}$	Yaw angular acceleration commanded [3]	rad/sec^2
AMAXGA		Upper limit of again [8]	unitless
AMINGA	G_{MIN}	Lower limit of AGAIN; 0.35 [1]	unitless
AMINOM	C_ω	Minimum percent of desired rotational rate; 0.99, [1]	unitless

TABLE A-XIII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ANGLDB	θ_{DB}, ψ_{DB}, ϕ_{DB}	5	
ANGMAX	$C_{\Delta MAX}$	Upper limit of percent desired angle change; 1.05 1	unitless
ANGMIN	$C_{\Delta MIN}$	Lower limit of percent desired angle change; 9.95 1	unitless
ANOAER	C_P	Percent of max acceleration with no aerodynamics 0.7 5	unitless
APDIFT		6	
APRATE(5)	$\dot{\theta}$	Body pitch rate 2	rad/sec
ARATDB	$\dot{\theta}_{DB}$, $\dot{\psi}_{DB}$, $\dot{\phi}_{DB}$	5	
ARATE(5)	$\dot{\Delta}$	Rotational rate($\dot{\theta}$, $\dot{\psi}$, $\dot{\phi}$); 1	rad/sec
ARATLM	ω_{LIM}	Angular rate Limit; 5.235987 E-2 1	rad/sec
ARCSPM		Pitch moment commanded by RCS model 5	ft lbs
ARCSRM		Roll moment commanded by RCS model 5	ft lbs
ARCSYM		Yaw moment commanded by RCS model 5	ft lbs
ARDIFT		6	
AREVRS	$C_{\Delta OS}$	Percent reversal of existing rotational rate; 1.20 1	unitless
ARMAX	ω_{MAX}	Maximumum allowable rotational rate; 1	
ARRATE(5)	$\dot{\phi}_B$	Body roll rate 2	
ATOTHR		Total engine thrust during present minor cycle 1	lbs
AYDIFT		6	
AYRATE(5)	$\dot{\phi}_B$	Body yaw rate 2	rad/sec
DFAB(4)		5 Aero forces in body coordinates	lbs
DMAXB		5 Aero moment about body X-axis	ft-lbs

TABLE A-XIII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
DMAYB		5 Aero moment about body Y-axis	ft-lbs
DMAZB		5 Aero moment about body Z-axis	ft-lbs
EBP(12)	θ_{GIM}	5	rad
EBY(12)	ψ_{GIM}	5	rad
EL(3)	EL	5	ft.
ELO(2,3)	ELO	5	ft.
EPE		5	
EPT		5	
H1		Altitude 5	
I	I	Do loop counter	
IABT		IABT = 1 after abort is begun 5	discrete
IBO	I_B	6	
IES	I_{ES}	5	discrete
IJ	IJ	Autopilot pass counter 1	
IPITCH	I_θ	Pitch acceleration calculation flag 1 , 2 , 3	discrete
IRESID	I_R	Residual rate calculation 1 , 2 , 3	discrete
IROLL	I_ϕ	Roll acceleration calcualation discrete 1 , 2 , 3	discrete
ISEP	I_{SEP}	Vehicle separation flag 2	discrete
IYAW	I_ψ	Yaw acceleration calculation flag 1 , 2 , 3	discrete
J	J	Pass counter 2	1 - 5
KGUID		Run terminate flag 5	discrete
P	P	Atmospheric Pressure 2	
T		5	
TGOT		Time to go to reach abort target 5	sec
WEP(4)		5	

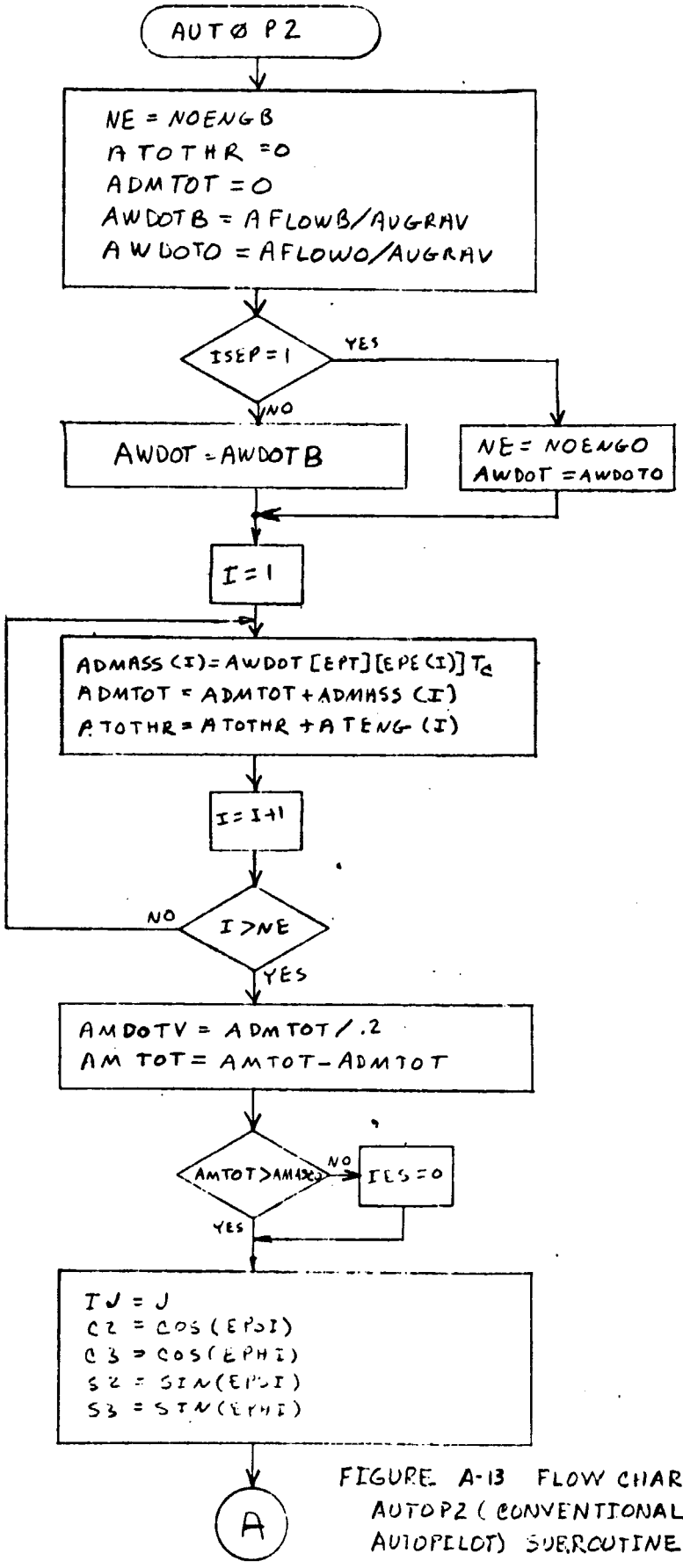


FIGURE A-13 FLOW CHART OF AUTOP2 (CONVENTIONAL AUTOPILOT) SUBROUTINE

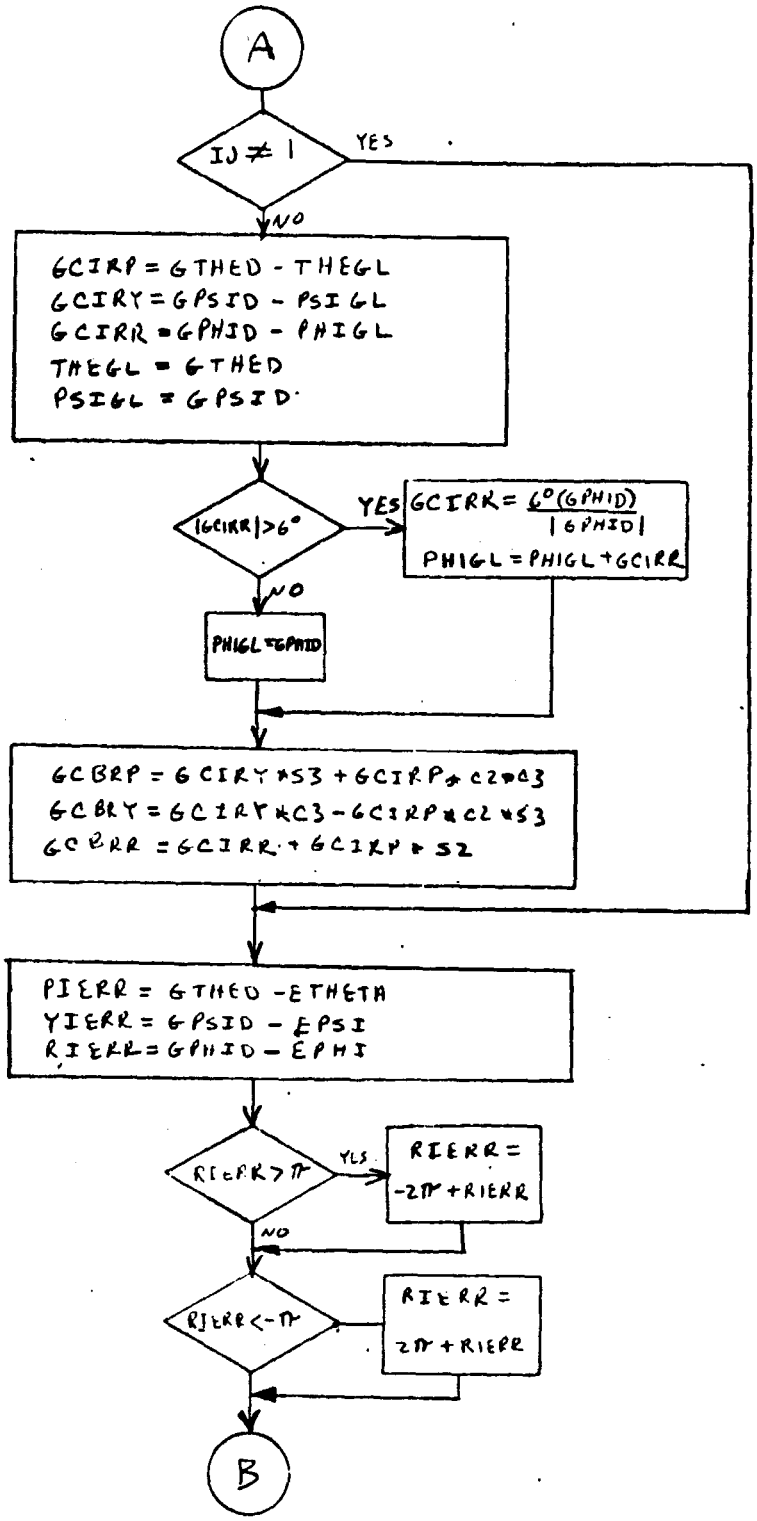


FIGURE A-13 CONT'D

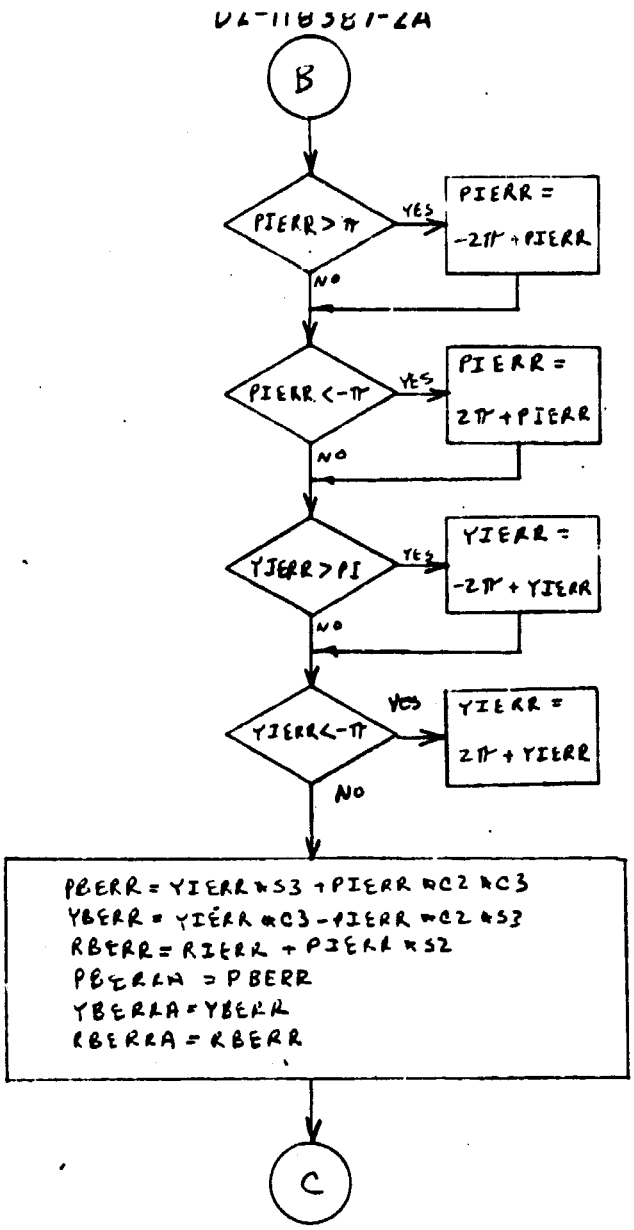


FIGURE A-13 CONT'D

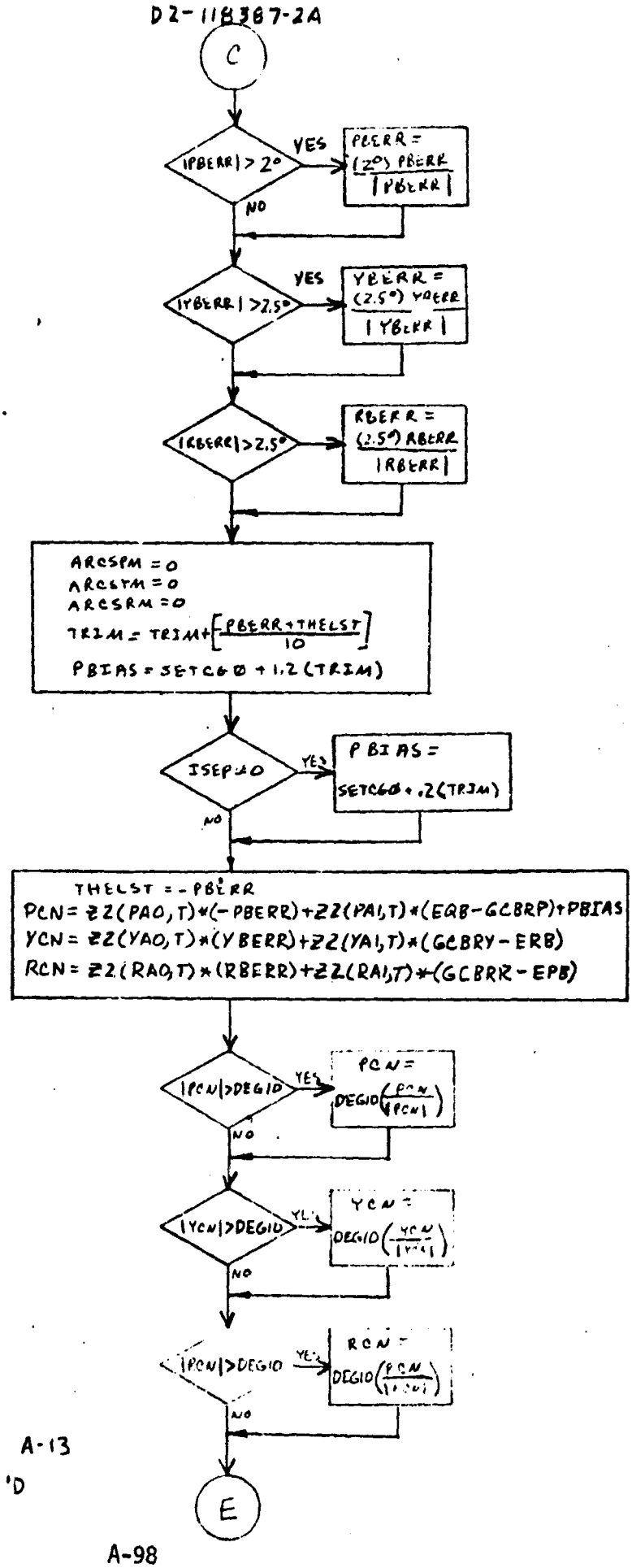


FIGURE A-13

CONT'D

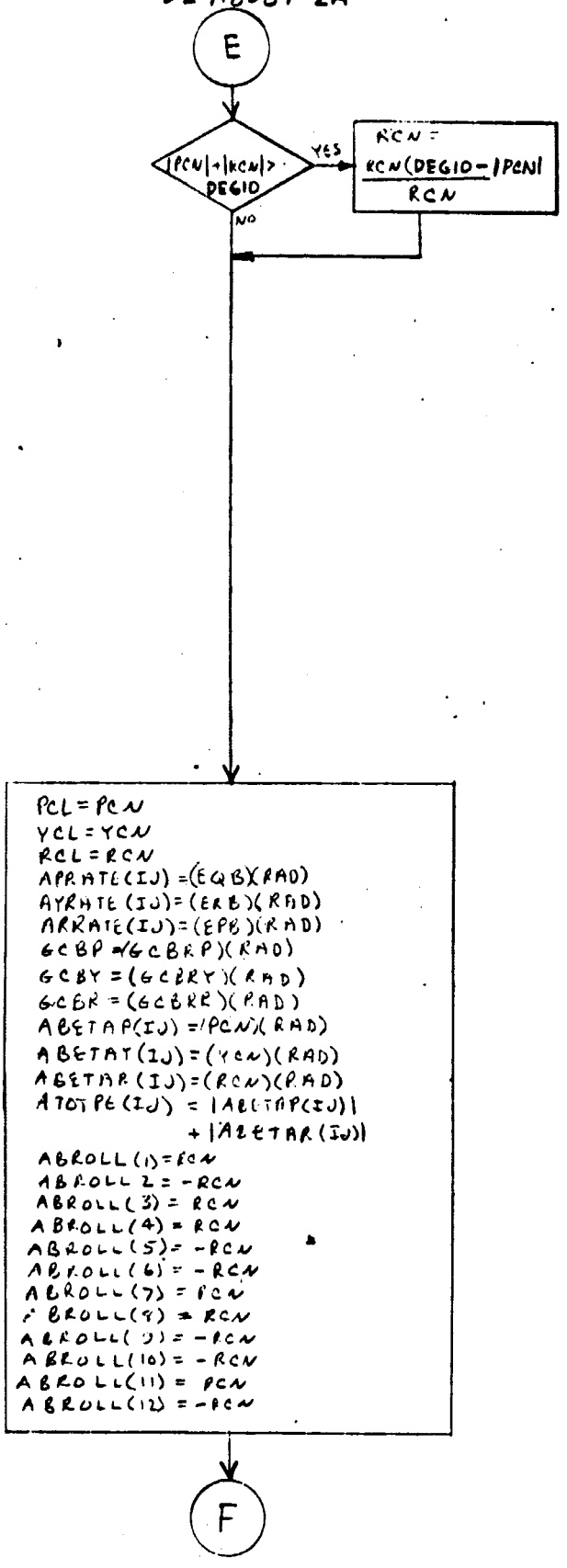


FIGURE A-13 CONT'D

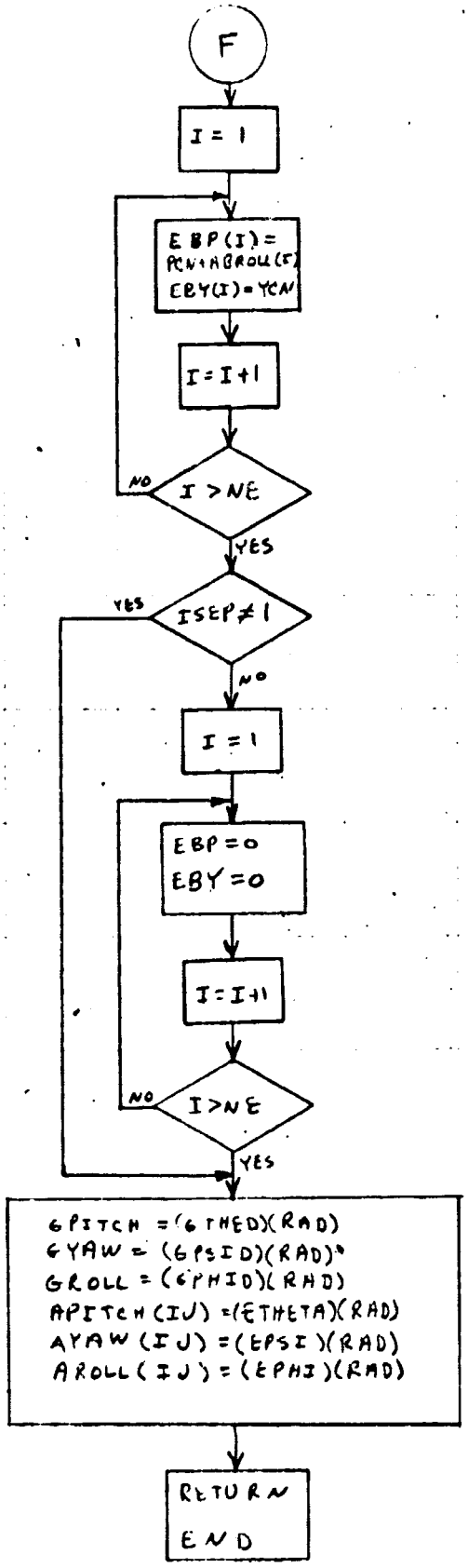
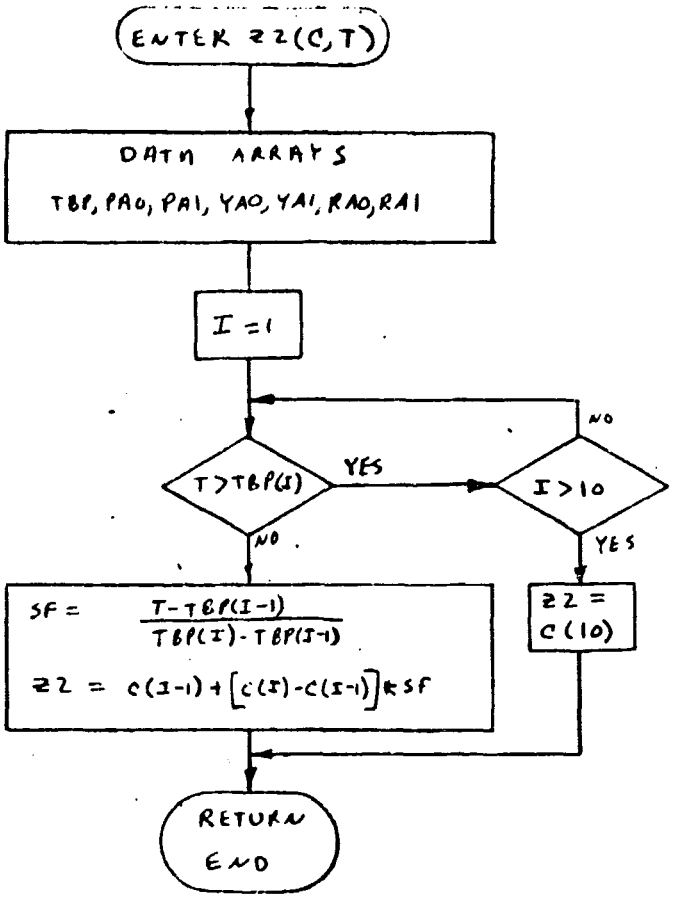


FIGURE A-13 CONT'D



NOTE: Z2 FUNCTION SUBROUTINE INTERPOLATES THE CONVENTIONAL AUTOPILOT GAIN TABLE WITH RESPECT TO GROUND ELAPSED TIME

FIGURE A-14 FLOW CHART OF Z2 FUNCTION SUBROUTINE

C3

TABLE XIV SYMBOL DEFINITIONS FOR AUTØP2 SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ABETAP(5)		Engine gimbal angle computed for pitch (3)	degrees
ABETAR(5)		Engine gimbal angle computed for roll (3)	degrees
ABETAY(5)		Engine gimbal angle computed for yaw (3)	degrees
ABPIT(12)		Pitch component of total pitch engine gimbal angle for booster (5)	radians
ABROLL(12)		Booster roll component of total pitch gimbal angle or orbiter roll component of total yaw gimbal angle (1)	radians
ABTOTP(12)		Total engine gimbal pitch angle (Booster) (5)	radians
ABTOTY(2)		Total engine gimbal yaw angle (Orbiter) (5)	radians
ABTT		Time of abort (5)	seconds
ABYAW(2)		Yaw component of total yaw engine gimbal angle for orbiter	radians
ACALMX(5)		Desired moment about X-body axis (5)	ft-lbs
ACALMY(5)		Desired moment about Y-body axis (5)	ft-lbs
ACALMZ(5)		Desired moment about Z-body axis (5)	ft-lbs
ACCLIM		Angular acceleration limit, .1745329 (5)	rad/sec^2
ACOMSM		Constant for "angular acceleration commanded to zero" test (5)	rad/sec^2
ACTALP(5)		Actual angular acceleration experienced (5)	rad/sec^2
ACTPAC(5)		Actual pitch angular acceleration experienced (5)	rad/sec^2
ACTRAC(5)		Actual roll angular acceleration experienced (5)	rad/sec^2
ACTYAC(5)		Actual yaw angular acceleration experienced (5)	rad/sec^2
ADESMX		(5)	
ADESMY		(5)	

C 3

TAVLE XIV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ADESMZ		5	
ADMASS(12)		Mass depleted per engine per .2 sec 1	slugs
ADMTOT		Total mass depleted per .2 sec 1	slugs
AFLOWB		Fuel flow rate of booster engine = 1021.27 8	lbs/sec
AFLOWO		Fuel flow rate of orbiter engine = 1021.27 8	lbs/sec
AFYMX(5)		Moment about X-body axis due to Y-body forces 5	lbs-ft
AFZMX(5)		Moment about X-body axis due to Z-body forces 5	lbs-ft
ALENGO		Length of orbiter vehicle = 148 5	feet
ALPHAC(5)		Angular acceleration commanded 5	rad/sec^2
ALPHPI(5)		Pitch angular acceleration commanded 5	rad/sec^2
ALPHRO(5)		Roll angular acceleration commanded 5	rad/sec^2
ALPHYA(5)		Yaw angular acceleration commanded 5	rad/sec^2
AMASCO		Mass cutoff for dry vehicle = 33,719.51 8	slugs
AMDOTV		Mass depletion rate 2	slugs/sec
AMINGA		Lower limit of again, = .35 5	unitless
AMINTB		Minimum total booster thrust = 44,000 5	lbs
AMINTO		Minimum total orbiter thrust = 8,000 5	lbs
AMTOT		Total vehicle mass remaining 2	slugs
ANGLDB		Angle deadband = 1.745329 5	radians
ANOAER		Per cent of max acceleration with no aero-dynamics 5	unitless
APDET		6	
APDIFT		6	

TABLE XIV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
APITCH(5)		Actual inertial attitude [1]	degrees
APRATE(5)		Body pitch rate [3]	deg/sec
ARATDB		Residual rotational rate deadband [5]	rad/sec
ARATE(5)		Rotational rate [3]	rad/sec
ARATLM		Angular rate limit = .05235987 [5]	rad/sec
ARCSPM		RCS pitch moment needed [3]	ft lbs
ARCSRM		RCS roll moment needed [3]	ft lbs
ARCSYM		RCS yaw moment needed [3]	ft lbs
ARDET		[6]	
ARDIFT		[6]	
AROLL(5)		Actual inertial roll angle [1]	degrees
ARRATE(5)		Body roll rate [5]	deg/sec
ATENG(12)		Engine thrust magnitude = 400,000 [5]	lbs
ATOTHR		Total engine thrust during present minor cycle [1]	lbs
ATOTPG(5)		Magnitude of total pitch & roll angles [3]	degrees
AUGRAV		Acceleration due to gravity at sea level [8]	ft/sec^2
AWDOT		Mass flow rate [1]	slugs/sec
AWDOTB		Mass flow rate of booster engines [1]	slugs/sec
AWDOTO		Mass flow rate of orbiter engines [1]	slugs/sec
AYAW(5)		Actual inertial yaw angle [1]	degrees
AYDET		[6]	
AYDIFT		[6]	
AYRATE(5)		Body yaw rate [3]	deg/sec

TABLE XIV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
C2		Cosine of actual inertial yaw angle (1)	unitless
C3		Cosine of actual inertial roll angle (1)	unitless
DEG01		1 degree constant = .01745329 (8)	radians
DEG08		(6)	radians
DEG09		(6)	radians
DEG10		10 degree constant = .1745329 (8)	radians
DFAB(4)		(5)	
DMAXB		(5)	
DMAYB		(5)	
DMAZB		(5)	
EAVPP(3)		(5)	
EBP(12)		Engine gimbal pitch angle (3)	radians
EBY(12)		Engine gimbal yaw angle (3)	radians
EL(12,3)		Booster engine locations (5)	ft
ELO(2,3)		Orbiter engine locations (5)	ft
EPA1		(5)	
EPB		Body roll rate (2)	rad/sec
EPBD		(5)	
EPE(12)		Per cent thrust due to engine out (2)	unitless
EPHI		Inertial roll angle (2)	radians
EPHID		(5)	
EPSI		Inertial yaw angle (2)	radians
EPSID		(5)	
EPT		Per cent engine thrust (2)	

TABLE XIV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EQB		Body pitch rate (2)	rad/sec
EQBD		(5)	
ERB		Body yaw rate (2)	rad/sec
ERBD		(5)	
ETHETA		Inertial pitch angle (2)	radians
ETHETD		(5)	
EVPP(3)		(5)	
GCBP		Body coordinate difference in present and past guidance pitch angle (3)	degrees
GCBR		Body coordinate difference in present and past guidance roll angle (3)	degrees
GCBRP		Body coordinate difference in present and past guidance pitch angle (1)	radians
GCBRR		Body coordinate difference in present and past guidance roll angle (1)	radians
GCBRY		Body coordinate difference in present and past guidance yaw angle (1)	radians
GCBY		Body coordinate difference in present and past guidance yaw angle (3)	degrees
GCIRP		Platform difference between present and past guidance pitch angle (1)	radians
GCIRR		Platform difference between present and past guidance roll angle (1)	radians
GCIRY		Platform difference between present and past guidance yaw angle (1)	radians
GM(4)		(5)	

TABLE XIV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
GPHID		Inertial roll angle requested from guidance 3	radians
GPITCH		Desired guidance pitch angle 3	degrees
GPSID		Inertial yaw angle requested from guidance 2	radians
GRLIMB		5	
GRLIMD		5	
GROLL		Desired guidance roll angle 3	degrees
GSTOPB		5	
GSTOPO		5	
GTHED		Inertial pitch angle requested from guidance 2	radians
GURP(4)		5	
GUYP(4)		5	
GUZP(4)		5	
GYAW		Desired guidance yaw angle 3	degrees
H1		Altitude 5	feet
I		Do loop counter 1	
IABT		5	
IBO		5	
IES		Engine start flag 2	
IJ		Autopilot pass counter 1	
IPITCH		Pitch acceleration calcualtion flag 5	discrete
IRESID		Residual rate calculation flag 5	discrete
IROLL		Roll acceleration calculation flag 5	discrete
ISEP		Vehicle separation flag 2	discrete
IYAW		Yaw acceleration calculation flag 5	discrete

TABLE XIV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
J		Pass counter [2]	
KGUID		Runn termination flag [5]	discrete
KP		[6]	
MANUAL		[5]	
NE		Number of vehicle engines [1]	unitless
NOENGB		Number of booster engines [2]	unitless
NOENGO		Number of orbiter engines [2]	unitless
P		Atomopheric pressure [5]	lbs/ft^2
PAO(10)		Pitch attitude gain [1]	unitless
PAL(10)		Pitch rate gain [1]	unitless
PBERR		Body pitch angle error [1]	radians
PBERRA		Past value of body pitch angle error [3]	unitless
PBIAS		Pitch bias due to cg offset and trim [1]	radians
PCL		Last TVC pitch command [2]	radians
PCN		New TVC pitch command [1]	radians
PHIGL		Past value of guidance roll angle [1]	radians
PI		π = 3.1415927 [8]	
PIERR		Inertial pitch angle error [1]	radians
PSIGL		Past value of guidance yaw angle [1]	radians
RAD		RAD = 57.295 [8]	deg/rad
RAO(10)		Roll attitude gain [1]	
RAI(10)		Roll rate gain [1]	unitless
RBERR		Body roll angle error [1]	radians
RBERRA		Past value of body roll angle error [3]	radians

TABLE XIV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
RCL		Last TVC roll command (2)	radians
RCN		New TVC roll command (1)	radians
RIERR		Inertial roll angle error (1)	radians
SEROT		(5)	
SETCGO		Angle between body X and thrust vector at launch (8)	radians
SGRAV		Acceleration due to gravity at launch pad	ft/sec^2
SMU		(5)	
SRMEAN		(5)	
S2		Sine on inertial yaw angle (1)	unitless
S3		Sine on inertial roll angle (1)	unitless
T		Time from launch (2)	unitless
TGOT		(5)	
THEGL		Past value of guidance pitch angle (1)	radians
THELST		Negative of last body pitch error (1)	radians
TRIM		Pitch trim angle (1)	radians
WEP(4)		Earth rotation rate (5)	rad/sec
YAO(10)		Yaw attitude gain (1)	
YA1(10)		Yaw rate gain (1)	
YBERR		Body yaw angle error (1)	radians
YBERRA		Past value of body yaw angle error (3)	radians
YCL		Last TVC yaw command (2)	radians
YCN		New TVC Yaw command (3)	radians
YIERR		Inertial yaw angle error (1)	radians
Z2		Array of control gain values	unitless

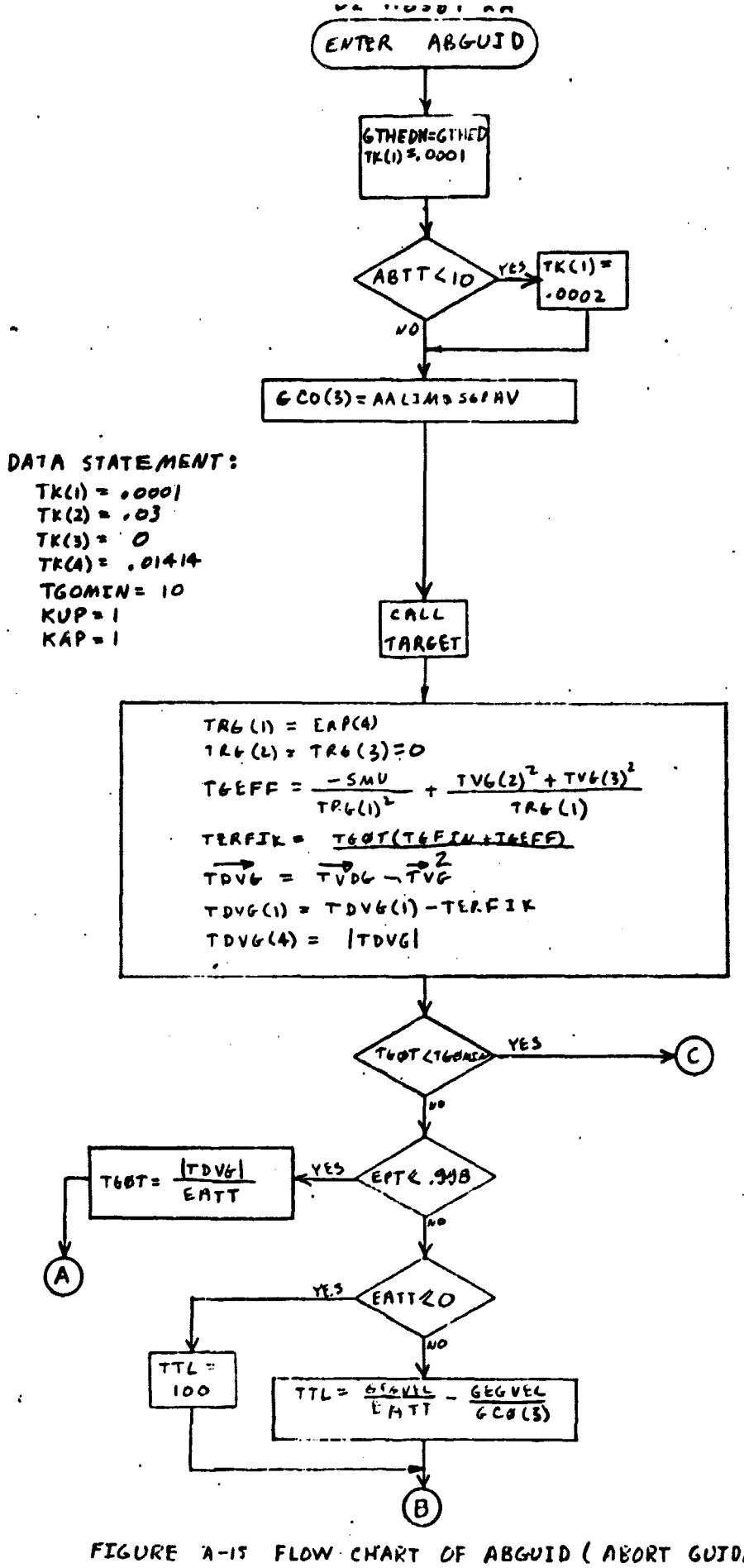


FIGURE A-15 FLOW CHART OF ABGUID (ABORT GUIDANCE) SUBROUTINE

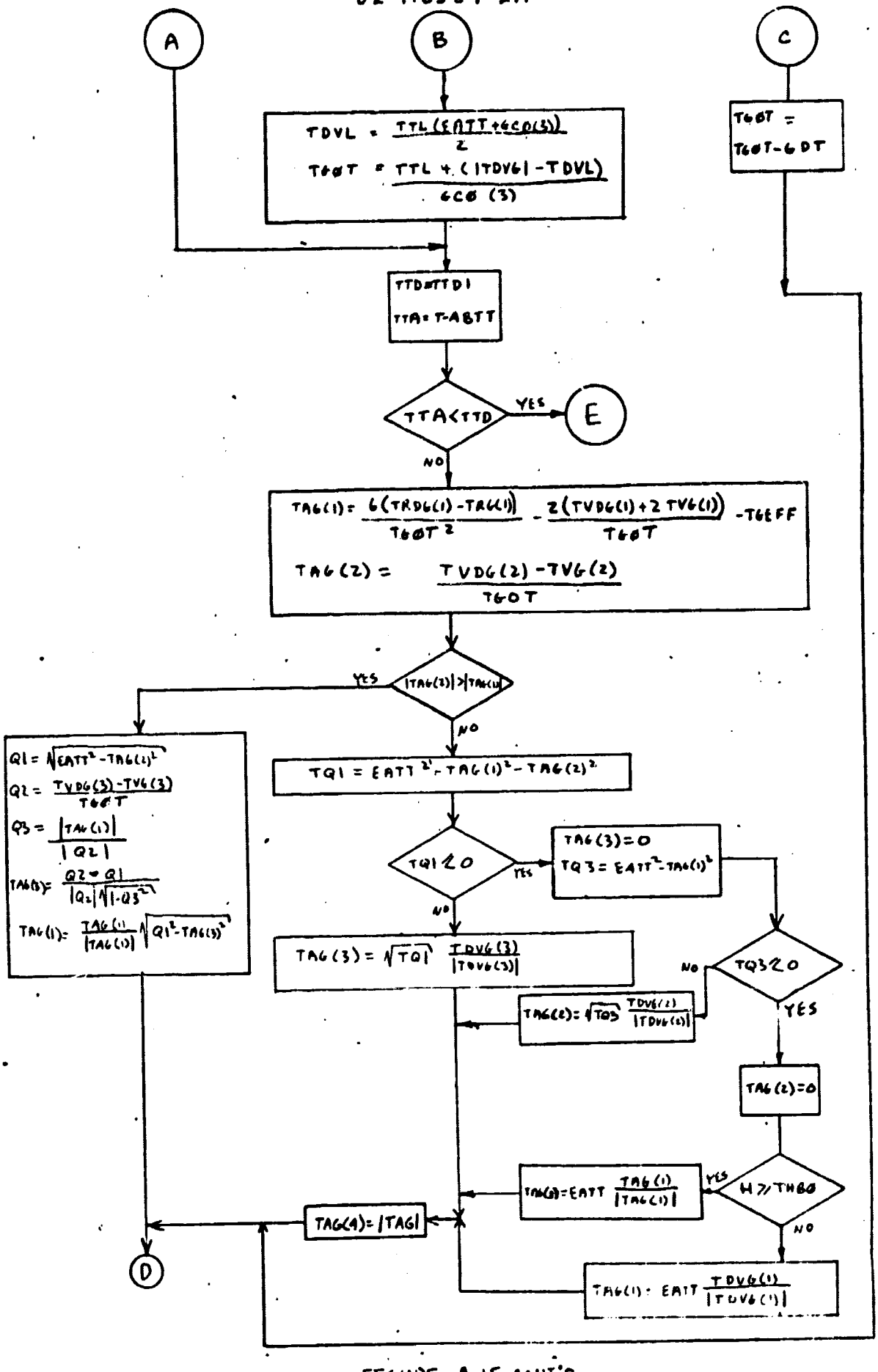


FIGURE A-15 CONT'D

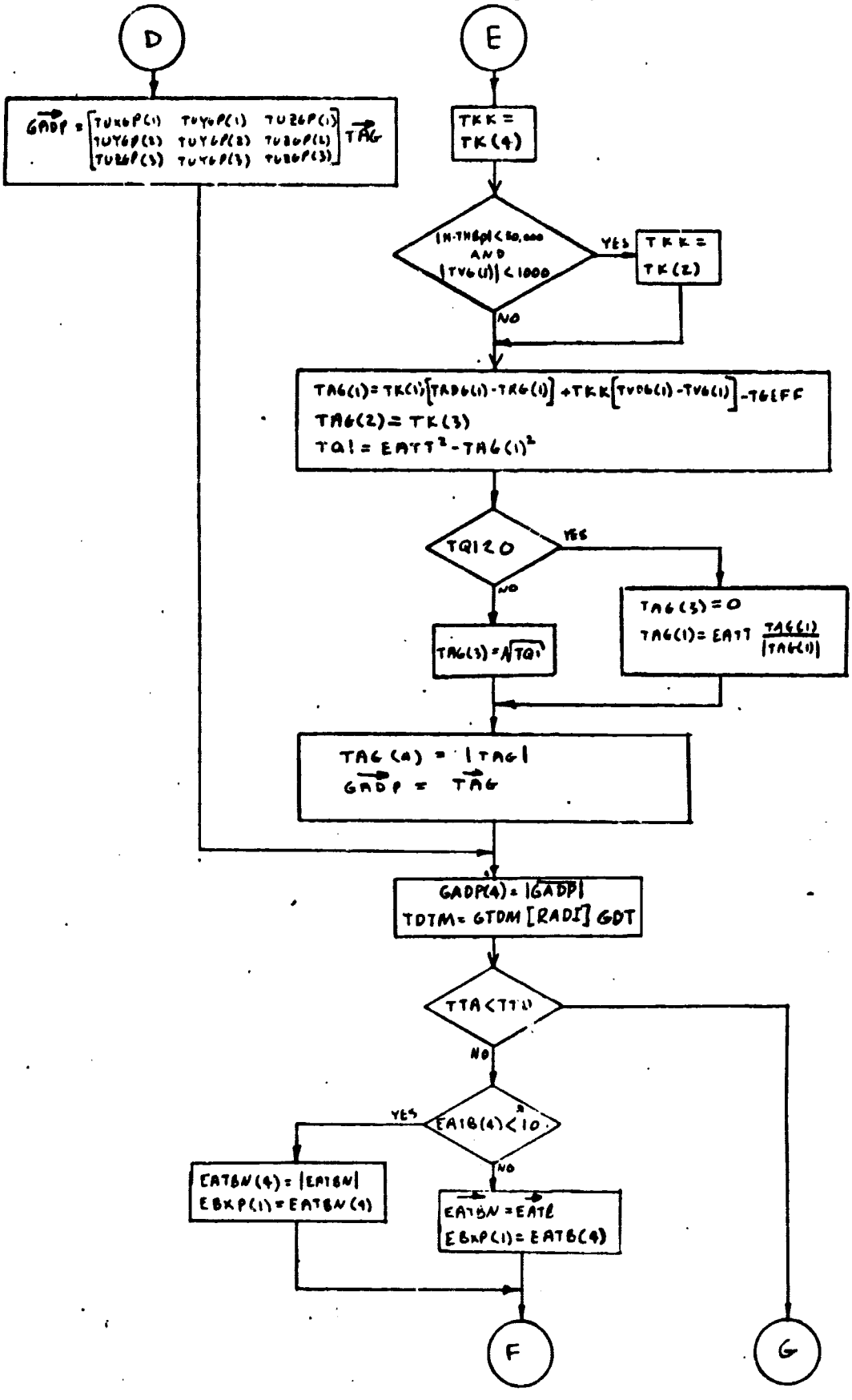


FIGURE A-15 CONT'D

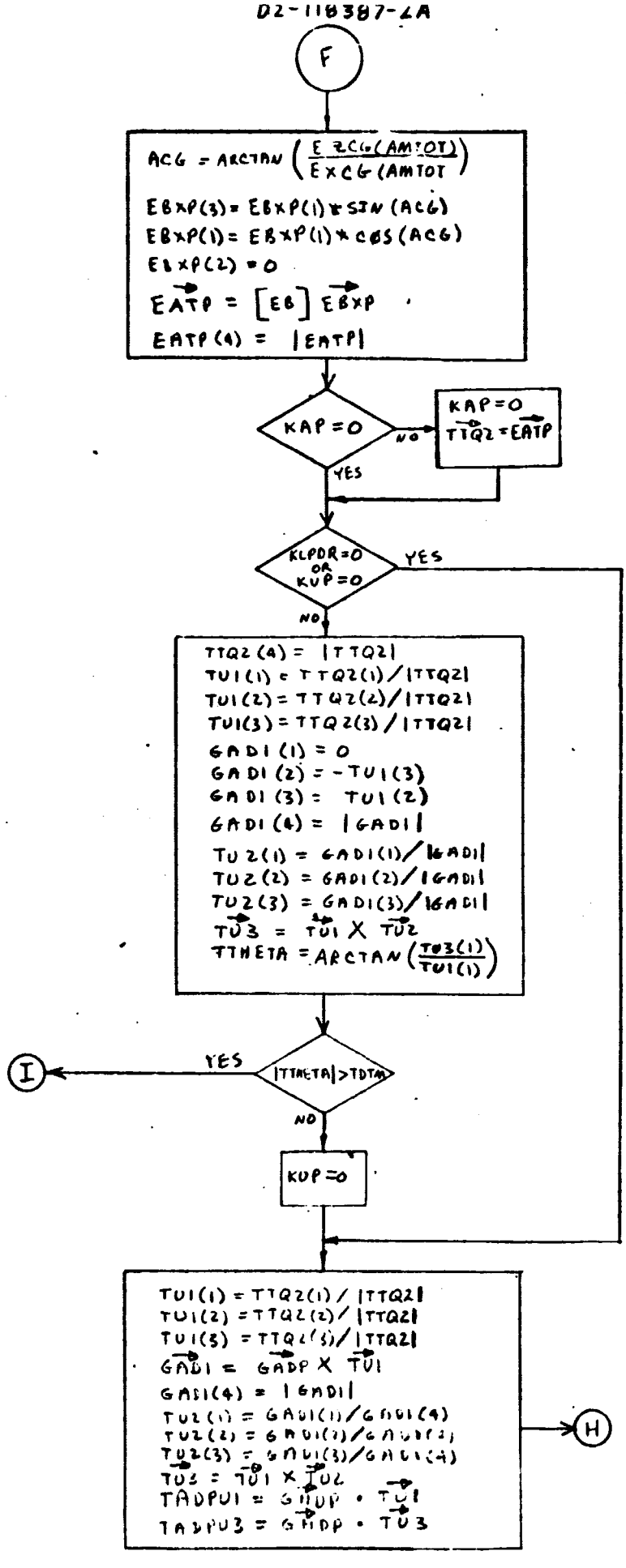


FIGURE A-15 CONT'D

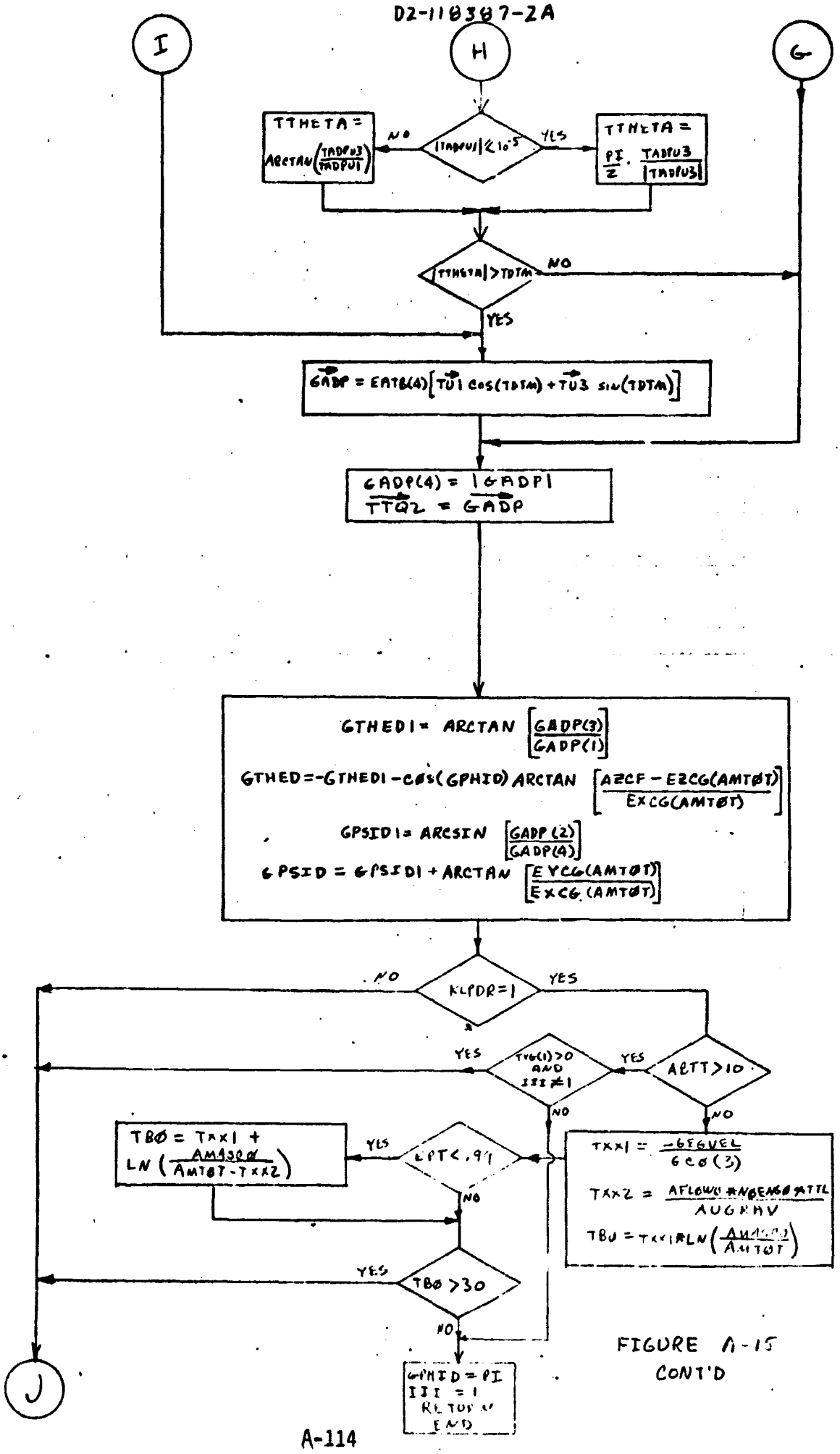


FIGURE A-15
CONT'D

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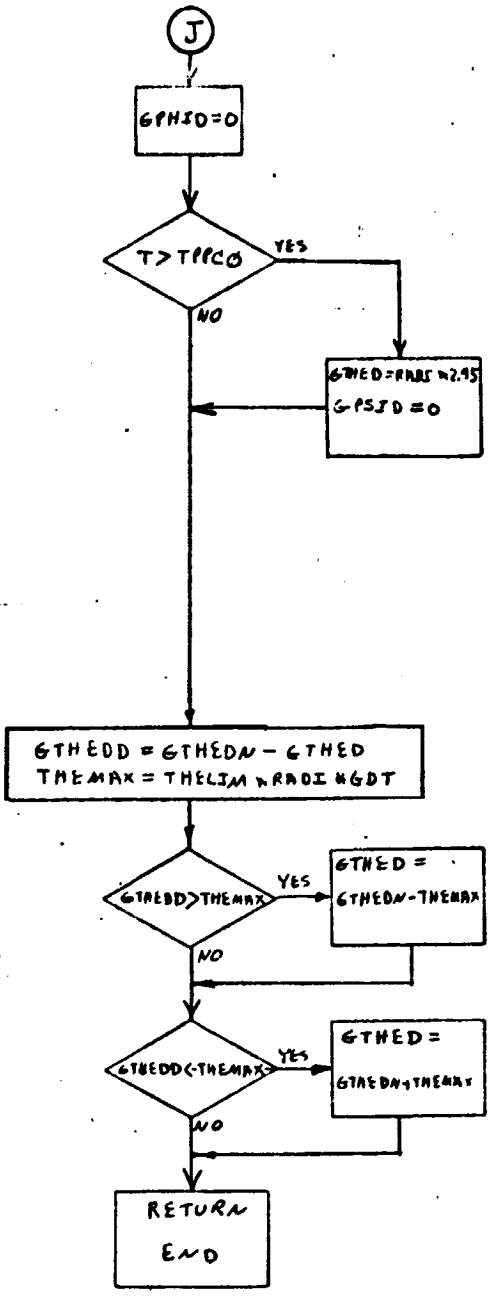


