

743

AE-C, AE-D & AE-E

ORBIT/ATTITUDE DATA & TELEMETRY DATA

73-101A-00D & 73-101A-00E

75-096A-00D & 75-096A-00E

75-107A-00D & 75-107A-00E

Table of Contents

1. Introduction
2. Errata/Change Log
3. LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC
INFORMATION SYSTEM
4. Catalog Materials
 - a. Associated Documents
 - b. Core Catalog Materials

1. INTRODUCTION:

The documentation for this data set was originally on paper, kept in NSSDC's Data Set Catalogs (DSCs). The paper documentation in the Data Set Catalogs have been made into digital images, and then collected into a single PDF file for each Data Set Catalog. The inventory information in these DSCs is current as of July 1, 2004. This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system. The information existing in the DSCs is now not needed for locating the data files, but we did not remove that inventory information.

The offline tape datasets have now been migrated from the original magnetic tape to Archival Information Packages (AIP's).

A prior restoration may have been done on data sets, if a requestor of this data set has questions; they should send an inquiry to the request office to see if additional information exists.

2. ERRATA/CHANGE LOG:

NOTE: Changes are made in a text box, and will show up that way when displayed on screen with a PDF reader.

When printing, special settings may be required to make the text box appear on the printed output.

Version	Date	Person	Page	Description of Change
01				
02				

3 LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC
INFORMATION SYSTEM:

<http://nssdc.gsfc.nasa.gov/nmc/>

[NOTE: This link will take you to the main page of the NSSDC Master Catalog. There you will be able to perform searches to find additional information]

4. CATALOG MATERIALS:

- a. Associated Documents To find associated documents you will need to know the document ID number and then click here.
<http://nssdcftp.gsfc.nasa.gov/miscellaneous/documents/>

- b. Core Catalog Materials

AE-C

Telemetry Data

73-101A-00D SPIO-00107

This data set consists of 33 magnetic tapes. The tapes were created on a VAX system written in high density. The DD tapes are 8mm and the DC tapes are 4mm. The tape numbers, labels and start/stop times are listed below.

D-Number	C-Number	Label	Start/Stop time	
-----	-----	-----	-----	-----
DD 103950	DC 031320	C000TM	06/30/73	10/70/80 **
DD 103951	DC 031321	C001TM	12/17/73	01/04/74
DD 103952	DC 031322	C002TM	01/07/74	01/28/74
DD 103953	DC 031323	C003TM	01/28/74	02/28/74
DD 103954	DC 031324	C004TM	02/28/74	03/21/74
DD 103955	DC 031325	C005TM	03/21/74	04/07/74
DD 103956	DC 031326	C006TM	04/08/74	04/24/74
DD 103957	DC 031327	C007TM	04/24/74	05/17/74
DD 103958	DC 031328	C008TM	05/17/74	06/04/74
DD 103959	DC 031329	C009TM	06/04/74	06/21/74
DD 103960	DC 031330	C010TM	06/21/74	07/15/74
DD 103961	DC 031331	C011TM	07/15/74	08/02/74
DD 103962	DC 031332	C012TM	08/03/74	08/23/74
DD 103963	DC 031333	C013TM	08/24/74	09/14/74
DD 103964	DC 031334	C014TM	09/15/74	10/04/74
DD 103965	DC 031335	C015TM	10/05/74	10/23/74
DD 103966	DC 031336	C016TM	10/23/74	11/18/74
DD 103967	DC 031337	C017TM	11/18/74	12/20/74
DD 103968	DC 031338	C018TM	12/20/74	01/27/75
DD 103969	DC 031339	C019TM	01/27/75	03/08/75
DD 103970	DC 031340	C020TM	03/08/75	05/06/75
DD 103971	DC 031341	C021TM	05/06/75	11/04/75
DD 103972	DC 031342	C022TM	11/05/75	04/14/76
DD 103973	DC 031343	C023TM	04/14/76	06/20/76
DD 103974	DC 031344	C024TM	06/20/76	09/04/76
DD 103975	DC 031345	C025TM	09/05/76	12/05/76
DD 103976	DC 031346	C026TM	12/05/76	03/10/77
DD 103977	DC 031347	C027TM	03/10/77	05/07/77
DD 103978	DC 031348	C028TM	05/02/77	06/26/77
DD 103979	DC 031349	C029TM	06/26/77	10/03/77
DD 103980	DC 031350	C030TM	10/03/77	01/03/78
DD 103981	DC 031351	C031TM	01/03/78	07/04/78
DD 103982	DC 031352	C032TM	07/05/78	10/11/79

** This tape, submitted by the PI, contains a compilation of several input tapes and the time coverage is not continuous.

AE-D

Telemetry Data

75-096A-00D SPIO-00039

This data set consists of 8 magnetic tapes. The tapes were created on a VAX system written in high density. The DD tapes are 8mm and the DC tapes are 4mm. The tape numbers, labels and start/stop times are listed below.

D-Number	C-Number	Label	Start/Stop time
-----	-----	-----	-----
DD 103983	DC 031353	D000TM	01/01/75 11/19/80 **
DD 103984	DC 031354	D003TM	10/06/75 10/22/75
DD 103985	DC 031355	D004TM	10/23/75 11/07/75
DD 103986	DC 031356	D005TM	11/07/75 11/25/75
DD 103987	DC 031357	D006TM	11/25/75 12/13/75
DD 103988	DC 031358	D007TM	12/13/75 01/02/76
DD 103989	DC 031359	D008TM	01/02/76 01/21/76
DD 103990	DC 031360	D009TM	01/21/76 01/29/76

** This tape, submitted by the PI, contains a compilation of several input tapes and the time coverage is not continous

AE-E

Telemetry Data

75-107A-00D SPIO-00106

This data set consists of 32 magnetic tapes. The tapes were created on a VAX system written in high density. The DD tapes are 8mm and the DC tapes are 4mm. The tape numbers, labels and start/stop times are listed below.

D-Number	C-Number	Label	Start/Stop time	
-----	-----	-----	-----	-----
DD 103991	DC 031361	E000TM	10/07/75	02/10/81 **
DD 103992	DC 031362	E010TM	11/20/75	12/12/75
DD 103993	DC 031363	E011TM	12/12/75	12/30/75
DD 103994	DC 031364	E012TM	12/30/75	02/01/76
DD 103995	DC 031365	E013TM	02/03/76	03/02/76
DD 103996	DC 031366	E014TM	03/02/76	04/26/76
DD 103997	DC 031367	E015TM	04/26/76	06/27/76
DD 103998	DC 031368	E016TM	06/27/76	08/27/76
DD 103999	DC 031369	E017TM	08/28/76	10/26/76
DD 104000	DC 031370	E018TM	10/27/76	01/07/77
DD 104001	DC 031371	E019TM	01/08/77	03/18/77
DD 104002	DC 031372	E020TM	03/19/77	05/16/77
DD 104003	DC 031373	E021TM	05/16/77	07/03/77
DD 104004	DC 031374	E022TM	07/04/77	09/19/77
DD 104005	DC 031375	E023TM	09/20/77	12/18/77
DD 104006	DC 031376	E024TM	12/19/77	04/06/78
DD 104007	DC 031377	E025TM	04/07/78	07/28/78
DD 104008	DC 031378	E026TM	07/29/78	11/10/78
DD 104009	DC 031379	E027TM	11/11/78	02/02/79
DD 104010	DC 031380	E028TM	02/02/79	04/03/79
DD 104011	DC 031381	E029TM	04/03/79	06/14/79
DD 104012	DC 031382	E030TM	06/14/79	08/31/79
DD 104013	DC 031383	E031TM	09/01/79	11/13/79
DD 104014	DC 031384	E032TM	11/13/79	01/27/80
DD 104015	DC 031385	E033TM	01/28/80	04/07/80
DD 104016	DC 031386	E034TM	04/08/80	06/20/80
DD 104017	DC 031387	E035TM	06/20/80	09/02/80
DD 104018	DC 031388	E036TM	09/03/80	11/05/80
DD 104019	DC 031389	E037TM	11/06/80	12/29/80
DD 104020	DC 031390	E038TM	12/30/80	02/19/81
DD 104021	DC 031391	E039TM	02/20/81	04/21/81
DD 104022	DC 031392	E040TM	04/22/81	06/10/81

** This tape, submitted by the PI, contains a compilation of several input tapes and the time coverage is not continuous.

AE-C, AE-D, & AE-E

Orbit/Attitude Data

73-101A-00E	XXNO-00550
75-096A-00E	XXNO-00434
75-107A-00E	XXNO-00040

These data sets are contained on 1 magnetic tape. The tape was created on a VAX system written in high density. The DD tape is 8mm and the DC tape is 4mm. The tape number, label and start/stop time is listed below.

D-Number	C-Number	Label	Start/Stop Time
-----	-----	-----	-----
DD-104023	DC 031393	AEOADA	

Σ-9 O/A info

May 1974

TM-3005-V00-R1

73-101A-00E

75-096A-00E

75-107A-00E

3.2 ORBIT/ATTITUDE DATA PROCESSING

3.2.1 Data Specifications

All orbit/attitude data are initially computed on the Orbit/Attitude Processor (IBM S/360-95) and transmitted to the Central Computer via hardwire lines. In the event there is a failure of the hardwire lines, backup orbit or attitude tapes are hand carried to the Central Computer. When data is being transmitted from the Orbit/Attitude Processor, it is received at the Central Computer by special Xerox software which copies it onto a disk file. When the transmission is complete, a DMF job is initiated to analyze the file for obvious errors and condense the data into a more efficient file structure for permanent storage on disk. In addition, the transmitted data is copied onto a 1600-bpi backup tape at this time.

It is estimated that all orbit/attitude data can be stored on disk. Therefore, there is no need for promotion of old data from tape to disk as is the case with telemetry data.

Orbit data and attitude data are created and managed completely independently. Four orbit files are maintained on the Central Computer: a predicted orbit element file, a definitive orbit element file, a daily orbit file, and a 4-minute orbit file. Concerning attitude data, a directory file and a permanent data file are maintained on the Central Computer.

Orbit data may be predicted or definitive. In the orbit files where all data is kept without any deletions, the newest data are considered most accurate in the case of time overlaps. In the orbit files where overwriting may occur, predicted data may be overlaid with predicted or definitive data in the case of overlaps. Definitive orbit data is not overlaid.

When a request is made for orbit/attitude data through OAREAD, the requested parameters are computed on the basis of the data stored in the previously mentioned OA data files. In the case of orbital parameters, definitive data are used

May 1974

TM-3005-V00-R1

in the computations whenever possible; whereas predicted data are used only when definitive data is lacking. To ensure accuracy, numerical interpolation over time is used in the computation of orbit/attitude data whose request time does not exactly correspond to the attached time of information on the OA Data Base.

3.2.2 OAREAD

3.2.2.1 Purpose

The purpose of the OAREAD subroutine is to provide FORTRAN-callable access to the AE orbit/attitude data base on the Central Computer. Requests for data are time referenced. Specific orbit/attitude parameters are selected through an output mapping feature. Data may be requested at a number of uniformly distributed times over (up to) a 30-minute period with a single call to OAREAD.

3.2.2.2 Calling Sequence

CALL OAREAD (SATID, DATE, TIME, IERR, MAP, DATA, N, INC,
MAX)

3.2.2.3 Input

<u>Argument</u>	<u>Type</u>	<u>Definition</u>
SATID	Character	A character specifying the AE satellite identification (must be C, D, or E). A literal such as C is an acceptable argument. If a (fullword) variable is used as the argument, the character must be the left-most byte in the word (i.e., left justified); the right-most three bytes may have any value.
DATE	Integer	A five-digit number of the form yyddd, which specifies the year (e.g., 73) and Julian day of year (e.g., January 1st = 001) of the first requested orbit/attitude data.
TIME	Integer	The number specifying the time in milliseconds of day of the first data requested.
MAP	Integer	An array (of length equal to the number of orbit/attitude parameters requested plus one) the contents of which are selection codes for orbit/attitude parameters. (See Table 3-2 for available orbit/attitude parameters.) MAP(1) must contain the number of additional words in MAP, say

Table 3-2. OAREAD Parameters (1 of 4)

MAP NO.	SYMBOL	DESCRIPTION	UNITS
1		PREDICT/DEFINITIVE ORBIT FLAG = 0, DEFINITIVE, = 1, PREDICTED	
2	P	PERIOD	MINUTES
3	i	INCLINATION	DEGREES
4	e	ECCENTRICITY	
5	a	SEMIMAJOR AXIS	KILOMETERS
6	ω	ARGUMENT OF PERIGEE	DEGREES
7	Ω	RIGHT ASCENSION OF ASCENDING NODE	DEGREES
8 - 10		GEI VECTOR NORMAL TO ORBIT PLANE (IN DIRECTION $P \times V$)	UNIT VECTOR
11		APOGEE HEIGHT	KILOMETERS
12		PERIGEE HEIGHT	KILOMETERS
13		ORBIT NUMBER	
14		TIME FROM PERIGEE	SECONDS
15		SUNLIGHT/DARKNESS FLAG = 0, DARKNESS, = 1, SUNLIGHT	
16	GST	GREENWICH SIDEREAL TIME ANGLE MEASURED EASTWARD FROM THE FIRST POINT OF ARIES TO THE GREENWICH MERIDIAN. GST ₀ WILL BE STORED ONCE PER DAY AT 0 U. T. (= t ₀). GST = GST ₀ + $\omega(t - t_0)$.	RADIANS
17 - 19	S _x S _y S _z	GEI VECTOR TOWARD SUN	UNIT VECTOR
20 - 22	M _x M _y M _z	GEI VECTOR FROM SATELLITE TOWARD MOON	KILOMETERS
23 - 25	P _x P _y P _z	GEI SATELLITE POSITION VECTOR	KILOMETERS
26 - 28	V _x V _y V _z	GEI SATELLITE VELOCITY VECTOR EACH VELOCITY COMPONENT WILL BE EVALUATED USING THE 4TH DEGREE POLYNOMIAL DERIVED FROM THE 5TH DEGREE FIT TO THE CORRESPONDING POSITION COMPONENT.	KILOMETERS PER SECOND
29 - 31	R _x R _y R _z	GEI SATELLITE VELOCITY RELATIVE TO ROTATING ATMOSPHERE $R_x = V_x + \omega P_y$ $R_y = V_y - \omega P_x$ $R_z = V_z$	KILOMETERS PER SECOND

Table 3-2. OAREAD Parameters (2 of 4)

MAP NO.	SYMBOL	DESCRIPTION	UNITS
32	h	HEIGHT ABOVE SPHERIOD FIRST COMPUTE $r = \sqrt{p_x^2 + p_y^2 + p_z^2}$ AND $\sin \varphi' = p_z/r$ THEN $h = r - R_e [1 - (f + 3/2f^2) \sin^2 \varphi' + 3/2f^2 \sin^4 \varphi']$	KILOMETERS
33	φ	GEODETTIC LATITUDE OF SUBSATELLITE POINT FIRST COMPUTE $\tan \varphi' = p_z / \sqrt{p_x^2 + p_y^2}$ THEN APPROXIMATE THE SUBSATELLITE POINT BY THE INTERSECTION OF THE RADIUS VECTOR WITH THE SPHERIOD AND CALCULATE ITS GEO-DETTIC LATITUDE: $\varphi = \frac{180}{\pi} \tan^{-1} [(1-f)^{-2} \tan \varphi']$	DEGREES
34	λ	EAST LONGITUDE OF SATELLITE $\lambda = \frac{180}{\pi} [\text{ATAN2}(p_y, p_x) - \text{GST}]$	DEGREES
35		MINIMUM RAY HEIGHT	KILOMETERS
36		MINIMUM RAY LATITUDE IF $(P \cdot S) \geq 0$, LET $Q = P$. IF $(P \cdot S) < 0$, CALCULATE $Q = P - (P \cdot S)S$. APPROXIMATE HEIGHT AND LATITUDE AS FOR PARAMETERS 32 AND 33 USING Q IN PLACE OF P	DEGREES
37		LOCAL APPARENT SOLAR TIME $12 + \frac{12}{\pi} \text{ATAN2}(p_y s_x - p_x s_y, p_x s_x + p_y s_y)$	HOURS
38		LOCAL MAGNETIC TIME SUPPOSE φ'_n AND λ_n ARE GEOCENTRIC LATITUDE AND EAST LONGITUDE OF NORTH MAGNETIC POLE: FIRST COMPUTE UNIT VECTOR, N , TOWARD MAGNETIC POLE $N_x = \sin \varphi'_n \cos (\lambda_n + \text{GST})$ $N_y = \sin \varphi'_n \sin (\lambda_n + \text{GST})$ $N_z = \cos \varphi'_n$ THEN COMPUTE SUN IN PLANE OF MAGNETIC EQUATOR $S_x = S - (S \cdot N)N$ $S_y = N \times S_x$ THEN LOCAL MAGNETIC TIME = $\text{ATAN2}(P S_y, P S_x)$	HOURS
39	L	McILWAIN'S SHELL PARAMETER	EARTH RADIUS

Table 3-2. OAREAD Parameters (3 of 4)

MAP NO.	SYMBOL	DESCRIPTION	UNITS
40		INVARIANT LATITUDE = $\frac{180}{\pi} \cos^{-1} \frac{1}{L}$	DEGREES
41	$ B $	MAGNETIC FIELD STRENGTH	GAUSS
42 - 44	$B_x B_y B_z$	GEI MAGNETIC FIELD VECTOR	GAUSS
45 - 47	$B_r B_\theta B_\varphi$	POLAR COMPONENTS OF MAGNETIC FIELD FIRST COMPUTE UNIT VECTORS IN THE DIRECTIONS $1_r = P / \sqrt{P_x^2 + P_y^2 + P_z^2}$ $1_\varphi = \langle -P_y, P_x, 0 \rangle / \sqrt{P_x^2 + P_y^2}$ $1_\theta = 1_\varphi \times 1_r$ THEN THE POLAR COMPONENTS OF THE FIELD ARE $B_r = B \cdot 1_r$ $B_\theta = B \cdot 1_\theta$ $B_\varphi = B \cdot 1_\varphi$	GAUSS
48	I	GEOCENTRIC MAGNETIC INCLINATION $I = \frac{180}{\pi} \sin^{-1} (-B_r / B)$	DEGREES
49 - 51	$I_x I_y I_z$	GEI COORDINATES OF INGRESS (NORTH) INTERSECT OF MAGNETIC FIELD LINE THROUGH SATELLITE	KILOMETERS
52 - 54	$E_x E_y E_z$	GEI COORDINATES OF EGRESS (SOUTH) INTERSECT POINT	KILOMETERS
55, 56	$\varphi_I \lambda_I$	GEODETTIC LATITUDE AND LONGITUDE OF INGRESS POINT $\varphi_I = \frac{180}{\pi} \tan^{-1} [(1-f)^{-2} I_z / \sqrt{I_x^2 + I_y^2}]$ $\lambda_I = \frac{180}{\pi} [\text{ATAN2}(I_y, I_x) - \text{GST}]$	DEGREES
57, 58	$\varphi_E \lambda_E$	GEODETTIC LATITUDE AND LONGITUDE OF EGRESS POINT	DEGREES
59 - 67	T	3-BY-3 ROTATION MATRIX FOR TRANSFORMATION FROM SPACECRAFT COORDINATES TO GEI COORDINATES. THIS MATRIX WILL BE COMPUTED AS DESCRIBED BY GRELL AND HEADRICK IN THEIR OCTOBER 6, 1972 CORRESPONDENCE. THIS CALCULATION TAKES INTO EFFECT PRECESSION (CONING) BUT NOT NUTATION DUE TO CYLINDRICAL ASYMMETRY. NOTE THAT $T^{-1} = T^T$ WILL TRANSFORM A GEI VECTOR INTO SPACECRAFT COORDINATES. NOTE ALSO THAT THE LAST COLUMN OF T (i.e.,	ORTHOGONAL MATRIX

Table 3-2. OAREAD Parameters (4 of 4)

MAP NO.	SYMBOL	DESCRIPTION	UNITS
59 – 67 (CONT'D)		T (, 3) = ITEMS 65 – 67) GIVES THE GEI COMPONENTS OF THE INSTANTANEOUS SPACECRAFT Z-AXIS.	
68 – 70	$L_x L_y L_z$	GEI COORDINATES OF SPACECRAFT ANGULAR MOMENTUM VECTOR	UNIT VECTOR
71	ψ	PHASE ANGLE OF SPIN – MEASURED FROM VELOCITY VECTOR TO X-AXIS OF SPACECRAFT	RADIANS
72	ω_z	SPIN RATE WITH RESPECT TO NADIR	RADIANS PER SECOND
73	θ_p	CONING ANGLE (BETWEEN L AND SPACECRAFT Z-AXIS)	RADIANS
74	ω_p	CONING RATE	RADIANS PER SECOND
75	ω_p	CONING PHASE – MEASURED FROM ASCENDING NODE IN PLANE NORMAL TO L	RADIANS

<u>Argument</u>	<u>Type</u>	<u>Definition</u>
MAP (Cont'd)		NP. MAP(2) through MAP(NP+1) contain the parameter codes of the parameters to be returned in the order that they are to be returned.
N	Integer	The number of parameter sets requested.
INC	Integer	A number representing the desired time resolution of the returned points in milliseconds. That is, the returned parameter sets will correspond to TIME, TIME+INC, TIME+2*INC, ..., TIME+(N-1)*INC. N times INC must be less than or equal to 30 minutes (i. e., 1,800,000 milliseconds).
MAX	Integer	A number equal to the actual leading dimension of the DATA array as specified in the DIMENSION statement. MAX must be greater than or equal to N.

3.2.2.4 Output

<u>Argument</u>	<u>Type</u>	<u>Definition</u>
IERR	Integer	Return code indicators: = 0, all requested data were returned = 1, at least one requested orbital map parameter (i. e., from 1-58) could not be computed; fill data inserted = 2, at least one requested attitude map parameter (i. e., from 59-75) could not be computed; fill data inserted = 3, file not available at this time (being updated) = 4, end of file encountered on one of the orbit/attitude data files = 5, invalid SATID argument passed = 6, invalid DATE or TIME argument passed = 7, invalid MAP element passed, i. e., element is greater than 75 or the element is duplicated = 99, outdated version of OAREAD exists in the executing load module

<u>Argument</u>	<u>Type</u>	<u>Definition</u>
IERR (Cont'd)		= -1, a disk input/output (I/O) error occurred = -2, invalid N or INC argument passed, i.e., either N is less than or equal to 0 or INC is less than 0 or N times INC is greater than 30 minutes (i.e., 1,800,000 milliseconds)
DATA	Real	An array that will contain the returned orbit/ attitude parameters. All parameters are returned as real (floating point) values. Each set of parameters, corresponding to a time, is stored in a row of the array. (DATA must be dimensioned at least $N \times NP$. Thus, the parameter requested by MAP(2) at TIME is stored in DATA(1, 1), from TIME+INC in DATA(2, 1), and so on. Fill data (i.e., 9999999.0) is inserted for those requested parameters which could not be computed.

3.2.2.5 Processing Narrative

Initially, OAREAD performs a syntax check on the parameters in the user's calling sequence. Barring no errors, OAREAD then determines which routines are to be invoked according to the requested map elements. The routines read data from one or more of the orbit/attitude data files before performing computations. In cases where the user's request time does not exactly correspond to the times of the data on the orbit/attitude data files, interpolations are performed to ensure accuracy. Following the computations of all of the map parameters for the N time requests, OAREAD sets the return code denoting the success of the call prior to returning to the calling program.

3.2.2.6 Programming Notes

The OAREAD routine performs only those calculations necessary to produce the requested parameters. Requesting parameters which are not used, wastes CPU time.

In the case where the user desires many parameter sets over a particular time interval, the most efficient manner is to make as few calls to OAREAD as possible and set N to a high value as opposed to making many calls to OAREAD with N set to a low value. Certain logic is repeated when multiple calls to OAREAD are made, but performed only once on a single call. However, this method can cause an anomaly if no attitude data exists for the specified start date/time. In this case, fill data is returned in the DATA array, even though data might exist for a portion of the time span. To avoid this, N should be set equal to 1 and INC equal to 0 to check whether data exists for the specified date/time. Then, if data does exist, N should be set to a high value for the actual data retrieval. Another possible approach would involve having two OAREAD calls, one for orbit data with N set to a high value, and one for attitude data with N set to a low value.

The size of the DATA array passed to the OAREAD routine must be large enough to accommodate the user's current request of M parameters (up to 75) for N time requests. Fill data (9999999.0) are inserted into the applicable portion of the DATA array [i.e., DATA(1,1) through DATA(N,M)] before any computations are attempted by OAREAD.

3.2.2.7 Restrictions

N times INC must be less than 30 minutes or 1,800,000 milliseconds. Therefore, for each call to OAREAD, data may not be requested for a period greater than 30 minutes.

3.2.2.8 Size

8.3K words.

May 1974

TM-3005-V00-R1

3.2.2.9 Example

In this example, orbit/attitude information on January 13, 1974, beginning at noon is requested. Ten points (times) at half-second intervals are specified.

```
INTEGER DATA
DIMENSION MAP(4), DATA(10,3)
DATA MAP/3, 2, 10, 12/, N/10/, MAX/10/
.
.
.
CALL OAREAD ('C', 74013, 43200000, IERR, MAP, DATA, N,
             500, MAX)
```

The 2nd, 10th, and 12th orbit/attitude parameters (orbit period, Z component of the GEI orbit normal, and perigee height) are selected for return. Upon return from OAREAD, N will contain the number of parameters sets returned and IERR will contain the appropriate return code for conditions encountered. Return orbit/attitude parameters will be stored in DATA as follows:

```
DATA(1,1) = 2nd parameter for time 43200000
DATA(1,2) = 10th parameter for time 43200000
DATA(1,3) = 12th parameter for time 43200000
DATA(2,1) = 2nd parameter for time 43200500
DATA(2,2) = 10th parameter for time 43200500
.
.
.
DATA(10,3) = 12th parameter for time 43204500
```

73-101A-00E
75-096A-00E
75-107A-00E

**DYNAMICS EXPLORER-2
ORBIT/ATTITUDE (O/A) INSTALLATION GUIDE**

Prepared for

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ABSTRACT

This document provides detailed procedures for installing a Dynamics Explorer (DE) Orbit/Attitude (O/A) data base on VAX computers using VMS operating system and relevant software tools to access the O/A data base. Section 1 provides loading instructions to download and query the Attitude, Intermediate Orbit, Daily Orbit, and Orbit Element files and to query each datum within the O/A data base. Section 2 provides software tools to access the O/A data base via the OAREAD subsystem using an identical call sequence as the one used on the IBM 4341 and Sigma-9 machines. Section 3 outlines the error code descriptions, and functional breakdown of the OAREAD software subsystem. Section 4 contains OAREAD data dictionary entries for the complete DE data base. A sample driver for OAREAD is shown in Section 5. Appendix A lists the Attitude passes with less than 6.5 minutes of data, and Appendix B provides a list of missing DE-2 Time Orbit data.

TABLE OF CONTENTS

<u>Section 1. LOADING SOFTWARE AND DATA FROM TAPE.....</u>	1
1.1 Introduction.....	1
1.2 Load Attitude Data.....	2
1.3 Query Attitude Data.....	3
1.4 Load Orbit Data Files.....	4
1.5 Query Orbit Data Files.....	5
1.6 Load Daily Orbit Data.....	6
1.7 Query Daily Orbit Data.....	7
1.8 Load Orbit Element Data.....	8
1.9 Query Orbit Element Data.....	9
<u>Section 2. OAREAD SUBSYSTEM FOR VAX.....</u>	10
2.1 Introduction.....	10
2.2 Linking Procedure.....	11
<u>Section 3. ORBIT/ATTITUDE ERROR CODE TRANSLATION.....</u>	12
3.1 Introduction.....	12
3.2 Parameter List of Available Return Arguments From OAREAD.....	13
<u>Section 4. O/A DATA DICTIONARY.....</u>	15
4.0 Introduction.....	15
4.1 Orbit/Attitude Data Dictionary of Data Elements (Part 1).....	15
4.2 Orbit/Attitude Data Dictionary of Data Elements (Part 2).....	16
4.3 Orbit/Attitude Data Dictionary of Data Elements (Part 3).....	18
<u>Section 5. OAREAD AND TEST DRIVER.....</u>	19
5.0 Introduction.....	19
5.1 Sample Link Procedure.....	21
<u>Appendix A - DE-B Attitude Passes Containing 6 Minutes or Less..</u>	22
<u>Appendix B - Missing DE-B Timed Orbit Data.....</u>	23

SECTION 1. LOADING SOFTWARE AND DATA FROM TAPE

1.1 INTRODUCTION

User sites of the Orbit/Attitude data base will have four tapes marked "OAREAD and Software Tools," "ATTITUDE," "ORBIT," and "DAILY ORBIT" respectively. The "OAREAD and Software Tools" tape is 1600 bpi with a tape label of OAREAD. The other three tapes are pure data recorded at 1600 bpi and are to be mounted FOREIGN. To load the software tape "OAREAD and Software Tools," mount the tape with the tape label of "OAREAD," set the input tape density to 1600 bpi and transfer the Transportable Applications Executive (TAE) contents of the magnetic tape into your directory via the VMS command "COPY." Make sure that all software tools are in your working directory before continuing. The list of software modules and data files needed follows:

FLD.OBJ	FORMTIME.OBJ	GENATT.OBJ	GENDAILY.OBJ
GENELEM.OBJ	GENORBIT.OBJ	KEY.OBJ	MAKEY.OBJ
OAREAD.OBJ	OATYPE.OBJ	PROMPT.OBJ	PRTORB.OBJ
QUERYATT.OBJ	QUERYDAY.OBJ	QUERYELM.OBJ	QUERYORB.OBJ
TIMORB.OBJ	OATYPE.MNU	AFLATELM.DAT	BFLATELMDAT

1.2 LOAD ATTITUDE DATA

After you have loaded the software tape into your VAX directory, you will have to link the object modules into executable programs. The attitude load program is called GENATT. To link GENATT simply do the following:

```
$ LINK GENATT, KEY, FLD
```

Once you create the executable module that produces VAX ISAM disk structures from a converted VAX attitude input tape, the following must be done:

1. Mount DE attitude tape on tape drive (1600 BPI).
2. Allocate your tape drive.
3. Mount your tape as a FOREIGN ASCII Tape.
4. Assign the logical name TAPE to your tape device: \$ASSIGN MTAO: TAPE.
5. Execute Program GENATT.

When GENATT starts executing, you will be prompted with several questions. An example of a GENATT run stream is shown below:

```
Which spacecraft (DE-A, or DE-B): B<Cr>
Enter start date (YYDDD): 0<Cr>
Enter end date (YYDDD): 83048<Cr>
```

Run time status messages

```
End of job; collect tape.
```

1.3 QUERY ATTITUDE DATA

Once your attitude load job is finished, your directory will contain a new disk file: BATTITUDE.DAT. It should have about 23,646 blocks allocated. It will be keyed by date and time to milliseconds.

If you desire to query the Attitude file, make sure that an executable version of the attitude query program is located in your directory. If not, do the following:

1. LINK QUERYATT, KEY, PROMPT, FORMTIME, FLD
2. RUN QUERYATT

QUERYATT will query the DE attitude file for DE. A typical run stream would be the following:

```
RUN QUERYATT
Query Attitude Function Activated
Enter: 'A' for DE-A, 'B' for DE-B
Enter Selection : B<Cr>
Enter date (YYDDD): 82030<Cr>
Do you want the time in milliseconds? Y<Cr>
Enter time (SSSSMMM, <seconds of day><milliseconds>: 0<Cr>
```

ATTITUDE RUN-TIME INFORMATION DISPLAYED FOR TIME INTERVAL.

- OR -

```
RUN QUERYATT<Cr>
Query Attitude Function Activated
Enter: 'A' for DE-A, 'B' for DE-B
Enter Selection : B<Cr>
Enter date (YYDDD): 82030<Cr>
Do you want the time in milliseconds? N<Cr>
Enter time (HHMMSS): 0<Cr>
```

ATTITUDE RUN-TIME INFORMATION DISPLAYED FOR TIME INTERVAL.

1.4 LOAD ORBIT DATA FILES

After you have loaded the software tape into your VAX directory, you will have to link the object modules into executable programs. The orbit load program is called GENORBIT. To link GENORBIT do the following:

```
$LINK GENORBIT, MAKEY
```

Once you create the executable module that produces VAX ISAM disk structures from a converted VAX orbit input tape, the following must be done:

1. Mount DE-B Orbit tape on tape drive (1600 BPI).
2. Allocate your tape drive.
3. Mount your tape as a FOREIGN ASCII tape.
4. Assign the logical name TAPE to your tape device.
5. Execute Program GENORBIT.

When GENORBIT starts executing you will be prompted with several questions. An example of GENORBIT run stream is shown below:

```
Which spacecraft (DE-A, or DE-B): B<Cr>
Enter start date (YYDDD): 0<Cr>
Enter end date (YYDDD): 83048<Cr>
```

ORBIT RUN-TIME INFORMATION DISPLAYED FOR TIME INTERVAL.

End of job; collect tape.

1.5 QUERY ORBIT DATA FILES

Once your load orbit job is finished, your directory will contain two new disk files: BORBLEVEL.DAT AND BTIMEDORB.DAT. The first should have about 1,392 blocks allocated, and the second should have about 49,935 blocks allocated. Both files will be keyed by date and time to the minute of the day. The BORBLEVEL.DAT file will also have a secondary key of the orbit number. If you want to query the orbit files, make sure that an executable version of the orbit query program is located in your directory. If not, do the following:

1. LINK QUERYORB, TIMORB, PRTORB, FORMTIME, FLD
2. RUN QUERYORB

QUERYORB will query the DE orbit file for DE-B. A typical run stream would be the following:

```
RUN QUERYORB
Query Attitude Function Activated
Enter: 'A' for DE-A, 'B' for DE-B
Enter Selection : B<Cr>
Enter date (YYDDD): 82030<Cr>
Do you want to query the timed orbit data base? Y<Cr>
Enter time (HHMMSS): 0<Cr>
```

TIMED ORBIT RUN-TIME INFORMATION DISPLAYED FOR TIME INTERVAL.

- OR -

```
RUN QUERYORB<Cr>
Enter date (YYDDD): 82030<Cr>
Do you want to query the timed orbit data base? N<Cr>
Do you want to query the orbit level data base? Y<Cr>
Do you want to key on (T=time, O=orbit number): T<Cr>
Enter time (HHMMSS): 0<Cr>
```

ORBIT LEVEL RUN-TIME INFORMATION DISPLAYED FOR TIME INTERVAL.

1.6 LOAD DAILY ORBIT DATA

After you have loaded the software tape into your VAX directory, you will have to link the object module into an executable program. The daily orbit load program is called GENDAILY. To link GENDAILY, simply type this command into your VAX system:

```
$LINK GENDAILY
```

Once you create the executable module that produces VAX ISAM disk structures from a converted VAX Daily orbit tape, the following must be done:

1. Mount DE daily orbit tape on tape drive (1600 BPI).
2. Allocate your tape drive.
3. Mount your tape as a FOREIGN ASCII tape.
4. Assign the logical name TAPE to your tape device: \$ ASSIGN MTAO: TAPE.
5. Execute Program GENDAILY.

When GENDAILY starts you will be prompted with several questions. An example of a GENDAILY run stream is shown below:

```
Enter start date (YYDDD): 0<Cr>  
Enter end date (YYDDD): 89365<Cr>
```

Run time status messages

End of job; collect tape.

1.7 QUERY DAILY ORBIT DATA

Once the daily orbit load job is finished, your directory will contain a new disk file: DAILYORB.DAT. It should have about 285 blocks allocated. It will be keyed by date. If you want to query the daily orbit file, make sure that an executable version of the daily orbit query program is located in your directory. If not, do the following:

1. LINK QUERYDAY, PROMPT
2. RUN QUERYDAY

QUERYDAY will query the DE Daily Orbit file for DE-B. A typical run stream would be the following:

```
RUN QUERYDAY
Enter date (YYDDD): 82030<Cr>
```

DAILY ORBIT RUN-TIME INFORMATION DISPLAYED FOR 82030.

1.8 LOAD ORBIT ELEMENT DATA

After you have loaded the software tape into your VAX directory, you will have to link the object module into an executable program. The orbit element load program is called GENELEM. To link GENELEM simply type this command into your VAX system:

```
$ LINK GENELEM
```

Once you create the executable module that produces VAX ISAM disk structures from a converted VAX Orbit Element file, the following must be done:

1. Make sure you have the input Orbit Element files on disk (contained on your source tape BFLATELM.DAT, AFLATELM.DAT).
2. Execute program GENELEM.

When GENELEM is executing in your directory, the input "flat file" BFLATELM.DAT or AFLATELM.DAT will be read record by record and written into an ISAM VAX VMS file. After execution, the ISAM file should be about 100 to 200 blocks in length. When the message "End of Job" appears, all orbit element data have been loaded into the ISAM file.

1.9 QUERY ORBIT ELEMENT DATA

Once you have loaded your Orbit Element file, your directory will contain a new disk file: BORBELM.DAT. It should have about 75 to 200 blocks allocated. It will be keyed by date. If you want to query the Orbit Element file, make sure that an executable version of the orbit element query program is located in your directory. If not, do the following:

1. LINK QUERYELM, PROMPT.
2. RUN QUERYELM.

QUERYELM will query the DE Orbit Element files. An example of a typical run stream follows:

```
Run QUERYELM
Which Orbit Element File (1=DE1, 2=DE2, 3=QUIT): B<Cr>
Enter date (YYDDD): 82030<Cr>
```

ORBIT ELEMENT RUN-TIME INFORMATION DISPLAYED FOR 82030.

SECTION 2. OAREAD SUBSYSTEM FOR VAX

2.1 INTRODUCTION

Subroutine OAREAD: Orbit and Attitude parameters READ is a 'self contained' object module about 100 blocks long. It takes as input map parameters and extracts/processes information from VAX ISAM disk structures to provide output map parameters (76 in all). If an error occurs during any phase of processing, an error will be returned to the user.

Language: VAX FORTRAN 77

Purpose: To retrieve orbit and attitude data from a data base for a given date and for a specified number of iterations of a specified length.

CALL OAREAD (SATID, DATE, TIME, IERR, MAP, DATA, N, INC, MAX)

<u>ARG NAME</u>	<u>DESCRIPTION OF USAGE</u>
SATID	The SATID (Satellite ID) is an input variable that must be assigned <u>character*1</u> when linking to OAREAD. Valid spacecraft identifications are either <upper case A> for DE-1 or <upper case B> for DE-2. No other values will be accepted.
DATE	The Date requested is an input variable that must be assigned Integer*4 when linking to OAREAD. The format for this input variable is: YYDDD, where YY is the least two significant digits of a calendar year, and DDD is the integer day within the year.
TIME	The time requested is an input variable that must be assigned Integer*4 when linking to OAREAD. The format for this input variable is SSSSSMMM, where SSSSS are seconds in the day and MMM are millisecond in the day.
IERR	An Integer*4 output variable that is associated with ERRBUF(1). (See Section 3, ERROR MESSAGES).
MAP	An Integer*4 input array that contains a list of parameters requested. MAP(1) equals the number of parameters requested.
DATA	A Real*4 output array that contains parameter values.
N	An input Integer*4 variable that contains the number of sets of data requested.
INC	An input Integer*4 variable that contains the number of seconds between sets of data.
MAX	An input Integer*4 variable that contains the maximum number of parameters in DATA.