FIGURE A-15 CONT'D

TABLE A-XV SYMBOL DEFINITIONS FOR ABGUID (ABORT GUIDANCE) SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
AALIM		Orbiter maximum linear acceleration during abort [2]	gees
ABTT		Time selected for abort [2]	sec
ACG		Angle between thrust vector and body X-axis [1]	radians
ADMASS(12)		[5]	
ADMTØT		[5]	
AFLØWB		Booster engines fuel flow rate [2]	slugs/sec
AFLØWØ		Orbiter engines fuel flow rate [2]	slugs/sec
ALENGØ		Length of orbiter vehicle [5]	ft
ALPHA		Angle of attack [5]	deg
AMASCØ		[5]	
AMDØTV		[5]	
AMINTB		Minimum total booster thrust [5]	lbs
AMINTØ		Minimum total orbiter thrust [5]	lbs
AMTØT	M_T	Total remaining mass of the vehicle [2]	slugs
ARCSPM		Pitch moment commanded by RCS model [5]	ft lbs
ARCSRM		Roll moment commanded by RCS model [5]	ft lbs
ARCSYM		Yaw moment commanded by RCS model [5]	ft lbs
ATENG(12)		Engine thrust magnitude [5]	lbs
AUGRAV		[5]	
AZCF	Z_{CF}	Distance between body X-axis and the engine cluster center line along the body Z-axis [2]	ft
BETA		Sideslip angle [5]	deg
EATB(4)		Booster engine acceleration due to thrust [2]	lbs
EATBN(4)		Engine thrust in body coordinates [2]	lbs

TABLE A-XV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EATP(4)		Engine thrust in platform coordinates (1)	lbs
EATT		Total thrust acceleration (2)	ft/sec^2
EB(3,3)		Direction cosine matrix relating platform coordinates to body coordinates (2)	
EBP(12)		(5)	
EBPØ		(5)	
EBXP(4)		Engine thrust along body X in platform coordinates (1)	lbs
EBY(12)		(5)	
EGEFF		(5)	
EL(12,3)		(5)	
ELØ(2,3)		(5)	
EPE(12)		(6)	
EPHI		Euler roll angle (about X-axis) (5)	rad
EPHID		EPHI rate (5)	rad/sec
EPSI		Euler yaw angle (about Z-axis) (5)	
EPSID		PSI rate (5)	rad/sec
EPT		Fractional throttle setting (2)	
ERP(4)	$\bar{R}_p$	Present vehicle position vecotr expressed in vehicle inertial or platform coordinates (2)	ft
ETHETA		Euler pitch angle (about Y-axis) (5)	rad
ETHETD		ETHETA Rate (5)	Rad/sec.
ETSLB(12)		(5)	
ETSLØ1		(5)	
ETSLØ2		(5)	

TABLE A-XV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EVP(4)	$\overline{V}_p$	Present vehicle velocity vector expressed in vehicle inertial or platform coordinates [2]	ft/sec
EXCG (AMTØT)	X_{CG}	Displacement of the vehicle center of gravity along body X-axis as a function of vehicle mass [2]	ft
EYCG (AMTØT)	Y_{CG}	Displacement of the vehicle center of gravity along body Y-axis as a function of vehicle mass [2]	ft
EZCG (AMTØT)	Z_{CG}	Displacement of the vehicle center of gravity along body Z-axis as a function of vehicle mass [2]	ft
GADP(4)	$\overline{A}_{DP}$	Desired vehicle acceleration vector expressed in vehicle inertial or platform coordinates [3]	ft/sec^2
GAD1(4)		Desired acceleration in thrust coordinates [1]	ft/sec^2
GCØ(3)	A_L	GCØ(1) is [5], GCØ(2) is [5] and GCØ(3) = 96.43965 [2]	ft/sec^2
GDT		[5]	
GDTV		[6]	
GEGVEL	V_e	Engine exhaust gas velocity [2]	ft/sec
GM(4)		[5]	
GPHID	ϕ_D	Inertial roll angle desired [3]	rad
GPSID	Ψ_D	Inertial yaw angle (angle between body X-axis and vehicle inertial or platform XZ plane) [3]	rad
GPSID1	Ψ_{D1}	Angle between desired thrust acceleration vector and vehicle inertial or platform XZ plane [1]	rad
GTDM		Abort pitchover pitch rate limit [2]	ft/sec^2

TABLE A-XV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
GTHED	θ_D	Inertial pitch angle (angle between body X-axis and vehicle inertial or platform X-axis) 3	rad
GTHEDD		Commanded inertial pitch angular rate 1	rad/sec
GTHEDN		Past value of GTHED 1	rad
GTHED1	θ_{D1}	Angle between desired thrust acceleration vector and vehicle inertial or platform X-axis 1	rad
GURP(4)		5	
GUYP(4)		5	
GUZP(4)		5	
H		Altitude 2	ft
I		Internal Counter 1	discrete
IABT		IABT = 1 after abort is begun 5	discrete
IBØ		6	
IES		Engine off discrete 2	
IGMT		6	
III		Rollout Flag 1	discrete
ISEP		5	
JUMP		5	
K		Do loop counter 1	
KAP		First pass flag 1	discrete
KGUID		Run terminate flag 2	discrete
KLPDR		KLPDR = 1 for abort to pad 2	discrete
KUP		First pass flag 1	discrete

TABLE A-XV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
MACH1		Mach number 5	unitless
NOENGB		Number of booster engines 2	
NOENGO		Number of orbiter engines 2	
PI	π	PI = 3.14159265 2	rad
QDOT		Heating rate 5	BTU/ft^2 sec
QUE		Dynamic Pressure 5	lbs/ft^2
Q1		ABGUID scratch variable 1	
Q2		ABGUID scratch variable 1	
Q3		ABGUID scratch variable 1	
RAD		5	
RADI		5	
SERØT		5	
SGRAV		5	
SMU	u	Gravitational constant (SMU = 14.07654 X 10^{15}) 2	ft^3/sec^2
SRD		5	
SRMEAN	R_E	Mean earth radius 2	ft
SUQ(4)		5	
SYD		5	
T		Ground elapsed time 2	sec
TADPU1		ABGUID scratch variable 1	
TADPU3		ABGUID scratch variable 1	
TAG(4)	$\ddot{R}_G, \ddot{Y}_G, \ddot{Z}_G$	Desired acceleration vector expressed in guidance or plumbline coordinates 3	ft/sec^2

TABLE A-XV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TBO		Time until engine burnout [1]	seconds
TDTM		Abort pitchover pitch rate limit [1]	rad/sec
TDVG (4)	$\dot{R}_G, \dot{Y}_G, \dot{Z}_G$	Desired velocity to be gained vector expressed in guidance or plumbline coordinates [3]	ft/sec
TDVL	V_{GL}	Intermediate symbol used in computing time-to-go (GTGØ) [1]	
TERFIK	g_{AV}	Intermediate symbol denoting average effective gravity acting on vehicle used in computing radial velocity to be gained (TDVG(1)) [1]	ft/sec^2
TF		Earth flattening constant [5]	unitless
TGEFF	g_{eff}	Effective gravity acting on vehicle during abort [3]	ft/sec^2
TGFIN	g_{fin}	Effective gravity at vehicle burnout or target velocities during abort [2]	ft/sec^2
TGØMIN		Minimum calculated time-to-go [2]	sec
TGØT		Estimated time to be at target [3]	sec
THBØ		Altitude of abort target [2]	
THELIM		Abort pitch rate limit [2]	deg/sec
THEMAX		Abort pitch rate limit [1]	rad/sec
TK(4)		Guidance weighting factors [2]	unitless
TKK		Guidance weighting factor [1]	unitless
TLAT		Latitude of landing site [2]	radians
TLONG		Longitude of landing site [2]	radians
TPPCO		Time for flight on pitch profile during abort [2]	sec
TQI		Intermediate variable used in computing $\dot{Z}$ desi-desired [1]	

TABLE A-XV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TQ3		Intermediate variable used in computing $\dot{Y}$ desired [1]	
TRDG(4)	R_D, Y_D, Z_D	Vector representing the position of the target in guidance or plumbline coordinates [2]	ft
TRG(4)	R,Y,Z	Present position vector expressed in guidance or plumbline coordinates [1]	ft
TRLSE(4)		Landing site position in rotating earth coordinates [5]	ft
TRLSP(4)		Landing site position in platform coordinates [5]	ft
TT(6)		Conversion matrix relating coast angle, reentry angle of attack and burnout velocity [5]	unitless
TTA		Time from start of abort [1]	sec
TTD		Time for open loop guidance during abort [1]	sec
TTD1		Time for open loop guidance during abort [2]	sec
TTHETA		Angle between X-body axis and desired guidance acceleration [1]	radians
TTL	T_{FL}	Time until thrust will be limited due to thrust acceleration constraint [1] [3]	sec
TTQ2(4)		Past value of desired thrust vector [1]	
TUXGP	$\hat{U}_{XGP}$	Unit vector describing guidance or plumbline X-axis in vehicle inertial or platform coordinates [2]	
TUYGP(4)	$\hat{U}_{VGP}$	Unit vector describing guidance or plumbline Y-axis in vehicle inertial or platform coordinates [2]	
TUZGP(4)	$\hat{U}_{ZGP}$	Unit vector describing guidance or plumbline Z-axis in vehicle inertial or platform coordinates [2]	

TABLE A-XV (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TU1(3)		Unit vector along existing thrust direction [1]	unitless
TU2(3)		Unit vector perpendicular to intersection of desired and existing thrust direction [1]	unitless
TU3(3)		$\vec{TU3} = \vec{TU1} \times \vec{TU2}$ [1]	
TVBO		Burnout velocity during abort targeting [5]	ft/sec.
TVBØN		[5]	
TVDG	$\dot{R}_D, \dot{Y}_D, \dot{Z}_D$	Velocity vector of the target expressed in guidance or plumbline coordinates [2]	ft/sec
TVG(4)	$\dot{R}, \dot{Y}, \dot{Z}$	Present velocity vector of the vehicle expressed in guidance or plumbline coordinates [3]	ft/sec
TWEP(4)		Angular rate of earth in platform coordinates [5]	rad/sec
TXX1		Intermediate variable [1]	
TXX2		Intermediate variable [1]	
UXTP(3)		[5]	
UYTP(3)		[5]	
UZTP(3)		[5]	
VA(4)		Relative velocity in platform coordinate [5]	ft/sec
VAB(4)		Relative velocity in body coordinate [5]	ft/sec

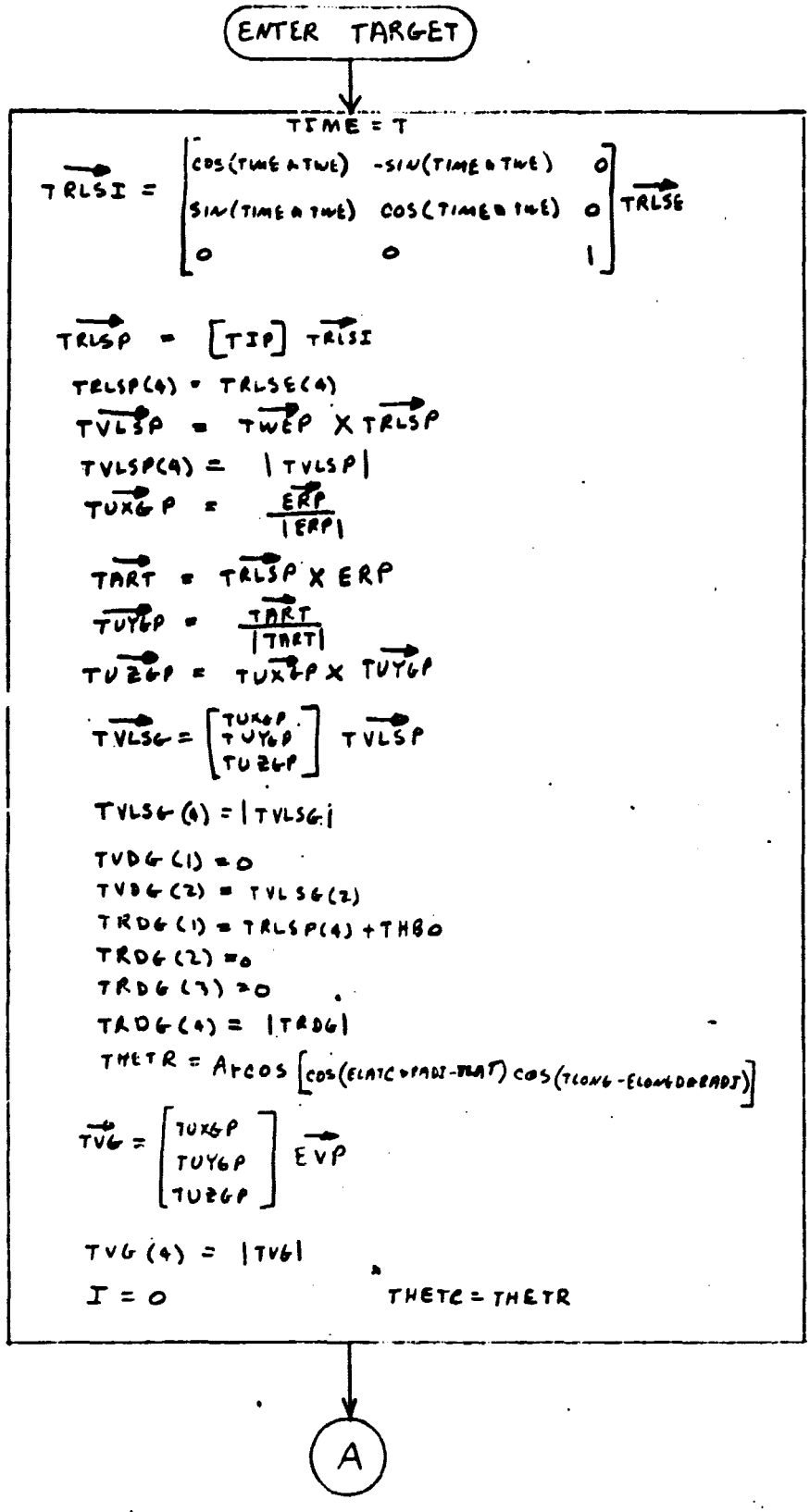


FIGURE A-16 FLOW CHART OF TARGET SUBROUTINE

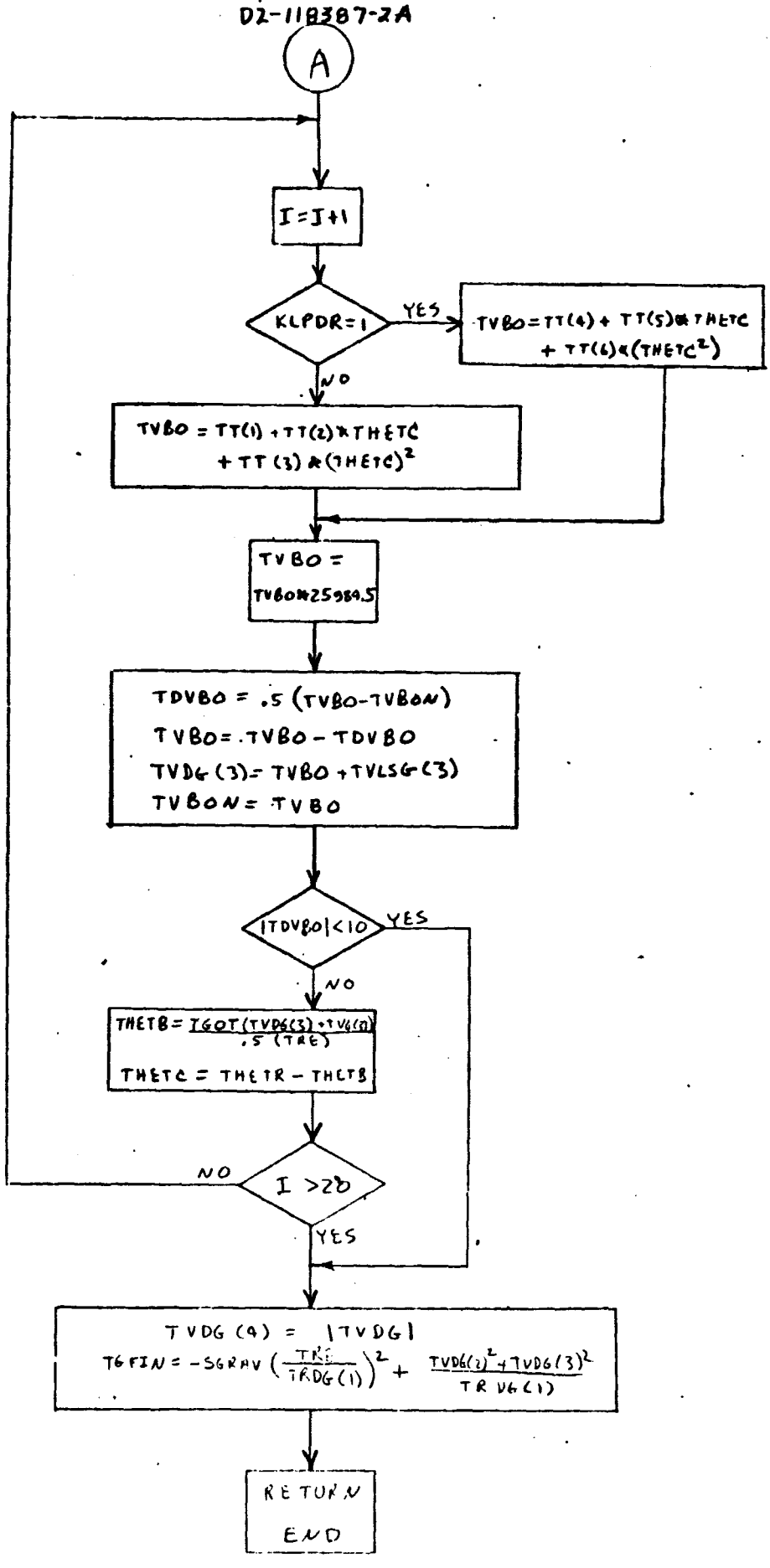


FIGURE A-16 CONT'D

TABLE A-XVI SYMBOL DEFINITIONS FOR ABORT TARGET SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ABTT		Time selected for abort [2]	sec
AZCF		[5]	
EATT	A_1	Magnitude of thrust acceleration [2]	ft/sec^2
EAVP(4)		[5]	
EB(3,3)		Direction cosine matrix relating body coordinates to platform coordinates [2]	
EBPØ		[5]	
EG		Acceleration due to gravity [5]	ft/sec^2
EGEFF		[5]	
ELATC		Geocentric latitude of launch site [2]	deg
ELONGD		Geodetic longitude of launch site [2]	deg
ERP(4)		Platform position vector [2]	ft
ETSLB(12)		[5]	
ETSLØ1		[5]	
ETSLØ2		[5]	
EVP(4)		Inertial Velocity in inertial coordinates [2]	
GADP(4)	A_{DP}	Desired vehicle acceleration expressed in vehicle inertial or platform coordinates [5]	ft/sec^2
GDTV		[6]	
GEGVEL		[5]	
GM(4)		[5]	
GPHID	ϕ_D	Inertial roll angle desired [5]	rad.
GPSID	ψ_D	Inertial yaw angle desired [5]	rad.
GTHED	Θ_D	Inertial pitch angle desired [5]	rad.

TABLE A-XVI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
GRUP(4)		5	
GUYP(4)		5	
GUZP(4)		5	
I		Internal counter 1	discrete
IABT		IABT = 1 after abort is begun 5	discrete
IGMT		6	
JUMP		5	
KGUID		Run terminate flag 5	discrete
KLPDR		KLPDR = 1 for abort to launch pad 2	discrete
PI		5	
RAD		5	
RADI		5	
SGRAV		5	
SLAT1		Latitude of launch pad 5	degrees
SLONG1		Longitude of launch pad 5	degrees
SMU	u	Gravitational constant (SMU = 14.07654) 2	ft^3/sec^2
T		Ground elapsed time 2	sec
TAE		6	
TAG(4)	A_{DG}	Desired vehicle acceleration expressed in guidance or plumbline coordinates 2	ft/sec^2
TART(4)		Intermediate variable used in computing unit vector and burnout velocity 1	
TDVBØ		Delta burnout velocity used in computing burnout velocity 1	ft/sec

TABLE A-XVI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TDVG(4)	$\dot{R}_G, \dot{Y}_G, \dot{Z}_G$	Desired velocity vector to be gained, expressed in guidance or plumbline coordinates [2]	ft/sec
TF		Earth flattening constant (TF = .00335233) [2]	
TGFIN	g_{fin}	Effective gravity at targeted velocities [3]	ft/sec^2
TGØT	T_{GO}	Same as TGØ except that it is used to initialize TARGET and used in MASTER to test time-to-go during abort [2] [3]	sec
THBØ	H_{BO}	Target altitude desired for engine cutoff during abort [2]	ft
THETB	θ_B	An estimate of the earth's central angle traversed to reach engine off during an abort (burn angle) [1]	rad
THETC	θ_C	An estimate of the central angle traversed after engine cutoff and attainment landing site latitude and longitude (coast angle) [1]	rad
THETR	θ_R	Earth's central angle between radial vectors passing through the vehicle and landing site [1]	rad
TIME	T	Ground elapsed time (same as T) [1]	sec
TIP(3,3)		Transformation matrix relating vehicle earth inertial and vehicle inertial or platform coordinates [2]	
TLAT	λ_{LS}	Latitude of landing site [5]	rad
TLAT1		Latitude of landing site [5]	degrees
TLØNG	ϕ_{LS}	Longitude of landing site [2]	rad
TLONG1		Longitude of landing site [5]	degrees
TRDG(4)	R_D, Y_D, Z_D	Position vector of targeted engine shutdown in guidance or plumbline coordinates [3]	ft

TABLE A-XVI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TRE	R_E	Radius of the earth at launch site (same as SRMEAN) [2]	ft
TRLSE(4)	$\overline{R}_{LSE}$	Landing site expressed in rotating earth coordinates [1]	ft
TRLSI(4)	$\overline{R}_{LSI}$	Landing site expressed in inertial earth coordinates [1]	ft
TRLSP(4)	$\overline{R}_{LSP}$	Landing site expressed in vehicle inertial or platform coordinates. [1] [4]	ft
TT(6)		Conversion matrix relating coast angle, reentry angle of attack, and burnout velocity [2] [1]	
TTL		Estimate time to thrust limiting (forward acceleration control) [2]	sec
TUXGP(4)	$\hat{U}_{XGP}$	Unit vector describing guidance or plumbline X-axis in vehicle inertial or platform coordinates [3]	
TUYGP(4)	$\hat{U}_{YGP}$	Unit vector describing guidance or plumbline Y-axis in vehicle inertial or platform coordinates [3]	
TUZGP(4)	$\hat{U}_{ZGP}$	Unit vector describing guidance or plumbline Z-axis in vehicle inertial or platform coordinates [3]	
TVBØ	$\dot{V}_{BO}$	Relative velocity (Ż) of vehicle desired at engine shutdown (burnout velocity) [1]	ft/sec
TVBØN		Past value of TVBØ [2] [1]	ft/sec
TVDG(4)	$\dot{R}_D, \dot{Y}_D, \dot{Z}_D$	Velocity vector desired at engine shutdown at abort target (earth rotation effects are computed at landing site) [3]	ft/sec
TVG(4)	$\dot{R}, \dot{Y}, \dot{Z}$	Present vehicle velocity expressed in guidance or plumbline coordinates [2]	ft/sec
TVLSG(4)	$\overline{V}_{LSG}$	Velocity vector resulting from earth rotation at landing site expressed in guidance or plumbline coordinates	ft/sec

TABLE A-XVI (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TVLSP(4)	$\overline{V}_{LSP}$	TVLSG expressed in vehicle inertial or platform coordinates [1]	ft/sec
TWE	We	Angular velocity of earth rotation (same as SEROT; TWE = 7.292115×10^{-5}) [2]	rad/sec
TWEP(3)	$\overline{We}p$	Vector quantity of TWE expressed in vehicle inertial or platform coordinates [2]	rad/sec

DATA BLOCK :

PALPMI = 22
PDT = 1
PVBAC1 = 0
PBAD = 10
PHPB(1) = 150,000
PHPB(2) = 100,000
PVPB(1) = 7,800
PVPB(2) = 1,860
ALPHA1(1) = 50
ALPHA1(2) = 50
ALPHA2(1) = 27.5
ALPHA2(2) = 35
ALPHA3(1) = 23
ALPHA3(2) = 23
PGMAX(1) = 3
PGMAX(2) = 2
PH1 = 195,000
PALPD1 = 5
PALPD2 = 1
PALPD3 = 5
PALPD4 = .5
PALPD5 = .5
PBIAS = 0
PGMAX2(1) = 1.8
PGMAX2(2) = 1.8
PTHEC = 25
PHLIM = 220,000
III = 1

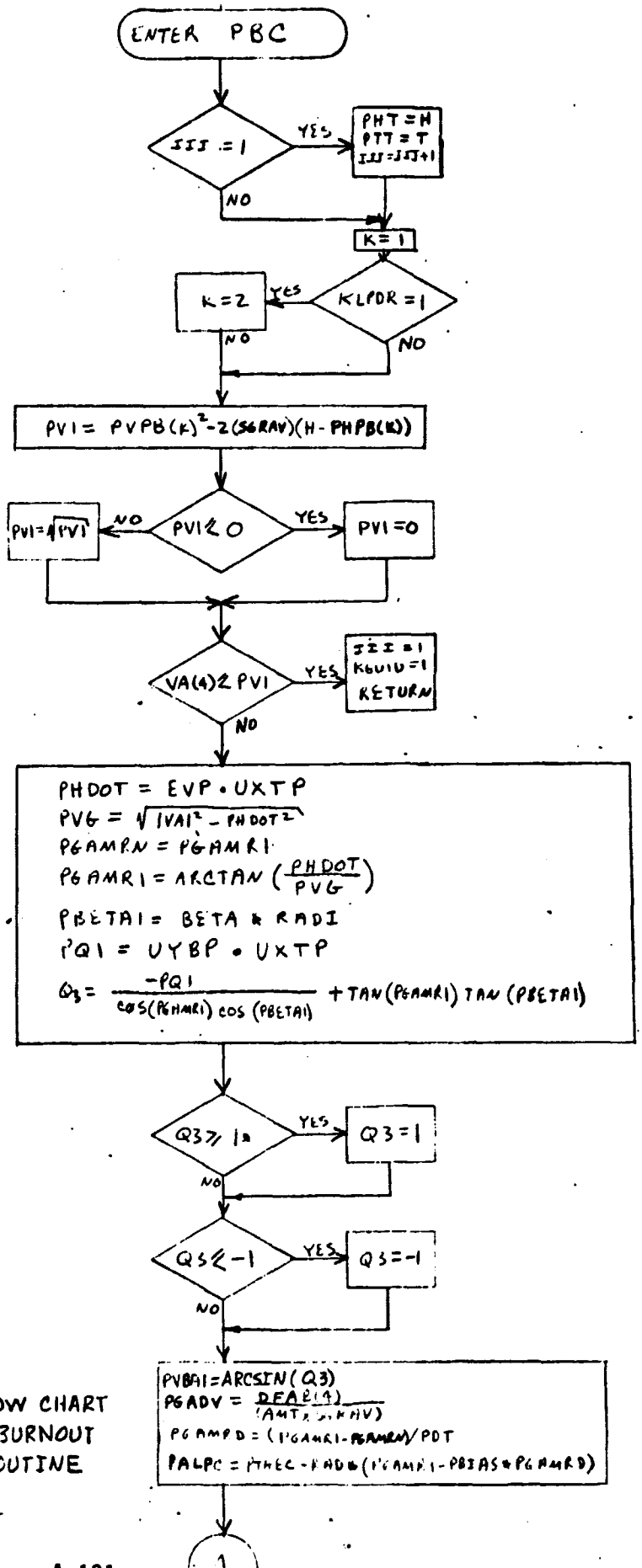


FIGURE A-17 FLOW CHART OF PBC (POST BURNOUT CONTROL) SUBROUTINE

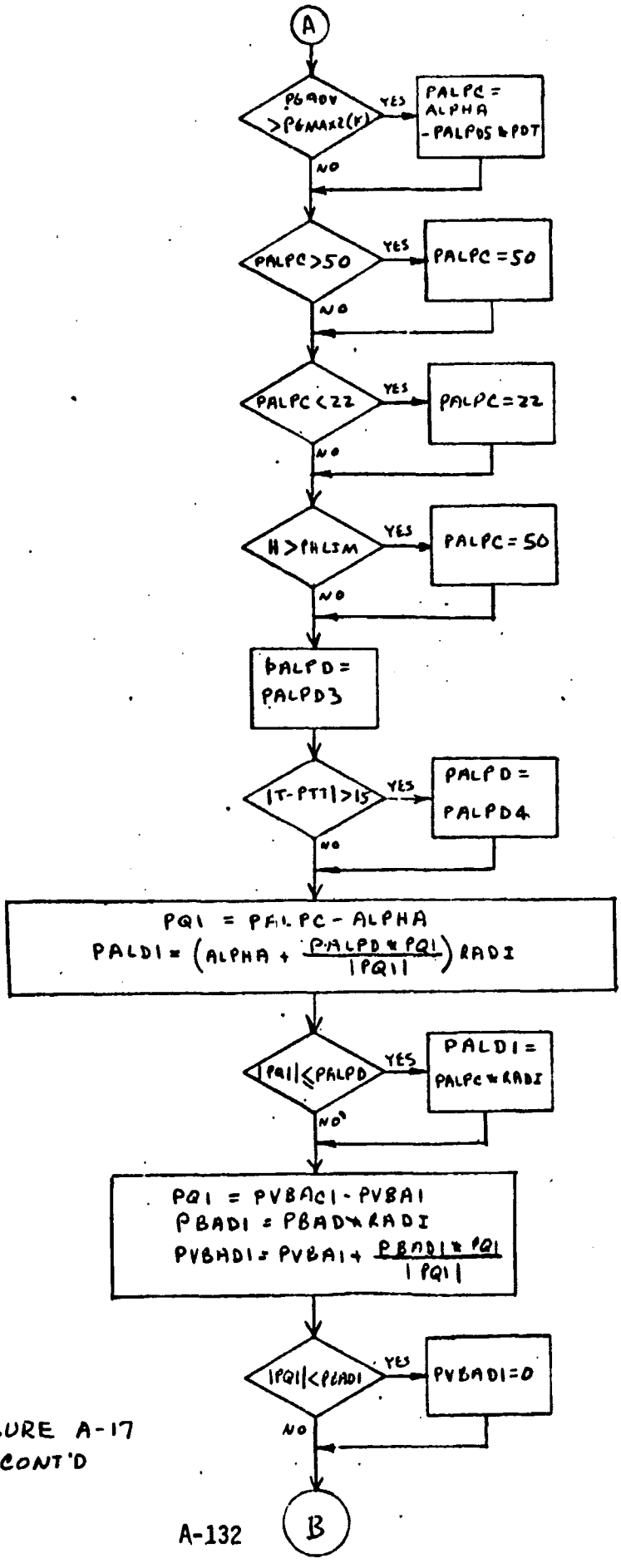


FIGURE A-17
CONT'D

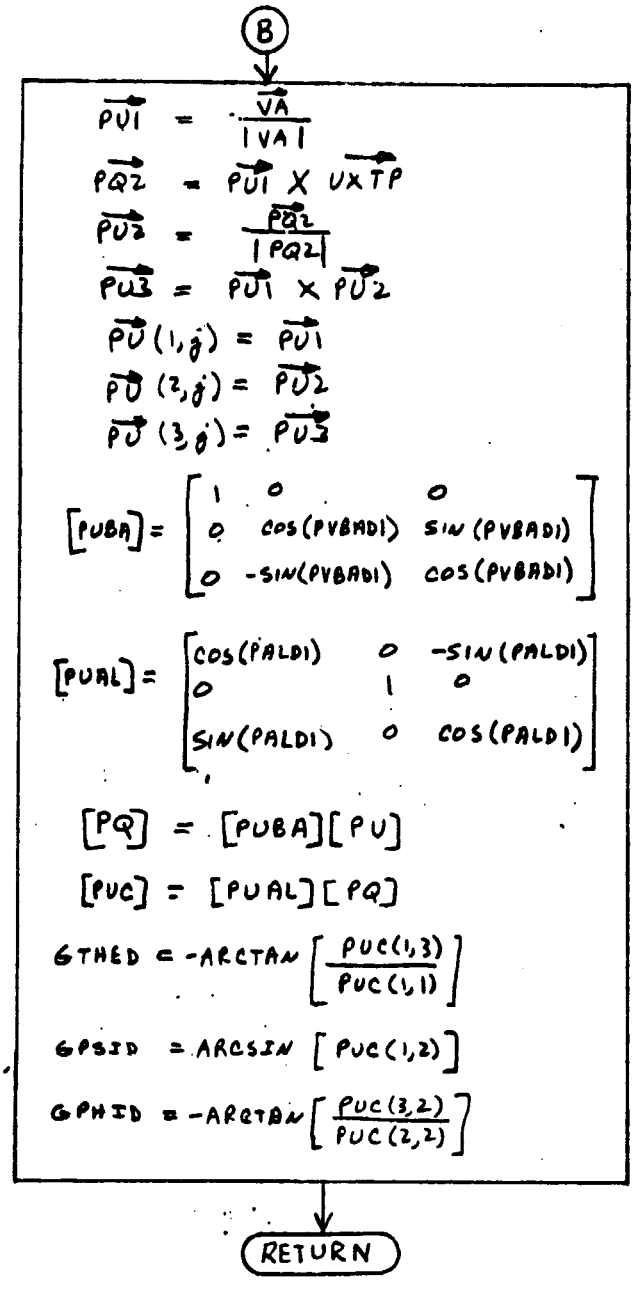


FIGURE A-17 CONT'D

TABLE XVII SYMBOL DEFINITION FOR POST BURNOUT CONTROL SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
ABTT		Time selected for abort 2	sec
ADMASS(12)		Mass depleted per engine per .2 sec. 5	slugs
ADMTOT		Total mass depleted per .2 sec 5	slugs
ALPHA		Angle of attack 2	degrees
ALPHA1(2)		6	
ALPHA2(2)		6	
ALPHA3(2)		6	
AMSCO		Mass of the vehicle at fuel depletion 5	slugs
AMDOTV		Mass depletion rate 5	
AMT		Total mass of the vehicle 2	
ATOTHR		Total engine thrust during present minor cycle 5	
AUGRAV		Acceleration of gravity at sea level =32.17404 2	ft/sec^2
AZCF		Distance between body X axis and the engine cluster centerline along the body Z axis 5	ft
BETA		Sideslip angle 2	degrees
DFAB(4)		Forces due to aerodynamics in body coordinates 2	lbs
DMAXB		Aero moment about body X axis 5	ft-lbs
DMAYB		Aero moment about body Y axis 5	ft-lbs
DMAZB		Aero moment about body Z axis 5	ft-lbs
EGEFF		Effective gravity 5	ft/sec^2
ERP(4)		Present inertial vehicle position 5	ft
EVP(4)		Present inertial vehicle velocity 5	ft/sec^2
GDTV		6	ft/sec^2
GEGVEL		Engine exhaust gas velocity 5	ft/sec
GM(4)		Gravity vector, platform coordinates 5	ft/sec^2
GPAID		Inertial roll angle 3	radians
GPSID		Inertial yaw angle 3	radians
GTHED		Inertial pitch angle 3	radians
GUXP(4)		Guidance X unit vector 5	unitless
GUYP(4)		Guidance Y unit vector 5	unitless
GUZP(4)		Guidance Z unit vector 5	unitless

TABLE XVII (Continued)

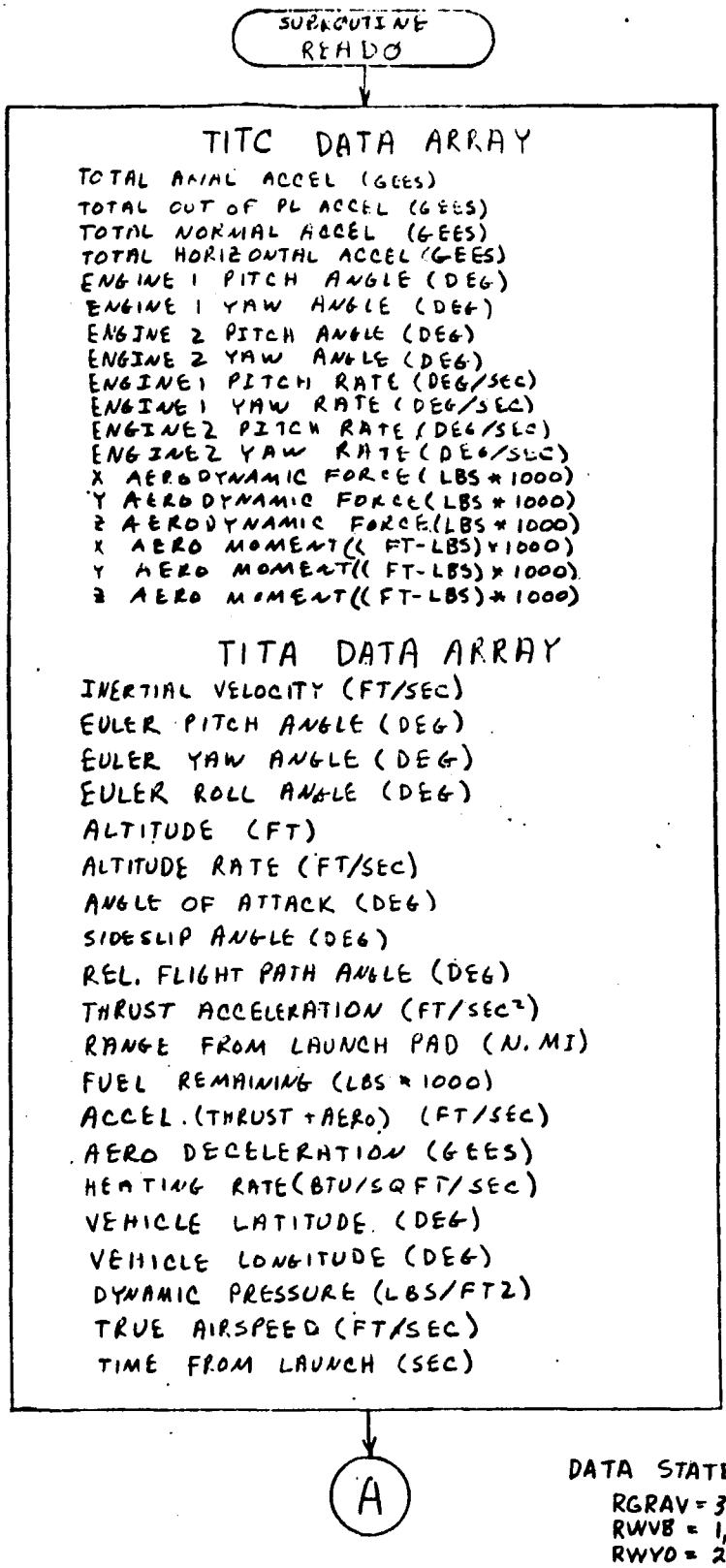
CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
H		Altitude [2]	ft
HI		Altitude [5]	ft
IABT		IABT=1 after abort is begun [5]	discrete
IGMT		[6]	
III		III=1 for first pass thru PBC [1]	discrete
J		Pass counter [1]	
K		K=KLPDR+1 [1]	discrete
KACOTC		[6]	
KGUID		Program terminate flag [3]	discrete
KLPDR		KLPDR = 1 for abort to pad [1]	discrete
MACH 1		[6]	
P		Ambient atmospheric pressure [5]	lbs/ft^2
PALDI		Angle of attack commanded by PBD [1]	radians
PALPC		Angle of attack commanded after initial pitch-over [1]	deg
PALPD		Angle of attack rate limit [1]	deg/sec
PALPD1		[6]	
PALPD2		[6]	
PALPD3		Angle of attack rate limit for 15 seconds after burnout [1]	deg/sec
PALPD4		Angle of attack rate limit after 15 seconds into coast [1]	deg/sec
PALPD5		Angle of attack rate command when load factor is exceeded [1]	deg/sec
PALPMI		[6]	
PBAD		Bank angle rate limit [1]	deg
PBAD1		Bank angle rate limit [1]	radians
PBETA1		Sideslip angle [1]	radians
PBIAS		Gamma offset, PBIAS = 0 [1]	unitless
PDT		Post-burnout cycle time [1]	seconds
PGADV		Aero deceleration [1]	gees
PGAMRD		Flight path angle rate [1]	rad/sec
PGAMRN		Past value of flight path angle [1]	radians

TABLE XVII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
PGAMR1		Present value of flight path angle [1]	radians
PGMAX (2)		[6]	
PGMAX2 (2)		[6]	
PHDOT		Altitude rate [1]	ft/sec
PHLIM		Altitude limit [1]	ft
PHPB (2)		Terminal altitude constraint [1]	ft
PHT		Altitude at burnout [1]	
PHI		[6]	
PI		= 3.1415926536 [2]	
PQ(3,3)		PVC scratch matrix [1]	
PQ1		PVC scratch variable [1]	
PQ2(3)		PVC scratch variable [1]	
PTHEC		Body x-axis attitude [1]	degrees
PTT		Time of burnout [1]	
PU(3,3)		Transformation from body to local vertical coordinates [1]	unitless
PUAL(3,3)		Matrix to rotate thru angle of attack [1]	unitless
PUBA(3,3)		Matrix to rotate thru bank angle [1]	
PUC (3,3)		Transformation from local vertical to wind axis coordinates [1]	unitless
PU1 (3)		x direction cosines fo PU matrix [1]	unitless
PU2 (3)		Y direction cosines of PU matrix [1]	unitless
PU3 (3)		Z direction cosines fo PU matrix [1]	unitless
PVBAC1		PVBAC1 = 0 [1]	degrees
PVBAD1		Desired bank angle [1]	radians
PVBA1		Present bank angle [1]	radians
PVG		Ground speed [1]	ft/sec
PVPB (2)		Terminal velocity constraint [1] [1]	ft/sec
PV1		Velocity remaining until program termination	ft/sec
QDOT		Aerodynamic heating rate [5]	btu/ft^{2}sec
QUE		Dynamic pressure [5]	
Q3		PBC scratch variable [1]	
RAD		RAD= 57.29578 [2]	deg/rad

TABLE XVII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
RADI		RADI = .01745329 [2] [5]	rad/deg
SEROT		Angular rate of earth rotation = 7.292115×10^{-5}	rad/sec
SGRAV		Acceleration due to gravity = 32.17404 [2]	ft/sec^2
SMU		Earth gravitation constant = 14.07654×10^{15} [5]	ft^3/sec^2
SRMEAN		Earth radius at launch pad = 20,909,740 [5]	ft
T		Ground elapsed time [2]	sec
TF		Earth flattening constant [5]	unitless
TGOT		Time to go to reach abort target [5]	sec
THBO		Abort burnout altitude [5]	ft
TLAT		Target latitude [5]	radians
TLONG		Target longitude [5]	radians
TT(6)		Conversion matrix relating coast angle, re-entry angle of attack, and burnout velocity [5]	
TWEP (3)		Earth rotational velocity in platform coordinates [5]	
UXBP (3)		Direction cosines relating body to platform coordinates	unitless
UXTP(3)		Unit vector along ERP [2]	unitless
UYBP (3)		Direction cosines relating body to platform coordinates [2]	unitless
UYTP (3)		Unit vector along EVP x ERP [5]	unitless
UZBP (3)		Direction cosines relating body to platform coordinates [5]	unitless
UZTP (3)		Unit vector along UXTP X UYTP [5]	unitless
VA(4)		Inertial velocity vector relative to earth [2]	ft/sec
VAB(4)		Body velocity vector relative to air [5]	ft/sec
WEP(4)		Earths rotation vector [5]	rad/sec



DATA STATEMENT:
RGRAV = 32.146537
RWVB = 1,670,710
RWYO = 274,721

FIGURE A-18 FLOW CHART OF READO (OUTPUT) SUBROUTINE

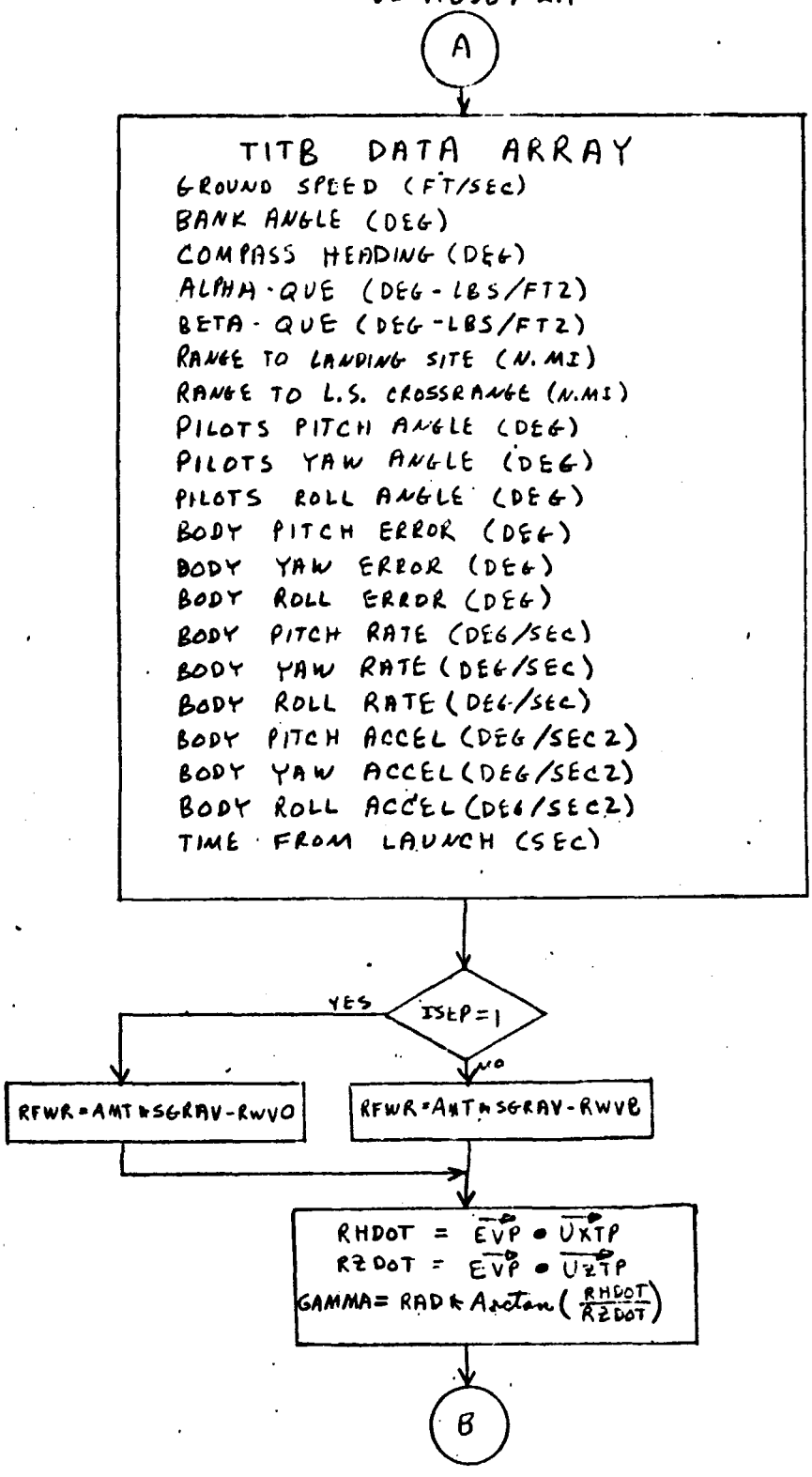


FIGURE A-18 CONT'D

B

$$\vec{RUVAX} = \frac{\vec{ERP}}{|ERP|}$$

$$\vec{RQ} = \vec{VA} \times \vec{RUVAX}$$

$$|RQ| = \sqrt{RQ_X^2 + RQ_Y^2 + RQ_Z^2}$$

$$\vec{RUVAY} = \frac{\vec{RQ}}{|RQ|}$$

$$\vec{RUVAZ} = \vec{RUVAX} \times \vec{RUVAY}$$

$$RVG = \vec{VA} \cdot \vec{RUVAZ}$$

$$RHDOT = \vec{VA} \cdot \vec{UKTP}$$

$$GAMMRI = \text{Arctan}\left(\frac{RHDOT}{RVG}\right)$$

GAMMAR = GAMMRI * RAD

RTHETA = ETHETA * RAD

RPSIA = EPSI * RAD

RPHIA = EPHI * RAD

RTHETD = GTHED * RAD

RPSID = GPSID * RAD

RPHID = GPHID * RAD

RPBD = EPBD * RAD

RQBD = EQBD * RAD

RRBD = ERBD * RAD

RPB = EPB * RAD

RQB = EQB * RAD

RRB = ERB * RAD

$$PGADV = \frac{|DFAB|}{AMT * SGRAV}$$

RLATLP = RADI * (ELATC - SLAT1)

RLONLP = RADI * (SLONG1 - ELONGD)