Error handling:

If this routine detects an error, the code for the error is stored in ERRBUF+1, the return code is set to BADRET and the routine exists. (See Table 1 for error returns.)

Return Code:

GOODRT	Good Return.
CONDRT	Conditional Return.
RADRET	Error was detected but not logged. ERRBUF contains additional codes.

Major Code (ERRBUF)---(See Section 3, Error Messages.)

Minor Code (ERRBUF+1)---(See Section 3, Error Messages.)

2.2 LINKING PROCEDURE: INSTALLING OAREAD SUBSYSTEM TO YOUR APPLICATION

To link your application software with OAREAD, just include the OAREAD object file with your LINK statement. It is a self-contained object module with no other library required by itself.

The OAREAD object module is 100 blocks long and contains all necessary subroutine and functions to process: timed orbit, orbit level, daily orbit, and attitude parameters, including eight orbit element parameters. The list of reserved subroutine names are the following: ATCOMP, ATPROC, ATTRTV, CLOSEOA, CODES, DMFERR, DMFVCK, FCROSP, FDOTP, FNINIT, IMOVE, INTEPR, OAACC, OAERROR, OARCLS, OPENOA, ORBATT, ORBELM, ORBIT, ORCOMP, ORTIM, POSITION, PVAL, PVELVL, SETERR, TSTBIT, VELPOL, YDMS.

Production software using OAREAD should not have any of the names listed above as subroutine/function names. The list of reserved common block names are the following: ATTCOM, OUTCOM, ERRCOM, OACOM, and POSITION. Production software using OAREAD should avoid using the common block names listed above.

SECTION 3. ORBIT/ATTITUDE ERROR CODE TRANSLATION

3.1 INTRODUCTION

This section lists possible error messages returned by OAREAD. A good return (all requested parameters returned) comes back as binary zero. Also listed in this section are all available map parameters that may be requested using OAREAD.

<u>Major Code ERRBUF(1)</u>	<u>Error Message Meaning</u>
0	Function successfully performed.
1	Function partially performed but may be acceptable.
2	Not currently used by OAREAD subsystem.
3	Not currently used by OAREAD subsystem.
4	Function terminated due to error that is probably the caller's responsibility.
5	Function terminated due to error that is probably equipment or facility related.

<u>Minor Code ERRBUF (2)</u>	<u>Error Message Meaning</u>
----------------------------------	------------------------------

ERROR IN INCREMENT INPUT.

0	All requested data were returned.
1	At least one requested map parameter from 1 to 58 could not be computed. File data were inserted.
2	At least one requested map parameter from 59 to 76 could not be computed. File data were inserted.
3	File not available at this time (being updated).
4	End of file encountered by one of the O/A data files.
5	Invalid SATID argument passed.
6	Invalid date or time argument passed.
7	Invalid map element passed. Either duplicate or element number > 76.

3.2 PARAMETER LIST OF AVAILABLE RETURN ARGUMENTS FROM OAREAD

<u>OAREAD Parameter</u>	<u>Description</u>
1	PREDICT/DEFINITIVE ORBIT FLAG. Definitive=0, Predictive=1.
2	PERIOD IN MINUTES.
3	INCLINATION IN DEGREES.
4	ECCENTRICITY.
5	SEMIMAJOR AXIS IN KILOMETERS.
6	ARGUMENT OF PERIGEE IN DEGREES.
7	RIGHT ASCENSION OF ASCENDING NODE IN DEGREES.
8	GEI VECTOR NORMAL TO ORBIT PLANE (UNIT VECTOR IN DIRECTION $P \times V$).
11	APOGEE HEIGHT IN KILOMETERS.
12	PERIGEE HEIGHT IN KILOMETERS.
13	ORBIT NUMBER.
14	TIME FROM PERIGEE IN SECONDS.
15	SUNLIGHT/DARKNESS FLAG Darkness=0, Sunlight=1.
16	GREENWICH SIDEREAL TIME IN RADIAN.
17	GEI VECTOR TOWARD SUN.
20	GEI VECTOR FROM SATELLITE TOWARD MOON.
23	GEI SATELLITE POSITION VECTOR.
26	GEI SATELLITE VELOCITY VECTOR.
29	GEI SATELLITE VELOCITY RELATIVE TO ROTATING ATMOSPHERE.
32	HEIGHT ABOVE SPHEROID.
33	GEODETIC, GEOCENTRIC, GEOMAGNETIC LATITUDE.
34	EAST LONGITUDE OF SATELLITE.

35	MINIMUM RAY HEIGHT.
36	MINIMUM RAY LATITUDE.
37	LOCAL APPARENT SOLAR TIME.
38	LOCAL MAGNETIC TIME.
39	McILWAIN'S SHELL PARAMETER.
40	INVARIANT LATITUDE.
41	GEI FIELD STRENGTH.
42	GEI MAGNETIC FIELD VECTOR.
45	POLAR COMPONENTS OF MAGNETIC FIELD.
48	GEOCENTRIC MAGNETIC INCLINATION.
49	GEI COORDINATES OF INGRESS (NORTH).
52	GEI COORDINATES OF EGRESS (SOUTH).
55	GEODETTIC LATITUDE AND LONGITUDE OF INGRESS POINT.
57	GEODETTIC LATITUDE AND LONGITUDE OF EGRESS POINT.
59	3-BY-3 ROTATION MATRIX FOR TRANSFORMATION FROM SPACECRAFT COORDINATES.
68	GEI COORDINATES OF SPACECRAFT ANGULAR MOMENTUM VECTOR.
71	PHASE ANGLE OF SPIN.
72	SPIN RATE WITH RESPECT TO NADIR.
73	CONING ANGLE.
74	CONING RATE.
75	CONING PHASE.
76	SOLAR ZENITH ANGLE.

SECTION 4. O/A DATA DICTIONARY

4.0 INTRODUCTION

The Data Dictionary is listed according to file type. Within each file type the data elements are listed and described by attribute, byte length, and what they represent. All keys are used in an indexed sequential manner and are used to directly access a block of data. Each block of data represents one or more logical records.

4.1 ORBIT/ATTITUDE DATA DICTIONARY OF DATA ELEMENTS (PART 1)

<u>Byte Span</u>	<u>Word Span</u>	<u>Data Type</u>	<u>Data Name</u>	<u>Attitude Record Layout Description</u>
1:16	1:4	Char	KEY	Date and time to millisecond <primary key>.
17:20	5	I*4	Status	See description on same page.
21:24	6	I*4	Date	Date of attitude point: YYDDD.
25:28	7	I*4	Time	Time of attitude point in milliseconds.
29:30	8	I*2	Alphan	Right ascension in radians.
31:32	8	I*2	DelTan	Declination in radians.
33:34	9	I*2	Psin	Azimuth angle in radians.
35:36	9	I*2	Filler	Will be used to define time to microsecond.
37:40	10	Real	OmegaZn	Spin angle in radians per second.
41:1140				Up to 56 copies of words 5 through 10.

KEY IS COMPUTED FROM LAST ATTITUDE POINT IN BLOCK. KEY FORMAT (YYDDDDHHMMSSXXX) WHERE YY IS THE LAST 2 NUMERIC DIGITS OF YEAR, 'DDD' IS THE DAY OF THE YEAR, 'HH' IS THE HOUR OF DAY, 'MM' IS THE MINUTE OF THE DAY, 'SS' IS THE SECOND OF THE DAY, AND 'XXX' IS THE MILLISECOND OF THE DAY.

STATUS WORD CONTAINS THE FOLLOWING:

'RRSSPPPP' WHERE 'RR' IS THE RECORD COUNT FOR ATTITUDE BLOCK, 'SS' IS THE BLOCK STATUS, WHERE:

SS = 0 = Not last block
SS = 1 = Last block
SS = 2 = First block
SS = 3 = Only block

'PPPP' CONTAINS THE PASS NUMBER FOR THE BLOCK.

<u>Byte Span</u>	<u>Word Span</u>	<u>Data Type</u>	<u>Data Name</u>	<u>Daily Orbit Record Layout Description</u>
1:4	1	I*4	KEY	Date <Primary key>
5:8	2	Real	SUNx	X component of Sun vector.
9:12	3	Real	SUNy	Y component of Sun vector.
13:16	4	Real	SUNz	Z component of Sun vector.
17:20	5	Real	MOONx	X component of Moon vector.
21:24	6	Real	MOONy	Y component of Moon vector.
25:28	7	Real	MOONz	Z component of Moon vector.
29:32	8	Real	SIDEREAL	Sidereal time.

KEY IS COMPUTED FROM DAILY ORBIT POINT IN RECORD. KEY FORMAT (YYDDD0000) WHERE YY IS THE LAST 2 NUMERIC DIGITS OF THE YEAR, 'DDD' IS THE DAY OF THE YEAR, AND '0000' IS THE MINUTE OF THE DAY.

4.2 ORBIT/ATTITUDE DATA DICTIONARY OF DATA ELEMENTS (PART 2)

<u>Byte Span</u>	<u>Word Span</u>	<u>Data Type</u>	<u>Data Name</u>	<u>Orbit Level Record Layout Description</u>
1:4	1	I*4	KEY	Date and time to minute <primary key>.
5:8	2	I*4	YYDDD	Year and date of data orbital item.
9:12	3	I*4	TIME	Millisecond of day for orbital item.
13:16	4	I*4	ORBIT	Orbit number <secondary key>.
17:17	5	BYTE	COUNTER1	Number of ascending nodes.
18:18	5	BYTE	COUNTER2	Number of perigees.
19:19	5	BYTE	COUNTER3	Number of Sun entrances and exits.
20:20	5	BYTE	FILLER	Not used.
21:24	6	I*4	AST1	Ascending node time 1 (not used = -1).
25:28	7	I*4	AST2	Ascending node time 2 (not used = -1).
29:32	8	I*4	AST3	Ascending node time 3 (not used = -1).
33:36	9	I*4	PT1	Perigee time 1 (not used = -1).
37:40	10	I*4	PT2	Perigee time 2 (not used = -1).
41:44	11	I*4	PT3	Perigee time 3 (not used = -1).
45:48	12	I*4	SET1	Sun entrance time 1 (not used = -1).
49:52	13	I*4	SET2	Sun entrance time 2 (not used = -1).
53:56	14	I*4	SET3	Sun entrance time 3 (not used = -1).
57:60	15	I*4	SLET1	Sun light exit time 1 (not used = -1).
61:64	16	I*4	SLET2	Sun exit time 2 (not used = -1).
65:68	17	I*4	SLET3	Sun exit time 3 (not used = -1).
69:72	18	I*4	PREDEF	Predictive/definitive flag from Sigma 9.

<u>Byte Span</u>	<u>Word Span</u>	<u>Data Type</u>	<u>Data Name</u>	<u>Timed Orbit Record Layout Description</u>
1:4	1	I*4	KEY	Date and time to minute <primary key>.
5:8	2	R*4	PX	X Coordinate of satellite position vector Phi.
9:12	3	R*4	PY	Y Coordinate of satellite position vector Phi.
13:16	4	R*4	PZ	Z Coordinate of satellite position vector Phi.

<u>Byte Span</u>	<u>Word Span</u>	<u>Data Type</u>	<u>Data Name</u>	<u>Timed Orbit Record Layout Description</u>
17:20	5	R*4	MCINV	Inverse of Mcilwain's shell parameter.
21:24	6	R*4	IX	X component of ingress (north).
25:28	7	R*4	IY	Y component of ingress (north).
29:32	8	R*4	EX	X component of egress (south).
33:36	9	R*4	EY	Y component of egress (south).
37:40	10	R*4	BMAG1	First 1-minute magnitude in gauss GEI.
41:44	11	R*4	BX1	First minute X component.
45:48	12	R*4	BY1	First minute Y component.
49:52	13	R*4	BZ1	First minute Z component.
53:56	14	R*4	BMAG2	Second 1-minute magnitude in gauss GEI.
57:60	15	R*4	BX2	Second minute X component.
61:64	16	R*4	BY2	Second minute Y component.
65:68	17	R*4	BZ2	Second minute Z component.
69:72	18	R*4	BMAG3	Third 1-minute magnitude in gauss GEI.
73:76	19	R*4	BX3	Third minute X component.
77:80	20	R*4	BY3	Third minute Y component.
81:84	21	R*4	BZ3	Third minute Z component.
85:88	22	R*4	BMAG4	Fourth 1-minute magnitude in gauss GEI.
89:92	23	R*4	BX4	Fourth minute X component.
93:96	24	R*4	BY4	Fourth minute Y component.
97:100	25	R*4	BZ4	Fourth minute Z component.
101:4324				Fourth four copies of words 2 through 25.

4.3 ORBIT/ATTITUDE DATA DICTIONARY OF DATA ELEMENTS (PART 3)

<u>Byte Span</u>	<u>Word Span</u>	<u>Data Type</u>	<u>Data Name</u>	<u>Orbit Element Record Layout Description</u>
1:4	1	I*4	Date	Primary key Date: 'YYDDD'.
5:8	2	I*4	Time	Transmission time in milliseconds.
9:12	3	R*4	Period	Period in minutes (time).
13:16	4	R*4	Inclination	Dimension less quantity.
17:20	5	R*4	Eccentricity	Dimension less quantity.
21:24	6	R*4	SemimajAxis	Semi-major axis (kilometers).
25:28	7	R*4	PerigeeArg	Argument of perigee (degrees).
29:32	8	R*4	RAAN	Ascending node right ascension (degrees).
33:36	9	R*4	ApogeeHeight	Apogee height (kilometers).
37:40	10	R*4	PerigeeAlt	Perigee height (kilometers).
41:44	11	R*4	PeriodRate	Period change rate (minutes/day).
45:48	12	R*4	PerigeeChg	Perigee change rate (degrees/day).
49:52	13	R*4	RAANCHG	Change rate of RAAN (degrees/day).

SECTION 5. OAREAD AND TEST DRIVER

5.0 INTRODUCTION

There is a test driver for the OAREAD subsystem which can extract selected OAREAD parameters for examination. The name of the test driver is OATYPE. It is provided in compiled form as OATYPE.OBJ. After linking the driver with the OAREAD subsystem, you should have OATYPE.MNU in your directory. This data file contains menu structures for OATYPE. To task build the driver with the OAREAD subsystem, do the following:

1. Make sure you have a copy of OATYPE.MNU in your working directory.
2. LINK OATYPE, OAREAD.

After you have completed the above you are ready to execute OATYPE. Below is a typical run stream execution of OATYPE. A list of valid parameters are provided so that the user may understand how the data are arranged in OAREAD.

```
$ RUN OATYPE
ORBIT / ATTITUDE DATA ACCESS ROUTINE
```

Enter the number of variables to be printed.

```
II
01
```

Number of variables printed = 1

```
Is this correct? (Y/N)
Y
```

Enter variable number 1.

```
II
59
```

3-by-3 rotation matrix for transformation from spacecraft coordinates.

```
Is this correct? (Y/N)
Y
```

Enter the date and time at which you would like to have data printed. Use the following format:

```
YYDDD      MSOFDAYX
82065      50000000
DATE=82065  TIME=50000000
```

```
Is this correct? (Y/N)
Y
```

The current increment between points is 500 ms.

Do you want to change this? (Y/N)

N

Currently the no. of pts. printed is set to 1.

Do you want to change this? (Y/N)

N

Enter the satellite for which the data are to be obtained (A/B).

B

Would you like the data to be sent to a temporary file? (Y/N).

N

Function successfully performed. All requested data were returned.

DATE = 82065 TIME = 50000000(13:53:20)

3-by-3 rotation matrix for transformation from spacecraft coordinates.

X	Y	Z
-0.1124197	-0.9391413	0.3246159
0.0144392	0.3251083	0.9455665
-0.9935558	0.1109875	-0.0229881

Do you want to print the next 1 point(s) of data? (Y/N)

N

Next date = 82065, Next time = 50000500

Do you want print data for another time period? (Y/N)

N

Do you want a different set of variables (Y/N)

N

OATYPE ENDING. HAVE A NICE DAY
FORTRAN STOP

5.1 SAMPLE LINK PROCEDURE

To link your application/production software with OAREAD, simply append OAREAD.OBJ to your list of object modules/libraries in your LINK MACRO. (e.g., if you were linking a new version of MVIDS to OAREAD, you would do the following):

```
$ LINK MVIDS, MVIDS.OLB, OAREAD.OBJ
-           -
:           :
:           :
:           : .....>VAX OAREAD SUBSYSTEM
:           : .....>MVIDS Production Library on VAX
:
:
: .....> The MVIDS main routine on VAX
```

The OAREAD object module is 100 blocks long and contains all necessary subroutine and functions to process the following: timed orbit, orbit level, deaily orbit, and attitude parameters including eight orbit element parameters. The list of reserved subroutine names are the following: ATCOMP, ATPROC, ATTRTV, CLOSEOA, CODES, DMFERR, DMFVCK, FCROSP, FDOTP,, FNINIT, IMOVE, INTERP, OAACC, OAERROR, OARCLS, OPENOA, ORBATT, ORBELM, ORBIT, ORCOMP, ORTIM, POSITION, PVAL, PVELVL, SETERR, TSTBIT, VELPOL, YDMS. Production software using OAREAD should not have any of the names listed above as subroutine/function names. The list of reserved common block names are the following: ATTCOM, OUTCOM, ERRCOM, OACOM, and POSITION. Production software using OAREAD should avoid using common block names listed above.

Technical Handbook

Prepared for
Goddard Space Flight Center
National Aeronautics and Space Administration
Washington, D. C.
Contract No. NAS 5-23003

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73-101A-00D
75-096A-00D
75-107A-00D

ALIGNMENT AND CALIBRATION DATA FOR THE ATMOSPHERE EXPLORER C SPACECRAFT

AED R-3973
November 28, 1973

RCA | Government and Commercial Systems
Astro-Electronics Division | Princeton, New Jersey

ALIGNMENT AND CALIBRATION BOOK
ATMOSPHERE EXPLORER "C" MISSION

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
	PREFACE	iii
1.0	Spacecraft Geometry Definition.	1-1
2.0	Alignment Summary	2-1
3.0	Weight, Moment of Inertia, Center of Gravity and Balance Measurements.	3-1
4.0	System Inertia versus Propellant	4-1
5.0	Command List.	5-1
6.0	Hazardous Command List.	6-1
7.0	Telemetry Format.	7-1
8.0	Temperature Telemetry	8-1
9.0	Magnetic Dipole Measurements.	9-1
10.0	Nadir Pulse Locations	10-1
11.0	RF Subsystems	11-1
12.0	Power Subsystem	12-1

APPENDIX A

Analog Telemetry Conversion Coefficients

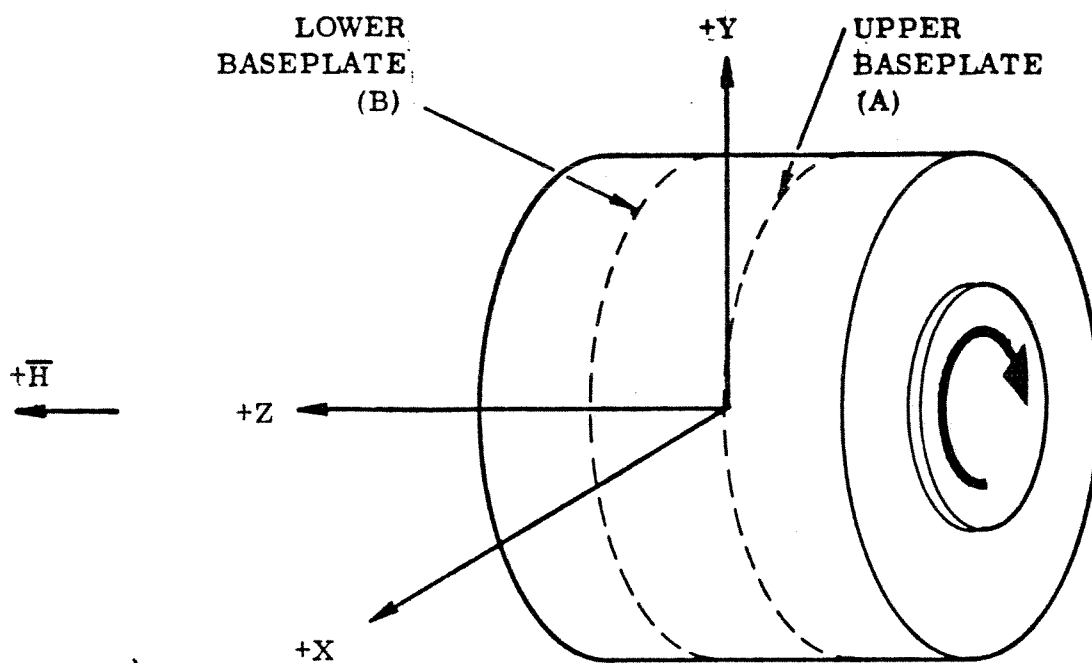
APPENDIX B

Component Serial Numbers

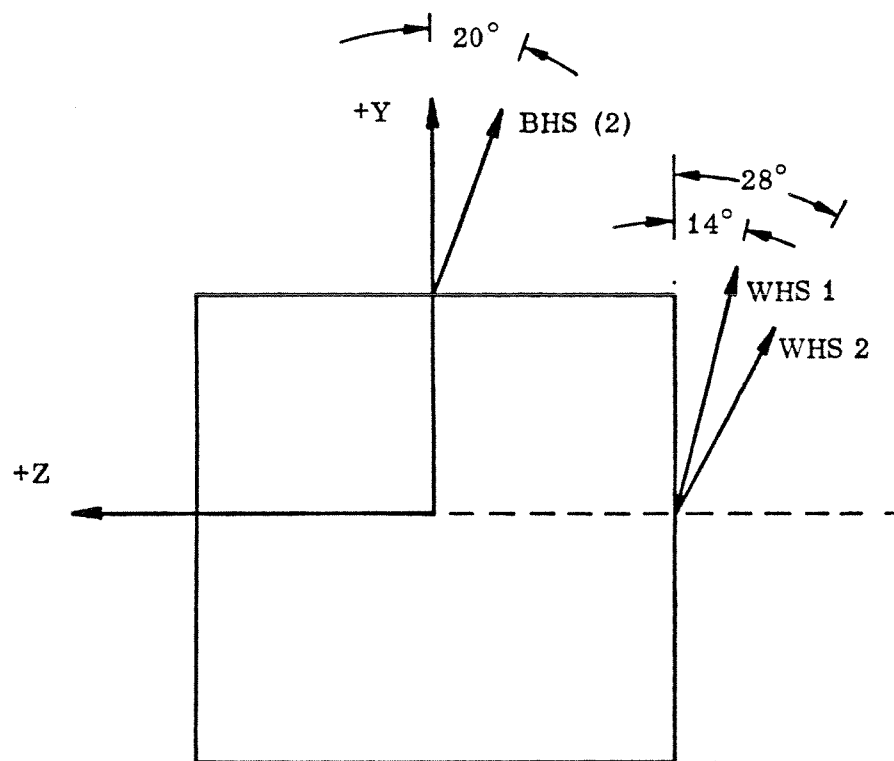
APPENDIX C

History Tape Index

SECTION 1.0



WHEEL ROTATES AS SHOWN (+X INTO +Y)



VIEW ALONG +X

Figure 1-1. Spacecraft Axis Definition

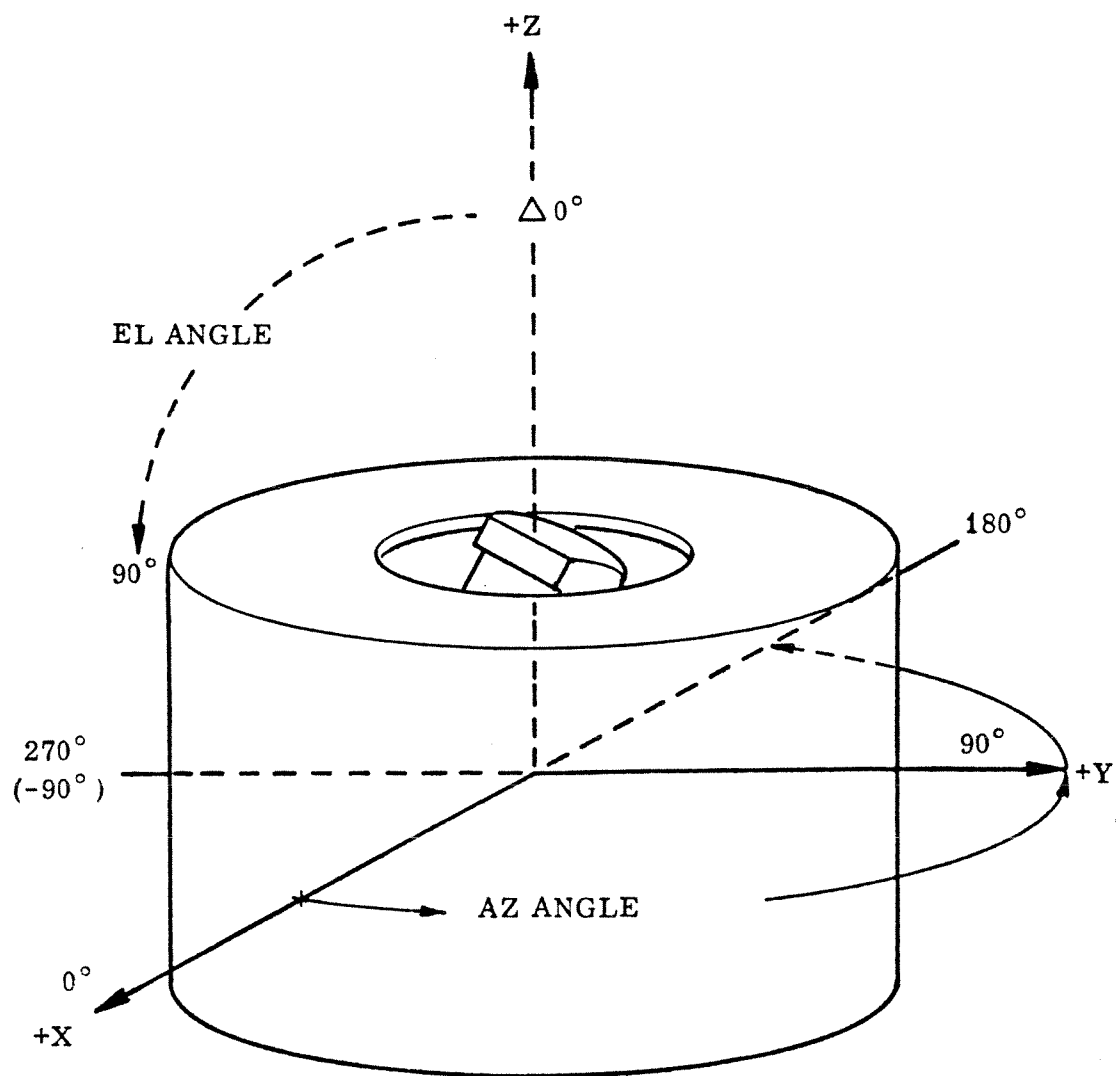
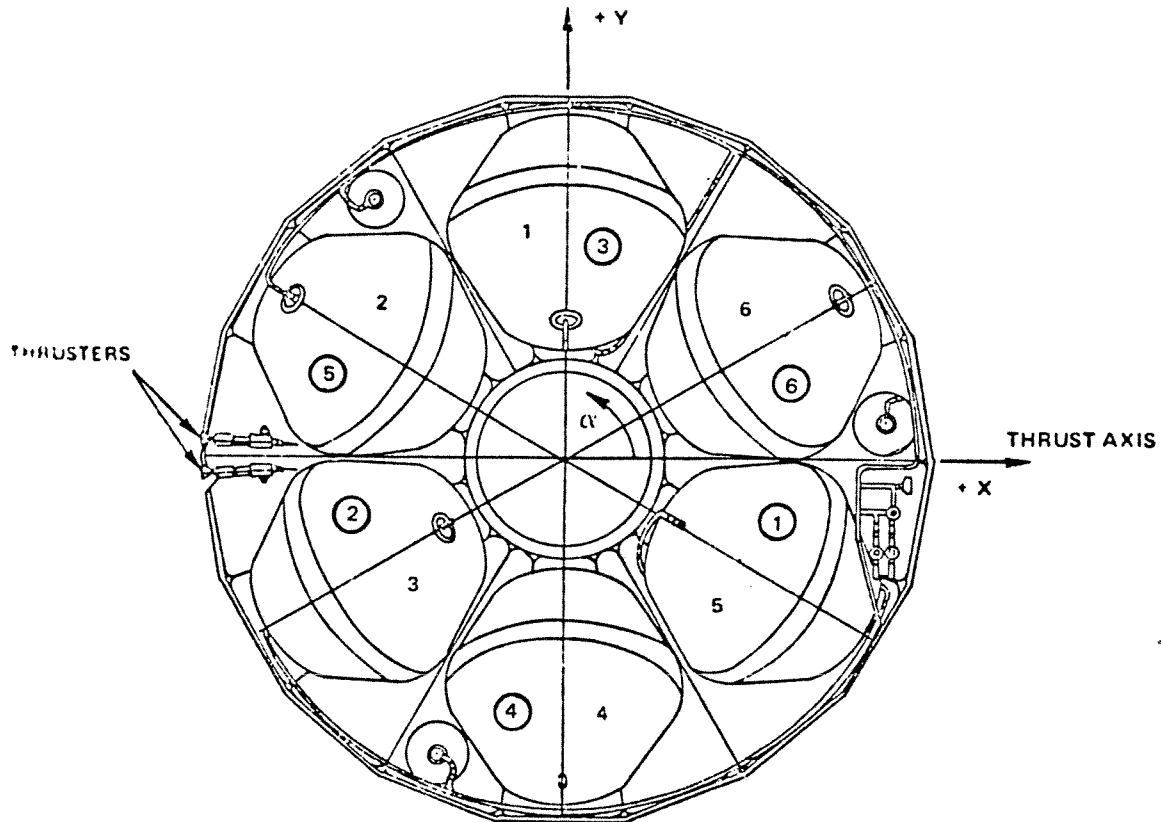


Figure 1-2. SPS Coordinates

○ = TRW and RCA Numbers



Tank Numbering System Used in C of M Control Computer Program
to be used by OCC

Figure 1-3. Propellant Tank Orientation (Top View)

SECTION 2.0

13 February 1974
74-AE-1063

National Aeronautics and
Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

RCA

Attention: Mr. R. Weaver, Code 420

Subject: Transmittal of Addendum to AE-C Alignment
and Calibration Data Book

Gentlemen:

Enclosed herewith are 15 copies of the addendum to
the "Alignment and Calibration Data for the Atmosphere
Explorer C Spacecraft" book.

The addendum consists of sections 2.0 and 3.0 dealing
with Optical Alignment and Mass Properties, respectively.

Very truly yours,

S. Toth

S. Toth
Manager
AE Project Operations

dr

Enclosures: Section 2.0, 4 pages
Section 3.0, 2 pages

cc: Mr. J. Findlay, Code 420, w/15 copies ENC

RCA/AED:	R. de Bastos	D. Shipley
	A. Heisman	B. Stewart
	G. Martch	P. Wise
	M. Perchick	File: 15

Addendum

SECTION 2.0

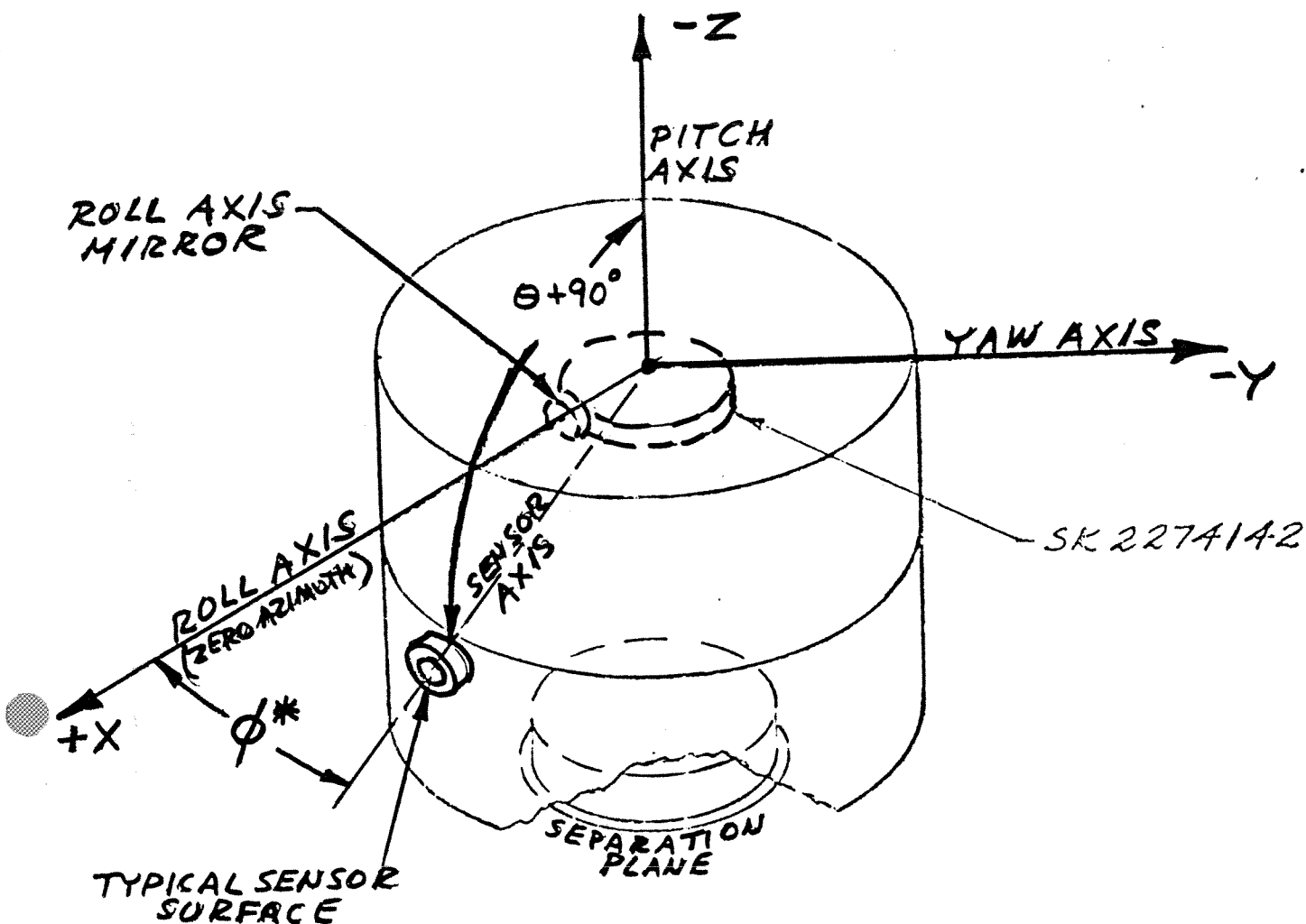
AE SPACECRAFT "C" OPTICAL ALIGNMENT DATA

Tables 2.1 and 2.2 provide the results of optical alignment measurements of the experiment and select black box/system reference surfaces. These measurements were taken in accordance with TP-OA-2271596 at three discrete times in the spacecraft integration and test program as follows:

17 August 1973	Pre-vibration
24 October 1973	Post-vibration
3 November 1973	Post-vibration Retest

The change in the pointing direction of the reference surface normals in the elevation and azimuth planes is provided for each of the two sets of data. The sign convention utilized for the data presentation is given in Figure 2.1.

FIGURE 2.1



ALIGNMENT DATA SIGN CONVENTION

The elevation angle θ is the angle between the MWA mounting plane and the sensor axis. The angle θ is negative when the angle between the sensor axis and the negative pitch axis (-Z) is less than 90 degrees. Conversely, the angle θ is positive when the angle between sensor and pitch axes is greater than 90 degrees.

The aximuth angle ϕ is the angle between roll/pitch plane (+X, -Z) and the plane defined by the pitch axis and sensor axis. The angle ϕ is positive when the plane defined by the pitch axis and the sensor axis is counter-clockwise of the +X, -Z plane as viewed from the -Z axis.

* Angle ϕ shown here is a positive angle.

TABLE 2.1

OPTICAL ALIGN DATA POST VIBR RETEST VS POST VIBR 3 NOV 1973/24 OCT 1973

EQUIPMENT	POST-VIBR		Δ		POST-VIBR RETEST		REQUIRED		REMARKS
	AZIM	ELEV	AZIM	ELEV	AZIM	ELEV	AZIM	ELEV	
BIMS	+8.2'	+4.8'	+0.8'	-1.5'	+9.0'	+3.3'	0° ±1°	±1°	Pre-vibr Az = +9.0'
PES No. 1	+9° 39.7'	+6.3'	-30.6'	+4.5'	+9° 9.1'	+10.8'	+9° ±1°	±1°	Pre-vibr Az = +9° 51.2'
DSAS - Mirror No. 1	-1° 11.5'	0.0'	+1° 13.8'	-1.4'	+2.3'	-1.4'	0° ±6'	±6'	Box repositioned about Azimuth
DSAS - Mirror No. 2	—	—	—	—	—	+11.7'	—	—	
BHS - Upper (S/N 006)	+269° 46.7'	-20° 14.4'	+8.6'	+17.7'	+269° 55.3'	-19° 56.7'	+270° ±6'	-20° ±6'	Box repositioned about Az. and Elev.
BHS - Lower (S/N 004)	+269° 48.8'	-20° 13.2'	+8.0'	+16.1'	+269° 56.8'	-19° 57.1'	+270° ±6'	-20° ±6'	As BHS Upper.
RPA Drift Hd.	-3.3'	+6.8'	+2.4'	-2.7'	-0.9'	+4.1'	0° ±6'	±6'	New box
RPA No. 1	-10.4'	+5.4'	+14.9'	+1.2'	+4.5'	+6.6'	0° ±1°	±1°	New box
RPA No. 2	+110° 19.9'	+12.6'	-30.3'	-15.5'	+109° 49.6'	-2.9'	+110° ±1°	±1°	New box
RPA No. 3	+229° 54.6'	+7.5'	-3.6'	-5.2'	+229° 51.0'	+2.3'	+230° ±1°	±1°	New box
RPA Drift Hd.	—	—	—	—	Side of Grid Vertical within 0.001" over 1.0"		—	—	New box
LEE	+270° 1.2'	-2.0'	-0.9'	-1.9'	+270° 0.3'	-3.9'	+270° ±1°	±1°	Pre-vibr Elev. = -12.2'

POST VIBR RETEST VS POST VIBR 3 NOV 1973 — 24 OCT 1973

EQUIPMENT	POST-VIBR		Δ		POST-VIBR RETEST			REQUIRED			REMARKS
	AZIM	ELEV	AZIM	ELEV	AZIM	RPO RAD	ELEV	AZIM	RPO RAD	ELEV	
OAPS YAW	—	—	—	—	+175° 23.0'	0.010"	-29° 17.1'	—	0.050"	30° Nom	
OAPS ΔV_A (Lft) (No. Load)	—	—	—	—	+175° 6.2'	0.030"	+5° 54.9'	—	0.050"	+6° ±30'	
OAPS ΔV_A (Lft) (Load $\approx$ 5.0 lb)	—	—	—	—	+175° 3.6'	0.033"	+6° 0.7'	—	0.050"	+6° ±30'	
OAPS ΔV_B (Rt) (No Load)	—	—	—	—	+184° 39.2'	0.087"	+5° 48.1'	—	0.050"	+6° ±30'	
OAPS ΔV_B (Rt) (Load $\approx$ 5.0 lb)	—	—	—	—	+184° 40.7'	0.050"	+5° 54.3'	—	0.050"	+6° ±30'	

2.0-3(A)

TABLE 2.2

EXPERIMENT	PRE-VIBRATION (8/17/73)		Δ		POST-VIBRATION (10/24/73)		REQUIREMENT	
	AZ	EL	AZ	EL	AZ	EL	AZ	EL
BIMS	+ 9.0'	+ 3.1'	- 0.8'	+ 1.7'	+ 8.2'	+ 4.8'	0° ±1°	± 1°
RPA DRIFT HEAD	- 3.2'	+ 3.0'	- 0.1'	+ 3.8'	- 3.3'	+ 6.8'	0° ±6'	± 6'
RPA #1	-10.6'	0.0'	+ 0.2'	+ 5.4'	-10.4'	+ 5.4'	0° ±1°	± 1°
RPA #2	+110° 18.2'	+13.9'	+ 1.7'	- 1.3'	+110° 19.9'	+12.6'	+110° ±1°	± 1°
LEE	+270° 1.2'	-12.2'	0.0	+10.2'	+270° 1.2'	- 2.0'	+270° ±1°	± 1°
PES #1	+ 9° 51.2'	+ 1.7'	-11.5'	+ 4.6'	+ 9° 39.7'	+ 6.3'	+ 9° ±1°	± 1°
PES #2	+189° 11.6'	-15.0'	- 3.8'	+ 4.7'	+189° 7.8'	-10.3'	+189° ±1°	± 1°
RPA #3	+229° 51.2'	-10.1'	+ 3.4'	+17.6'	+229° 54.6'	+ 7.5'	+230° ±1°	± 1°
OSS	- 5.6'	+ 2.7'	- 0.4'	+ 5.6'	- 6.0'	+ 8.3'	0° ±1°	± 1°
MIMS	+16.6'	+ 1.9'	- 3.3'	+ 1.0'	+13.3'	+ 2.9'	0° ±2°	± 2°
UVNO	+179° 44.7'	-27.6'	+ 1.2'	- 7.8'	+179° 45.9'	-35.4'	+180° ±1°	± 1°
DSAS (Mirror #1)	1° 11.3'	- 1.1'	- 0.2'	+ 1.1'	- 1° 11.5'	0.0	0° ±6'	± 6'
CEPR	+ 89° 50.7'	- 6.0'	+23.7'	+ 4.7'	90° 14.4'	- 1.3'	+ 90° ±2°	±30'
ESUM	+ 90° 2.2'	- 6.8'	-	-	-	-	+ 90° ±1°	± 1°
NATE	+329° 35.2'	+ 5.6'	+ 6.4'	+ 6.6'	+329° 41.6'	+12.2'	+330° ±1°	± 1°
NACE	-29.6'	- 4.6'	+18.8'	+25.1'	-10.8'	+20.5'	0° ±1°	± 1°
BHS - UPPER (S/N 006)	+269° 53.7'	-20.0° 15.7'	- 6.0'	+ 1.3'	+269° 46.7'	-20.0° 14.4'	+270° ±6'	-20° ± 6'
BHS - LOWER (S/N 004)	+269° 55.0'	-20.0° 17.1'	- 6.2'	+ 3.9'	+269° 48.8'	-20.0° 13.2'	+270° ±6'	-20° ± 6'
UP BPL, +X FLAT	- 0.7'	- 1.2'	+ 0.5'	- 0.2'	- 0.2'	- 1.4'	0° ±7'	± 8'
LOW BPL, +X FLAT	+ 2.2'	+ 2.5'	- 0.8'	+ 1.3'	+ 1.4'	+ 3.8'	0° ±9'	± 8'
VAE (-X) TO UVNO	-	-	-	-	$\Delta = 17.1', \Delta = 37.6'$	-	-	-
VAE (WIDE TO NARROW)	-	-	-	-	$\Delta = 89° 56.2', \Delta = 2.7'$	-	-	-
VAE - WIDE CH. (+Y)	-	-	-	-	X=0.302" Y=1.106"	-	-	-
VAE - NARROW CH. (-X)	-	-	-	-	X=4.390" Y=2.143"	-	-	-
VAE - WIDE CH.	+269° 48.7'	+ 1.4'	+10.5'	+ 3.5'	+269° 59.2'	+ 4.9'	+270° ±1°	± 1°
VAE - NARROW CH.	+179° 52.3'	- 0.8'	+10.7'	+ 3.0'	+180° 3.0'	+ 2.2'	180° ±1°	± 1°

SECTION 3.0

Addendum

Section 3.0 Weight, Moment of Inertia, Center of Gravity and Balance Measurements

Final measured/calculated mass properties for A.E. Spacecraft C are given in Table 3.1. Tabulations for four configurations are as follows:

- 1) OAP's empty
- 2) Launch
- 2) Beginning of Life (B.O.L.) - 373.0 lbs. fuel
- 3) End of Life (E.O.L.) - 18.0 lbs. fuel

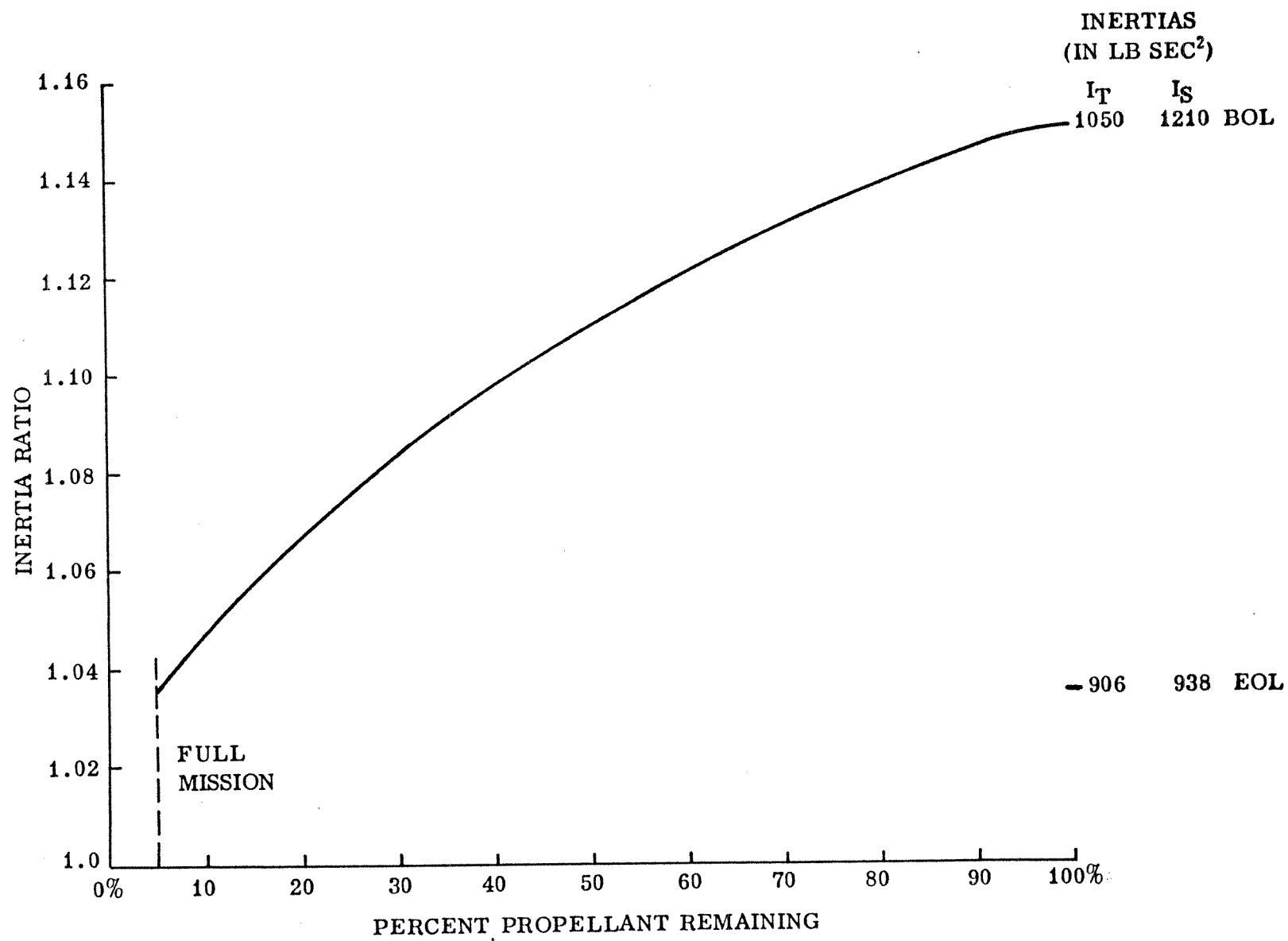
Table 3.1

AE-C MASS PROPERTIES

S/C Configuration	Weight (lbs)	(inches $\times 10^3$)			(lb-in ²)		(lb-in ² $\times 10^{-3}$)		Inertia Ratio
		$\bar{X}$	$\bar{Y}$	$\bar{Z}$	WXZ	WYZ	I_S	$I_{LAT-MAX}$	
1 OAP's Empty	1117.3	47	5	5	-	-	-	-	-
2 Launch	1493.7	21	-15	4	504 max.	202 max.	-	-	-
3 B.O.L.	1490.3	-20	-18	6	113 max.	113 max.	537	455	1.181
4 E.O.L.	1135.3	-26	-24	8	113 max.	113 max.	399	381	1.048

3.0-2 (A)

SECTION 4.0



SECTION 5.0

COMMAND LIST

THE COMMAND FORMAT USED FOR THE AE "C" SPACECRAFT
IS SHOWN IN FIGURE 5-1. THE SEVEN BIT ADDRESS FOR AE
"C" IS GIVEN IN BINARY AS 1101000.

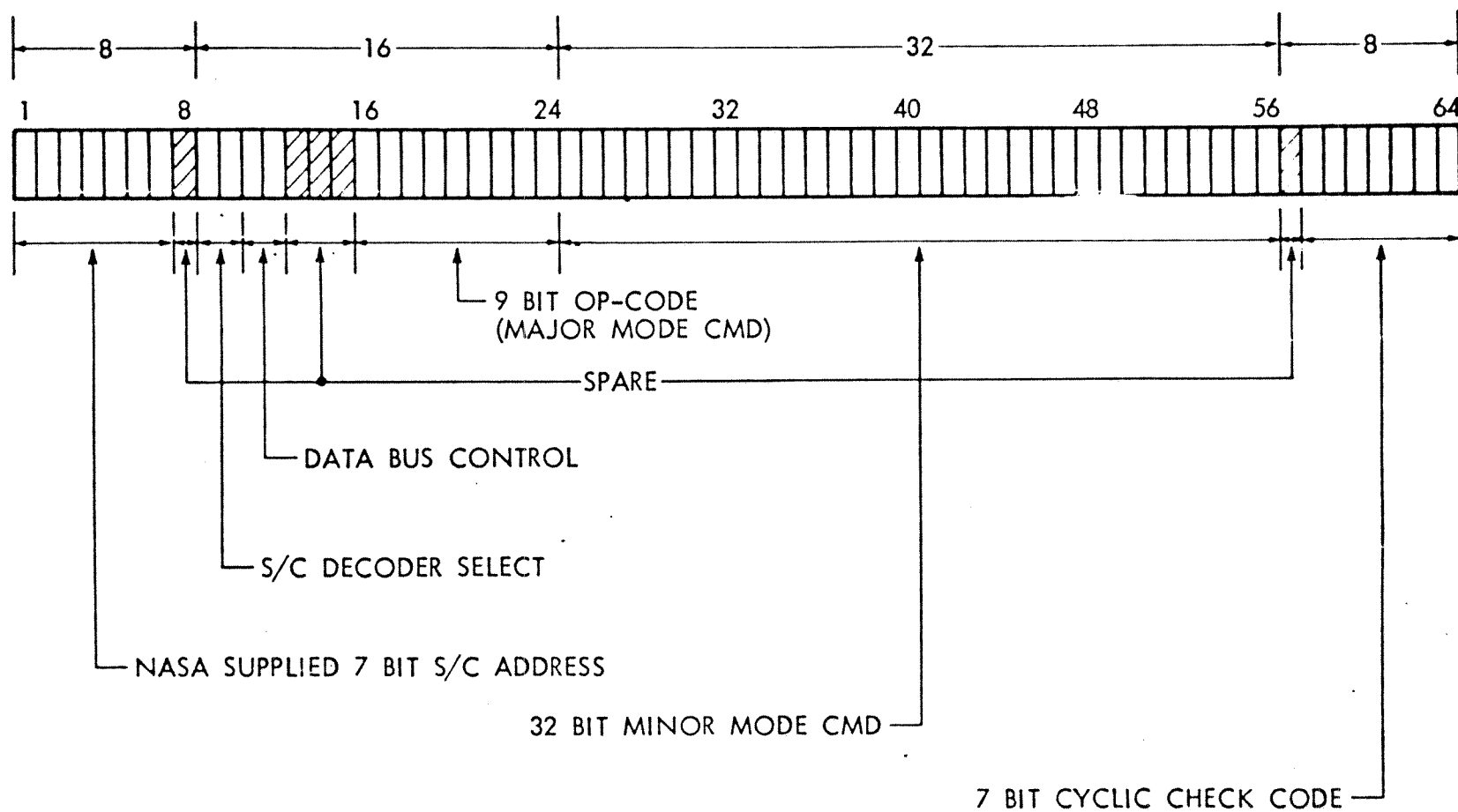


Figure 5-1. Command Word Structure - Real-Time Command

Command Word Format

The actual format of the 64-bit command word is as follows:

- Bits 1-7 - X'EO' - Satellite address code
- Bit 8 - Spare bit = 0
- Bits 9, 10 - Decoder select code; 01 = decoder 1, 10 = decoder 2 and 00 or 11 signifies neither decoder
- Bits 11, 12 - Data bus control code; 00, 01, 10 - no minor mode data, 11 signifies minor mode data is present
- Bit 13 - Spare = 0
- Bit 14 - Spare = 0
- Bit 15 - Spare = 0
- Bits 16-24 - 9 bit OP CODE
- Bits 25-56 - 32 bit MINOR MODE DATA; these bits are all 0's if minor mode data is not included
- Bit 57 - Spare = 0
- Bits 58-64 - Cyclic code check bits

It should be noted that for all command transmissions, whether for individual 64-bit commands, or a group of such commands, the command string is always preceded by a special "frame sync" word containing 63 logic 0 bits followed by a logic 1 bit. (See Figure 5-1 for Command Word Structure.)

ATMOSPHERE EXPLORER
MISSIONS C, D, AND E

Title: AE COMMAND LIST

DN- 832-2.2(AE)

Written by: R. Borlik

Date: 20 July 1972

Approved by: B. Stewart

Date: 24 July 1972

REVISIONS

Ltr.	Description	Date	Author
A	Added the command "RSL LOAD MINOR MODE"	1 Aug 1972	R. Borlik
B	Added op codes; revised command terminology to agree with telemetry list; deleted the Command "Telemetry Power Off"; added the commands "H.K. TLM (A) Power Off" and "H.K. TLM (B) Power Off". Combined the commands to fire the SPS AZ and EL Ordnance. Added commands: "Initialize Shunt Limiter Relays", "Reg. Bus Min. Load OFF", "Enable DSAI Power", "Disable DSAI Power".	27 Oct. 1972	R. Borlik
C	Corrected command name for Op Code 544 (Page 7) to DSAI PWR Disable. Sheet 12 - Change command name typo, last line "Initialize Shunt Limiter Relays". Sheet 17 change 9 bit op code for "LEE H.V. #2 ON" to 627.	31 Oct 1972	R. Borlik
D	DSAI code allocations changed. (Page 7) Code 146 connected to PCMC 2. (Page 13)	27 Nov 72	W. V. Fuldner
E	Corrected DSAI Pwr Disable Op-Code (Page 7)	12 Mar 73	W. V. Fuldner
F	Recorrected DSAI Pwr Disable Op-Code (pg. 7) and Corrected CEP Instr. Pwr off Op-Code (pg. 3)	26 Mar 73	W. V. Fuldner
CONTINUED...			

ATMOSPHERE EXPLORER
MISSIONS C, D, AND E

TITLE: AE COMMAND LIST

DN-832-2.2(AE)

REVISIONS CONTINUED...

Ltr.	Description	Date	Author
G	Changed "Use Memory 2, Not 1" to 057(p 24); Added PROG 1 Nadir Flip 667(p 25); PROG 2 Nadir Flip 630(p 25); Deleted "Memories OFF"(p 24); Changed "ESUM Motor Power ON" to OP Code 650(p 14); "ESUM BIPH HTR PWR ON" to OP Code 747(p 14); "PES INSTR POWER ON" to Op Code 657(p 5); "PES INSTR POWER OFF" to Op Code 422(p 5); Deleted "DSAI PWR ENABLE" (p 7); "DSAI PWR DISABLE"(p 7); Added "ATC AUX HTRS Commands" (p 21); "ATC REF TEMP Commands" (p 21).	28 Oct 73	W. V. Fuldner
H	Added "Damper Fire 1" Op Code (p 25) "Damper Fire 2" Op Code (p 25)	20 Nov 73	W.V. Fuldner

AE COMMAND LIST

This note lists the commands used for AE spacecraft C, D, and E. The 9-bit op codes are coded in octal with the corresponding 2 of 32 codes also listed. Correspondence between the 9-bit and 2 of 32 codes is defined in DN-716-11.1(AE). Commands are transmitted MSB first. As an example, the first command in the list, "DISABLE OAPS" has the 9-bit op code 036₈, which is transmitted as:

000011110

↑ MSB, first bit transmitted

The remaining columns in the table indicate that the command is decoder eleven times on baseplate A as a relay type command and once on baseplate A and twice on baseplate B as a logic level command and is used in spacecraft C, D, and E. Minor mode commands are indicated by asterisks.

In assigning the op codes, the number of bit lines used for a particular system was kept to a minimum as far as possible to reduce the probability of erroneous responses in the event of a bit line failure in the active state. An additional consideration was keeping the loading of the 32 bit lines approximately equal.

A summary of the command op code utilization is given below.

No. of Codes			Where Used
C	D	E	
187	187	185	CDU A only
16	16	15	LIU A only
149	153	147	CDU B only
40	38	40	LIU B only
5	5	5	CDU A and CDU B
2	2	2	LIU A and LIU B
1	1	1	LIU A & B and CDU A

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
DISABLE OAPS	036	30,31	11(A)		1(A) 2(B)	A&B	X	X	X
ENABLE OAPS P.L. BUS. A, NOT B	034	28,29	2			A			
ENABLE OAPS P.L. BUS. B, NOT A	033	27,28	2			A			
OAPS TANK VALVE 1 ON	031	25,26	1			A			
OAPS TANK VALVE 2	072	26,28	1			A			
OAPS TANK VALVE 3	131	25,28	1			A			
OAPS TANK VALVE 4	130	24,27	1			A			
OAPS TANK VALVE 5	230	24,29	1			A			
OAPS TANK VALVE 6	070	24,26	1			A			
ENABLE YAW. THRSTR. NOT ΔV	032	26,27	3			A			
ENABLE $\Delta V1$ THRSTR, NOT YAW OR $\Delta V2$	171	25,29	3			A			
ENABLE $\Delta V2$ THRSTR, NOT YAW OR $\Delta V1$	170	24,28	3			A			
FIRE OAPS N.O. VALVE COMD. 1	132	26,29	1			A			
FIRE OAPS N.O. VALVE COMD. 2	071	25,27	1			A			
FIRE OAPS N.C. VALVE COMD. 1	133	27,30	1			A			
FIRE OAPS N.C. VALVE COMD. 2	232	26,31	1			A			

Command Function	Op Code		Utilization				Spacecraft		
	<u>9Bit</u>	<u>2of32</u>	<u>Rly.</u>	<u>R.D.</u>	<u>L.L.</u>	<u>Base-Plate</u>	<u>C</u>	<u>D</u>	<u>E</u>
CEP, INSTR. PWR. ON	350	8,16	1			A	X	X	X
INSTR. PWR. OFF	362	18,26	1			A	1		
ENABLE BIPH HTRS	437	8,31	1			A			
DISABLE BIPH HTRS	536	9,30	1			A			
RAD. PROBE HTR. ON	476	8,30	1			A			
AX PROBE HTR. ON	636	11,30	1			A			
RAD. BIPH HTR. ON	634	9,28	1			A			
AX BIPH HTR. ON	754	12,28	1			A			
ALL HTRS. OFF	635	10,29	4			A			
PROBES NORMAL	575	9,29		1		A			
PROBES REVERSED	674	10,28		1		A			
SYSTEM 1 MODE 1	675	11,29		1		A			
SYSTEM 1 MODE 2	676	12,30		1		A			
SYSTEM 2 MODE 1	577	11,31		1		A			
SYSTEM 2 MODE 2	735	12,29		1		A			
SYSTEM 2 MODE 3	637	12,31		1		A			
VA REFERENCE +1	715	13,28		1		A			
VA REFERENCE -1	716	14,29		1		A			
VA REFERENCE 0	576	10,30		1		A			
INTERNAL CLK.	755	13,29		1		A			
EXTERNAL CLK.	656	14,28		1		A	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
CEP, CALIBRATE	560	16,28			1	A	X	X	X
UVNO INSTR. PWR. ON	145	5,9	1			A	X	X	
INSTR. PWR. OFF	252	10,16	1			A	X	X	
LOAD MINOR MODE *	037	0,31			1	A	X	X	
OSS INSTR. PWR. ON	153	11,15	1			A	X	X	X
INSTR. PWR. OFF	446	6,16	1			A			
PUMP PWR. ON	213	11,16	1			A			
PUMP PWR. OFF	347	7,15	1			A			
FIRE CMD. #1	447	7,17	1			A			
FIRE CMD. #2	550	8,20	1			A			
FILAMENT #1 ON	174	0,28			1	A			
FILAMENT #2 ON	175	1,29			1	A			
FILAMENTS OFF	234	1,28			1	A			
LOAD MINOR MODE *	135	0,29			1	A	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
NACE INSTR. PWR. ON	511	9,20	1			A	X	X	X
INSTR. PWR. OFF	610	8,21	1			A			
ENABLE COVER PWR.	546	6,18	1			A			
DISABLE COVER PWR.	547	7,19	1			A			
COVER PWR. ON	507	7,18	1			A			
COVER PWR. OFF	606	6,19	1			A			
FIRE CMD #1	646	6,20	1			A			
FIRE CMD #2	647	7,21	1			A			
SEL. MIN. MODE REG. A	607	7,20		1		A			
SEL. MIN. MODE REG. B	706	6,21		1		A			
BYPASS MODE	543	3,15		1		A			
NORMAL MODE	603	3,16		1		A			
LOAD MINOR MODE A *	427	0,23			1	A			
LOAD MINOR MODE B *	467	1,23			1	A	↓	↓	↓
PES INSTR. PWR. ON	657	15,29	1			A	X	X	X
INSTR. PWR. OFF	422	18,27	1			A			
HI VOLT 1 ON	351	9,17		1		A			
HI VOLT 1 OFF	151	9,13		1		A			
HI VOLT 2 ON	112	10,13		1		A	↓	↓	↓

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base- Plate	C	D	E
PES HI VOLT 2 OFF	113	11,14		1		A	X	X	X
CAL. MODE ENABLE	152	10,14		1		A			
CAL. MODE DISABLE	053	11,13		1		A			
CAL. MODE INITIATE	430	1,24			1	A			
LOAD MINOR MODE *	370	0,24			1	A	Y	Y	Y
MAG INSTR. PWR. ON	235	2,29	1			B	X	X	X
INSTR. PWR. OFF	236	3,30	1			B	X	X	X
CALIBRATE	617	15,28			1	B	X	X	X
PSA INSTR. PWR. ON	205	5,10	1			A	X	X	X
INSTR. PWR. OFF	506	6,17	1			A			
FIRE COMD. 1	253	11,17	1			A			
FIRE COMD. 2	537	10,31	1			A	Y	Y	Y
PSB INSTR. PWR. ON	105	5,8	1			A	X	X	X
INSTR. PWR. OFF	212	10,15	1			A			
ENABLE HTR. PWR.	154	12,16	1			A	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	<u>9Bit</u>	<u>2of32</u>	<u>Rly.</u>	<u>R.D.</u>	<u>L.L.</u>	<u>Base-Plate</u>	<u>C</u>	<u>D</u>	<u>E</u>
PSB DISABLE HTR. PWR.	410	8,17	1			A	X	X	X
HEATER ON	407	7,16	1			A	X	X	X
HEATER OFF	545	5,17	1			A	X	X	X
TAL INSTR. PWR. ON	717	15,30	1			A	X	X	X
INSTR. PWR. OFF	522	18,29	1			A			
SEL. TC-1/RWT-1	673	9,27		1		A			
SEL. TC-2/RWT-2	267	23,29		1		A			
SEL. AMP A	411	9,18		1		A			
SEL. AMP B	227	23,28		1		A			
DSAI PWR. ON	042	2,4	1			A	X	X	X
PWR. OFF	207	7,12	1			A	X	X	X
ENABLE SQUIB BUS. A, NOT B	073	27,29	1			A	X	X	X
ENABLE SQUIB BUS. B, NOT A	075	29,31	1			A	X	X	X
DISABLE SQUIB BUSSES	074	28,30	2			A	X	X	X

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
USE LIU. XTAL A, NOT B	573	7,27	1(A)	2		A&B	X	X	X
USE LIU. XTAL B, NOT A	574	8,28	1(A)	2		A&B	X	X	X
USE TIME BASE MASTER A, SLAVE B	633	8,27		2		A&B	X	X	X
USE TIME BASE MASTER B, SLAVE A	534	7,28		2		A&B	X	X	X
TELEM PWR. ON	012	10,11	2			A&B	X	X	X
A TELEM. PWR. OFF	240	0,6	1			A	X	X	X
B TELEM. PWR. OFF	655	13,27	1			B	X	X	X
PCE 1 H.S. CONVRT. PWR. ON	104	4,7	1			A	X	X	X
PCE 1 H.S. CONVRT. PWR. OFF	201	1,6	1			A			
PCE 2 H.S. CONVRT. PWR. ON	142	2,6	1			A			
PCE 2 H.S. CONVRT. PWR. OFF	143	3,7	1			A			
BHS1 ON, 2 OFF	102	2,5		2		A			
BHS2 ON, 1 OFF	045	5,7		2		A			
BOTH BHS OFF	300	0,7		2		A	↓	↓	↓
PCE PITCH SENSE NORMAL	001	1,2		2		A	X	X	X
PITCH SENSE CROSSED	100	0,3		2		A	X	X	X

[illegible]

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
SELECTED SBT ON	564	0,20	2			A	X	X	X
SELECTED SBT OFF	565	1,21	2			A			
SBT-1 AUTO ACQ. MODE ENABLE	306	6,13	1			A			
SBT-2 AUTO ACQ. MODE ENABLE	525	0,21	1			A			
SBT AUTO ACQ. MODE DISABLE	307	7,14	2			A			
SBT OSC TEST MODE	623	0,19		2		A			
SBT HI PWR. ENABLE	662	0,18		2		A			
SBT LO PWR. ENABLE	721	0,17		2		A			
SELECT SBT 1, NOT 2	247	7,13		1		A			
SELECT SBT 2, NOT 1	346	6,14		1		A			
SBT RANGING ENABLE	740	0,16		2		A			
SBT RANGING DISABLE	700	0,15		2		A			
SBT OSC NORMAL MODE	157	15,19		2		A			
SELECT PMP 1, NOT 2	312	10,17	1			A			
SELECT PMP 2, NOT 1	054	12,14	1			A			
SELECTED PMP ON	250	8,14	2			A			
SELECTED PMP OFF	014	12,13	2			A			
PMP PLBK. MODE	551	9,21		2		A			
PMP R.T. ONLY MODE	450	8,18		2		A			
SELECT VBT 1, NOT 2	517	15,26	1	1		B			
SELECT VBT 2, NOT 1	520	16,27	1	1		B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
SELECTED VBT ON	460	16,26	2			A	X	X	X
SELECTED VBT OFF	557	15,27	2			A			
VBT BEACON MODE ENABLE	711	9,24		2		A			
VBT TELEM. MODE ENABLE	611	9,22		2		A	Y	Y	Y
POWER SUPPLY ELECTRX							X	X	X
BOTH REGULATORS OFF	024	20,21		2		A			
REGUL. 1 ON, ONLY	221	17,22	1**	1		A			
REGUL. 2 ON, ONLY	222	18,23	1**	1		A			
PSE FAILED CONTROL AMP DISCONN.	261	17,23		1		A			
CONNECT ALL CHR.G. CNTRLS.	123	19,22		3		A			
CHRG. CONTROL 1 DISCONNECT	026	22,23		1		A			
CHRG. CONTROL 2 DISCONNECT	262	18,24		1		A			
CHRG. CONTROL 3 DISCONNECT	263	19,25		1		A			
3RD ELECTRODE INHIB. CHG. CNTRL. 1	064	20,22		1		A			
3RD ELECTRODE ENABLE CHG. CNTRL. 1	163	19,23		1		A			
3RD ELECTRODE INHIB. CHG. CNTRL. 2	025	21,22		1		A			
3RD ELECTRODE ENABLE CHG. CNTRL. 2	124	20,23		1		A			
3RD ELECTRODE INHIB. CHG. CNTRL. 3	065	21,23		1		A			
3RD ELECTRODE ENABLE CHG. CNTRL. 3	321	17,24		1		A	Y	Y	Y

**One relay operated by either command.

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base- Plate	C	D	E
PSE CHG. CNTRL. 1 FAIL DET. ENABLE	224	20,25		1		A	X	X	X
CHG. CNTRL. 1 FAIL DET. DISABLE	223	19,24		1		A			
CHG. CNTRL. 2 FAIL DET. ENABLE	125	21,24		1		A			
CHG. CNTRL. 2 FAIL DET. DISABLE	322	18,25		1		A			
CHG. CNTRL. 3 FAIL DET. ENABLE	027	23,24		1		A			
CHG. CNTRL. 3 FAIL DET. DISABLE	126	22,25		1		A			
ATC 1 DISCONNECT	164	20,24		1		A			
ATC 2 DISCONNECT	165	21,25		1		A			
ATC 3 DISCONNECT	066	22,24		1		A			
ATC 4 DISCONNECT	361	17,25		1		A			
CONNECT ALL ATC's	061	17,19		2		A			
REG. BUS. DET ENABLE	022	18,20		1		A			
REG. BUS. DET DISABLE	121	17,20		1		A			
UNREG. BUS. DET ENABLE	062	18,20		1		A			
UNREG. BUS. DET DISABLE	161	17,21		1		A			
REG. BUS. CURR. TLM - FINE SCALE	023	19,20		1		A			
REG. BUS. CURR. TLM - COARSE SCALE	122	18,21		1		A			
UNREG. BUS. CURR. TLM - FINE SCALE	063	19,21		1		A			
UNREG. BUS. CURR. TLM - COARSE SCALE	162	18,22		1		A			
REG. BUS MIN. LOAD OFF	620	16,29	1			A			
INITIALIZE SHUNT LIMITER RELAYS	366	22,30		2		A	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	<u>9Bit</u>	<u>2of32</u>	<u>Rly.</u>	<u>R.D.</u>	<u>L.L.</u>	<u>Base-Plate</u>	<u>C</u>	<u>D</u>	<u>E</u>
PCM CONTROL									
ENABLE PCMC 1	013	11,12	1			A	X	X	X
ENABLE PCMC 2	146	6,10	1			A			
DISABLE PCM	047	7,9	2			A			
PCM 1 ON	007	7,8		1		A			
PCM 1 OFF	106	6,9		1		A			
PCM 2 ON	107	7,10		1		A			
PCM 2 OFF	246	6,12		1		A			
ENABLE PCM 1, NOT 2 DATA TO PMP	147	7,11		2		A			
ENABLE PCM 2, NOT 1 DATA TO PMP	046	6,8		2		A			
DISABLE PCM DATA TO PMP	111	9,12		2		A			
ENABLE PCM 1, NOT 2, DATA TO T.R.	150	8,12		2		A			
ENABLE PCM 2, NOT 1, DATA TO T.R.	245	5,11		2		A			
ENABLE PCM 1, NOT 2, DATA TO VBT	052	10,12		2		A			
ENABLE PCM 2, NOT 1, DATA TO VBT	010	8,9		2		A			
COMD. PCM 1 TO ROM MODE	050	8,10			1	A			
COMD. PCM 1 TO MARC MODE	051	9,11			1	A			
COMD. PCM 2 TO ROM MODE	011	9,10			1	A			
COMD. PCM 2 TO MARC MODE	110	8,11			1	A	Y	Y	Y

-14-

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base- Plate	C	D	E
ESUM INSTR. PWR. ON	376	6,30	1			B	X	X	X
MOTOR PWR. ON	650	8,22	1			B			
BIPHENYL. HTR. PWR. ON	747	7,23	1			B			
PWR. OFF	377	7,31	3			B			
ENABLE PL. & UNREG. BUSSES	707	7,22	1			B			
DISABLE PL. & UNREG. BUSSES	710	8,23	1			B			
HI V. ON	746	6,22		1		B			
HI V. OFF	730	7,24		1		B			
LOAD MINOR MODE *	136	1,30			1	B	Y	Y	Y
VAE INSTR. PWR. ON	501	1,12	1			B	X	X	X
INSTR. PWR. OFF	503	3,14	1			B			
ENABLE BIPH. HTR. PWR	403	3,12	1			B			
DISABLE BIPH. HTR. PWR.	601	1,14	1			B			
BIPH. 1 HTR. PWR. ON	442	2,12	1			B			
BIPH 2 HTR. PWR. ON	502	2,13	1			B			
NORMAL/BIPH. HTR. PWR. OFF	643	3,17	2	1		B			
INVERT	644	4,18		1		B			
LOAD MINOR MODE 1 *	731	8,25			1	B			
LOAD MINOR MODE 2 *	672	8,26			1	B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base- Plate	C	D	E
MIMS INSTR. PWR. ON	325	21,28	1			B	X	X	
INSTR. PWR. OFF	326	22,29	1			B	X	X	
LOAD MINOR MODE *	732	9,26			1	B	X	X	
BIMS INSTR. PWR. ON	365	21,29	1			B	X		X
INSTR. PWR. OFF	266	22,28	1			B	X		X
OVERRIDE MODE	303	3,10			1	B	X		X
LOAD MINOR MODE *	343	3,11			1	B	X		X
EUVS LOW VOLT PWR. ON	314	12,19	1			B	X	X	X
ENABLE PL & UNREG. PWR.	452	10,20	1			B			
MOTOR PWR. 1 ON	512	10,21	1			B			
MOTOR PWR. 2 ON	414	12,21	1			B			
LV & MOT. PWR. OFF	413	11,20	3			B			
STBY. PWR. ON	354	12,20	1			B			
STBY. PWR. OFF	255	13,19	1			B	Y	Y	Y

-16-

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base- Plate	C	D	E
EUVS HV SUPPLY 1 ON	514	12,23		1		B	X	X	X
HV SUPPLY 1 OFF	515	13,24		1		B			
HV SUPPLY 2 ON	455	13,23		1		B			
HV SUPPLY 2 OFF	456	14,24		1		B			
HV SUPPLY PMT ON	416	14,23		1		B			
HV SUPPLY PMT OFF	554	12,24		1		B			
HI RATE OVERRIDE 1	352	10,18			1	B			
APERTURE 1 POSIT. 1	313	11,18			1	B			
APERTURE 1 POSIT. 2	412	10,19			1	B			
GRATING 1 MANUAL UP	353	11,19			1	B			
GRATING 1 MANUAL DWN.	315	13,20			1	B			
HI RATE OVERRIDE 2	256	14,20			1	B			
APERTURE 2 POSIT. 1	355	13,21			1	B			
APERTURE 2 POSIT. 2	316	14,21			1	B			
GRATING 2 MANUAL UP	612	10,23			1	B			
GRATING 2 MANUAL DWN.	553	11,23			1	B			
LOAD MINOR MODE 1	357	15,23			1	B			
LOAD MINOR MODE 2	320	16,23			1	B			
DISABLE PL & UNREG. PWR.	453	11,21	1			B			
HI RATE NORMAL 1	652	10,24			1	B			
HI RATE RESET 1	613	11,24			1	B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
EUVS HI RATE NORMAL 2	417	15,24			1	B	X	X	X
HI RATE RESET 2	360	16,24			1	B	X	X	X
LEE INST. PWR. ON	645	5,19	1			B	X	X	
INST. PWR. OFF	625	2,21	1			B	X	X	
H.V. 1 ON	567	3,23		1		B	X	X	
H.V. 1 OFF	570	4,24		1		B	X	X	
SSO ON	627	4,23		1		B	X		
SSO OFF	530	3,24		1		B	X		
H.V. 2 ON	627	4,23		1		B		X	
H.V. 2 OFF	530	3,24		1		B		X	
LOAD MINOR MODE *	751	9,25			1	B	X	X	
NATE INST. PWR. ON	602	2,15	1			B	X	X	X
INST. PWR. OFF	701	1,16	1			B			
ENABLE COVER PWR.	702	2,17	1			B			
DISABLE COVER PWR.	703	3,18	1			B			
COVER PWR. ON	641	1,15	1			B			
COVER PWR. OFF	642	2,16	1			B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
NATE FIRE COMD. 1	741	1,17	1			B	X	X	X
FIRE COMD. 2	742	2,18	1			B			
SELECT MINOR MODE REG. A	723	2,19		1		B			
SELECT MINOR MODE REG. B	566	2,22		1		B			
NORMAL MODE	743	3,19		1		B			
BY PASS MODE	626	3,22		1		B			
LOAD MINOR MODE A *	744	4,20			1	B			
LOAD MINOR MODE B *	725	4,21			1	B	Y	Y	Y
MESA XY PWR. ON	331	0,25	1			B	X	X	X
XY PWR. OFF	332	1,26	1			B			
YX PWR. ON	371	1,25	1			B			
YX PWR. OFF	372	2,26	1			B			
Z PWR. ON	471	3,25	1			B			
Z PWR. OFF	472	4,26	1			B			
XY SUSPENSION RANGE A	431	2,25		1		B			
XY SUSPENSION RANGE B	432	3,26		1		B			
XY SUSPENSION RANGE C	531	4,25		1		B			
XY CONSTRAINT RANGE A	233	0,27		1		B			
XY CONSTRAINT RANGE B	571	5,25		1		B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
MESA XY CONSTRAINT RANGE C	137	2,31		1		B	X	X	X
YX SUSPENSION RANGE A	532	5,26		1		B			
YX SUSPENSION RANGE B	237	4,31		1		B			
YX SUSPENSION RANGE C	375	5,29		1		B			
YX CONSTRAINT RANGE A	433	4,27		1		B			
YX CONSTRAINT RANGE B	336	5,30		1		B			
YX CONSTRAINT RANGE C	177	3,31		1		B			
Z SUSPENSION RANGE A	473	5,27		1		B			
Z SUSPENSION RANGE B	434	5,28		1		B			
Z SUSPENSION RANGE C	273	1,27		1		B			
Z CONSTRAINT RANGE A	373	3,27		1		B			
Z CONSTRAINT RANGE B	526	1,22		1		B			
Z CONSTRAINT RANGE C	466	0,22		1		B	Y	Y	Y
RPA INST. PWR. ON	614	12,25	1			B	X	X	X
INST. PWR. OFF	615	13,26	1			B			
DRIFT HEAD PWR. ON	555	13,25	1			B			
DRIFT HEAD PWR. OFF	556	14,26	1			B			
HI SWEEP LEVEL	552	10,22		1		B			
LO SWEEP LEVEL	753	11,27		1		B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
RPA MULTIPLEX SWITCH	714	12,27		1		B	X	X	X
ORIENTED MODE	454	12,22		1		B			
SPIN MODE	752	10,26		1		B			
NORMAL RESOLUTION	415	13,22		1		B			
HIGH RESOL.	616	14,27		1		B			
BIAS HEAD 2	663	1,19		1		B			
BIAS HEAD 3	624	1,20		1		B			
LOAD MINOR MODE *	724	3,20			1	B			
ELECTROMETER SWITCH	513	11,22		1		B	Y	Y	Y
SPS LOAD MINOR MODE' *	665	3,21			1	B	X	X	X
REG. PWR. ON	203	3,8	1			B			
AZ MTR PWR. ON	301	1,8	1			B			
EL MTR PWR. ON	242	2,8	1			B			
POWER OFF	204	4,9	3			B			
ENABLE UNREG. PWR.	340	0,8	1			B			
DISABLE UNREG. PWR.	341	1,9	1			B			
FIRE COMD. 1	144	4,8	1			B			
FIRE COMD. 2	302	2,9	1			B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
LIU RASTER SCAN ON	474	6,28		1		B	X	X	X
LIU RASTER SCAN RESET	475	7,29		1		B			
ENABLE LIU RSL. PWR.	436	7,30		1		B			
DISABLE LIU RSL. PWR.	435	6,29		1		B			
RSL LOAD MINOR MODE *	311	9,16			1	B	↓	↓	↓
ENABLE MASC COIL 1	272	0,26	1			B	X	X	X
ENABLE MASC COIL 2	333	2,27	1			B	X	X	X
DISABLE MASC COILS	334	3,28	2			B	X	X	X
ATC, ENABLE AUX HTR	444	4,14	1			B	X	X	X
ATC, DISABLE AUX HTR	345	5,13	1			B	X	X	X
ATC, AUX HTR ON	243	3,9	1			B	X	X	X
ATC, AUX HTR OFF	244	4,10	1			B	X	X	X
ATC 1 5° REF	445	5,15	1			A	X	X	X
ATC 1 12° REF	544	4,16	1			A	X	X	X
ATC 2 5° REF	443	3,13	1			A	X	X	X
ATC 2 12° REF	722	1,18	1			A	X	X	X
ATC 3 5° REF	160	16,20	1			A	X	X	X
ATC 3 12° REF	257	15,21	1			A	X	X	X
ATC 4 5° REF	217	15,20	1			A	X	X	X
ATC 4 12° REF	220	16,21	1			A	X	X	X