RCALPV = Arcos(cos(RLATLP) * cos(RLONLP))

$$RRLP = \frac{RCALPV * SPMEAN}{6080.27}$$

RAMT = AMT * SGRAV

$$|EAVP| = \sqrt{EAVP(1)^2 + EAVP(2)^2 + EAVP(3)^2}$$

RQALP = ALPHA * QUE

RQBETA = BETA * QUE

RLATLS = (TLAT1 - ELATC) * RADI

RLONLS = (ELONGD - TLONG1) * RADI

RCAVLS = ARCOS.(COS(RLATLS) COS(RLONLS))

$$RRLS = \frac{(RCAVLS * SPMEAN)}{6080.27}$$

C

FIGURE A-18 CONT'D

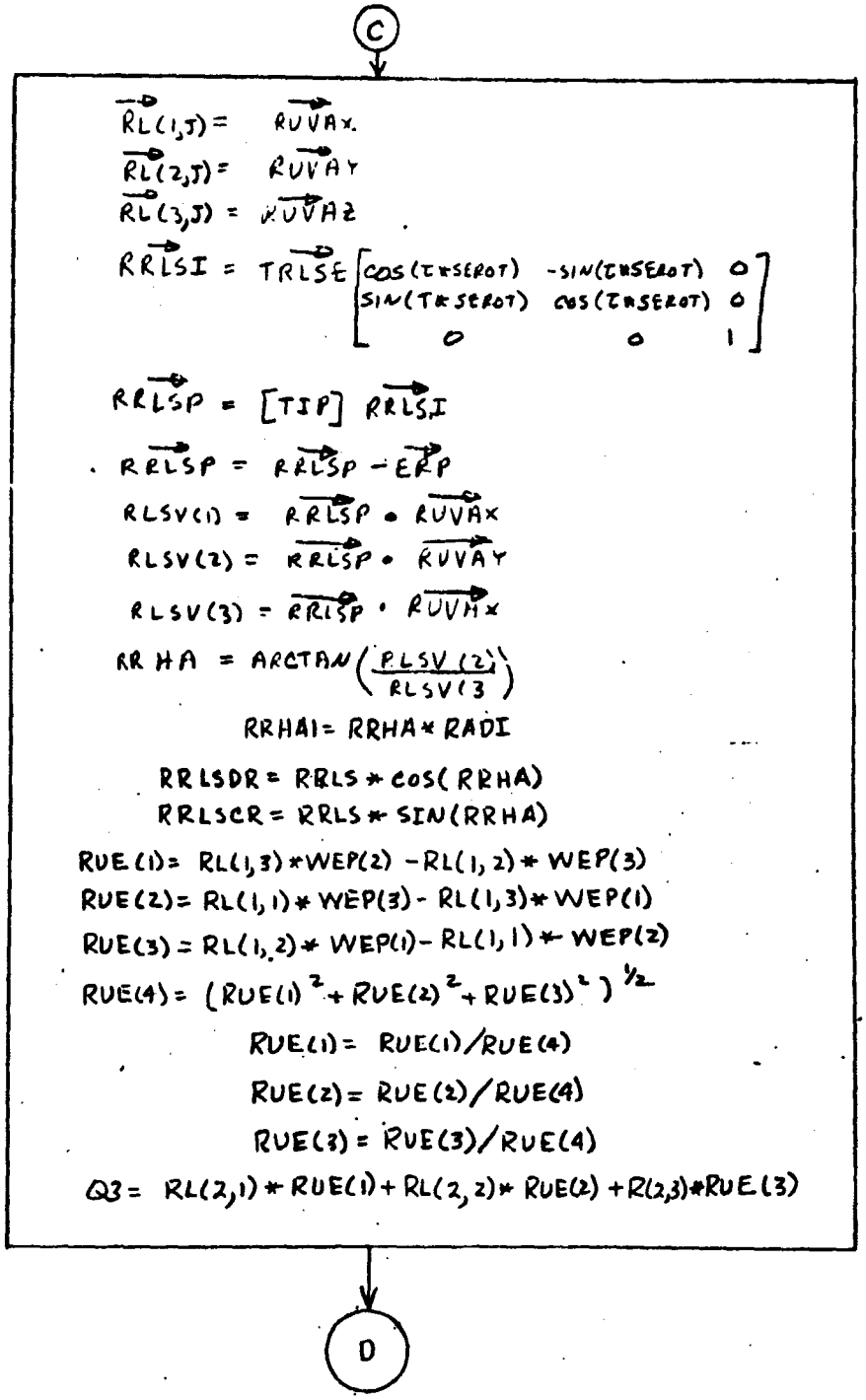


FIGURE A-16 CONT'D

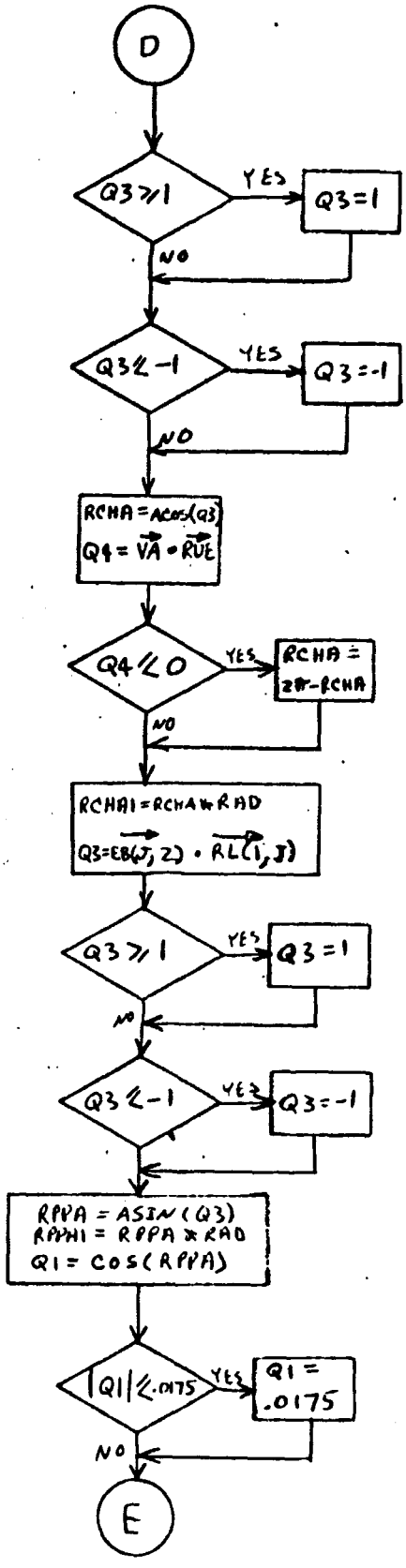


FIGURE A-18 CONT'D

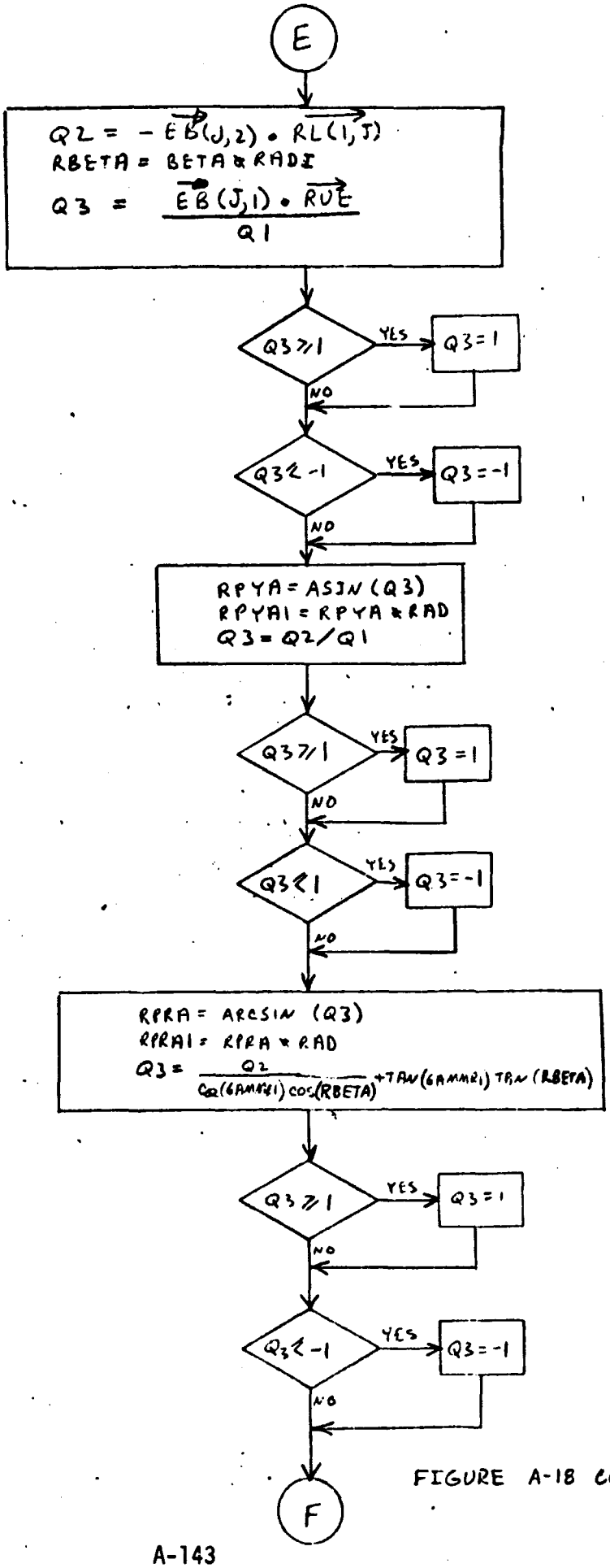


FIGURE A-18 CONT'D

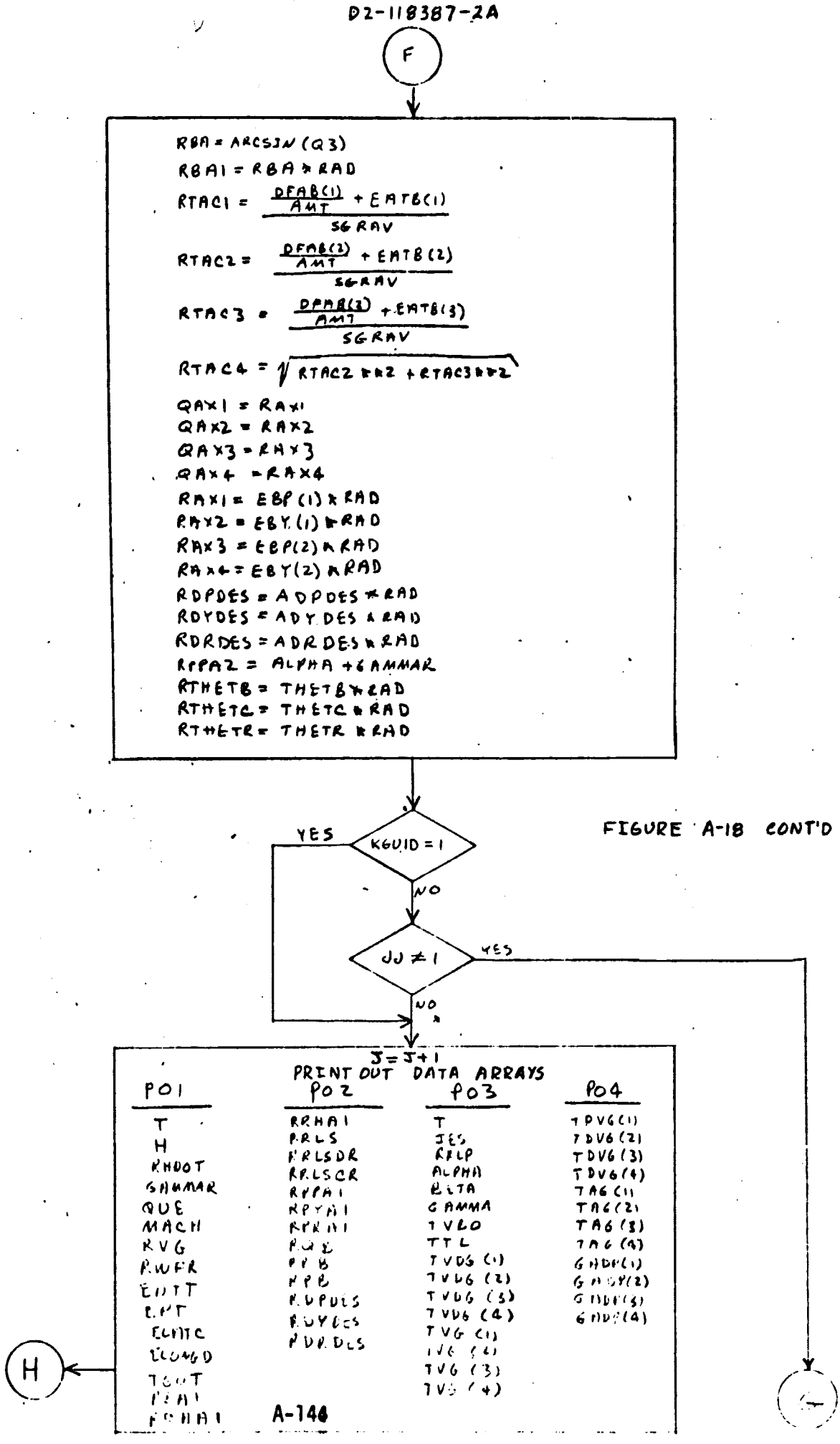
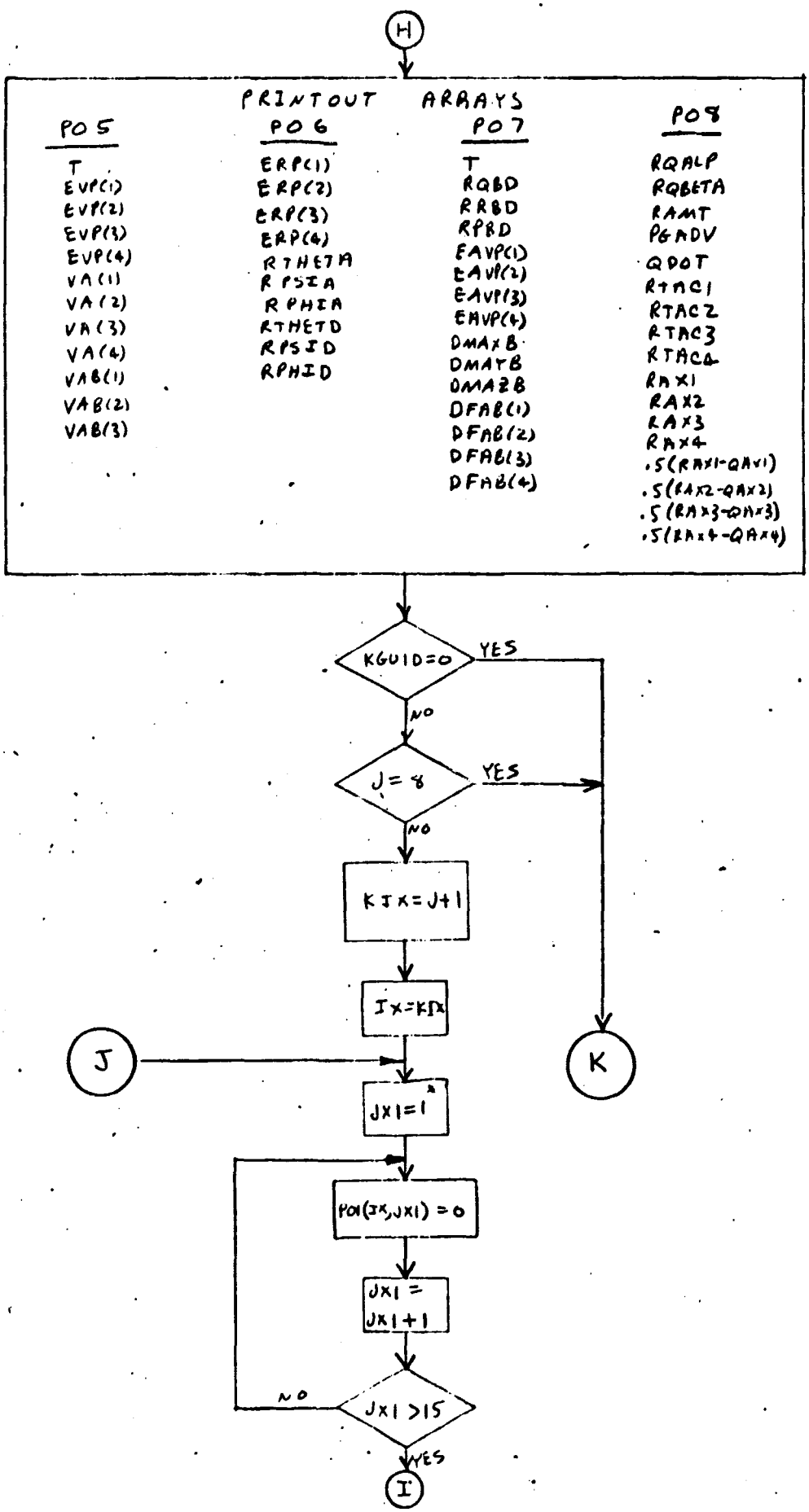


FIGURE A-18 CONT'D



A-145 FIGURE A-18 CONT'D

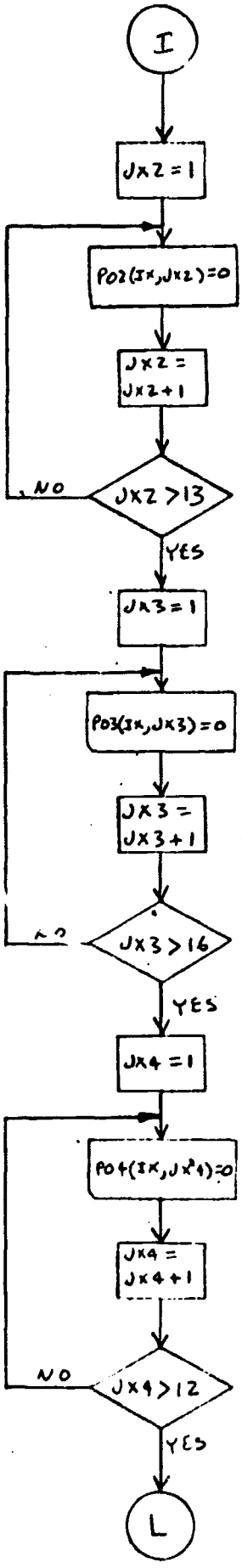


FIGURE A-18 CONT'D

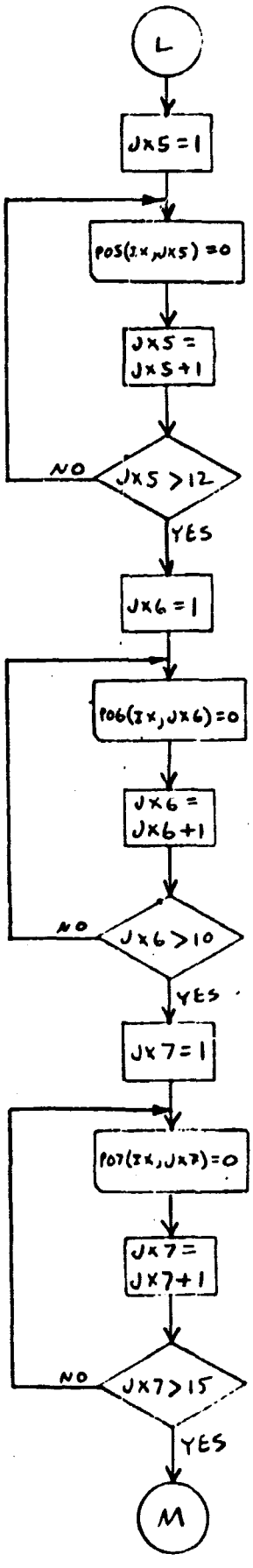


FIGURE A-18 CONT'D

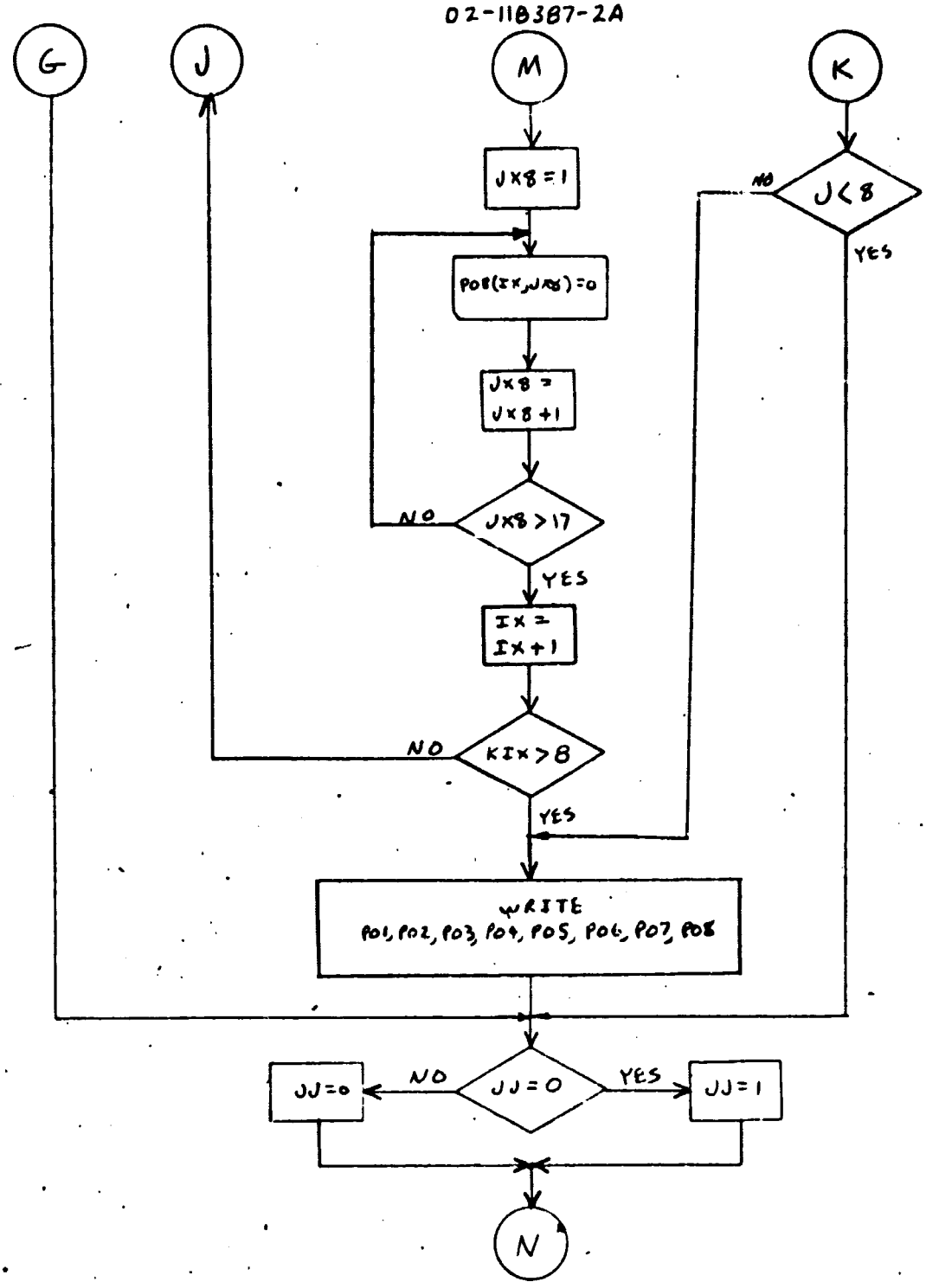


FIGURE A-18 CONT'D

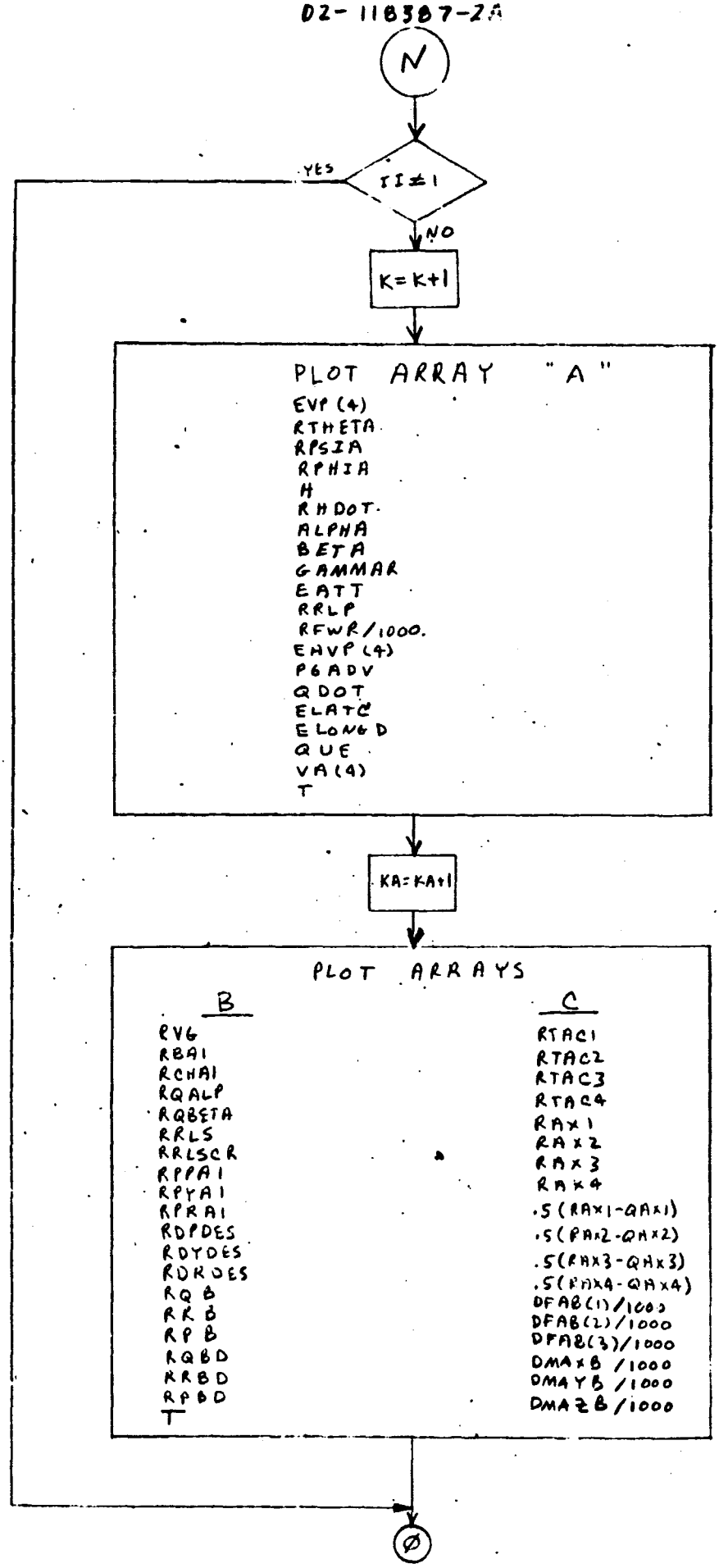
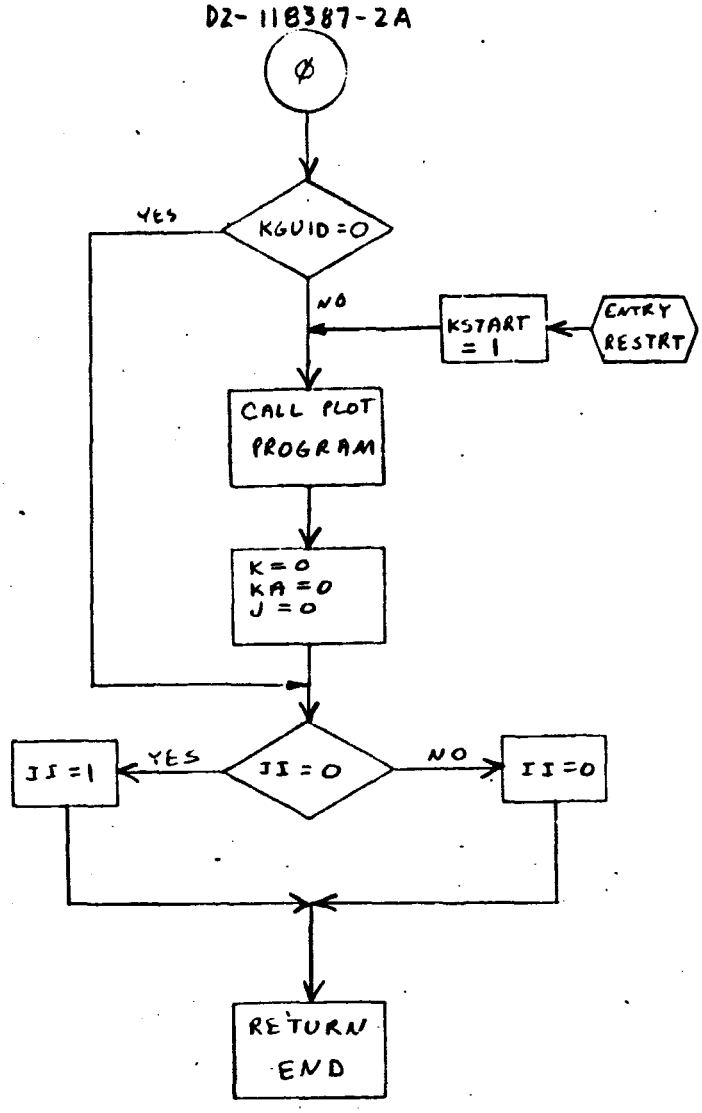


FIGURE A-18 CONT'D



PLOT OUTPUT

A(K,J) ARRAY	B(K,J) ARRAY	C(K,J) ARRAY
EVP(4)	RVG	RTAC1
PTHETA	RBAI	RTAC2
RPSIA	RCHAI	RTAC3
RPHIA	RQALP	RTAC4
H	RQBETA	RAX1
RHDØT	RRLS	RAX2
ALPHA	RRLSCR	RAX3
BETA	RPPAI	RAX4
GAMMAR	RPYAI	.5(RAX1-QAX1)
EATT	RPRAI	.5(RAX2-QAX2)
RRLP	RDPDES	.5(RAX3-QAX3)
RWFR/1000	RDYDES	.5(RAX4-QAX4)
AVP(4)	RDRDES	DFAB(1)/1000
PGADV	RQB	DFAB(2)/1000
QDØT	RRB	DFAB(3)/1000
ELATC	RPB	DMAXB/1000
ELØNGD	RQBD	DMAYB/1000
QUE	RRBD	DMAZB/1000
VA(4)	RPBD	

FIGURE A-18 CONT'D

TABLE XVIII SYMBOL DEFINITION FOR READØ (OUTPUT) SUBROUTINE

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
A(500,20)		Output plot array [1]	
ABIT		Time selected for abort [2]	sec
ADMASS(12)		Mass depleted per engine per .2 sec [5]	slugs
ADMTOT		Total mass depleted per .2 sec [5]	slugs
ADPDES		Desired change in body pitch angle [2]	rad
ADRDES		Desired change in body roll angle [2]	rad
ADYDES		Desired change in body yaw angle [2]	rad
ALPHA		Angle of attack [2] [4]	degrees
AMASCO		Mass DF vehicle at fuel depletion [2]	slugs
AMDOTV		Mass depletion rate [5]	slugs/sec
AMT		Total mass of vehicle [2]	slugs
ARCSPM		Pitch moment commanded by RCS model [5]	ft-lbs
ARCSRM		Roll moment commanded by RCS model [5]	ft-lbs
ARCSYM		Yaw moment commanded by RCS model [5]	ft-lbs
ATENG(12)		Engine thrust magnitude [5]	lbs
ATOTHR		Total engine thrust during pressure minor cycle [5]	lbs
AUGRAV		Accel. of gravity at sea level = 32.17404 [2]	ft/sec^2
AZCF		Distance between body x axis and the engine cluster centerline along the body z axis [5]	ft
B(500,20)		Output plot array [1]	
BETA		Sideslip angle [2] [4]	deg
C(500,18)		Output plot array [1]	
DFAB(4)		Forces due to aerodynamics in body coordinates [2] [4]	lbs
DMAXB		Aero moment about body x axis [2] [4]	ft-lbs
DMAYB		Aero moment about body y axis [2] [4]	
DMAZB		Aero moment about body z axis [2] [4]	ft-lbs
EATB(4)		Booster engine acceleration due to thrust 2	ft/sec^2
EATT		Vehicle acceleration due to thrust [2] [4]	ft/sec^2
EAVP(3)		Vehicle acceleration in platform coordinates [2] [4]	ft/sec^2
EAVPP(3)		Past value of vehicle inertial acceleration [5]	ft/sec^2

TABLE XVIII SYMBOL DEFINITION FOR READØ (OUTPUT) SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
EB(3,3)		Direction cosine matrix relative vehicle platform to vehicle body coordinates [2]	unitless
EBP(12)		Engine pitch gimbal angle [1]	radians
EBPO		Engine pitch gimbal angle offset [5]	radians
EBY(12)		Engine yaw gimbal angle [1]	radians
EG(3)		Acceleration due to gravity [5]	ft/sec^2
EGEFF		Effective gravity [5]	ft/sec^2
EL(12,3)		Booster engine locations [5]	ft
ELATC		Geocentric latitude of vehicle [2] [4]	deg
ELO(2,3)		Orbiter engine locations [5]	ft
ELONGD		Geodetic longitude of vehicle [2] [4]	deg
EPA1		Sea level atmospheric pressure = 2116.8 [5]	lbs/ft^2
EPB		Angular rate about body x axis [2]	rad/sec
EPBD		Ang. accel. about body x axis [2]	rad/sec^2
EPE(12)		Percent thrust due to engine out [5]	unitless
EPHI		Actual euler roll angle (about x axis) [2]	radians
EPHID		EPHI rate [5]	rad/sec
EPSI		Actual euler yaw angle (about z axis) [2]	rad
EPSID		EPSI rate [5]	rad/sec
EPT		Fractional throttle setting [2] [4]	unitless
EQB		Angular rate about body y axis [2]	rad/sec
EQBD		Angular acceleration about body y axis [2]	rad/sec^2
ERB		Angular rate about body z axis [2]	rad/sec
ERBD		Angular acceleration about body z axis [2]	rad/sec^2
ERP(4)		Present inertial vehicle position [2] [4]	ft
ETHETA		Actual euler pitch angle (about y axis) [2]	radians
ETHETD		ETHETA rate [5]	rad/sec
ETSLB(12)		Booster sea level engine thrust [5]	lbs
ETSLO1		Orbiter engine one sea level thrust [5]	lbs
ETSLO2		Orbiter engine two sea level thrust [5]	lbs
EVP(4)		Present vehicle inertial velocity [2] [4]	ft/sec
EVPP(4)		Past value of EVP [5]	ft/sec

TABLE XVIII SYMBOL DEFINITION FOR READØ (OUTPUT) SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
GADP(4)		Desired vehicle acceleration vector expressed in vehicle inertial or platform coordinates [2] [4]	ft/sec^2
GAMMA		Inertial flight path angle [4]	deg
GAMMAR		Relative flight path angle [4]	deg
GAMMR1		Flight path angle [1]	radians
GDTV		[6]	
GEGVEL		Engine exhaust gas velocity [5]	ft/sec^2
GM(4)		Gravity vector [5]	ft/sec^2
GPHID		Inertial roll angle [2]	radians
GPSID		Inertial yaw angle [2]	radians
GTFTL		Estimate of time remaining until vehicle thrust is limited to remain within thrust acceleration limits [5]	sec
GTGO		An estimate of time to reach orbit insertion [5]	sec
GTHED		Inertial pitch angle [2]	radians
GURP(4)		Guidance x unit vector [5]	unitless
GUYP(4)		Guidance y unit vector [5]	unitless
GUZP(4)		Guidance z unit vector [5]	unitless
H		Altitude [2] [4]	ft
H1		Altitude [5]	ft
I		Integer count variable [1]	discrete
IABT		IABT=1 after abort is begun [5]	discrete
IBO		[6]	
IES		A one indicates engines are on [2] [4]	discrete
IGMT		[6]	
II		Pass toggle flag [1]	discrete
IJ		Counter index [1]	discrete
IRERUN		[6]	
ISEP		A one indicates vehicles are separated [2]	discrete
ITITLE(9)		Alphameric plot title array [1]	Alphameric
IX		Counter index [1]	Discrete

TABLE XVIII SYMBOL DEFINITION FOR READØ (OUTPUT) SUBROUTINE (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
J		Pass counter [1]	discrete
JJ		Pass toggle flag [1]	discrete
JUMP		Inner loop control for lass execution [1]	discrete
JX1		Printout index [1]	discrete
JX2		Printout index [1]	discrete
JX3		Printout index [1]	discrete
JX4		Printout index [1]	discrete
JX5		Printout index [1]	discrete
JX6		Printout index [1]	discrete
JX7		Printout index [1]	discrete
JX8		Printout index [1]	discrete
K		Plot index [1]	discrete
KA		Plot index [1]	discrete
KGUID		Program terminate flag [2]	discrete
KIX		Pass index [1]	discrete
KSTART		Plot release from merr $ flag [2]	discrete
MACH		Mach number [2] [4]	unitless
NLAST		Plot index [1]	discrete
P		Ambient atmospheric pressure [5]	lbs/ft^2
PGADV		Aero deceleration in gees [4]	unitless
PI		= 3.14159 26536 [2]	unitless
PO1(8,15)		Printout variable array [1]	
PO2(8,13)		Printout variable array [1]	
PO3(8,16)		Printout variable array [1]	
PO4(8,12)		Printout variable array [1]	
PO5(8,12)		Printout variable array [1]	
PO6(8,10)		Printout variable array [1]	
PO7(8,15)		Printout variable array [1]	
PO8(8,17)		Printout variable array [1]	
QAX1		Past value of engine 1 pitch angle [1]	degrees
QAX2		Past value of engine 1 yaw angle [1]	degrees
QAX3		Past value of engine 2 pitch angle [1]	degrees

TABLE XVIII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
QAX4		Past value of engine 2 yaw angle [1]	degrees
QDOT		Aerodynamic heating rate [2] [4]	BTU/ft^{2}sec
QUE		Dynamic pressure [2] [4]	lbs/ft^2
Q1		Readout scratch variable [1]	
Q2		Readout scratch variable [1]	
Q3		Readout scratch variable [1]	
Q4		Readout scratch variable [1]	
RAD		RAD = 57.29578 [2]	deg/rad
RADI		RADI = 1.745329 X 10^{-2} [2]	rad/deg
RAMT		Vehicle weight [4]	lbs
RAXI		Engine 1 pitch gimbal angle [4]	deg
RAX2		Engine 1 yaw gimbal angle [4]	deg
RAX3		Engine 2 pitch gimbal angle [4]	deg
RAX4		Engine 2 yaw gimbal angle [4]	deg
RBA		Bank angle [1]	radians
RBA1		Bank angle [4]	degrees
RBETA		Sideslip angle [1]	radians
RCALPV		Central angle from launch pad to present position [1]	radians
RCAVLS		Central angle from vehicle to landing site [2]	radians
RCHA		Compass heading angle [1]	radians
RCHA1		Compass heading angle [4]	degrees
RDPDES		Body pitch attitude error [4]	degrees
RDRDES		Body roll attitude error [4]	degrees

TABLE XVIII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
RDYDES		Body yaw attitude error 4	degrees
RGRAV		RGRAV = 32.146537 6	
RHDOT		Altitude rate 2 4	ft/sec
RL(3,3)		Direction cosine matrix relating platform coordinates to local vertical coordinates 1	unitless
RLATLP		Latitude difference between launch pad and vehicle position 1	radians
RLATLS		Latitude difference between landing site and vehicle position 1	radians
RLONLP		Longitude difference between launch pad and vehicle position 1	radians
RLOMS		Latitude difference between launch pad and vehicle position 1	radians
RLSLV(3)		Position of landing site in local vertical coordinates	ft
RPB		Angular rate about body X-axis 4	deg/sec
RPBD		Angular acceleration about body X-axis 4	deg/sec
RPHIA		Actual Euler roll angle (about X-axis) 4	deg
RPHID		Desired Euler roll angle 4	deg
RPPA		Pilot's pitch angle 1	radians
RPPA1		Pilots pitch angle 4	degrees
RPPA2		6	
RPRA		Pilots roll angle 1	radians
RPRA1		Pilots roll angle 4	degrees
RPSIA		Actual Euler yaw angle (about Z-axis) 4	degrees
RPSID		Desired euler yaw angle 4	
RPYA		Pilots yaw angle 1	radians
RPYA1		Pilots yaw angle 4	degrees
RQ(4)		READØ scratch variable 1	ft/sec

TABLE XVIII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
RQALP		Product of angle of attack and dynamic pressure [4]	lb-deg/ft^2
RQB		Angular rate about body Y-axis [4]	deg/sec
RQBD		Angular acceleration about body Y-axis [4]	
RQBETA		Product of sideslip angle and dynamic pressure [4]	lb-deg/ft^2
RRB		Angular rate about body Z-axis [4]	deg/sec
RRBD		Angular acceleration about body Z-axis [4]	deg/sec
RRHA		Relative heading angle [1]	radians
RRHA1		Relative heading angle [4]	degrees
RRLP		Range from vehicle to launch pad [4]	N.MI.
RRLS		Range from vehicle to landing site [4]	N.MI.
RRLSCR		Cross range distance to landing site [4]	N.MI.
RRLSDR		Downrange distance to landing site [4]	N.MI.
RRLSI(3)		Range to landing site in inertial coordinates [1]	ft.
RRLSP(4)		Range to landing site in platform coordinates [1]	ft.
RTAC1		Axial aero & thrust acceleration [4]	gees
RTAC2		Out-of-plane aero and thrust acceleration [4]	gees
RTAC3		Normal aero and thrust acceleration [4]	gees
RTAC4		Horizontal aero and thrust acceleration [4]	gees
[illegible]TA		Actual Euler pitch angle (about Y-axis) [4]	degrees
RTHETB		An estimate of the earth's central angle traversed to reach engine off during abort [6]	degrees
RTHETC		Estimate of angle traversed from engine cutoff to achievement of target latitude & longitude [6]	degrees

TABLE XVIII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
RTHETD		Desired Euler pitch angle [4]	degrees
RTHETR		Earth central angle between readial vectors passing through vehicle and landing site [6]	degrees
RUE(4)		East unit vector [1]	unitless
RUVAX(4)		X local vertical unit vector in platform coordinates [1]	unitless
RUVAY(4)		Y local vertical unit vector in platform coordinates [1]	unitless
RUVAZ(4)		Z local vertical unit vector in platform coordinates [1]	unitless
RVG		Ground speed [4]	ft/sec
RWFR		Weight of fuel remaining [4]	lbs
RWVB		Weight of empty booster [1]	lbs
RWVD		Weight of empty orbiter [1]	lbs
RZDOT		Horizontal component of inertial velocity [1]	ft/sec
SEROT		Angular rate of earth rotation = $7.292115X10^{-5}$ [2]	rad/sec
SGRAV		Acceleration due to gravity = 32.17404 [2]	ft/sec^2
SLAT1		Latitude of launch pad [2]	degrees
SLONG1		Longitude of launch pad [2]	degrees
SMU		Gravitational constant = $14.07654X10^{15}$ [2]	ft^3/sec^2
SRMEAN		Earth radius at launch pad = 20,909,740 [2]	ft
T		Ground elapsed time [2] [4]	sec
TAE		Angle of attack desired for re-entry after abort [6]	radians
TAG(4)		Desired vehicle acceleration in guidance coordinates [2] [4]	ft/sec^2
TDVG(4)		Desired velocity vector to be gained in guidance coordinates [2] [4]	ft/sec

TABLE XVIII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TGFIN		Effective gravity at targeted velocities 5	
TGOT		Time-to-go to reach abort target 2 4	sec
THETB		An estimate of the earth's central angle traversed to reach engine off during abort 2	radians
THETC		Estimate of angle traversed from engine cutoff to achievement of target latitude & longitude 2	radians
THETR		Earth central angle between radial vectors passing thru vehicle and landing site 2	radians
TIP(3,3)		Transformation between earth fixed inertial coordinates and vehicle plotform coordinates 2	unitless
TITA(5,20)		Alphanumeric title array 1	
TITB(5,20)		Alphanumeric title array 1	
TITC(5,18)		Alphanumeric title array 1	
TLAT1		Target latitude 2	degrees
TLONG1		Target longitude 2	degrees
TRDG(4)		Position vector of targeted engine shutdown in guidance coordinates 2	ft
TRLSE(4)		Landing site position in rotating earth coordinates 2	ft
TRLSP(4)		Landing site position in platform coordinates 5	ft
TTL		Estimate of time to thrust limiting 2 4	sec
TUXGP(4)		Unit vector describing guidance X-axis in platform coordinates 5	unitless
TUYGP(4)		Unit vector describing guidance Y-axis in platform coordinates 5	unitless
TUZGP(4)		Unit vector describing guidance Z-axis in platform coordiantes 5	unitless

TABLE XVIII (Continued)

CODED SYM.	ENGR. SYM.	SYMBOL DEFINITION OR USE	UNITS
TVBO		Burnout velocity during abort targeting [2] [4]	ft/sec
TVBON		Past value of burnout velocity during abort targeting velocity vector desired at engine shutdown [5]	ft/sec
TVDG(4)		At abort target [2] [4]	ft/sec
TVG(4)		Present vehicle velocity in guidance coordinates [2] [4]	
UXTP(3)		Unit vector along R_p [5]	unitless
UYTP(3)		Unit vector along $V_p \times R_p$ [5]	unitless
UZTP(3)		Unit vector along $\overrightarrow{UXTP} \times \overrightarrow{UYTP}$ [5]	unitless
VA(4)		Inertial velocity vector relative to earth [2] [4]	ft/sec
VAB(4)		Body velocity vector relative to A & R [2] [4]	ft/sec
WEP(4)		Earth's rotation vector [5]	rad/sec
XMAX		Scratch variable for plot routine [1]	
XMIN		Scratch variable for plot routine [1]	
YMAX(22)		Scratch variable for plot routine [1]	
YMIN(22)		Scratch variable for plot routine [1]	

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@ FOR,* FUN,FUN                                                    01 JUN 72        22:38:23. 76
UNIVAC 1108 FORTRAN V EXEC 11 LEVEL 25A  -(EXEC8 LEVEL E120100UA)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:23

-15,16

-39,39

   MAIN PROGRAM

   STORAGE USED: CODE(1) 000416  DATA(3) 000046  BLANK COMMON(2) 000000

   COMMON BLOCKS:

   0003   EA2     000125
   0004   IA1     000021
   0005   IG2     000034
   0006   IG3     000015
   0007   MA1     000036
   0010   IT1     000016
   0011   MI1     000032
   0012   MP1     000031
   0013   MP2     000031
   0014   MA2     000035
   0015   MR1     000011
   0016   SR1     000015
   0017   MA4     000006

   EXTERNAL REFERENCES (BLOCK, NAME)

   0020   RECOV
   0021   INITIA
   0022   GUIDAN
   0023   ANGUID
   0024   PSC
   0025   AERO
   0026   EOM
   0027   AUTOP1
   0030   AUTOP2
   0031   READD
   0032   ATAN
   0033   ATAN2
   0034   NROUS
   0035   NIO1S
   0036   NIO2S
   0037   NSTOPS

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

   0001   000132 1L      0001   000106 1JL     0000   000021 100F    0001   000410 100DL   0001   000152 11L
   0001   000205 12L     0001   000240 13L     0001   000137 1376    0001   000244 14L     0001   000257 15L
   0001   000075 171G    0001   000127 2L      0001   000154 2146    0001   000412 3[illegible]L   0001   000402 3256
   0001   000272 49L     0001   000225 59L     0001   000230 69L     0001   000273 79L     0001   000306 80L
   0000   000017 800F    0001   000311 81L     0001   000313 82L     0014 R 000000 AALIM    0002 R 000001 ABTT
   0004   000004 ADMASS  0004   000000 ADMTOT   0004 R 000003 AMASCO   0004   000001 AMDOTV   0004 R 000002 AMTOT
   0017   000000 APDET   0003   000122 ARCSPM   0003   000124 ARCSRM   0003   000123 ARCSYM   0017   000002 ARDET

B-2

D2-11838 7-24
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REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.


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0004 R 000020 AUGRAV   0017   000001 AYDET    0006 R 000002 AZCF     0000 R 000010 DT1      0000 R 000011 DT2
0000 R 000012 DT3      0016   000003 EAVP     0003 R 000044 EBP      0003 R 000060 EBY      0016   000000 EG
0006   000013 EGEFF    0003   000000 EL       0016   000007 ELATC    0003   000114 ELO      0016   000010 ELONGD
0003   000074 EPE      0003   000110 EPT      0006   000007 ERP      0006 R 000003 EVP      0006   000014 GDTV
0006 R 000001 GEGVEL   0005   000003 GMT      0005   000017 GTA      0014 R 000003 GTDM     0005   000033 GTPPCO
0000 I 000016 I        0007 I 000002 IABT     0003   000112 IBO      0000 I 000003 IBR      0003 I 000111 IES
0006   000000 IGMT     0000 I 000002 IOI      0000 I 000013 IRERUN   0003 I 000113 ISEP     0015 I 000000 ITITLE
0000 I 000014 JOY      0007 I 000000 JUMP     0012 I 000000 KACOTC   0013 I 000000 KAUT     0000 I 000004 KCOAST
0000 I 000000 KC11     0000 I 000001 KC12     0007 I 000005 KGUID    0000 I 000007 KGUIDN   0010 I 000015 KLPDR
0000 I 000004 KNT      0000 I 000015 KP       0000 I 000005 KUNT     0017   000003 MANUAL   0017 R 000005 SETCGO
0011 R 000000 SINC1    0016   000013 SLAT1    0011 R 000001 SLAZ1    0016   000014 SLONG1   0005   000000 SRDOTD
0005   000001 SYDOTD   0005 R 000002 SZDOTD   0007 R 000001 T        0010   000000 TF       0007 R 000004 TGOT
0010 R 000006 THBO     0014 R 000004 THELIM   0010   000001 TLAT     0016 R 000011 TLAT1    0010   000002 TLONG
0016 R 000012 TLONG1   0014 R 000002 TPPCO    0017 R 000004 TRIM     0010   000007 TT       0014 R 000001 TTD1
0010   000003 TWEP
```

```
00101          COMMON /EA2/ EL(12,3),EBP(12),EBY(12),EPE(12),EPT,IES,IBO,ISEP
00101         * ,ELO(2,3),ARCSPM,ARCSYM,ARCSRM
00103          COMMON/IA1/ADMTOT,AMDOTV,AMTOT,AMASCO,ADMASS(12),AUGRAV
00104          COMMON /IG2/ SRDOTD,SYDOTD,SZDOTD,GMT(12),GTA(12),GTPPCO
00105          COMMON /IG3/ IGMT,GEGVEL,AZCF,EVP(4),ERP(4),EGEFF,GDTV
00106          COMMON/MA1/ JUMP,T,IABT,ABTT,TGOT,KGUID
00107          COMMON /IT1/ TF,TLAT,TLONG,TWEP(3),THBO,TT(6),KLPDR
00110          COMMON /MI1/ SINC1,SLAZ1
00111          COMMON /MP1/ KACOTC
00112          COMMON /MP2/ KAUT
00113          COMMON /MA2/ AALIM,TTD1,TPPCO,GTDM,THELIM
00114          COMMON /MR1/ ITITLE(9)
00115          COMMON /SR1/ EG(3),EAVP(4),ELATC,ELONGD,TLAT1,TLONG1,SLAT1,SLONG1
00116          COMMON/MAN/APDET,AYDET,ARDET,MANUAL,TRIM,SETCGO
00117          SETCGO=0.                                                    **-2
00120          KC11= 1
00121          KC12= 1
00122          IOI= 0
00123          IBR= 0
00124          KNT= 0
00125          KUNT= 0
00126          IABT= 0
00127          KGUID= 0
00130          KCOAST= 0
00131          KGUIDN= 0
00132          DT1= 1.
00133          DT2= 1.
00134          DT3= 1.
00135          READ (5,800) ITITLE
00143          READ (5,100) ABTT,TTD1,TLAT1,TLONG1,AALIM,KAUT,KLPDR,KACOTC,
00143         1IRERUN,SINC1,SLAZ1,THBO,TPPCO,GTDM,THELIM
00164          CALL RECOV
00165      800 FORMAT (8A6,A2)
00166      100 FORMAT(5F14.4/4I3,4F14.4/2F10.4)
00167          CALL INITIA
00170          DO 1000 JOY = 1,700
00173          IF(T.GT.ABTT) GO TO 10                                       **-1
00175          CALL GUIDAN
00176          GO TO 11
```

```
00177    40*      10 IF(KCOAST.EQ.1) GO TO 1
00201    41*         CALL ABGUID
00202    42*         IF(TGOT.LT.DT1) GO TO 2
00204    43*         IF(AMTOT.LT.AMASCO) GO TO 2
00206    44*         GO TO 11
00207    45*       2 KCOAST= 1
00210    46*         GO TO 11
00211    47*       1 IF(KGUID.EQ.1.AND.KGUIDN.EQ.1) GO TO 3000
00213    48*         CALL PBC
00214    49*         KGUIDN= KGUID
00215    50*      11 DO 2000 JUMP=1,5
00220    51*         IF(ISEP.EQ.1)GO TO 12
00222    52*         IF(AMTOT.LT.AMASCO) IES=0
00224    53*         IF(IES.EQ.1)GO TO 69
00226    54*         KNT=KNT+1
00227    55*         IF(KNT.EQ.KC11)ISEP=1
00231    56*         GO TO 69
00232    57*      12 IF(AMTOT.LT.AMASCO) GO TO 49
00234    58*         IF(IES.EQ.1)GO TO 69
00236    59*         KUNT=KUNT+1
00237    60*         IF (KUNT.EQ.KC12) GO TO 59
00241    61*         GO TO 69
00242    62*      59 IES= 1
00243    63*         IBR= 1
00244    64*      69 CONTINUE
00245    65*         IF(ABS(T-ABTT).LE..5) GO TO 13
00247    66*         GO TO 14
00250    67*      13 IF(IBR.NE.1) GO TO 49
00252    68*      14 IF(T.GT.ABTT) GO TO 15
00254    69*         IF(EVP(4).GT.SZDO(D) GO TO 49
00256    70*         GO TO 79
00257    71*      15 IF(ISEP.NE.1) GO TO 79
00261    72*         IABT=1
00262    73*         IF(TGOT.GE.DT2) GO TO 79
00264    74*      49 IES= 0
00265    75*      79 CALL AERO
00266    76*         CALL EOM
00267    77*         IF(IES.EQ.0)GO TO 80
00271    78*         IF(KAUT.EQ.1)GO TO 80
00273    79*         GO TO 81
00274    80*      80    CALL AUTOP1
00275    81*            GO TO 82
00276    82*      81    CALL AUTOP2
00277    83*      82    CONTINUE
00300    84*            T=T+.2
00301    85*            KP= 0
00302    86*      2000 CONTINUE
00304    87*            CALL READO
00305    88*            IF(ISEP.EQ.0) GO TO 1000
00307    89*            IF(ISEP.EQ.1.AND.IES.EQ.1) IO1=1
00311    90*            IF(IES.EQ.1) GO TO 1000
00313    91*            IF(IO1.EQ.1.AND.IES.EQ.0) GO TO 1000
00315    92*            IF(TGOT.LT.DT3) GO TO 1000
00317    93*            AMTOT=26705.9
00320    94*            AMASCO=275000./AUGRAV
00321    95*            AZCF=2.25
00322    96*            TRIM=0.
00323    97*            SETCGO=-ATAN(2.74/53.75)
```

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

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```
00324      98.          DO 500 I=1,3
00327      99.          EBP(I)=ATAN2(-2.74,53.75)
00330     100.      500 EBY(I)=0.
00332     101.          GEGVEL= 14780.
00333     102.     1000 CONTINUE
00335     103.     3000 CONTINUE
00336     104.          STOP
00337     105.          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
   FUN            SYMBOLIC                                  04 APR 72  15:10:06   0  01464656    19   108  (DELETED)
   FUN     CODE   RELOCATABLE                               04 APR 72  15:10:06   1  01467626    A9     1  (DELETED)
                                                                                   0  01467752    19    32
```

D2-118387-2A

```
@ ASM RECO                                                                                  20 MAR 72          57:13.319
ASSEMBLED BY UNIVAC 1108 EXEC 11 ASSEMBLER   2404 0008A
THIS ASSEMBLY WAS DONE ON 20 MAR 72 AT 09:57:13
000001      02   000000                          $(2),N RES     1                                    .FALL0042
000002      01   000000  06 00 13 00 0 000000    $(1),RECOV* SX 11,N                                 .FALL0043
000003           000001  74 13 13 00 0 001007          LMJ     11,MSEA$                             .FALL0044
000004           000002  000000 000011                 +       0,MIERR$                             .FALL0045
000005 U         000003  72 01 00 00 0 000000          SLJ     QZKILL                               .FALL0046
000006           000004  74 06 00 00 0 000000          NOP
000007           000005  27 00 13 00 0 000000          LX      11,N                                 .FALL0048
000008           000006  74 04 00 13 0 000001          J       1,11                                 .FALL0049
000009                                                 END
                                                 QZKILL
```

```
@ ASM QZKILL                                                                                  20 MAR 72          9:57:14.425
ASSEMBLED BY UNIVAC 1108 EXEC 11 ASSEMBLER   2404 0008A
THIS ASSEMBLY WAS DONE ON 20 MAR 72 AT 09:57:14
000001      00   000000                          $(0),TEMP RES  1                                    .FALL0053
000002      01   000000  74 06 00 00 0 000000    $(1),QZKILL.   NOP
000003           000001  06 00 13 00 0 000000          SX      11,TEMP                              .FALL0055
000004           000002  74 13 13 00 0 001010          LMJ     11,MREA$                             .FALL0056
000005           000003  000000 000011                 +       0,MIERR$                             .FALL0057
000006           000004  74 06 00 00 0 000000          NOP
000007 U         000005  74 13 13 00 0 000000          LMJ     11,RESTRT                            .FALL0059
000008           000006  000000000000                  +       TEMP                                 .FALL0060
000009           000007  74 06 00 00 0 000000          NOP
000010                                                 END
                                                 RESTRT
```

D2-I18387-2A

OF THE ORIGINAL PAGE IS POOR.

```
@ FOR,* INITIA,INITIA
UNIVAC 1108 FORTRAN V EXEC 11 LEVEL 25A  -(EXEC8 LEVEL 11201001OA)                    01 JUN 72          22:38:24.805
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:24

    SUBROUTINE INITIA     ENTRY POINT 000740

    STORAGE USED: CODE(1) 000751; DATA(3) 000031; BLANK COMMON(2) 000000

     COMMON BLOCKS:

     0003    AD1    000007
     0004    AD2    000007
     0005    CG     000160
     0006    CON    000007
     0007    DA1    000016
     0010    EA1    000022
     0011    EA2    000125
     0012    IA1    000021
     0013    IA2    000017
     0014    IA3    000014
     0015    IA4    000007
     0016    IA5    000007
     0017    IA6    000031
     0020    IA7    000040
     0021    IA8    000031
     0022    IA9    000047
     0023    ID1    000017
     0024    ID2    000126
     0025    ID3    000574
     0026    IE1    000015
     0027    IE2    000032
     0030    IE3    000021
     0031    IG1    000012
     0032    IG2    000034
     0033    IG3    000015
     0034    IG4    000023
     0035    IG6    000011
     0036    IT1    000016
     0037    IT2    000013
     0040    MA1    000036
     0041    MAN    000036
     0042    MII    000002
     0043    MA2    000035
     0044    MP1    000011
     0045    MP2    000031
     0046    PAR    000011
     0047    TR1    000011
     0050    SR1    000015

    EXTERNAL REFERENCES (BLOCK, NAME)

     0051    DOTPRD
     0052    MATMAT
     0053    SQRT
     0054    COS
```


02-1183 87-24

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
0055   SIN
0056   ASIN
0057   ACOS
0060   NADUS
0061   NI02S
0062   NI01S
0063   NERR3S
```

STORAGE ASSIGNMENT (BLOCK, TYPE, RELATIVE LOCATION, NAME)

```
0000    000111 1F        0000    000303 10F       0000    000327 14F       0000    000143 2F        0000    000225 3F
0000    000260 4F        0001    000206 422G      0001    000232 435G      0001    000300 447G      0001    000324 461G
0001    001705 605G      0000  R 000075 A         0043  R 000000 AALIM     0020    000012 ABETAP    0022    000012 ABETAR
0021    000012 ABETAY    0020    000017 ABPIT     0022    000017 ABROLL    0022    000033 ABTOTP    0014    000005 ABTOTY
0040  R 000063 ABTT      0014    000003 ABYAW     0022    000005 ACALMX    0023    000005 ACALMY    0021    000005 ACALMZ
0016  R 000003 ACCLIM    0016  R 000004 ACOMSM    0017    000024 ACTALP    0020    000000 ACTPAC    0022    000000 ACTRAC
0021    000000 ACTYAC    0014    000000 ADESMX    0014    000001 ADESMY    0014    000002 ADESMZ    0012  R 000004 ADMASS
0012  R 000000 ADMTOT    0043  R 000002 AFLOWB    0003  R 000003 AFLOWO    0021    000017 AFYMX     0021    000024 AFZMX
0004  R 000000 AGAIN1    0004  R 000001 AGAIN2    0003    000006 ALENGO    0024  R 000060 ALP       0017    000017 ALPMAC
0017    000000 ALPHP1    0017    000012 ALPHMO    0017    000005 ALPHYA    0012  R 000003 AMASCO    0004  R 000002 AMAXGA
0012  R 000001 AMDOTV    0016  R 000006 AMINGA    0004  R 000005 AMINOM    0003    000004 AMINTB    0003    000005 AMINTO
0012  R 000002 AMTOT     0016  R 000000 ANGLUB    0004  R 000004 ANGMAX    0004  R 000003 ANGMIN    0016  R 000005 ANOAER
0041    000000 APDET     0015    000000 APDIFT    0013    000000 APRATE    0016  R 000001 ARATDB    0020    000033 ARATE
0016  R 000002 ARATLM    0011    000122 ARCSPM    0011    000124 ARCSRM    0011    000123 ARCSYM    0041    000002 ARDET
0015    000002 ARDIFT    0023  R 000005 AREA      0004  R 000006 AREVRS    0013    000012 ARRATE    0010  R 000006 ATENG
0007    000015 ATOTMR    0014    000007 ATOTPG    0012  R 000020 AUGRAV    0041    000001 AYDET     0015    000001 AYDIFT
0013    000005 AYRATE    0033  R 000002 AZCF      0023  R 000003 C         0023  R 000007 CHORD     0025    000310 CM
0025    000430 CN        0025    000000 CX        0025    000150 CY        0025    000170 CZ        0007    000003 DFAR
0007    000000 DMAXB     0007    000001 DMAYB     0007    000002 DMAZB     0030  R 000000 EAEB      0030  R 000014 EAEO1
0030  R 000015 EAEO2     0027  R 000017 EATT      0000  R 000001 EATVPM    0000  R 000002 EATVPN    0050    000003 EAVP
0026  R 000007 EAVPP     0027    000021 EB        0011  R 000144 EBP       0027  R 000016 EBPO      0011    000040 EBY
0046  R 000010 ECZ       0050  R 000000 EG        0033  R 000013 EGEFF     0030  R 000016 EGP       0011  R 000000 EL
0050    000007 ELATC     0011  R 000114 ELO       0050    000010 ELONGD    0026  R 000000 EPAI      0026    000001 EPB
0026    000004 EPBD      0011  R 000074 EPE       0010    000002 EPHI      0010    000005 EPHID     0010    000001 EPSI
0010    000004 EPSID     0011  R 000110 EPT       0026    000002 EQB       0026    000005 EQBD      0026    000003 ERB
0026    000006 ERBD      0033  R 000007 ERP       0010  R 000000 ETHETA    0010    000003 ETHETD    0027  R 000002 ETSLR
0027  R 000000 ETSL01    0027  R 000001 ETSL02    0033  R 000003 EVP       0026  R 000012 EVPP      0031  R 000004 GCO
0000  R 000063 GCTI      0031  R 000007 GDT       0033    000014 GDTV      0033  R 000001 GEGVEL    0035  R 000001 GISO1
0035  R 000002 GISO2     0035  R 000003 GISO3     0034    000014 GM        0032  R 000003 GMT       0034  R 000022 GPHID
0034    000021 GPSID     0032  R 000017 GTA       0035  R 000000 GTAU      0043  R 000003 GTDM      0034    000020 GTMED
0035  R 000004 GTMEV     0032  R 000033 GTPPCO    0034  R 000000 GURP      0034  R 000010 GUYP      0034  R 000004 GUZP
0035  R 000005 GVGVEC    0024  R 000000 HB        0023  R 000100 HMAX      0007    000014 HI        0000  1 000076 I
0040    000002 IABT      0011    000112 I80       0011  I 000111 IES       0033  I 000000 IGMT      0000    000357 INJPS
0015    000003 IPITCH    0015    000006 IRESID    0015    000005 IROLL     0011  I 000113 ISEP      0015    000004 IYAW
0040    000000 JUMP      0044    000000 KACOTC    0045  I 000000 KAUT      0040    000005 KGUID     0036  I 000015 KLPDR
0041    000003 MANUAL    0025    000550 MCH       0005  R 000070 MXX       0005  R 000142 MXZ       0005  R 000106 MYY
0005  R 000124 MZZ       0003  I 000000 NOENGB    0003  I 000001 NOENGO    0007    000013 P         0004  R 000002 PI
0006  R 000000 RAD       0006  R 000001 RADI      0000  R 000067 SA        0000  R 000103 SAP       0046  R 000000 SAPOH
0000  R 000077 SBETA     0000  R 000014 SCF       0000  R 000025 SCG       0000  R 000047 SCGM      0000  R 000036 SCH
0000  R 000101 SCTL      0000  R 000102 SCOG      0000  R 000105 SDELI     0003  R 000072 SE        0000  R 000073 SECCEN
0006  R 000005 SEROT     0041    000005 SETCGO    0006  R 000003 SGRAV     0003  R 000071 SM        0046  R 000004 SINC
0000  R 000107 SINCA     0000  R 000104 SINCCO    0042  R 000000 SINCI    0046  R 000002 SLAT      0050  R 000013 SLATI
0046  R 000005 SLAZ      0042  R 000001 SLAZI     0046  R 000003 SLONG    0050  R 000014 SLONGI    0004  R 000006 SMU
0023  R 000001 SPAN      0046  R 000001 SPERH     0000  R 000110 SQI       0000  R 000066 SMA       0031  R 000010 SRD
0032  R 000000 SRDOTD    0000  R 000000 SRLPP     0006  R 000004 SRMEAN    0000  R 000040 SRMEEQ    0000  R 000065 SRP
0000  R 000006 SS        0000  R 000104 SSALF     0000  R 000100 SSG       0000  R 000064 STHETA    0046    000006 STI
0031  R 000000 SUQ       0046  R 000007 SVELI     0000  R 000003 SVLPP     0000  R 000070 SVP       0031  R 000011 SYD
```

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0032 R 000001 SYDOTD    0032 R 000002 SZDOTD    0040 R 000001 T         0037   000011 TAE       0036 R 000000 TF
0040 R 000004 TGOT      0036 R 000006 THBO      0043 R 000009 THELIM    0037 R 000000 TIP       0036 R 000001 TLAT
0050 R 000011 TLATI     0036 R 000002 TLONG     0050 R 000012 TLONGI    0024 R 000030 TRB       0043 R 000002 TPPCO
0041   000004 TRIM      0047 R 000005 TRLSE     0047   000000 TRLSP     0036 R 000007 TT        0043 R 000001 TTDI
0027   000020 TTL       0047   000004 TVBO      0037   000012 TVBON     0036 R 000003 TWEP      0000 R 000074 W
0007 R 000007 WEP       0005 R 000000 WT        0000 R 000011 WU        0005 R 000016 XCG       0029 R 000110 XGB
0023 R 000011 XREF      0005 R 000034 YCG       0023 R 000013 YREF      0024 R 000012 ZB        0005 R 000052 ZCG
0023 R 000015 ZREF
```

```
00101     1•        SUBROUTINE INITIA
00103     2•        REAL MXX,MYY,MZZ,MXZ
00104     3•        DIMENSION SRLPP(3),SVLPP(3),SS(3),WU(3)
00105     4•        DIMENSION SCF(3,3),SCG(3,3),SCM(3,3),SCGM(3,3)
00106     5•        COMMON/AD1/NOENGB,NOENGO,AFLOWB,AFLOWO,AMINTB,AMINTO,ALENGO
00107     6•        COMMON/AD2/AGAIN1,AGAIN2,AMAXGA,ANGMIN,ANGMAX,AMINOM,AREVRS
00110     7•        COMMON /CG/WT(19),XCG(19),YCG(19),ZCG(19),MXX(19),MYY(19),
00110     8•       •   MZZ(19),MXZ(19)
00111     9•        COMMON /CON/ RAD,RADI,PI,SGRAV,SRMEAN,SEROT,SMU
00112    10•        COMMON /DA1/ DMAXB,DMAYB,DMAZB,DFAB(4),WEP(9),P,MI,ATOTHR
00113    11•        COMMON/EA1/ETHETA,EPSI,EPHI,ETHETD,EPSID,EPHID,ATENG(12)
00114    12•        COMMON /EA2/ EL(12,3),EBP(12),EBT(12),EPE(12),EPT,IES,IBO,ISEP
00114    13•       • ,ELO(2,3),ARCSPM,ARCSYM,ARCSRM
00115    14•        COMMON/IA1/ADMTOT,AMDOTV,AMTOT,AMASCO,ADMASS(12),AUGRAV
00116    15•        COMMON/IA2/APRATE(5),AYRATE(5),ARRATE(5)
00117    16•        COMMON/IA3/ADESMX,ADESMY,ADESMZ,ABYAW(2),ABTOTY(2),ATOTPG(5)
00120    17•        COMMON/IA4/APDIFT,AYDIFT,ARDIFT,IPITCH,IYAW,IROLL,IRESID
00121    18•        COMMON/IA5/ANGLOB,ARATDB,ARATLM,ACCLIM,ACOMSM,ANOAER,AMINGA
00122    19•        COMMON/IA6/ALPHPI(5),ALPHYA(5),ALPHRO(5),ALPHAC(5),ACTALP(5)
00123    20•        COMMON/IA7/ACTPAC(5),ACALMY(5),ABETAP(5),ABPIT(12),ARATE(5)
00124    21•        COMMON /IA8/ ACTYAC(5),ACALMZ(5),ABETAY(5),AFYMX(5),AFZMX(5)
00125    22•        COMMON /IA9/ ACTRAC(5),ACALMX(5),ABETAR(5),ABROLL(12),ABTOTP(12)
00126    23•        COMMON/ID1/HMAX,SPAN(2),C(2),AREA(2),CHORD(2),XREF(2),YREF(2),
00126    24•       •     ZREF(2)
00127    25•        COMMON/ID2/HB(10),ZB(19),THB(29),ALP(29),XGB(19)
00130    26•        COMMON/ID3/CX(20,2),CY(90,2),CZ(90,2),CM(90,2),CN(90,2),MCH(20)
00131    27•        COMMON /IE1/ EPAI,EPB,EGB,ERB,EPBD,EGBD,ERBD,EAVPP(3),EVPP(3)
00132    28•        COMMON /IE2/ ETSLO1,ETSLO2,ETSLB(12),EBPO,EATT,TTL,EB(3,3)
00133    29•        COMMON /IE3/ EAEB(12),EAEO1,EAEO2,EGP(3)
00134    30•        COMMON /IG1/ SUQ(9),GCO(3),GDT,SMD,STD
00135    31•        COMMON /IG2/ SHDOTD,SYDOTD,SZDOTD,GMT(12),GTA(12),GTPPCO
00136    32•        COMMON /IG3/ IGMT,GEGVEL,AZCF,EVP(9),ERP(9),EGEFF,GDTV
00137    33•        COMMON /IG4/ GURP(9),GUZP(9),GUYP(9),GM(9),GTHED,GPSID,GPHID
00140    34•        COMMON /IG6/ GTAU,GISO1,GISO2,GISO3,GTMEV,GVGVEC(9)
00141    35•        COMMON /IT1/ TF,TLAT,TLONG,TWEP(3),THBO,TT(6),KLPDR
00142    36•        COMMON /IT2/ TIP(3,3),TAE,TVBON
00143    37•        COMMON/HA1/ JUMP,T,IABT,ABTT,TGOT,KGUID
00144    38•        COMMON/HAN/APDET,AYDET,ARDET,MANUAL,TRIM,SETCGO
00145    39•        COMMON /MI1/ SINCI,SLAZI
00146    40•        COMMON /MA2/ AALIM,TTDI,TPPCO,GTDM,THELIM
00147    41•        COMMON /MP1/ KACOTC
00150    42•        COMMON /MP2/ KAUT
00151    43•        COMMON /PAR/ SAPOH,SPERM,SLAT,SLONG,SINC,SLAZ,STI,SVEII,EC2
00152    44•        COMMON /TR1/ TRLSP(9),TVBO,THLSE(9)
00153    45•        COMMON /SR1/ EG(3),EAVP(9),ELATC,ELONGD,TLATI,TLONGI,SLATI,SLONGI
00154    46•        DATA WT/9415.3,12297.1,15178.8,18060.6,20942.3,23829.1,26705.9,
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02-1183 87-2A

```
00154          *   51750.4,68417.5,85083.9,103033.1,120982.4,139553.3,156875.8/
00156           DATA XCG/  44.28,  45.85,  47.43,  49.01,  50.59,  52.17,  53.75,
00156          *          106.96, 114.55, 118.88, 129.92, 134.23, 140.80, 147.48/
00160           DATA YCG/ 14*0./
00162           DATA ZCG/   3.40,   3.66,   3.93,   4.19,   4.46,   4.72,   4.99,
00162          *          -11.32,  -8.09,  -6.14,  -5.17,  -4.19,  -3.70,  -3.23/
00164           DATA MXX/  2.734,  3.230,  3.726,  4.221,  4.717,  5.212,  5.708,
00164          *          29.170, 32.859, 34.852, 35.858, 36.794, 37.552, 38.310/
00166           DATA MYY/ 20.972, 23.156, 25.339, 27.522, 29.706, 32.889, 34.072,
00166          *         241.190,304.817,363.439,423.213,483.000,542.822,602.627/
00170           DATA MZZ/ 22.756, 25.401, 28.047, 30.693, 33.339, 35.985, 38.631,
00170          *         233.248,293.603,358.663,409.902,469.225,528.758,588.273/
00172           DATA MXZ/  0.080,  0.067,  0.055,  0.043,  0.030,  0.018,  0.006,
00172          *         -37.336,-35.769,-32.867,-28.843,-25.054,-21.853,-18.652/
00172     C         INITIALIZATION
00174           DATA RAD,RADI,PI,SGRAV,SRMEAN,SEROT,SMU/57.29578,1.745329E-2,
00174          *3.1415926536 ,32.17404,2.090974E7,7.292115E-5,1.407654E16/
00204           DATA SAPOH,SPERH,SLATI,SLONGI,SVEII,EC2/6.076115E5,3.098819E5,
00204          128.532  , -80.565 ,-17.0,220./
00213           DATA SRMEEQ/2.09257382E7/
00213     C         EOM
00215           DATA  EL/12*0.,-4.7,4.7,-14.1,-4.7,4.7,14.1,-14.1,-4.7,4.7,14.1,
00215          * -4.7,4.7,2*14.1,4*4.7,4*-4.7,2*-14.1/
00217           DATA EPE,EGEFF,EATT,ELO/12*1.,32.14655,40.,2*0.,-6.5,6.5,2*2.25/
00224           DATA ETSLB,EAEB,EBP,EPT/12*550000.,12*25.517,12*-.02189,1./
00231           DATA EPA1,EAEO1,EAEO2,EBPO,T/2116.8,61.903,68.046,5.585053E-2,0./
00237           DATA EATVPM,EATVPN,ETSLO1,ETSLO2,ETHETA/40.,41.,2*4.88E5,-.02189/
00237     C         GUIDANCE
00245           DATA GCO,GPHIO,GEGVEL,AZCF,EPT/8.,80.4351,96.5221,0.,14136.,0.,1./
00253           DATA GMT /14.,20.,30.,40.,50.,60.,100.,120.,140.,180.,220.,240./
00255           DATA GTA/-.02189,-.06383,-.10598,-.15467,-.22454,-.31066,
00255          1 -.81915,-1.04268,-1.21357,-1.41588,-1.56391,-1.59823/
00257           DATA GTPPCO,GOT,GC11,GURP,GUZP,GUYP,IES/212.,1.,4.,12*.5,1/
00267           DATA GTAU,GISO1,GISO2,GISO3,GTHEV,GVGVEC/290.,8*0./,ISEP/0/
00277           DATA IGMT/0/
00277     C         AUTOPILOT DATA
00301           DATA  ADMTOT,AMDOTV,ADMASS,AMTOT,AMASCO,AUGRAV,ATENG/14*0.,
00301          * 156875.8,51933.48,32.17404,12*550000./
00311           DATA ANOAER,AMINGA,ACOMSM,ACCLIM,ARATLM,ANGLDB,ARATDB/.7,.35,
00311          1 1.745329E-7,2.268928E-1,1.047197E-1,1.745329E-5,1.745329E-4/
00321           DATA  NOENGB,NOENGO,AFLOWB,AFLOWO/12,2,2*1375./
00326           DATA     AGAIN1,AGAIN2,AMAXGA,ANGMIN,ANGMAX,AMINOM,AREVRS/.9,.7,
00326          1 1.3,.95,1.05,.99,1.20/
00326     C         ABORT GUIDANCE
00336           DATA TT,TGOT/.06236,2.47813,-3.47331,.06236,2.47813,-3.4733,200./
00341           DATA TF      /.00335233/
00341     C     AERODYNAMICS DATA
00343           DATA /C/10.,9.80665E-4/,HMAX/5.E5/
00346           DATA  SPAN,AREA,CHORD/150.,122.3,8308.,6484.,74.,70.6/
00352           DATA  XREF,YREF,ZREF/235.,46.58,4*0./
00356           DATA HB            /-5000.0,0.0,11000.0,20000.0,32000.0,47000.0,
00356          152000.0,61000.0,79000.0,88743.0/
00360           DATA ZB       /90000.0,100000.0,110000.0,120000.0,150000.0,16
00360          10000.0,170000.0,190000.0,230000.0,300000.0,400000.0,500000.0,60000
00360          20.0,700000.0/
00362           DATA TMB            /320.65,288.65,216.65,216.65,228.65,270.65,
00362          1270.65,252.65,180.65,180.65,180.65,210.65,260.65,360.65,
00362          2960.65,1110.65,1210.65,1350.65,1550.65,1830.65,2160.65,
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00362  105*          32420.65,2590.65,2700.65/
00369  106*           DATA ALP             /12.087778,11.526088,10.027120,8.4079235,
00369  107*          [6.7662077,4.7086738,4.0775458,2.7019653,.37006732E-1,-1.8055749,
00369  108*          2-1.8055749,-3.5040610,-4.9124564,-5.9828218,-7.5886378,-7.9035491,
00369  109*          3-8.1833670,-8.6884557,-9.5726883,-10.879639,-12.421649,-13.724116,
00369  110*          4-14.879663,-15.942630/
00366  111*           DATA XGB             /9.535,9.505,9.476,9.447,9.360,9.331,9.302,
00366  112*          19.246,9.139,8.942,8.679,8.428,8.187,7.956/
00370  113*           TLAT= TLAT1*RAD1
00371  114*           TLONG= TLONG1*RAD1
00372  115*           SINC= SINC1*RAD1
00373  116*           SLAZ= SLAZ1*RAD1
00374  117*           SLAT= SLAT1*RAD1
00375  118*           SLONG= SLONG1*RAD1
00376  119*           STHETA=0.
00377  120*           SRP=SRMEAN*SPERM
00400  121*           SRA=SRMEAN*SAPOM
00401  122*           SA=.5*(SRA+SRP)
00402  123*           SVP=SQRT(SMU*((2./SRP)-1./SA))
00403  124*           SH=SRP*SVP
00404  125*           SE=.5*(SVP**2)-SMU/SRP
00405  126*           SECCEN=(SAPOM-SPERM)/(SRA+SRP)
00406  127*           SYO=0.
00407  128*           SRO=(SA*(1.-SECCEN**2))/(1.+SECCEN*COS(STHETA))
00410  129*           SZDOTO=SH/SRO
00411  130*           SRDOTO=SQRT(ABS(SMU*((2./SRO)-(1./SA))-((SH**2)/(SRO**2))))
00412  131*           SYDOTO=0.
00413  132*            W = SEROT
00414  133*           A = PI/2. - SLAT
00415  134*           WEP(1) = W * COS(A)
00416  135*           WEP(2) = -W * SIN(SLAZ)*SIN(A)
00417  136*           WEP(3) = W * COS(SLAZ)*SIN(A)
00420  137*           WEP(4) = SQRT(WEP(1)**2+WEP(2)**2+WEP(3)**2)
00421  138*           DO 30I=1,3
00424  139*        30 THEP(I)= WEP(I)
00426  140*           SRLPP(1)=SRMEAN
00427  141*           SRLPP(2)=0.
00430  142*           SRLPP(3)=0.
00431  143*           SVLPP(1)=0.
00432  144*           SVLPP(2)=W*SRMEAN*COS(SLAT)*COS(SLAZ)
00433  145*           SVLPP(3)=W*SRMEAN*COS(SLAT)*SIN(SLAZ)
00434  146*           DO53I=1,3
00437  147*           ERP(I) = SRLPP(I)
00440  148*           EVP(I) = SVLPP(I)
00441  149*           EVPP(I) = EVP(I)
00442  150*        53 EAVPP(I) = 0.
00444  151*           EVP(4)=SQRT(EVP(1)**2+EVP(2)**2+EVP(3)**2)
00445  152*           ERP(4) = SQRT(ERP(1)**2+ERP(2)**2+ERP(3)**2)
00446  153*           DO 54 I=1,3
00451  154*           EG (I)=-SMU*ERP(I)/(ERP(4)**3)
00452  155*        54 EGP(I)=EG(I)
00454  156*           SBETA=SVE1*RAD1
00455  157*           SS(1)=COS(SBETA)
00456  158*           SS(2)= 0.
00457  159*           SS(3)=SIN(SBETA)
00460  160*           DO 56 I=1,3
00463  161*        56 WU(I)=WEP(I)/WEP(4)
00465  162*           CALL DOTPRD(SS,WU,SSG)
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00466    163.          SCIL=SIN(SLAZ)*COS(SLAT)
00467    164.          SCOG=SQRT(1.-SSG**2)
00470    165.          SAP=SCIL/SCOG
00471    166.          SSALF=COS(SINC)/SCOG
00472    167.          SDELI=ASIN(SAP)-ASIN(SSALF)
00473    168.          SUQ(1)=-SIN(SBETA)*SIN(SDELI)
00474    169.          SUQ(2)=COS(SDELI)
00475    170.          SUQ(3)=COS(SBETA)*SIN(SDELI)
00476    171.          SUQ(4)=SQRT(SUQ(1)**2+SUQ(2)**2+SUQ(3)**2)
00477    172.          CALL DOTPRD (SUQ,MU,SINCCO)
00500    173.          SINCA=(ACOS(-SINCCO))*RAD
00501    174.          SQI= .5*PI-SLAZ
00502    175.          SCF(1,1)=1.
00503    176.          SCF(1,2)=0.
00504    177.          SCF(1,3)=0.
00505    178.          SCF(2,1)=0.
00506    179.          SCF(2,2)=SIN(SQI)
00507    180.          SCF(2,3)=-COS(SQI)
00510    181.          SCF(3,1)=0.
00511    182.          SCF(3,2)=COS(SQI)
00512    183.          SCF(3,3)=SIN(SQI)
00513    184.          SCG(1,1)=COS(SLAT)
00514    185.          SCG(1,2)=0.
00515    186.          SCG(1,3)=SIN(SLAT)
00516    187.          SCG(2,1)=0.
00517    188.          SCG(2,2)=1.
00520    189.          SCG(2,3)=0.
00521    190.          SCG(3,1)=-SIN(SLAT)
00522    191.          SCG(3,2)=0.
00523    192.          SCG(3,3)=COS(SLAT)
00524    193.          SCH(1,1)= COS(SLONG)
00525    194.          SCH(1,2)= SIN(SLONG)
00526    195.          SCH(1,3)=0.
00527    196.          SCH(2,1)=-SCH(1,2)
00530    197.          SCH(2,2)= SCH(1,1)
00531    198.          SCH(2,3)=0.
00532    199.          SCH(3,1)=0.
00533    200.          SCH(3,2)=0.
00534    201.          SCH(3,3)=1.
00535    202.          CALL MATMAT(SCG,SCH,SCGH)
00536    203.          CALL MATMAT(SCF,SCGH,TIP)
00537    204.          TRLSE(4)=SRMEEQ*(1.-TF)/SQRT(1.-TF*(2.-TF)*(COS(TLAT)**2))
00540    205.          TRLSE(1)=TRLSE(4)*COS(TLAT)*COS(TLONG)
00541    206.          TRLSE(2)=TRLSE(4)*COS(TLAT)*SIN(TLONG)
00542    207.          TRLSE(3)=TRLSE(4)*SIN(TLAT)
00543    208.          WRITE(6,1)ABTT,TLATI,TLONGI,THBO
00551    209.          WRITE(6,10) TTDI,AALIM,KLPOR,KAUT
00557    210.          WRITE(6,14) TPPCO,GTDM,THELIM
00564    211.          WRITE(6,2)SLATI,SLONGI,SLAZI,SVEII,SINCI,SINCA,SPERH,SAPOH
00576    212.          WRITE(6,3)SRD,SYD,SRDOTD,SYDOTD,SZDOTD,SUQ
00611    213.          WRITE(6,4)SRMEAN,SGRAV,SEROT,SMU
00617    214.      1   FORMAT(40X,'ABORT PARAMETERS'//1X,'ABORT TIME= ',1PE13.6,2X,'L.S.
00617    215.     1LATITUDE=',1PE13.6,2X,'L.S. LONGITUDE=',1PE13.6,2X,'ABORT TARGET A
00617    216.     2LTITUDE=',1PE13.6)
00620    217.      2   FORMAT (/40X,'LAUNCH PARAMETERS'//1X,'LAUNCH LATITUDE=',1PE13.6,2X
00620    218.     1,'LAUNCH LONGITUDE=',1PE13.6,2X,'LAUNCH AZIMUTH=',1PE13.6,2X,'BETA
00620    219.     2 ANGLE=',1PE13.6,//40X,'ORBIT PARAMETERS'//1X,'ORBIT INC. DESIRED=
00620    220.     3',1PE13.6,2X,'ORBIT INC. ACTUAL=',1PE13.6,2X,'PERIGEE=',1PE13.6,2X
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REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

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00620          4,'APOGEE=',1PE13.6)
00621      3   FORMAT (/40X,'LAUNCH TARGET PARAMETERS'//1X,8H    SRD=,1PE13.6,8H
00621         1   SYD=,1PE13.6,8H SRDOTD=,1PE13.6,8H SYDOTD=,1PE13.6,8H SZDOTD=,
00621         21PE13.6,/1X,5H  SUQ,4(1PE20.7))
00622      4   FORMAT(//40X,'UTILITY PARAMETERS'//1X,8H SRMEAN=,1PE13.6,8H  SGRAV
00622         1=,1PE13.6,8H  SEROT=,1PE13.6,8H    SMU=,1PE13.6)
00623       10 FORMAT(1X,'T DELAY ABORT',1PE13.6,2X,'ABORT ACCEL THROTTLE',1PE13.
00623         16,2X,'RETURN TO LP',I8,4X,'IDEAL A. P. ABORT',I8)
00624       14 FORMAT(1X,'ABORT PITCH PROFILE CUTTOFF',1PE13.4,4X,'TVC ROTATION R
00624         1ATE',1PE13.4,4X,'THETA ROTATION RATE',1PE13.4)
00625          RETURN
00626          END

    END OF COMPILATION:        NO  DIAGNOSTICS.
  INITIA          SYMBOLIC                                  04 APR 72  15:10:09   0  01470652    14   232  (DELETED)
  INITIA  CODE    RELOCATABLE                               04 APR 72  15:10:09   1  01477132   180     1  (DELETED)
                                                                                   0  01477416    14   117
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D2-118387-24

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@ FOR,* GUIDAN;GUIDAN                                                    01 JUN 72          22:38:50.304
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:50

   SUBROUTINE GUIDAN    ENTRY POINT 001256

   STORAGE USED: CODE(1) 001266; DATA(0) 000136; BLANK COMMON(2) 000000

   COMMON BLOCKS:

    0003   CON    000007
    0004   EA2    000125
    0005   GR1    000002
    0006   GT1    000004
    0007   IE2    000032
    0010   IG1    000012
    0011   IG2    000034
    0012   IG3    000015
    0013   IG4    000023
    0014   IG6    000011
    0015   MAI    000006
    0016   EG1    000004
    0017   TAJ    000020

   EXTERNAL REFERENCES (BLOCK, NAME)

    0020   EYCG
    0021   EXCG
    0022   MAG
    0023   VECPRD
    0024   UNTVEC
    0025   DOTPRD
    0026   MATVEC
    0027   EZCG
    0030   SQRT
    0031   ATAN
    0032   COS
    0033   SIN
    0034   ALOG
    0035   ASIN
    0036   NERR3S

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001  000477 10L      0001  000062 145G     0001  001133 20L      0001  000053 212L     0001  000111 219L
    0001  000222 221L     0001  000437 224L     0001  000432 229L     0001  000442 225L     0001  000408 226L
    0001  000470 227L     0001  000455 228L     0001  000621 229L     0001  000733 230L     0001  000727 231L
    0001  000447 232L     0001  001227 234L     0001  001226 236L     0001  001147 240L     0001  001161 241L
    0001  001102 336G     0001  001120 345G     0001  001236 371G     0001  001025 401L     0001  001033 403L
    0001  001241 501L     0015  000003 ABTT     0000 R 000037 AMTOT    0004  000122 ARCSPM   0004  000124 ARCSRM
    0004  000123 ARCSYM   0012 R 000002 AZCF     0016 R 000000 EAT8     0006 R 000000 EAT8N    0000 R 000000 EATP
    0007 R 000017 EATT     0007 R 000021 EB       0004  000044 EBP      0007  000016 EBPQ     0004  000060 EBT
    0012 R 000013 EGEFF    0004  000000 EL       0004  000114 ELO      0004  000074 EPE      0004 R 000110 EPT
    0012 R 000007 ERP      0007  000002 ETSL8     0007  000000 ETSL01   0007  000001 ETSL02   0012 R 000003 EVP
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02-1183 87-2A

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0021	R	000000	EXCG	0020	R	000000	EYCG	0027	R	000000	EZCG	0000	R	000063	GA
0000	R	000031	GATBMP	0000	R	000071	GATDM	0000	R	000067	GATDR	0000	R	000070	GATDY
0000	R	000057	GAT2	0000	R	000060	GA21	0000	R	000061	GA22	0000	R	000064	GB
0010	R	000004	GCO	0000	R	000066	GD	0000	R	000042	GDELTA	0000	R	000045	GDRDOT
0000	R	000073	GDTM	0012		000014	GDTV	0000	R	000046	GDYDOT	0000	R	000047	GDZDOT
0000	R	000025	GEMP	0000	R	000050	GGEFF	0000	R	000004	GGQI	0014	R	000001	GISQI
0014	R	000003	GISQ3	0013	R	000014	GM	0011	R	000003	GMT	0013	R	000022	GPHID
0013	R	000021	GPSID	0000	R	000035	GPSIDN	0000	R	000075	GPSIDI	0000	R	000072	GQQI
0000	R	000053	GQ2	0000	R	000055	GQ3	0000	R	000056	GQ4	0000	R	000042	GRDOT
0014	R	000000	GTAU	0000	R	000024	GTDM	0005	R	000000	GTFTL	0005	R	000001	GTGO
0000	R	000034	GTHEDN	0000	R	000032	GTHEDI	0014		000004	GTHEV	0000	R	000040	GTIEG
0013	R	000000	GURP	0013	R	000010	GUYP	0013	R	000004	GUZP	0000	R	000010	GUI
0000	R	000020	GU3	0014	R	000005	GVGVEC	0000	R	000044	GYDOT	0000	R	000043	GZDOT
0015		000002	IABT	0004		000112	IBO	0000	I	000041	IEPT	0004	I	000111	IES
0000		000115	INJPS	0004	I	000113	ISEP	0015		000000	JUMP	0000	I	000076	K
0000	I	000051	KK	0000	I	000033	L	0003	R	000002	PI	0003		000000	RAD
0003		000005	SEROT	0003		000003	SGRAV	0003		000006	SMU	0010	R	000010	SRD
0003		000004	SRMEAN	0010	R	000000	SUQ	0010	R	000011	SYD	0011	R	000001	SYDOTD
0015	R	000001	T	0017		000010	TAG	0017		000004	TDVG	0015		000004	TGOT
0017		000000	TVG												

0000	R	000063	GA	0017	R	000014	GADP								
0000	R	000070	GATDY	0000	R	000059	GAII								
0000	R	000065	GC	0000	R	000007	GDT								
0000	R	000047	GDZDOT	0012	R	000001	GEGVEL								
0014	R	000001	GISQI	0014	R	000002	GISQ2								
0000	R	000022	GPHID	0000	R	000036	GPMIDN								
0000	R	000072	GQQI	0000	R	000052	GQI								
0011	R	000043	GRDOT	0011	R	000017	GTA								
0005	R	000001	GTGO	0013	R	000020	GTHED								
0000	R	000040	GTIEG	0011	R	000033	GTPPCO								
0000	R	000010	GUI	0000	R	000014	GU2								
0000	R	000043	GZDOT	0000	I	000074	I								
0000	I	000111	IES	0012		000000	IGMT								
0000	I	000076	K	0015		000005	KGUID								
0003	R	000002	PI	0003	R	000001	RADI								
0010	R	000010	SRD	0011	R	000000	SRDOTD								
0011	R	000001	SYDOTD	0011	R	000002	SZDOTD								
0015		000004	TGOT	0007		000020	TTL								

```
00101     1•          SUBROUTINE GUIDAN
00103     2•          COMMON /CON/ RAD,RADI,PI,SGRAV,SRMEAN,SEROT,SMU
00104     3•          COMMON /EA2/ EL(12,3),EBP(12),EBT(12),EPE(12),EPT,IES,IBO,ISEP
00104     4•         • ,ELO(2,3),ARCSPM,ARCSYM,ARCSRM
00105     5•          COMMON /GRI/ GTFTL,GTGO
00106     6•          COMMON /GT1/ EATBN(4)
00107     7•          COMMON /IE2/ ETSLO1,ETSLO2,ETSLB(12),EBPO,EATT,TTL,EB(3,3)
00110     8•          COMMON /IG1/ SUQ(4),GCO(3),GDT,SRD,SYD
00111     9•          COMMON /IG2/ SRDOTD,SYDOTD,SZDOTD,GMT(12),GTA(12),GTPPCO
00112    10•          COMMON /IG3/ IGMT,GEGVEL,AZCF,EVP(4),ERP(4),EGEFF,GDTV
00113    11•          COMMON /IG4/ GURP(4),GUZP(4),GUYP(4),GM(4),GTHED,GPSID,GPHID
00114    12•          COMMON /IG6/ GTAU,GISO1,GISO2,GISO3,GTHEV,GVGVEC(4)
00115    13•          COMMON/MA1/ JUMP,T,IABT,ABTT,TGOT,KGUID
00116    14•          COMMON /EG1/ EATB(4)
00117    15•          COMMON /TA3/ TVG(4),TDVG(4),TAG(4),GADP(4)
00120    16•          DIMENSION EATP(4),       GGQI(4),GUI(4),GUZ(4),GU3(4)
00121    17•          DATA GTDM /2./
00123    18•          DIMENSION GEMP(4)
00124    19•          GATBMP=EATT
00125    20•          GURP(1)=ERP(1)/ERP(4)
00126    21•          GURP(2)=ERP(2)/ERP(4)
00127    22•          GURP(3)=ERP(3)/ERP(4)
00130    23•          GURP(4)= SQRT(GURP(1)**2+GURP(2)**2+GURP(3)**2)
00131    24•          IF(IES.EQ.0)GO TO 236
00133    25•          IF(T.GT.GTPPCO) GO TO 221
00135    26•          IF(T.LE.GMT(1)) GTHED1=GTA(1)
00137    27•          IF(T.GT.GMT(1)) GO TO 212
00141    28•          GO TO 219
00142    29•      212 IF(T.GT.GMT(12)) GO TO 221
00144    30•          DO 213 L=2,12
00147    31•          IF(T.LE.GMT(L)) GTHED1=GTA(L-1)+((T-GMT(L-1))/(GMT(L)-GMT(L-1)))•
00147    32•         1 (GTA(L)-GTA(L-1))
00151    33•      213 IF(T.LE.GMT(L)) GO TO 219
00154    34•      219 GTHEDN=GTHED
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D2-11838-7-24

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```
00155    35•          GPSIDN=GPSID
00156    36•          GPHIDN=GPHID
00157    37•          GTHED = GTHED1
00160    38•          GPSID= ATAN(EYCG(AMTOT)/EXCG(AMTOT))
00161    39•          GPHID= 0.
00162    40•          GTIEG=GTPPCO-6.
00163    41•          IF(ABS(T-GTIEG).LT..1) GTGO= 150.
00165    42•          GADP(1)=GATBMP*COS(GTHED)*COS(GPSID)
00166    43•          GADP(2)=GATBMP*SIN(GPSID)
00167    44•          GADP(3)=-GATBMP*COS(GPSID)*SIN(GTHED)
00170    45•          CALL MAG(GADP)
00171    46•          IF(T.LT.10.) IEPT=0
00173    47•          IF(IEPT.LT..998) IEPT=1
00175    48•          GO TO 234
00176    49•      221 CALL VECPRD(GURP,SUN,GEMP)
00177    50•          CALL UNTVEC(GEMP,GUZP)
00200    51•          CALL VECPRD(GUZP,GURP,GEMP)
00201    52•          CALL UNTVEC(GEMP,GUYP)
00202    53•          GRDOT=EVP(1)*GURP(1)+EVP(2)*GURP(2)+EVP(3)*GURP(3)
00203    54•          GZDOT=EVP(1)*GUZP(1)+EVP(2)*GUZP(2)+EVP(3)*GUZP(3)
00204    55•          GYDOT=EVP(1)*GUYP(1)+EVP(2)*GUYP(2)+EVP(3)*GUYP(3)
00205    56•          CALL VECPRD(GURP,EVP,GM)
00206    57•          GM(4)=GM(1)**2+GM(2)**2+GM(3)**2
00207    58•          GDRDOT=SRDOTD-GRDOT
00210    59•          GDYDOT=SYDOTD-GYDOT
00211    60•          GDZDOT=SZDOTD-GZDOT
00212    61•          GVGVEC(1)=GDRDOT*GURP(1)+GDYDOT*GUYP(1)+GDZDOT*GUZP(1)
00213    62•          GVGVEC(2)=GDRDOT*GURP(2)+GDYDOT*GUYP(2)+GDZDOT*GUZP(2)
00214    63•          GVGVEC(3)=GDRDOT*GURP(3)+GDYDOT*GUYP(3)+GDZDOT*GUZP(3)
00215    64•          GGEFF=-EGEFF+GM(4)/ERP(4)
00216    65•          GVGVEC(1)=GVGVEC(1)-.5*GTGO*GGEFF*GURP(1)
00217    66•          GVGVEC(2)=GVGVEC(2)-.5*GTGO*GGEFF*GURP(2)
00220    67•          GVGVEC(3)=GVGVEC(3)-.5*GTGO*GGEFF*GURP(3)
00221    68•          GVGVEC(4)=SQRT(GVGVEC(1)**2+GVGVEC(2)**2+GVGVEC(3)**2)
00222    69•          GTAU= GEGVEL/EATT
00223    70•          IF(IEPT.EQ.1)GO TO 2242
00225    71•          IF(IEPT.LT..998) IEPT=1
00227    72•      2242 IF(ISEP.EQ.0)GOTO224
00231    73•          KK=3
00232    74•          GOTO225
00233    75•      224 KK=2
00234    76•          GO TO 232
00235    77•      225 IF(IEPT.EQ.1)GO TO 226
00237    78•          GOTO227
00240    79•      232 IF(GTGO .GE. GCO(1)) GO TO 228
00242    80•          GOTO229
00243    81•      220 IF(IEPT.EQ.1)GO TO 226
00245    82•          IF(EATT.GT.0.) GO TO 227
00247    83•          GTFTL= 40.
00250    84•          GO TO 10
00251    85•      227 GTFTL=GEGVEL/EATT  -  (GEGVEL/(GCO(KK)))
00252    86•       10 GISO1=ALOG(1.-GTFTL/GTAU)
00253    87•          GTGO= GTFTL+(GVGVEC(4)+GEGVEL*GISO1)/GCO(KK)
00254    88•          GQ1= GEGVEL*GISO1
00255    89•          GQ2= GTGO-GTFTL
00256    90•          GA11= -GQ1+GCO(KK)*GQ2
00257    91•          GQ3= GTAU*GQ1
00260    92•          GQ4= GEGVEL*GTFTL
```


REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
00261    930          GA12= -GQ3-GQ4+.5*GCO(KK)*((GTGO)**2-(GTFTL)**2)
00262    940          GA21= GQ3+GQ4-GQ1*GTGO+.5*GCO(KK)*(GQ2**2)
00263    950          GA22= GTAU*(GQ3+GQ4-GTGO*GQ1)+GQ4*(GTFTL/2.-GTGO)
00263    960        1 +GCO(KK)*( GTGO**3-3.*GTGO*((GTFTL)**2)+2.* GTFTL**3)/6.
00264    970          GOTO229
00265    980      226 GTGO= GVGVEC(4)/GCO(KK)
00266    990          GA11= GCO(KK)*GTGO
00267   1000          GA12= GA11*GTGO/2.
00270   1010          GA21= GA12
00271   1020          GA22= GA12*GTGO/3.
00272   1030      229 GDELTA=GA11*GA22-GA12*GA21
00273   1040          CALL DOTPRD (SUQ,ERP,GQ1)
00274   1050          GA=(-GA12*(SRD-ERP(4)-GRDOT*GTGO)+GA22*GDRDOT)/GDELTA
00275   1060          GB=(GA11*(SRD-ERP(4)-GRDOT*GTGO)-GA21*GDRDOT)/GDELTA
00276   1070          GC=(-GA12*(SYD-GQ1-GYDOT*GTGO)+GA22*GDYDOT)/GDELTA
00277   1080          GD=(GA11*(SYD-GQ1-GYDOT*GTGO)-GA21*GDYDOT)/GDELTA
00300   1090          GATDR=EATT  *(GA+GB*GDT)-GGEFF
00301   1100          GATDY=EATT  *(GC+GD*GDT)
00302   1110          GISO2=EATT**2  -GATDR**2-GATDY**2
00303   1120          IF(GISO2.GT.0.)GOTO231
00305   1130          GATDH=0.
00306   1140          GOTO230
00307   1150      231 GATDH=SQRT(GISO2)
00310   1160      230 GISO3=SQRT(GATDH**2+GATDR**2)
00311   1170          GTHEDN=GTHED
00312   1180          GPSIDN=GPSID
00313   1190          GPHIDN=GPHID
00314   1200          GADP(1)=GATDR*GURP(1)+GATDY*GUYP(1)+GATDH*GUZP(1)
00315   1210          GADP(2)=GATDR*GURP(2)+GATDY*GUYP(2)+GATDH*GUZP(2)
00316   1220          GADP(3)=GATDR*GURP(3)+GATDY*GUYP(3)+GATDH*GUZP(3)
00317   1230          CALL MAG (GADP)
00320   1240          IF(EATB(4).LT.10.) GO TO 401
00322   1250          CALL MATVEC(1,EB,EATB,EATP)
00323   1260          GO TO 403
00324   1270      401 CALL MATVEC(1,EB,EATBN,EATP)
00325   1280      403 CONTINUE
00326   1290          CALL VECPRD(GADP,EATP,GGQ1)
00327   1300          CALL MAG(GGQ1)
00330   1310          CALL MAG(EATP)
00331   1320          GQQ1= ASIN(GGQ1(4)/(EATP(4)*GADP(4)))
00332   1330          GDTM= GTDM*RAD1*GDT
00333   1340          IF(ABS(GQQ1).LE.GDTM) GO TO 20
00335   1350          DO 22 I=1,3
00340   1360          GU1(I)= EATP(I)/EATP(4)
00341   1370       22 GU2(I)= GGQ1(I)/GGQ1(4)
00343   1380          CALL VECPRD(GU1,GU2,GU3)
00344   1390          DO 21 I=1,3
00347   1400       21 GADP(I)= GADP(4)*(GU1(I)*COS(GDTM)+GU3(I)*SIN(GDTM))
00351   1410          CALL MAG(GADP)
00352   1420       20 CONTINUE
00353   1430          IF(GADP(1).LE.0.) GO TO 240
00355   1440          GTHED1=ATAN(GADP(3)/GADP(1))
00356   1450          GO TO 241
00357   1460      240 GTHED1=-ATAN(GADP(1)/GADP(3))+PI/2.
00360   1470      241 GTHED =-GTHED1 - ATAN((AZCF-EZCG(AMTOT))/EXCG(AMTOT))
00361   1480          GPSID1=ASIN(GADP(2)/GADP(4))
00362   1490          GPSID = GPSID1 + ATAN(EYCG(AMTOT)/EXCG(AMTOT))
00363   1500          GO TO 234
```


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```
00364    151.        236 IEPT=0
00365    152.        234 CONTINUE
00366    153.            IF(EATB(9).LT.10.) GO TO 501
00370    154.            DO 500 K=1,9
00373    155.        500 EATBN(K)=EATB(K)
00375    156.        501 CONTINUE
00376    157.            RETURN
00377    158.            END
```

END OF COMPILATION: NO DIAGNOSTICS.

GUIDAN	SYMBOLIC	04 APR 72 15:11:10	0	01627616	14	158	(DELETED)
GUIDAN CODE	RELOCATABLE	04 APR 72 15:11:10	1	01634062	84	1	(DELETED)
			0	01634206	14	22	

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```
@ FOR,* EOM,EOM                                                                    01 JUN 72          22:38:53. 84
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:53

-100,101

    EQBD=(EMTYB+DMAYB+ARCSPM+EPB*ERB*(EMZZI-EMXXI)+(ERB**2-EPB**2)*

    * EMXZI)/EMYYI

  SUBROUTINE EOM        ENTRY POINT 001063

  STORAGE USED: CODE(1) 001074; DATA(0) 000264; BLANK COMMON(2) 000000

   COMMON BLOCKS:

   0003   CON    000007
   0004   DA1    000016
   0005   EA1    000022
   0006   EA2    000125
   0007   IA1    000021
   0010   IE1    000015
   0011   IE2    000032
   0012   IE3    000021
   0013   IG1    000012
   0014   IG3    000015
   0015   IT1    000016
   0016   IT2    000013
   0017   MA1    000036
   0020   SR1    000015
   0021   EG1    000004

  EXTERNAL REFERENCES (BLOCK, NAME)

   0022   EXCG
   0023   EYCG
   0024   EZCG
   0025   EMXX
   0026   EMXZ
   0027   EMYY
   0030   EMZZ
   0031   MATVEC
   0032   MAG
   0033   COS
   0034   SIN
   0035   SQRT
   0036   ASIN
   0037   ATAN2
   0040   NERR3S

  STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

   0001   000055 100L      0001   000063 101L      0001   000066 162G      0001   000075 170G      0001   000105 174G
   0001   000115 209G      0001   000130 214G      0001   000202 233G      0001   000216 242G      0001   000243 251G
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D2-118387-2A

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0001		000255	2576	0001		000372	3006	0001		000706	3526	0001		000020	91L
0001		000033	99L	0001		000035	95L	0001		000113	96L	0001		000100	97L
0017		000003	ABTT	0007		000009	ADMASS	0007		000000	ADMTOT	0007		000003	AMASCO
0007	R	000002	AMT	0006	R	000122	ARCSPM	0006	R	000129	ARCSRM	0006	R	000123	ARCSYM
0009		000015	ATOTHR	0007		000020	AVGRAV	0019		000002	AZCF	0009	R	000003	DFAB
0009	R	000001	DMAYB	0008	R	000002	DMAZB	0012	R	000000	EAEB	0012	R	000019	EAEO1
0021	R	000000	EATB	0000	R	000171	EATEST	0011	R	000017	EATT	0030	R	000059	EAVB
0020	R	000003	EAVP	0010	R	000037	EAVPP	0011	R	000021	EB	0006	R	000099	EBP
0006	R	000060	EBY	0000	R	000110	ECEBP	0000	R	000190	ECEBY	0000	R	000216	EC1
0000	R	000213	EC3	0000	R	000050	EFB	0000	R	000100	EFBA	0000	R	000049	EFTB
0019	R	000013	EGEFF	0012	R	000016	EGP	0006	R	000000	EL	0020	R	000007	ELATC
0020	R	000019	ELONGD	0000	R	000275	EM	0000	R	000173	EMTXB	0000	R	000179	EMTYB
0025	R	000000	EMXX	0000	R	000271	EMXXI	0026	R	000000	EMXZ	0000	R	000202	EMXZI
0000	R	000203	EMYYI	0030	R	000010	EMZZ	0000	R	000209	EMZZI	0030	R	000206	EN
0010	R	000001	EPB	0019	R	000039	EPBD	0006		000079	EPE	0000	R	000211	EPH
0005	R	000005	EPHID	0000	R	000210	EPS	0005	R	000001	EPSI	0005	R	000009	EPSID
0010	R	000002	EQB	0010	R	000035	EQBD	0010	R	000003	ERB	0010	R	000006	ERBD
0019	R	000007	ERP	0000	R	000129	ESEBP	0000	R	000159	ESEBY	0000	R	000217	ES1
0000	R	000219	ES3	0000	R	000030	ETBX	0000	R	000019	ETBY	0000	R	000030	ETBZ
0005	R	000000	ETHETA	0005	R	000003	ETHETD	0011	R	000002	ETSLB	0011	R	000000	ETSLO1
0000	R	000060	ETT	0019	R	000033	EVP	0010	R	000012	EVPP	0022	R	000000	EXCG
0023	R	000000	EYCG	0000	R	000177	EYCGI	0024	R	000000	EZCG	0000	R	000200	EZCGI
0013		000007	GDT	0019		000019	GDTV	0019		000001	GEGVEL	0009	R	000019	HI
0017		000002	IABT	0006		000112	IBO	0036	I	000111	IES	0019		000000	IGMT
0006	I	000113	ISEP	0017		000000	JUMP	0017		000005	KGUID	0015		000015	KLPDR
0009	R	000013	P	0003		000002	PI	0003	R	000000	RAD	0003		000001	RADI
0003		000003	SGRAV	0020		000313	SLATI	0020		000019	SLONGI	0003	R	000006	SMU
0003		000009	SRMEAN	0013		000000	SUQ	0013		000011	SYD	0017	R	000001	T
0015		000006	TF	0017		000009	TGOT	0015		000006	THBO	0016	R	000000	TIP
0020		000011	TLATI	0015		000002	TLONG	0020		000012	TLONGI	0015		000007	TT
0016		000012	TVBON	0015		000033	TWEP	0009		000007	WEP				

```
00101     1•          SUBROUTINE EOM
00103     2•          COMMON /CON/ RAD,RADI,PI,SGRAV,SRMEAN,SEROT,SMU
00104     3•          COMMON /DA1/ DMAXB,DMAYB,DMAZB,DFAB(9),DEP(9),P,HI,ATOTHR
00105     4•          COMMON/EA1/ETHETA,EPSI,EPHI,ETHETD,EPSID,EPHID,ATENG(12)
00106     5•          COMMON /EA2/ EL(12,3),EBP(12),EBY(12),EPE(12),EPT,IES,IBO,ISEP
00106     6•         *,ELO(2,3),ARCSPM,ARCSYM,ARCSRM
00107     7•          COMMON/IA1/ADMTOT,AMDOTV,AMT  ,AMASCO,ADMASS(12),AVGRAV
00110     8•          COMMON /IE1/ EPA1,EPB,EQB,ERB,EPBD,EQBD,ERBD,EAVPP(3),EVPP(3)
00111     9•          COMMON /IE2/ ETSLO1,ETSLO2,ETSLB(12),EDPO,EATT,TTL,EB(3,3)
00112    10•          COMMON /IE3/ EAEB(12),EAEO1,EAEO2,EGP(3)
00113    11•          COMMON /IG1/ SUQ(9),GCU(3),GDT,SRD,SYD
00114    12•          COMMON /IG3/ IGMT,GEGVEL,AZCF,EVP(9),ERP(9),EGEFF,GDTV
00115    13•          COMMON /IT1/ TF,TLAT,TLONG,TWEP(3),THBO,TT(6),KLPDR
00116    14•          COMMON /IT2/ TIP(3,3),TAE,TVBON
00117    15•          COMMON/MA1/ JUMP,T,IABT,ABTT,TGOT,KGUID
00120    16•          COMMON /SR1/ EG(3),EAVP(9),ELATC,ELONGD,TLATI,TLONGI,SLATI,SLONGI
00121    17•          DIMENSION ETBX(12),ETBY(12),ETBZ(12)
00122    18•          COMMON /EG1/ EATB(9)
00123    19•          DIMENSION EFTB(9),EFB(9),EAVB(9)
00124    20•          DIMENSION ETT(12),EHF(9),   EFBA(9),EAVBA(9)
00125    21•          DIMENSION ECEBP(12),ESEBP(12),ECEBY(12),ESEBY(12)
00126    22•          IF(ISEP.EQ.0)GOTO91
00130    23•          NE = 2
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REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
00131    24*          IF(EATEST.LT.GCO(3)) GO TO 42
00133    25*          EPT= GCO(3)/EATEST
00134    26*          GOTO45
00135    27*       42 EPT=1.
00136    28*          GOTO45
00137    29*       41 NE = 12
00140    30*          IF(EATEST.LT.GCO(2)) GO TO 44
00142    31*          EPT= GCO(2)/EATEST
00143    32*          GOTO45
00144    33*       44 EPT=1.
00145    34*       45 IF(IES.EQ.0)GOTO46
00147    35*          IF(ISEP.EQ.0)GOTO47
00151    36*          IF(HI.GT.90000.) GO TO 100
00153    37*          ETT(1)=(ETSLO1+EAEO1*(EPA1- P ))
00154    38*          ETT(2)= ETT(1)
00155    39*          GO TO 101
00156    40*      100 ETT(1)= (ETSLO1+EAEO2*(EPA1-P))
00157    41*          ETT(2)= ETT(1)
00160    42*      101 CONTINUE
00161    43*          DO 22 I=1,3
00164    44*          EL(1,I)=ELO(1,I)
00165    45*       22 EL(2,I)=ELO(2,I)
00167    46*          DO 34 I =3,12
00172    47*       34 ETT(I) = 0.
00174    48*          GOTO48
00175    49*       47 DO621I=1,12
00200    50*      621 ETT(I)=(ETSLB(I)+EAEB(I)*(EPA1-  P ))
00202    51*          GOTO48
00203    52*       46 DO622I=1,12
00206    53*      622 ETT(I)=0.
00210    54*          GOTO48
00211    55*       48 IF(IES.EQ.0) EPT=0.
00213    56*          DO623I=1,NE
00216    57*          ATENG(I) = ETT(I)
00217    58*          ECEBP(I)= COS(EBP(I))
00220    59*          ESEBP(I)= SIN(EBP(I))
00221    60*          ECEBY(I)= COS(EBY(I))
00222    61*          ESEBY(I)= SIN(EBY(I))
00223    62*          ETBX(I)= ETT(I)*ECEBP(I)*ECEBY(I)
00224    63*          ETBY(I)=-ETT(I)*ESEBY(I)
00225    64*      623 ETBZ(I)=-ETT(I)*ESEBP(I)*ECEBY(I)
00227    65*          EFTB(1)=0.
00230    66*          EFTB(2)=0.
00231    67*          EFTB(3)=0.
00232    68*          DO629I=1,NE
00235    69*          EFTB(1)=EFTB(1)+ETBX(I)
00236    70*          EFTB(2)=EFTB(2)+ETBY(I)
00237    71*      629 EFTB(3)=EFTB(3)+ETBZ(I)
00241    72*          DO99I=1,3
00244    73*       99 EATB(I)=EFTB(I)*EPT/(AMT)
00246    74*          EATB(4)=SQRT((EATB(1))**2+(EATB(2))**2+(EATB(3))**2)
00247    75*          EATT=EATB(4)
00250    76*          DO50I=1,3
00253    77*          EFB(I)=EFTB(I)*EPT+DFAB(I)
00254    78*       50 EFBA(I)=EFTB(I) +DFAB(I)
00256    79*          DO51I=1,3
00261    80*          EAVB(I)=EFB(I)/(AMT)
00262    81*       51 EAVBA(I)=EFBA(I)/AMT
```


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```
00264    82.          EATEST=          SQRT(EAVBA(1)**2+EAVBA(2)**2+EAVBA(3)**2)
00265    83.          EMTXB=0.
00266    84.          EMTYB=0.
00267    85.          EMTZB=0.
00270    86.          EXCG1= EXCG(AMT)
00271    87.          EYCG1= EYCG(AMT)
00272    88.          EZCG1= EZCG(AMT)
00273    89.          EMXX1= EMXX(AMT)
00274    90.          EMXZ1= EMXZ(AMT)
00275    91.          EMYY1= EMYY(AMT)
00276    92.          EMZZ1= EMZZ(AMT)
00277    93.          DO96I=1,NE
00302    94.          EMTXB= EMTXB+ETBZ(I)*(EL(I,2)-EYCG1)-ETBY(I)*(EL(I,3)-EZCG1)
00303    95.          EMTYB= EMTYB+ETBX(I)*(EL(I,3)-EZCG1)+ETBZ(I)*(EXCG1-EL(I,1))
00304    96.       96 EMTZB= EMTZB-ETBX(I)*(EL(I,2)-EYCG1)-ETBY(I)*(EXCG1-EL(I,1))
00306    97.          EM= EMTXB*DMAXB+EQB*ERB*(EMYY1-EMZZ1)+EPB*EQB*EMXZ1+ARCSRM
00307    98.          EN= EMTZB*DMAZB+EPB*EQB*(EMXX1-EMYY1)-EQB*ERB*EMXZ1+ARCSYM
00310    99.          EPBD= (EM*EMZZ1+EN*EMXZ1)/(EMXX1*EMZZ1-(EMXZ1**2))
00311   100.          EQBD=(EMTYB*DMAYB+ARCSPM+EPB*ERB*(EMZZ1-EMXX1)+(ERB**2-EPB**2)*      *NE*
00311   101.         * EMXZ1)/EMYY1                                                        *NE*
00312   102.          ERBD= (EM*EMXZ1+EN*EMXX1)/(EMXX1*EMZZ1-(EMXZ1**2))                   **-2
00313   103.          EPB=EPB+.2*EPBD
00314   104.          EQB=EQB+.2*EQBD
00315   105.          ERB=ERB+.2*ERBD
00316   106.          ETH= ETHETD
00317   107.          EPS= EPSID
00320   108.          EPH= EPHID
00321   109.          IF(T.LT..3) EC2= 1.
00323   110.          ETHETD= (EQB*(EC3)/EC2)-(ERB*ES3/EC2)
00324   111.          EPSID=  (EQB*ES3)+ERB*EC3
00325   112.          EPHID= EPB-(EQB*EC3*ES2/EC2)+(ERB*ES3*ES2/EC2)
00326   113.          ETHETA= ETHETA+.1*ETH+.1*ETHETD
00327   114.          EPSI= EPSI+.1 *EPS+.1*EPSID
00330   115.          EPHI= EPHI+.1*EPH+.1*EPHID
00331   116.          EC1= COS(ETHETA)
00332   117.          ES1= SIN(ETHETA)
00333   118.          EC2= COS(EPSI)
00334   119.          ES2= SIN(EPSI)
00335   120.          EC3= COS(EPHI)
00336   121.          ES3= SIN(EPHI)
00337   122.          EB(1,1)= EC1*EC2
00340   123.          EB(1,2)=-EC1*ES2*EC3+ES1*ES3
00341   124.          EB(1,3)= EC1*ES2*ES3+ES1*EC3
00342   125.          EB(2,1)= ES2
00343   126.          EB(2,2)= EC2*EC3
00344   127.          EB(2,3)=-EC2*ES3
00345   128.          EB(3,1)=-ES1*EC2
00346   129.          EB(3,2)= ES1*ES2*EC3+EC1*ES3
00347   130.          EB(3,3)=-ES1*ES2*ES3+EC1*EC3
00350   131.          CALL MATVEC(1,EB,EAVB,EAVP)
00351   132.           DO 59 I=1,3
00354   133.          EG(I) =-SMU*ERP(I) / (ERP(9)**3)
00355   134.          EVP(I) = EVP(I)+((3.*EAVP(I)-EAVPP(I))+(3.*EG(I)-EGP(I)))*.1
00356   135.          ERP(I) = ERP(I)+.1*(EVP(I)+EVPP(I))
00357   136.          EVPP(I) = EVP(I)
00360   137.          EAVPP(I) = EAVP(I)
00361   138.       59 EGP(I) = EG(I)
00363   139.          EGEFF = SQRT(EG(1)**2+EG(2)**2+EG(3)**2)
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REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.