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
ENABLE MARC PWR.	653	11,25	1			B		X	X
DISABLE MARC PWR.	654	12,26	1			B		X	X
MARC ON	516	14,25		1		B		X	X
MARC OFF	733	10,27		1		B		X	X
SEL. PCMC-1 NRZ DATA TO MARC	535	8,29		1		B		X	X
SEL. PCMC-2 NRZ DATA TO MARC	337	6,31		1		B		X	X
DISABLE QUOMAC COILS	275	3,29	2			B	X	X	X
ENABLE QUOMAC COIL 1	374	4,28	1			B	X	X	X
ENABLE QUOMAC COIL 2	274	2,28	1			B	X	X	X
ENABLE OAPS HEATERS	327	23,30	1			B	X	X	X
DISABLE OAPS HEATERS	330	24,31	1			B			
Δ V1 THRUST HTR. ON	367	23,31	1			B			
Δ V1 THRUST HTR. OFF	270	24,30	1			B			
Δ V2 THRUST HTR. ON	172	26,30	1			B			
Δ V2 THRUST HTR. OFF	271	25,31	1			B			
YAW THRUST HTR. ON	231	25,30	1			B			
YAW THRUST HTR. OFF	134	28,31	1			B			
OAPS TANK HTRS. ON	173	27,31	1			B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base-Plate	C	D	E
OAPS TANK HTRS. OFF	035	29,30	1			B	X	X	X
BOTH DECODERS NORMAL	632	7,26		2		B	X	X	X
DISABLE DEC 1 STORED COMDS.	727	6,23		1		B	X	X	X
DISABLE DEC 2 STORED COMDS.	750	8,24		1		B	X	X	X
TAPE RCDR. CONTROL									
TR-1 ON	664	2,20	1			B	X	X	X
TR-1 OFF	726	5,22	1			B			
TR-1 SEL RCD, NOT PLBK	323	19,26	1			B			
TR-1 SEL PLBK, NOT RCD	324	20,27	1			B			
TR-1 SEL TRK 1, NOT 2	424	20,29		1		B			
TR-1 SEL TRK 2, NOT 1	423	19,28		1		B			
TR-1 OUTPUT BUFFER ENABLE	264	20,26	1			B			
TR-1 OUTPUT BUFFER DISABLE	363	19,27	1			B			
TR-2 ON	666	4,22	1			B			
TR-2 OFF	745	5,21	1			B			
TR-2 SEL RCD, NOT PLBK	225	21,26	1			B			
TR-2 SEL PLBK, NOT RCD	226	22,27	1			B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base- Plate	C	D	E
TAPE RCDR CONTROL (Continued)									
TR-2 SEL TRK 1, NOT 2	463	19,29		1		B	X	X	X
TR-2 SEL TRK 2, NOT 1	364	20,28		1		B			
TR-2 OUTPUT BUFFER ENABLE	166	22,26	1			B			
TR-2 OUTPUT BUFFER DISABLE	265	21,27	1			B	Y	Y	Y
PROGRAMMER									
SEL PROG. 1, NOT 2	015	13,14	1			B	X	X	X
SEL PROG. 2, NOT 1	021	17,18	1			B			
SELECTED PROG. ON	017	15,16		2		B			
SELECTED PROG. OFF	116	14,17		2		B			
USE MEMORY 1, NOT 2	117	15,18		2		B			
USE MEMORY 2, NOT 1	057	15,17		2		B			
PROG. NADIR. ZERO REF.	155	13,17		2		B			
SPIN OAPS PLUS	020	16,17		2		B			
SPIN OAPS MINUS	156	14,18		2		B			
PROG. SET LOAD/DUMP *	757	15,31			2	B			
PROG. LOAD MEM. - MAJOR *	720	16,31			2	B	Y	Y	Y

Command Function	Op Code		Utilization				Spacecraft		
	9Bit	2of32	Rly.	R.D.	L.L.	Base- Plate	C	D	E
PROGRAMMER (Continued)									
PROG. LOAD MEM. - MINOR *	661	17,31			2	B	X	X	X
PROG. LOAD MEM. - DATA *	622	18,31			2	B			
PROG. LOAD OAPS DELTA *	055	13,15			1A 3B	A&B			
PROG. LOAD ATTITUDE DATA *	056	14,16			2	B			
MEM. PROG. ON	016	14,15			2	B			
MEM. PROG. STBY.	115	13,16			2	B			
PROG. THRUST ON CMD.	736	13,30			1A 3B	A&B			
THRUST OFF CMD.	677	13,31			2	B			
AUTO ROLL MEASURE ON	756	14,30			2	B			
AUTO ROLL STBY.	660	16,30			2	B			
NADIR. PROG. ON	621	17,30			2	B			
NADIR. PROG. STBY.	562	18,30			2	B	Y	Y	Y
PROG 1 NADIR FLIPPED REF	667	5,23			2	B			
PROG 2 NADIR FLIPPED REF	630	5,24			2	B			
DAMPER , FIRE 1	505	5,16	1			A			
DAMPER, FIRE 2	406	6,15	1			A	Y	Y	Y

The following section is taken from the performance specification for the dual programmer. Included are the bit allocations for the minor mode commands associated with the programmer for :

Memory programmer

Auto roll Programmer

QCMAC/MASC Programmer

CAFS programmer

1	4	5	15	16	26	27	32	
TAG	0	ADDRESS	LSB	0	MSB	WORDS	LSB	SPARE

While in the Load Mode, the MP shall increment the Load/Dump address following receipt of any of the three Load Memory commands (see following subparagraphs) starting from the starting address. The MP shall also count the number of 32 bit words loaded (load commands received) and terminate the mode after the specified number of words has been loaded.

The Load Memory Major command will be a minor mode command input to the PROG. The thirty-two bits of minor mode data shall have the following format. (See Figure 3.1.4a also.)

[illegible]

<u>Field</u>	<u>Bits</u>	<u>Description</u>
Time	1-16	This time is the time as measured by the 16 least significant bits of the S/C time code at which the attached OP Code is to be presented to the DEC for execution. The total programmable time is 72 hours, 49 minutes, 4 seconds in 4 second increments.
Spare	17	At present this bit is not being used.
OP Code	18-26	One of the 9 bit codes specifying any of the commands in the S/C glossary.
DBC	27	The Data Bus Control bit must be a "0" if the OP Code is for a major mode command and a "1" if the OP Code is for a minor mode command.
P	28	A Parity bit chosen such that odd parity is maintained over bits 17-28.
Tag	29-32	Bits 29 & 30 of the Tag field shall be loaded into the CMU as "0's" regardless of what is sent. These bits are used internal to the MP as status indicators (see 3.1.1.1.2.3.3.1). Bits 31 & 32 shall be loaded as sent but are presently unused.

While the MP is in the Load mode, the receipt of a Load Memory Major command shall cause the associated minor mode data to be stored in the CMU. The thirty-two bits of data shall be stored in four consecutive 10 bit words in the CMU. The current Load/Dump address shall be used as the ten MSB of the CMU address with the two LSB being 00, 01, 10, and 11 respectively for the four CMU words.

For the Load Memory Major command, the control field (first 2 bits) of each ten bit CMU word shall be loaded as 01. Figure 3.1.4b shows the format for the data as stored in the CMU.

3.1.1.1.2.1.3 Load Memory Minor Command

The Load Memory Minor command will be a minor mode command input to the PROG. The thirty-two bits of minor mode data shall have exactly the same format as for the Load Memory Major command except that the DBC bit must be a "1". (See format in Paragraph 3.1.1.1.2.1.2.)

While the MP is in the Load mode, the receipt of a Load Memory Minor command shall cause the associated minor mode data to be stored in the CMU. The thirty-two bits of data shall be stored in four consecutive 10 bit words in the CMU. The current Load/Dump address shall be used as the ten MSB of the CMU address with the two LSB being 00, 01, 10, and 11 respectively for the four CMU words.

For the Load Memory Minor command, the control field (first 2 bits) of each ten bit CMU word shall be loaded as 10. Figure 3.1.4c shows the format for the data as stored in the CMU.

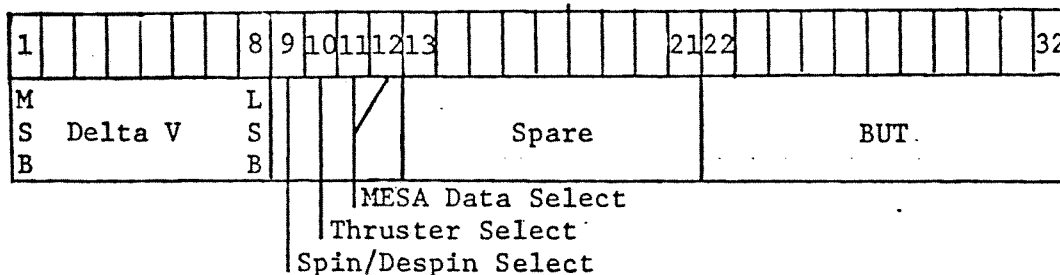
3.1.1.1.2.1.4 Load Memory Data Command

The Load Memory Data command will be a minor mode command input to the PROG. The thirty-two bits of minor mode data will be arbitrary binary data to be sent to the DEC along with an associated minor mode command. See Figure 3.1.4d for the format as sent from the ground.

While the MP is in the Load mode, the receipt of a Load Memory Data command shall cause the associated minor mode data to be stored in the CMU. The thirty-two bits of data shall be stored in four consecutive ten bit words in the CMU. The current Load/Dump address shall be used as the ten MSB of the CMU address with the two LSB being 00, 01, 10, and 11 respectively for the four CMU words.

For the Load Memory Data command, the control field (first 2 bits) of each ten bit CMU word shall be loaded as 00. Figure 3.1.4e shows the format for the data as stored in the CMU.

The PROG shall accept a Load OAPS Delta minor mode command as input. On receipt of this command, the OP shall enter one of its four active modes. The format for the 32 bits of minor mode data is as follows:



<u>BITS</u>	<u>FIELD</u>	<u>DEFINITION</u>
1-8	Delta V	One of 256 possible binary numbers corresponding to the 256 velocity change increments possible. The programmable range corresponds to Delta V's from zero to 44.11 ft/s.
9	Spin/Despin Select	Code 0 in this bit specifies despun operation of the thruster. Code 1 specifies spinning operation of the thruster.
10	Thruster Select	Code 0 in this bit enables the thrust on/off outputs to the Delta V thruster drivers. Code 1 enables the thrust on/off outputs to the Yaw thruster drivers.
11-12	MESA Data Select	Code 00 selects neither MESA data output. Code 10 selects MESA XY data output. Code 01 selects MESA YX data output. Code 11 is unused but selects neither MESA data output.

<u>BITS</u>	<u>FIELD</u>	<u>DEFINITION</u>
13-21	Spare	These bits are unused at present.
22-32	BUT	These bits are used by the BUT in the LIU; however, they shall also be accepted as part of a good Load OAPS Delta command by the PROG.

After receipt of a valid Load OAPS Delta command the OP shall examine the Spin/Despin select and Thruster select fields of the loaded word to determine which active mode to enter. While this command sets the active mode, no thruster shall be activated by this command and the integration of the acceleration as measured by the MESA shall not be started. The allowed modes and corresponding codes in the select fields are as follows:

Bits: 9 & 10	<u>Mode</u>
0 0	Delta V Despun
1 0	Delta V Spin
0 1	Yaw Despun
1 1	Yaw Spin

The Thrust On command received after a Load OAPS Delta command shall actually turn on the appropriate thrusters and initiate the Delta V comparison. If a new Load OAPS Delta command is received before a Thrust On command, the OP shall accept it and enter the new mode. Once the Thrust On command has been received, however, receipt of a new Load OAPS Delta command shall cause the OP to return to Standby Mode.

Any of the four active modes shall be terminated by receipt of the Disable OAPS command or the BUT overflow signal. Additionally, the Delta V Despun mode shall be terminated when the measured Delta V from the MESA is greater than or equal to the programmed Delta V loaded via the Load OAPS Delta command.

3.1.1.2.2.1 Delta V Despun Mode

While in this mode, the OP shall accept the first Thrust On command which occurs, turn on the two sets of outputs to the Delta V thruster, and start integrating the output of the accelerometer. The OP shall continually compare this measured Delta V with that loaded via the Load OAPS Delta V command which set the mode. When the measured Delta V is greater than or equal to the programmed one, the OP shall return the Thrus-

5-36

Size

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Code Ident No.

49671

PS-2271629

Sheet 41

ter On/Off outputs to the inactive level and enter Standby mode. This mode shall also be terminated and the OP returned to Standby mode on receipt of the Disable OAPS command or on receipt of the BUT overflow signal.

Receipt of additional Thrust On/Off commands while the Delta V is being measured shall control the Thruster On/Off outputs but shall not interrupt the measurement or comparison of the Delta V.

The selected input from the Miniature Electro-Static Accelerometer (MESA) will be a frequency proportional to the S/C acceleration (see Paragraph 3.1.1.2.10). After receipt of the first Thrust On command in this mode, the OP shall integrate the MESA data to measure the velocity change (Delta V) of the S/C. The integration shall be done by counting the pulses on the selected MESA Data input. The OP shall provide for Delta V in the range of zero feet per second to 44.11 feet per second corresponding to a range of 2^{13} counts to $2^{20}-2^{13}$ counts.

The OP shall continually compare the eight MSB of this accumulated count against the programmed Delta V from the Load OAPS Delta command. The granularity on the programmable Delta V shall be 0.173 feet per second and there shall be 255 uniform steps in the range. The count shall always start from zero on receipt of the first Thrust On command occurring during the Delta V Despun mode and shall continue until a Delta V match is detected or the mode is terminated. The count shall not be reset nor be inhibited by receipt of further Thrust On/Off commands.

3.1.1.2.2.2 Delta V Spin Mode

While in this mode, the OP shall accept the first Thrust On command which occurs, enable the two sets of outputs to the Delta V Thrusters, enable the OAPS Nadir Commutation, and inhibit the Delta V match.

In this mode the Thrust On command enables the outputs to the Delta V Thrusters but the actual turn on and off of the thrusters shall be under control of the OAPS Delta V Nadir Commutation. (See Paragraphs 3.1.1.5.1.7 and 3.1.1.5.1.8) The OP shall receive the commutation signals from the Nadir Programmer (NP) internal to the PROG. After the Delta V thruster outputs are enabled by the Thrust On command, the receipt of OAPS Delta V Nadir 1 shall turn on the Delta V thrusters and the receipt of OAPS Delta V Nadir 2 shall turn them off. This action shall continue until the Thrust Off command disables the thruster outputs or until the mode is terminated by the Disable OAPS command or the BUT overflow signal. Receipt of additional Thrust On/Off commands while in this mode shall enable/disable the Delta V thrust outputs but shall not terminate the mode.

USED BY ARP																USED BY QS				USED BY MS																											
1	2						8	9	10						16	17	18	19	20	21	22	23	24							32																	
F C B	M S B	UPPER THRESHOLD						L S B	S P A R E	M S B	LOWER THRESHOLD						L S B	F B	Q ON	Q ON	F B	M ON	M ON	M ON	M ON	MASC NADIR						L S B															
																				Programmable MASC Nadir																											
																				MASC																											
																				Commutation On/Off																											
																				MASC Minus On/Off																											
																				MASC Plus On/Off																											
																				Field Control Bit for MASC (Bits 20-32)																											
																																				QOMAC Minus On/Off											
																																				QOMAC Plus On/Off											
																																				Field Control Bit for QOMAC (Bits 17-19)											
																																Auto Roll Lower Threshold															
																																Spare															
																																Auto Roll Upper Threshold															
																Field Control Bit for Auto Roll (Bits 1-16)																															

For further description of the data in each field and the modes associated with them refer to the paragraphs which specify the appropriate Programmer section.

Thus a real time or stored QOMAC program shall be executed with the polarity reversed from that received by the QS.

3.1.1.3.1.3 QOMAC Inhibit Mode

The QS shall operate in the Inhibit mode when the ARP indicates a measured roll error which is between the loaded lower threshold and upper threshold. In this mode neither the QOMAC Plus On nor the QOMAC Minus On commands shall activate either the QOMAC Coil Plus outputs nor the QOMAC Coil Minus outputs. Thus a real time or stored QOMAC program received by the QS shall not be executed.

3.1.1.3.2 QOMAC Control Commands

Bits 17, 18, and 19 of the Load Attitude Data minor mode command (see Paragraph 3.1.1.6.1.9) shall be used by the QS to control its state or operation. The codes for these bits and the corresponding commands are listed below:

Bits:	<u>17</u>	<u>18</u>	<u>19</u>	Command
	1	0	0	QOMAC Off
	1	1	0	QOMAC Plus On
	1	0	1	QOMAC Minus On
	1	1	1	This code is not allowed--neither coil drive shall be energized
	0	X	X	No new command - state stays the same

X - Don't Care Condition

The QS shall monitor these bits continuously and shall respond to the corresponding commands as described in Paragraph 3.1.1.3.1, depending on the mode set by the ARP. Bit 17, the QOMAC field control bit, must be a "1" to initiate a new QOMAC command.

3.1.1.3.6 MASC Control Commands

Bits 20, 21, 22, and 23 of the Load Attitude Data minor mode command (see Paragraph 3.1.1.6.1.9) shall be used by the MS to control its state. The codes for these bits and the corresponding commands are listed below:

Bits:	<u>20</u>	<u>21</u>	<u>22</u>	Command
	1	0	0	MASC Off
	1	1	0	MASC Plus On
	1	0	1	MASC Minus On
	1	1	1	This code is not allowed--neither coil drive shall be energized.
	0	X	X	No new command - state stays the same.

Bits:	<u>20</u>	<u>23</u>	Command
	1	0	MASC Commutation Off
	1	1	MASC Commutation On
	0	X	No new command - State stays the same.

X - Don't Care Condition

The MS shall monitor these bits continuously and shall respond to the corresponding commands as described in Paragraph 3.1.1.3.5. Bit 20, the MASC field control bit, must be a "1" to initiate a new MASC command.

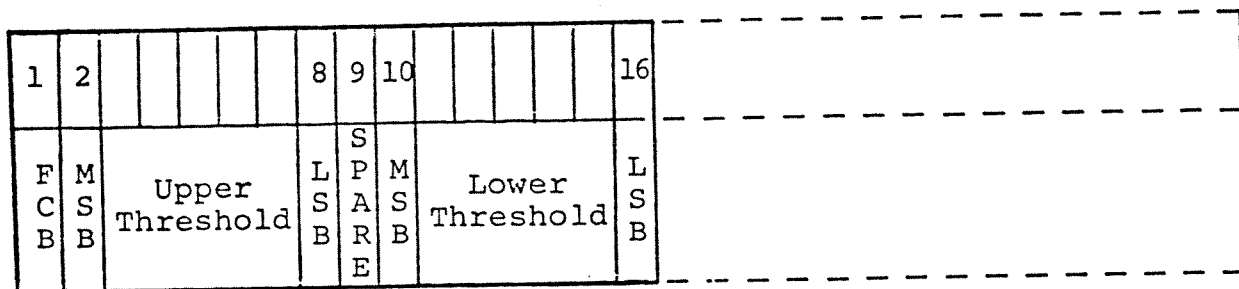
3.1.1.3.7 MASC Coil Plus

The PROG shall provide four identical MASC Coil Plus outputs to the coil drivers in the CDU. These signals shall become active upon receipt of the appropriate MASC Plus On and MASC Minus On commands as described in Paragraph 3.1.1.3.5 depending on the commanded mode. When active, these signals shall cause current to flow in the positive sense in the Enabled MASC Coil(s). These signals shall never be active at the same time that the MASC Coil Minus outputs are active, and shall make all transitions at least 30 milliseconds away

these commands as received by the QMP to provide an automatic turnoff of the ARP active mode.

3.1.1.4.2 Load Auto Roll

Bits 1 through 16 of the Load Attitude Data minor mode command (See Paragraph 3.1.1.6.1.9) shall be used by the ARP to program the upper and lower thresholds. The format for these bits is as follows:



Bits	Field	Definition
1	Auto Roll Field Control Bit	This bit must be a "1" to load new threshold values into the ARP.
2-8	Upper Threshold	A binary number representing the counts of 4096Hz clock corresponding to the desired Earth Time difference for the upper limit of roll error.
9	Spare	This bit is unused at present.
10-16	Lower Threshold	A binary number representing the counts of 4096Hz clock corresponding to the desired Earth Time difference for the lower limit of roll error.

Each time the Load Attitude Data command is received and the AR FCB is a "1", the ARP shall load the new thresholds but shall take no further action. This command shall not turn on the ARP nor shall it change the state of the outputs if the ARP is already on. The thresholds may be changed while the

The following tables delineate the bit allocations for pitch offset and wheel speed bias for the mino mode command used by the pitch control subsystem.

PITCH OFFSET (COMMAND)

Numbers refer to offset in degrees

BIT #

BIT #																	2	3	4
	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1			
5	0	0	0	0	1	1	1	1	0	0	0	0	0	1	1	1			
6	0	0	1	1	0	0	1	1	0	0	1	1	1	0	0	1			
7	0	1	0	1	0	1	0	1	0	1	0	1	1	0	1	0			
8																			
9																			
00000	0	32	64	96	128	160	192	224	256	288	320	352	NOT VALID						
00001	1	33	65	97	129	161	193	225	257	289	321	353							
00010	2	34	66	98	130	162	194	226	258	290	322	354							
00011	3	35	67	99	131	163	195	227	259	291	323	355							
00100	4	36	68	100	132	164	196	228	260	292	324	356							
00101	5	37	69	101	133	165	197	229	261	293	325	357							
00110	6	38	70	102	134	166	198	230	262	294	326	358							
00111	7	39	71	103	135	167	199	231	263	295	327	359							
01000	8	40	72	104	136	168	200	232	264	296	328								
01001	9	41	73	105	137	169	201	233	265	297	329								
01010	10	42	74	106	138	170	202	234	266	298	330								
01011	11	43	75	107	139	171	203	235	267	299	331								
01100	12	44	76	108	140	172	204	236	268	300	332								
01101	13	45	77	109	141	173	205	237	269	301	333								
01110	14	46	78	110	142	174	206	238	270	302	334								
01111	15	47	79	111	143	175	207	239	271	303	335								
10000	16	48	80	112	144	176	208	240	272	304	336								
10001	17	49	81	113	145	177	209	241	273	305	337								
10010	18	50	82	114	146	178	210	242	274	306	338								
10011	19	51	83	115	147	179	211	243	275	307	339								
10100	20	52	84	116	148	180	212	244	276	308	340								
10101	21	53	85	117	149	181	213	245	277	309	341								
10110	22	54	86	118	150	182	214	246	278	310	342								
10111	23	55	87	119	151	183	215	247	279	311	343								
11000	24	56	88	120	152	184	216	248	280	312	344								
11001	25	57	89	121	153	185	217	249	281	313	345								
11010	26	58	90	122	154	186	218	250	282	314	346								
11011	27	59	91	123	155	187	219	251	283	315	347								
11100	28	60	92	124	156	188	220	252	284	316	348								
11101	29	61	93	125	157	189	221	253	285	317	349								
11110	30	62	94	126	158	190	222	254	286	318	350								
11111	31	63	95	127	159	191	223	255	287	319	351								

SPEED BIAS COMMAND

Bit. No

14
13

BIT NO.			1	1	0	0
12	11	10	1	0	1	0
1	1	1	10	18	26	34
1	1	0	11	19	27	35
1	0	1	12	20	28	36
1	0	0	13	21	29	37
0	1	1	14	22	30	38
0	1	0	15	23	31	39
0	0	1	16	24	32	40
0	0	0	17	25	33	41

SPEED BIAS IS IN RAD/SEC

The following tables delineate the bit allocations for the minor mode command associated with the SPS and RSL.

SPS MINOR MODE DATA CODES

BIT # (OF MINOR MODE DATA TO SPS)

		67 ---->							
		8 9	00	01	10	11			
SPS DATA CODE vs OFFSET ANGLE & OFFSET STEP NUMBER FOR EVALUATION OR CROSS-EVALUATION OFFSETS	0 0	0.	1	14.	5	28.	9	42.	13
	0 1	3.5	2	17.5	6	31.5	10	45.5	14
	1 0	7.	3	21.	7	35.	11	49.	15
	1 1	10.5	4	24.5	8	38.5	12	52.5	16
		+11% +1.5 ARC MINUTES DEVIATION FROM NULL							
		Step Number							

		67 ---->							
		8 9	00	01	10	11			
SPS DATA CODE vs ELEVATION ANGLE AND EL COMMAND ANGLE FOR ELEVATION COARSE SETTINGS IN ACQUISITION	0 0	7.7	10	28.9	30	50.2	50	71.4	70
	0 1	13.0	15	34.2	35	55.5	55	76.7	75
	1 0	18.3	20	39.5	40	60.8	60	82.0	80
	1 1	23.6	25	44.8	45	66.1	65	87.3	85
		+2.7° ANGLE FROM +Z AXIS							
		COMMAND ANGLE							

MINOR MODE COMMAND TYPE	MINOR MODE DATA BIT VALUES (NUMBERED IN TIME ORDER OF APPEARANCE)																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Commands to SPS			Register Select			Data For Selected Reg.					Offset EN/DIS						
1) El Angle	0	1	1	0	0	x ₆	x ₇	x ₈	x ₉	0							
2) El Offset	0	1	0	1	0	x ₆	x ₇	x ₈	x ₉	1							
3) Cross-El Offset	0	1	0	0	1	x ₆	x ₇	x ₈	x ₉	1							

NOTES: 1) Bit locations above, which are not filled in, are "Don't Care" bits.

2) El Angle bit values designated x_n to SPS are values x_n of the echo command received by RSL.

RSL DATA CODES

BIT NUMBER (OF RSL TELEMETRY READOUT, WD 119,4 & 120,4)

RSL DATA CODE	1 2 3	NAME	DESCRIPTION
vs			
RSL MODE	0 0 0	REST	Do not send any commands to SPS.
(119,4) 1,2,3			
ARE STATUS BITS	0 0 1	ECHO	Send bits 3 thru 10 of the last RSL input command to the SPS, without modification
OF LAST COMMAND			
TO RSL, BITS 17,			
16, & 15, RES-	0 1 0	Scan Rstr	Column by Column
PECTIVELY			
	0 1 1	Scan e	Scan up and down a column--2 sec per step
	1 0 0	REST	
	1 0 1	ECHO	
	1 1 0	Scan Rstr	Row by Row--change offset point each 2 sec
	1 1 1	Scan γ	Scan back and forth across a row--2 sec per step
		NAME	DESCRIPTION
RSL 2 SEC SYNC	14		RSL internal status--2 sec square wave; 1 → 0 starts command to SPS from RSL
RSL-TO-SPS	5 - 12		Bits 5 thru 12 of RSL TLM readout convey the same information as that being sent to the SPS in bits 3 thru 10, respectively, of SPS minor mode data. See "SPS Minor Mode Data Codes."
DATA BITS TO BE SENT TO SPS AS MINOR MODE DATA			
RSL TLM SPARE	13		Spare--arbitrarily set to "0."

RSL DATA CODES Continued...

	NAME	DESCRIPTION
RSL DESTINATION SELECT	<u>14</u>	RSL internal status--in the next command to SPS from RSL, load data into SPS cross-elevation register ("1") or elevation register ("0") if RSL mode bit 2 is "1." If mode bit 2 is "0," bit 14 has no effect on RSL or SPS.
	<u>15 16</u>	<u>DESCRIPTION</u>
RSL COMMAND LOAD- ING STATUS	0 0	Executing latest command to RSL; generating Xfr.
	0 1	Awaiting next command to RSL.
	1 0	Waiting to execute latest command to RSL.
	1 1	Loading a command to RSL.

RSL MINOR MODE DATA CODES

Minor Mode Command Type	Minor Mode Data Bit Values (numbered in time order of appearance)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
Commands to RSL																	RSL Mode Select <u>m₃ m₂ m₁</u>			
1) Echo	0	1	x ₃	x ₄	x ₅	x ₆	x ₇	x ₈	x ₉	x ₁₀							l ₁	0 ₀	0 ₁	
2) El Scan (scan ε)	0	1				x ₆	x ₇	x ₈	x ₉	1							1	1	0	
						el value														
3) Cross-El Scan(scan γ)	0	1				x ₆	x ₇	x ₈	x ₉	1							1	1	1	
						xel value														
4) Raster Scan by rows	0	1				x ₆	x ₇	x ₈	x ₉	1	x ₁₁	x ₁₂	x ₁₃	x ₁₄	0 ₀	1 ₁	1 ₀			
by columns	0	1				xel value				el value										
5) Rest																				

- NOTES: 1) Bit locations above, which are not filled in, are "Don't Care" bits.
- 2) El Angel bit values designated x_n to SPS are values x_n of the echo command receivedⁿ by RSL.

SECTION 6.0

ATMOSPHERE EXPLORER
MISSIONS C, D, AND E

Title: AE HAZARDOUS COMMANDS

DN-1070-17.2/17.3(AE)

Written by: W. V. Fuldner

Date: 1/18/73

Approved by: B. Stewart

Date: 1/19/73

REVISIONS

Ltr.	Description	Date	Author
A	Delete NATE LOAD SENSE Commands, Add. SBT Hi Pwr and SP5 MTR Pwr CMOS	3/9/73	W.V.Fuldner
B	Delete SBT Hi Pwr Enable	3/26/73	W. V. Fuldner
C	Add PWR System Safety Circuit Enable & Disable Cmds, and ATC Aux Htr Cmds.	10/29/73	W. V. Fuldner
D	Add CEP Probe Heater Commands and Add Mnemonic Table	11/9/73	W. V. Fuldner
E	Add Damper Ordnance Commands	11/20/73	W.V. Fuldner

AE HAZARDOUS COMMANDS

1.0 INTRODUCTION

The following list of commands have been identified as potentially hazardous to the spacecraft and/or experiments if executed at undesirable times. As concerns the spacecraft and experiment equipment, only major mode commands are involved.

2.0 HAZARDOUS COMMAND LIST

FIRE	OAPS	N.O.	VALVE	COMD	1
"	"	"	"	"	2
"	"	N.C.	"	"	1
"	"	"	"	"	2

ENABLE	OAPS	P.L.	BUS	A, NOT B
"	"	"	"	B, NOT A

CEP ENABLE BIPH HTRS
 CEP RAD BIPH HTR ON
 CEP AX BIPH HTR ON
 CEP RAD PROBE HTR ON
 CEP AX PROBE HTR ON

OSS	FIRE	COMD	#1
"	"	"	#2
NACE	FIRE	COMD	#1
"	"	"	#2
PSA	FIRE	COMD	#1
"	"	"	#2

ESUM	BIPH	HTR	PWR	ON
VAE	ENABLE	BIPH	HTR	
VAE	BIPH	1	HTR	ON
"	"	2	"	"

NATE	FIRE	COMD	#1
"	"	"	#2

SPS	FIRE	COMD	#1
"	"	"	#2

-2-

ENABLE SQUIB BUS A, NOT B
 " " " B, NOT A

OAPS TANK VALVE 1 ON
 " " " 2 "
 " " " 3 "
 " " " 4 "
 " " " 5 "
 " " " 6 "

ENABLE $\Delta V1$ THRSTR, NOT $\Delta V2$ OR YAW
 " $\Delta V2$ " " $\Delta V1$ " "
 " YAW " " $\Delta V1$ " $\Delta V2$

ESUM ENABLE PL AND UNREG BUSES

SBT OSC TEST MODE

SPSAZ MTR PWR ON
 SPS EL MTR PWR ON

REG BUS DETECTOR ENABLE
 " " " DISABLE

UNREG BUS DETECTOR ENABLE
 " " " DISABLE

CHARGE CONTROL #1 FAILURE DETECTOR ENABLE
 " " #1 " " DISABLE
 " " #2 " " ENABLE
 " " #2 " " DISABLE
 " " #3 " " ENABLE
 " " #3 " " DISABLE

ATC AUX HEATER ENABLE
 " " " ON

DAMPER FIRE COMMAND NO. 1
 DAMPER FIRE COMMAND NO. 2

<u>MNEMONIC</u>	<u>OP CODE (OCTAL)</u>
/CEP, HT RENA.	437
/CEP, APBON.	754
/CEP, RPBON.	634
/CEP, RPHON.	476
/CEP, APHON.	636
/OSS, N1FIRE	447
/OSS, N2FIRE	550
/NACE, N1FIRE.	646
/NACE, N2FIRE.	647
/NATE, N1FIRE	741
/NATE, N2FIRE	742
/PSA, N1FIRE	253
/PSA, N2FIRE	537
/ESUM, PLUBENA.	707
/ESUM, HTRON.	747
/VAE, HTRENA	403
/VAE, HTR1ON	442
/VAE, HTR2ON	502
/SPS, N1FIRE.	144
/SPS, N2FIRE	302
/SPS, AZPWRON.	301
/SPS, ELPWRON.	242
/SQUIB, BUSAENA	073
/SQUIB, BUSBENA	075
/OAPS, NO1FIRE	132
/OAPS, NO2FIRE	071
/OAPS, NC1FIRE.	133
/OAPS, NC2FIRE.	232
/OAPS, PLAENA	034
/OAPS, PLBENA.	033
/OAPS, VAL1ON.	031
/OAPS, VAL2ON.	072
/OAPS, VAL3ON	131
/OAPS, VAL4ON	130
/OAPS, VAL5ON	230
/OAPS, VAL6ON	070
/OAPS, DV1ENA.	171
/OAPS, DV2ENA.	170
/OAPS, YAWENA.	032

<u>MNEMONIC</u>	<u>OP CODE (OCTAL)</u>
/SBT, OSCTEST.	623
/PSE, OVCG1ENA.	224
/PSE, OVCG1DIS.	223
/PSE, OVCG2ENA.	125
/PSE, OVCG2DIS.	322
/PSE, OVCG3ENA.	027
/PSE, OVCG3DIS.	126
/ATC, AXHTRENA.	444
/ATC, AXHTRON.	243
/DAMPER, FIRE 1	505
/DAMPER, FIRE 2	406

SECTION 7.0

ATMOSPHERE EXPLORER
MISSIONS C, D, AND E

Title: COMMAND VERIFICATION WORD BIT ASSIGNMENTS DN-918-2.3(AE)

Written by: R. Borlik

Date: 22 September 1972

Approved by: B. Stewart

Date: 22 September 1972

REVISIONS

Ltr.	Description	Date	Author
A	Revised description of Bits 1 and 11.	11/9/72	W. V. Fuldner

COMMAND VERIFICATION WORD BIT ASSIGNMENTS

I. INTRODUCTION

This design note defines the coding of the command verification and telemetry format identification information contained in word locations 4 and 5 of the telemetry main frame. Bit 1 corresponds to bit 1 of main frame word 4 and is transmitted first in real time. The bit order is reversed on playback of the spacecraft tape recorder.

Bit 1 Load/Dump Error Flag - A logic 1 in this bit will indicate that one of the following errors has occurred in attempting to command the memory and memory programmer.

- I. If the memory programmer is operating in a load mode or in a dump mode, and the memory address counter in the memory programmer overflows, (attempted wrap-around), the error will be flagged. (The memory programmer will not wrap-around.)
- II. If the memory programmer is not in the load mode, and a load memory major, or load memory minor, or load memory data command is received, the error will be flagged. (The command will not be accepted.)
- III. If the memory programmer is in a load mode or in a dump mode and a set load/dump command is received, the error will be flagged. (The command will not be accepted.)

Bit 2 Stored Command Execution - A logic 1 indicates that a stored command is being executed during the main telemetry frame in which the logic 1 occurs. The command may have been stored in either the Programmer memory or in the MARC.

Bits 3,4,5 Decoder 1 Status - Bit 3 will normally be a logic 1 indicating that bits 4 and 5 represent new information since the last telemetry frame. If this bit is a logic 0, it indicates that the Decoder telemetry has not been updated since last sampled by the telemetry subsystem, and bits 4 and 5 do not represent new information. This fact is necessary for proper command verification bookkeeping on the ground. Bits 4 and 5 indicate state of DEC real time command logic as follows:

Bit 4/Bit 5

0	0	Squelch State - Command clock amplitude below threshold or DEC phase locked oscillator not in phase with received clock signal. Neither commands nor frame sync will be accepted by DEC in this state.
1	0	Sync Search - Decoder is in condition to accept the frame sync patten.
1	1	Address Check - Frame sync has been recognized and Decoder will accept a command with valid address. This state always occurs once immediately after frame sync is received.
0	1	Execute - This state indicates that a valid command has been received and will be executed.