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00369   1900          ERP(4) = SQRT(ERP(1)**2+ERP(2)**2+ERP(3)**2)
00365   1910          EVP(4)=SQRT(EVP(1)**2+EVP(2)**2+EVP(3)**2)
00366   1920          CALL MATVEC (2,TIP,ERP,ERF)
00367   1930          CALL MAG(ERF)
00370   1940          ELATC= ASIN(ERF(3)/ERF(4))
00371   1950          ELONGD= ATAN2(ERF(2),ERF(1))-SEROT*T
00372   1960          ELATC= ELATC*RAD
00373   1970          ELONGD= ELONGD*RAD
00374   1980          RETURN
00375   1990          END

    END OF COMPILATION:        NO  DIAGNOSTICS.
 EOM            SYMBOLIC                                  04 APR 72  15:11:13   0  01636279    19   199  (DELETED)
 EOM     CODE   RELOCATABLE                               04 APR 72  15:11:13   1  01692392    96     1  (DELETED)
                                                                                 0  01692502    19    64
```

@ FOR,* AENO,AERO
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A -(EXEC8 LEVEL E120100108) 01 JUN 72 22138142.471
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22138142

SUBROUTINE AERO ENTRY POINT 000532

STORAGE USED: CODE(1) 005441 DATA(2) 000106 BLANK COMMON(2) 000000

COMMON BLOCKS:

0003	COM	000037
0004	DAI	000016
0005	DPI	000011
0006	DRI	000021
0007	DR2	000006
0010	EAI	000022
0011	EA2	000125
0012	IE2	000032
0013	FIRST	000005
0014	PRINT	000001
0015	IAI	000021
0016	IDI	000017
0017	IG3	000015
0020	THIRD	000004

EXTERNAL REFERENCES (BLOCK, NAME)

0021	EMXX
0022	EMYY
0023	EMZZ
0024	EXCG
0025	EYCG
0026	EZCG
0027	UNTVEC
0030	VECPRD
0031	DOTPRD
0032	ATMOS3
0033	COEFO
0034	COEF
0035	SQRT
0036	ATAN2
0037	NEXP6S
0040	NERR3S

STORAGE ASSIGNMENT (BLOCK, TYPE, RELATIVE LOCATION, NAME)

0001	000106	155G	0001	000512	20L	0001	000343	200L	0001	000350	201L	0001	000513	21L	
0001	000356	224G	0001	000466	308L	0015	000004	ADMASS	0015	000000	ADMIOT	0007	R 000000	ALPHA	
0015	000003	AMASCO	0015	000001	AMDOTV	0015	R 000002	AMTOT	0003	R 000030	AMX	0000	R 000031	AMY	
0000	R 000032	AMZ	0000	R 000015	ANSW	0011	000122	ARCSPM	0011	000124	ARCSRM	0011	000123	ARCSYM	
0016	R 000005	AREA	0010	000006	ATENG	0004	000315	ATOTHR	0015	000020	AUGMAV	0017	000002	AZCF	
0007	R 000001	BETA	0016	000003	C	0016	R 000007	CHORD	0013	000003	CMA	0013	000004	CMB	
0000	R 000025	CONF1	0000	R 000026	CONF2	0003	R 000300	CONS	0013	000001	CYB	0013	000002	CZA	
0012	000017	EATT	0012	R 000021	EB	0011	000044	EBP	0012	000016	EBPQ	0011	000060	EBY	

02-1183 87-24

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0017   000013 EGEFF      0011   000000 EL       0011   000114 ELO      0021 R 000000 EMXX     0022 R 000000 EMYY
0023 R 000000 EMZZ       0011   000074 EPE      0010   000005 EPHID    0010   000004 EPSID    0011   000110 EPT
0010   000003 ETHETD     0012   000052 ETSLB    0012   000000 ETSL01   0012   000001 ETSL02   0024 R 000000 EXCG
0025 R 000000 EYCG       0026 R 000000 EZCG     0004 R 000003 FAB      0017   000014 GDTV     0017   000001 GEGVEL
0007 R 000002 H          0000 R 000035 HH       0016 R 000100 HMAA     0004 R 000014 HI       0000 I 000033 I
0011   000112 IBO        0011   000111 IES      0017   000000 IGHT     0000   000043 IHJPS    0011 I 000113 ISEP
0000 I 000041 K          0014   000000 KP       0020 I 000003 KSEP     0004 R 000000 MAB      0013 R 000000 MACH
0007 R 000003 MACHI      0004 I 000013 P        0010   000000 PITCH    0007 R 000005 QDOT     0000 R 000034 QQ1
0000 R 000043 QQ2        0000 R 000044 QQ3      0000 R 000042 QQ4      0007 R 000004 QUE      0000 R 000000 Q1
0000 R 000003 Q2         0000 R 000010 Q3       0000 R 000037 RHO      0010   000002 ROLL     0017 R 000007 RP
0016 R 000001 SPAN       0000 R 000034 TH       0012   000020 TTL      0005 R 000000 UXBP     0006 R 000010 UXTP
0005 R 000003 UYBP       0006 R 000013 UYTP     0005 R 000006 UZBP     0006 R 000016 UZTP     0006 R 000004 VA
0006 R 000000 VAB        0017 R 000003 VP       0000 R 000040 VS       0004 R 000007 WEP      0020 R 000000 XCG
0016 R 000011 XREF       0010   000021 YAW      0020 R 000001 YCG      0016 R 000013 YREF     0020 R 000002 ZCG
0000 R 000027 ZETA       0016 R 000015 ZREF
```

```
00101     1•          SUBROUTINE AERO
00103     2•          REAL MACH,MAB ,MACHI
00104     3•          COMMON /CON/ CONS(7)
00105     4•          COMMON /DA1/ MAB(3),FAB(4),AEP(4),P,HI,ATOTHR
00106     5•          COMMON /DP1/ UXBP(3),UYBP(3),UZBP(3)
00107     6•          COMMON /DR1/ VAB(4),VA(4),UXTP(3),UYTP(3),UZTP(3)
00110     7•          COMMON /DR2/ ALPHA,BETA,H,MACHI,QUE,QDOT
00111     8•          COMMON/EA1/PITCH,YAW,ROLL,ETHETD,EPSID,EPHID,ATENG(12)
00112     9•          COMMON /EA2/ EL(12,3),EBP(12),EBY(12),EPE(12),EPT,IES,IBO,ISEP
00112    10•         • ,ELO(2,3),ARCSPH,ARCSYH,ARCSRH
00113    11•          COMMON /IE2/ ETSLO1,ETSLO2,ETSLB(12),EBPO,EATT,TTL,EB(3,3)
00114    12•          COMMON /FIRST/ MACH,CYB,CZA,CMA,CNB
00115    13•          COMMON/PR,NT/K9
00116    14•          COMMON/IA1/ADMTOT,AMDOTV,AMTOT,AMASCO,ADMASS(12),AUGRAV
00117    15•          COMMON/ID1/HMAX,SPAN(2),C(2),AREA(2),CHORD(2),XREF(2),YREF(2),
00117    16•         •           ZREF(2)
00120    17•          COMMON /IG3/ IGHT,GEGVEL,AZCF, VP(4), RP(4),EGEFF,GDTV
00121    18•          COMMON /THIRD/XCG,YCG,ZCG,KSEP
00122    19•          DIMENSION Q1(3),Q2(5),Q3(5),ANS#(8)
00123    20•          DATA CONF1,CONF2,ZETA/57.29578,.3048,.7/
00127    21•          AMX=EMXX(AMTOT)
00130    22•          AMY=EMYY(AMTOT)
00131    23•          AMZ=EMZZ(AMTOT)
00132    24•          XCG = EXCG(AMTOT)
00133    25•          YCG = EYCG(AMTOT)
00134    26•          ZCG = EZCG(AMTOT)
00135    27•          KSEP = ISEP+1
00136    28•          CALL UNTVEC(RP,UXTP)
00137    29•          CALL VECPRD(VP,RP,Q1)
00140    30•          CALL UNTVEC(Q1,UYTP)
00141    31•          CALL VECPRD(UXTP,UYTP,UZTP)
00142    32•          UXBP(1)= EB(1,1)
00143    33•          UXBP(2)= EB(2,1)
00144    34•          UXBP(3)= EB(3,1)
00145    35•          UYBP(1)= EB(1,2)
00146    36•          UYBP(2)= EB(2,2)
00147    37•          UYBP(3)= EB(3,2)
00150    38•          UZBP(1)= EB(1,3)
00151    39•          UZBP(2)= EB(2,3)
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      UZBP(3)= EB(3,3)
      CALL VECPRD(WEP,RP,Q1)
      DO 12 I = 1,3
   12 VA(I) = VP(I) - Q1(I)
      VA(4) = SQRT(VA(1)**2 + VA(2)**2 + VA(3)**2)
      CALL DOTPRD(VA,UXBP,VAB(1))
      CALL DOTPRD(VA,UYBP,VAB(2))
      CALL DOTPRD(VA,UZBP,VAB(3))
      VAB(4) = SQRT(VAB(1)**2 + VAB(2)**2 + VAB(3)**2)
      IF(ABS(VAB(3)).GT.0..OR.ABS(VAB(1)).GT.0.)
     1ALPHA = ATAN2(VAB(3),VAB(1))
      QQ1=SQRT(VAB(1)**2+VAB(3)**2)
      IF(ABS(QQ1).GT.0..AND.ABS(VAB(1)).GT.0.)
     1BETA=(ATAN2(VAB(2),QQ1))*CONF1
      ALPHA = ALPHA*CONF1
      H = RP(4) - CONS(5)
      H1= H
      HM = H*CONF2
      CALL ATMOS3(HM,HMAX,ANSW)
      P = ANSW(1)*2116.22
      TN = ANSW(2)*288.16
      RHO = ANSW(3)*2.376885E-3
      VS = ANSW(4)*1116.45
      MACH = VAB(4)/VS
      MACH1= MACH
      QUE = .5*RHO*VAB(4)**2
      IF (VAB(4) .LT. 3. .AND. VAB(2) .LT. .01) BETA = 0.
      Q1(1) = MACH
      Q1(2) = ALPHA
      Q1(3) = BETA
      K = KSEP
      IF(ISEP.EQ.0) GO TO 200
      CALL COEFO(Q1,Q2,Q3)
      GO TO 201
  200 CALL COEF(Q1,Q2,Q3)
  201 QQ4 = QUE*AREA(K)
      DO 19 I = 1,3
   19 FAB(I) = Q2(I)*QQ4
      FAB(4) = SQRT(FAB(1)**2 + FAB(2)**2 + FAB(3)**2)
      QQ1 = XCG - XREF(K)
      QQ2 = YCG - YREF(K)
      QQ3 = ZCG - ZREF(K)
      IF(ABS(VAB(1)).LT.1.E-3) GO TO 308
      MAB(1)=QQ4*(Q2(2)*QQ3-Q2(3)*QQ2+SPAN(K)*Q3(1)+SPAN(K)**2/(2*VAB(1)
     * )*(Q3(2)+Q3(3)))
      MAB(2)=QQ4*(Q2(4)*CHORD(K)+Q2(3)*QQ1-Q2(1)*QQ3)
      MAB(3)=QQ4*(Q2(1)*QQ2-Q2(2)*QQ1+SPAN(K)*Q2(5)+SPAN(K)**2/(2*VAB(1)
     * )*(Q3(4)+Q3(5)))
  308 CONTINUE
      IF (VAB(4) .LE. 10.) GO TO 20
      QDOT=17600.*SQRT(ANSW(3))*(VAB(4)/26000.)**3.15
      GO TO 21
   20 QDOT = 0.0
   21 CONTINUE
      RETURN
      END
```

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@ FOR,* COEF,COEF                                                    01 JUN 72          22:38:46.19*
UNIVAC 1108 FORTRAN V EXEC 11 LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:46

    SUBROUTINE COEF      ENTRY POINT 000154

    STORAGE USED: CODE(1) 000165; DATA(3) 000263; BLANK COMMON(2) 000000

     COMMON BLOCKS:

     0003   FIRST  000005

    EXTERNAL REFERENCES (BLOCK, NAME)

     0004   WERR3S

    STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

     0001   000106 IL        0001   000010 I266      0001   000136 I57G      0001   000133 ZL        0000 R 000176 CL
     0000 R 000110 CM        0003   000003 CMA       0000 R 000154 CN        0003   000004 CNB       0000 R 000000 CX
     0000 R 000022 CY        0003   000001 CYB       0000 R 000044 CZ        0003   000002 CZA       0000 I 000242 I
     0000   000247 INJPS     0003 R 000000 MACH      0000 R 000220 MCH       0000 R 000243 SF        0000 R 000244 SI
     0000 R 000245 S2

00101     1*          SUBROUTINE COEF(A,B,C)
00103     2*          DIMENSION A(3),B(5),C(5)
00104     3*          DIMENSION CX(18),CY(18),CZ(36),CM(36),CN(18),CL(18),MCH(18)
00105     4*          REAL MACH,MCH
00106     5*          COMMON /FIRST/ MACH,CYB,CZA,CMA,CNB
00107     6*          DATA MCH/ 0.00,0.50,0.60,0.70,0.80,0.90,1.00,1.10,1.20,1.30,
00107     7*         2          1.40,1.50,1.75,2.00,3.00,4.00,5.00,20.0/
00111     8*          DATA CX/ -.320, -.180, -.170, -.160, -.155, -.160, -.235, -.240,
00111     9*         2         -.200, -.175, -.150, -.135, -.090, -.062, -.020, +.020,
00111    10*         3         +.035, +.045/
00113    11*          DATA CY/ -.023, -.023, -.026, -.030, -.034, -.038, -.041, -.043,
00113    12*         2         -.041, -.040, -.038, -.037, -.034, -.032, -.030, -.028,
00113    13*         3         -.026, -.023/
00115    14*          DATA CZ/ -.020, -.040, -.065, -.090, -.140, -.175, -.180, -.170,
00115    15*         2         -.138, -.112, -.091, -.075, -.035, -.005,  .010, -.015,
00115    16*         3         -.005,  .000, -.062, -.067, -.068, -.068, -.068, -.067,
00115    17*         4         -.068, -.071, -.069, -.062, -.058, -.055, -.049, -.045,
00115    18*         5         -.037, -.035, -.033, -.020/
00117    19*          DATA CM/ -.075, -.119, -.120, -.119, -.117, -.113, -.107, -.100,
00117    20*         2         -.090, -.080, -.070, -.062, -.045, -.032, +.005, +.010,
00117    21*         3         +.010, +.010, -.117, -.128, -.131, -.132, -.133, -.133,
00117    22*         4         -.137, -.141, -.138, -.123, -.114, -.108, -.095, -.087,
00117    23*         5         -.069, -.065, -.060, -.036/
00121    24*          DATA CN/  .017,  .018,  .018,  .019,  .020,  .022,  .025,  .030,
00121    25*         2          .029,  .027,  .026,  .025,  .022,  .021,  .018,  .016,
00121    26*         3          .014,  .012/
00123    27*          DATA CL/ -.005, -.005, -.005, -.006, -.006, -.007, -.008, -.008,
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D2-11838 7-24

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00123          2          -.007, -.007, -.006, -.006, -.005, -.005, -.004, -.004,
00123          3          -.003, -.003/
00125            DO 1 I=1,18
00130            IF(MACH .GT. MCH(I) ) GO TO 1
00132            SF = (MACH - MCH(I-1))  /(MCH(I)    - MCH(I-1))
00133            B(1)= CX(I-1) +(CX(I)    -CX(I-1) )*SF
00134            B(2)=(CY(I-1) +(CY(I)    -CY(I-1) )*SF)*A(3)
00135            S1  = CZ(I-1) +(CZ(I)    -CZ(I-1) )*SF
00136            S2  = CZ(I+17)+(CZ(I+18)-CZ(I+17))*SF
00137            B(3)=S1+A(2)*S2
00140            S1  = CM(I-1) +(CM(I)    -CM(I-1) )*SF
00141            S2  = CM(I+17)+(CM(I+18)-CM(I+17))*SF
00142            B(4)=S1+A(2)*S2
00143            B(5)=(CN(I-1) +(CN(I)    -CN(I-1) )*SF)*A(3)
00144            C(1)=(CL(I-1) +(CL(I)    -CL(I-1) )*SF)*A(3)
00145            GO TO 2
00146          1 CONTINUE
00150            B(1)= CX(18)
00151            B(2)= CY(18)*A(3)
00152            B(3)=CZ(18)+A(2)*CZ(36)
00153            B(4)=CM(18)+A(2)*CM(36)
00154            B(5)= CN(18)*A(3)
00155            C(1)= CL(18)*A(3)
00156          2 DO 3 I=2,5
00161          3 C(I)=0.
00163            RETURN
00164            END

    END OF COMPILATION:        NO  DIAGNOSTICS.
  COEF            SYMBOLIC                                  04 APR 72  15:10:48   0  01612270    14    54  (DELETED)
  COEF    CODE    RELOCATABLE                               04 APR 72  15:10:48   1  01613654    24     1  (DELETED)
                                                                                   0  01613704    14    28
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D2-118387-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

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@ FOR,* COEFO,COEFO
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)                    01 JUN 72          22:38:47.853
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:47

   SUBROUTINE COEFO     ENTRY POINT 000246

   STORAGE USED: CODE(1) 000262  DATA(0) 003205  BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   FIRST  000005
    0004   IEI    000015

   EXTERNAL REFERENCES (BLOCK, NAME)

    0005   ZI
    0006   HERN3S

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000030 IL      0001   000231 IUL     0001   003013 1456    0001   000034 1566    0001   000051 1646
    0001   000032 2L      0001   000055 5L      0000 R 003157 ALPHA   0000 R 000122 ALPHAB  0000 R 003160 BETA
    0000 R 001505 CL      0000 R 001747 CLP     0000 R 002211 CLR     0000 R 001001 CM      0003   000003 CMA
    0000 R 001243 CN      0003   000004 CN8     0000 R 002453 CNP     0000 R 002715 CNR     0000 R 000033 CA
    0000 R 000275 CY      0003   000001 CYB     0000 R 000537 CZ      0003   000002 CZA     0004   000007 EAVPP
    0004   000000 EPAI    0004   000004 EPBD    0004   000005 EQBD    0004   000006 ERBD    0004   000012 EVPP
    0000 I 003161 I       0000   003170 INJPS   0000 I 003163 J       0003 R 000000 MACH    0000 R 000000 MCH
    0004 R 000001 P       0004   000002 Q       0004 R 000003 R       0000 R 003162 SF      0000 R 003169 SFA
    0005 R 000000 ZI

00101    1*            SUBROUTINE COEFO(A,B,C)
00103    2*            DIMENSION A(3),B(5),C(5),MCH(18),ALPHAB(9)
00104    3*            DIMENSION CX(18,9),CY(18,9),CZ(18,9),CM(18,9),CN(18,9)
00105    4*            DIMENSION CL(18,9),CLP(18,9),CLR(18,9),CNP(18,9),CNR(18,9)
00106    5*            REAL MACH,MCH
00107    6*            COMMON /FIRST/ MACH,CYB,CZA,CMA,CN8
00110    7*            COMMON /IEI/ EPAI,P,Q,R,EPBD,EQBD,ERBD,EAVPP(3),EVPP(3)
00111    8*            DATA MCH/ 0.00, 0.50, 0.60, 0.70, 0.80, 0.90, 1.00, 1.10, 1.20,
00111    9*           2        1.30, 1.40, 1.50, 1.75, 2.00, 3.00, 4.00, 5.00, 30.0/
00113   10*            DATA ALPHAB/ 0., 5., 10., 15., 20., 30., 45., 60., 90./
00115   11*            DATA  CX/ -.020,-.020,-.021,-.022,-.025,-.030,-.040,-.052,-.060,
00115   12*           *          -.058,-.057,-.055,-.052,-.050,-.041,-.037,-.035,-.027,      0
00115   13*           2         -.010,-.013,-.015,-.016,-.018,-.023,-.034,-.047,-.056,
00115   14*           *          -.053,-.052,-.049,-.046,-.044,-.038,-.036,-.033,-.026,      5
00115   15*           3           .014, .012, .011, .009, .007, .005,-.010,-.025,-.041,
00115   16*           *          -.040,-.039,-.038,-.037,-.036,-.034,-.032,-.031,-.025,     10
00115   17*           4           .054, .052, .053, .054, .055, .053, .032, .009,-.010,
00115   18*           *          -.013,-.018,-.021,-.025,-.029,-.033,-.032,-.029,-.024,     15
00115   19*           5           .090, .091, .092, .090, .088, .083, .065, .046, .030,
00115   20*           *           .023, .014, .008,-.005,-.019,-.031,-.030,-.028,-.022,     20
00115   21*           6          -.058,-.044,-.040,-.028,-.017,-.008,-.014,-.022,-.027,
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02-11838 7-2A

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00115   224.        .   -.019,-.013,-.003,-.012,-.021,-.025,-.027,-.024,-.018,   30
00115   230.        7   -.044,-.020,-.017,-.013,-.010,-.006,-.011,-.015,-.023,
00115   240.        .   -.022,-.021,-.020,-.021,-.021,-.019,-.019,-.017,-.012,   45
00115   250.        8   -.015,-.007,-.006,-.006,-.006,-.006,-.010,-.012,-.013,
00115   260.        .   -.012,-.011,-.010,-.012,-.014,-.011,-.009,-.008,-.005,   60
00115   270.        9   -.015,-.007,-.006,-.006,-.006,-.006,-.010,-.012,-.013,
00115   280.        .   -.012,-.011,-.010,-.012,-.014,-.011,-.009,-.008,-.005/  90
00117   290.      DATA CY/ -.100,-.103,-.105,-.110,-.115,-.120,-.120,-.128,-.130,
00117   300.        .   -.128,-.123,-.115,-.110,-.105,-.110,-.107,-.100,-.090,   0
00117   310.        2   -.095,-.097,-.100,-.107,-.115,-.121,-.127,-.128,-.130,
00117   320.        .   -.125,-.120,-.115,-.110,-.105,-.110,-.102,-.095,-.082,   5
00117   330.        3   -.097,-.101,-.105,-.111,-.119,-.125,-.127,-.128,-.127,
00117   340.        .   -.123,-.118,-.113,-.108,-.107,-.105,-.098,-.088,-.078,  10
00117   350.        4   -.100,-.105,-.110,-.116,-.123,-.129,-.130,-.129,-.125,
00117   360.        .   -.121,-.116,-.110,-.105,-.105,-.105,-.094,-.082,-.075,  15
00117   370.        5   -.120,-.122,-.125,-.132,-.139,-.145,-.135,-.125,-.114,
00117   380.        .   -.111,-.108,-.105,-.103,-.102,-.102,-.090,-.075,-.070,  20
00117   390.        6   -.203,-.175,-.135,-.145,-.162,-.171,-.150,-.080,-.068,
00117   400.        .   -.080,-.088,-.086,-.095,-.092,-.089,-.084,-.079,-.068,  30
00117   410.        7   -.125,-.120,-.105,-.075,-.068,-.068,-.075,-.087,-.100,
00117   420.        .   -.097,-.090,-.083,-.083,-.084,-.083,-.080,-.079,-.070,  45
00117   430.        8   -.125,-.120,-.105,-.075,-.068,-.068,-.075,-.087,-.100,
00117   440.        .   -.097,-.090,-.083,-.083,-.084,-.083,-.094,-.093,-.085,  60
00117   450.        9   -.125,-.120,-.105,-.075,-.068,-.068,-.075,-.087,-.100,
00117   460.        .   -.097,-.090,-.083,-.083,-.084,-.083,-.094,-.093,-.085/  90
00121   470.      DATA CZ/  0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.07, 0.06, 0.05,
00121   480.        .    0.05, 0.04, 0.04, 0.04, 0.04, 0.03, 0.03, 0.03, 0.02,   0
00121   490.        2   -0.15,-0.14,-0.13,-0.13,-0.12,-0.12,-0.13,-0.14,-0.15,
00121   500.        .   -0.15,-0.15,-0.15,-0.13,-0.11,-0.08,-0.06,-0.04,-0.02,   5
00121   510.        3   -0.36,-0.34,-0.34,-0.34,-0.34,-0.34,-0.35,-0.37,-0.38,
00121   520.        .   -0.37,-0.35,-0.34,-0.33,-0.26,-0.22,-0.18,-0.15,-0.08,  10
00121   530.        4   -0.55,-0.53,-0.52,-0.52,-0.53,-0.53,-0.56,-0.58,-0.60,
00121   540.        .   -0.57,-0.55,-0.53,-0.47,-0.41,-0.34,-0.28,-0.25,-0.15,  15
00121   550.        5   -0.75,-0.73,-0.72,-0.72,-0.73,-0.74,-0.77,-0.79,-0.81,
00121   560.        .   -0.77,-0.75,-0.72,-0.65,-0.57,-0.48,-0.42,-0.37,-0.26,  20
00121   570.        6   -1.21,-1.13,-1.10,-1.11,-1.13,-1.14,-1.17,-1.21,-1.23,
00121   580.        .   -1.18,-1.16,-1.12,-1.03,-0.92,-0.80,-0.73,-0.67,-0.57,  30
00121   590.        7   -1.51,-1.35,-1.31,-1.35,-1.39,-1.43,-1.51,-1.60,-1.68,
00121   600.        .   -1.67,-1.67,-1.67,-1.60,-1.52,-1.36,-1.26,-1.23,-1.17,  45
00121   610.        8   -1.63,-1.43,-1.38,-1.43,-1.49,-1.54,-1.68,-1.83,-1.98,
00121   620.        .   -1.98,-1.99,-2.00,-2.10,-2.20,-2.00,-1.91,-1.83,-1.78,  60
00121   630.        9   -1.63,-1.43,-1.38,-1.43,-1.49,-1.54,-1.68,-1.83,-1.98,
00121   640.        .   -1.98,-1.99,-2.00,-2.10,-2.20,-2.00,-1.91,-1.83,-1.78/  90
00123   650.      DATA CM/  .055,  .090,  .115,  .150,  .195,  .257,  .280,  .290,  .280,
00123   660.        .    .260,  .230,  .180,  .120,  .085,-.020,-.040,-.040,-.065,   0
00123   670.        2   -.032,-.010,  .002,  .035,  .070,  .102,  .070,-.030,-.135,
00123   680.        .   -.140,-.140,-.130,-.100,-.070,-.025,-.020,-.020,-.020,   5
00123   690.        3   -.122,-.110,-.102,-.085,-.068,-.052,-.220,-.388,-.555,
00123   700.        .   -.507,-.459,-.410,-.310,-.210,-.033,  .005,  .030,  .040,  10
00123   710.        4   -.213,-.211,-.212,-.209,-.206,-.203,-.320,-.760,-.850,
00123   720.        .   -.780,-.670,-.600,-.420,-.295,-.040,  .040,  .065,  .070,  15
00123   730.        5   -.308,-.330,-.342,-.350,-.358,-.375,-.490,-.880,-.975,
00123   740.        .   -.920,-.820,-.700,-.500,-.340,-.060,  .030,  .060,  .110,  20
00123   750.        6   -.569,-.575,-.580,-.587,-.594,-.600,-.690,-.840,-.935,
00123   760.        .   -.910,-.810,-.700,-.520,-.380,-.165,-.070,-.010,  .080,  30
00123   770.        7   -.260,-.325,-.355,-.395,-.460,-.562,-.750,-.930,-1.04,
00123   780.        .   -1.03,-.940,-.835,-.720,-.640,-.462,-.370,-.320,-.240,  45
00123   790.        8   -.260,-.325,-.355,-.395,-.460,-.562,-.750,-.930,-1.04,
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02-1183 87-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

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00123   90*          •     -1.03,-.940,-.835,-.720,-1.10,-.880,-.810,-.770,-.690,      60
00123   91*          9     -.260,-.325,-.355,-.395,-.460,-.562,-.750,-.930,-1.04,
00123   92*          •     -1.03,-.940,-.835,-.720,-1.10,-.880,-.810,-.770,-.690/      90
00125   93*        DATA CN/  .160,  .180,  .190,  .200,  .210,  .220,  .225,  .230,  .225,
00125   94*          •       .220,  .205,  .185,  .145,  .110,-.015,-.060,-.070,-.070,    0
00125   95*          2       .150,  .170,  .180,  .190,  .199,  .207,  .205,  .199,  .187,
00125   96*          •       .174,  .155,  .134,  .094,  .060,-.043,-.078,-.086,-.090,    5
00125   97*          3       .140,  .160,  .170,  .180,  .187,  .194,  .185,  .167,  .149,
00125   98*          •       .127,  .105,  .082,  .042,  .010,-.071,-.096,-.103,-.110,   10
00125   99*          4       .130,  .150,  .160,  .170,  .175,  .180,  .165,  .135,  .110,
00125  100*          •       .083,  .055,  .030,-.010,-.040,-.100,-.115,-.120,-.130,   15
00125  101*          5       .184,  .178,  .168,  .176,  .185,  .194,  .432,  .072,  .007,
00125  102*          •     -.003,-.067,-.114,-.108,-.103,-.140,-.142,-.149,-.140,      20
00125  103*          6     .090,-.130,-.050,-.030,-.010,-.015,-.050,-.150,-.220,
00125  104*          •     -.255,-.269,-.268,-.245,-.220,-.210,-.190,-.180,-.170,      30
00125  105*          7     -1.50,-.680,-.500,-.330,-.235,-.230,-.245,-.290,-.330,
00125  106*          •     -.355,-.362,-.360,-.285,-.245,-.238,-.225,-.210,-.240,      45
00125  107*          8     -1.50,-.680,-.500,-.330,-.235,-.230,-.245,-.290,-.330,
00125  108*          •     -.355,-.362,-.360,-.350,-.340,-.330,-.325,-.320,-.320,      60
00125  109*          9     -1.50,-.680,-.500,-.330,-.235,-.230,-.245,-.290,-.330,
00125  110*          •     -.355,-.362,-.360,-.350,-.340,-.330,-.325,-.320,-.320/      90
00127  111*        DATA CL/ -.047,-.055,-.060,-.070,-.095,-.120,-.137,-.140,-.138,
00127  112*          •     -.130,-.120,-.103,-.075,-.053,  .008,  .014,  .000,-.010,    0
00127  113*          2     -.099,-.115,-.120,-.125,-.138,-.151,-.159,-.163,-.164,
00127  114*          •     -.154,-.144,-.129,-.103,-.083,-.032,-.022,-.030,-.033,    5
00127  115*          3     -.151,-.175,-.180,-.180,-.181,-.182,-.181,-.186,-.190,
00127  116*          •     -.178,-.168,-.155,-.131,-.113,-.072,-.058,-.060,-.046,   10
00127  117*          4     -.205,-.235,-.240,-.235,-.223,-.212,-.203,-.208,-.215,
00127  118*          •     -.203,-.192,-.182,-.158,-.142,-.112,-.095,-.090,-.080,   15
00127  119*          5     -.136,-.198,-.253,-.239,-.217,-.199,-.208,-.213,-.215,
00127  120*          •     -.199,-.183,-.166,-.165,-.165,-.152,-.133,-.118,-.119,   20
00127  121*          6      .250,-.075,-.150,-.095,  .000,  .050,  .000,-.130,-.210,
00127  122*          •     -.215,-.200,-.190,-.210,-.220,-.200,-.193,-.190,-.180,   30
00127  123*          7     -.165,-.295,-.340,-.310,-.240,-.210,-.222,-.248,-.270,
00127  124*          •     -.282,-.285,-.280,-.236,-.220,-.240,-.252,-.250,-.220,   45
00127  125*          8     -.165,-.295,-.340,-.310,-.240,-.210,-.222,-.248,-.270,
00127  126*          •     -.282,-.285,-.280,-.236,-.220,-.240,-.252,-.250,-.220,   60
00127  127*          9     -.165,-.295,-.340,-.310,-.240,-.210,-.222,-.248,-.270,
00127  128*          •     -.282,-.285,-.280,-.236,-.220,-.240,-.252,-.250,-.220/   90
00131  129*        DATA CLP/ -.187,-.200,-.205,-.211,-.220,-.230,-.242,-.249,-.250,
00131  130*          •     -.248,-.237,-.220,-.190,-.167,-.125,-.100,-.065,-.040,    0
00131  131*          2     -.190,-.204,-.210,-.215,-.222,-.230,-.239,-.243,-.244,
00131  132*          •     -.236,-.226,-.210,-.180,-.164,-.123,-.094,-.075,-.050,    5
00131  133*          3     -.194,-.210,-.214,-.219,-.225,-.231,-.236,-.237,-.238,
00131  134*          •     -.230,-.216,-.201,-.172,-.157,-.125,-.100,-.080,-.060,   10
00131  135*          4     -.205,-.218,-.224,-.228,-.233,-.238,-.240,-.236,-.230,
00131  136*          •     -.217,-.203,-.192,-.168,-.153,-.118,-.096,-.078,-.063,   15
00131  137*          5     -.216,-.227,-.230,-.235,-.240,-.245,-.240,-.230,-.216,
00131  138*          •     -.205,-.194,-.185,-.165,-.152,-.115,-.092,-.080,-.070,   20
00131  139*          6     -.162,-.162,-.163,-.164,-.166,-.168,-.170,-.173,-.170,
00131  140*          •     -.163,-.152,-.145,-.138,-.134,-.125,-.118,-.116,-.118,   30
00131  141*          7     -.096,-.106,-.110,-.114,-.120,-.130,-.140,-.153,-.166,
00131  142*          •     -.175,-.183,-.188,-.185,-.177,-.162,-.156,-.153,-.156,   45
00131  143*          8     -.096,-.106,-.110,-.114,-.120,-.130,-.140,-.153,-.166,
00131  144*          •     -.175,-.183,-.188,-.185,-.177,-.162,-.156,-.153,-.156,   60
00131  145*          9     -.096,-.106,-.110,-.114,-.120,-.130,-.140,-.153,-.166,
00131  146*          •     -.175,-.183,-.188,-.185,-.177,-.162,-.156,-.153,-.156/   90
00133  147*        DATA CLR/  .055,  .054,  .053,  .053,  .054,  .055,  .060,  .070,  .085,
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00133     *          .097, .104, .107, .105, .095, .060, .045, .045, .045,      0
00133     2          .070, .071, .070, .069, .070, .070, .074, .082, .095,
00133     *          .105, .109, .111, .108, .095, .059, .045, .044, .043,      5
00133     3          .085, .087, .088, .087, .086, .085, .090, .095, .107,
00133     *          .112, .114, .115, .110, .095, .057, .045, .040, .040,     10
00133     4          .097, .097, .096, .095, .095, .096, .100, .111, .119,
00133     *          .124, .124, .123, .114, .095, .041, .030, .026, .025,     15
00133     5          .110, .105, .105, .105, .106, .107, .113, .127, .133,
00133     *          .135, .133, .130, .118, .095, .025, .015, .010, .007,     20
00133     6          .120, .118, .115, .110, .100, .098, .097, .100, .103,
00133     *          .095, .078, .065, .053, .043, .028, .018, .013, .009,     30
00133     7          .180, .170, .165, .162, .160, .158, .145, .135, .128,
00133     *          .120, .110, .098, .060, .045, .030, .020, .016, .012,     45
00133     8          .180, .170, .165, .162, .160, .158, .145, .135, .128,
00133     *          .120, .110, .098, .060, .045, .030, .023, .018, .015,     60
00133     9          .180, .170, .165, .162, .160, .158, .145, .135, .128,
00133     *          .120, .110, .098, .060, .045, .030, .023, .018, .015/     90
00135      DATA CNP/ .078, .085, .088, .092, .096, .103, .113, .125, .140,
00135     *          .150, .156, .158, .150, .138, .094, .070, .060, .055,      0
00135     2          .059, .068, .071, .075, .080, .087, .094, .105, .120,
00135     *          .129, .135, .136, .132, .122, .081, .062, .053, .050,      5
00135     3          .041, .051, .055, .059, .064, .070, .078, .087, .100,
00135     *          .109, .114, .115, .113, .105, .090, .052, .045, .044,     10
00135     4          .058, .063, .066, .070, .075, .082, .089, .097, .105,
00135     *          .111, .114, .115, .112, .099, .038, .029, .025, .025,     15
00135     5          .075, .076, .078, .082, .088, .096, .102, .107, .110,
00135     *          .112, .114, .115, .110, .093, .008, .005, .005, .005,     20
00135     6          .087, .091, .090, .078, .060, .046, .045, .052, .054,
00135     *          .046, .032, .025, .020, .015, .008, .008, .008, .008,     30
00135     7          .044, .049, .050, .051, .052, .053, .049, .043, .040,
00135     *          .041, .042, .043, .023, .010, .010, .012, .012, .012,     45
00135     8          .044, .049, .050, .051, .052, .053, .049, .043, .040,
00135     *          .041, .042, .043, .023, .010, .010, .015, .015, .015,     60
00135     9          .044, .049, .050, .051, .052, .053, .049, .043, .040,
00135     *          .041, .042, .043, .023, .010, .010, .015, .015, .015/     90
00137      DATA CNR/ -.190,-.200,-.210,-.220,-.235,-.250,-.275,-.330,-.363,
00137     *          -.378,-.388,-.393,-.390,-.380,-.315,-.280,-.260,-.250,      0
00137     2          -.200,-.210,-.220,-.232,-.250,-.270,-.297,-.342,-.364,
00137     *          -.373,-.378,-.379,-.376,-.367,-.309,-.275,-.255,-.245,      5
00137     3          -.210,-.220,-.230,-.245,-.265,-.290,-.320,-.355,-.365,
00137     *          -.366,-.368,-.365,-.363,-.355,-.300,-.270,-.250,-.240,     10
00137     4          -.210,-.215,-.221,-.232,-.257,-.290,-.320,-.352,-.362,
00137     *          -.364,-.366,-.365,-.363,-.352,-.258,-.240,-.230,-.225,     15
00137     5          -.210,-.210,-.213,-.220,-.250,-.290,-.320,-.350,-.360,
00137     *          -.363,-.364,-.365,-.363,-.350,-.213,-.210,-.210,-.210,     20
00137     6          -.120,-.121,-.124,-.130,-.154,-.184,-.213,-.240,-.245,
00137     *          -.239,-.200,-.185,-.197,-.212,-.235,-.233,-.232,-.230,     30
00137     7          -.200,-.200,-.210,-.220,-.250,-.275,-.290,-.298,-.302,
00137     *          -.305,-.302,-.298,-.280,-.265,-.270,-.260,-.260,-.260,     45
00137     8          -.200,-.200,-.210,-.220,-.250,-.275,-.290,-.298,-.302,
00137     *          -.305,-.302,-.298,-.280,-.265,-.270,-.290,-.290,-.290,     60
00137     9          -.200,-.200,-.210,-.220,-.250,-.275,-.290,-.298,-.302,
00137     *          -.305,-.302,-.298,-.280,-.265,-.270,-.290,-.290,-.290/     90
00141      MACH=A(1)
00142      ALPHA=A(2)
00143      BETA=A(3)
00144      DO 1 I=1,18
00147      IF(MACH.GT.MCH(I)) GO TO 1
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00151          SF=(MACH-MCH(I-1))/(MCH(I)-MCH(I-1))
00152          GO TO 2
00153        1 CONTINUE
00155        2 DO 3 J=2,9
00160        3 IF(ABS(ALPHA).LT.ALPHAB(J)) GO TO 5
00163          DO 4 I=1,5
00166          B(I)=0.
00167        4 C(I)=0.
00171          GO TO 10
00172        5 SFA =(ABS(ALPHA)-ALPHAB(J-1))/(ALPHAB(J)-ALPHAB(J-1))
00173          B(1)=Z1(CX,SF,SFA,I,J)
00174          B(2)=BETA*Z1(CY,SF,SFA,I,J)*.1
00175          B(3)=Z1(CZ,SF,SFA,I,J)
00176          B(3)= B(3)*(ALPHA/ABS(ALPHA))
00177          B(4)=Z1(CM,SF,SFA,I,J)*.1
00200          B(4)= B(4)*(ALPHA/ABS(ALPHA))
00201          B(5)=BETA*Z1(CN,SF,SFA,I,J)*.01
00202          C(1)=BETA*Z1(CL,SF,SFA,I,J)*.01
00203          C(2)=P*Z1(CLP,SF,SFA,I,J)
00204          C(3)=P*Z1(CLR,SF,SFA,I,J)
00205          C(4)=P*Z1(CNP,SF,SFA,I,J)
00206          C(5)=R*Z1(CNR,SF,SFA,I,J)
00207       10 RETURN
00210          END

   END OF COMPILATION:        NO  DIAGNOSTICS.
COEFO          SYMBOLIC                                  04 APR 72  15:10:46  0  01577532   14   219  (DELETED)
COEFO   CODE   RELOCATABLE                               04 APR 72  15:10:46  1  01605524   24     1  (DELETED)
                                                                              0  01605554   14   170
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@ FOR,* Z1,Z1                                                                    01 JUN 72          22:39: 2.458
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E:20100010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:02

   FUNCTION Z1          ENTRY POINT 000035

   STORAGE USED: CODE(1) 000040; DATA(0) 000011; BLANK COMMON(2) 000000

   EXTERNAL REFERENCES (BLOCK, NAME)

    0003   NERR3S

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000   000003 INJPS     0000 R 000001 S1        0000 R 000002 S2        0000 R 000000 Z1


00101      1*          FUNCTION Z1(D,SF,SFA,I,J)
00103      2*          DIMENSION D(18,9),I(18),J(9)
00104      3*          S1=D(I-1,J-1)+(D(I,J-1)-D(I-1,J-1))*SF
00105      4*          S2=D(I-1,J)+(D(I,J)-D(I-1,J))*SF
00106      5*          Z1=S1+(S2-S1)*SFA
00107      6*          RETURN
00110      7*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
   Z1              SYMBOLIC                                  04 APR 72  15:10:55  0  01624012   14    7  (DELETED)
   Z1       CODE   RELOCATABLE                               04 APR 72  15:10:55  1  01624154   24    1  (DELETED)
                                                                                   0  01624204   14    4
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D2-118387-2A

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@ FOR,* ATMOS3,ATMOS3                                                    01 JUN 72          22138194.43A
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL L[20100010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:94

   SUBROUTINE ATMOS3  ** ENTRY POINT 000457

   STORAGE USED: CODE(I) 000471  DATA(D) 000177  BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   ID2     000126

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004   ALOG
    0005   EXP
    0006   .EXP6S
    0007   .ERR3S

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000064 10L      0001   000100 12L      0001   000103 13L      0001   000066 1326     0001   000112 19L
    0001   000140 16L      0001   000163 1646     0001   000150 20L      0001   000161 22L      0001   000172 24L
    0001   000175 25L      0001   000200 26L      0001   000245 26L      0001   000257 30L      0001   000320 32L
    0001   000355 34L      0001   000375 35L      0001   000405 499L     0001   000416 500L     0001   000053 6L
    0001   000062 9L       0000 R 000004 AL       0003 R 000000 ALP      0000 R 000006 ALPP     0000 R 000014 CS
    0000 R 000001 G        0003 R 000110 GB       0000 R 000010 GG       0003 R 000002 H        0003 R 000000 HB
    0000   000101 IHJPS    0000   000007 M        0000   000003 N        0003 R 000011 P        0000 R 000012 RHO
    0000 R 000015 T        0000 R 000005 TM       0003 R 000130 TMB      0003 R 000013 WN       0000 R 000016 XMU
    0000 R 000000 Z        0003 R 000012 ZB

                                                                                                          02-1183 87-24

0001      10      SUBROUTINE ATMOS3(ZZ,ZMAX,ANSW)                                          0050
0003      20      COMMON/ID2/HB(10),ZB(19),TMB(29),ALP(29),GB(19)
0004      30      DIMENSION ANSW(8)
0005      40      Z=ZZ                                                                     0070
0006      50      IF(Z-GT.ZMAX) GO TO 999
0010      60    3 G=(((((-5.5905936E-33*Z+2.9724462E-26)*Z-1.5167771E-19)*Z+7.2539[9     0960
0010      70     155E-13)*Z-3.0859195E-6)*Z+9.80665                                      0970
0011      80      IF(Z-9[000.0) 4,4,20                                                   0980
0014      90    4 M=(((((-9.50[3649E-35*Z)+6.0621354E-28)*Z-3.8667054E-21)*Z+          0990
0014     100     12.9656553E-14)*Z-1.5731262E-7)*Z+1.0)*Z                               1000
0015     110      IF(Z) 6,5,10                                                           1010
0020     120    5 N=2                                                                    1020
0021     130      GO TO 9                                                                1030
0022     140    6 IF(Z+5[00.0) 499,7,7                                                   1040
0025     150    7 N=1                                                                    1050
0026     160      GO TO 13                                                               1060
0027     170    9 AL=0.0                                                                 1070
0030     180      GO TO 14                                                               1080
0031     190   13 DO 11 H=3,10                                                           1090
0034     200      IF(H-HB(N)) 12,9,11                                                    1100
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00137      11 CONTINUE
00141         N=9
00142         GO TO 9
00143      12 N=N-1
00144      13 AL=(TMB(N+1)-TMB(N))/(HB(N+1)-HB(N))
00145      14 TM=TMB(N)+AL*(H-HB(N))
00146         IF(AL) 15,16,15
00151      15 ALPP=ALP(N)-3.41631947E-2*ALOG((AL*(H-HB(N))+TMB(N))/TMB(N))/AL
00152         GO TO 30
00153      16 ALPP=ALP(N)-3.41631947E-2*(H-HB(N))/TMB(N)
00154         GO TO 30
00155      20 IF(Z-700000.0) 22,21,21
00160      21 M=14
00161         N=24
00162         GO TO 26
00163      22 DO 23 M=2,14
00166         IF(Z-ZB(M)) 24,25,23
00171      23 CONTINUE
00173      24 M=M-1
00174      25 N=M+10
00175      26 AL =(TMB(N+1)-TMB(N))/(ZB(M+1)-ZB(M))
00176         GG=(G+GB(M))/2.0
00177         TM=TMB(N)+AL *(Z-ZB(M))
00200         IF(AL ) 27,28,27
00203      27 ALPP=ALP(N)-3.48367635E-3*GG*ALOG((Z-ZB(M)+TMB(N)/AL)*AL/TMB(N))/A
00203        1L
00204         GO TO 30
00205      28 ALPP=ALP(N)-3.48367635E-3*GG*(Z-ZB(M))/TMB(N)
00206      30 P=EXP(ALPP)
00207         RHO=2.84381743E-3*P/TM
00210         IF(Z-90000.0) 31,31,32
00213      31 WM=28.9644
00214         CS      =.589102444E-1*TM**.5
00215         T=TM*WM/28.9644
00216         XMU=8.14785279E-2*T**1.5/(T+110.4)
00217         GO TO 500
00220      32 CS      =.791785926
00221         XMU=6.7974E-1
00222         Z=Z*1.E-3
00223         IF(Z-169.5) 33,34,34
00226      33 WM= (((((((.10923927E-13*Z-.11006185E-10)*Z+.49584323E-9)*Z-.13071
00226        1742E-5)*Z+.22007775E-3)*Z-.24083631E-1)*Z+.16586041E1)*Z-.65156805
00226        2E2)*Z+1139.0647
00227         GO TO 35
00230      34 WM= ((((((-.21764045E-18*Z+.18921597E-14)*Z-.43903233E-11)*Z+.4509
00230        16184E-8)*Z-.23285059E-5)*Z+.63311551E-3)*Z-.11575533)*Z+36.084062
00231      35 T=TM*WM/28.9644
00232         Z=Z*1.E3
00233         GO TO 500
00234     499 T=0.0
00235         TM=0.0
00236         P=0.0
00237         RHO=0.0
00240         G=0.0
00241         WM=0.0
00242         CS      =.791785926
00243         XMU=0.0
00244     500 ANSW(1)=P/.101325E6
```

ORIGINAL PAGE IS POOR.