Bits 6,7,8 Decoder 2 Status - Bits 6, 7, and 8 are identical in function to bits 3, 4, and 5, respectively.

Bits 9 & 10 PCMC 1 Status - Bits 9 and 10 indicate the mode of the PCMC which formatted the telemetry data.

Bit 9/Bit 10

0	0	Power off.
1	0	MARC Mode - Telemetry format under control of MARC.
0	1	ROM Mode - Telemetry frame in standard format defined by rest-only memories contained in PCMC.
1	1	Memory Dump Mode - Telemetry format is standard as in ROM mode, except that 32 words in the telemetry main frame contain data from the command memory in place of the normal experiment data.

Bit 11 Bad Sequence Flag - If this bit is a logic 1, it indicates that one of two abnormalities was detected by the format checking logic of the memory Programmer.

- I. During memory load, signifies either that
 - (a) a Load Memory Major or Minor command is received when Load Memory Data command is expected following a Load Memory Minor command, or
 - (b) a Load Memory Data command is received when not expected, that is, whenever the previous load command was not Load Memory Minor, or
 - (c) the memory Programmer left the load mode after receiving a Load Memory Minor, but before receiving a Load Memory Data command.

- II. While in PROGRAM mode, signifies that a stored minor mode command op code was transferred to the Decoder, but not executed because the stored control fields read out of memory with the minor mode data were not all correct.

Bits 12-16

Check Bits - These bits are parity check bits which provide a check over all bits except bit 1.

ATMOSPHERE EXPLORER
MISSIONS C, D, AND E

Title: AE-C, D, E SPACECRAFT TELEMETRY DATA FORMATS DN-836-2.3(AE)

Written by: W. V. Fuldner

Date: 25 July 1972

Approved by: B. Stewart

Date: 25 July 1972

REVISIONS

Ltr.	Description	Date	Author
A	Revised format, add analog/digital indication and baseplate locations of source.	22 Aug 72	W. V. Fuldner
B	Revised word order in main frame words 17 & 18, corrected typos and added Appendix B	31 Aug 72	W. V. Fuldner
C	Interchange Main Frame Words 71 and 127 corrected typos, corrected flag bit allocations, re-identified OAPS Temp. TLM. Added Appendices C & D.	17 Oct 72	W. V. Fuldner
D	On Spacecraft 8-sec subcom, deleted use of word 116 to accommodate ROM error. (Read out word 48 of same subcom) Shifted 116 thru 119 data 1 position higher (See Sheet 11)	30 Nov 72	W. V. Fuldner
E	Delete VHF 1 & 2 output stage temps (Channels 67 & 68 now Spare Delete VHF 1 & 2 Conv. Temps (Channels 71 & 72 now Spare) } S/C 8 sec Subcom	16 Jan 73	W. V. Fuldner
F	Changed Array Temp Designations. Deleted DSAI Enable Flag, 65,22 Bit 4. Changed EUVS HV PMT Flag from 68,106 Bit 5 to Bit 6. Added Tables 6,7,8, and 9.	22 Oct 73	W. V. Fuldner
G	Added Memory -10V TLM to Word (66,121) pg. 11	20 Nov 73	W. V. Fuldner

AE-C, D, E SPACECRAFT TELEMETRY DATA FORMAT

1.0 INTRODUCTION

This design note presents the telemetry format for the spacecraft telemetry contained in the following main frame locations:

1. Words 4 & 5; Command Verification and Frame Identification
2. Word 20; SPS/EUVS eight word analog subcom
3. Words 17 & 18; Attitude information four word subcom
4. Word 65; Spacecraft housekeeping sixty-four word subcom
5. Word 66; Spacecraft housekeeping one hundred twenty-eight word subcom
6. Word 81; Body rotation time reference
7. Word 82; Sun angle time reference
8. Words 119 & 120; MESA/RSL four word subcom

Also included in the attached tables are the formats for the experiment flag bits which are assembled by the spacecraft for the experiment 128 word subcom. Attached in Appendix A is the NASA supplied main frame telemetry format and and experiment subcom formats which are understood to be the mission requirements for the AE-C spacecraft. Note that in the experiment 64 word subcom, word 21 is now an analog for the C magnetometer and word 23 is a digital spare.

Note that in spacecraft flag word 46 of the 4 sec spacecraft subcom, bits 4 thru 8 originate on the B baseplate while the flag bit multiplexer used is located on the A baseplate. Thus, these spare relay flag bits from CDU-B are taken across the baseplate to baseplate interface when they are used in the system.

The A or B indication in the upper right hand corner indicates the baseplate on which the source circuit is mounted. The notation in the lower right hand corner identifies the Analog (and polarity) or Digital nature of the signal.

Appendix B contains the memory dump format.

Included in Appendix C are the main frame and experiment subcom frames for the AE-D spacecraft. The word locations shown shaded indicate the changes in the formats from the C spacecraft which require modification to the PCMC Read-Only-Memory, and require additional circuitry in the appropriate LIU's to permit the LIU designs to be interchangeable between to either the C, D, or E spacecraft. Appendix D contains the AE-E main frame and subcom frame formats. With the exception of the magnetometer telemetry, these frames are subsets of the corresponding frames for the AE-C spacecraft. As the system design permits either the analog magnetometer (C) or the digital magnetometer (D), either format is hardware available from the LIU. If it is acceptable to utilize the analog version for the E spacecraft word locations, then the Read-only-Memories of the PCMC for the C spacecraft may be used for the E spacecraft. In all conditions, the overwritten locations for the memory dumps are the same and the spacecraft telemetry locations are the same.

The following tables present the spacecraft telemetry for the AE-C, D, E spacecraft.

TABLE 1

4 sec (64 wd)

8 sec (128 wd)

1	Shunt Diss Current	A	Upper Hat Temp 1 Upper Panel 16	A	1
		AN-	TBA42	AN-	
2	Side Solar Array Current	A	Lower Hat Temp 2 Bottom Array	A	2
		AN-	+X Outboard TBA40	AN-	
3	Bottom Solar Array Current	A	Lower Hat Temp 3 Lower Panel 4	A	3
		AN-	TBA44	AN-	
4	Batt 1 Chg Current	A	Lower Hat Temp 1 +X near adapter	A	4
		AN+	TBA41	AN-	
5	Batt 2 Chg Current	A	Lower Hat Temp 2 -X midway	A	5
		AN+	TBA42	AN-	
6	Batt 3 Chg Current	A	Batt 1 3rd Elect V	A	6
		AN+		AN-	
7	(2 scales) Unreg Bus Current	A	Batt 2 3rd Elect V	A	7
		AN-		AN-	
8	(2 scales) Reg Bus Current	A	Batt 3 3rd Elect V	A	8
		AN-		AN-	
9	← S/C TIME CODE →			A	9
				DIG	
10	Batt 1 Dischg Current	A	Batt 1 Temp	A	10
		AN-		AN-	
11	Batt 2 Dischg Current	A	Batt 2 Temp	A	11
		AN-		AN-	
12	Batt 3 Dischg Current	A	Batt 3 Temp	A	12
		AN-		AN-	
13	Solar Array Bus Voltage	A	Lower Hat Temp 1 Panel 9 Center Lower	A	13
		AN-	A45	AN-	
14	Unreg Bus Voltage	A	Lower Hat Temp 2 Panel 1 Lower	A	14
		AN-	A43	AN-	

TABLE 1 (Continued)

4 sec (64 wd)

8 sec (128 wd)

15	Batt 1 Voltage	A	Side Array Temp 3 Panel 9 Upper	A	15
		AN-	A44	AN-	
16	Batt 2 Voltage	A	Top Temp 4 -X, +Y Quad 2	A	16
		AN-	A40	AN-	
17	Batt 3 Voltage	A	Top Temp 5 +X, -Y Quad 4	A	17
		AN-	A41	AN-	
18	Pulse Load Bus Voltage	A	Upper BP Temp 1 +X, +Y Quad 1	A	18
		AN-		AN-	
19	Reg Bus Voltage	A	Upper BP Temp 2 -X, +Y Quad 2	A	19
		AN-		AN-	
20	PCE 1 Comp Amp	A	Upper BP Temp 3 +X, -Y Quad 4	A	20
		AN-		AN-	
21	PCE 2 Comp Amp	A	Upper BP Temp 4 -X, -Y Quad 3	A	21
		AN-		AN-	
22	Relay Flags*	A	Lower BP Temp 1 +X, +Y Quad 1	B	22
		DIG		AN-	
23	Relay Flags*	A	Lower BP Temp 2 -X, +Y Quad 2	B	23
		DIG		AN-	
24	Relay Flags*	A	Lower BP Temp 3 -X, -Y Quad 3	B	24
		DIG		AN-	
25	Relay Flags*	B	Lower BP Temp 4 +X, -Y Quad 4	B	25
		DIG		AN-	
26	Relay Flags*	B	ATC 1 Housing Temp	A	26
		DIG		AN-	
27	Relay Flags*	B	ATC 2 Housing Temp	A	27
		DIG		AN-	
28	Relay Flags*	B	ATC 3 Housing Temp	A	28
		DIG		AN-	

*See Table 2

TABLE 1 (Continued)

4 sec (64 wd)			8 sec (128 wd)		
29	Relay Flags*	A	ATC 4 Housing Temp	A	29
		DIG		AN-	
30	Relay Flags*	A	ΔV Thruster 1 Valve Temp	A	30
		DIG		AN-	
31	Relay Flags*	B	ΔV Thruster 2 Valve Temp	A	31
		DIG		AN-	
32	Relay Flags*	A	Yaw Thruster Valve Temp	A	32
		DIG		AN-	
33	Relay Flags*	B	Bay 2 OAPS Plumbing Temp	A	33
		DIG		AN-	
34	Relay Flags*	A	Bay 5 OAPS Plumbing Temp	A	34
		DIG		AN-	
35	Relay Flags*	A	Bay 6 OAPS Plumbing Temp	A	35
		DIG		AN-	
36	Relay Flags*	A	OAPS Tank 1 Temp	A	36
		DIG		AN-	
37	Relay Flags*	B	OAPS Tank 2 Temp	A	37
		DIG		AN-	
38	Relay Flags*	B	OAPS Tank 5 Temp	A	38
		DIG		AN-	
39	Relay Flags*	A	OAPS Tank 6 Temp	A	39
		DIG		AN-	
40	Relay Flags*	A	OAPS Pressure 1	A	40
		DIG		AN-	
41	Relay Flags*	A	OAPS Pressure 2	A	41
		DIG		AN-	

* See Table 2

TABLE 1 (Continued)

4 sec (64 wd)			8 sec (128 wd)		
42	Relay Flags*	A	RCVR 1 Signal Strength	A	42
		DIG		AN-	
43	Relay Flags*	A	RCVR 2 Signal Strength	A	43
		DIG		AN-	
44	Relay Flags*	A	RCVR 1 Phase Offset	A	44
		DIG		AN-	
45	Relay Flags*	B	RCVR 2 Phase Offset	A	45
		DIG		AN-	
46	Relay Flags*	A	RCVR 1 Conv Voltage	A	46
		DIG		AN-	
47	Spare Digital Word	A	RCVR 2 Conv Voltage	A	47
		DIG		AN-	
48	Logic Flags**	B	SBT 1 Output Stage Temp	A	48
		DIG		AN-	
49	Logic Flags**	A	SBT 2 Output Stage Temp	A	49
		DIG		AN-	
50	Logic Flags**	B	Selected SBT RF Out Pwr	A	50
		DIG		AN-	
51	Logic Flags**	B	Selected SBT DC Conv Volt.	A	51
		DIG		AN-	
52	DSAI Data	A	SBT 1 Conv Temp	A	52
		DIG		AN-	
53	Mem Prog Stat(2)*** Slip Time Counter(6)	B	SBT 2 Conv Temp	A	53
		DIG		AN-	
54	OAPS Prog/A.R.Prog/Nadir Prog Stat. See Table 4	B	SBT Pressure	A	54
		DIG		AN-	
55	OAPS Loaded ΔV	B	Top Array +X off Axis 4"	A	55
		DIG		A43 AN-	

* See Table 2

** See Table 3

*** See Table 6

TABLE 1 (Continued)

4 sec (64 wd)

8 sec (128 wd)

56	OAPS Measured ΔV	B	Lower Hat Panel 9 Near Thruster	B	56
		DIG		AN-	
57	Auto Roll Meas ΔT	B	DSAI DC/DC Conv	A	57
		DIG		AN-	
58	Auto Roll Lower Thr (7)	Auto Roll Upper Thr (7)	ARP Stat * (2)	B	58
				DIG	
59	Attitude Prog Status See Table 5			B	59
				DIG	
60	Selected B.H.S. Earth Time (16)			B	60
				DIG	
61	Selected B.H.S. Period (16)			B	61
				DIG	
62	But 1 Accum Ct (10)	Output Active (1)	But 1 Seq Stat (4)	But 1 Sel	62
				A	
				DIG	
63	But 2 Accum Ct (10)	Output Active	But 2 Seq Stat (4)	But 2 Sel	63
				B	
				DIG	
64	Selected Despin (9 Bits)**	Orientation	Wheel Speed Bias (5 Bits)***	Spare (2)	64
				A	
				DIG	
			VHF 1 RF Output Pwr	A	65
				AN+	
			VHF 2 RF Output Pwr	A	66
				AN+	
			SPARE	A	67
				AN+	
			SPARE	A	68
				AN+	
			VHF XMTR 1 Conv Volt	A	69
				AN+	

*See Table 7.

**See Table 8.

***See Table 9.

TABLE 1 (Continued)

4 sec (64 wd)

8 sec (128 wd)

	VHF XMTR 2 Conv Volt	A	70
		AN+	
	SPARE	A	71
		AN+	
	SPARE	A	72
		AN+	
9	S/C Time Code	A	73
		DIG	
	SPS Target Eye En/Dis	B	74
		AN+	
	Az Coarse Sensor	B	75
		AN+	
	El Angle Cmd Status	B	76
		AN+	
	Az Shaft Position	B	77
		AN+	
	El Motor Current	B	78
		AN+	
	Az Motor Current	B	79
		AN+	
	Az Bearing Temp	B	80
		AN+	
	TR 1 Temp	B	81
		AN-	
	TR 2 Temp	B	82
		AN-	
	TR 1 Pressure	B	83
		AN-	

TABLE 1 (Continued)

TR 2 Pressure	B	84
	AN-	
TR 1 Upper Roller Tape Tension	B	85
	AN-	
TR 1 Lower Roller Tape Tension	B	86
	AN-	
TR 2 Upper Roller Tape Tension	B	87
	AN-	
TR 2 Lower Roller Tape Tension	B	88
	AN-	
TR 1 Humidity Monitor	B	89
	AN-	
TR 2 Humidity Monitor	B	90
	AN-	
TR 1 Playback Level	B	91
	AN-	
TR 2 Playback Level	B	92
	AN-	
TR 1 Motor Current	B	93
	AN-	
TR 2 Motor Current	B	94
	AN-	
PMP 1 Conv Voltage	A	95
	AN-	
PMP 2 Conv Voltage	A	96
	AN-	
MWA Bearing Temp	A	97
	AN-	
MWA Motor 1 Current	A	98
	AN-	

TABLE 1 (Continued)

MWA Motor 2 Current	A	99
	AN-	
PCE 1 Motor Conn/Disc	A	100
	AN-	
PCE 2 Motor Conn/Disc	A	101
	AN-	
H.S. DC/DC Conv 1	A	102
	AN-	
H.S. DC/DC Conv 2	A	103
	AN-	
Dec 1 70 kHz Subc Level	B	104
	AN+	
Dec 2 70 kHz Subc Level	B	105
	AN+	
Dec 1 Squelch Level	B	106
	AN+	
Dec 2 Squelch Level	B	107
	AN+	
Dec 1 DC/DC Conv	B	108
	AN+	
Dec 2 DC/DC Conv	B	109
	AN+	
Prog 1 DC/DC Conv	B	110
	AN+	
Prog 2 DC/DC Conv	B	111
	AN+	
PCMC 1 DC/DC Conv	A	112
	AN+	
PCMC 2 DC/DC Conv	A	113
	AN+	

TABLE 1 (Continued)

	PCE 1 DC/DC Conv	A	114
		AN-	
	PCE 2 DC/DC Conv	A	115
		AN-	
	Not available for TLM-Data Same as word 48 of this subcom	A	116
		AN-	
	PSE Bias Reg No. 1	A	117
		AN-	
	PSE Bias Reg No. 2	A	118
		AN-	
	PSE Bias Reg No. 3	A	119
		AN-	
	PSE Heat Sink Temp.	A	120
		AN-	
	Memory -10V (Mem 1 thru PCMC 1 & Mem 2 thru PCMC 2)	B	121
		AN-	
58	Auto Roll Thresholds and ARP Status	B	122
		DIG	
59	Attitude Prog Status	B	123
		DIG	
60	Sel BHS Earth Time	B	124
		DIG	
61	Sel BHS Period	B	125
		DIG	
62	B.U.T 1	A	126
		DIG	
63	B.U.T. 2	B	127
		DIG	
64	Wheel Speed Bias and Orientation	A	128
		DIG	

TABLE 2. 4 SEC SUBCOM - RELAY FLAGS

WORD \ BIT		1	2	3	4	5	6	7	8	B.P.
22		-24.5V REG 1 ON/OFF	-24.5V REG 2 ON/OFF	PES INST PWR ON/ OFF	SPARE	PSB UNREG PWR EN/ DIS	PSB HTR PWR ON/ OFF	PSB INST PWR ON/ OFF	U VNO INST PWR ON/ OFF	A
23		CEP UNREG PWR EN/ DIS	CEP RAD HTR ON/ OFF	CEP AX HTR ON/ OFF	CEP INST PWR ON/ OFF	CEP BIPH RAD PWR ON/OFF	CEP BIPH AX PWR ON/OFF	PSA INST PWR ON/ OFF	DSAI INST PWR ON/ OFF	A
24		NACE UN- REG PWR EN/DIS	NACE COVER PWR ON/OFF	NACE INST PWR ON/ OFF	OSS INST PWR ON/ OFF	OSS PUMP PWR ON/ OFF	PCE 1/2 SELECTED	PCE 1 ON/OFF	PCE 2 ON/OFF	A
25		NATE UN- REG PWR EN/DIS	NATE COVER PWR ON/OFF	NATE INST PWR ON/ OFF	EUVS UN- REG PWR EN/DIS	EUVS STDBY PWR ON/OFF	EUVS LOW PWR ON/ OFF	EUVS MTR PWR 1 ON/ OFF	EUVS MTR PWR 2 ON/ OFF	B

7-18

TABLE 2. (CONTINUED)

BIT → ↓ WORD		1	2	3	4	5	6	7	8	
26		SPS UNREG PWR EN/ DIS	SPS INST PWR ON/ OFF	SPS AZ MTR PWR ON/ OFF	VAE UNREG PWR EN/ DIS	VAE BIPH.1 PWR ON/ OFF	VAE BIPH.2 PWR ON/ OFF	VAE INST PWR ON/ OFF	SPS EL MTR PWR ON/ OFF	B
27		RPA INST PWR ON/ OFF	RPA DRIFT PWR ON/ OFF	BIMS INST PWR ON/ OFF	MIMS INST PWR ON/ OFF	ESUM UN- REG PWR EN/DIS	ESUM BI PH. PWR ON/OFF	ESUM INST PWR ON/ OFF	PROG 1/2 SELECTED	B
28		MESA X-Y PWR ON/ OFF	MESA Y-X PWR ON/ OFF	MESA Z PWR ON/ OFF	QOMAC 1 EN/DIS	QOMAC 2 EN/DIS	MASC 1 EN/DIS	MASC 2 EN/DIS	LEE INST PWR ON/ OFF	B
29		OAPS BUS A EN/DIS	OAPS BUS B EN/DIS	TANK VALVE 1 ON/OFF	TANK VALVE 2 ON/OFF	TANK VALVE 3 ON/OFF	TANK VALVE 4 ON/OFF	TANK VALVE 5 ON/OFF	TANK VALVE 6 ON/OFF	A

TABLE 2. (CONTINUED)

WORD ↓	BIT →	1	2	3	4	5	6	7	8	
30		Δ V THR 1 EN/ DIS	Δ V THR 2 EN/ DIS	YAW THR EN/ DIS	PITCH LP MTR PWR 1/2 SEL.	PCE 1 H.S. CONV. ON/ OFF	PCE 2 H.S. CONV. ON/ OFF	SBT 1 OSC NORM/ TEST	SBT 2 OSC NORM/TEST	A
31		T.R. 1 PWR ON/ OFF	T.R. 1 REC/PB SELECTED	T.R. 1 BUFF PWR EN/ DIS	T.R. 2 PWR ON/ OFF	T.R. 2 REC/ PB SELECTED	T.R. 2 BUFF PWR EN/ DIS	MARC PWR EN/ DIS	MARC PWR ON/ OFF	B
32		PCMC 1 EN/ DIS	PCMC 2 EN/ DIS	PCMC 1 PWR ON/ OFF	PCMC 2 PWR ON/ OFF	PCMC 1 TO SEL. PMP	PCMC 2 TO SEL. PMP	PCMC 1 TO SEL. T.R.	PCMC 2 TO SEL. T.R.	A
33		DEC 1 STRD CMD EN/ DIS	DEC 2 STRD CMD EN/ DIS	PROG 1 ON/ OFF	PROG 2 ON/ OFF	PROG 1 NADIR FLIP	PROG 2 NADIR FLIP	PROG 1 OAPS SPIN ORIENT.	PROG 2 OAPS SPIN ORIENT.	B

TABLE 2. (CONTINUED)

WORD ↓	BIT →								
	1	2	3	4	5	6	7	8	
34	SBT 1/2 SELECTED	SBT 1 AUTO ACQ EN/ DIS	SBT 2 AUTO ACQ EN/ DIS	SBT 1 PWR ON/ OFF	SBT 2 PWR ON/ OFF	SBT 1 LO/ HI MODE	SBT 2 LO/ HI MODE	H.K. TLM (A) PWR ON/ OFF	A
35	SBT 1 AUTO ACQ ON/ OFF	SBT 2 AUTO ACQ ON/ OFF	PMP 1/2 SELECTED	PMP 1 PWR ON/ OFF	PMP 2 PWR ON/OFF	PMP 1 PB/ RT MODE	PMP 2 PB/ RT MODE	TIME BASE 1/2 (CDU A) SELECTED	A
36	VBT 1/2 SELECTED	VBT 1 PWR ON/ OFF	VBT 2 PWR ON/ OFF	VBT 1 BEA/ TLM MODE	VBT 2 BEA/ TLM MODE	BHS 1 PWR ON/ OFF	BHS 2 PWR ON/ OFF	TAL INST PWR ON/ OFF	A
37	PROG 1 CMU PWR SEL.	CMU 1 SELECTED	PROG 2 CMU PWR SEL.	CMU 2 SELECTED	H.K.TLM(B) PWR ON/ OFF	SPARE RELAY CDU B	MARC ON/ OFF (LIU- B)	MARC B.U. CLK ON/OFF (LIU-B)	B

TABLE 2. (CONTINUED)

WORD ↓	BIT →								
	1	2	3	4	5	6	7	8	
38	PCMC 1/2 TO MARC (LIU B)	RASTER SCAN ON/ OFF (LIU- B)	RASTER SCAN EN/ DIS	XTAL A/ B SELECT (LIU-B)	TIME BASE 1/2 SEL. (I) (LIU-B)	TIME BASE 1/2 SEL.(II) (LIU-B)	SPARE RELAY CDU B	SPARE RELAY CDU-B	B
39	XTAL A/B SELECT (LIU-A)	TIME BASE 1/2 SEL (I) (LIU-A)	TIME BASE 1/2 SEC (II) (LIU-A)	REG BUS CUR TLM LO/ HI	ATC 1 EN/ DIS	ATC 2 EN/ DIS	ATC 3 EN/ DIS	ATC 4 EN/ DIS	A
40	UNREG BUS CUR TLM LO/ HI	UNREG U.V. EN/ DIS	BATT CHGR 1 SAFETY EN/ DIS	BATT CHGR 2 SAFETY EN/ DIS	BATT CHGR 3 SAFETY EN/ DIS	BATT CHGR 1 ON/ OFF	BATT CHGR 2 ON/ OFF	BATT CHGR 3 ON / OFF	A
41	UNREG U.V. ON/ OFF	REG BUS SAFETY EN/ DIS	SH. LIM AMP 1 ON/ OFF	SH. LIM AMP 2 ON/ OFF	WHS NORM/ CROSSED PCE 1	WHS NORM/ CROSSED PCE 2	PCMC 1 TO SEL VBT	PCMC 2 TO SEL VBT	A

TABLE 2. (CONTINUED)

WORD ↓	BIT →								
	1	2	3	4	5	6	7	8	
42	PCE 1 COARSE/ NORM SWITCH	PCE 2 COARSE/ NORM SWITCH	PCE 1 GAIN SWITCH C/ F	PCE 2 GAIN SWITCH C/ F	PCE 1 OPEN/ CLOSED	PCE 2 OPEN/ CLOSED	PCE 1 SPIN DESPIN	PCE 2 SPIN DESPIN	A
43	3RD EL 1 EN/ DIS	3RD EL2 EN/ DIS	3RD EL3 EN/ DIS	3RD EL 1 FIRE	3RD EL 2 FIRE	3RD EL 3 FIRE	SQUIB BUS A EN/ DIS	SQUIB BUS B EN/ DIS	A
44	YAW THR VALVE COIL 1 ON/ OFF	YAW THR VALVE COIL 2 ON/ OFF	Δ V THR 1 VALVE COIL 1 ON/ OFF	Δ V THR1 VALVE COIL 2 ON/ OFF	Δ V THR 2 VALVE COIL 1 ON/ OFF	Δ V THR 2 VALVE COIL 2 ON/ OFF	REG BUS MIN. LOAD ON/ OFF	SPARE RELAY- CDU-A	A
45	SPARE RELAY CDU-B	ESUM MTR PWR ON/ OFF	OAPS HTR EN/ DIS	OAPS TANK HTRS ON/ OFF	Δ V THR 1 HTR ON/ OFF	Δ V THR 2 HTR ON/ OFF	YAW THR HTR ON/ OFF	MAG INST PWR ON/ OFF	B
46	SPARE RELAY CDU-A	SPARE RELAY CDU-A	SPARE RELAY CDU-A	SPARE RELAY CDU-B	SPARE RELAY CDU-B	SPARE RELAY CDU-B	SPARE RELAY CDU-B	SPARE RELAY CDU-B	A

TABLE 3. 4 SEC SUBCOM LOGIC (CONDITIONAL) FLAGS

WORD ↓	BIT →								
	1	2	3	4	5	6	7	8	
48	QOMAC 1 + ON/ OFF	QOMAC 1 - ON/ OFF	QOMAC 2+ ON/ OFF	QOMAC 2 - ON/ OFF	MASC 1 + ON/ OFF	MASC 1 - ON/ OFF	MASC 2 + ON/ OFF	MASC 2 - ON/ OFF	B
49	LIU-A DEC 1 ON/ OFF	LIU-A DEC 2 ON/ OFF	LIU-A PCMC-1 ON/ OFF	LIU-A PCMC-2 ON/ OFF	RCVR 1 LOCK STATUS	RCVR 2 LOCK STATUS	SBT 1 RANGING EN/ DIS	SBT 2 RANGING EN/ DIS	A
50	LIU-B DEC 1 ON/ OFF	LIU-B DEC 2 ON/ OFF	LIU-B PCRC-1 ON/ OFF	LIU-B PCRC-2 ON/ OFF	SPARE RELAY- CDU-B	TR 1 TRACK 1/2	TR 2 TRACK 1/2	PROG ARP FIELD CONT BIT	B
51	TR 1 PRI BOT	TR 1 PRI EOT	TR 1 BUFF ON/ OFF	TR 1 REDUN BOT/ EOT	TR 2 PRI BOT	TR 2 PRI EOT	TR 2 BUFF ON/ OFF	TR 2 REDUN BOT/ EOT	B

TABLE 4. WD 54 BIT ALLOCATIONS (4 SEC SUBCOM)

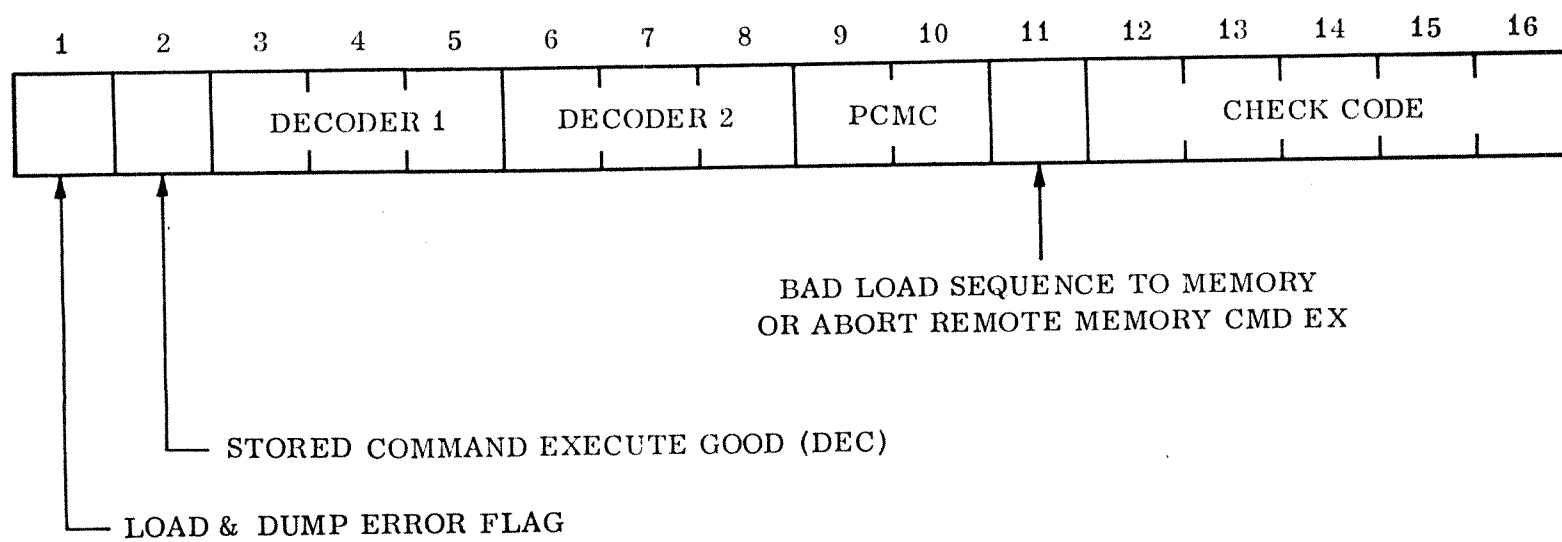
1	2	3	4	5	6	7	8
OAPS THRUST ON/ OFF	OAPS SPIN/ DESPIN	OAPS Δ V/ YAW	MESA XY SELECT	MESA YX SELECT	# AUTO ROLL CYCLES REMAINING (See Below)		NADIR PROG ON/ OFF

TABLE 5. WD 59 (123) BIT ALLOCATIONS (4 AND 8 SEC SUBCOM)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
QOMAC FIELD CONT BIT	QOMAC + ON/ OFF	QOMAC - ON/ OFF	MASC FIELD CONT BIT	MASC + ON/ OFF	MASC - ON/ OFF	MASC COMM ON/ OFF	←				MASC	NADIR			→

Cycles Remaining	Bit 6	Bit 7
3	1	1
2	0	1
1	1	0
0 or 4	0	0

MAIN FRAME WORDS 4&5 - CMD VERIFICATION



OTHER S/C TLM

MAIN FRAME, WDS 17, 18

	17	18
1	W.H.S. 1 EARTH TIME	A DIG
2	W.H.S. 2 EARTH TIME	A DIG
3	PCE SPLIT TO INDEX PULSE TIME	A DIG
4	SELECTED W.H.S. PERIOD	A DIG

MAIN FRAME 81: MAIN FRAME SYNC TO SELECTED BHS
SKY/EARTH TRANSITION TIME.

MAIN FRAME 82: MAIN FRAME SYNC TO SOLAR GATE
PULSE TIME.

MAIN FRAME, WDS 119, 120

	119	120
1	MESA XY	B DIG
2	MESA YX	B DIG
3	MESA Z	B DIG
4	RSL SEQ- (4)	RSL LOADED CMD SEQ- (12) B DIG

MAIN FRAME WORD 20

8 WORD SPS ANALOG SUBCOM

1	A_Z (CROSS-EL) OFFSET STATUS	B
		AN+
2	EL OFFSET STATUS	B
		AN+
3	FINE EYE A_Z (CROSS-EL) SIGNAL	B
		AN+
4	FINE EYE EL SIGNAL	B
		AN+
5	ELEVATION POSITION	B
		AN+
6	OFFSET ENABLE/DISABLE	B
		AN+
7	FINE EYE A_Z SIGNAL	B
		AN+
8	FINE EYE EL SIGNAL	B
		AN+

Experiment Relay Flag Bits in 8 Sec. Expt. Subcom (M.F 68)

EXP 8 SEC SUBCUM WORD#	BIT #								
	1	2	3	4	5	6	7	8	
12 DIG	PES H.V. # 1 OFF	PES H.V. # 2 OFF	PES CAL MODE ENABLE/ DISABLE	OSS BREAKOFF CAP STATUS	TAL FLAG BIT #1	TAL FLAG BIT #2	SPARE	SPARE	A
62 DIG	MESA XY SUSP BIT #1	MESA XY SUSP BIT # 2	MESA YX SUSP BIT #1	MESA YX SUSP BIT #2	MESA Z SUSP BIT #1	MESA Z SUSP BIT #2	MESA XY CONST BIT #1	MESA XY CONST BIT #2	B
90 DIG	MESA YX CONST BIT #1	MESA YX CONST BIT #2	MESA Z CONST BIT #1	MESA Z CONST BIT #2	RPA HI/ LO SWEEP LEVEL	RPA ELECT MULTIPLEX SWITCH	RPA ORIENTED/ SPIN MODE	RPA NORMAL/ HI RESOLU- TION	B
106 DIG	ESUM H.V. RELAY (RELAY FLAG)	EUVS FLAG H V SIDE 1	EUVS FLAG H V SIDE 2	VAE FLAG	NOT USED	EUVS FLAG HV PMT	LEE H V ON	LEE SUN SENSOR OVERRIDE	B

TABLE 6. MEMORY PROGRAMMER STATUS
Word 65,53, Bits 1 & 2

Condition	Bit 1	Bit 2
Standby	0	0
Load	0	1
Dump	1	0
Program	1	1

TABLE 7. AUTO ROLL PROGRAMMER STATUS
Word 66,58 Bits 7 & 8

Condition	Bit 7	Bit 8
Standby	1	1
Invert	1	0
Inhibit	0	1
Normal	0	0

TABLE 8. DESPIN ORIENTATION

DN-836-2.3(AE)

WORD 65,64 BITS 1-8

WORD 66,64 BIT 1 (LABELLED 9 BELOW)

BIT #				1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
1				1	1	1	1	0	0	0	0	1	1	1	1	0	0	0
2				1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
3				1	0	1	0	1	0	1	0	1	0	1	0	1	0	0
4				1	0	1	0	1	0	1	0	1	0	1	0	1	0	0
6	7	8	9	1	32	64	96	128	160	192	224	256	288	320	352	NOT VALID		
1	1	1	1	0	32	64	96	128	160	192	224	256	288	320	352			
1	1	1	0	1	33	65	97	129	161	193	225	257	289	321	353			
1	1	0	1	2	34	66	98	130	162	194	226	258	290	322	354			
1	1	0	0	3	35	67	99	131	163	195	227	259	291	323	355			
1	0	1	1	4	36	68	100	132	164	196	228	260	292	324	356			
1	0	1	0	5	37	69	101	133	165	197	229	261	293	325	357			
1	0	0	1	6	38	70	102	134	166	198	230	262	294	326	358			
1	0	0	0	7	39	71	103	135	167	199	231	263	295	327	359			
0	1	1	1	8	40	72	104	136	168	200	232	264	296	328				
0	1	1	0	9	41	73	105	137	169	201	233	265	297	329				
0	1	0	1	10	42	74	106	138	170	202	234	266	298	330				
0	1	0	0	11	43	75	107	139	171	203	235	267	299	331				
0	0	1	1	12	44	76	108	140	172	204	236	268	300	332				
0	0	1	0	13	45	77	109	141	173	205	237	269	301	333				
0	0	0	1	14	46	78	110	142	174	206	238	270	302	334				
0	0	0	0	15	47	79	111	143	175	207	239	271	303	335				
1	1	1	1	16	48	80	112	144	176	208	240	272	304	336				
1	1	1	0	17	49	81	113	145	177	209	241	273	305	337				
1	1	0	1	18	50	82	114	146	178	210	242	274	306	338				
1	1	0	0	19	51	83	115	147	179	211	243	275	307	339				
1	0	1	1	20	52	84	116	148	180	212	244	276	308	340				
1	0	1	0	21	53	85	117	149	181	213	245	277	309	341				
1	0	0	1	22	54	86	118	150	182	214	246	278	310	342				
1	0	0	0	23	55	87	119	151	183	215	247	279	311	343				
0	1	1	1	24	56	88	120	152	184	216	248	280	312	344				
0	1	1	0	25	57	89	121	153	185	217	249	281	313	345				
0	1	0	1	26	58	90	122	154	186	218	250	282	314	346				
0	1	0	0	27	59	91	123	155	187	219	251	283	315	347				
0	0	1	1	28	60	92	124	156	188	220	252	284	316	348				
0	0	1	0	29	61	93	125	157	189	221	253	285	317	349				
0	0	0	1	30	62	94	126	158	190	222	254	286	318	350				
0	0	0	0	31	63	95	127	159	191	223	255	287	319	351				

TABLE 9. WHEEL SPEED BIAS
Word 66, 64 Bits 2 - 6

BIT #	5,6 2,3,4				
		00	10	01	11
000		10	18	26	34
100		11	19	27	35
010		12	20	28	36
110		13	21	29	37
001		14	22	30	38
101		15	23	31	39
011		16	24	32	40
111		17	25	33	41