```
00245    79*        ANSW(2)=T/288.16                                    1690
00246    80*        ANSW(3)=RHO                                         1700
00247    81*        ANSW(4)=CS                                          1710
00250    82*        ANSW(5)=G/9.80665                                   1720
00251    83*        ANSW(6)=TM/288.16                                   1730
00252    84*        ANSW(7)=WH                                          1740
00253    85*        ANSW(8)=XMU                                         1750
00254    86*        RETURN                                              1760
00255    87*         END

    END OF COMPILATION:        NO  DIAGNOSTICS.
  ATMOS3          SYMBOLIC                    04 APR 72  15:10:51   0  01614514   14   87  (DELETED)
  ATMOS3  CODE    RELOCATABLE                 04 APR 72  15:10:51   1  01617016   24    1  (DELETED)
                                                                    0  01617046   14   38
```

D2-118387-2A

```
@ FOR,* EMXX,EMXX                                                                    01 JUN 72          22:39: 9.213
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:04

   FUNCTION EMXX        ENTRY POINT 000021

   STORAGE USED: CODE(1) 000025; DATA(0) 000007; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CG     000160

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004   FAT
    0005   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000 R 000000 EMXX      0000   000002 INJP$     0003 R 000070 MXX       0003 R 000142 MXZ       0003 R 000106 MYY
    0003 R 000124 MZZ       0003 R 000000 WT        0003   000016 XCG       0003   000034 YCG       0003   000052 ZCG


00101      1*          FUNCTION EMXX(EWT)
00103      2*          COMMON /CG/WT(14),XCG(14),YCG(14),ZCG(14),MXX(14),MYY(14),
00103      3*         *   MZZ(14),MXZ(14)
00104      4*          REAL MXX,MYY,MZZ,MXZ
00105      5*          CALL FAT(EMXX,EWT,MXX,WT)
00106      6*          EMXX=EMXX*1.E6
00107      7*          RETURN
00110      8*          END

      END OF COMPILATION:        NO  DIAGNOSTICS.
   EMXX            SYMBOLIC                                  04 APR 72  15:11:02   0  01626360    14     8  (DELETED)
   EMXX    CODE    RELOCATABLE                               04 APR 72  15:11:02   1  01626540    24     1  (DELETED)
                                                                                     0  01626570    14     3
```

D2-118387-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

DOCUMENT OF THE ORIGINAL PAGE IS POOR.

```
@ FOR,* EMXZ,EMXZ                                                                    01 JUN 72          22:39: 3.403
UNIVAC 1108 FORTRAN V EXEC II LEVEL 26A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:03

   FUNCTION EMXZ          ENTRY POINT 000021

   STORAGE USED: CODE(1) 000025; DATA(0) 000007; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CG      000160

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004   FAT
    0005   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000 R 000000 EMXZ      0000   000002 INJP$     0003 R 000070 MXX      0003 R 000142 MXZ      0003 R 000106 MYY
    0003 R 000124 MZZ       0003 R 000000 #T        0003   000016 XCG      0003   000034 YCG      0003   000052 ZCG


00101      1.          FUNCTION EMXZ(E#T)
00103      2.          COMMON /CG/#T(14),XCG(14),YCG(14),ZCG(14),MXX(14),MYY(14),
00103      3.          *   MZZ(14),MXZ(14)
00104      4.          REAL MXX,MYY,MZZ,MXZ
00105      5.          CALL FAT(EMXZ,E#T,MXZ,#T)
00106      6.          EMXZ=EMXZ*1.E6
00107      7.          RETURN
00110      8.          END

      END OF COMPILATION:        NO  DIAGNOSTICS.
    EMXZ            SYMBOLIC                                  04 APR 72  15:10:58   0  01625332    14     8  (DELETED)
    EMXZ    CODE    RELOCATABLE                               04 APR 72  15:10:58   1  01625512    24     1  (DELETED)
                                                                                      0  01625542    14     3
```

D2-118387-2A

DISCLAIMER OF THE ORIGINAL PAGE IS POOR.

```
9 FOR,* EMYY,EMYY
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)                    01 JUN 72          22:39: 5. 23
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:05

   FUNCTION EMYY          ENTRY POINT 000021

   STORAGE USED: CODE(1) 000025: DATA(0) 000007: BLANK COMMON (2) 000000

    COMMON BLOCKS:

    0003   CG      000160

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004   FAT
    0005   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000 R 000000 EMYY      0000   000002 INJPS     0003 R 000070 MXX      0003 R 000142 MXZ      0003 R 000106 MYY
    0003 R 000124 MZZ       0003 R 000000 WT        0003   000016 XCG      0003   000034 YCG      0003   000052 ZCG

00101      1*          FUNCTION EMYY(EWT)
00103      2*          COMMON /CG/AT(14),XCG(14),YCG(14),ZCG(14),MXX(14),MYY(14),
00103      3*         *   MZZ(14),MXZ(14)
00104      4*          REAL MXX,MYY,MZZ,MXZ
00105      5*          CALL FAT(EMYY,EWT,MYY,WT)
00106      6*          EMYY=EMYY*1.E6
00107      7*          RETURN
00110      8*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
   EMYY            SYMBOLIC                                  04 APR 72  15:11:01   0  01626076    14     8  (DELETED)
   EMYY    CODE    RELOCATABLE                               04 APR 72  15:11:01   1  01626256    24     1  (DELETED)
                                                                                     0  01626306    14     3
```

D2-118387-2A

```
@ FOR,* EMZZ,EMZZ                                                                    01 JUN 72          22:39: 5.867
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:05

   FUNCTION EMZZ        ENTRY POINT 000021

   STORAGE USED: CODE(1) 000025; DATA(0) 000007; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CG     000160

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004   FAT
    0005   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000 R 000000 EMZZ      0000   000002 INJPS     0003 R 000070 MXX       0003 R 000142 MXZ       0003 R 000186 MYY
    0003 R 000124 MZZ       0003 R 000000 WT        0003   000016 XCG       0003   000034 YCG       0003   000052 ZCG


00101      1*          FUNCTION EMZZ(EWT)
00103      2*          COMMON /CG/WT(14),XCG(14),YCG(14),ZCG(14),MXX(14),MYY(14),
00103      3*         *   MZZ(14),MXZ(14)
00104      4*          REAL MXX,MYY,MZZ,MXZ
00105      5*          CALL FAT(EMZZ,EWT,MZZ,WT)
00106      6*          EMZZ=EMZZ*1.E6
00107      7*          RETURN
00110      8*          END

      END OF COMPILATION:        NO  DIAGNOSTICS.
   EMZZ            SYMBOLIC                                  04 APR 72  15:10:59   0  01625614    14     8  (DELETED)
   EMZZ    CODE    RELOCATABLE                               04 APR 72  15:10:59   1  01625774    24     1  (DELETED)
                                                                                     0  01626024    14     3
```

D2-118387-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
@ FOR,* EXCG,EXCG                                                                    01 JUN 72          22:39: 6.947
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:57

   FUNCTION EXCG          ENTRY POINT 000016

   STORAGE USED: CODE(1) 000022; DATA(0) 000006; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CG     000160

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004   FAT
    0005   NERR3S

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000 R 000000 EXCG      0000   000001 INJPS     0003 R 000070 MXX      0003 R 000142 MXZ      0003 R 000106 MYY
    0003 R 000124 MZZ       0003 R 000000 WT        0003 R 000016 XCG      0003   000034 YCG      0003   000052 ZCG

00101      1*          FUNCTION EXCG(EWT)
00103      2*          COMMON /CG/WT(14),XCG(14),YCG(14),ZCG(14),MXX(14),MYY(14),
00103      3*         *   MZZ(14),MXZ(14)
00104      4*          REAL MXX,MYY,MZZ,MXZ
00105      5*          CALL FAT(EXCG,EWT,XCG,WT)
00106      6*          RETURN
00107      7*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
    EXCG            SYMBOLIC                                  04 APR 72  15:11:06   0  01627352    14     7  (DELETED)
    EXCG    CODE    RELOCATABLE                               04 APR 72  15:11:06   1  01627514    24     1  (DELETED)
                                                                                     0  01627544    14     3
```

D2-T18387-21

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
@ FOR,* EYCG,EYCG                                                                    01 JUN 72          22:39: 7.A92
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 31 JUN 72 AT 22:39:08

   FUNCTION EYCG          ENTRY POINT 000016

   STORAGE USED: CODE(1) 000022; DATA(3) 000006; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CG     000160

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004   FAT
    0005   NERR3S

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000 R 000000 EYCG      0000   000001 INJPS     0003 R 000070 MXX      0003 R 000142 MXZ      0003 R 000106 MYY
    0003 R 000124 MZZ       0003 R 000000 WT        0003   000016 XCG      0003 R 000039 YCG      0003   000052 ZCG

00101      1*          FUNCTION EYCG(EWT)
00103      2*          COMMON /CG/WT(14),XCG(14),YCG(14),ZCG(14),MXX(14),MYY(14),
00103      3*         *   MZZ(14),MXZ(14)
00104      4*          REAL MXX,MYY,MZZ,MXZ
00105      5*          CALL FAT(EYCG,EWT,YCG,WT)
00106      6*          RETURN
00107      7*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
    EYCG            SYMBOLIC                                  04 APR 72  15:11:05   0  01627106   14    7  (DELETED)
    EYCG    CODE    RELOCATABLE                               04 APR 72  15:11:05   1  01627250   24    1  (DELETED)
                                                                                     0  01627300   14    3
```

D2-118387-2A

```
@ FOR,* EZCG,EZCG                                                    01 JUN 72          22:39:08.803
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E|20100101A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:08

   FUNCTION EZCG        ENTRY POINT 000016

   STORAGE USED: CODE(I) 000022; DATA(D) 000006; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CG      00016C

   EXTERNAL REFERENCES (BLOCK, NAME)

    000    FAT
    0005   WERR35

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000 R 000000 EZCG      0000   000001 INJPS     0003 R 000070 MXX       0003 R 000142 MXZ       0003 R 000196 MYY
    0003 R 000124 MZZ       0003 R 000000 AT        0003   000016 XCG       0003   000034 YCG       0003 R 000052 ZCG

00101      1*          FUNCTION EZCG(EWT)
00103      2*          COMMON /CG/WT(19),XCG(19),YCG(19),ZCG(19),MXX(19),MYY(19),
00103      3*         *   MZZ(19),MXZ(19)
00104      4*          REAL MXX,MYY,MZZ,MXZ
00105      5*          CALL FAT(EZCG,EWT,ZCG,AT)
00106      6*          RETURN
00107      7*          END

    END OF COMPILATION:       NO  DIAGNOSTICS.
    EZCG            SYMBOLIC                              04 APR 72  15:11:03   0  01626442   19    7  (DELETED)
    EZCG    CODE    RELOCATABLE                           04 APR 72  15:11:03   1  01627009   29    1  (DELETED)
                                                                                  0  01627039   19    3
```

02-1183 87-2A

BEST AVAILABLE COPY OF THE ORIGINAL PAGE IS POOR.

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
@ FOR,* FAT,FAT                                                                    01 JUN 72          22:39: 9.481
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:09

   SUBROUTINE FAT        ENTRY POINT 000150

   STORAGE USED: CODE(1) 000172; DATA(0) 000026; BLANK COMMON(2) 000000

   EXTERNAL REFERENCES (BLOCK, NAME)

    0003   NERR3S

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000016 IDSG      0001   000107 62L       0001   000076 63L       0001   000061 64L       0001   000120 65L
    0000   000005 INJPS     0000 1 000000 K         0000 R 000002 WT1       0000 R 000001 WT2       0000 R 000004 XCG1
    0000 R 000003 XCG2

00101      1*          SUBROUTINE FAT(EXCG,EWT,XCG,WT)
00103      2*          DIMENSION XCG(14),WT(14)
00104      3*          DO61K=1,14
00107      4*          IF(EWT.LT.WT(K).AND.K.EQ.1) GO TO 62
00111      5*          IF(EWT.GT.WT(K).AND.K.EQ.14)GOTO63
00113      6*       61 IF(EWT.LT.WT(K))GOTO64
00116      7*       64 WT2=WT(K)
00117      8*          WT1=WT(K-1)
00120      9*          XCG2=XCG(K)
00121     10*          XCG1=XCG(K-1)
00122     11*          GOTO65
00123     12*     63   WT2=WT(14)
00124     13*          WT1=WT(13)
00125     14*          XCG2=XCG(14)
00126     15*          XCG1=XCG(13)
00127     16*          GOTO65
00130     17*     62   WT2=WT(2)
00131     18*          WT1=WT(1)
00132     19*          XCG2=XCG(2)
00133     20*          XCG1=XCG(1)
00134     21*          GOTO65
00135     22*     65   EXCG=(XCG1*(WT2-EWT)-XCG2*(WT1-EWT))/(WT2-WT1)
00136     23*          RETURN
00137     24*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
   FAT            SYMBOLIC                                  04 APR 72  15:10:57   0  01624274    14    24  (DELETED)
   FAT     CODE   RELOCATABLE                               04 APR 72  15:10:57   1  01625014    24     1  (DELETED)
                                                                                   0  01625044    14    13
```

D2-118387-24

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

D2-118387-24

```
@ FOR,* AUTOPI,AUTOPI                                                                  01 JUN 72          22:38:37.418
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:37

SUBROUTINE AUTOPI    ENTRY POINT 001022

STORAGE USED: CODE(1) 001030; DATA(0) 000070; BLANK COMMON(2) 000000

COMMON BLOCKS:

0003   ARI    000003
0004   CON    000007
0005   MAT    000016
0006   MAN    000006
0007   IA1    000021
0010   IA2    000017
0011   IA3    000019
0012   IA4    000037
0013   IA5    000037
0014   IA6    000031
0015   IA7    000040
0016   IA8    000031
0017   IA9    000047
0020   IF1    000015
0021   DA1    000016
0022   PRINT  000001
0023   CLA    000074
0024   EA1    000022
0025   EA2    000125
0026   IG4    000023
0027   AD1    000007

EXTERNAL REFERENCES (BLOCK, NAME)

0030   ACC
0031   EMYY
0032   EZCG
0033   EXCG
0034   EMZZ
0035   EYCG
0036   EMXX
0037   COS
0040   SIN
0041   SQRT
0042   ASIN
0043   NERR3$

STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

0001   000020 11L      0001   000024 12L      0001   000057 126L     0001   000200 130L     0001   000240 131L
0001   000220 132L     0001   000242 133L     0001   000254 134L     0001   000270 135L     0001   000472 136L
0001   000655 137L     0001   000421 142L     0001   000033 144G     0001   000444 145L     0001   000456 146L
0001   000442 148L     0001   000604 152L     0001   000627 155L     0001   000641 156L     0001   000625 158L
0001   000323 20L      0001   000316 252G     0001   000331 260G     0001   000416 273G     0001   000503 323G
```

0001		001601	3366	0001		000666	3666	0001		000767	4156	0001		001002	4256	0001		001007	44L
0015	R	000012	ABETAP	0017	R	000012	ABETAR	0016	R	000012	ABETAY	0015	R	000017	ABPIT	0017	R	000017	ABROLL
0017	R	000033	ABTOTP	0011		000025	ABTOTY	0005		000003	ABTY	0011		000003	ABYAW	0017	R	000005	ACALMX
0015	R	000005	ACALMY	0016	R	000025	ACALMZ	0013		000003	ACCLIM	0000	R	000029	ACOAP	0000	R	000032	ACOAY
0000	R	000025	ACOBP	0000	R	000033	ACOBY	0000	R	000026	ACOMP1	0000	R	000027	ACOMP2	0015		000009	ACOMSM
0000	R	000034	ACOMY1	0000	R	000035	ACOMY2	0014		000029	ACTALP	0015		000000	ACTPAC	0017		000000	ACTRAC
0016		000000	ACTYAC	0011		000000	ADESMX	0011		000001	ADESMY	0011		000002	ADESMZ	0000	R	000017	ADINCP
0010	R	000021	ADINCR	0000	R	000020	ADINCY	0007	R	000034	ADMASS	0007	R	000000	ADMTOT	0003	R	000000	ADPDES
0000	R	000019	ADPEND	0000	R	000016	ADPERR	0000	R	000011	ADPTOT	0003	R	000002	ADRDES	0000	R	000016	ADREND
0000	R	000010	ADRERR	0000	R	000013	ADRTOT	0003	R	000001	ADYDES	0000	R	000015	ADYEND	0000	R	000007	ADYERR
0000	R	000012	ADYTOT	0027	R	000032	AFLOWB	0027	R	000033	AFLOWO	0016	R	000017	AFYMX	0016	R	000024	AFZMX
0000	R	000023	AGAINP	0000	R	000037	AGAINR	0000	R	000031	AGAINY	0027		000006	ALENGO	0019		000017	ALPHAC
0019	R	000000	ALPHPI	0019	R	000012	ALPHRO	0019	R	000035	ALPHYA	0007	R	000003	AMASCO	0007		000001	AMDOTV
0013		000006	AMINGA	0027		000004	AMINIB	0027		000005	AMINTO	0007	R	000002	AMTOT	0013	R	000000	ANGLDB
0013		000005	ANDAER	0000	R	000022	AOMEGP	0000	R	000036	AOMEGR	0000	R	000030	AOMEGY	0006	R	000000	APDET
0012		000000	APDIFT	0019	R	000000	APRATE	0013	R	000001	ARATDB	0015		000033	ARATE	0000	R	000040	ARATIO
0013		000002	ARATLM	0025	R	000122	ARCSPM	0025	R	000124	ARCSRM	0025	R	000123	ARCSYM	0006	R	000002	ARDET
0012		000002	ARDIFT	0019	R	000012	ARRATE	0024	R	000006	ATENG	0021	R	000015	ATOTMR	0011		000007	ATOTPG
0017	R	000020	AUGRAV	0000	R	000003	AWDOT	0000	R	000001	AWDOTB	0000	R	000002	AWDOTO	0006	R	000001	AYDET
0012		000001	AYDIFT	0010	R	000005	AYRATE	0021		000003	DFAB	0021		000000	DMAXB	0021		000001	DMAYB
0021		000002	DMAZB	0020		000007	EAVPP	0025	R	000049	EBP	0025	R	000060	EBY	0025	R	000000	EL
0025	R	000119	ELO	0036	R	000000	EMXX	0031	R	000000	EMYY	0034	R	000000	EMZZ	0020		000000	EPAI
0020	R	000001	EPB	0020		000004	EPBD	0025	R	000074	EPE	0024	R	000002	EPHI	0024		000005	EPHID
0024	R	000001	EPSI	0024		000004	EPSID	0025	R	000110	EPT	0020	R	000002	EQB	0020		000005	EQBD
0020	R	000003	ERB	0020		000006	ERBD	0024	R	000000	ETHETA	0024		000003	ETHETD	0020		000012	EVPP
0033	R	000000	EXCG	0035	R	000000	EYCG	0032	R	000000	EZCG	0026		000019	GM	0024	R	000022	GPHID
0026	R	000021	GPSID	0026	R	000020	GTHED	0026		000000	GURP	0026		000010	GUYP	0026		000004	GUZP
0021		000019	HI	0000	I	000004	I	0005		000002	IABT	0025		000112	IBO	0025	I	000111	IES
0000	I	000005	IJ	0000		000053	INJPS	0012	I	000003	IPITCH	0012	I	000006	IRESID	0012	I	000005	IROLL
0025	I	000113	ISEP	0012	I	000004	IYAW	0005	I	000000	J	0005		000005	KGUID	0022		000000	KP
0006	I	000003	MANUAL	0030	I	000000	NE	0027	I	000000	NOENGB	0027	I	000001	NOENGO	0021		000013	P
0023		000000	PAD	0023		000012	PAI	0024	R	000002	PI	0004		000000	RAD	0004		000001	RADI
0023		000050	RAD	0023		000062	RAI	0004		000005	SEROT	0006		000005	SETCGO	0004		000003	SGRAV
0004		000006	SMU	0024		000004	SRMEAN	0005		000001	T	0005		000004	TGOT	0006		000004	TRIM
0021		000007	WEP	0023		000024	YAD	0023		000036	YAI								

```
00101      1•          SUBROUTINE AUTOPI
00103      2•          COMMON /AR1/ ADPDES,ADYDES,ADRDES
00104      3•          COMMON /CON/ RAD,RADI,PI,SGRAV,SRMEAN,SEROT,SMU
00105      4•          COMMON/MAI/ J    ,T,IABT,ABTT,TGOT,KGUID
00106      5•          COMMON/MAN/APDET,AYDET,ARDET,MANUAL,TRIM,SETCGO
00107      6•          COMMON/IA1/ADMTOT,AMDOTV,AMTOT,AMASCO,ADMASS(12),AUGRAV
00110      7•          COMMON/IA2/APRATE(5),AYRATE(5),ARRATE(5)
00111      8•          COMMON/IA3/ADESMX,ADESMY.ADESMZ,ABYAW(2),ABTOTY(2),ATOTPG(5)
00112      9•          COMMON/IA4/APDIFT,AYDIFT,ARDIFT,IPITCH,IYAW,IROLL,IRESID
00113     10•          COMMON/IA5/ANGLDB,ANATDB,ARATLM,ACCLIM,ACOMSM,ANDAER,AMINGA
00114     11•          COMMON/IA6/ALPHPI(5),ALPHYA(5),ALPHRO(5),ALPHAC(5),ACTALP(5)
00115     12•          COMMON/IA7/ACTPAC(5),ACALMY(5),ABETAP(5),ABPIT(12),ARATE(5)
00116     13•          COMMON /IA8/ ACTYAC(5),ACALMZ(5),ABETAY(5),AFYMX(5),AFZMX(5)
00117     14•          COMMON /IA9/ ACTRAC(5),ACALMX(5),ABETAR(5),ABROLL(12),ABTOTP(12)
00120     15•          COMMON /IE1/ EPAI,EPB,EQB,ERB,EPBD,EQBD,ERBD,EAVPP(3),EVPP(3)
00121     16•          COMMON /DA1/ DMAXB,DMAYB,DMAZB,DFAB(4),GEP(4),P,HI,ATOTHR
00122     17•          COMMON/PRINT/KP
00123     18•          COMMON /CLA/ PAD(10),PAI(10),YAD(10),YAI(10),RAD(10),RAI(10)
00124     19•          COMMON/EA1/ETHETA,EPSI,EPHI,ETHETD,EPSID,EPHID,ATENG(12)
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REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

02-11-83 8:7: 21

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00125    20.        COMMON /EA2/ EL(12,3),EBP(12),EBY(12),EPE(12),EPT,IES,IBO,ISEP
00125    21.       * ,ELO(2,3),ARCSPM,ARCSYM,ARCSRM
00126    22.        COMMON /IG4/ GURP(4),GUZP(4),GUYP(4),GM(4),GTHED,GPSID,GPHID
00127    23.        COMMON/ADI/NOENGB,NOENGO,AFLOWB,AFLOWO,AMINTB,AMINTO,ALENGO
00130    24.        NE=NOENGB
00131    25.        ATOTHR=0.
00132    26.        ADMTOT=0.
00133    27.        AWDOTB=AFLOWB/AUGRAV
00134    28.        AWDOTO=AFLOWO/AUGRAV
00135    29.        IF(ISEP.EQ.1) GO TO 11
00137    30.        AWDOT=AWDOTB
00140    31.        GO TO 12
00141    32.     11 NE=NOENGO
00142    33.        AWDOT=AWDOTO
00143    34.     12 DO 125 I=1,NE
00146    35.        ADMASS(I)=AWDOT*EPT*EPE(I)**2
00147    36.        ADMTOT=ADMTOT+ADMASS(I)
00150    37.    125 ATOTHR = ATOTHR+ATENG(I)
00152    38.        AMDOTV=ADMTOT/.2
00153    39.        AMTOT=AMTOT-ADMTOT
00154    40.        IF(AMTOT.GT.AMASCO) GO TO 126
00156    41.        IES=0
00157    42.    134 IJ=J
00160    43.    135 IF(IJ.NE.1) GO TO 130
00162    44.        ADPDES=GTHED-ETHETA
00163    45.        ADYDES=GPSID-EPSI
00164    46.        ADRDES=GPHID-EPHI
00165    47.        IF(ADRDES.GT. PI) ADRDES=-2.*PI+ADRDES
00167    48.        IF(ADRDES.LT.-PI) ADRDES= 2.*PI+ADRDES
00171    49.        ADPERR=ADYDES*SIN(EPHI)+ADPDES*COS(EPHI)*COS(EPSI)
00172    50.        ADYERR=ADYDES*COS(EPHI)-ADPDES*SIN(EPHI)*COS(EPSI)
00173    51.        ADRERR=ADRDES+ADPDES*SIN(EPSI)
00174    52.        ADPDES=ADPERR
00175    53.        ADYDES=ADYERR
00176    54.        ADRDES=ADRERR
00177    55.        ADPTOT=0.
00200    56.        ADYTOT=0.
00201    57.        ADRTOT=0.
00202    58.        ADPEND=0.
00203    59.        ADYEND=0.
00204    60.        ADREND=0.
00205    61.        ADINCP=ADPDES-EQB
00206    62.        ADINCY=ADYDES-ERB
00207    63.        ADINCR=ADRDES-EPB
00210    64.    130 APRATE(IJ)=EQB
00211    65.        AYRATE(IJ)=ERB
00212    66.        ARRATE(IJ)=EPB
00213    67.        IF(MANUAL.EQ.0) GO TO 132
00215    68.        ALPHPI(IJ)=APDET-EQB
00215    69.        ALPHYA(IJ)=AYDET-ERB
00217    70.        ALPHRO(IJ)=ARDET-EPB
00220    71.        GO TO 134
00221    72.    132 IPITCH=0
00222    73.        IYAW=0
00223    74.        IROLL=0
00224    75.        IF(ABS(ADPDES).GE.ANGLDB) GO TO 133
00226    76.        IF(ABS(APRATE(IJ)).GE.ARATDB) GO TO 131
00230    77.        ALPHPI(IJ)=0.
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```
      GO TO 134
  131 IRESID= 1
  133 IPITCH=1
      CALL ACC (ADPDES,ADINCP,ADPTOT,ADPEND,ADMEGP,AGAINP)
  134 ACALMY(IJ)=EMYY(AMTOT)*ALPHPI(IJ)
      IF(IES.EQ.1) GO TO 135
      ARCSPM=ACALMY(IJ)
      GO TO 142
  135 ARCSPM=0.
      ACOAP=0.
      ACOBP=0.
      IF(.SEP.NE.1) GO TO 20
      IF(ISEP.EQ.1.AND.IES.EQ.1) GO TO 20
      DO 21 I=1,3
      EL(1,I)=ELO(1,I)
   21 EL(2,I)=ELO(2,I)
   20 DO 140 I=1,NE
      ACOAP=ACOAP+ATENG(I)*(EL(I,3)-EZCG(AMTOT))
  140 ACOBP=ACOBP-ATENG(I)*EXCG(AMTOT)
  149 ACOMP1=ACALMY(IJ)/SQRT(ACOAP**2+ACOBP**2)
      IF (ABS(ACOMP1).GT..999999) ACOMP1=SIGN(.999999,ACOMP1)
      ACOMP2=.999999*ACOAP/(SQRT(ACOAP**2+ACOBP**2))
  500 ABETAP(IJ)=-ASIN(ACOMP1)+ASIN(ACOMP2)
      DO 141 I=1,NE
  141 ABPIT(I)=ABETAP(IJ)
  142 IF(MANUAL.EQ.1) GO TO 146
      IF(ABS(ADYDES).GE.ANGLDB) GO TO 145
      IF(ABS(AYRATE(IJ)).GE.ARATDB) GO TO 148
      ALPHYA(IJ)=0.
      GO TO 146
  148 IRESID= 1
  145 IYAW=1
      CALL ACC (ADYDES,ADINCY,ADYTOT,ADYEND,ADMEGY,AGAINY)
  146 ACALMZ(IJ)=EMZZ(AMTOT)*ALPHYA(IJ)
      IF(IES.EQ.1) GO TO 136
      ARCSYM=ACALMZ(IJ)
      GO TO 152
  136 ARCSYM=0.
      ACOAY=0.
      ACOBY=0.
      DO 150 I=1,NE
      ACOAY=ACOAY-(COS(ABETAP(IJ)))*ATENG(I)*(EL(I,2)-EYCG(AMTOT))
  150 ACOBY=ACOBY+ATENG(I)*EXCG(AMTOT)
  159 ACOMY1=ACALMZ(IJ)/SQRT(ACOAY**2+ACOBY**2)
      IF (ABS(ACOMY1).GT..999999) ACOMY1=SIGN(.999999,ACOMY1)
      ACOMY2= .999999*ACOAY/SQRT(ACOAY**2+ACOBY**2)
  501 ABETAY(IJ)=ASIN(ACOMY1)+ASIN(ACOMY2)
      DO 151 I=1,NE
  151 EBY(I)=ABETAY(IJ)*.95
  152 IF(MANUAL.EQ.1) GO TO 156
      IF(ABS(ADRDES).GE.ANGLDB) GO TO 155
      IF(ABS(ARRATE(IJ)).GE.ARATDB) GO TO 158
      ALPHRO(IJ)=0.
      GO TO 156
  158 IRESID= 1
  155 IROLL=1
      CALL ACC (ADRDES,ADINCR,ADRTOT,ADREND,ADMEGR,AGAINR)
  156 ACALMX(IJ)=EMXX(AMTOT)*ALPHRO(IJ)
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D2-118387-2A

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00356          IF(IES.EQ.1) GO TO 137
00360          ARCSRM=ACALMX(IJ)
00361          GO TO 44
00362      137 ARCSRM=0.
00363          AFYMX(IJ)=0.
00364          AFZMX(IJ)=0.
00365          DO 160 I=1,NE
00370          AFYMX(IJ)=AFYMX(IJ)+ATENG(I)*SIN(EBY(I))*(EL(I,3)-EZCG(AMTOT))
00371          AFZMX(IJ)=AFZMX(IJ)+ATENG(I)*COS(EBY(I))*ABS((EL(I,2)-
00371         *EYCG(AMTOT)))
00372      160 CONTINUE
00374      169 ARATIO=(ACALMX(IJ)-AFYMX(IJ))/AFZMX(IJ)
00375      170 IF(ABS(ARATIO).GT..1222) ARATIO=SIGN(.1222,ARATIO)
00377      502 ABETAR(IJ)=ASIN (ARATIO)*.95
00400      165 ABROLL(1)=+ABETAR(IJ)
00401          ABROLL(2)=-ABETAR(IJ)
00402          ABROLL(3)=+ABETAR(IJ)
00403          ABROLL(4)=+ABETAR(IJ)
00404          ABROLL(5)=-ABETAR(IJ)
00405          ABROLL(6)=-ABETAR(IJ)
00406          ABROLL(7)=+ABETAR(IJ)
00407          ABROLL(8)=+ABETAR(IJ)
00410          ABROLL(9)=-ABETAR(IJ)
00411          ABROLL(10)=-ABETAR(IJ)
00412          ABROLL(11)=+ABETAR(IJ)
00413          ABROLL(12)=-ABETAR(IJ)
00414          DO 167 I=1,NE
00417          ABTOTP(I)=ABPIT(I)+ABROLL(I)
00420      167 EBP(I)=ABTOTP(I)
00422          IF(ISEP.NE.1) GO TO 44
00424       42 DO 43 I=3,12
00427          ABROLL(I)=0.
00430          ABPIT(I)=0.
00431          EBP(I)=0.
00432       43 EBY(I)=0.
00434       44 CONTINUE
00435          RETURN
00436          END

   END OF COMPILATION:        NO  DIAGNOSTICS.
AUTOPI          SYMBOLIC                                  04 APR 72  15:10:31   0  01560404    14   173  (DELETED)
AUTOPI  CODE    RELOCATABLE                               04 APR 72  15:10:31   1  01565372   120     1  (DELETED)
                                                                                0  01565562    14    59
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@ FOR,* ACC.ACC
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12D10010A)                    01 JUN 72          22:38:40. 63
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:40

    SUBROUTINE ACC        ENTRY POINT 001921

    STORAGE USED: CODE(1) 001112; DATA(0) 000026; BLANK COMMON(2) 000000

     COMMON BLOCKS:

     0003    HA1     000006
     0004    IA2     000017
     0005    IA4     000007
     0006    IA5     000007
     0007    IA6     000031
     0010    IA7     000040
     0011    IA8     000031
     0012    IA9     000047
     0013    AD2     000007
     0014    DA1     000016
     0015    EA2     000125

    EXTERNAL REFERENCES (BLOCK, NAME)

     0016    NERR3S

    STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

     0001    000105 19L      0001    001004 100L     0001    000054 11L      0001    000162 12L      0001    000021 127G
     0001    000066 13L      0001    000033 137G     0001    000071 14L      0001    000045 147G     0001    000126 15L
     0001    000206 20L      0001    000257 22L      0001    000302 23L      0001    000223 25L      0001    000314 30L
     0001    000756 352G     0001    000405 36L      0001    000767 362G     0001    000415 37L      0001    001000 372G
     0001    000425 38L      0001    000433 39L      0001    000464 40L      0001    000473 41L      0001    000500 42L
     0001    000531 43L      0001    000537 44L      0001    000572 45L      0001    000562 46L      0001    000617 520L
     0001    000031 521L     0001    000043 522L     0001    000640 82L      0001    000645 83L      0001    000652 85L
     0001    000704 89L      0001    000693 90L      0001    000724 91L      0001    000737 93L      0001    000754 94L
     0001    000765 96L      0001    000776 98L      0010    000012 ABETAP   0012    000012 ABETAR   0011    000012 ABETAY
     0010    000017 ABPIT    0012    000017 ABROLL   0012    000033 ABTOTP   0003    000003 ABTT     0012    000005 ACALMX
     0010    000005 ACALMY   0011    000005 ACALMZ   0006 R  000003 ACCLIM   0003 R  000002 ACMAXB   0000 R  000003 ACMAXO
     0006 R  000004 ACOMSM   0007 R  000024 ACTALP   0010 R  000000 ACTPAC   0012 R  000000 ACTRAC   0011 R  000000 ACTYAC
     0011    000017 AFYMX    0011    000024 AFZMX    0013 R  000000 AGAINI   0013 R  000001 AGAIN2   0007 R  000017 ALPHAC
     0007 R  000000 ALPHPI   0007 R  000012 ALPHRO   0007 R  000005 ALPHYA   0013 R  000002 AMAXGA   0006 R  000006 AMINGA
     0013 R  000005 AMINOM   0006    000000 ANGLOB   0013 R  000004 ANGMAX   0013 R  000003 ANGMIN   0006 R  000005 ANOAEP
     0005    000000 APDIFT   0004 R  000000 APRATE   0006    000001 ARATDB   0010 R  000033 ARATE    0006 R  000002 ARATLM
     0015    000122 ARCSPM   0015    000124 ARCSRM   0015    000123 ARCSYM   0005    000002 ARDIFT   0013 R  000004 AREVRS
     0000 R  000004 ARMAX    0004 R  000012 ARRATE   0014    000015 ATOTMB   0005    000001 AYDIFT   0004 R  000005 AYRATE
     0014    000003 DFAB     0014    000000 DMAXB    0014    000001 DMAYB    0014    000002 DMAZB    0015    000044 EBP
     0015    000060 EBY      0015    000000 EL       0015    000114 ELO      0015    000074 EPE      0015    000110 EPT
     0014    000014 HI       0000 I  000001 I        0003    000002 IABT     0015    000112 IBO      0015    000111 IES
     0000 I  000000 IJ       0000    000015 INJPS    0005 I  000003 IPITCH   0005 I  000006 INESID   0005 I  000005 IROLL
     0015 I  000113 ISEP     0015 I  000004 IYAW     0003 I  000000 J        0003    000005 KGUID    0014 R  000013 P
     0003    000001 T        0003    000004 TGOT     0014    000007 WEP
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00101     1.      SUBROUTINE ACCTADDES,ADINC,ADTOT,ADEND,AOMEGA,AGAIN)
00103     2.      COMMON/MA1/ J    ,T,IABT,AHTT,TGUT,KGUID
00104     3.      COMMON/IA2/APRATE(5),AYRATE(5),ANRATE(5)
00105     4.      COMMON/IA4/APDIFT,AYDIFT,ARDIFT,IPITCH,IYAW,INOLL,IRESID
00106     5.      COMMON/IA5/ANGLDB,AHATDB,ARATLM,ACCLIM,ACOMSM,ANOAER,AMINGA
00107     6.      COMMON/IA6/ALPHPI(5),ALPHYA(5),ALPHRO(5),ALPHAC(5),ACTALP(5)
00110     7.      COMMON/IA7/ACTPAC(5),ACALHY(5),ABETAP(5),ABPIT(12),ARATE(5)
00111     8.      COMMON /IA8/ ACTYAC(5),ACALMZ(5),ABETAY(5),AFYMX(5),AFZMX(5)
00112     9.      COMMON /IA9/ ACTRAC(5),ACALMX(5),ABETAR(5),ABROLL(12),ABTOTP(12)
00113    10.      COMMON/AU2/AGAIN1,AGAIN2,AMAXGA,ANGMIN,ANGMAX,AMINOM,ARLVMS
00114    11.      COMMON /DA1/ DMAXB,DMAYB,DMAZB,DFAB(4),WEP(4),P,M1,ATOTHR
00115    12.      COMMON /EA2/ EL(12,3),EBP(12),EHY(12),LPE(12),EPT,IES,IBU,ISEP
00115    13.     *,ELU(2,3),ARCSPM,ARCSYM,ARCSRM
00116    14.      IJ=J
00117    15.      IF(IPITCH.EQ.1) GO TO 520
00121    16.      IF(IYA..EQ.1) GO TO 521
00123    17.      IF(IROLL.EQ.1) GO TO 522
00125    18.      GO TO 100
00126    19.  520 DO 420 I=1,5
00131    20.      ARATE(I)=APRATE(I)
00132    21.      ALPHAC(I)=ALPHPI(I)
00133    22.  420 ACTALP(I)=ACTPAC(I)
00135    23.      GO TO 11
00136    24.  521 DO 421 I=1,5
00141    25.      ARATE(I)=AYRATE(I)
00142    26.      ALPHAC(I)=ALPHYA(I)
00143    27.  421 ACTALP(I)=ACTYAC(I)
00145    28.      GO TO 11
00146    29.  522 DO 422 I=1,5
00151    30.      ARATE(I)=ANRATE(I)
00152    31.      ALPHAC(I)=ALPHRO(I)
00153    32.  422 ACTALP(I)=ACTRAC(I)
00155    33.   11 IF(P.GT..75) GO TO 13
00157    34.      ACMAXB=ACCLIM*ANOAER
00160    35.      ACMAXO=ACCLIM*ANOAER
00161    36.      GO TO 14
00162    37.   13 ACMAXB=ACCLIM
00163    38.      ACMAXO=ACCLIM
00164    39.   14 AOMEGA=ADDES
00165    40.      IF(ABS(AOMEGA).LE.ARATLM) GO TO 10
00167    41.      AOMEGA=AOMEGA*ARATLM/ABS(AOMEGA)
00170    42.   10 IF(IJ.NE.1) GO TO 20
00172    43.      ACTALP(IJ)=5.*(ARATE(IJ)-ARATE(IJ+1))
00173    44.      IF(ABS(ALPHAC(IJ+1)).GT.ACOMSM) GO TO 15
00175    45.      AGAIN=AGAIN1
00176    46.      GO TO 30
00177    47.   15 IF(ALPHAC(IJ+1).GT.0..AND.ACTALP(IJ).GT.0.)GO TO 12
00201    48.      IF(ALPHAC(IJ+1).LT.0..AND.ACTALP(IJ).LT.0.)GO TO 12
00203    49.      AGAIN=AGAIN2
00204    50.      GO TO 30
00205    51.   12 AGAIN=ABS(ACTALP(IJ)/ALPHAC(IJ+1))
00206    52.      IF(AGAIN.GT.AMAXGA) AGAIN=.9
00210    53.      IF(AGAIN.LT.AMINGA) AGAIN=AMINGA
00212    54.      GO TO 30
00213    55.   20 ACTALP(IJ)=5.*(ARATE(IJ)-ARATE(IJ-1))
00214    56.      IF(ABS(ALPHAC(IJ-1)).GT.ACOMSM) GO TO 25
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00216    57.          AGAIN=AGAIN1
00217    58.          GO TO 23
00220    59.       25 IF(ALPHAC(IJ-1).GT.0..AND.ACTALP(IJ).GT.0.)GO TO 22
00222    60.          IF(ALPHAC(IJ-1).LT.0..AND.ACTALP(IJ).LT.0.)GO TO 22
00224    61.          AGAIN=AGAIN2
00225    62.          GO TO 23
00226    63.       22 AGAIN=ABS(ACTALP(IJ)/ALPHAC(IJ-1))
00227    64.          IF(AGAIN.GT.AMAXGA) AGAIN=.9
00231    65.          IF(AGAIN.LT.AMINGA) AGAIN=AMINGA
00233    66.       23 ADTOT=ADTOT+.5*ACTALP(IJ)*.2*.2+ARATE(IJ-1)*.2
00234    67.       30 ADEND=ADTOT+.1*ARATE(IJ)
00235    68.          IF(IRESID.EQ.1) GO TO 41
00237    69.       35 IF(ARATE(IJ).LT.0..AND.ADINC.LT.0.)GO TO 39
00241    70.          IF(ARATE(IJ).GT.0..AND.ADINC.GT.0.)GO TO 39
00243    71.          IF(ADDES.GT.0..AND.ADEND.GT.0.) GO TO 36
00245    72.          IF(ADDES.LT.0..AND.ADEND.LT.0.) GO TO 36
00247    73.          GO TO 42
00250    74.       36 IF(ABS(ADEND).GE.ABS(ADDES)*ANGMIN) GO TO 37
00252    75.          GO TO 43
00253    76.       37 IF(ABS(ADEND).GT.ABS(ADDES)*ANGMAX) GO TO 38
00255    77.          GO TO 41
00256    78.       38 ALPHAC(IJ)=-AREVRS*ARATE(IJ)*3.
00257    79.          GO TO 90
00260    80.       39 IF(ADDES.GT.0..AND.ADEND.GT.0.) GO TO 40
00262    81.          IF(ADDES.LT.0..AND.ADEND.LT.0.) GO TO 40
00264    82.          GO TO 42
00265    83.       40 IF(ABS(ADEND).LT.ABS(ADDES)*ANGMIN) GO TO 42
00267    84.       41 ALPHAC(IJ)=-ARATE(IJ)*3.
00270    85.          GO TO 90
00271    86.       42 IF(ARATE(IJ).GT.0..AND.AOMEGA.GT.0.) GO TO 44
00273    87.          IF(ARATE(IJ).LT.0..AND.AOMEGA.LT.0.) GO TO 44
00275    88.       43 ALPHAC(IJ)=(AOMEGA-ARATE(IJ))*5.
00276    89.          GO TO 90
00277    90.       44 IF(ABS(ARATE(IJ)).LT.ABS(AOMEGA)*AMINOM) GO TO 43
00301    91.          IF(ABS(ARATE(IJ)).LT.ABS(AOMEGA)*AREVRS) GO TO 46
00303    92.          ALPHAC(IJ)=(AOMEGA-ARATE(IJ))*3.
00304    93.       46 IF(ABS(ARATE(IJ)).GT.ARATLM) GO TO 45
00306    94.          ALPHAC(IJ)=0.
00307    95.          GO TO 90
00310    96.       45 ARMAX=SIGN(ARATLM,ARATE(IJ))
00311    97.          ALPHAC(IJ)=(ARMAX-ARATE(IJ))*5.
00312    98.       90 IF(IJ.NE.1)GO TO 85
00314    99.          IF(ALPHAC(IJ).GE.0..AND.ALPHAC(IJ+4).GE.0.)GO TO 83
00316   100.          IF(ALPHAC(IJ).LE.0..AND.ALPHAC(IJ+4).LE.0.)GO TO 83
00320   101.       82 ALPHAC(IJ)=ALPHAC(IJ)*AGAIN
00321   102.          GO TO 89
00322   103.       83 ALPHAC(IJ)=ALPHAC(IJ)/AGAIN
00323   104.          GO TO 89
00324   105.       85 IF(ALPHAC(IJ).GE.0..AND.ALPHAC(IJ-1).GE.0.)GO TO 83
00326   106.          IF(ALPHAC(IJ).LE.0..AND.ALPHAC(IJ-1).LE.0.)GO TO 83
00330   107.          GO TO 82
00331   108.       89 IF(ISEP.EQ.1) GO TO 91
00333   109.          IF(ABS(ALPHAC(IJ)).LT.ACMAXB) GO TO 93
00335   110.          ALPHAC(IJ)=SIGN(ACMAXB,ALPHAC(IJ))
00336   111.          GO TO 93
00337   112.       91 IF(ABS(ALPHAC(IJ)).LT.ACMAXO) GO TO 93
00341   113.          ALPHAC(IJ)=SIGN(ACMAXO,ALPHAC(IJ))
00342   114.       93 IF(IPITCH.EQ.1) GO TO 94
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00344          IF(IYAW.EQ.1) GO TO 96
00346          IF(IROLL.EQ.1) GO TO 98
00350          GO TO 100
00351       94 DO 300 I=1,5
00354          ALPHPI(I) = ALPHAC(I)
00355      300 ACTPAC(I) = ACTALP(I)
00357       95 IPITCH=0
00360          GO TO 100
00361       96 DO 301 I=1,5
00364          ALPHYA(I) = ALPHAC(I)
00365      301 ACTYAC(I) = ACTALP(I)
00367       97 IYAW=0
00370          GO TO 100
00371       98 DO 302 I=1,5
00374          ALPHRO(I) = ALPHAC(I)
00375      302 ACTRAC(I) = ACTALP(I)
00377       99 IROLL=0
00400      100 IRESID=0
00401          RETURN
00402          END

   END OF COMPILATION:        NO  DIAGNOSTICS.
ACC            SYMBOLIC                                  04 APR 72  15:10:28   0  01553272   14   134  (DELETED)
ACC     CODE   RELOCATABLE                               04 APR 72  15:10:28   1  01557016   60     1  (DELETED)
                                                                                0  01557112   14    59
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D2-118387-2A

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@ FOR,* AUTOP2,AUTOP2                                                                    01 JUN 72          22:38:34.166
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:34

   SUBROUTINE AUTOP2    ENTRY POINT 000715

   STORAGE USED: CODE(1) 000726; DATA(0) 000134; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003    AR1     000003
    0004    MA1     000006
    0005    MAN     000006
    0006    IA1     000021
    0007    IA2     000017
    0010    IA3     000014
    0011    IA4     000007
    0012    IA5     000007
    0013    IA6     000031
    0014    IA7     000040
    0015    IA8     000031
    0016    IA9     000047
    0017    IE1     000015
    0020    DA1     000016
    0021    EA1     000022
    0022    EA2     000125
    0023    IG4     000023
    0024    AD1     000007
    0025    CON     000007
    0026    PRINT   000001
    0027    CLA     000074

   EXTERNAL REFERENCES (BLOCK, NAME)

    0030    Z2
    0031    COS
    0032    SIN
    0033    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001    000020 11L      0001    000024 12L      0001    000057 126L     0001    000166 128L     0001    000652 134L
    0001    000134 154L     0001    000144 155L     0001    000033 167G     0001    000633 340G     0001    000647 350G
    0001    000677 999L     0014 R  000012 ABETAP   0016 R  000012 ABETAR   0015 R  000012 ABETAY   0014    000017 ABPIT
    0016 R  000017 ABROLL   0016    000033 ABTOTP   0010    000005 ABTOTY   0004    000003 ABTT     0010    000003 ABYAW
    0016    000005 ACALMX   0014    000005 ACALMY   0015    000005 ACALMZ   0012    000003 ACCLIM   0012    000004 ACOMSM
    0013    000024 ACTALP   0014    000000 ACTPAC   0016    000000 ACTRAC   0015    000000 ACTYAC   0010    000000 ADESMX
    0010    000001 ADESMY   0010    000002 ADESMZ   0006 R  000004 ADMASS   0006 R  000000 ADMTOT   0024 R  000002 AFLOWB
    0024 R  000003 AFLOWO   0015    000017 AFYMX    0015    000024 AFZMX    0024    000006 ALENGO   0013    000017 ALPHAC
    0013    000000 ALPHPI   0013    000012 ALPHRO   0013    000005 ALPHYA   0006 R  000003 AMASCO   0006 R  000001 AMDOTV
    0012    000006 AMINGA   0024    000004 AMINTB   0024    000005 AMINTO   0006 R  000002 AMTOT    0012    000000 ANGLDB
    0012    000005 ANOAER   0005    000000 APDET    0011    000000 APDIFT   0000 R  000000 APITCH   0007 R  000000 APRATE
    0012    000001 ARATDB   0014    000033 ARATE    0012    000002 ARATLM   0022 R  000122 ARCSPM   0022 R  000124 ARCSRM
    0022 R  000123 ARCSYM   0005    000002 ARDET    0011    000002 ARDIFT   0000 R  000012 AROLL    0007 R  000012 ARRATE
```

D2-118387-21

```
0021 R 000006 ATENG     0020 R 000015 ATOTHR    0010 R 000007 ATOTPG    0006 R 000320 AUGRAV    0000 R 00 0041 AXDOT
0030 R 000037 AXDOTB    0000 R 000040 AXDOTO    0000 R 000005 AYAW      0005   000001 AYDLT     0011   00 0001 AYDIFT
0007 R 000005 AYRATE    0030 R 000044 C2        0000 R 000045 CJ        0000 R 000335 DEG01     0000 R 00 0032 DEG08
0030 R 000033 DEG09     0030 R 000034 DEG10     0020   000003 DFAB      0020   000000 DMAXB     0020   00 0001 DMAYB
0020   000002 DMAZB     0017   000007 EAVPP     0022 R 000044 EBP       0022 R 000360 EBY       0022   00 0000 EL
0022   000114 ELO       0017   000030 EPAI      0017 R 000001 EPB       0017   000004 EPBD      0022 R 00 0079 EPE
0021 R 000002 EPHI      0021   000005 EPHID     0021 R 000001 EPSI      0021   000004 EPSID     0022 R 00 0110 EPT
0017 R 000002 EQB       0017   000005 EQBD      0017 R 000003 ERB       0017   000006 ERBD      0021 R 00 0000 ETHETA
0021   000003 ETHETD    0017   000012 EVPP      0000 R 000070 GCBP      0000 R 000072 GCBR      0000 R 00 0053 GCBRP
0030 R 000055 GCBRR     0000 R 000054 GCBRY     0000 R 000071 GCBY      0000 R 000050 GCIRP     0000 R 00 0052 GCIRR
0030 R 000051 GCIRY     0023   000014 GM        0023 R 000022 GPHID     0000 R 000073 GPITCH    0023 R 00 0021 GPSID
0030 R 000027 GRLIMB    0000 R 000030 GRLIMO    0000 R 000075 GROLL     0000 R 000025 GSTOPB    0000 R 00 0026 GSTOPO
0023 R 000020 GTHED     0023   000000 GURP      0023   000010 GUYP      0023   000004 GUZP      0000 R 00 0074 GYAW
0020   000014 HI        0000 I 000042 I         0004   000002 IABT      0022   000112 IBO       0022 I 00 0111 IES
0000 I 000043 IJ        0000   000107 INJPS     0011   000003 IPITCH    0011   000006 IRESID    0011   00 0005 IROLL
0022 I 000113 ISEP      0011   000004 IYAW      0004 I 000010 J         0004   000005 KGUID     0026 I 00 0000 KP
0005   000053 MANUAL    0000 I 000036 NE        0024 I 000000 NOENGB    0024 I 000001 NOENGO    0020   00 0013 P
0027 R 000020 PAD       0027 R 000012 PAI       0000 R 000001 PBERR     0003 R 000000 PBERRA    0000 R 00 0064 PBIAS
0000 R 000022 PCL       0000 R 000065 PCN       0000 R 000021 PHIGL     0025 R 000002 PI        0000 R 00 0056 PIERR
0000 R 000020 PSIGL     0025 R 000000 RAD       0025   000001 RADI      0027 R 000050 RAD       0027 R 00 0062 RAI
0000 R 000063 RBERR     0003 R 000002 RBERRA    0000 R 000024 RCL       0000 R 000067 RCN       0000 R 00 0060 RIERR
0025   000035 SEROT     0005 R 000005 SETCGO    0025   000003 SGRAV     0025   000006 SMU       0025   00 0009 SRMEAN
0030 R 000046 S2        0005 R 000047 SJ        0004 R 000001 T         0004   000004 TGOT      0000 R 00 0017 THEGL
0030 R 000031 THELST    0005 R 000004 TRIM      0020   000007 WEP       0027 R 000024 YAD       0027 R 00 0036 YAI
0030 R 000062 YBERR     0003 R 000001 YBERRA    0000 R 000023 YCL       0000 R 000066 YCN       0000 R 00 0057 YIERR
0030 R 000000 ZZ
```

```
00101      1*          SUBROUTINE AUTOP2
00103      2*          COMMON/AR1/PBERRA,YBERRA,RBERRA
00104      3*          COMMON /MA1/ J,T,IABT,ABTT,TGOT,KGUID
00105      4*          COMMON/MAN/APDET,AYDET,ARDET,MANUAL,TRIM,SETCGO
00106      5*          COMMON/IA1/ADMTOT,AMDOTV,AMTOT,AMASCO,ADMASS(12),AUGRAV
00107      6*          COMMON/IA2/APRATE(5),AYRATE(5),ARRATE(5)
00110      7*          COMMON/IA3/ADESMX,AUESMY,ADESMZ,ABYAW(2),ABTOTY(2),ATOTPG(5)
00111      8*          COMMON/IA4/APDIFT,AYDIFT,ARDIFT,IPITCH,IYAW,IROLL,IRESID
00112      9*          COMMON/IA5/ANGLOB,AMATJB,ARATLM,ACCLIM,ACOMSM,ANOAER,AMINGA
00113     10*          COMMON/IA6/ALPHPI(5),ALPHYA(5),ALPHRO(5),ALPHAC(5),ACTALP(5)
00114     11*          COMMON/;A7/ACTPAC(5),ACALMY(5),ABETAP(5),ABPIT(12),ARATE(5)
00115     12*          COMMON /IA8/ ACTYAC(5),ACALMZ(5),ABETAY(5),AFYMX(5),AFZMX(5)
00116     13*          COMMON /IA9/ ACTRAC(5),ACALMX(5),ABETAR(5),ABROLL(12),ABTOTP(12)
00117     14*          COMMON /IE1/ EPAI,EPB,EQB,ERB,EPBD,EQBD,ERBD,EAVPP(3),EVPP(3)
00120     15*          COMMON /DA1/ DMAXB,DMAYB,DMAZB,DFAB(4),DEP(4),P,HI,ATOTHR
00121     16*          COMMON/EA1/ETHETA,EPSI,EPHI,ETHETD,EPSID,EPHID,ATENG(12)
00122     17*          COMMON /EA2/ EL(12,3),EBP(12),EBY(12),EPE(12),EPT,IES,IBO,ISEP
00122     18*         * ,ELO(2,3),ARCSPM,ARCSYM,ARCSRM
00123     19*          COMMON /IG4/ GURP(4),GUZP(4),GUYP(4),GM(4),GTHED,GPSID,GPHID
00124     20*          COMMON/ADI/NOENGB,NOENGO,AFLOWB,AFLOWO,AMINTB,AMINTO,ALENGO
00125     21*          COMMON /CON/ RAD,RADI,PI,SGRAV,SRMEAN,SEROT,SMU
00126     22*          COMMON/PRINT/KP
00127     23*          COMMON /CLA/ PAD(10),PAI(10),YAD(10),YAI(10),RAD(10),RAI(10)
00130     24*          DIMENSION APITCH(5),AYAW(5),AROLL(5)
00131     25*          DATA THEGL,PSIGL,PHIGL,PCL,YCL,RCL,GSTOPB,GSTOPO,GRLIMB,GRLIMO/
00131     26*         *6*0.,4*.1745329/
00134     27*          DATA THELST,TRIM,DEG08,DEG09,DEG10/2*0.,1.3962634E-1,1.5707963E-1,
00144     28*         *1.745329E-1/,DEG01/1.745329E-2/
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ORIGINAL PAGE IS POOR.