SPEED BIAS IN RADIANS/SEC

APPENDIX A

ATMOSPHERE EXPLORER TELEMETRY

MAIN FRAME FORMAT

AE-C SATELLITE

1	A	2	A	3	A	4	B	5	B	6	B	7	A	8	A
SYNC	D	SYNC	D	SYNC	D	COMMAND	D	COMMAND	D	RPA	+A	UVNO	D	UVNO	D
9	A	10	B	11	B	12	B	13	B	14	B	15	B	16	B
CEP	+A	BIMS	+A	EUVS	D	EUVS	D	EUVS	D	EUVS	D	RPA	+A	BIMS	+A
17	A	18	A	19	B	20	B	21	A	22	A	23	B	24	B
S/C	D	S/C	D	MIMS	+A	EUVS	+A	NACE	D	NACE	D	BIMS	+A	RPA	+A
25	A	26	B	27	B	28	B	29	A	30	B	31	B	32	B
CEP	+A	MIMS	+A	NATE	D	NATE	D	UVNO	D	NATE	+A	NATE	D	RPA	+A
33	B	34	B	35	B	36	B	37	A	38	A	39	A	40	A
RPA	+A	ESUM	D	ESUM	D	BIMS	+A	SUBCOM	D	PES	D	PES	D	PES	D
41	A	42	B	43	B	44	B	45	B	46	B	47	B	48	B
CEP	+A	RPA	+A	LEE	D	LEE	D	LEE	D	VAE	D	VAE	D	VAE	D
49	B	50	A	51	B	52	B	53	A	54	A	55	B	56	B
BIMS	+A	UVNO	D	RPA	+A	RPA	+A	NACE	D	NACE	D	ESUM	+A	BIMS	D
57	A	58	B	59	B	60	B	61	B	62	B	63	A	64	A
CEP	+A	MIMS	+A	NATE	D	NATE	D	RPA	+A	BIMS	+A	OSS	D	OSS	D
65	A/B	66	A/B	67	A/B	68	A/B	69	A	70	B	71	B	72	A
SUBCOM		SUBCOM		SUBCOM		SUBCOM		PSA	D	RPA	+A	RPA	D	UVNO	D
S/C 64		S/C 128		EXP 64		EXP 128									
73	A	74	B	75	B	76	A	77	A	78	A	79	B	80	B
CEP	+A	MIMS	+A	BIMS	+A	OSS	D	OSS	D	OSS	D	RPA	+A	BIMS	D
81	B	82	A	83	B	84	B	85	A	86	A	87	B	88	B
S/C	D	S/C	D	MIMS	+A	MIMS	+A	NACE	D	NACE	D	BIMS	+A	RPA	+A
89	A	90	B	91	B	92	B	93	A	94	A	95	A	96	B
CEP	+A	MIMS	+A	NATE	D	NATE	D	UVNO	D	OSS	+A	NACE	+A	RPA	+A
97	B	98	B	99	B	100	B	101	A	102	A	103	A	104	A
RPA	+A	ESUM	D	ESUM	D	BIMS	+A	PSB	+A	PES	D	PES	D	PES	D
105	A	106	B	107	B	108	B	109	B	110	B	111	B	112	B
CEP	+A	RPA	+A	MAG	+A	MAG	+A	MAG	+A	VAE	D	VAE	D	VAE	D
113	B	114	A	115	B	116	A	117	A	118	A	119	B	120	B
BIMS	+A	UVNO	D	RPA	+A	NACE	D	NACE	D	NACE	D	MESA	D	MESA	D
121	A	122	B	123	B	124	B	125	B	126	B	127	A	128	B
CEP	+A	MIMS	+A	NATE	D	NATE	D	RPA	+A	BIMS	+A	TAL	+A	LFE	A

AE-C Satellite

29

ATMOSPHERE EXPLORER

8 Second Subcom Format

AE-C Satellite

1	A	2	A	3	A	4	A	5	A	6	A	7	A	8	A
UVNO		UVNO		UVNO		UVNO		UVNO		UVNO		UVNO		UVNO	
	+A		+A		+A		+A		+A		+A		+A		+A
9	B	10	B	11	B	12	A	13	B	14	B	15	B	16	B
MESA		MESA		MESA		RELAY STATUS		BIMS		VAE		VAE		VAE	
	+A		+A		+A	D			+A	D		D		D	
17	B	18	B	19	B	20	B	21	B	22	B	23	B	24	B
VAE		VAE		VAE		VAE		VAE		VAE		VAE		VAE	
	+A		+A		+A		+A		+A		+A		+A		+A
25	B	26	B	27	B	28	B	29	B	30	B	31	B	32	A
RPA		RPA		RPA		LEE		LEE		LEE		LEE		NACE	
	+A		+A		+A	D		D		D		D			+A
33	A	34	A	35	A	36	A	37	A	38	A	39	A	40	A
NACE		NACE		NACE		NACE		NACE		NACE		NACE		NACE	
	+A		+A		+A		+A		+A		+A		+A		+A
41	A	42	A	43	A	44	A	45	A	46	A	47	A	48	A
OSS		OSS		OSS		OSS		OSS		OSS		NACE		NACE	
	+A		+A		+A		+A		+A		+A	D			+A
49	A	50	A	51	A	52	A	53	A	54	A	55	A	56	B
OSS		OSS		OSS		OSS		OSS		OSS		PES		BIMS	
	+A		+A		+A		+A		+A		+A	D		D	
57	B	58	B	59	B	60	B	61	B	62	B	63	B	64	B
LEE		LEE		LEE		LEE		LEE		RELAY STATUS		NATE		RPA	
	+A		+A		+A		+A		+A	D		D		D	
65	A	66	A	67	A	68	A	69	A	70	A	71	B	72	B
CEP		CEP		CEP		CEP		CEP		CEP		NATE		NATE	
	+A		+A		+A		+A		+A		+A		+A		+A
73	B	74	B	75	B	76	B	77	B	78	B	79	B	80	B
NATE		NATE		NATE		NATE		NATE		NATE		NATE		NATE	
	+A		+A		+A		+A		+A		+A		+A		+A
81	B	82	B	83	B	84	B	85	B	86	B	87	B	88	B
MIMS		MIMS		MIMS		MIMS		MIMS		MIMS		MIMS		MIMS	
	+A		+A		+A		+A		+A		+A		+A		+A
89	B	90	B	91	A	92	A	93	A	94	A	95	A	96	A
MIMS		RELAY STATUS		PES		PES		PES		PES		PES		PES	
	+A	D			+A		+A		+A		+A		+A		+A
97	B	98	B	99	B	100	B	101	B	102	B	103	B	104	B
ESUM		ESUM		ESUM		ESUM		ESUM		ESUM		ESUM		ESUM	
	+A		+A		+A		+A		+A		+A		+A		+A
105	B	106	B	107	B	108	B	109	A	110	A	111	A	112	A
ESUM		RELAY STATUS		NATE		NATE		NACE		NACE		NACE		NACE	
	+A	D		D		D		D		D		D		D	
113	B	114	B	115	B	116	B	117	B	118	B	119	A	120	B
EUVS		EUVS		EUVS		EUVS		BIMS		BIMS		PES		BIMS	
	+A		+A		+A		+A	D		D		D		D	
121	B	122	B	123	B	124	B	125	B	126	B	127	B	128	B
BIMS		BIMS		BIMS		BIMS		BIMS		BIMS		NATE		RPA	
	+A		+A		+A		+A		+A		+A	D		D	

March 8, 1972

Revised 17 Aug. 72

APPENDIX B

ATMOSPHERE EXPLORER TELEMETRY

MAIN FRAME FORMAT

AE-C, D, E SATELLITE
MEMORY DUMP SHOWN SHADED

1	A	2	A	3	A	4	B	5	B	6	B	7	A	8	A
SYNC	D	SYNC	D	SYNC	D	COMMAND	D	COMMAND	D	RPA	+A	UVNO	D	UVNO	D
9	A	10	B	11	B	12	B	13	B	14	B	15	B	16	B
CEP	+A	BIMS	+A	EUVS	D	EUVS	D	EUVS	D	EUVS	D	RPA	+A	BIMS	+A
17	A	18	A	19	B	20	B	21	A	22	A	23	B	24	B
S/C	D	S/C	D	MIMS	+A	EUVS	+A	NACE	D	NACE	D	BIMS	+A	RPA	+A
25	A	26	B	27	B	28	B	29	A	30	B	31	B	32	B
CEP	+A	MIMS	+A	NATE	D	NATE	D	UVNO	D	NATE	+A	NATE	D	RPA	+A
33	B	34	B	35	B	36	B	37	A	38	A	39	A	40	A
RPA	+A	ESUM	D	ESUM	D	BIMS	+A	SUBCOM	D	PES	D	PES	D	PES	D
41	A	42	B	43	B	44	B	45	B	46	B	47	B	48	B
CEP	+A	RPA	+A	LEE	D	LEE	D	LEE	D	VAE	D	VAE	D	VAE	D
49	B	50	A	51	B	52	B	53	A	54	A	55	B	56	B
BIMS	+A	UVNO	D	RPA	+A	RPA	+A	NACE	D	NACE	D	ESUM	+A	BIMS	D
57	A	58	B	59	B	60	B	61	B	62	B	63	A	64	A
CEP	+A	MIMS	+A	NATE	D	NATE	D	RPA	+A	BIMS	+A	OSS	D	OSS	D
65	A/B	66	A/B	67	A/B	68	A/B	69	A	70	B	71	B	72	A
SUBCOM	D	SUBCOM	D	SUBCOM	D	SUBCOM	D	PSA	D	RPA	+A	RPA	D	UVNO	D
73	A	74	B	75	B	76	A	77	A	78	A	79	B	80	B
CEP	+A	MIMS	+A	BIMS	+A	OSS	D	OSS	D	OSS	D	RPA	+A	BIMS	D
81	B	82	A	83	B	84	B	85	A	86	A	87	B	88	B
S/C	D	S/C	D	MIMS	+A	MIMS	+A	NACE	D	NACE	D	BIMS	+A	RPA	+A
89	A	90	B	91	B	92	B	93	A	94	A	95	A	96	B
CEP	+A	MIMS	+A	NATE	D	NATE	D	UVNO	D	OSS	+A	NACE	+A	RPA	+A
97	B	98	B	99	B	100	B	101	A	102	A	103	A	104	A
RPA	+A	ESUM	D	ESUM	D	BIMS	+A	PSB	+A	PES	D	PES	D	PES	D
105	A	106	B	107	B	108	B	109	B	110	B	111	B	112	B
CEP	+A	RPA	+A	MAG	+A	MAG	+A	MAG	+A	VAE	D	VAE	D	VAE	D
113	B	114	A	115	B	116	A	117	A	118	A	119	B	120	B
BIMS	+A	UVNO	D	RPA	+A	NACE	D	NACE	D	NACE	D	MESA	D	MESA	D
121	A	122	B	123	B	124	B	125	B	126	B	127	A	128	B
CEP	+A	MIMS	+A	NATE	D	NATE	D	RPA	+A	BIMS	+A	TAL	+A	LFE	A

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APPENDIX C

ATMOSPHERE EXPLORER TELEMETRY

MAIN FRAME FORMAT

AE-D SATELLITE

1 SYNC	2 SYNC	3 SYNC	4 COMD	5 STAT	6 RPA	7 UVNO	8 UVNO
9 CEP	10 LEE	11 EUVS	12 EUVS	13 EUVS	14 EUVS	15 RPA	16 LEE
17 S/C	18 S/C	19 MIMS	20 EUVS	21 NACE	22 NACE	23 LEE	24 RPA
25 CEP	26 MIMS	27 NATE	28 NATE	29 UVNO	30 NATE	31 NATE	32 RPA
33 RPA	34 ESUM	35 ESUM	36 LEE	37 SUBCOM COUNTER	38 PES	39 PES	40 PES
41 CEP	42 RPA	43 LEE	44 LEE	45 LEE	46 VAE	47 VAE	48 VAE
49 LEE	50 UVNO	51 RPA	52 RPA	53 NACE	54 NACE	55 ESUM	56 LEE
57 CEP	58 MIMS	59 NATE	60 NATE	61 RPA	62 LEE	63 OSS	64 OSS
65 SUBCOM	66 SUBCOM	67 SUBCOM	68 SUBCOM	69 PSA	70 RPA	71 RPA	72 UVNO
73 CEP	74 MIMS	75 LEE	76 OSS	77 OSS	78 OSS	79 RPA	80 LEE
81 S/C	82 S/C	83 MIMS	84 MIMS	85 NACE	86 NACE	87 LEE	88 RPA
89 CEP	90 MIMS	91 NATE	92 NATE	93 UVNO	94 LEE	95 NACE	96 RPA
97 RPA	98 ESUM	99 ESUM	100 LEE	101 PSB	102 PES	103 PES	104 PES
105 CEP	106 RPA	107 MAG	108 MAG	109 MAG	110 VAE	111 VAE	112 VAE
113 LEE	114 UVNO	115 RPA	116 NACE	117 NACE	118 NACE	119 MESA	120 MESA
121 CEP	122 MIMS	123 NATE	124 NATE	125 RPA	126 LEE	127 LEE	128 LEE

AE-D Satellite

35

ATMOSPHERE EXPLORER

8 Second Subcom Format

AE-D Satellite

1	A	2	A	3	A	4	A	5	A	6	A	7	A	8	A
UVNO	+A	UVNO	+A	UVNO	+A	UVNO	+A	UVNO	+A	UVNO	+A	UVNO	+A	UVNO	+A
9	B	10	B	11	B	12	A	13	B	14	B	15	B	16	B
MESA	+A	MESA	+A	MESA	+A	RELAY STATUS	D	SPARE	+A	VAE	D	VAE	D	VAE	D
17	B	18	B	19	B	20	B	21	B	22	B	23	B	24	A
VAE	+A	VAE	+A	VAE	+A	VAE	+A	VAE	+A	VAE	+A	VAE	+A	VAE	+A
25	B	26	B	27	B	28	B	29	B	30	B	31	B	32	A
RPA	+A	RPA	+A	RPA	+A	LEE	D	LEE	D	LEE	D	LEE	D	NACE	+A
33	A	34	A	35	A	36	A	37	A	38	A	39	A	40	A
NACE	+A	NACE	+A	NACE	+A	NACE	+A	NACE	+A	NACE	+A	NACE	+A	NACE	+A
41	A	42	A	43	A	44	A	45	A	46	A	47	A	48	A
OSS	+A	OSS	+A	OSS	+A	OSS	+A	OSS	+A	OSS	+A	NACE	D	NACE	+A
49	A	50	A	51	A	52	A	53	A	54	A	55	A	56	B
OSS	+A	OSS	+A	OSS	+A	OSS	+A	OSS	+A	OSS	+A	PES	D	SPARE	D
57	B	58	B	59	B	60	B	61	B	62	B	63	B	64	B
LEE	+A	LEE	+A	LEE	+A	LEE	+A	LEE	+A	RELAY STATUS	D	NATE	D	RPA	D
65	A	66	A	67	A	68	A	69	A	70	A	71	B	72	B
CEP	+A	CEP	+A	CEP	+A	CEP	+A	CEP	+A	CEP	+A	NATE	+A	NATE	+A
73	B	74	B	75	B	76	B	77	B	78	B	79	B	80	B
NATE	+A	NATE	+A	NATE	+A	NATE	+A	NATE	+A	NATE	+A	NATE	+A	NATE	+A
81	B	82	B	83	B	84	B	85	B	86	B	87	B	88	B
MIMS	+A	MIMS	+A	MIMS	+A	MIMS	+A	MIMS	+A	MIMS	+A	MIMS	+A	MIMS	+A
89	B	90	B	91	A	92	A	93	A	94	A	95	A	96	A
MIMS	+A	RELAY STATUS	D	PES	+A	PES	+A	PES	+A	PES	+A	PES	+A	PES	+A
97	B	98	B	99	B	100	B	101	B	102	B	103	B	104	B
ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A
105	B	106	B	107	B	108	B	109	A	110	A	111	A	112	A
ESUM	+A	RELAY STATUS	D	NATE	D	NATE	D	NACE	D	NACE	D	NACE	D	NACE	D
113	B	114	B	115	B	116	B	117	B	118	B	119	A	120	B
EUVS	+A	EUVS	+A	EUVS	+A	EUVS	+A	SPARE	D	SPARE	D	PES	D	SPARE	D
121	B	122	B	123	B	124	B	125	B	126	B	127	B	128	B
SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	NATE	D	RPA	D

March 8, 1972

Revised 17 Aug. '72

APPENDIX D

ATMOSPHERE EXPLORER TELEMETRY

MAIN FRAME FORMAT

AE-E SATELLITE

1 SYNC A	2 SYNC A	3 SYNC D	4 COMD D	5 STAT D	6 RPA A	7 SPARE A	8 SPARE A
9 CEP A	10 BIMS A	11 EUVS D	12 EUVS D	13 EUVS D	14 EUVS D	15 RPA A	16 BIMS A
17 S/C A	18 S/C A	19 SPARE D	20 EUVS A	21 NACE D	22 NACE D	23 BIMS A	24 RPA A
25 CEP A	26 SPARE D	27 NATE D	28 NATE D	29 SPARE D	30 NATE D	31 NATE D	32 RPA A
33 RPA A	34 ESUM D	35 ESUM D	36 BIMS A	37 SUBCOM COUNTER A	38 PES D	39 PES D	40 PES D
41 CEP A	42 RPA A	43 SPARE D	44 SPARE D	45 SPARE D	46 VAE D	47 VAE D	48 VAE D
49 BIMS A	50 SPARE D	51 RPA A	52 RPA A	53 NACE D	54 NACE D	55 ESUM A	56 BIMS D
57 CEP A	58 SPARE D	59 NATE D	60 NATE D	61 RPA A	62 BIMS A	63 OSS D	64 OSS D
65 SUBCOM D	66 SUBCOM D	67 SUBCOM D	68 SUBCOM D	69 PSA D	70 RPA A	71 RPA D	72 SPARE D
73 CEP A	74 SPARE D	75 BIMS A	76 OSS D	77 OSS D	78 OSS D	79 RPA A	80 BIMS D
81 S/C A	82 S/C A	83 SPARE D	84 SPARE D	85 NACE D	86 NACE D	87 BIMS A	88 RPA A
89 CEP A	90 SPARE D	91 NATE D	92 NATE D	93 SPARE D	94 SPARE D	95 NACE A	96 RPA A
97 RPA A	98 ESUM D	99 ESUM D	100 BIMS A	101 PSB A	102 PES D	103 PES D	104 PES D
105 CEP A	106 RPA A	107 SPARE A	108 SPARE A	109 SPARE A	110 VAE D	111 VAE D	112 VAE D
113 BIMS A	114 SPARE D	115 RPA A	116 NACE D	117 NACE D	118 NACE D	119 MESA D	120 MESA D
121 CEP A	122 SPARE D	123 NATE D	124 NATE D	125 RPA A	126 BIMS A	127 SPARE A	128 SPARE A

AE-E Satellite

39

ATMOSPHERE EXPLORER

8 Second Subcom Format

AE-E Satellite

1	A	2	A	3	A	4	A	5	A	6	A	7	A	8	A
SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A
9	B	10	B	11	B	12	A	13	B	14	B	15	B	16	B
MESA	+A	MESA	+A	MESA	+A	RELAY STATUS	D	BIMS	+A	VAE	D	VAE	D	VAE	D
17	B	18	B	19	B	20	B	21	B	22	B	23	B	24	B
VAE	+A	VAE	+A	VAE	+A	VAE	+A	VAE	+A	VAE	+A	VAE	+A	VAE	+A
25	B	26	B	27	B	28	B	29	B	30	B	31	B	32	A
RPA	+A	RPA	+A	RPA	+A	SPARE	D	SPARE	D	SPARE	D	SPARE	D	NACE	+A
33	A	34	A	35	A	36	A	37	A	38	A	39	A	40	A
NACE	+A	NACE	+A	NACE	+A	NACE	+A	NACE	+A	NACE	+A	NACE	+A	NACE	+A
41	A	42	A	43	A	44	A	45	A	46	A	47	A	48	A
OSS	+A	OSS	+A	OSS	+A	OSS	+A	OSS	+A	OSS	+A	NACE	D	NACE	+A
49	A	50	A	51	A	52	A	53	A	54	A	55	A	56	B
OSS	+A	OSS	+A	OSS	+A	OSS	+A	OSS	+A	OSS	+A	PES	D	BIMS	D
57	B	58	B	59	B	60	B	61	B	62	B	63	B	64	B
SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	RELAY STATUS	D	NATE	D	RPA	D
65	A	66	A	67	A	68	A	69	A	70	A	71	B	72	B
CEP	+A	CEP	+A	CEP	+A	CEP	+A	CEP	+A	CEP	+A	NATE	+A	NATE	+A
73	B	74	B	75	B	76	B	77	B	78	B	79	B	80	B
NATE	+A	NATE	+A	NATE	+A	NATE	+A	NATE	+A	NATE	+A	NATE	+A	NATE	+A
81	B	82	B	83	B	84	B	85	B	86	B	87	B	88	B
SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A	SPARE	+A
89	B	90	B	91	A	92	A	93	A	94	A	95	A	96	A
SPARE	+A	RELAY STATUS	D	PES	+A	PES	+A	PES	+A	PES	+A	PES	+A	PES	+A
97	B	98	B	99	B	100	B	101	B	102	B	103	B	104	B
ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A	ESUM	+A
105	B	106	B	107	B	108	B	109	A	110	A	111	A	112	A
ESUM	+A	RELAY STATUS	D	NATE	D	NATE	D	NACE	D	NACE	D	NACE	D	NACE	D
113	B	114	B	115	B	116	B	117	B	118	B	119	A	120	B
EUVS	+A	EUVS	+A	EUVS	+A	EUVS	+A	BIMS	D	BIMS	D	PES	D	BIMS	D
121	B	122	B	123	B	124	B	125	B	126	B	127	B	128	B
BIMS	+A	BIMS	+A	BIMS	+A	BIMS	+A	BIMS	+A	BIMS	+A	NATE	D	RPA	D

W/O	1	2	3	4	5	6	7	8
22	REG 1 1: ON	REG 2 1: ON	PES POWER 1: ON	SPARE	PSB UNREG PWR 1: ENA	PSB HTR PWR 1: ON	PSB POWER 1: ON	UVNO POWER 1: ON
23	CEP UNREG PWR 1: ENA	CEP HTR PWR 1: ON	CEP AX HTR PWR 1: ON	CEP INST PWR 1: ON	CEP BIPH RAD PWR 1: ON	CEP BIPH AX PWR 1: ON	PSA POWER 1: ON	DSAI POWER 1: ON
24	NACE HTR PWR 1: ENA	NACE COVER PWR 1: ON	NACE PWR 1: ON	OSS PWR 1: ON	OSS PUMP PWR 1: ON	PCE SELECT 1: N1	PCC-1 1: ON	PCC-2 1: ON
25	NATE HTR PWR 1: ENA	NATE COVER PWR 1: ON	NATE PWR 1: ON	EVVS UNREG PWR 1: ENA	EVVS STDBY PWR 1: ON	EVVS LOW PWR 1: ON	EVVS HTR PWR 1: ON	EVVS HTR PWR 1: ON
26	SPS UNREG PWR 1: ENA	SPS PWR 1: ON	SPS HTR PWR 1: ON	VAE UNREG PWR 1: ENA	VAE BIPH 1 PWR 1: ON	VAE BIPH 2 PWR 1: ON	VAE PWR 1: ON	SPS GL HTR PWR 1: ON
27	RPA POWER 1: ON	RPA DRIFT PWR 1: ON	BIMS POWER 1: ON	MIMS POWER 1: ON	ESUM UNREG PWR 1: ENA	ESUM BIPH PWR 1: ON	ESUM POWER 1: ON	PROG SELECT 1: #1 0: #2
28	MESA XY PWR 1: ON	MESA YX PWR 1: ON	MESA Z PWR 1: ON	QOMAC COIL #1 1: ENA	QOMAC COIL #2 1: ENA	MASC COIL #1 1: ENA	MASC COIL #2 1: ENA	LEE POWER 1: ON
29	OAPS BUS-A 1: ENA	OAPS BUS-B 1: ENA	TANK VALVE #1 1: ON	TANK VALVE #2 1: ON	TANK VALVE #3 1: ON	TANK VALVE #4 1: ON	TANK VALVE #5 1: ON	TANK VALVE #6 1: ON
30	ΔV THRUSTER #1 1: ENA	ΔV THRUSTER #2 1: ENA	YAN THRUSTER 1: ENA	PCE HTR PWR 1: #1EN	WHS #1 CONV PWR 1: ON	WHS #2 CONV PWR 1: ON	SEF #1 OSC 1: NORM 0: TEST	SFT #2 OSC 1: NORM 0: TEST
31	TR #1 POWER 1: ON	TR #1 RCL: 1 P3: 0	TR #1 BUFF PWR 1: ENA	TR #2 POWER 1: ON	TR #2 ZEC: 1 PA: 0	TR #2 BUFF PWR 1: ENA	MARC POWER 1: ENA	MARC POWER 1: ON
32	PMCL #1 1: ENA	PMCL #2 1: ENA	PMCL #1 POWER 1: ON	PMCL #2 POWER 1: ON	PMCL #1 1: TO PMP	PMCL #2 1: TO PMP	PMCL #1 1: TO TR	PMCL #2 1: TO TR
33	DEC #1 STRO CMD 1: ENA	DEC #2 STRO CMD 1: ENA	PROG #1 1: ON	PROG #2 1: ON	PROG #1 NABIR 1: NORM 0: FLIP	PROG #2 NABIR 1: NORM 0: FLIP	PROG #1 CAPS SPIN 1: MINUS 0: PLUS	PROG #2 CAPS SPIN 1: MINUS 0: PLUS
34	SBT SELECT 1: SBT #1	SBT #1 AUTO ACQ 1: ENA	SBT #2 AUTO ACQ 1: ENA	SBT #3 POWER 1: ON	SBT #2 POWER 1: ON	SBT #1 PWR MODE 1: N1 0: L0	SBT #2 PWR MODE 1: N1 0: L0	HK TLM BP-A 1: ON
35	SBT #1 AUTO ACQ 1: ON	SBT #2 AUTO ACQ 1: ON	PMP SELECT 1: PMP #1	PMP #1 POWER 1: ON	PMP #2 POWER 1: ON	PMP #1 MODE 1: PB 0: RT	PMP #2 MODE 1: PB 0: RT	TIME BASE SELECT 1: TALA
36	VBT SELECT 1: VBT #1	VBT #1 POWER 1: ON	VBT #2 POWER 1: ON	VBT #1 MODE 1: TLM 0: BCN	VBT #2 MODE 1: TLM 0: BCN	BNS #1 POWER 1: ON	BNS #2 POWER 1: ON	TAL POWER 1: ON

W/O	1	2	3	4	5	6	7	8
37	PROG #1 CMU PWR 1: ON	CMU #1 1: SELECT	ALUG #2 CMU PWR 1: ON	CMU #2 1: SELECT	HK TLM BP-3 1: ON	SPARE	MARC LIV-3 1: ON	MARC 34 CLK LIV-3 1: ON
38	PMCL #1 TO MARK (LIV-1) 1: SELECT	RSL 1: ON	RSL 1: ENA	XHAL-SEL (LIV-3) 1: XHAL B	TIME BASE LIV-8 1: TBI SCALE	TIME BASE LIV-3 1: TBI MASTER	ATC AUX HTR 1: ENA	ATC AUX HTR 1: ON
39	XHAL-SEL (LIV-1) 1: XHAL A	TIME BASE (LIV-1) 1: TBI SCALE	TIME BASE (LIV-1) 1: TBI MASTER	REG BUS CUR TLM SCALE 1: COARSE 0: FINE	ATC 1 1: DISABLE	ATC 2 1: DISABLE	ATC 3 1: DISABLE	ATC 4 1: DISABLE
40	UNREG BUS CUR TLM SCALE 1: COARSE 0: FINE	UNREG BUS UNREG INST DETECTION 1: DISABLE	BATT CHGR #1 SAFETY 1: DISABLE	BATT CHGR #2 SAFETY 1: DISABLE	BATT CHGR #3 SAFETY 1: DISABLE	BATT #1 CHARGER 1: ON	BATT #2 CHARGER 1: ON	BATT #3 CHARGER 1: ON
41	UNREG BUS UNREG INST DETECTION 1: TRIP 0: OFF	REG BUS UNREG INST DETECTION 1: DISABLE	SHUNT LIMITER #1 1: OFF	SHUNT LIMITER #2 1: OFF	WHS (REC-1) 1: NORM 0: Y'0	WHS (REC-2) 1: NORM 0: X'0	PMCL #1 1: TO VBT	PMCL #2 1: TO VBT
42	PCE GAIN (M) 1: NORM 0: COARSE	PCE 2 GAIN CMD 1: NORM 0: COARSE	PCE 1 GAIN STATE 1: FINE 0: COARSE	PCE 2 GAIN STATE 1: FINE 0: COARSE	PCE 1 LOOP MODE 1: CLOSED 0: OPEN	PCE 2 LOOP MODE 1: CLOSED 0: OPEN	PCE 1 SPIN MODE 1: NORM 0: SPIN	PCE 2 SPIN MODE 1: NORM 0: SPIN
43	3RD ELECT #1 1: ON	3RD ELECT #2 1: ENA	3RD ELECT #3 1: ENA	3RD ELECT #1 1: FIRE 0: OFF	3RD ELECT #2 1: FIRE 0: OFF	3RD ELECT #3 1: FIRE 0: OFF	SQUIB BUS-A 1: ENA	SQUIB BUS-B 1: ENA
44	YAW T R VALVE COIL #1 1: ON	YAW TMR VALVE COIL #2 1: ON	ΔV THR #1 VALVE COIL #1 1: ON	ΔV THR #1 VALVE COIL #2 1: ON	ΔV THR #2 VALVE COIL #1 1: ON	ΔV THR #2 VALVE COIL #2 1: ON	REG BUS MIN. LOAD 1: ON	SPARE
45	ESUM HTR PWR 1: ON	NOT SO	OAPS HEATERS 1: ENA	OAPS TANK HTR 1: ON	ΔV THR #1 HEATER 1: ON	ΔV THR #2 HEATER 1: ON	YAW TMR HEATER 1: ON	MAG POWER 1: ON
46	AS	PA	RE		ATC #1 REF 1: #5 0: #12	ATC #2 REF 1: #5 0: #12	ATC #3 REF 1: #5 0: #12	ATC #4 REF 1: #5 0: #12
47	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE	SPARE
48	QOMAC #1 PLV 1: ON	QOMAC #1 MINUS 1: ON	QOMAC #2 PLUS 1: ON	QOMAC #2 MINUS 1: ON	MASC #1 PLUS 1: ON	MASC #1 MINUS 1: ON	MASC #2 PLUS 1: ON	MASC #2 MINUS 1: ON
49	LIV-1 DEC #1 1: ON	LIV-A DEC #2 PWR 1: ON	LIV-A PMCL #1 1: ON	LIV-A PMCL #2 1: ON	RCVR #1 STATUS 1: LOCK	RCVR #2 STATUS 1: LOCK	SBT #1 RANGING 1: ENA	SBT #2 RANGING 1: ENA
50	LIV-B DEC #1 PWR 1: ON	LIV-B DEC #2 PWR 1: ON	LIV-B PMCL #1 1: ON	LIV-B PMCL #2 1: ON	SPARE	TR #1 1: TRACK 2 0: TRACK 1	TR #2 1: TRACK 2 0: TRACK 1	TR #3 ARP FEB 1: ON
51	TR #1 PRI 20T 1: OFF	TR #1 PRI 20T 1: OFF	TR #1 BUFF PWR 1: OFF	TR #1 REUNDRANT 90T/COV 1: OFF	TR #2 PRI 20T 1: OFF	TR #2 PRI 20T 1: OFF	TR #2 BUFF PWR 1: OFF	TR #2 REUNDRANT 90T/COV 1: OFF

HEX	DEC
A	10
B	11
C	12
D	13
E	14
F	15

AE-C FLAGS
9/1/73

AE-C FLAGS
9/1/73
SHEET 1 OF 1

DSAI DATA CODE VS. SUN ANGLE

Bit Number (of read-out)											
234-----→											
5	6	7	8	000	001	010	011	100	101	110	111
0	0	0	0	.5	31.5	63.5	32.5			64.5	
0	0	0	1	1.5	30.5	62.5	33.5			65.5	
0	0	1	0	3.5	28.5	60.5	35.5			67.5	
0	0	1	1	2.5	29.5	61.5	34.5			66.5	
0	1	0	0	7.5	24.5	56.5	39.5			71.5	88.5
0	1	0	1	6.5	25.5	57.5	38.5			70.5	89.5
0	1	1	0	4.5	27.5	59.5	36.5			68.5	
0	1	1	1	5.5	26.5	58.5	37.5			69.5	
1	0	0	0	15.5	16.5	48.5	47.5			79.5	80.5
1	0	0	1	14.5	17.5	49.5	46.5			78.5	81.5
1	0	1	0	12.5	19.5	51.5	44.5			76.5	83.5
1	0	1	1	13.5	18.5	50.5	45.5			77.5	82.5
1	1	0	0	8.5	23.5	55.5	40.5			72.5	87.5
1	1	0	1	9.5	22.5	54.5	41.5			73.5	86.5
1	1	1	0	11.5	20.5	52.5	43.5			75.5	84.5
1	1	1	1	10.5	21.5	53.5	42.5			74.5	85.5

↑
Angle in degrees $\pm .5^\circ$
from spacecraft X-Y
plane

For the sun in -Z hemisphere, bit 1=1 and angles above as shown.
For the sun in +Z hemisphere, bit 1=0 and angles above negated.
Post-interrogate pattern: 1 0 1 0 1 0 1 0

SECTION 8.0

TEMPERATURE TELEMETRY

The following table and figures identify the spacecraft temperature telemetry points. Note that the items appearing without an accompanying telemetry word number were used for external instrumentation during the AE-C Thermal Balance Test and are not available in the spacecraft 8 second SUBCOM.

TABLE II
TELEMETRY TEMPERATURE SENSORS

NO.	LOCATION	TELEMETRY WORD NO.	PART NO.
1	ATC Housing QUAD 1	66,26	2274189-501
2	ATC Housing QUAD 2	66,27	2274189-501
3	ATC Housing QUAD 3	66,28	2274189-501
4	ATC Housing QUAD 4	66,29	2274189-501
5	Upper Hat - Top QUAD 1 Ext	66,55	2270700-502
6	Upper Hat - Top QUAD 2 Ext	66,16	2270700-502
7	Upper Hat - Top QUAD 4 Ext	66,17	2270700-502
8	Upper Hat Panel 9 Int	66,15	2270700-502
9	Upper Hat Panel 16 Int	66,1	2270700-501
10	Lower Hat Panel 1 Int	66,14	2270700-501
11	Lower Hat Panel 4 Int	66,3	2270700-501
12	Lower Hat Panel 9 Int	66,13	2270700-502
13	Lower Hat Panel 9 Int	66,56	2270700-503
14	Lower Hat Bottom +X Int	66,2	2270700-501
15	Lower Hat Bottom +X Int	66,4	2270700-501
16	Lower Hat Bottom -X Int	66,5	2270700-502
17	Upper Baseplate QUAD 1	66,18	1964402-501
18	Upper Baseplate QUAD 2	66,19	1964402-501
19	Upper Baseplate QUAD 3	66,21	1964402-501
20	Upper Baseplate QUAD 4	66,20	1964402-501
21	PSA Electronics Box		
22	NACE Electronics Box		

TABLE II

TELEMETRY TEMPERATURE SENSORS

NO.	LOCATION	TELEMETRY WORD NO.	PART NO.
23	NACE Experiment		
24	OSS Experiment		
25	OSS Experiment Sensor		
26	PES-1 Experiment		
27	Battery 1	66,10	
28	SBT1 Output Stage	66,48	
29	SBT2 Output Stage	66,49	
30	SBT1 Conv	66,52	
31	UVNO Experiment		
32	UVNO Experiment		
33	Battery 2	66,11	
34	PES-2 Experiment		
35	Battery 3	66,12	
36	PSE Heat Sink	66,120	
37	CEP Electronics		
38	ΔV Thruster 1 Valve	66,30	
39	ΔV Thruster 2 Valve	66,31	
40	YAW Thruster Valve	66,32	
41	OAPS Bay 2 Plumbing	66,33	1964402-501
42	OAPS Bay 5 Plumbing	66,34	1964402-501
43	OAPS Bay 6 Plumbing	66,35	1964402-501
44	OAPS Bay Tank 1	66,36	1964402-501

8-3

Size
ACode Ident No.
49671

TP-TV-2271596

Sheet 63

TABLE II

TELEMETRY TEMPERATURE SENSORS

NO.	LOCATION	TELEMETRY WORD NO.	PART NO.
45	OAPS Bay Tank 2	66,37	1964402-501
46	OAPS Bay Tank 5	66,38	1964402-501
47	OAPS Bay Tank 6	66,39	1964402-501
48	Lower Baseplate QUAD 1	66,22	1964402-501
49	Lower Baseplate QUAD 2	66,23	1964402-501
50	Lower Baseplate QUAD 3	66,24	1964402-501
51	Lower Baseplate QUAD 4	66,25	1964402-501
52	NATE Electronics		
53	RPA-1 Experiment		
54	RPA-1 Experiment		
55	BIMS Experiment		
56	NATE Experiment		
57	RPA-3 Experiment		
58	VAE Electronics		
59	VAE Experiment		
60	Tape Recorder #1	66,81	
61	Tape Recorder #2	66,82	
62	RPA-2 Experiment		
63	ESUM Experiment		
64	ESUM Experiment		
65	ESUM Experiment		
66	ESUM Experiment		

8-4

Size
ACode Ident No.
49671

TP-TV-2271596

Sheet 64

TABLE II
TELEMETRY TEMPERATURE SENSORS

NO.	LOCATION	TELEMETRY WORD NO.	PART NO.
67	MIMS Experiment		
68	MESA Experiment		
69	MESA Experiment		
70	MESA Experiment		
71	MWA Bearing		
72	SPS Azimuth Bearing	66,80	
73	SBT2 Conv	66,53	

8-5

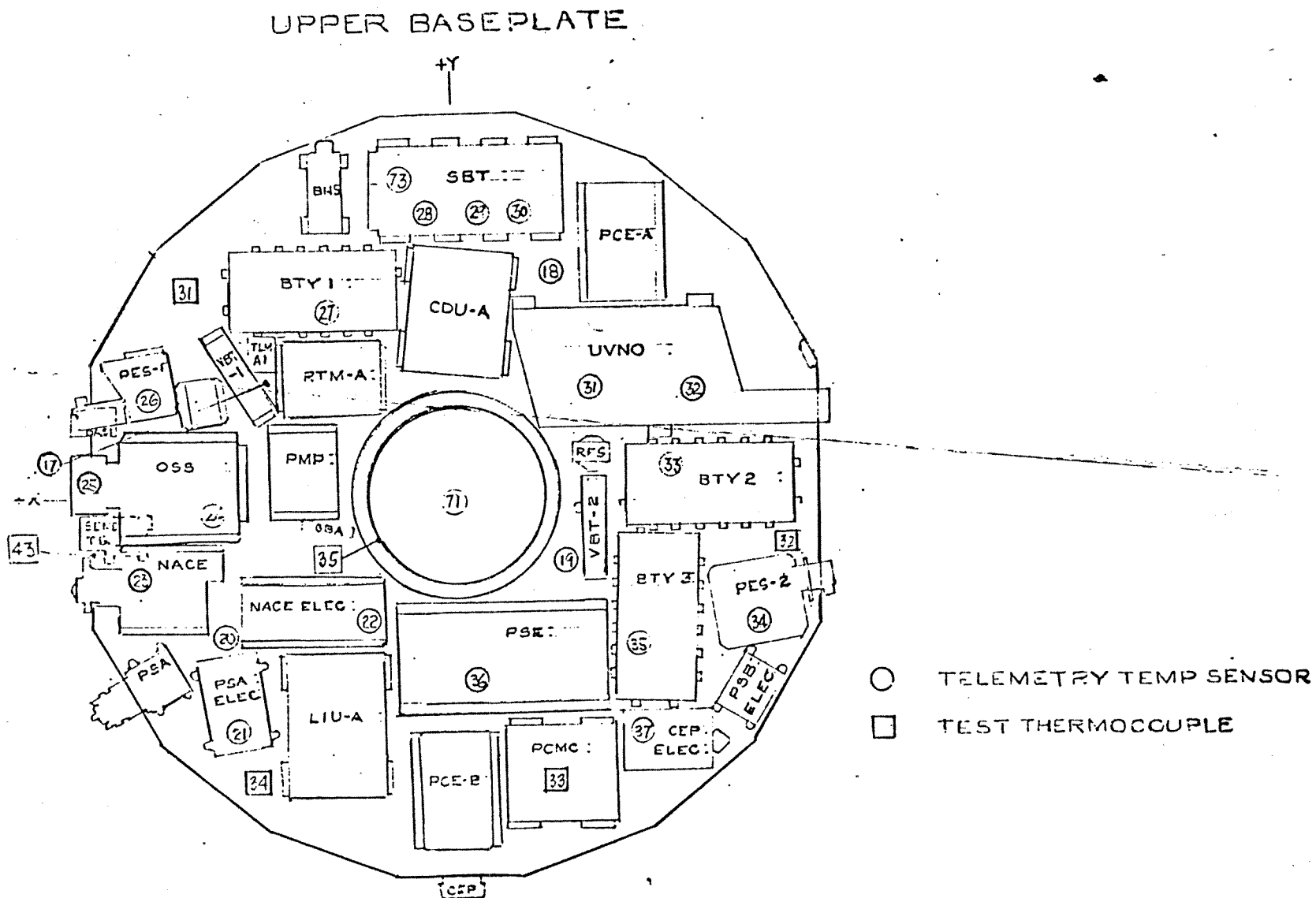
Size
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Code Ident No.
49671