```
      NE=NOENGB
      ATOTHR=0.
      ADMTOT=0.
      AWDOTB=AFLOWB/AUGRAV
      AWDOTO=AFLOWO/AUGRAV
      IF(ISEP.EQ.1) GO TO 11
      AWDOT=AWDOTB
      GO TO 12
   11 NE=NOENGO
      AWDOT=AWDOTO
   12 DO 125 I=1,NE
      ADMASS(I)=AWDOT*EPI*EPE(I)*.2
      ADMTOT=ADMTOT+ADMASS(I)
  125 ATOTHR = ATOTHR+ATENG(I)
      AMDOTV=ADMTOT/.2
      AMTOT=AMTOT-ADMTOT
      IF(AMTOT.GT.AMASCO) GO TO 126
      IES=0
  126 IJ=J
      C2=COS(EPSI)
      C3=COS(EPHI)
      S2=SIN(EPSI)
      S3=SIN(EPHI)
  127 IF(IJ.NE.1) GO TO 128
      GCIRP=GTHED-THEGL
      GCIRY=GPSID-PSIGL
      GCIRR=GPHID-PHIGL
      THEGL=GTHED
      PSIGL=GPSID
      IF(ABS(GCIRR).GT.6.*DEGOI) GO TO 154
      PHIGL=GPHID
      GO TO 155
  154 GCIRR= 6.*DEGOI*GPHID/ABS(GPHID)
      PHIGL=PHIGL+GCIRR
  155 GCBRP=GCIRY*S3+GCIRP*C2*C3
      GCBRY=GCIRY*C3-GCIRP*C2*S3
      GCBRR=GCIRR+GCIRP*S2
  128 PIERR=GTHED-ETHETA
      YIERR=GPSID-EPSI
      RIERR=GPHID-EPHI
      IF(RIERR.GT.PI) RIERR=-2.*PI+RIERR
      IF(RIERR.LT.-PI) RIERR=2.*PI+RIERR
      IF(PIERR.GT.PI)PIERR=-2.*PI+PIERR
      IF(PIERR.LT.-PI)PIERR=2.*PI+PIERR
      IF(YIERR.GT.PI)YIERR=-2.*PI+YIERR
      IF(YIERR.LT.-PI)YIERR=2.*PI+YIERR
      PBERR=YIERR*S3+PIERR*C2*C3
      YBERR=YIERR*C3-PIERR*C2*S3
      RBERR=RIERR+PIERR*S2
      PBERRA=PBERR
      YBERRA=YBERR
      RBERRA=RBERR
      IF(ABS(PBERR).GT. 2.*DEGOI) PBERR= 2.*DEGOI*PBERR/ABS(PBERR)
      IF(ABS(YBERR).GT.2.5*DEGOI) YBERR=2.5*DEGOI*YBERR/ABS(YBERR)
      IF(ABS(RBERR).GT.2.5*DEGOI) RBERR=2.5*DEGOI*RBERR/ABS(RBERR)
      ARCSPM=0.
      ARCSYM=0.
      ARCSRM=0.
```

```
      TRIM=TRIM+.1*(-PBERR+THELST)
      PBIAS=SETCGO+1.2*TRIM
      IF(ISEP.NE.0) PBIAS=SETCGO+.20*TRIM
      THELST=-PBERR
      PCN=Z2(PAO,T)*(-PBERR)+Z2(PAI,T)*(EQB-GCBRP)+PBIAS
      YCN=Z2(YAO,T)*(YBERR)+Z2(YAI,T)*(GCBRY-ERB)
      RCN=Z2(RAO,T)*(RBERR)+Z2(RAI,T)*(GCBRR-EPB)
      IF(ABS(PCN).GT.DEG10) PCN=DEG10*PCN/ABS(PCN)
      IF(ABS(YCN).GT.DEG10) YCN=DEG10*YCN/ABS(YCN)
      IF(ABS(RCN).GT.DEG10) RCN=DEG10*RCN/ABS(RCN)
      IF(ABS(PCN)+ABS(RCN).GT.DEG10) RCN=(DEG10-ABS(PCN))*RCN/ABS(RCN)
  402 CONTINUE
      PCL=PCN
      YCL=YCN
      RCL=RCN
      APRATE(IJ)=EQB*RAD
      AYRATE(IJ)=ERB*RAD
      ARRATE(IJ)=EPB*RAD
      GCBP=GCBRP*RAD
      GCBY=GCBRY*RAD
      GCBR=GCBRR*RAD
      ABETAP(IJ)=PCN*RAD
      ABETAY(IJ)=YCN*RAD
      ABETAR(IJ)=RCN*RAD
      ATOTPG(IJ)=ABS(ABETAP(IJ))+ABS(ABETAR(IJ))
      ABROLL(1)=RCN
      ABROLL(2)=-RCN
      ABROLL(3)=RCN
      ABROLL(4)=RCN
      ABROLL(5)=-RCN
      ABROLL(6)=-RCN
      ABROLL(7)=RCN
      ABROLL(8)=RCN
      ABROLL(9)=-RCN
      ABROLL(10)=-RCN
      ABROLL(11)=RCN
      ABROLL(12)=-RCN
      DO 132 I=1,NE
      EBP(I)=PCN+ABROLL(I)
  132 EBY(I)=YCN
      IF(ISEP.NE.1) GO TO 134
      DO 133 I=3,12
      EBP(I)=0.
  133 EBY(I)=0.
  134 CONTINUE
      GPITCH=GTHED*RAD
      GYAW=GPSID*RAD
      GROLL=GPHID*RAD
      APITCH(IJ)=ETHETA*RAD
      AYAW(IJ)=EPSI*RAD
      AROLL(IJ)=EPHI*RAD
      IF(KP.EQ.0)GO TO 999
  999 CONTINUE
      RETURN
      END

END OF COMPILATION:        NO  DIAGNOSTICS.
```

THE ORIGINAL PAGE IS POOR.

```
@ FOR,* Z2,Z2                                                                    01 JUN 72          22:38:36.472
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E1201001UA)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:36

   FUNCTION Z2          ENTRY POINT 000052

   STORAGE USED: CODE(1) 000065; DATA(0) 000030; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CLA    000074

   EXTERNAL REFERENCES (BLOCK, NAME)

    0004   NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000031 10L      0001   000036 11L      0001   000007 1296     0000 I 000013 I        0000   000015 INJP$
    0003 R 000000 PA0      0003 R 000012 PA1      0003 R 000050 RA0      0003 R 000062 RA1      0000 R 000019 SF
    0000 R 000001 TBP      0003 R 000024 YA0      0003 R 000036 YA1      0000 R 000000 Z2


00101      1*          FUNCTION Z2(C,Y)
00103      2*          COMMON /CLA/ PA0(10),PA1(10),YA0(10),YA1(10),RA0(10),RA1(10)
00104      3*          DIMENSION C(10),TBP(10)
00105      4*          DATA TBP/0.,74.,140.,200.,215.,216.,218.,230.,300.,480./
00107      5*          DATA PA0/1.39,.319,.922,.737,.737,1.08,1.08,1.13,1.02,.871/
00111      6*          DATA PA1/1.30,1.05,.855,.689,.689,1.05,1.05,1.05,.954,.797/
00113      7*          DATA YA0/1.35,1.05,.968,.720,.720,1.28,1.28,1.26,1.15,.933/
00115      8*          DATA YA1/1.26,1.02,.874,.668,.668,1.19,1.19,1.18,1.07,.870/
00117      9*          DATA RA0/1.67,1.49,1.38,1.20,1.20,1.56,1.56,1.51,1.23,.781/
00121     10*          DATA RA1/1.55,1.39,1.29,1.12,1.12,1.46,1.46,1.41,1.15,.729/
00123     11*          DO 10 I=1,10
00126     12*          IF(T.GT.TBP(I)) GO TO 10
00130     13*          SF=(T-TBP(I-1))/(TBP(I)-TBP(I-1))
00131     14*          Z2=C(I-1)+(C(I)-C(I-1))*SF
00132     15*          GO TO 11
00133     16*       10 CONTINUE
00135     17*          Z2=C(10)
00136     18*       11 RETURN
00137     19*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
   Z2              SYMBOLIC                                  04 APR 72  15:11:15   0  01644302    14    19  (DELETED)
   Z2      CODE    RELOCATABLE                               04 APR 72  15:11:15   1  01644714    24     1  (DELETED)
                                                                                    0  01644744    14    13
```

D2-118387-2A

```
FOR,* ABGUID,ARGUID                                                    01 JUN 72          22:38:27.493
IVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
IS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:27

5,15

9,19

3,37

79,179

82,187

   GPSID1= ASIN(GADP(2)/GADP(4))

05,207

   IF(T.LT.TPPCO) GO TO 61

   GO TO 62

10,219

 SUBROUTINE ABGUID    ENTRY POINT 001256

 STORAGE USED: CODE(1) 001263; DATA(0) 000135; BLANK COMMON(2) 000000

  COMMON BLOCKS:

  0003   CON    000007
  0004   AD1    000007
  0005   DR1    000021
  0006   DR2    000006
  0007   EA1    000022
  0010   EA2    000125
  0011   IA1    000021
  0012   IE2    000032
  0013   IG1    000012
  0014   IG3    000015
  0015   IG4    000023
  0016   IT1    000016
  0017   MA1    000006
  0020   MA2    000005
  0021   GT1    000004
  0022   EG1    000004
  0023   TA1    000025
  0024   TA3    000020
  0025   TR1    000011

 EXTERNAL REFERENCES (BLOCK, NAME)

  0026   TARGET
  0027   MAG
  0030   LZCG
```

D2-1183 8.7-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
@ FOR,* ABGUID,ABGUID                                                    01 JUN 72          22:38:27.493
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:27

-15,15

-19,19

-33,37

-179,179

-182,187

      GPSID1= ASIN(GADP(2)/GADP(4))

-205,207

      IF(T.LT.TPPCO) GO TO 61

      GO TO 62

-210,219

   SUBROUTINE ABGUID    ENTRY POINT 001256

   STORAGE USED: CODE(1) 001263; DATA(0) 000135; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CON    000007
    0004   AD1    000007
    0005   DR1    000021
    0006   DR2    000006
    0007   EA1    000022
    0010   EA2    000125
    0011   IA1    000021
    0012   IE2    000032
    0013   IG1    000012
    0014   IG3    000015
    0015   IG4    000023
    0016   IT1    000016
    0017   MA1    000006
    0020   MA2    000005
    0021   GT1    000004
    0022   EG1    000004
    0023   TA1    000025
    0024   TA3    000020
    0025   TR1    000011

   EXTERNAL REFERENCES (BLOCK, NAME)

    0026   TARGET
    0027   MAG
    0030   LZCG
```

D2-1183 8.7-2A

```
0031   EXCG
0032   MATVEC
0033   VECPRD
0034   DOTPRD
0035   EYCG
0036   SQRT
0037   ATAN2
0040   SIN
0041   COS
0042   ATAN
0043   ASIN
0044   ALOG
0045   NERR3S
```

STORAGE ASSIGNMENT (BLOCK, TYPE, RELATIVE LOCATION, NAME)

0001		000261	100L	0001		000753	112L	0001		000761	113L	0001		000946	153G	0001		000211	16L
0001		000255	17L	0001		000233	18L	0001		000471	24L	0001		000417	26L	0001		000432	264G
0001		000425	27L	0001		000514	304G	0001		000575	330G	0001		000334	40L	0001		000522	401L
0001		000527	403L	0001		001001	406G	0001		001244	41L	0001		001016	415G	0001		000121	42L
0001		000124	43L	0001		000342	44L	0001		001104	47L	0001		001161	470L	0001		001175	471L
0001		001202	48L	0001		000105	50L	0001		000400	501L	0001		001011	503L	0001		000669	504L
0001		000767	505L	0001		000107	51L	0001		000436	60L	0001		001211	61L	0001		001215	62L
0001		000242	70L	0001		000250	71L	0020	R	000000	AALIM	0017	R	000003	ABTT	0000	R	000065	ACG
0011		000004	ADMASS	0011		000000	ADMTOT	0004		000002	AFLOWB	0004	R	000003	AFLOWO	0004		000006	ALENGO
0006		000000	ALPHA	0011	R	000003	AMASCO	0011		000001	AMDOTV	0004		000004	AMINTB	0004		000005	AMINTO
0011	R	000002	AMTOT	0010		000122	ARCSPM	0010		000124	ARCSRM	0010		000123	ARCSYM	0007		000006	ATENG
0011	R	000020	AUGRAV	0014	R	000002	AZCF	0006		000001	BETA	0022	R	000000	EATB	0021	R	000000	EATBN
0000	R	000007	EATP	0012	R	000017	EATT	0012	R	000021	EB	0010		000044	EBP	0012		000016	EBPO
0000	R	000027	EBXP	0010		000060	EBY	0014		000013	EGEFF	0010		000000	EL	0010		000114	ELO
0010		000074	EPE	0007		000002	EPHI	0007		000005	EPHID	0007		000001	EPSI	0007		000004	EPSID
0010	R	000110	EPT	0014	R	000007	ERP	0007		000000	ETHETA	0007		000003	ETHETD	0012		000002	ETSLB
0012		000000	ETSL01	0012		000001	ETSL02	0014		000003	EVP	0031	R	000000	EXCG	0035	R	000000	EYCG
0030	R	000000	FZCG	0024	R	000014	GADP	0000	R	000037	GADT	0013	R	000004	GCO	0013	R	000007	GDT
0014		000014	GETV	0014	R	000001	GEGVEL	0015		000014	GM	0015	R	000022	GPHID	0015	R	000021	GPSID
0000	R	000072	GPSI01	0020	R	000003	GTDM	0015	R	000020	GTHED	0000	R	000077	GTHEDD	0000	R	000046	GTHEDN
0000	R	000071	GTHE01	0015		000000	GURP	0015		000010	GUYP	0015		000004	GUZP	0006	R	000002	H
0000	I	000051	I	0017		000002	IABT	0010		000112	IBO	0010		000111	IES	0014		000000	IGMT
0000	I	000076	III	0010		000122	INJPS	0010		000113	ISEP	0017		000000	JUMP	0000	I	000064	K
0000	I	000045	KAP	0017		000005	KGUID	0016	I	000015	KLPUR	0000	I	000044	KUP	0006		000003	MACHI
0004		000000	NOENGB	0004	I	000001	NOENGO	0003	R	000002	PI	0006		000005	QDOT	0006		000004	QUE
0000	R	000057	Q1	0000	R	000060	Q2	0000	R	000061	Q3	0003		000000	RAD	0003	R	000001	RADI
0003		000005	SEROT	0003	R	000003	SGRAV	0003	R	000004	SMU	0013		000010	SRD	0003		000004	SRMEAN
0013		000000	SUQ	0013		000011	SYD	0017	R	000001	T	0000	R	000067	TADPUI	0000	R	000070	TADPU3
0024	R	000010	TAG	0000	R	000075	TBO	0000	R	000063	TDTM	0024	R	000004	TDVG	0000	R	000052	TDVL
0000	R	000050	TERFIK	0016		000000	TF	0030	R	000047	TGEFF	0023	R	000024	TGFIN	0000	R	000043	TGOMIN
0017	R	000004	TGOT	0016	R	000006	THBO	0020	R	000004	THELIM	0000	R	000100	THEMAX	0030	R	000003	TK
0000	R	000062	TKK	0016		000001	TLAT	0016		000002	TLONG	0020	R	000002	TPPCO	0000	R	000055	TQI
0000	R	000056	TQ3	0023	R	000020	TRDG	0000	R	000000	TRG	0025		000005	TRLSE	0025		000000	TRLSP
0016		000007	TT	0000	R	000054	TTA	0000	R	000053	TTD	0020	R	000001	TTDI	0000	R	000046	TTHETA
0012	R	000020	TTL	0000	R	000033	TTQ2	0023	R	000000	TUXGP	0023	R	000004	TUYGP	0023	R	000010	TUZGP
0000	R	000013	TUI	0000	R	000017	TU2	0000	R	000023	TU3	0025		000004	TVBO	0023	R	000014	TVDG
0024	R	000000	TVG	0016		000003	TWEP	0000	R	000073	TXXI	0000	R	000074	TXX2	0005		000010	UXTP
0005		000013	UYTP	0005		000016	UZTP	0005		000004	VA	0005		000000	VAB				

```
00101     1*          SUBROUTINE ABGUID
00103     2*          COMMON/CON/RAD,RADI,PI,SGRAV,SMMEAN,SEROT,SMU
00104     3*          COMMON/AD1/NOENGB,NOENGO,AFLOWB,AFLOWO,AMINTB,AMINTO,ALENGO
00105     4*          COMMON /DR1/ VAB(4),VA(4),UXTP(3),UYTP(3),UZTP(3)
00106     5*          COMMON /DR2/ ALPHA,BETA,M,MACH1,QUE,QDOT
00107     6*          COMMON/EA1/ETHETA,EPSI,EPHI,ETHEID,EPSID,EPHID,ATENG(12)
00110     7*          COMMON /EA2/ EL(12,3),EBP(12),EBV(12),EPE(12),EPT,IES,IBO,ISEP
00110     8*         *,ELO(2,3),ARCSPH,ARCSYM,ARCSRM
00111     9*          COMMON/IA1/ADMTOT,AMDOTV,AMTOT,AMASCO,ADMASS(12),AUGRAV
00112    10*          COMMON /IE2/ ETSLO1,ETSLO2,ETSLB(12),EBPO,EATT,TTL,EB(3,3)
00113    11*          COMMON /IG1/ SUQ(4),GCO(3),GDT,SMD,SYD
00114    12*          COMMON/IG3/IGMT,GEGVEL,AZCF,EVP(4),ERP(4),EGEFF,GDTV
00115    13*          COMMON/IG4/GURP(4),GUZP(4),GUYP(4),GM(4),GTHED,GPSID,GPHID
00116    14*          COMMON /IT1/ TF,TLAT,TLONG,TEP(3),THBO,TT(6),KLPDR
00117    15*          COMMON/MA1/ JUMP,T,IABT,ABTT,TGOT,KGUID                    ***1
00120    16*          COMMON /MA2/ AALIM,TTD1,TPPCO,GTDM,THELIM
00121    17*          COMMON /GT1/ EATBN(4)
00122    18*          COMMON /EG1/ EATB(4)                                       ***1
00123    19*          COMMON/TA1/TUXGP(4),TUYGP(4),TUZGP(4),TVDG(4),TRDG(4),TGFIN
00124    20*          COMMON/TA3/TVG(4),TDVG(4),TAG(4),GADP(4)
00125    21*          COMMON /TR1/ TRLSP(4),TVBO,TRLSE(4)
00126    22*          DIMENSION TRG(3),TK(4)
00127    23*          DIMENSION EATP(4),TU1(4),TU2(4),TU3(4)
00130    24*          DIMENSION EBXP(4),TTG2(4),GAD1(4)
00131    25*          DATA TK,TGOMIN/.0001,.03,0.,.01[4,10./
00134    26*          DATA KUP/1/,KAP/1/
00137    27*          GTHEO=GTHED
00140    28*          TK(1)= .0001
00141    29*          IF(ABTT.LT.10.) TK(1)= .0002
00143    30*          GCO(3)= AALIM*SGRAV
00144    31*          CALL TARGET                                                ***5
00145    32*          TRG(1)= ERP(4)
00146    33*          TRG(2)= 0.
00147    34*          TRG(3)= 0.
00150    35*          TGEFF=-SMU/(TRG(1)**2)+(TVG(2)**2+TVG(3)**2)/TRG(1)
00151    36*          TERFIK= .5*(TGFIN+TGEFF)*TGOT
00152    37*          DO 30I=1,3
00155    38*          TDVG(I)= TVDG(I)-TVG(I)
00156    39*       30 CONTINUE
00160    40*          TDVG(1)= TDVG(1)-TERFIK
00161    41*          CALL MAG(TDVG)
00162    42*          IF(TGOT.LT.TGOMIN) GO TO 40
00164    43*          IF(EPT.LE..998) GO TO 42
00166    44*          IF(EATT.LE.0.) GO TO 50
00170    45*          TTL= GEGVEL/EATT-GEGVEL/GCO(3)
00171    46*          GO TO 51
00172    47*       50 TTL= 100.
00173    48*       51 CONTINUE
00174    49*          TDVL= .5*(EATT+GCO(3))*TTL
00175    50*          TGOT= TTL+(TDVG(4)-TDVL)/GCO(3)
00176    51*          GO TO 43
00177    52*       42 TGOT= TDVG(4)/EATT
00200    53*       43 CONTINUE
00201    54*          TTD=TTD1
00202    55*          TTA=T-ABTT
00203    56*          IF(TTA.LT.TTD) GO TO 46
00205    57*          TAG(1)= 6.*(TRDG(1)-TRG(1))/(TGOT**2)-2.*(TVDG(1)+2.*TVG(1))/TGOT
```

02-1183 8 7-24

```
      1-TGEFF
      TAG(2)= (TVDG(2)-TVG(2))/TGOT
      IF(ABS(TAG(2)).GT.ABS(TAG(1)))GO TO 100
      TQ1= (EATT**2-TAG(1)**2-TAG(2)**2)
      IF(TQ1.LE.0.) GO TO 16
      TAG(3)= SQRT(TQ1)*TDVG(3)/ABS(TDVG(3))
      GO TO 17
   16 TAG(3)= 0.
      TQ3= EATT**2-TAG(1)**2
      IF(TQ3.LE.0.) GO TO 18
      TAG(2)= SQRT(TQ3)*TDVG(2)/ABS(TDVG(2))
      GO TO 17
   18 TAG(2)= 0.
      IF(H.GE.THBO)GO TO 70
      GO TO 71
 70   TAG(1)=EATT*TAG(1)/ABS(TAG(1))
      GO TO 17
 71   TAG(1)=EATT*TDVG(1)/ABS(TDVG(1))
   17 CALL MAG(TAG)
      GO TO 60
 100  Q1=SQRT(EATT**2-TAG(2)**2)
      Q2=(TVDG(3)-TVG(3))/TGOT
      Q3=ABS(TAG(1))/ABS(Q2)
      TAG(3)=(Q2/ABS(Q2))*Q1/SQRT(1.+Q3**2)
      TAG(1)=(TAG(1)/ABS(TAG(1)))*SQRT(Q1**2-TAG(3)**2)
      GO TO 60
   40 TGOT= TGOT-GDT
      GO TO 60
   46 CONTINUE
      TKK= TK(4)
      IF(ABS(H-THBO).LT.50000..AND.ABS(TVG(1)).LT.1000.) TKK= TK(2)
      TAG(1)= TK(1)*(TRDG(1)-TRG(1))+TKK*(TVDG(1)-TVG(1))-TGEFF
      TAG(2)= TK(3)
      TQ1= EATT**2-TAG(1)**2
      IF(TQ1.LE.0.) GO TO 26
      TAG(3)= SQRT(TQ1)
      GO TO 27
   26 TAG(3)= 0.
      TAG(1)= EATT*(TAG(1)/(ABS(TAG(1))))
   27 CALL MAG (TAG)
      DO 23 I=1,3
   23 GADP(I)= TAG(I)
      GO TO 24
   60 CONTINUE
      GADP(1)= TAG(1)*TUXGP(1)+TAG(2)*TUYGP(1)+TAG(3)*TUZGP(1)
      GADP(2)= TAG(1)*TUXGP(2)+TAG(2)*TUYGP(2)+TAG(3)*TUZGP(2)
      GADP(3)= TAG(1)*TUXGP(3)+TAG(2)*TUYGP(3)+TAG(3)*TUZGP(3)
   24 CALL MAG(GADP)
      TDTM=GTDM*RADI*GDT
      IF(TTA.LT.TTD)GOTO503
      IF(EATB(4).LT.10.)GO TO 401
      DO402K=1,4
 402  EATBN(K)=EATB(K)
      EBXP(1)=EATB(4)
      GO TO 403
 401  CONTINUE
      CALL MAG(EATBN)
      EBXP(1)=EATBN(4)
```

D2-118387-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
00315   1160      493  CONTINUE
00316   1170           ACG=ATAN2(EZCG(AMTOT),EXCG(AMTOT))
00317   1180           EBXP(3)=EBXP(1)*SIN(ACG)
00320   1190           EBXP(1)=EBXP(1)*COS(ACG)
00321   1200           EBXP(2)=0.
00322   1210           CALL MATVEC(1,EB,EBXP,EATP)
00323   1220           CALL MAG(EATP)
00324   1230           IF(KAP.EQ.0)GO TO 501
00326   1240           KAP=0
00327   1250           DO502I=1,3
00332   1260      502  TTQ2(I)=EATP(I)
00334   1270      501  IF(KLPDN.EQ.0. ON.KUP.EQ.0)GOTO504
00336   1280           CALL MAG(TTQ2)
00337   1290           TU1(1)=TTQ2(1)/TTQ2(4)
00340   1300           TU1(2)=TTQ2(2)/TTQ2(4)
00341   1310           TU1(3)=TTQ2(3)/TTQ2(4)
00342   1320           GAD1(1)=0.
00343   1330           GAD1(2)=-TU1(3)
00344   1340           GAD1(3)= TU1(2)
00345   1350           CALL MAG(GAD1)
00346   1360           TU2(1)=GAD1(1)/GAD1(4)
00347   1370           TU2(2)=GAD1(2)/GAD1(4)
00350   1380           TU2(3)=GAD1(3)/GAD1(4)
00351   1390           CALL VECPRD(TU1,TU2,TU3)
00352   1400           TTHETA=ATAN2(TU3(1),TU1(1))
00353   1410           IF (ABS(TTHETA).GT.TDTM)GO TO 505
00355   1420           KUP=0
00356   1430      504  CONTINUE
00357   1440           CALL MAG(TTQ2)
00360   1450           TU1(1)=TTQ2(1)/TTQ2(4)
00361   1460           TU1(2)=TTQ2(2)/TTQ2(4)
00362   1470           TU1(3)=TTQ2(3)/TTQ2(4)
00363   1480           CALL VECPRD(GADP,TU1,GAD1)
00364   1490           CALL MAG(GAD1)
00365   1500           TU2(1)=GAD1(1)/GAD1(4)
00366   1510           TU2(2)=GAD1(2)/GAD1(4)
00367   1520           TU2(3)=GAD1(3)/GAD1(4)
00370   1530           CALL VECPRD(TU1,TU2,TU3)
00371   1540           CALL DOTPRD(GADP,TU1,TADPU1)
00372   1550           CALL DOTPRD(GADP,TU3,TADPU3)
00373   1560           IF(ABS(TADPU1).LE.1.E-5) GO TO 112
00375   1570           TTHETA=ATAN2(TADPU3,TADPU1)
00376   1580           GO TO 113
00377   1590      112  TTHETA=.5*PI*TADPU3/ABS(TADPU3)
00400   1600      113  CONTINUE
00401   1610           IF (ABS(TTHETA).GT.TDTM)GO TO 505
00403   1620           GO TO 503
00404   1630      505  CONTINUE
00405   1640           DO506I=1,3
00410   1650           GADP(I)=EATB(4)*(TU1(I)*COS(TDTM)+TU3(I)*SIN(TDTM))
00411   1660      506  CONTINUE
00413   1670      503  CALL MAG(GADP)
00414   1680           DO 510I=1,4
00417   1690           TTQ2(I)=GADP(I)
00420   1700      510  CONTINUE
00422   1710       20  CONTINUE
00423   1720           GTHED1=ATAN2(GADP(3),GADP(1))                    **-1
00424   1730           GTHED=-GTHED1-(ATAN((AZCF-EZCG(AMTOT))/EXCG(AMTOT)))*COS(GPHID)
```

```
00425          GPSID1= ASIN(GADP(2)/GADP(4))                                    *NEW
00426          GPSID = GPSID1+ATAN(EYCG(AMTOT)/EXCG(AMTOT))                     **-6
00427          IF(KLPDR.EQ.1) GO TO 47
00431          GO TO 48
00432     47   CONTINUE
00433          IF(ABTT.GT.10.) GO TO 470
00435          TXX1=-GEGVEL/GCO(3)
00436          TXX2= (AFLOWO*NOENGO*TTL)/AUGRAV
00437          TBO= TXX1*ALOG(AMASCO/AMTOT)
00440          IF(EPT.LT..99) TBO= TTL+TXX1*ALOG(AMASCO/(AMTOT-TXX2))
00442          IF(TBO.GT.30.) GO TO 48
00444          GO TO 471
00445    470   IF(TVG(1).GT.0..AND.III.NE.1) GO TO 48
00447    471   CONTINUE
00450          GPHID= PI
00451          III= 1
00452          GO TO 41
00453     48   GPHID= 0.
00454          IF(T.LT.TPPCO) GO TO 61                                          *NEW
00456          GO TO 62                                                         *NEW
00457     61   GTHED= RADI*2.95                                                 **-3
00460          GPSID= 0.
00461     62   CONTINUE                                                         *-10
00462          GTHEDD= GTHEDN-GTHED
00463          THEMAX= THELIM*RADI*GDT
00464          IF(GTHEDD.GT.THEMAX) GTHED= GTHEDN-THEMAX
00466          IF(GTHEDD.LT.-THEMAX) GTHED= GTHEDN+THEMAX
00470     41   RETURN
00471          END

   END OF COMPILATION:        NO  DIAGNOSTICS.
   ABGUID          SYMBOLIC                          04 APR 72  15:10:21   0  01533674    14   256  (DELETED)
   ABGUID  CODE    RELOCATABLE                       04 APR 72  15:10:21   1  01542030   120     1  (DELETED)
                                                                           0  01542220    14    89
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D2-118387-2A

```
@ FOR,* TARGET,TARGET                                                    01 JUN 72          22:38:32.493
UNIVAC 1108 FORTRAN V EXEC 11 LEVEL 25A  -(EXEC8 LEVEL E)20100010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:32

-15,16


   SUBROUTINE TARGET    ENTRY POINT 000316


   STORAGE USED: CODE(1) 000320; DATA(0) 000351; BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CON    000007
    0004   IE2    000032
    0005   IG3    000015
    0006   IG4    000023
    0007   IT1    000016
    0010   IT2    000013
    0011   MA1    000006
    0012   TA1    000025
    0013   TA3    000020
    0014   TR1    000011
    0015   TR2    000003
    0016   SR1    000015

   EXTERNAL REFERENCES (BLOCK, NAME)

    0017   MATVEC
    0020   VECPRD
    0021   MAG
    0022   UNTVEC
    0023   DOTPRD
    0024   COS
    0025   SIN
    0026   ACOS
    0027   MEMRSS

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000270 2OL      0001   000291 3OL      0001   000221 4OL      0001   000231 5OL      0011   000003 ABTT
    0005   000002 AZCF     0004   000017 EATT     0016   000003 EAVP     0004   000021 EB       0004   000016 EBPO
    0016   000000 EG       0005   000013 EGEFF    0016 R 000007 ELATC    0016 R 000010 ELONGD    0005 R 000007 ERP
    0004   000002 ETSLB    0004   000030 ETSL01   0004   000001 ETSL02   0005 R 000003 EVP      0013   000019 GADP
    0005   000014 GDTV     0005   000021 GEGVEL   0006   000014 GM       0006   000022 GPHID    0006   000021 GPSID
    0006   000020 GTHED    0006   000000 GURP     0006   000010 GUYP     0006   000004 GUZP     0000 I 000020 I
    0011   000002 IABT     0005   000000 IGNT     0000   000026 INJPS    0011   000000 JUMP     0011   000005 KGUID
    0007 I 000015 KLPDR    0003   000002 PI       0003   000000 RAD      0003 R 000001 RADI     0003 R 000003 SGRAV
    0016   000013 SLATI    0016   000014 SLONGI   0003   000006 SMU      0011 R 000001 T        0010   000011 TAE
    0013   000010 TAG      0000 R 000014 TART     0000 R 000021 TDVBO    0013   000004 TDVG     0007   000000 TF
    0012 R 000024 TGFIN    0011 R 000004 TGOT     0007 R 000006 THBO     0015 R 000000 THETB    0015 R 000001 THETC
    0015 R 000002 THETR    0000 R 000017 TIME     0010 R 000000 TIP      0007 R 000001 TLAT     0016   000011 TLATI
    0007 R 000002 TLONG    0016   000012 TLONGI   0012 R 000020 TKDG     0003 R 000004 TRE      0014 R 000005 TRLSE
    0000 R 000000 TRLSI    0014 R 000000 TRLSP    0007 R 000007 TT       0004   000020 TTL      0012 R 000000 TUXGP
    0012 R 000004 TUYGP    0012 R 000010 TUZGP    0014 R 000004 TVBO     0010 R 000012 TVBON    0012 R 000014 TVDG
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D2-11838 7-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
0013 R 000000 TVB      0010 R 000010 TVLSB    0000 R 000004 TVLSP    0003 R 000005 TWE      0007 R 000003 TWEP

00101     1•          SUBROUTINE TARGET
00103     2•          COMMON/CON/RAD,RADI,PI,SGRAV,TRE,TWE,SMU
00104     3•          COMMON /IE2/ ETSLO1,ETSLO2,ETSLB(12),EBPO,EATT,TTL,EB(3,3)
00105     4•          COMMON/IG3/IGMT,GLGVEL,AZCF,EVP(4),ERP(4),LGEFF,GDTV
00106     5•          COMMON/IG4/GURP(4),GUZP(4),GUYP(4),GM(4),GTHED,GPSID,GPHID
00107     6•          COMMON /IT1/ TF,TLAT,TLONG,TWEP(3),THBO,TT(6),ALPDR
00110     7•          COMMON /IT2/ TIP(3,3),TAE,TVBON
00111     8•          COMMON/MA1/ JUMP,T,TABT,ANTT,TGOT,KGUID
00112     9•          COMMON/TA1/TUXGP(4),TUYGP(4),TUZGP(4),TVDG(4),TRDG(4),TGFIN
00113    10•          COMMON/TA3/TVG(4),TUVG(4),TAG(4),GADP(4)
00114    11•          COMMON /TR1/ TRLSP(4),TVBO,TPLSL(4)
00115    12•          COMMON /TR2/ THETB,THETC,THETR
00116    13•          COMMON /SL1/ EG(3),EAVP(4),ELATC,ELONGD,TLATI,TLONGI,SLATI,SLONGI
00117    14•          DIMENSION TRLSI(4),TVLSP(4),TVLSG(4),TART(3)
00120    15•          TIME= T                                                    **-2
00121    16•          TRLSI(1)=TRLSE(1)*COS(TIME*TWE)-TRLSE(2)*SIN(TIME*TWE)
00122    17•          TRLSI(2)=TRLSE(1)*SIN(TIME*TWE)+TRLSE(2)*COS(TIME*TWE)
00123    18•          TRLSI(3)=TRLSE(3)
00124    19•          CALL MATVEC(1,TIP,TRLSI,TRLSP)
00125    20•          TRLSP(4)= TRLSE(4)
00126    21•          CALL VECPRD(TWEP,TRLSP,TVLSP)
00127    22•          CALL MAG(TVLSP)
00130    23•          CALL UNTVEC(ERP,TUXGP)
00131    24•          CALL VECPRD(TRLSP,ERP,TART)
00132    25•          CALL UNTVEC(TART,TUYGP)
00133    26•          CALL VECPRD(TUXGP,TUYGP,TUZGP)
00134    27•          CALL DOTPRD(TVLSP,TUXGP,TVLSG(1))
00135    28•          CALL DOTPRD(TVLSP,TUYGP,TVLSG(2))
00136    29•          CALL DOTPRD(TVLSP,TUZGP,TVLSG(3))
00137    30•          CALL MAG(TVLSG)
00140    31•          TVDG(1)=0.
00141    32•          TVDG(2)=TVLSG(2)
00142    33•          TRDG(1)=TRLSP(4)+THBO
00143    34•          TRDG(2)=0.
00144    35•          TRDG(3)=0.
00145    36•          CALL MAG(TRDG)
00146    37•          THETR=ACOS(COS((ELATC*RAD)-TLAT)*COS(TLONG-(ELONGD*RAD)))
00147    38•          THETC=THETR
00150    39•          CALL DOTPRD(EVP,TUXGP,TVG(1))
00151    40•          CALL DOTPRD(EVP,TUYGP,TVG(2))
00152    41•          CALL DOTPRD(EVP,TUZGP,TVG(3))
00153    42•          CALL MAG(TVG)
00154    43•          I= 0
00155    44•       30 CONTINUE
00156    45•          I= I+1
00157    46•          IF(KLPDR.EQ.1) GO TO 40
00161    47•          TVBO= TT(1)+TT(2)*THETC+TT(3)*(THETC**2)
00162    48•          GO TO 50
00163    49•       40 TVBO= TT(4)+TT(5)*THETC+TT(6)*(THETC**2)
00164    50•       50 TVBO= TVBO*25989.5
00165    51•          TDVBO= .5*(TVBO-TVBON)
00166    52•          TVBO= TVBO-TDVBO
00167    53•          TVDG(3)= TVBO+TVLSG(3)
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00170          TVBON= TVBO
00171          IF(ABS(TDVBO).LT.10.) GO TO 20
00173          THETB= TGOT*(TVDG(3)+TVG(3))*(.5/TRE)
00174          THETC=THETR-THETB
00175          IF(I.GT.20) GO TO 20
00177          GO TO 30
00200       20 CONTINUE
00201          CALL MAG(TVDG)
00202          TGFIN=-SGRAV*(TRE/TRDG(1))**2+(TVDG(2)**2+TVDG(3)**2)/TRDG(1)
00203          RETURN
00204          END

   END OF COMPILATION:        NO  DIAGNOSTICS.
TARGET          SYMBOLIC                          04 APR 72  15:10:25   0  01550572   19   66  (DELETED)
TARGET  CODE    RELOCATABLE                       04 APR 72  15:10:25   1  01552426   89    1  (DELETED)
                                                                        0  01552552   19   24
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```
@ FOR,* PBC,PBC
UNIVAC 1108 FORTRAN V EXEC II LEVEL 28A  -(EXEC8 LEVEL E12010010A:                01 JUN 72          22138130.813
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:38:30

-12,13

-22,22

      DATA PHLIM/229000./,III/17

   SUBROUTINE PBC        ENTRY POINT 000476

   STORAGE USED: CODE(1) 000546 DATA(0) 000177 BLANK COMMON(2) 000000

    COMMON BLOCKS:

    0003   CON    000037
    0004   DA1    000016
    0005   DP1    000011
    0006   DR1    000021
    0007   DR2    000006
    0010   IA1    000021
    0011   IG3    000015
    0012   IG4    000023
    0013   IT1    000016
    0014   MA1    000006

   EXTERNAL REFERENCES (BLOCK, NAME)

    0015   DOTPRD
    0016   UNTVEC
    0017   VECPRD
    0020   MATMAT
    0021   SQRT
    0022   ATAN2
    0023   COS
    0024   TAN
    0025   ASIN
    0026   SIN
    0027   HLNR35

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001    000456 I3L      0001    000461 I5L      0001    000047 Z0L      0001    000046 Z1L      0001    000005 S0L
    0001    000014 S1L      0004    000003 AMTT     0010    000000 ADMASS   0010    000000 ADMTOT   0007 R  000000 ALPHA
    0000 R  000077 ALPHA1   0000 R  000101 ALPHA2   0000 R  000103 ALPHA3   0010    000003 AMASCO   0010    000001 AMDOTV
    0010 R  000002 AMT      0004    000015 ATOTHR   0010    000020 AUGKAV   0011    000002 AZCF     0007 R  000001 BETA
    0004 R  000003 DFAB     0004    000000 DMAXB    0004    000001 DMAYB    0004    000002 DMAZB    0011    000013 EGEFF
    0011    000007 ERP      0011    000003 EVP      0011    000014 GDTV     0011    000001 GEGVEL   0012    000014 GM
    0012 R  000022 GPM10    0012 R  000021 GPS10    0012 R  000020 GTMED   0012    000000 GURP     0012    000010 GUTP
    0012    000004 GUZP     0007 R  000002 H        0004    000014 HI       0014    000002 IABT     0011    000000 IGMT
    0000 I  000129 III      0010    000155 INJPS    0014    000000 J        0000 I  000127 K        0014 I  000005 K6U1D
    0013 I  000015 KLPDN    0007    000003 MACH1    0004    000013 P        0000 R  000145 PALD1    0000 R  000143 PALPC
    0000 R  000144 PALPD    0000 R  000114 PALPD1   0000 R  000115 PALPD2   0000 R  000116 PALPD3   0000 R  000117 PALPD4
```

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0000 R 000120 PALPDS    0000 R 000110 PALPHI    0000 R 000113 PBAD      0000 R 000146 PBAUI     0000 R 000136 PBETAI
0000 R 000121 PBIAS     0000 R 000111 PDT       0000 R 000141 PGADV     0000 R 000142 PGAMRD    0000 R 000133 PGAMRN
0000 R 000139 PGAMRI    0000 R 000105 PGMAX     0000 R 000071 PGMAX2    0000 R 000131 PHDOT     0000 R 000123 PHLIM
0000 R 000073 PHPB      0000 R 000125 PHT       0000 R 000107 PHI       0003   000002 PI        0000 R 000044 PP
0000 R 000136 PQI       0001 R 000066 PQ2       0000 R 000122 PTHEC     0000 R 000126 PTT       0000 R 000011 PU
0000 R 000033 PUAL      0001 R 000022 PUBA      0000 R 000055 PUC       0000 R 000000 PUI       0000 R 000003 PU2
0000 R 000006 PU3       0000 R 000112 PVBACI    0000 R 000147 PVBADI    0000 R 000140 PVBAI     0000 R 000132 PVG
0000 R 000075 PVPB      0000 R 000130 PVI       0007   000005 QDOT      0007   000004 QUE       0000 R 000137 R3
0003 R 000000 RAD       0003 R 000001 RADI      0003   000005 SEKJT     0003 R 000003 SGRAV     0003   000006 SMU
0003   000004 SRMEAN    0014 R 000001 T         0013   000000 TF        0014   000004 TGOT      0013   000006 THBO
0013   000001 TLAT      0013   000002 TLONG     0013   000007 TT        0013   000003 TWEP      0005   000000 UXBP
0006 R 000010 UXTP      0005 R 000003 UYBP      0006   000013 UYTP      0005   000006 UZBP      0006   000016 UZTP
0006 R 000004 VA        0006   000000 VAB       0004   000007 WEP
```

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00101     10          SUBROUTINE PBC
00103     20          COMMON /CON/RAD,RADI,PI,SGRAV,SRMEAN,SEROT,SMU
00104     30          COMMON /DAI/ DMAXB,DMAYB,DMAZB,DFAB(4),WEP(4),P,MI,ATOTMM
00105     40          COMMON /DPI/ UXBP(3),UYBP(3),UZBP(3)
00106     50          COMMON /URI/ VAB(4),VA(4),UXTP(3),UYTP(3),UZTP(3)
00107     60          COMMON /DR2/ ALPHA,BETA,M,MACHI,QUE,QDOT
00110     70          COMMON/IAI/ADMTOT,AMDOTV,AMT   ,AMASCO,ADMASS(12),AUGRAV
00111     80          COMMON /IG3/ IGMT,GEGVEL,AZCF,EVP(4),ERP(4),EGEFF,GDTV
00112     90          COMMON /IG4/ GURP(4),GUZP(4),GUYP(4),GM(4),GTHED,GPSID,GPHID
00113     100         COMMON /ITI/TF,TLAT,TLONG,TWEP(3),THBO,TT(6),KLPDR
00114     110         COMMON/MAI/ J   ,T,IABT,AUTT,TGOT,KGUID
00115     120         DIMENSION PUI(3),PU2(3),PU3(3),PU(3,3),PUBA(3,3),PUAL(3,3),PQ(3,3)        **-2
00115     130        1,PUC(3,3),PQ2(3),PGMAX2(2)
00116     140         DIMENSION PHPB(2),PVPB(2),ALPHA1(2),ALPHA2(2),ALPHA3(2),PGMAX(2)
00117     150         DATA PHPB,PVPB,ALPHA1,ALPHA2,ALPHA3,PGMAX,PHI/150000.,100000.,.7800
00117     160        1.,1860.,50.,50.,27.5,35.,23.,23.,3.,2.,195000./
00127     170         DATA PALPHI,PDT,      PVBACI,PBAU/22.,1.,   0.,10./
00139     180         DATA PALPDI,PALPD2,PALPD3,PALPD4,PALPD5/5.,1.,5.,.5,.5/
00142     190         DATA PBIAS,PGMAX2,PTHEC/0.,1.8,1.8,25./
00146     200         DATA PHLIM/220000./,III/1/                                              *NE.
00151     210         IF(III.EQ.1)GO TO 50                                                    **-1
00153     220         GO TO 51
00154     230       50 PHT=M
00155     240         PTT= T
00156     250         III= III+1
00157     260       51 CONTINUE
00160     270         K= 1
00161     280         IF(KLPDR.EQ.1) K= 2
00163     290         PVI=     (PVPB(K)**2-2.*SGRAV*(M -PHPB(K)))
00164     300         IF(PVI.LE.0.) GO TO 21
00166     310         PVI= SQRT(PVI)
00167     320         GO TO 20
00170     330        21 PVI= 0.
00171     340        20 IF(VA(4).LE.PVI) GO TO 10
00173     350         CALL DOTPRD(VA,UXTP,PHDOT)
00174     360         PVG=SQRT(VA(4)**2-PHDOT**2)
00175     370         PGAMRN=PGAMRI
00176     380         PGAMRI= ATAN2(PHDOT,PVG)
00177     390         PBETAI= BETA*RADI
00200     400         CALL DOTPRD(UYBP,UXTP,PQI)
00201     410         Q3=      (-PQI/(COS(PGAMRI)*COS(PBETAI)))+TAN(PGAMRI)*TAN(PBETAI))
```

```
0202    42.         IF(Q3.GE.1.) Q3= 1.
0204    43.         IF(Q3.LE.-1.) Q3=-1.
0206    44.         PVBA1= ASIN(Q3)
0207    45.         PGADV= DFAB(4)/(AMT*SGRAV)
0210    46.         PGAMRD= (PGAMR1-PGAMRN)/PDT
0211    47.         PALPC= PTHEC-(PGAMR1-PBIAS*PGAMRD)*RAD
0212    48.         IF(PGADV.GT.PGMAX2(K)) PALPC= ALPHA-PALPDS*PDT
0214    49.         IF(PALPC.GE.50.) PALPC= 50.
0216    50.         IF(PALPC.LE.22.) PALPC= 22.
0220    51.         IF(H.GT.PHLIM) PALPC= 50.
0222    52.         PALPD=PALPD3
0223    53.         IF((T-PTT).GT.15.) PALPD= PALPD4
0225    54.         PQ1= PALPC-ALPHA
0226    55.         PALD1= (ALPHA+PALPD*PQ1/ABS(PQ1))*RAD1
0227    56.         IF(ABS(PQ1).LE.PALPD) PALD1=PALPC*RAD1
0231    57.         PQ1= PVBAC1-PVBA1
0232    58.         PBAD1= PBAD*RAD1
0233    59.         PVBAD1= PVBA1+PBAD1*PQ1/ABS(PQ1)
0234    60.         IF(ABS(PQ1).LE.PBAD1) PVBAD1=0.
0236    61.         CALL UNITVEC(VA,PU1)
0237    62.         CALL VECPRD(PU1,UXTP,PW2)
0240    63.         CALL UNITVEC(PW2,PU2)
0241    64.         CALL VECPRD(PU1,PU2,PU3)
0242    65.         PU(1,1)=PU1(1)
0243    66.         PU(1,2)=PU1(2)
0244    67.         PU(1,3)=PU1(3)
0245    68.         PU(2,1)=PU2(1)
0246    69.         PU(2,2)=PU2(2)
0247    70.         PU(2,3)=PU2(3)
0250    71.         PU(3,1)=PU3(1)
0251    72.         PU(3,2)=PU3(2)
0252    73.         PU(3,3)=PU3(3)
0253    74.         PUBA(1,1)= 1.
0254    75.         PUBA(1,2)= 0.
0255    76.         PUBA(1,3)= 0.
0256    77.         PUBA(2,1)= 0.
0257    78.         PUBA(2,2)= COS(PVBAD1)
0260    79.         PUBA(2,3)= SIN(PVBAD1)
0261    80.         PUBA(3,1)= 0.
0262    81.         PUBA(3,2)=-PUBA(2,3)
0263    82.         PUBA(3,3)= PUBA(2,2)
0264    83.         PUAL(1,1)= COS(PALD1)
0265    84.         PUAL(1,2)= 0.
0266    85.         PUAL(1,3)=-SIN(PALD1)
0267    86.         PUAL(2,1)= 0.
0270    87.         PUAL(2,2)= 1.
0271    88.         PUAL(2,3)= 0.
0272    89.         PUAL(3,1)=-PUAL(1,3)
0273    90.         PUAL(3,2)= 0.
0274    91.         PUAL(3,3)= PUAL(1,1)
0275    92.         CALL MATMAT(PUBA,PU,PQ)
0276    93.         CALL MATMAT(PUAL,PQ,PUC)
0277    94.         GTHEU =-ATAN2(PUC(1,3),PUC(1,1))
0300    95.         GPSIU = ASIN(PUC(1,2))
0301    96.         GPHIU =-ATAN2(PUC(3,2),PUC(2,2))
0302    97.         GO TO 15
0303    98.      10 KGUID= 1
0304    99.         III= 1
```


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D2-118387-2A

```
00305    100*        15 RETURN
00306    101*           END

   END OF COMPILATION:        NO  DIAGNOSTICS.
 PBC              SYMBOLIC                          04 APR 72  15:10:23   0  01544556   14   103  (DELETED)
 PBC      CODE    RELOCATABLE                       04 APR 72  15:10:23   1  01547420   72     1  (DELETED)
                                                                          0  01547530   14    39
```

C(KA,18)= DMAZ871300.