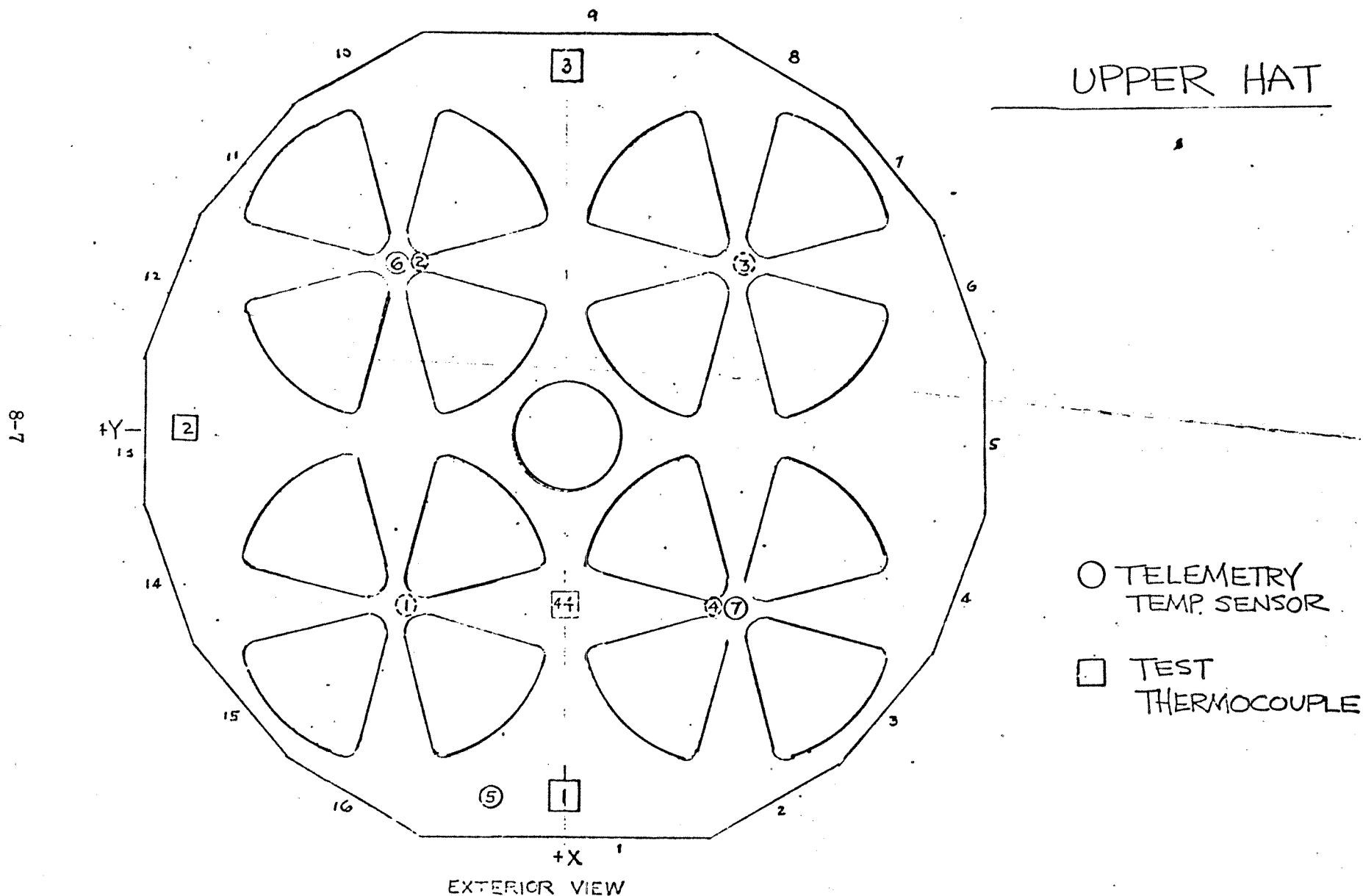
TP-TV-2271596

Sheet 65

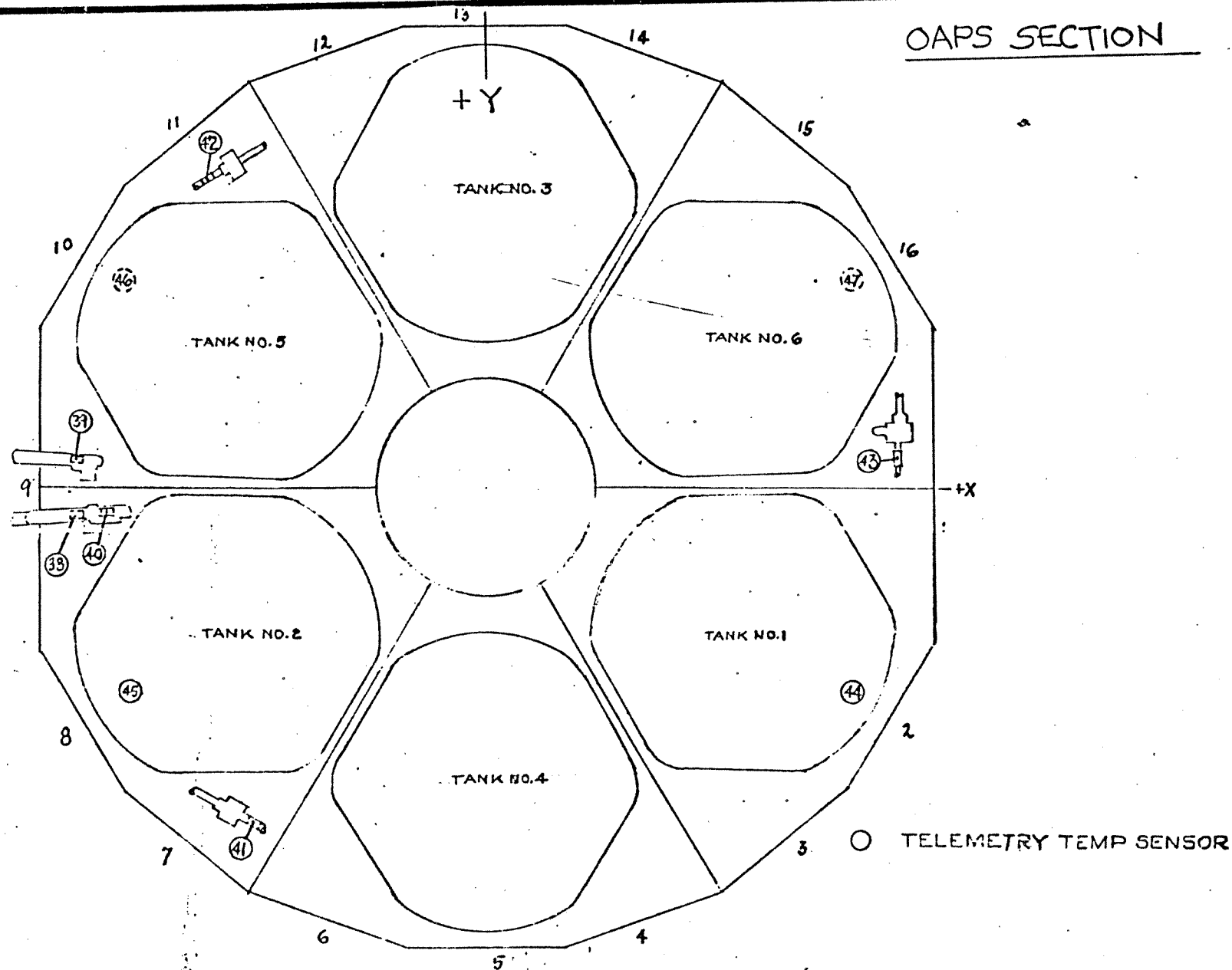
LOCATION OF TELEMETRY TEST SENSORS AND TEST
THERMOCOUPLES ON UPPER BASEPLATE



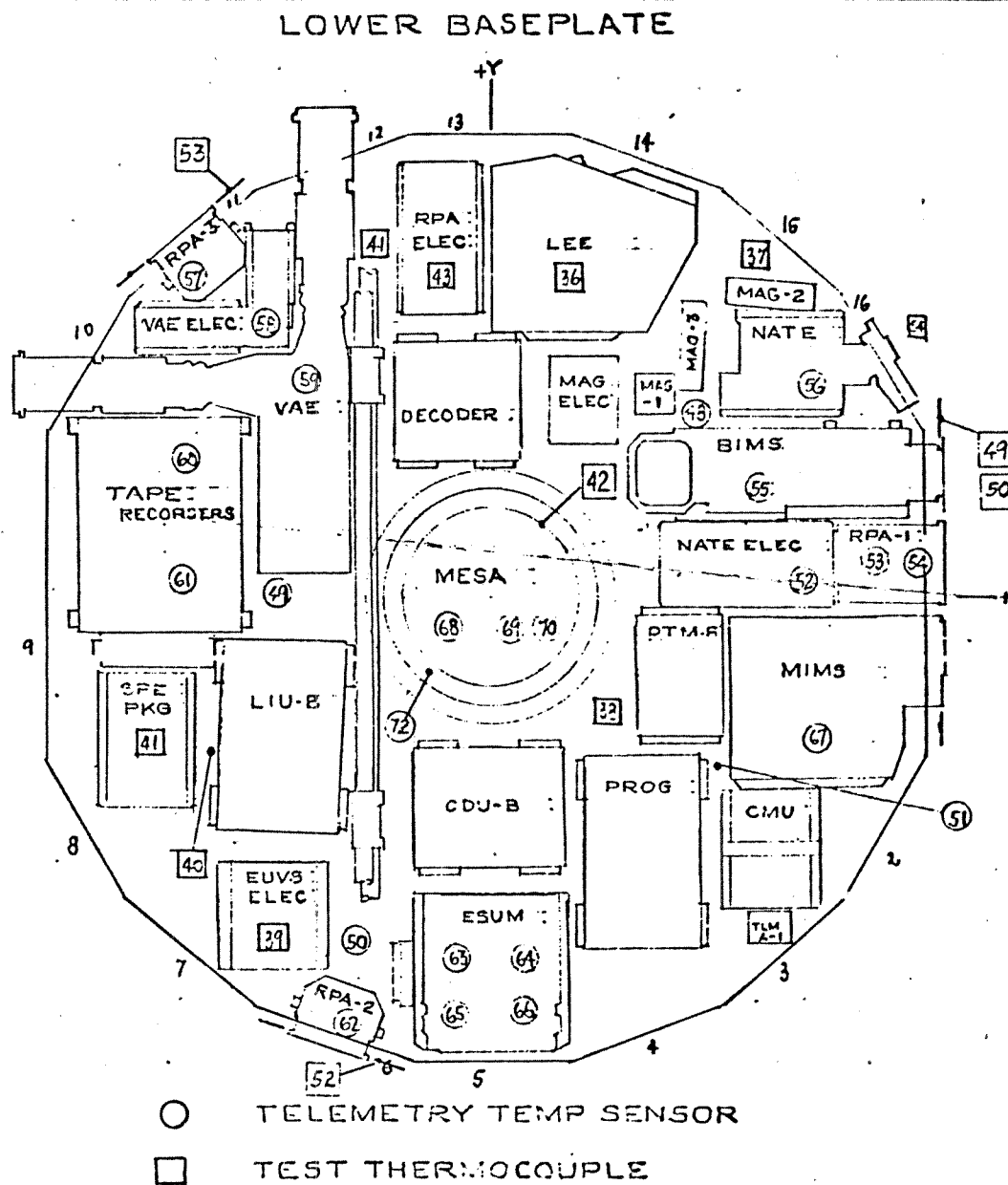
LOCATION OF TELEMETRY TEST SENSORS AND TEST
THERMOCOUPLES ON UPPER HAT



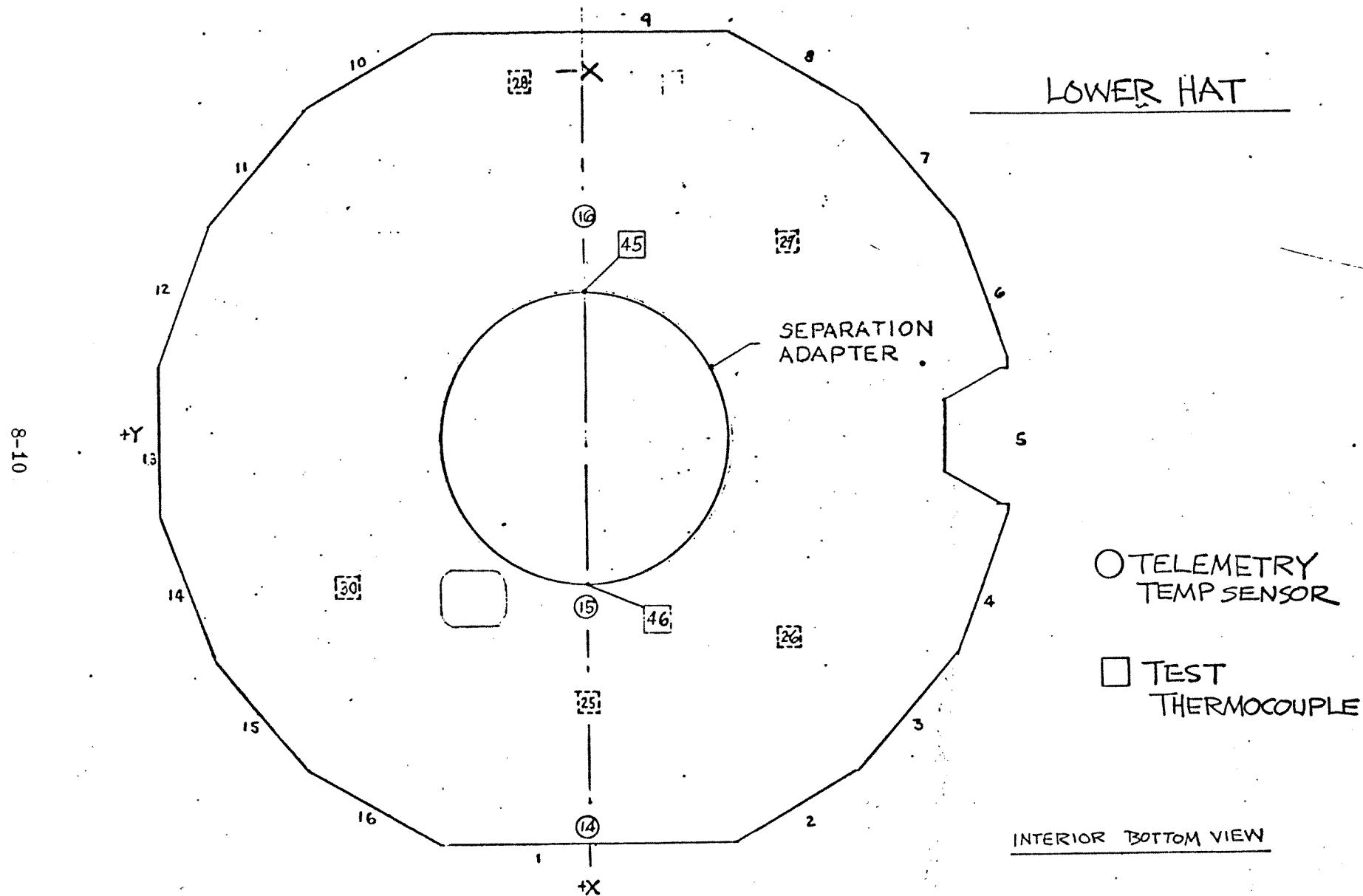
LOCATION OF TELEMETRY TEST SENSORS AND TEST
THERMOCOUPLES ON OAPS SECTION



LOCATION OF TELEMETRY TEST SENSORS AND TEST
THERMOCOUPLES ON LOWER BASEPLATE



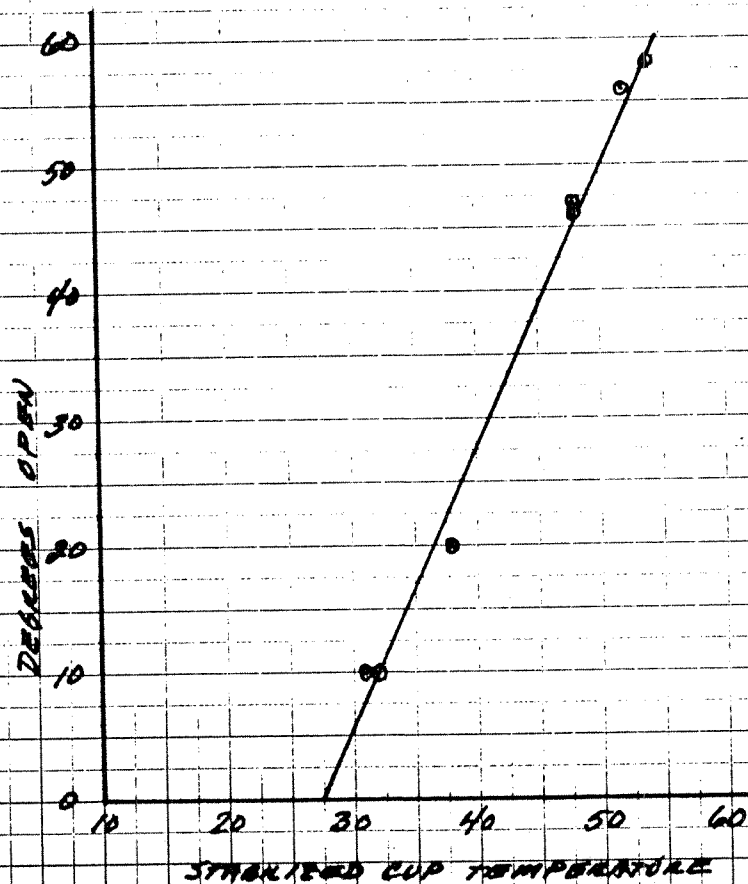
LOCATION OF TELEMETRY TEST SENSORS AND TEST
THERMOCOUPLES ON LOWER HAT



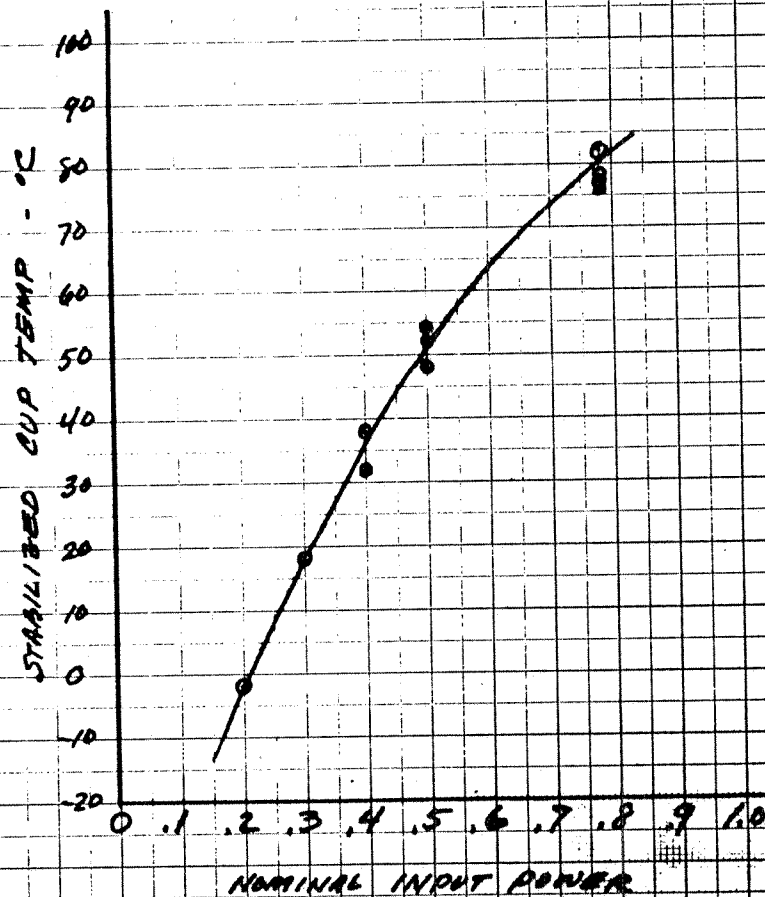
ATC SUMMARY

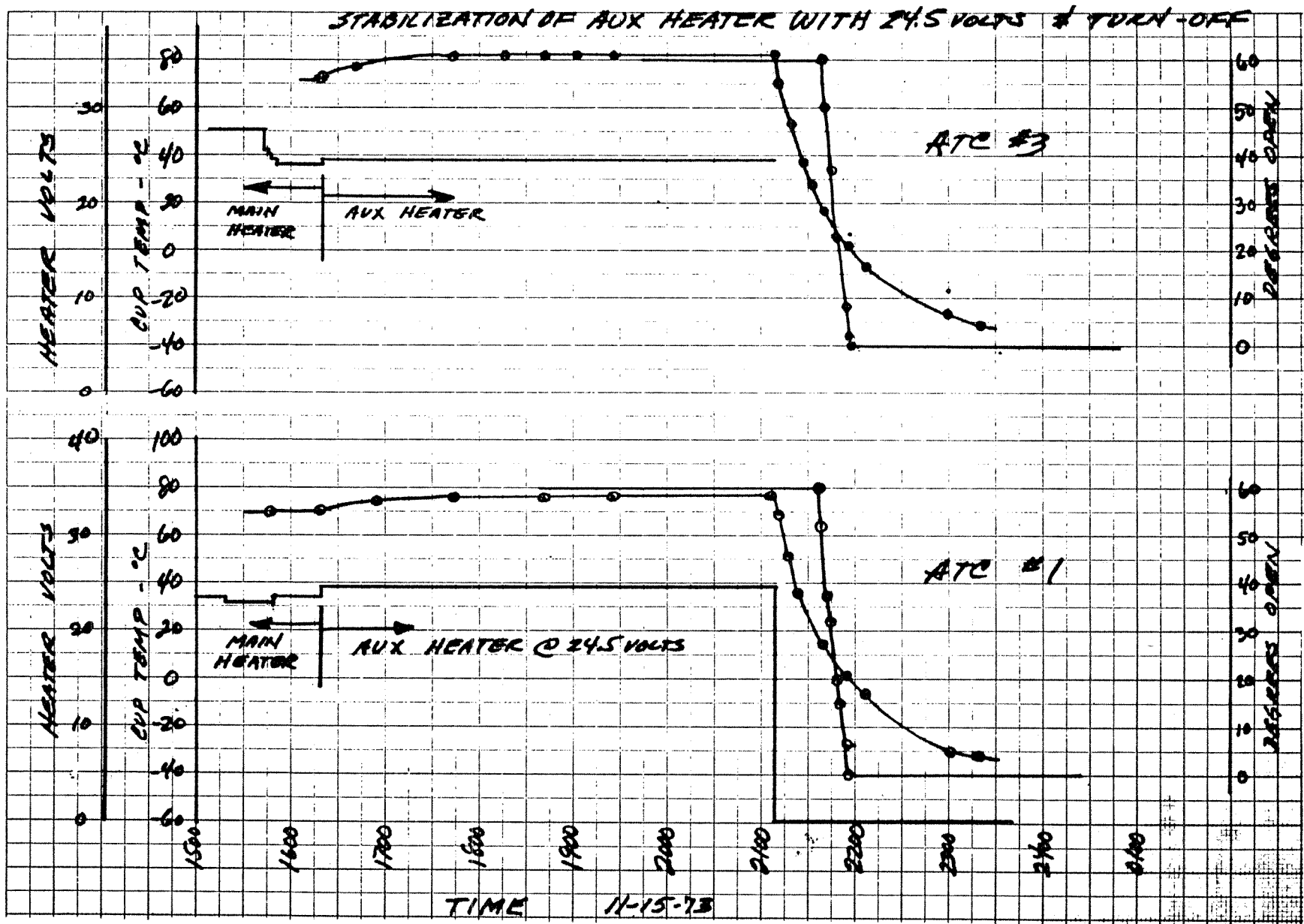
	ATC			
	1	2	3	4
Time to Reach 70°C With 1.0 Watt (From -50°C)	40 Min	42 Min	40	43 Min
Time to Reach 0° From Stabilized 70° No Power		42 Min		44 Min
Time to Reach 70°C With 2.0 Watts (From -40°C)		13 Min		13 Min
Stab Temp With 24.5 Volts on Aux	77°C	76°C	82°C	78°C
Time to Reach 70° With 2.8 Watts (From -50°)		7 Min		7 Min
Time to Reach 100° With 2.8 Watts (From -50°)		11 Min		11 Min
1 Watt at -50° Time for Full Open	52 Min	57 Min	49 Min	55 Min
2 Watt at -40° Time for Full Open		41 Min		36 Min
2.8 Watt at -50°, Time for Full Open		28 Min		28 Min
Stab at 70°, Time for Full Close From Pwr Off		40 Min		46 Min
Stab at 24.5 On Aux, Time for Full Close From Pwr Off	48 Min	43 Min	50 Min	49 Min
Nom Power to Maintain 70° Cup Temp	0.72W	0.75W	0.72W	0.69W
Voltage Req'd to Maintain 70° Cup Temp	23.5 V	24 V	23.5 V	23 V

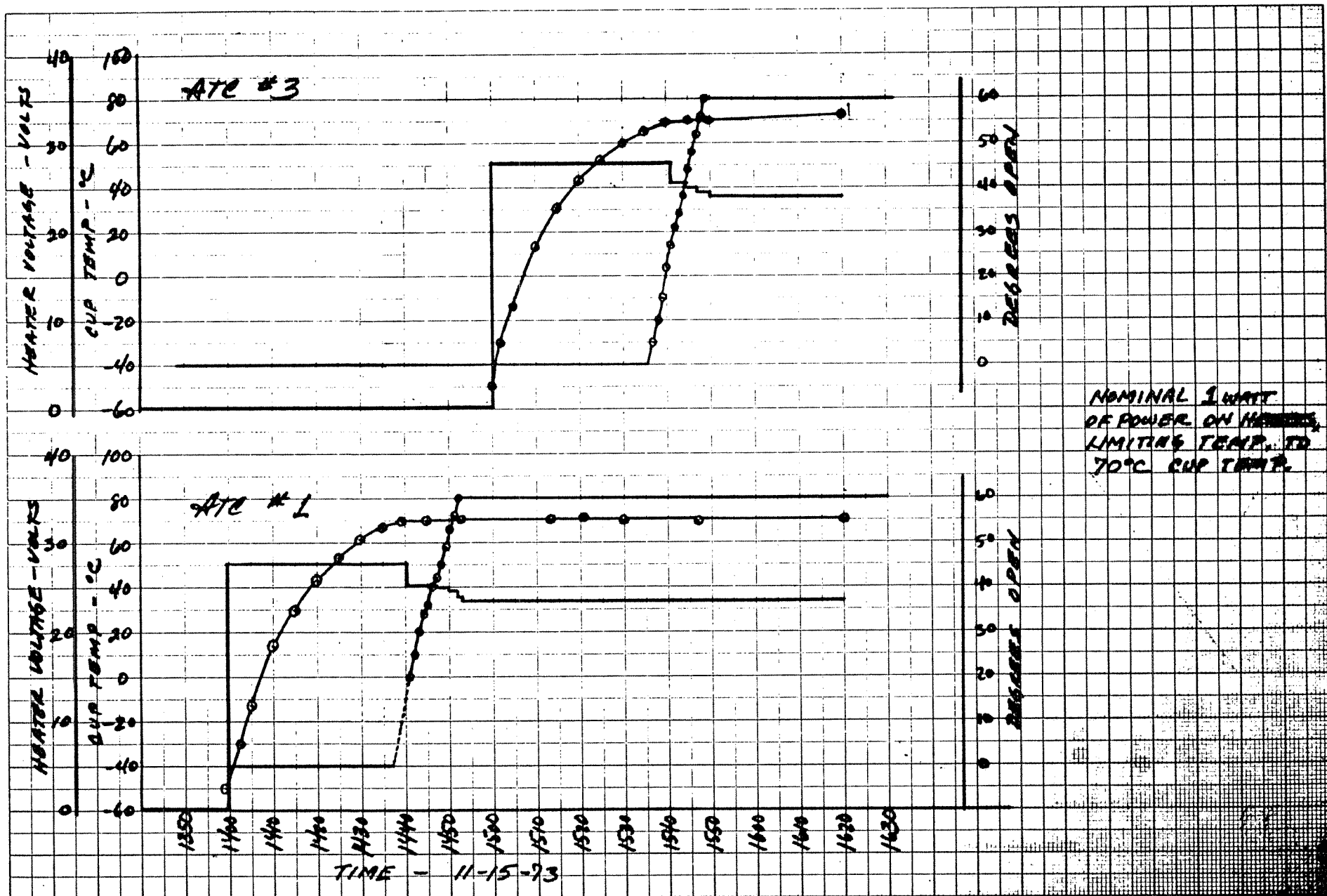
NOMINAL OPERATION
STABILIZED CUP TEMP
VS POSITION

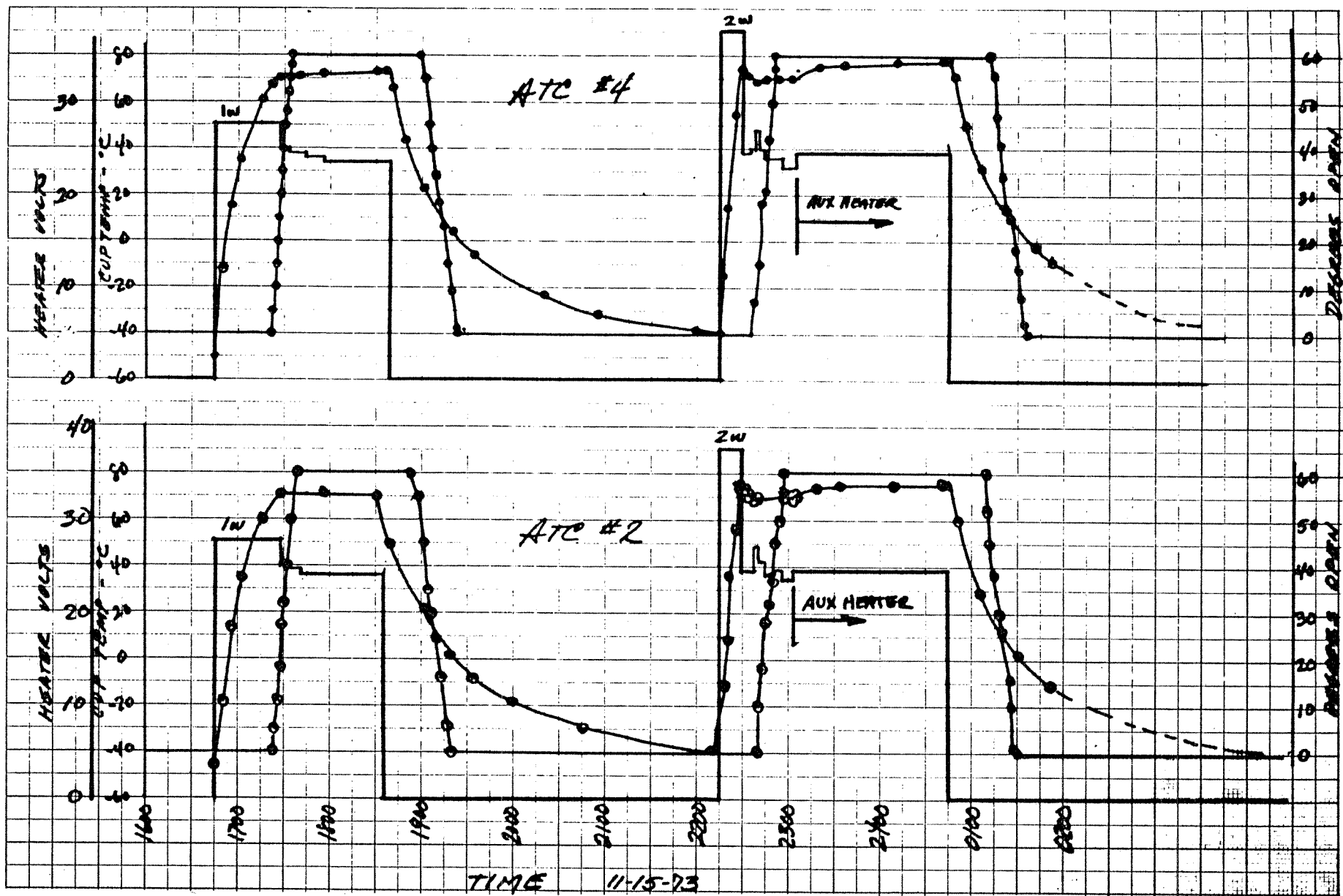


STABILIZED ATE CUP
TEMPERATURE AS A
FUNCTION OF HEATER
POWER

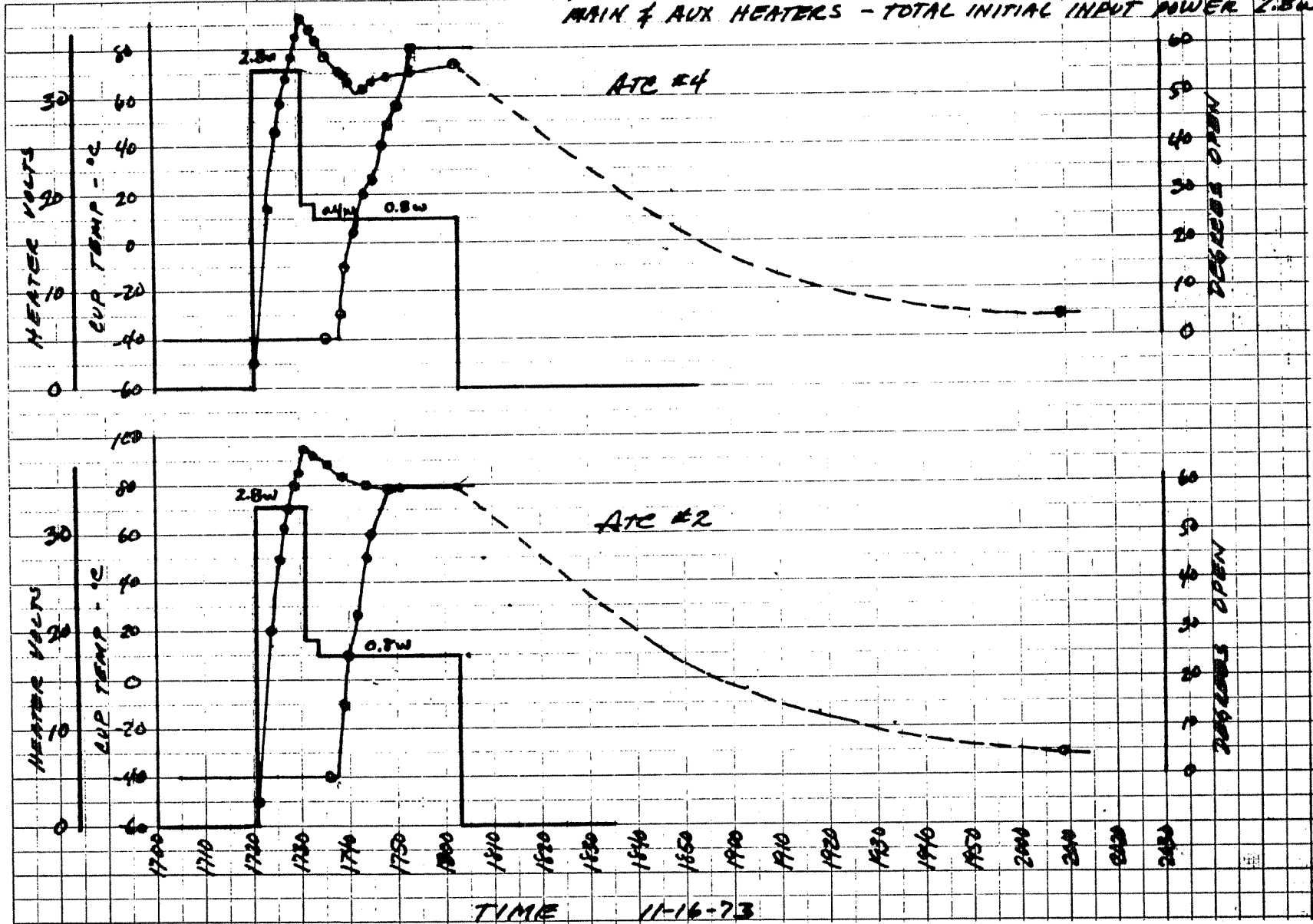








HEATER POWER INITIALLY APPLIED TO BOTH
MAIN & AUX HEATERS - TOTAL INITIAL INPUT POWER 2.8W



SECTION 9.0

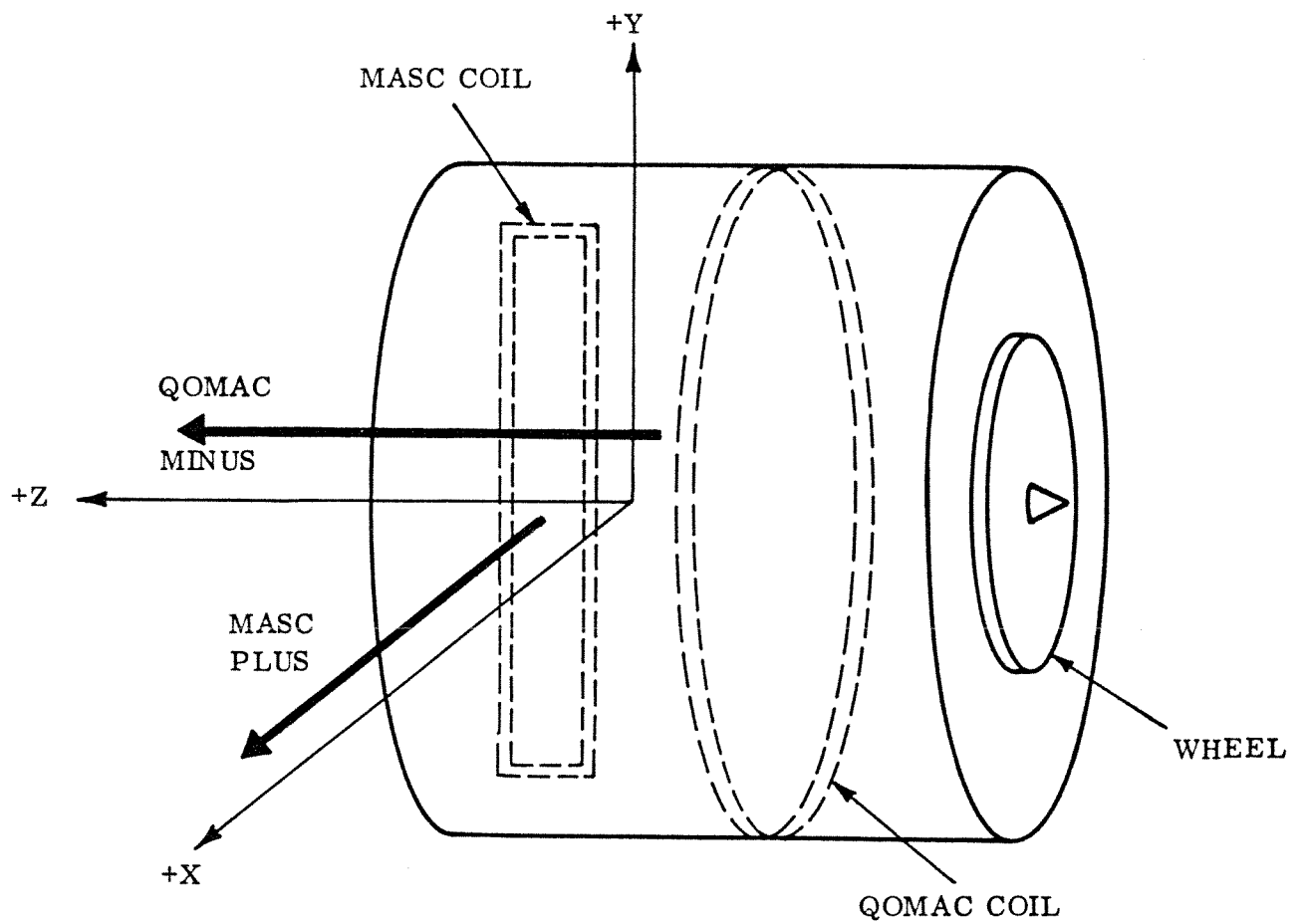


Figure 9-1. Attitude Coil Sense

SECTION 10.0

TABLE 3.1.1(a) - NF NADIRS

C MISSION

Spacecraft Function	Depends after the S/C Nadir that a Functional Nadir is to occur	
	YAW Orientations	
	0° Orientation	180° Orientation
MINS Experiment	348°	168°
MPA-1 Experiment	357°	177°
UVNO Experiment	180°	180°
ESUM Experiment	360°	360°
CEP Experiment	360°	360°
VAE Experiment	240°	240°
AV 1+ (See Figure 1)	330°	150°
AV 2+ (See Figure 1)	30°	210°
AV 2- (See Figure 1)	210°	30°
AV 1- (See Figure 1)	150°	330°
YAW 3+ (See Figure 2)	60°	60°
YAW 4+ (See Figure 2)	120°	120°
YAW 3- (See Figure 2)	240°	240°
YAW 4- (See Figure 2)	300°	300°
MASC Nadir A	Programmed Value (0° - 360°)	Programmed Value (0° - 360°)
MASC Nadir B	180° After Pro- grammed Value	180° After Pro- grammed Value

FIGURE 3.1.12(a) - OAPS AV CONFIGURATION

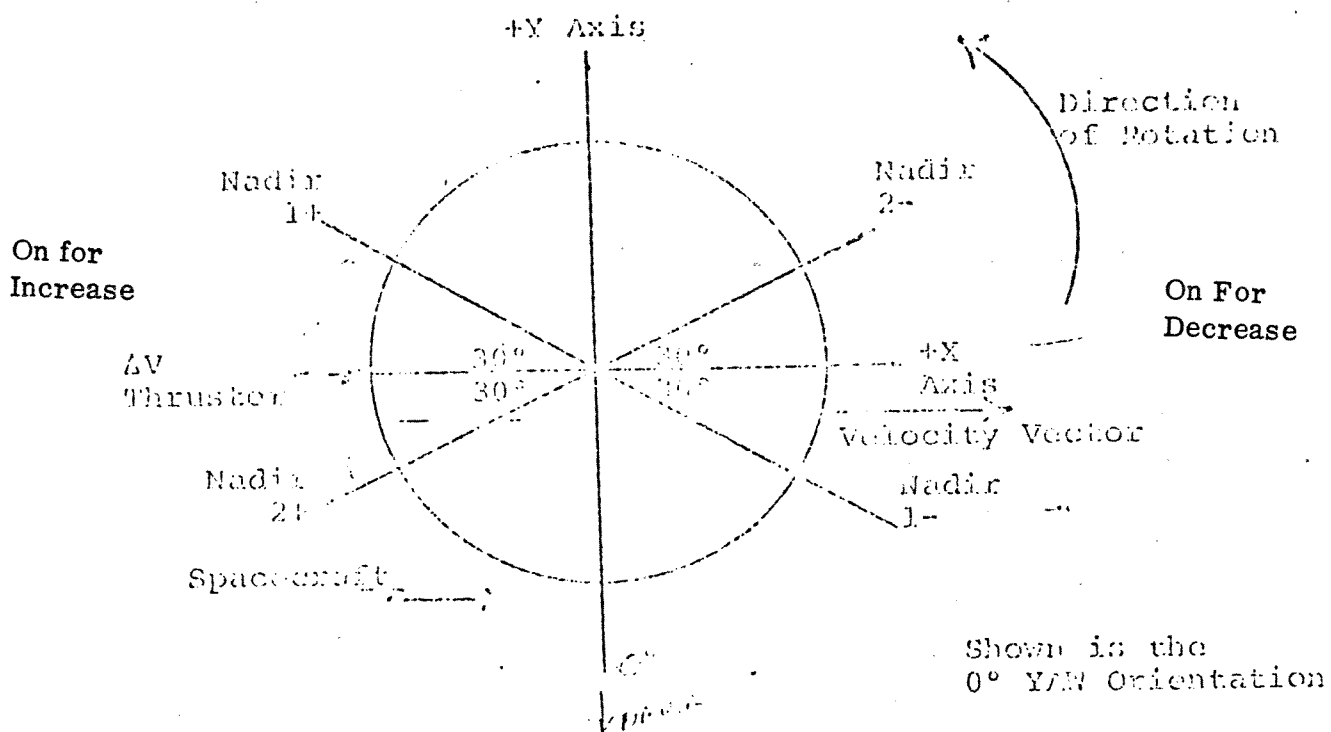
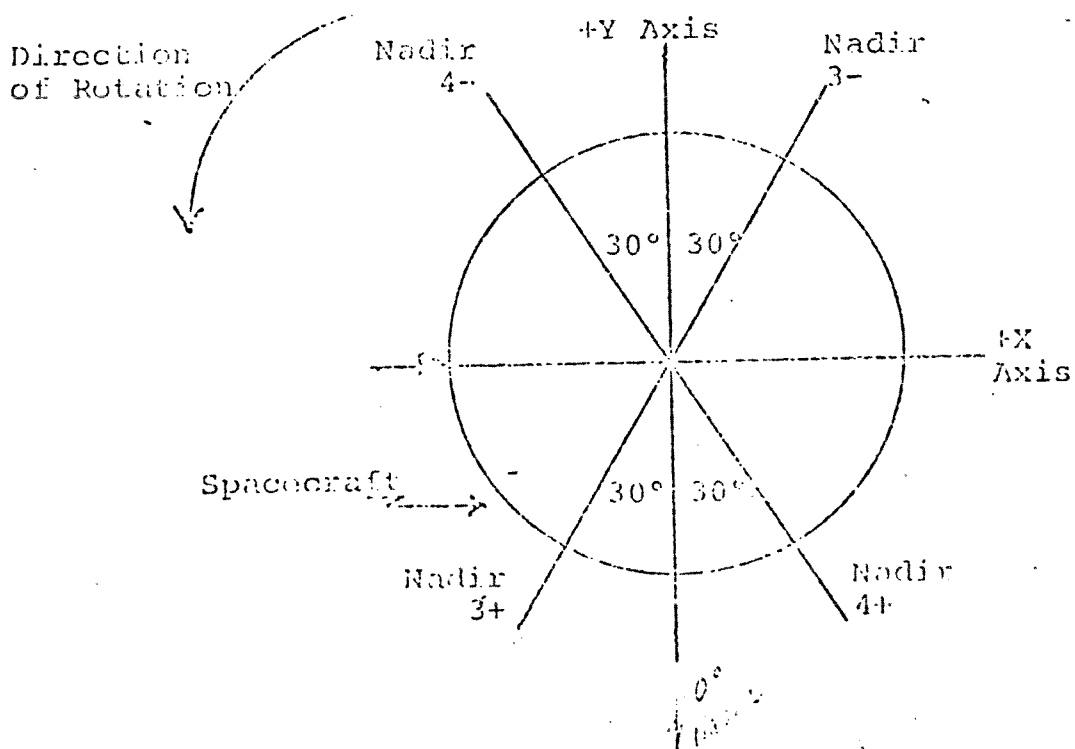


FIGURE 3.1.12(b) - OAPS YAW CONFIGURATION



10-2

Size	Code Ident No.	
A	49671	
		Sheet

SECTION 11.0

RF SYSTEMS

AE-C has a complement of a Dual S-Band Transponder, two VHF transmitters, an RF switch for VHF, an S-band belt antenna and associated power splitter and a VHF whip antenna and associated cables. The Transponder is modulated by a Dual Premodulation Processor. Manufacturer and serial numbers of these units are given in the following tabulation.

Unit	Serial Number	Manufacturer
Transponder	01P	Motorola
VHF Transmitter #1	01P	RCA/Limited
VHF Transmitter #2	02	RCA/Limited
Belt Antenna		Ball Brothers Research Corp.
Power Splitter		Ball Brothers Research Corp.
RF Switch		RCA/AED
VHF Antenna		RCA/AED
PMP		Vector

A summary of key transponder parameters is presented in the table below.

Parameter	Side 1	Side 2	
Receiver Frequency	2108.2479 ^{+0.0021} _{-0.0015} MHz	2108.2471 ^{+0.0019} _{-0.0014} MHz	
Receiver Sensitivity	-113.9 ^{+2.7} _{-1.6} dBm	-113.7 ^{+2.9} _{-2.0} dBm	
Ranging Delay*	1008.7 ^{+15.3} _{-13.8} ns	998.0 ^{+20.1} _{-20.8} ns	
Transmitter Frequency			
AUX OSC	2289.4905 ^{+0.0035} _{-0.0045} MHz	2289.4862 ^{+0.0078} _{-0.0102} MHz	
VCXO	2289.502 ^{+0.008} _{-0.012} MHz	2289.496 ^{+0.004} _{-0.006} MHz	
Carrier Level {	Low Power Mode	+29.2 ^{+0.5} _{-1.0} dBm	+29.2 ± 1.2dBm
	High Power Mode	+35.8 ^{+0.9} _{-0.5} dBm	+36.2 ^{+0.8} _{-0.4} dBm
<u>Transmitter Mod Index</u>			
GRARR (Uplink Mod = 1 radian, 70kHz sinusoid)			
Sideband/ Carrier Level	-11.0 ⁺⁰ _{-0.2} dB	-11.4 ± 0.1dB	
PRN (Uplink Mod = 0.38 radian, 496kHz square wave)			
Sideband/ Carrier Level	-18.0dB	-18.0dB	

* Variation shown includes effects of +5° to +35° temperature range, ± 90kHz doppler and -95dBm to -55dBm signal strength

Parameter	Side 1	Side 2
Transmitter Mod Index (Cont.)		
Real Time		
<u>1024kHz/Carrier</u>		
with PMP 1	$-3.0^{+0.1}_{-0.2}$ dB	-3.1 ± 0.1 dB
with PMP 2	$-3.2^{+0.2}_{-0.4}$	$-2.8^{+0.1}_{-0.2}$ dB
Playback		
<u>1024kHz SB/Carrier</u>		
with PMP 1	-12.1 ± 0.3 dB	$-12.0^{+0.2}_{-0.0}$ dB
with PMP 2	-12.1 ± 0.3 dB	-11.8 ± 0.2 dB
<u>768kHz SB/Carrier</u>		
with PMP 1	$-3.4^{+0.2}_{-0.4}$ dB	$-3.4^{+0}_{-0.1}$ dB
with PMP 2	-3.3 ± 0.3 dB	-3.1 ± 0.1 dB

A summary of key VHF Transmitter parameters is presented below.

Parameter	Side 1	Side 2
Carrier Frequency	$137.2295^{+0.0015}_{-0.0005}$ MHz	$137.2300^{+0.0010}_{-0.0003}$ MHz
RF Power - Beacon Mode	$+26.3 \pm 0.3$ dBm	$+25.8^{+0.5}_{-0.4}$ dBm
RF Power - TLM Mode	$+31.3^{+0.4}_{-0.2}$ dBm	$+31.5^{+0.3}_{-0.2}$ dBm
<u>Modulation Index</u>		
Carrier Drop with Mod	-2.6 dB	-3.1 dB
16kHz Sideband Below Carrier	-4.4 dB	-3.6 dB

SECTION 12.0

POWER SUBSYSTEM

The AE-C Power Subsystem consists of an upper and lower Solar Array with integral shunt dissipating elements, a Power Supply Electronics Unit containing redundant -24.5V regulators and battery conditioning equipment and three 6 Ampere-hour capacity batteries. Unit serial numbers are listed below.

Upper Solar Array	--	001
Lower Solar Array	--	001
Power Supply Electronics	--	001
Battery #1	--	001
Battery #2	--	002
Battery #3	--	003

POWER SUBSYSTEM OPERATING PARAMETERS

1 OF 2

SHUNT LIMITER THRESHOLD VOLTAGE = -38.2V

REG. BUS OVERVOLTAGE TRIP VOLTAGE = -26.4V

REG. BUS UNDERVOLTAGE TRIP VOLTAGE = -23.1V

UNREG. BUS UNDERVOLTAGE TRIP VOLTAGE = -25.9V

THIRD ELECTRODE TRIP VOLTAGES (TELEMETRY VOLTAGE)

BATTERY #1 = 0.415V

BATTERY #2 = 0.625V

BATTERY #3 = 0.625V

POWER SUBSYSTEM OEPRATING PARAMETERS

2 OF 2

BATTERY CAPACITY

BATTERY #1 = 6.95AH

BATTERY #2 = 7.00AH

BATTERY #3 = 7.05AH

CHARGE CONTROLLER SATURATION CURRENT

BATTERY #1 = 1.59A

BATTERY #2 = 1.58A

BATTERY #3 = 1.62A

CHARGE CONTROLLER TRICKLE CHARGE CURRENT

BATTERY #1 = 125 mA

BATTERY #2 = 125 mA

BATTERY #3 = 125 mA

AE "C" LOAD PROFILE SUMMARY

COMPONENT	V _{RB}	V _{UB}	CURRENT	
NACE	✓		651	mA
NATE	✓		697	mA
OSS	✓		113	mA
MESA XY	✓		228	mA
MESA YX	✓		258	mA
MESA ZZ	✓		231	mA
VAE	✓		232	mA
UVNO	✓		320	mA
LEE	✓		29	mA
RPA	✓		117	mA
RPA DRFON	✓		117	mA
PES	✓		88	mA
MIMS	✓		176	mA
BIMS	✓		30	mA
CEP	✓		147	mA
PSA	✓		35	mA
MAG	✓		89	mA
PSB	✓		59	mA
TAL	✓		10	mA
OSS VIP	✓		59	mA
ESUM	✓		50	mA
EUVS	✓		140	mA
PSB HTR		✓	77	mA

AE "C" LOAD PROFILE SUMMARY

COMPONENT	V _{RB}	V _{UB}	CURRENT
TLM POWER	✓		29.6 mA
TR 1 STDBY	✓		29.5 mA
TR 1 REC	✓		207.1 mA [STDBY TO REC]
TR 1 PB	✓		443.3 mA [STDBY TO PB]
TR 2 STDBY	✓		29.5 mA
TR 2 REC	✓		207.1 mA
TR 2 PB	✓		354.7 mA [STDBY TO PB]
PCMC 2 ON		✓	39.6 mA
PMP 1 ON		✓	69.5 mA
PMP 2 ON		✓	67.8 mA
PROG 2 ON		✓	39.7 mA
DSAI ON		✓	9.6 mA
WHS 1		✓	38.3 mA
BHS 1		✓	19.2 mA
SBT 1 LOW		✓	429 mA
SBT 1 HIGH		✓	950 mA
SBT 2 LOW		✓	446 mA
SBT 2 HIGH		✓	972 mA
PL @ 10 RAD/SEC		✓	198 mA

AE "C" LOAD PROFILE SUMMARY

COMPONENT	V _{RB}	V _{UB}	CURRENT
QOMAC 1 COIL		✓	178 mA
QOMAC 2 COIL		✓	178 mA
MASC 1 COIL		✓	117 mA
MASC 2 COIL		✓	113 mA
OAPS TANK HTR		✓	350 mA
V1 HTR		✓	57 mA
V2 HTR		✓	57 mA
YAW HTR		✓	57 mA
VALVE 1		✓	820 mA
VALVE 2		✓	820 mA
VALVE 3		✓	820 mA
VALVE 4		✓	820 mA
VALVE 5		✓	820 mA
VALVE 6		✓	820 mA
V1 THRUSTER		✓	174 mA
V2 THRUSTER		✓	166 mA
YAW THRUSTER		✓	170 mA
VB1 1 BCN		✓	50 mA
VB1 1 TLM		✓	108 mA
VB2 2 BCN		✓	48 mA
VB2 2 TLM		✓	107 mA

AE "C" LOAD PROFILE SUMMARY

COMPONENT	V _{RB}	V _{UB}	CURRENT
ATC 1		✓	50 mA
ATC 2		✓	50 mA
ATC 3		✓	50 mA
ATC 4		✓	50 mA
ATC AUX. HTR.	✓		200 mA
MIN POWER SBT RECEIVERS & DECODERS		✓	767 mA

CHARGE CONTROLLER / BATTERY PARAMETERS

TELEMETRY TEST DATA VOLTAGE / TEMPERATURE

		+5 °C	+22 °C	+37 °C
BATT 1	VB1	35.55 V	34.66 V	33.95 V
	IC1	1.08 A	0.92 A	0.89 A
	TB1	6.7°	22.5°	30.20°

BATT 2	VB2	35.37 V	34.66 V	33.95 V
	IC2	0.34 A	0.85 A	0.69 A
	TB2	6.7°	21.5°	30.45°

BATT 3	VB3	35.37 V	34.66 V	33.95 V
	IC3	0.18 A	0.66 A	0.38 A
	TB3	6.7°	22.7°	30.70°

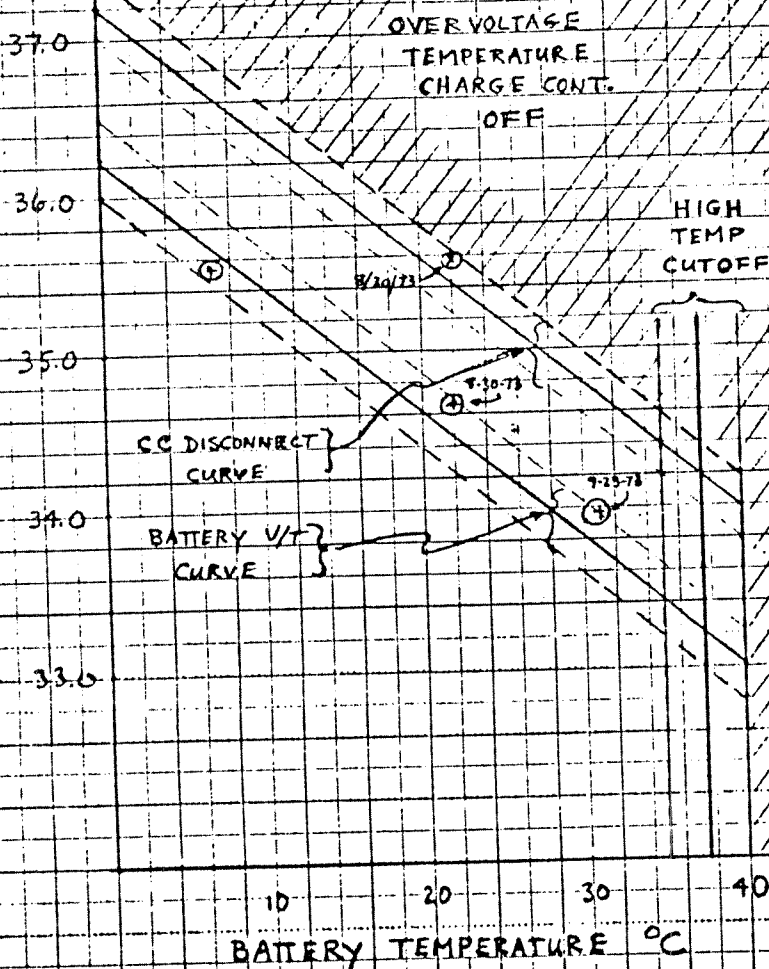
OVER VOLTAGE CUTOFF VOLTS +22 °C

BATT 1	35.54
BATT 2	35.94
BATT 3	35.77

BATTERY TELEMETRY VOLTAGE

CALIBRATION DATA		TELEMETRY V.	ACTUAL V.
BATT 1	x	34.666	34.59
BATT 2	=	34.666	34.57
BATT 3	=	34.666	34.55

BATTERY VOLTAGE, VOLTS
12-8



5.1(9)

KEUFFEL & ESSER CO

APPENDIX A
ANALOG TELEMETRY
CONVERSION COEFFICIENTS

*CONVCDEF, TM(20,1), D'.6875', D'.0625'.	1 0F 1
*CONVCDEF, TM(20,2), D'.6875', D'.0625'.	1 0F 1
*CONVCDEF, TM(20,3), D'.37.195', D'-.30019'.	1 0F 1
*CONVCDEF, TM(20,4), D'.36.051', D'-.289855'.	1 0F 1
*CONVCDEF, TM(20,5), D'.95.14574', D'-.381166'.	1 0F 1
*CONVCDEF, TM(20,6), 0, D'.0.02', RAW VBLTS BFESET EN/DSA	
*CONVCDEF, TM(20,7), D'.37.195', D'-.30019'.	1 0F 1
*CONVCDEF, TM(20,8), D'.36.051', D'-.289855'.	1 0F 1
*CONVCDEF, TM(37), 0, 1.	
*CONVCDEF, TM(43), 0, 1.	
*CONVCDEF, TM(44), 0, 1.	
*CONVCDEF, TM(45), 0, 1.	
*CONVCDEF, TM(65,001), D'=-0.1191449E00', D'0.2833101E-01'.	1 0F 2
*CONVCDEF, TM(65,001), C, D'=-0.1191061E-04'.	2 0F 2
*CONVCDEF, TM(65,002), D'=-0.1884664E00', D'0.1966319E-01'.	1 0F 2
*CONVCDEF, TM(65,002), C, D'=-0.5505020E-05'.	2 0F 2
*CONVCDEF, TM(65,003), D'=-0.1428571E00', D'0.9523810E-02'.	1 0F 1
*CONVCDEF, TM(65,004), D'=-0.1242785E00', D'0.9030219E-02'.	1 0F 2
*CONVCDEF, TM(65,004), C, D'0.6436588E-05'.	2 0F 2
*CONVCDEF, TM(65,005), D'=-0.1242785E00', D'0.9030219E-02'.	1 0F 2
*CONVCDEF, TM(65,005), C, D'0.6436588E-05'.	2 0F 2
*CONVCDEF, TM(65,006), D'=-0.1242785E00', D'0.9030219E-02'.	1 0F 2
*CONVCDEF, TM(65,006), C, D'0.6436588E-05'.	2 0F 2
*CONVCDEF, TM(65,010), D'=-0.1461748E00', D'0.1852167E-01'.	1 0F 1
*CONVCDEF, TM(65,011), D'=-0.1461748E00', D'0.1852167E-01'.	1 0F 1
*CONVCDEF, TM(65,012), D'=-0.1461748E00', D'0.1852167E-01'.	1 0F 1
*CONVCDEF, TM(65,13), 0, D'0.1777777'.	
*CONVCDEF, TM(65,14), 0, D'0.1777777'.	
*CONVCDEF, TM(65,15), 0, D'0.1777777'.	
*CONVCDEF, TM(65,16), 0, D'0.1777777'.	
*CONVCDEF, TM(65,17), 0, D'0.1777777'.	
*CONVCDEF, TM(65,18), 0, D'0.1777777'.	
*CONVCDEF, TM(65,19), 0, D'0.1777777'.	
*CONVCDEF, TM(65,20), D'15.', D'-.12'.	
*CONVCDEF, TM(65,21), D'15.', D'-.12'.	
*CONVCDEF, TM(65,55), 0, D'0.173'.	
*CONVCDEF, TM(65,56), 0, D'0.173'.	
*CONVCDEF, TM(66,01), D'=-0.1463103E02', D'0.1047607E01'.	
*CONVCDEF, TM(66,01), C, D'=-0.6542340E-02', D'0.2406993E-04'.	
*CONVCDEF, TM(66,01), C, D'=-0.2892203E-07'.	
*CONVCDEF, TM(66,02), D'=-0.1463103E02', D'0.1047607E01'.	1 0F 3
*CONVCDEF, TM(66,02), C, D'=-0.6542340E-02', D'0.2406993E-04'.	2 0F 3
*CONVCDEF, TM(66,02), C, D'=-0.2892203E-07'.	3 0F 3
*CONVCDEF, TM(66,03), D'=-0.1463103E02', D'0.1047607E01'.	1 0F 3
*CONVCDEF, TM(66,03), C, D'=-0.6542340E-02', D'0.2406993E-04'.	2 0F 3
*CONVCDEF, TM(66,03), C, D'=-0.2892203E-07'.	3 0F 3
*CONVCDEF, TM(66,04), D'=-0.1463103E02', D'0.1047607E01'.	
*CONVCDEF, TM(66,04), C, D'=-0.6542340E-02', D'0.2406993E-04'.	
*CONVCDEF, TM(66,04), C, D'=-0.2892203E-07'.	
*CONVCDEF, TM(66,05), D'=-0.8377271E02', D'0.1558943E01'.	1 0F 3
*CONVCDEF, TM(66,05), C, D'=-0.2359146E-01', D'0.2058943E-03'.	2 0F 3
*CONVCDEF, TM(66,05), C, D'=-0.8553150E-06', D'0.1364426E-08'.	3 0F 3
*CONVCDEF, TM(66,006), D'=-0.6905144E-01', D'0.3686159E-02'.	1 0F 1

*C0NVCEEF, TM(66,007), D'=-0.6905144E-01', D'0.3686159E-02'.	1 0F 1
*C0NVCEEF, TM(66,008), D'=-0.6905144E-01', D'0.3686159E-02'.	1 0F 1
*C0NVCEEF, TM(66,10), D'=-0.2894656E02', D'0.6013906E00'.	1 0F 2
*C0NVCEEF, TM(66,10), C, D'=-0.2366422E-02', D'0.5252951E-05'.	2 0F 2
*C0NVCEEF, TM(66,11), D'=-0.2894656E02', D'0.6013906E00'.	1 0F 2
*C0NVCEEF, TM(66,11), C, D'=-0.2366422E-02', D'0.5252951E-05'.	2 0F 2
*C0NVCEEF, TM(66,12), D'=-0.2894656E02', D'0.6013906E00'.	1 0F 2
*C0NVCEEF, TM(66,12), C, D'=-0.2366422E-02', D'0.5252951E-05'.	2 0F 2
*C0NVCEEF, TM(66,13), D'=-0.8377271E02', D'0.1558943E01'.	
*C0NVCEEF, TM(66,13), C, D'=-0.2359146E-01', D'0.2058943E-03'.	
*C0NVCEEF, TM(66,13), C, D'=-0.8553150E-06', D'0.1364426E-08'.	
*C0NVCEEF, TM(66,14), D'=-0.1463103E02', D'0.1047607E01'.	
*C0NVCEEF, TM(66,14), C, D'=-0.6542340E-02', D'0.2406993E-04'.	
*C0NVCEEF, TM(66,14), C, D'=-0.2892203E-07'.	
*C0NVCEEF, TM(66,15), D'=-0.8377271E02', D'0.1558943E01'.	
*C0NVCEEF, TM(66,15), C, D'=-0.2359146E-01', D'0.2058943E-03'.	
*C0NVCEEF, TM(66,15), C, D'=-0.8553150E-06', D'0.1364426E-08'.	
*C0NVCEEF, TM(66,16), D'=-0.8377271E02', D'0.1558943E01'.	1 0F 3
*C0NVCEEF, TM(66,16), C, D'=-0.2359146E-01', D'0.2058943E-03'.	2 0F 3
*C0NVCEEF, TM(66,16), C, D'=-0.8553150E-06', D'0.1364426E-08'.	3 0F 3
*C0NVCEEF, TM(66,17), D'=-0.8377271E02', D'0.1558943E01'.	1 0F 3
*C0NVCEEF, TM(66,17), C, D'=-0.2359146E-01', D'0.2058943E-03'.	2 0F 3
*C0NVCEEF, TM(66,17), C, D'=-0.8553150E-06', D'0.1364426E-08'.	3 0F 3
*C0NVCEEF, TM(66,18), D'=-0.4073354E02', D'0.1486012E01'.	
*C0NVCEEF, TM(66,18), C, D'=-0.1925653E-01', D'0.1425990E-03'.	
*C0NVCEEF, TM(66,18), C, D'=-0.5010382E-06', D'0.6713350E-09'.	
*C0NVCEEF, TM(66,19), D'=-0.4073354E02', D'0.1486012E01'.	
*C0NVCEEF, TM(66,19), C, D'=-0.1925653E-01', D'0.1425990E-03'.	
*C0NVCEEF, TM(66,19), C, D'=-0.5010382E-06', D'0.6713350E-09'.	
*C0NVCEEF, TM(66,20), D'=-0.4073354E02', D'0.1486012E01'.	
*C0NVCEEF, TM(66,20), C, D'=-0.1925653E-01', D'0.1425990E-03'.	
*C0NVCEEF, TM(66,20), C, D'=-0.5010382E-06', D'0.6713350E-09'.	
*C0NVCEEF, TM(66,21), D'=-0.4073354E02', D'0.1486012E01'.	
*C0NVCEEF, TM(66,21), C, D'=-0.1925653E-01', D'0.1425990E-03'.	
*C0NVCEEF, TM(66,21), C, D'=-0.5010382E-06', D'0.6713350E-09'.	
*C0NVCEEF, TM(66,22), D'=-0.4073354E02', D'0.1486012E01'.	
*C0NVCEEF, TM(66,22), C, D'=-0.1925653E-01', D'0.1425990E-03'.	
*C0NVCEEF, TM(66,22), C, D'=-0.5010382E-06', D'0.6713350E-09'.	
*C0NVCEEF, TM(66,23), D'=-0.4073354E02', D'0.1486012E01'.	
*C0NVCEEF, TM(66,23), C, D'=-0.1925653E-01', D'0.1425990E-03'.	
*C0NVCEEF, TM(66,23), C, D'=-0.5010382E-06', D'0.6713350E-09'.	
*C0NVCEEF, TM(66,24), D'=-0.4073354E02', D'0.1486012E01'.	
*C0NVCEEF, TM(66,24), C, D'=-0.1925653E-01', D'0.1425990E-03'.	
*C0NVCEEF, TM(66,24), C, D'=-0.5010382E-06', D'0.6713350E-09'.	
*C0NVCEEF, TM(66,25), D'=-0.4073354E02', D'0.1486012E01'.	
*C0NVCEEF, TM(66,25), C, D'=-0.1925653E-01', D'0.1425990E-03'.	
*C0NVCEEF, TM(66,25), C, D'=-0.5010382E-06', D'0.6713350E-09'.	
*C0NVCEEF, TM(66,26), D'=-0.9090340E02', D'0.3885745E01'.	
*C0NVCEEF, TM(66,26), C, D'=-0.6210560E-01', D'0.5689736E-03'.	
*C0NVCEEF, TM(66,26), C, D'=-0.2840136E-05', D'0.7261843E-08'.	
*C0NVCEEF, TM(66,26), C, D'=-0.7387759E-11'.	
*C0NVCEEF, TM(66,27), D'=-0.9090340E02', D'0.3885745E01'.	
*C0NVCEEF, TM(66,27), C, D'=-0.6210560E-01', D'0.5689736E-03'.	

*C0NVC0EF, TM(66,27), C,D'=0.2840136E-05', D'0.7261843E-08'.
 *C0NVC0EF, TM(66,27), C,D'=0.7387759E-11'.
 *C0NVC0EF, TM(66,28), D'=0.9090340E02', D'0.3885745E01'.
 *C0NVC0EF, TM(66,28), C,D'=0.6210560E-01', D'0.5689736E-03'.
 *C0NVC0EF, TM(66,28), C,D'=0.2840136E-05', D'0.7261843E-08'.
 *C0NVC0EF, TM(66,28), C,D'=0.7387759E-11'.
 *C0NVC0EF, TM(66,29), D'=0.9090340E02', D'0.3885745E01'.
 *C0NVC0EF, TM(66,29), C,D'=0.6210560E-01', D'0.5689736E-03'.
 *C0NVC0EF, TM(66,29), C,D'=0.2840136E-05', D'0.7261843E-08'.
 *C0NVC0EF, TM(66,29), C,D'=0.7387759E-11'.
 *C0NVC0EF, TM(66,30), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,30), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,30), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,31), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,31), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,31), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,32), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,32), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,32), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,33), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,33), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,33), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,34), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,34), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,34), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,35), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,35), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,35), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,36), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,36), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,36), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,37), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,37), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,37), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,38), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,38), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,38), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,39), D'=0.4073354E02', D'0.1486012E01'.
 *C0NVC0EF, TM(66,39), C,D'=0.1925653E-01', D'0.1425990E-03'.
 *C0NVC0EF, TM(66,39), C,D'=0.5010382E-06', D'0.6713350E-09'.
 *C0NVC0EF, TM(66,040), 0, D'2.4'. 1 0F 1
 *C0NVC0EF, TM(66,041), 0, D'2.4'. 1 0F 1
 *C0NVC0EF, TM(66,42), D'.8098064E02', D'=.4057421E01'.
 *C0NVC0EF, TM(66,42), D'0.742834E02', D'=4.067683'. SBT=1
 *C0NVC0EF, TM(66,42), C,D'0.4335085E-01', D'=-0.2380833E-03'. SBT=1
 *C0NVC0EF, TM(66,42), C,D'0.4754119E-06'. SBT=1
 *C0NVC0EF, TM(66,43), D'0.113664E03', D'=4.637298'. SBT=2
 *C0NVC0EF, TM(66,43), C,D'0.4576475E-01', D'=-0.2291532E-03'. SBT=2
 *C0NVC0EF, TM(66,43), C,D'0.4213886E-06'. SBT=2
 *C0NVC0EF, TM(66,44), D'0.2062742E03', D'=1.568281'. SBT=1
 *C0NVC0EF, TM(66,44), C,D'0.2216206E-03'. SBT=1
 *C0NVC0EF, TM(66,45), D'0.2185566E03', D'=1.589109'. SBT=2
 *C0NVC0EF, TM(66,45), C,D'0.2625564E-03'. SBT=2

*C0NVC0EF, TM(66,46), 0, D'0.08329'.	
*C0NVC0EF, TM(66,47), 0, D'0.08329'.	
*C0NVC0EF, TM(66,48), D'=-0.3595834E02', D'1.297792'.	SBT=1
*C0NVC0EF, TM(66,48), C, D'=-0.1096077E=01', D'0.482827E=04'.	SBT=1
*C0NVC0EF, TM(66,48), C, D'=-0.7369744E=07'.	SBT=1
*C0NVC0EF, TM(66,49), D'=-0.3580249E02', D'1.29888'.	SBT=2
*C0NVC0EF, TM(66,49), C, D'=-0.1094458E=01', D'0.4783706E=04'.	SBT=2
*C0NVC0EF, TM(66,49), C, D'=-0.7238685E=07'.	SBT=2
*C0NVC0EF, TM(66,50), D'0.8013453E=02', D'=-0.1460101E=02'.	SBT
*C0NVC0EF, TM(66,50), C, D'0.8332485E=04'.	SBT
*C0NVC0EF, TM(66,51), 0, D'0.08329'.	
*C0NVC0EF, TM(66,52), D'=-0.3563728E02', D'1.289082'.	SBT=1
*C0NVC0EF, TM(66,52), C, D'=-0.1083165E=01', D'0.4751932E=04'.	SBT=1
*C0NVC0EF, TM(66,52), C, D'=-0.7227311E=07'.	SBT=1
*C0NVC0EF, TM(66,53), D'=-0.3574165E02', D'1.299829'.	SBT=2
*C0NVC0EF, TM(66,53), C, D'=-0.1099943E=01', D'0.485184E=04'.	SBT=2
*C0NVC0EF, TM(66,53), C, D'=-0.7417475E=07'.	SBT=2
*C0NVC0EF, TM(66,54), D'=-0.6805646', D'0.7602352E=01'.	SBT
*C0NVC0EF, TM(66,54), C, D'=-0.1954722E=04'.	SBT
*C0NVC0EF, TM(66,55), D'=-0.8377271E02', D'0.1558943E01'.	
*C0NVC0EF, TM(66,55), C, D'=-0.2359146E=01', D'0.2058943E=03'.	
*C0NVC0EF, TM(66,55), C, D'=-0.8553150E=06', D'0.1364426E=08'.	
*C0NVC0EF, TM(66,56), D'=-39.72', D'4.2128', D'=-.1003937'.	1 0F 4
*C0NVC0EF, TM(66,56), C, D'1.453884E=02', D'=-.1212753E=04'.	2 0F 4
*C0NVC0EF, TM(66,56), C, D'1.5756058E=07', D'=-.1440808E=09'.	3 0F 4
*C0NVC0EF, TM(66,56), C, D'1.1475630E=12'.	4 0F 4
*C0NVC0EF, TM(66,57), 0, D'1.040001'.	10F1
*C0NVC0EF, TM(66,65), D'1.3632903E=01', D'1.9168290E=02'.	VBT 01PAE
*C0NVC0EF, TM(66,65), C, D'1.1937583E=03'.	VBT 01PAE
*C0NVC0EF, TM(66,66), D'0.3142945E=01', D'0.8981928E=02'.	VBT 02AE
*C0NVC0EF, TM(66,66), C, D'0.1846361E=03'.	VBT 02AE
*C0NVC0EF, TM(66,69), 0, D'0.231633'.	VBT
*C0NVC0EF, TM(66,70), 0, D'0.231633'