SUBROUTINE READO ENTRY POINT 002724
RESTRT ENTRY POINT 002727

STORAGE USED: CODE(1) 002732; DATA(3) 075043; BLANK COMMON(2) 000000

COMMON BLOCKS:

0003	AK1	000003
0004	CON	000007
0005	DA1	000016
0006	DK1	000021
0007	DK2	000036
0010	EA1	000022
0011	EA2	000125
0012	GK1	000052
0013	IA1	000021
0014	IA4	000015
0015	IE2	000032
0016	IG3	000015
0017	IG4	000023
0020	IT2	000013
0021	MA1	000036
0022	TA1	000025
0023	TA3	000020
0024	TK1	000011
0025	TK2	000013
0026	SR1	000015
0027	MA3	000001
0030	MK1	000011
0031	EG1	000004

EXTERNAL REFERENCES (BLOCK, NAME)

0032	OUTPKD
0033	VICPKD
0034	MAG
0035	MATVEC
0036	FILMAV
0037	GRID
0040	PLOTIV
0041	RITE2V
0042	ATAN2
0043	SQRT
0044	COS
0045	ACOS
0046	SIN
0047	ASIN
0050	TAN
0051	WIDUS
0052	NIOIS
0053	WIOZS
0054	NSTOPS
0055	NERR3S

02-1183 8 7-21

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STORAGE ASSIGNMENT (BLOCK, TYPE, RELATIVE LOCATION, NAME)

0001		002127	IL	0000		073752	13F	0001		000011	101L	0001		000015	102L	0001		002144	106G
0001		002150	107G	0000		074176	11F	0001		002646	110L	0001		002205	110G	0001		002654	112L
0001		002324	112G	0001		002330	112G	0001		002361	114G	0001		002473	115G	0001		002477	116G
0001		002536	117G	0000		074243	12F	0001		002122	120L	0001		001560	121L	0001		001701	122L
0001		001705	123L	0001		001707	124L	0000		074360	13F	0001		001553	134L	0001		001065	135L
0000		074544	14F	0000		074747	15F	0001		000037	166G	0001		000067	175G	0001		002652	200L
0001		000346	255G	0001		001471	567G	0001		001472	572G	0001		001475	600G	0001		001500	606G
0001		001503	614G	0001		001506	622G	0001		001511	630G	0001		001514	636G	0001		001517	644G
0001		001567	663G	0001		001601	671G	0001		001613	677G	0000		073212	7F	0001		001625	705G
0001		001637	713G	0001		001651	721G	0001		001663	727G	0001		001675	735G	0000		073404	8E
0000		073550	9F	0000	R	001627	A	0021		000003	ABTT	0013		000004	ADMASS	0013		000000	ADMTOT
0003	R	000000	ADPDES	0003	R	000002	ADRDES	0003	R	000001	ADYDES	0007	R	000000	ALPHA	0013		000003	AMASCD
0013		000001	AMDOTV	0013	R	000002	AMT	0011		000122	ARCSPM	0011		000124	ARCSRM	0011		000123	ARCSYM
0010		000006	ATENG	0005		000015	ATOTHR	0013		000020	AUGRAV	0016		000002	AZCF	0000	R	024247	B
0007	R	000001	BETA	0000	R	050743	C	0005	R	000003	DFAB	0005	R	000000	DMAXB	0005	R	000001	DMAYB
0005	R	000002	DMAZB	0131	R	000003	EATB	0015	R	000017	EATT	0026	R	000003	EAVP	0014		000007	EAVPP
0015	R	000021	EB	0011	R	000044	EBP	0015		000016	EBPO	0011	R	000060	EBY	0026		000000	EG
0016		000013	EGEFF	0011		000000	EL	0026	R	000007	ELATC	0011		000114	ELO	0026	R	000010	ELONGD
0014		000000	EPAI	0014	R	000001	EPB	0014	R	000004	EPBD	0011		000074	EPE	0010	R	000002	EPHI
0010		000005	EPHIO	0010	R	000001	EPSI	0010		000004	EPSIO	0011	R	000110	EPT	0014	R	000002	EQB
0014	R	000005	EQBD	0014	R	000003	ERB	0014	R	000006	ERBD	0016	R	000007	ERP	0010	R	000000	ETHETA
0010		000003	ETHETO	0015		000002	ETSLB	0015		000000	ETSLOI	0015		000001	ETSLO2	0014	R	000003	EVP
0014		000012	EVPP	0023	R	000014	GADP	0060	R	073065	GAMMA	0060	R	073071	GAMMAR	0000	R	073070	GAMMR1
0016		000014	GDTV	0016		000001	GEGVEL	0017		000014	GH	0017	R	000022	GPHID	0017	R	000021	GPSID
0012		000000	GTFTL	0012		000001	GTGO	0017	R	000020	GTHED	0017		000000	GURP	0017		000010	GUYP
0017		000004	GUZP	0007	R	000002	H	0005		000014	HI	0000	I	073066	I	0021		000002	IABT
0011		000112	IBO	0011	I	000111	IES	0016		000000	IGMT	0000	I	073204	II	0000	I	073206	IJ
0000		075010	INJPS	0027		000000	IRERUN	0011	I	000113	ISEP	0030	I	000000	ITITLE	0000	I	073173	IX
0000	I	073171	J	0000	I	073170	JJ	0021		000000	JUMP	0000	I	073174	JX1	0000	I	073175	JX2
0000	I	073176	JX3	0000	I	073177	JX4	0000	I	073200	JX5	0000	I	073201	JX6	0000	I	073202	JX7
0000	I	073203	JX8	0000	I	073055	K	0000	I	073056	KA	0021	I	000005	KGUID	0000	I	073172	KIX
0000	I	073205	KSTART	0007	R	000003	MACH	0000	I	073211	NLAST	0005		000013	P	0000	R	073106	PGADV
0004	R	000002	PI	0000	R	000047	P01	0000	R	000237	P02	0000	R	000407	P03	0000	R	000607	P04
0000	R	000747	P05	0000	R	001107	P06	0000	R	001227	P07	0000	R	001417	P08	0000	R	073151	QAX1
0000	R	073153	QAX2	0000	R	073155	QAX3	0000	R	073157	QAX4	0007	R	000005	QDOT	0007	R	000004	QUE
0000	R	073134	Q1	0000	R	073135	Q2	0000	R	073126	Q3	0000	R	073130	Q4	0004	R	000000	RAD
0004	R	000001	RADI	0000	R	073113	RAMT	0000	R	073152	RAX1	0000	R	073154	RAX2	0000	R	073156	RAX3
0000	R	073160	RAX4	0000	R	073143	RBA	0000	R	073144	RBA1	0000	R	073136	RBETA	0000	R	073111	RCALPV
0000	R	073120	RCAVLS	0000	R	073127	RCHA	0000	R	073131	RCHA1	0000	R	073161	RDPDES	0000	R	073163	RDRDES
0000	R	073162	RDYDES	0000	R	073057	RGRAV	0000	R	073063	RHDOT	0000	R	000000	RL	0000	R	073107	RLATLP
0000	R	073116	RLATLS	0000	R	073110	RLONLP	0000	R	073117	RLONLS	0000	R	000004	RLSLV	0000	R	073103	RPB
0000	R	073100	RPBD	0000	R	073074	RPHIA	0000	R	073077	RPHID	0000	R	073132	RPPA	0000	R	073133	RPPA1
0000	R	073164	RPPA2	0000	R	073141	RPRA	0000	R	073142	RPRA1	0000	R	073073	RPSIA	0000	R	073076	RPSID
0000	R	073137	RPYA	0000	R	073140	RPYA1	0000	R	000021	RQ	0000	R	073114	RQALP	0000	R	073104	RQB
0000	R	073101	RQBD	0000	R	073115	RQBETA	0000	R	073105	RRB	0000	R	073102	RRBD	0000	R	073122	RRHA
0000	R	073123	RRHA1	0000	R	073112	RRLP	0000	R	073121	RRLS	0000	R	073125	RRLSCR	0000	R	073124	RRLSDR
0000	R	000041	RRLSI	0000	R	000015	RRLSP	0000	R	073145	RTAC1	0000	R	073146	RTAC2	0000	R	073147	RTAC3
0000	R	073150	RTAC4	0000	R	073072	RTHETA	0000	R	073165	RTHETB	0000	R	073166	RTHETC	0000	R	073075	RTHETD
0000	R	073167	RTHETR	0000	R	000011	RUE	0000	R	000025	RUVAX	0000	R	000031	RUVAY	0000	R	000035	RUVAZ
0000	R	073067	RVG	0000	R	073062	RWFR	0000	R	073060	RWVB	0000	R	073061	RWVO	0000	R	073064	RZDOT
0004	R	000005	SEROT	0004	R	000003	SGRAV	0026	R	000013	SLATI	0026	R	000014	SLONGI	0004		000006	SMU
0004	R	000004	SRMEAN	0021	R	000001	T	0020		000011	TAE	0023	R	000010	TAG	0023	R	000004	TDV6
0022		000024	TGFIN	0021	R	000024	TGOT	0025	R	000000	THETB	0025	R	000001	THETC	0025	R	000002	THETR
0020	R	000000	TIP	0000	R	072413	TITA	0000	R	072557	TITB	0000	R	072723	TITC	0026	R	000011	TLATI

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0026 R 000012 TLONG1     0022   000021 TRDG      0024 R 000005 TRLSE     0024   000000 TRLSP     0015 R 000020 TTL
0022   000000 TUXGP      0022   000004 TUYGP     0022   000010 TUZGP     0024 R 000009 TVBO      0020   000012 TVBON
0022 R 000014 TVDG       0023 R 000000 TVG       0006 R 000010 UXTP      0006   000013 UYTP      0006 R 000016 UZTP
0006 R 000004 VA         0006 R 000000 VAB       0005 R 000007 WEP       0000 R 073210 XMAX      0000 R 073207 XMIN
0000 R 050667 YMAX       0000 R 050715 YMIN
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00101     1•          SUBROUTINE READO
00103     2•          REAL MACH
00104     3•          COMMON /AR1/ ADPDES,ADYDES,ADRDES
00105     4•          COMMON /CON/ RAD,RADI,PI,SGRAV,SRMEAN,SEROT,SMU
00106     5•          COMMON /DA1/ DMAXB,DMAYB,DMAZB,DFAB(4),WEP(4),P,MI,ATOTHR
00107     6•          COMMON /DR1/ VAB(4),VA(4),UXTP(3),UYTP(3),UZTP(3)
00110     7•          COMMON /DR2/ ALPHA,BETA,H,MACH,QUE,QDOT
00111     8•          COMMON/EA1/ETHETA,EPSI,EPHI,ETHETD,EPSID,EPHID,ATENG(12)
00112     9•          COMMON /EA2/ EL(12,3),EBP(12),EBY(12),EPE(12),EPT,IES,IBO,ISEP
00112    10•         1,ELO(2,3),ARCSPM,ARCSYM,ARCSRM
00113    11•         COMMON /GR1/ GIFTL,GTGO
00114    12•         COMMON/IA1/ADMTOT,AMDOTV,AMT   ,AMASCO,ADMASS(12),AUGRAV
00115    13•         COMMON /IE1/ EPAI,EPB,EGB,ERB,EPBD,EGBD,ERBD,EAVPP(3),EVPP(3)
00116    14•         COMMON /IE2/ ETSLOI,ETSLO2,ETSLB(12),EBPO,EATT,TTL,EB(3,3)
00117    15•         COMMON /IG3/ IGMT,GEGVEL,AZCF,EVP(4),ERP(4),EGEFF,GDTV
00120    16•         COMMON /IG4/ GURP(4),GUZP(4),GUYP(4),GM(4),GTHED,GPSID,GPHID
00121    17•         COMMON /IT2/ TIP(3,3),TAE,TVBON
00122    18•         COMMON/MA1/ JUMP,T,IABT,AUTT,TGOT,KGUID
00123    19•         COMMON/TA1/TUXGP(4),TUYGP(4),TUZGP(4),TVDG(4),TRDG(4),TGFIN
00124    20•         COMMON/TA3/TVG(4),TUVG(4),TAG(4),GADP(4)
00125    21•         COMMON /TR1/ TRLSP(4),TVBO,TRLSE(4)
00126    22•         COMMON /TR2/ THEIB,THETC,THETR
00127    23•         COMMON /SR1/ EG(3),EAVP(4),ELATC,ELONGD,TLATI,TLONGI,SLATI,SLONGI
00130    24•         DIMENSION RL(3,3),RVE(4)                                          •NE•
00131    25•         COMMON /MA3/ IRERUN                                               •••1
00132    26•         COMMON /MR1/ ITITLE(9)
00133    27•         DIMENSION RRLSP(4),RQ(4),RUVAX(4),RUVAY(4),RUVAZ(4),RRLSI(3),
00133    28•        1RLSLV(3)
00134    29•         DIMENSION PO1(8,15),PO2(8,13),PO3(8,16),PO4(8,12),PO5(8,12),
00134    30•        1PO6(6,10),PO7(8,15),PO8(8,17)
00135    31•         COMMON /EG1/EATB(4)
00136    32•         DIMENSION A(500,20),B(500,20),YMAX(22),YMIN(22),C(500,18)
00137    33•         DIMENSION TITA(5,20),TITB(5,20),TITC(5,18)
00140    34•         DATA TITC/' TOTAL AXIAL ACCEL. (GEES)    ',
00140    35•        2          'TOTAL OUT OF PL. ACCEL. (GEES)',
00140    36•        3          ' TOTAL NORMAL ACCEL. (GEES)   ',
00140    37•        4          'TOTAL HORIZONTAL ACCEL. (GEES)',
00140    38•        5          ' ENGINE 1 PITCH ANGLE (DEG.)  ',
00140    39•        6          ' ENGINE 1 YAW   ANGLE (DEG.)  ',
00140    40•        7          ' ENGINE 2 PITCH ANGLE (DEG.)  ',
00140    41•        8          ' ENGINE 2 YAW   ANGLE (DEG.)  ',
00140    42•        9          ' ENGINE 1 PITCH RATE (DEG/SEC)',
00140    43•        *          ' ENGINE 1 YAW   RATE (DEG/SEC)',
00140    44•        1          ' ENGINE 2 PITCH RATE (DEG/SEC)',
00140    45•        2          ' ENGINE 2 YAW   RATE (DEG/SEC)',
00140    46•        3          'X AERODYNAMIC FORCE (LBS*1000)',                      •NE•
00140    47•        4          'Y AERODYNAMIC FORCE (LBS*1000)',                      •NE•
00140    48•        5          'Z AERODYNAMIC FORCE (LBS*1000)',                      •NE•
00140    49•        6          ' X AERO MOMENT ((FT-LBS)*1000)',                      •NE•
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00140      7          ' Y AERO MOMENT ((FT-LBS)*1000)',                    *NEW
00140      8          ' Z AERO MOMENT ((FT-LBS)*1000)'/                    *NEW
00142      DATA K,KA/0,0/                                                  **-6
00145      DATA TITA/'  INERTIAL VELOCITY (FT/SEC)  ',
00145      2          '    EULER PITCH ANGLE (DEG)   ',
00145      3          '     EULER YAW ANGLE (DEG)    ',
00145      4          '    EULER ROLL ANGLE (DEG)    ',
00145      5          '        ALTITUDE (FT)         ',
00145      6          '    ALTITUDE RATE (FT/SEC)    ',
00145      7          '     ANGLE OF ATTACK (DEG)    ',
00145      8          '     SIDESLIP ANGLE (DEG)     ',
00145      9          ' REL. FLIGHT PATH ANGLE (DEG) ',
00145      *          'THRUST ACCELERATION (FT/SEC2) ',
00145      1          'RANGE FROM LAUNCH PAD (N. MI) ',
00145      2          '   FUEL REMAINING (LBS*1000)  ',
00145      3          'ACCEL. (THRUST+AERO) (FT/SEC) ',
00145      4          '   AERO DECELERATION (GEES)   ',
00145      5          ' HEATING RATE (BTU/SQ FT/SEC) ',
00145      6          '    VEHICLE LATITUDE (DEG)    ',
00145      7          '   VEHICLE LONGITUDE (DEG)    ',
00145      8          '  DYNAMIC PRESSURE (LBS/FT2)  ',
00145      9          '    TRUE AIRSPEED (FT/SEC)    ',
00145      *          '    TIME FROM LAUNCH (SEC)    '/
00147      DATA TITB/'     GROUND SPEED (FT/SEC)    ',
00147      2          '       BANK ANGLE (DEG)       ',
00147      3          '    COMPASS HEADING (DEG)     ',
00147      4          '   ALPHA-QUE (DEG-LBS/FT2)    ',
00147      5          '    BETA-QUE (DEG-LBS/FT2)    ',
00147      6          'RANGE TO LANDING SITE (N.MI)  ',
00147      7          'RANGE TO L.S.CROSSRANGE (N.MI)',
00147      8          '   PILOTS PITCH ANGLE (DEG)   ',
00147      9          '    PILOTS YAW ANGLE (DEG)    ',
00147      *          '    PILOTS ROLL ANGLE (DEG)   ',
00147      1          '    BODY PITCH ERROR (DEG)    ',
00147      2          '     BODY YAW ERROR (DEG)     ',
00147      3          '    BODY ROLL ERROR (DEG)     ',
00147      4          '  BODY PITCH RATE (DEG/SEC)   ',
00147      5          '   BODY YAW RATE (DEG/SEC)    ',
00147      6          '   BODY ROLL RATE (DEG/SEC)   ',
00147      7          ' BODY PITCH ACCEL. (DEG/SEC2) ',
00147      8          ' BODY YAW ACCEL. (DEG/SEC2)   ',
00147      9          ' BODY ROLL ACCEL. (DEG/SEC2)  ',
00147      *          '    TIME FROM LAUNCH (SEC)    '/
00151      DATA RGRAV,RWVB,RWVO/32.146537,1670910.,274721./
00155      IF(ISEP.EQ.1) GO TO 101
00157      RWFR= AMT*SGRAV-RWVB
00160      GO TO 102
00161  101 RWFR= AMT*SGRAV-RWVO
00162  102 CALL DOTPRD(EVP,UXTP,RHDOT)
00163      CALL DOTPRD(EVP,UZTP,RZDOT)
00164      GAMMA= (ATAN2(RHDOT,RZDOT))*RAD
00165      DO 113 I=1,3                                                    *-11
00170  113 RUVAX(I)= ERP(I)/ERP(4)
00172      CALL VECPRD(VA,RUVAX,RQ)
00173      RQ(4)= SQRT(RQ(1)**2+RQ(2)**2+RQ(3)**2)
00174      DO 114 I=1,3
00177  114 RUVAY(I)= RQ(I)/RQ(4)
00201      CALL VECPRD(RUVAX,RUVAY,RUVAZ)
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      CALL DOTPRD (VA,RUVAZ,RVG)
      CALL DOTPRD(VA,UXTP,RHDOT)
      GAMMR1= ATAN2(RHDOT,RVG)
      GAMMAR= GAMMR1*RAD
      RTHETA= ETHETA*RAD
      RPSIA= EPSI*RAD
      RPHIA= EPHI*RAD
      RTHETD= GTHED*RAD
      RPSID= GPSID*RAD
      RPHID= GPHID*RAD
      RPBD= EPBD*RAD
      RQBD= EQBD*RAD
      RRBD= ERBD*RAD
      RPB= EPB*RAD
      RQB= EQB*RAD
      RRB= ERB*RAD
      PGADV= DFAB(4)/(AMT*SGRAV)
      RLATLP= (ELATC-SLAT1)*RADI
      RLONLP= (SLONG1-ELONGD)*RADI
      RCALPV= ACOS(COS(RLATLP)*COS(RLONLP))
      RRLP= (RCALPV*SRMEAN)/6080.27
      RAMT= AMT*SGRAV
      CALL MAG(EAVP)
      RQALP= ALPHA*QUE
      RQBETA= BETA*QUE
      RLATLS=(TLAT1-ELATC)*RADI
      RLONLS= (ELONGD-TLONG1)*RADI
      RCAVLS= ACOS(COS(RLATLS)*COS(RLONLS))
      RRLS= (RCAVLS*SRMEAN)/6080.27
      RL(1,1)= RUVAX(1)
      RL(1,2)= RUVAX(2)
      RL(1,3)= RUVAX(3)
      RL(2,1)= RUVAY(1)
      RL(2,2)= RUVAY(2)
      RL(2,3)= RUVAY(3)
      RL(3,1)= RUVAZ(1)
      RL(3,2)= RUVAZ(2)
      RL(3,3)= RUVAZ(3)
      RRLSI(1)= TRLSE(1)*COS(T*SEROT)-TRLSE(2)*SIN(T*SEROT)
      RRLSI(2)= TRLSE(1)*SIN(T*SEROT)+TRLSE(2)*COS(T*SEROT)
      RRLSI(3)= TRLSE(3)
      CALL MATVEC(1,TIP,RRLSI,RRLSP)
      DO 111 I=1,3
  111 RRLSP(I)= RRLSP(I)-ERP(I)
      CALL DOTPRD(RRLSP,RUVAX,RLSLV(1))
      CALL DOTPRD(RRLSP,RUVAY,RLSLV(2))
      CALL DOTPRD(RRLSP,RUVAZ,RLSLV(3))
      RRHA= ATAN2(RLSLV(2),RLSLV(3))
      RRHA1= RRHA*RAD                                                  **-1
      RRLSDR= RRLS*COS(RRHA)                                           **-2
      RRLSCR= RRLS*SIN(RRHA)
      RUE(1)= RL(1,3)*WEP(2)-RL(1,2)*WEP(3)                            *NE*
      RUE(2)= RL(1,1)*WEP(3)-RL(1,3)*WEP(1)                            *NE*
      RUE(3)= RL(1,2)*WEP(1)-RL(1,1)*WEP(2)                            *NE*
      RUE(4)= SQRT(RUE(1)**2+RUE(2)**2+RUE(3)**2)                      *NE*
      RUE(1)= RUE(1)/RUE(4)                                            *NE*
      RUE(2)= RUE(2)/RUE(4)                                            *NE*
      RUE(3)= RUE(3)/RUE(4)                                            *NE*
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00277   166.        Q3=      (RL(2,1)*RUE(1)+RL(2,2)*RUE(2)+RL(2,3)*RUE(3))                    *-10
00300   167.        IF(Q3.GE.1.) Q3= 1.
00302   168.        IF(Q3.LE.-1.) Q3=-1.
00304   169.        RCHA= ACOS(Q3)
00305   170.        CALL DOTPRD(VA,RUE,Q4)
00306   171.        IF(Q4.LE.0.) RCHA= 2.*PI-RCHA
00310   172.        RCHAI= RCHA*RAD
00311   173.        Q3=      (EB(1,1)*RL(1,1)+EB(2,1)*RL(1,2)+EB(3,1)*RL(1,3))
00312   174.        IF(Q3.GE.1.) Q3= 1.
00314   175.        IF(Q3.LE.-1.) Q3=-1.
00316   176.        RPPA= ASIN(Q3)
00317   177.        RPPAI=RPPA*RAD
00320   178.        Q1= COS(RPPA)
00321   179.        IF(ABS(Q1).LE..0175) Q1= .0175
00323   180.        Q2= -(EB(1,2)*RL(1,1)+EB(2,2)*RL(1,2)+EB(3,2)*RL(1,3))
00324   181.        RBETA= BETA*RAD1
00325   182.        Q3=      ((EB(1,1)*RUE(1)+EB(2,1)*RUE(2)+EB(3,1)*RUE(3))/Q1)
00326   183.        IF(Q3.GE.1.) Q3= 1.
00330   184.        IF(Q3.LE.-1.) Q3=-1.
00332   185.        RPYA= ASIN(Q3)
00333   186.        RPYAI= RPYA*RAD
00334   187.        Q3= Q2/Q1
00335   188.        IF(Q3.GE.1.) Q3= 1.
00337   189.        IF(Q3.LE.-1.) Q3=-1.
00341   190.        RPRA= ASIN(Q3)
00342   191.        RPRAI= RPRA*RAD
00343   192.        Q3=      (Q2/(COS(GAMMR1)*COS(RBETA1)+TAN(GAMMR1)*TAN(RBETA1))
00344   193.        IF(Q3.GE.1.) Q3= 1.
00346   194.        IF(Q3.LE.-1.) Q3=-1.
00350   195.        RBA= ASIN(Q3)
00351   196.        RBAI= RBA*RAD
00352   197.        RTAC1=((DFAB(1)/AMT)+EATB(1))/SGRAV
00353   198.        RTAC2=((DFAB(2)/AMT)+EATB(2))/SGRAV
00354   199.        RTAC3=((DFAB(3)/AMT)+EATB(3))/SGRAV
00355   200.        RTAC4=SQRT(RTAC2**2+RTAC3**2)
00356   201.        QAX1= RAX1
00357   202.        QAX2= RAX2
00360   203.        QAX3= RAX3
00361   204.        QAX4= RAX4
00362   205.        RAX1= EBP(1)*RAD
00363   206.        RAX2= EBY(1)*RAD
00364   207.        RAX3= EBP(2)*RAD
00365   208.        RAX4= EBY(2)*RAD
00366   209.        RDPDES= ADPDES*RAD
00367   210.        RDYDES= ADYDES*RAD
00370   211.        RDRDES= ADRDES*RAD
00371   212.        RPPA2= ALPHA+GAMMAR
00372   213.        RTHETB= THETB*RAD
00373   214.        RTHETC= THETC*RAD
00374   215.        RTHETR= THETR*RAD
00375   216.        IF(KGUID.EQ.1) GO TO 135
00377   217.        IF(JJ.NE.1) GO TO 122
00401   218.    135 CONTINUE
00402   219.        J= J+1
00403   220.        POI(J, 1)= T
00404   221.        POI(J, 2)= H
00405   222.        POI(J, 3)= RHDOT
00406   223.        POI(J, 4)= GAMMAR
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02-1183 87-24

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00407   224.        PO1(J, 5)= QUE
00410   225.        PO1(J, 6)= MACH
00411   226.        PO1(J, 7)= RVG
00412   227.        PO1(J, 8)= RRFR
00413   228.        PO1(J, 9)= EATT
00414   229.        PO1(J,10)= EPT
00415   230.        PO1(J,11)= ELATC
00416   231.        PO1(J,12)= ELONGD
00417   232.        PO1(J,13)= TGOT
00420   233.        PO1(J,14)= RBAI
00421   234.        PO1(J,15)= RCHAI
00422   235.        PO2(J, 1)= RRHAI
00423   236.        PO2(J, 2)= RRLS
00424   237.        PO2(J, 3)= RRLSDR
00425   238.        PO2(J, 4)= RHLSCR
00426   239.        PO2(J, 5)= RPPAI
00427   240.        PO2(J, 6)= RPYAI
00430   241.        PO2(J, 7)= RPRAI
00431   242.        PO2(J, 8)= RQB
00432   243.        PO2(J, 9)= RRB
00433   244.        PO2(J,10)= RPB
00434   245.        PO2(J,11)= RDPDES
00435   246.        PO2(J,12)= RDYDES
00436   247.        PO2(J,13)= RDRDES
00437   248.        PO3(J, 1)= T
00440   249.        PO3(J, 2)= IES
00441   250.        PO3(J, 3)= RRLP
00442   251.        PO3(J, 4)= ALPHA
00443   252.        PO3(J, 5)= BETA
00444   253.        PO3(J, 6)= GAMMA
00445   254.        PO3(J, 7)= TVBO
00446   255.        PO3(J, 8)= TTL
00447   256.        PO3(J, 9)= TVDG(1)
00450   257.        PO3(J,10)= TVDG(2)
00451   258.        PO3(J,11)= TVDG(3)
00452   259.        PO3(J,12)= TVDG(4)
00453   260.        PO3(J,13)= TVG(1)
00454   261.        PO3(J,14)= TVG(2)
00455   262.        PO3(J,15)= TVG(3)
00456   263.        PO3(J,16)= TVG(4)
00457   264.        PO4(J, 1)= TDVG(1)
00460   265.        PO4(J, 2)= TDVG(2)
00461   266.        PO4(J, 3)= TDVG(3)
00462   267.        PO4(J, 4)= TDVG(4)
00463   268.        PO4(J, 5)= TAG(1)
00464   269.        PO4(J, 6)= TAG(2)
00465   270.        PO4(J, 7)= TAG(3)
00466   271.        PO4(J, 8)= TAG(4)
00467   272.        PO4(J, 9)= GADP(1)
00470   273.        PO4(J,10)= GADP(2)
00471   274.        PO4(J,11)= GADP(3)
00472   275.        PO4(J,12)= GADP(4)
00473   276.        PO5(J, 1)= T
00474   277.        PO5(J, 2)= EVP(1)
00475   278.        PO5(J, 3)= EVP(2)
00476   279.        PO5(J, 4)= EVP(3)
00477   280.        PO5(J, 5)= EVP(4)
00500   281.        PO5(J, 6)= VA(1)
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00501   282.          POS(J, 7)= VA(2)
00502   283.          POS(J, 8)= VA(3)
00503   284.          POS(J, 9)= VA(4)
00504   285.          POS(J,10)= VAB(1)
00505   286.          POS(J,11)= VAB(2)
00506   287.          POS(J,12)= VAB(3)
00507   288.          PO6(J, 1)= ERP(1)
00510   289.          PO6(J, 2)= ERP(2)
00511   290.          PO6(J, 3)= ERP(3)
00512   291.          PO6(J, 4)= ERP(4)
00513   292.          PO6(J, 5)= RTHETA
00514   293.          PO6(J, 6)= RPSIA
00515   294.          PO6(J, 7)= RPHIA
00516   295.          PO6(J, 8)= RTHETD
00517   296.          PO6(J, 9)= RPSID
00520   297.          PO6(J,10)= RPHID
00521   298.          PO7(J, 1)= T
00522   299.          PO7(J, 2)= RQBD
00523   300.          PO7(J, 3)= RRBD
00524   301.          PO7(J, 4)= RPBD
00525   302.          PO7(J, 5)= EAVP(1)
00526   303.          PO7(J, 6)= EAVP(2)
00527   304.          PO7(J, 7)= EAVP(3)
00530   305.          PO7(J, 8)= EAVP(4)
00531   306.          PO7(J, 9)= DMAXB
00532   307.          PO7(J,10)= DMAYB
00533   308.          PO7(J,11)= DMAZB
00534   309.          PO7(J,12)= DFAB(1)
00535   310.          PO7(J,13)= DFAB(2)
00536   311.          PO7(J,14)= DFAB(3)
00537   312.          PO7(J,15)= DFAB(4)
00540   313.          PO8(J, 1)= RQALP
00541   314.          PO8(J, 2)= RQBETA
00542   315.          PO8(J, 3)= RAMT
00543   316.          PO8(J, 4)= PGRDV
00544   317.          PO8(J, 5)= QDOT
00545   318.          PO8(J,6)=RTAC1
00546   319.          PO8(J,7)=RTAC2
00547   320.          PO8(J,8)=RTAC3
00550   321.          PO8(J,9)=RTAC4
00551   322.          PO8(J,10)= RAX1
00552   323.          PO8(J,11)= RAX2
00553   324.          PO8(J,12)= RAX3
00554   325.          PO8(J,13)=RAX4
00555   326.          PO8(J,14)=.5*(RAX1  -QAX1)
00556   327.          PO8(J,15)=.5*(RAX2  -QAX2)
00557   328.          PO8(J,16)=.5*(RAX3  -QAX3)
00560   329.          PO8(J,17)=.5*(RAX4  -QAX4)
00561   330.          IF(KGUID.EQ.0) GO TO 134
00563   331.          IF(J.EQ.8)GO TO 134
00565   332.          KIX= J+1
00566   333.          DO 125 IX=KIX,8
00571   334.          DO 126 JX1=1,15
00574   335.          PO1(IX,JX1)= 0.
00575   336.      126 CONTINUE
00577   337.          DO 127 JX2=1,13
00602   338.          PO2(IX,JX2)= 0.
00603   339.      127 CONTINUE
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      DO 128 JX3=1,16
      POS(IX,JX3)= 2.
  128 CONTINUE
      DO 129 JX4=1,12
      POV(IX,JX4)= 0.
  129 CONTINUE
      DO 130 JX5=1,12
      POS(IX,JX5)= 2.
  130 CONTINUE
      DO 131 JX6=1,10
      POG(IX,JX6)= 2.
  131 CONTINUE
      DO 132 JX7=1,15
      POZ(IX,JX7)= 2.
  132 CONTINUE
      DO133 JX8=1,17
      POB(IX,JX8)= 2.
  133 CONTINUE
  125 CONTINUE
      GO TO 121
  134 CONTINUE
      IF(J.LT.8) GO TO 122
  121 CONTINUE
      J=0
      WRITE(6,7) P01
      WRITE(6,8) P02
      WRITE(6,9) P03
      WRITE(6,10) P04
      WRITE(6,11) P05
      WRITE(6,12) P06
      WRITE(6,13) P07
      WRITE(6,14) P08
    7 FORMAT(//40X,'PILOT DISPLAY PARAMETERS',//1X,
     2'TIME FROM LAUNCH (SEC)      ',8(1PE13.4),/1X,
     3'ALTITUDE (FEET)             ',8(1PE13.4),/1X,
     4'ALTITUDE RATE (FT/SEC)      ',8(1PE13.4),/1X,
     5'REL. FLT. PATH ANGLE (DEG)',8(1PE13.4),/1X,
     6'DYNAMIC PRESS. (LBS/FT2)    ',8(1PE13.4),/1X,
     7'MACH NUMBER                 ',8(1PE13.4),/1X,
     8'GROUNDSPEED (FT/SEC)        ',8(1PE13.4),/1X,
     9'FUEL REMAINING (LBS)        ',8(1PE13.4),/1X,
     0'THRUST ACCEL. (FT/SEC2)     ',8(1PE13.4),/1X,
     1'THROTTLE                    ',8(1PE13.4),/1X,
     2'VEHICLE LATITUDE (DEG)      ',8(1PE13.4),/1X,
     3'VEHICLE LONGITUDE (DEG)     ',8(1PE13.4),/1X,
     4'TIME TO GO (SEC)            ',8(1PE13.4),/1X,
     5'BANK ANGLE (DEG)            ',8(1PE13.4),/1X,
     6'COMPASS HEADING (DEG)       ',8(1PE13.4)
    8 FORMAT(1X,'RANGE HEADING ANGLE          ',8(1PE13.4),/1X,
     2'RANGE FROM L.S. (N.MI.)     ',8(1PE13.4),/1X,
     3'RANGE ALONG VEL. (N.MI.)    ',8(1PE13.4),/1X,
     4'RANGE NORMAL VEL. (N.MI.)   ',8(1PE13.4),/1X,
     5'PILOTS PITCH ANGLE (DEG)    ',8(1PE13.4),/1X,
     6'PILOTS YAW ANGLE (DEG)      ',8(1PE13.4),/1X,
     7'PILOTS ROLL ANGLE (DEG)     ',8(1PE13.4),/1X,
     8'BODY ATT. RATE (D/S) PITCH',8(1PE13.4),/1X,
     9'                     YAW  ',8(1PE13.4),/1X,
     0'                     ROLL ',8(1PE13.4),/1X,
     1
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00742   3980          1'BODY ATT ERROR (DEG) PITCH',8(1PE13.4),/1X,
00742   3990          2'                     YAW  ',8(1PE13.4),/1X,
00742   4000          3'                     ROLL ',8(1PE13.4))
00743   4010        9 FORMAT(//95X,'ADDITIONAL STUDY PARAMETERS'//1X,
00743   4020          1'TIME FROM LAUNCH (SEC)    ',8(1PE13.4),/1X,
00743   4030          2'ENGINES ON                ',8(1PE13.4),/1X,
00743   4040          3'RANGE FROM L. P. (N. MI.) ',8(1PE13.4),/1X,
00743   4050          4'ANGLE OF ATTACK (DEG)     ',8(1PE13.4),/1X,
00743   4060          5'ANGLE OF SIDESLIP (DEG)   ',8(1PE13.4),/1X,
00743   4070          6'INT. FLIGHT PATH ANGLE (D)',8(1PE13.4),/1X,
00743   4080          7'BURNOUT VEL. (FT/SEC)     ',8(1PE13.4),/1X,
00743   4090          8'TIME TO THRUST LIMIT (SEC)',8(1PE13.4),/1X,
00743   4100          9'ABORT TAR.VEL.(F/S)TVDG(1)',8(1PE13.4),/1X,
00743   4110          *'                   TVDG(2)',8(1PE13.4),/1X,
00743   4120          1'                   TVDG(3)',8(1PE13.4),/1X,
00743   4130          2'                   TVDG(4)',8(1PE13.4),/1X,
00743   4140          3'VEL. LV COORD (F/S) TVG(1)',8(1PE13.4),/1X,
00743   4150          4'                    TVG(2)',8(1PE13.4),/1X,
00743   4160          5'                    TVG(3)',8(1PE13.4),/1X,
00743   4170          6'                    TVG(4)',8(1PE13.4))
00744   4180        10 FORMAT(1X,'VEL TO GAIN  (F/S) TDVG(1)',8(1PE13.4),/1X,
00744   4190          2'                   TDVG(2)',8(1PE13.4),/1X,
00744   4200          3'                   TDVG(3)',8(1PE13.4),/1X,
00744   4210          4'                   TDVG(4)',8(1PE13.4),/1X,
00744   4220          5'DESIRED ACCEL.      TAG(1)',8(1PE13.4),/1X,
00744   4230          6'LV COORD. (FT/SEC2) TAG(2)',8(1PE13.4),/1X,
00744   4240          7'                    TAG(3)',8(1PE13.4),/1X,
00744   4250          8'                    TAG(4)',8(1PE13.4),/1X,
00744   4260          9'DESIRED ACCEL P.   GADP(1)',8(1PE13.4),/1X,
00744   4270          *'COORD. (FT/SEC2)   GADP(2)',8(1PE13.4),/1X,
00744   4280          1'                   GADP(3)',8(1PE13.4),/1X,
00744   4290          2'                   GADP(4)',8(1PE13.4))
00745   4300        11 FORMAT(/1X,'TIME FROM LAUNCH (SEC)    ',8(1PE13.4),/1X,
00745   4310          2'INERTIAL VEL. P.    EVP(1)',8(1PE13.4),/1X,
00745   4320          3'COORD. (FT/SEC)     EVP(2)',8(1PE13.4),/1X,
00745   4330          4'                    EVP(3)',8(1PE13.4),/1X,
00745   4340          5'                    EVP(4)',8(1PE13.4),/1X,
00745   4350          6'REL. VEL. PLAT.      VA(1)',8(1PE13.4),/1X,
00745   4360          7'COORD. (FT/SEC)      VA(2)',8(1PE13.4),/1X,
00745   4370          8'                     VA(3)',8(1PE13.4),/1X,
00745   4380          9'                     VA(4)',8(1PE13.4),/1X,
00745   4390          *'REL. VEL. BODY      VAB(1)',8(1PE13.4),/1X,
00745   4400          1'COORD. (FT/SEC)     VAB(2)',8(1PE13.4),/1X,
00745   4410          2'                    VAB(3)',8(1PE13.4))
00746   4420        12 FORMAT(1X,'INERTIAL POS. (FT)  EMP(1)',8(1PE13.4),/1X,
00746   4430          2'                    EMP(2)',8(1PE13.4),/1X,
00746   4440          3'                    EMP(3)',8(1PE13.4),/1X,
00746   4450          4'                    EMP(4)',8(1PE13.4),/1X,
00746   4460          5'ATTITUDE (ACT) (DEG) PITCH',8(1PE13.4),/1X,
00746   4470          6'                     YAW  ',8(1PE13.4),/1X,
00746   4480          7'                     ROLL ',8(1PE13.4),/1X,
00746   4490          8'ATTITUDE (DES) (DEG) PITCH',8(1PE13.4),/1X,
00746   4500          9'                     YAW  ',8(1PE13.4),/1X,
00746   4510          *'                     ROLL ',8(1PE13.4))
00747   4520        13 FORMAT(/1X,'TIME FROM LAUNCH (SEC)    ',8(1PE13.4),/1X,
00747   4530          2'ANGULAR BODY ACCEL. PITCH',8(1PE13.4),/1X,
00747   4540          3'  (DEG/SEC2)        YAW  ',8(1PE13.4),/1X,
00747   4550          4'                     ROLL ',8(1PE13.4),/1X,
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00747   456*          5*TRANSLATIONAL      EAVP(1)*,8(1PE13.4),/1X,
00747   457*          6* ACCEL. P. COORD.  EAVP(2)*,8(1PE13.4),/1X,
00747   458*          7* (FT/SEC2)         EAVP(3)*,8(1PE13.4),/1X,
00747   459*          8*                   EAVP(4)*,8(1PE13.4),/1X,
00747   460*          9*AERO MOMENT ABOUT   X-AXIS*,8(1PE13.4),/1X,
00747   461*          0* BODY (FT/LBS)      Y-AXIS*,8(1PE13.4),/1X,
00747   462*          1*                    Z-AXIS*,8(1PE13.4),/1X,
00747   463*          2*AERO FORCES BODY    DFAB(1)*,8(1PE13.4),/1X,
00747   464*          3* COORD. (LBS)       DFAB(2)*,8(1PE13.4),/1X,
00747   465*          4*                    DFAB(3)*,8(1PE13.4),/1X,
00747   466*          5*                    DFAB(4)*,8(1PE13.4))
00750   467*       14 FORMAT(1X,*ALPHA-DUE (DEG-LBS/FT2)   *8(1PE13.4)//1X,
00750   468*          2*BETA-DUE (DEG-LBS/FT2)     *8(1PE13.4),/1X,
00750   469*          3*VEHICLE WEIGHT (LBS)       *8(1PE13.4),/1X,
00750   470*          4*AERO DECELERATION (GEES)   *8(1PE13.4),/1X,
00750   471*          5*HEAT RATE (BTU/FT2/SEC)    *8(1PE13.4),/1X,
00750   472*          6 *TOTAL AXIAL ACCEL.(GEES)  *8(1PE13.4),/1X,
00750   473*          7 *TOTAL OUT OF PL. ACC. (GS)*8(1PE13.4),/1X,
00750   474*          8 *TOTAL NORMAL ACCEL. (GEES)*8(1PE13.4),/1X,
00750   475*          9 *TOTAL HORIZ ACCEL.(GEES)  *8(1PE13.4),/1X,
00750   476*          * *ENG1 PITCH ANGLE (DEG.) *8(1PE13.4),/1X,
00750   477*          1 *ENG1 YAW   ANGLE (DEG.) *8(1PE13.4),/1X,
00750   478*          2 *ENG2 PITCH ANGLE (DEG.) *8(1PE13.4),/1X,
00750   479*          3 *ENG2 YAW   ANGLE (DEG.) *8(1PE13.4),/1X,
00750   480*          4 *ENG1 PITCH RATE (DEG/S) *8(1PE13.4),/1X,
00750   481*          5 *ENG1 YAW   RATE (DEG/S) *8(1PE13.4),/1X,
00750   482*          6 *ENG2 PITCH RATE (DEG/S) *8(1PE13.4),/1X,
00750   483*          7 *ENG2 YAW   RATE (DEG/S) *8(1PE13.4))
00751   484*     122 CONTINUE
00752   485*         IF(JJ.EQ.0) GO TO 123
00754   486*         JJ= 0
00755   487*         GO TO 124
00756   488*     123 JJ= 1
00757   489*     124 CONTINUE
00760   490*         IF(II.NE.1) GO TO 120
00762   491*         K=K+1
00763   492*         A(K, 1)=EVP(4)
00764   493*         A(K, 2)=RTHETA
00765   494*         A(K, 3)=RPSIA
00766   495*         A(K, 4)=RPHIA
00767   496*         A(K, 5)=H
00770   497*         A(K, 6)=RHDOT
00771   498*         A(K, 7)=ALPHA
00772   499*         A(K, 8)=BETA
00773   500*         A(K, 9)=GAMMAR
00774   501*         A(K,10)=EATT
00775   502*         A(K,11)=RRLP
00776   503*         A(K,12)=RWFR/1000.
00777   504*         A(K,13)=EAVP(4)
01000   505*         A(K,14)=PGADV
01001   506*         A(K,15)=QDOT
01002   507*         A(K,16)=ELATC
01003   508*         A(K,17)=ELONGD
01004   509*         A(K,18)=QUE
01005   510*         A(K,19)=VA(4)
01006   511*         A(K,20)=T
01007   512*         KA=KA+1
01010   513*         B(KA, 1)=RVG
```


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```
      B(KA, 2)=RBA1
      B(KA, 3)=RCHA1
      B(KA, 4)=RQALP
      B(KA, 5)=RQBETA
      B(KA, 6)=RRLS
      B(KA, 7)=RRLSCR
      B(KA, 8)=RPPA1
      B(KA, 9)=RPYA1
      B(KA,10)=RPWA1
      B(KA,11)=RDPDES
      B(KA,12)=RDYDES
      B(KA,13)=RDRDES
      B(KA,14)=RQB
      B(KA,15)=RRB
      B(KA,16)=RPB
      B(KA,17)=RQBD
      B(KA,18)=RRBD
      B(KA,19)=RPBD
      B(KA,20)=T
      C(KA, 1)=RTAC1
      C(KA, 2)=RTAC2
      C(KA, 3)=RTAC3
      C(KA, 4)=RTAC4
      C(KA, 5)= RAX1
      C(KA, 6)= RAX2
      C(KA, 7)= RAX3
      C(KA, 8)= RAX4
      C(KA, 9)=.5*(RAX1  -QAX1)
      C(KA,10)=.5*(RAX2  -QAX2)
      C(KA,11)=.5*(RAX3  -QAX3)
      C(KA,12)=.5*(RAX4  -QAX4)
      C(KA,13)= DFAB(1)/1000.                                    *NEW
      C(KA,14)= DFAB(2)/1000.                                    *NEW
      C(KA,15)= DFAB(3)/1000.                                    *NEW
      C(KA,16)= DMAXB/1000.                                      *NEW
      C(KA,17)= DMAYB/1000.                                      *NEW
      C(KA,18)= DMAZB/1000.                                      *NEW
  120 IF(KGUID.EQ.0)GO TO 110                                    **-6
      GO TO 1
      ENTRY RESTRT
      KSTART=1
    1 CONTINUE
      DO 60 IJ=1,19
      YMAX(IJ)=A(1,IJ)
      YMIN(IJ)=A(1,IJ)
      DO 60 I=2,K
      IF(YMAX(IJ).LT.A(I,IJ))YMAX(IJ)=A(I,IJ)
   60 IF(YMIN(IJ).GT.A(I,IJ))YMIN(IJ)=A(I,IJ)
      XMIN=A(1,20)
      XMAX=A(K,20)
      DO 65 I=1,19
      CALL FILMAV(2)
      CALL GRID(100,1000,50,950,XMIN,XMAX,YMIN(I),YMAX(I))
      CALL PLOT1V(1,1,A(1,20),A(1,I),K,1,1H )
      CALL RITE2V(120,1014,1023,90,1,50,1,ITITLE,NLAST)
      CALL RITE2V(10,200,1023,180,1,30,1,TITA(1,I),NLAST)
      CALL RITE2V(275,10,1023,90,1,30,1,TITA(1,20),NLAST)
   65 CONTINUE
```

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D2-118387-2A

```
01117          XMIN=B(1,20)
01120          XMAX=B(KA,20)
01121          DO 66 IJ=1,19
01124          YMAX(IJ)=B(1,IJ)
01125          YMIN(IJ)=B(1,IJ)
01126          DO 66 I=2,K
01131          IF(YMAX(IJ).LT.B(I,IJ))YMAX(IJ)=B(I,IJ)
01133       66 IF(YMIN(IJ).GT.B(I,IJ))YMIN(IJ)=B(I,IJ)
01137          DO 68 I=1,19
01142          CALL FILMAV(2)
01143          CALL GRID(100,1000,50,950,XMIN,XMAX,YMIN(I),YMAX(I))
01144          CALL PLOT1V(1,1,B(1,20),B(1,I),KA,1,1H )
01145          CALL RITE2V(120,1014,1023,90,1,50,1,ITITLE,NLAST)
01146          CALL RITE2V(10,200,1023,180,1,30,1,TITB(1,I),NLAST)
01147          CALL RITE2V(275,10,1023,90,1,30,1,TITB(1,20),NLAST)
01150       68 CONTINUE
01152          XMIN=B(1,20)
01153          XMAX=B(KA,20)
01154          DO 70IJ=1,18
01157          YMAX(IJ)=C(1,IJ)
01160          YMIN(IJ)=C(1,IJ)
01161          DO 70 I=2,K
01164          IF(YMAX(IJ).LT.C(I,IJ))YMAX(IJ)=C(I,IJ)
01166       70 IF(YMIN(IJ).GT.C(I,IJ))YMIN(IJ)=C(I,IJ)
01172          DO 71I=1,18
01175          CALL FILMAV(2)
01176          CALL GRID(100,1000,50,950,XMIN,XMAX,YMIN(I),YMAX(I))
01177          CALL PLOT1V(1,1,B(1,20),C(1,I),KA,1,1H )
01200          CALL RITE2V(120,1014,1023,90,1,50,1,ITITLE,NLAST)
01201          CALL RITE2V(10,200,1023,180,1,30,1,TITC(1,I),NLAST)
01202          CALL RITE2V(275,10,1023,90,1,30,1,TITB(1,20),NLAST)
01203       71 CONTINUE
01205          K=0
01206          KA=0
01207          J=0
01210          WRITE (6,15)
01212       15 FORMAT (40X,'OUTPUT HAS BEEN PLOTTED')
01213          IF(KSTART.EQ.1)STOP
01215      110 CONTINUE
01216          IF(II.EQ.0)GO TO 200
01220          II=0
01221          GO TO 112
01222      200 II=1
01223      112 CONTINUE
01224          RETURN
01225          END

   END OF COMPILATION:        NO  DIAGNOSTICS.
READO          SYMBOLIC                                  04 APR 72  15:10:17   0  01502564    14   6.4  (DELETED)
READO   CODE   RELOCATABLE                               04 APR 72  15:10:17   1  01524040   132     1  (DELETED)
                                                                               0  01524244    14   276
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```
@ FOR,* MATMAT,MATMAT                                                                    01 JUN 72          22:39:10.796
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:10

   SUBROUTINE MATMAT    ENTRY POINT 000051

   STORAGE USED: CODE(1) 000067; DATA(0) 000027; BLANK COMMON(2) 000000

   EXTERNAL REFERENCES (BLOCK, NAME)

   .0003   NFRR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000005 106G      0001   000010 111G      0001   000013 115G      0000 I 000002 I          0000   000011 INJP$
    0000 I 000003 J         0000 I 000004 K         0000 D 000000 SUM


00101      1*          SUBROUTINE MATMAT(A,B,C)
00103      2*          DIMENSION A(3,3),B(3,3),C(3,3)
00104      3*          DOUBLE PRECISION SUM
00105      4*          DO 2 I = 1,3
00110      5*          DO 2 J = 1,3
00113      6*          SUM = 0.0D0
00114      7*          DO 1 K = 1,3
00117      8*        1 SUM = SUM + A(I,K)*B(K,J)
00121      9*        2 C(I,J) = SUM
00124     10*          RETURN
00125     11*          END

      END OF COMPILATION:        NO  DIAGNOSTICS.
   MATMAT          SYMBOLIC                                  04 APR 72  15:10:36   0  01574702    14    11  (DELETED)
   MATMAT  CODE    RELOCATABLE                               04 APR 72  15:10:36   1  01575134    24     1  (DELETED)
                                                                                    0  01575164    14     7
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D2-118387-2A

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@ FOR,* MATVEC,MATVEC                                                                    01 JUN 72          22:39:11.A09
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:11

   SUBROUTINE MATVEC     ENTRY POINT 000100

   STORAGE USED: CODE(1) 000117; DATA(0) 000027; BLANK COMMON(2) 000000

   EXTERNAL REFERENCES (BLOCK, NAME)

   .0003   NERR3S

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001   000017 110G      0001   000024 114G      0001   000046 125G      0001   000053 131G      0001   000041 3L
    0001   000064 6L        0000 I 000002 I         0000   000010 INJPS     0000 I 000003 J         0000 n 000000 SUM


00101      1*          SUBROUTINE MATVEC(K,A,B,C)
00103      2*          DIMENSION A(3,3),B(3),C(3)
00104      3*          DOUBLE PRECISION SUM
00104      4*     C    A IS TRANSPOSED WHEN K=2
00105      5*          IF(K.EQ.2) GO TO 3
00107      6*          DO2I=1,3
00112      7*          SUM=0.0D0
00113      8*          DO1J=1,3
00116      9*      1   SUM= SUM+A(I,J)*B(J)
00120     10*      2   C(I)= SUM
00122     11*          GO TO 6
00123     12*      3   CONTINUE
00124     13*          DO 5I=1,3
00127     14*          SUM= 0.0D0
00130     15*          DO4J=1,3
00133     16*      4   SUM= SUM+A(J,I)*B(J)
00135     17*      5   C(I)= SUM
00137     18*      6   RETURN
00140     19*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
   MATVEC          SYMBOLIC                                  04 APR 72  15:10:38   0  01575326    14    19  (DELETED)
   MATVEC  CODE    RELOCATABLE                               04 APR 72  15:10:38   1  01575740    24     1  (DELETED)
                                                                                     0  01575770    14     9
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@ FOR,* UNTVEC,UNTVEC                                                                    01 JUN 72          22:39:13. 93
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:13

   SUBROUTINE UNTVEC     ENTRY POINT 000027

   STORAGE USED: CODE(1) 000036; DATA(0) 000010; BLANK COMMON(2) 000000

   EXTERNAL REFERENCES (BLOCK, NAME)

    0003    MAG
    0004    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000000 INJP$


00101      1*          SUBROUTINE UNTVEC(A,B)
00103      2*          DIMENSION A(4),B(3)
00104      3*          CALL MAG(A)
00105      4*          B(1) = A(1)/A(4)
00106      5*          B(2) = A(2)/A(4)
00107      6*          B(3) = A(3)/A(4)
00110      7*          RETURN
00111      8*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
   UNTVEC          SYMBOLIC                          04 APR 72  15:10:39   0  01576166    14     8  (DELETED)
   UNTVEC  CODE    RELOCATABLE                       04 APR 72  15:10:39   1  01576346    24     1  (DELETED)
                                                                           0  01576376    14     4
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D2-118387-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
@ FOR,* DOTPRD,DOTPRD                                                                    01 JUN 72          22:39:14.049
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:15

   SUBROUTINE DOTPRD    ENTRY POINT 000031

   STORAGE USED: CODE(1) 000044; DATA(0) 000020; BLANK COMMON(2) 000000

   EXTERNAL REFERENCES (BLOCK, NAME)

    0003    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001    000007 107G      0000 I 000002 I          0000    000006 INJP$      0000 D 000000 SUM


00101      1*            SUBROUTINE DOTPRD(A,B,C)
00103      2*            DIMENSION A(3),B(3)
00104      3*            DOUBLE PRECISION SUM
00105      4*            SUM = 0.000
00106      5*            DO 3 I = 1,3
00111      6*          3 SUM = SUM + A(I)*B(I)
00113      7*            C = SUM
00114      8*            RETURN
00115      9*            END

      END OF COMPILATION:        NO  DIAGNOSTICS.
    DOTPRD          SYMBOLIC                                  04 APR 72  15:10:42   0  01576714    14     9  (DELETED)
    DOTPRD  CODE    RELOCATABLE                               04 APR 72  15:10:42   1  01577112    24     1  (DELETED)
                                                                                     0  01577142    14     5
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D2-118387-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
) FOR,* VECPRD,VECPRD
UNIVAC 1108 FORTRAN V EXEC II LEVEL 25A  -(EXEC8 LEVEL E12010010A)          01 JUN 72          22:39:15.461
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:15

  SUBROUTINE VECPRD     ENTRY POINT 000036

  STORAGE USED: CODE(1) 000043; DATA(0) 000010; BLANK COMMON(2) 000000

  EXTERNAL REFERENCES (BLOCK, NAME)

   0003    .ERR3S

  STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

   0000    000000 .INJPS


0101      1*            SUBROUTINE VECPRD(A,B,C)
0103      2*            DIMENSION A(3),B(3),C(3)
0104      3*            C(1) = A(2) * B(3) - A(3) * B(2)
0105      4*            C(2) = A(3) * B(1) - A(1) * B(3)
0106      5*            C(3) = A(1) * B(2) - A(2) * B(1)
0107      6*            RETURN
0110      7*            END

    END OF COMPILATION:      NO  DIAGNOSTICS.
VECPRD          SYMBOLIC                    04 APR 72  15:10:43   0  01577250    14     7  (DELETED)
VECPRD  CODE    RELOCATABLE                 04 APR 72  15:10:43   1  01577412    24     1  (DELETED)
                                                                  0  01577442    14     4  .
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02-1183871-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.

```
@ FOR,* MAG,MAG                                                                    01 JUN 72          22:39:14. 3A
UNIVAC 1108 FORTRAN V EXEC 11 LEVEL 25A  -(EXEC8 LEVEL E12010010A)
THIS COMPILATION WAS DONE ON 01 JUN 72 AT 22:39:14

   SUBROUTINE MAG        ENTRY POINT 000026

   STORAGE USED: CODE(1) 000031; DATA(0) 000007; BLANK COMMON(2) 000000

   EXTERNAL REFERENCES (BLOCK, NAME)

    0003    SQRT
    0004    NERR3$

   STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0000    000000 INJP$


00101      1*          SUBROUTINE MAG(A)
00103      2*          DIMENSION A(4)
00104      3*          A(4) = SQRT(A(1)**2+A(2)**2+A(3)**2)
00105      4*          RETURN
00106      5*          END

     END OF COMPILATION:        NO  DIAGNOSTICS.
   MAG              SYMBOLIC                                  04 APR 72  15:10:41   0  01576466    14     5  (DELETED)
   MAG      CODE    RELOCATABLE                               04 APR 72  15:10:41   1  01576574    24     1  (DELETED)
                                                                                     0  01576624    14     4
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D2-118387-2A

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR.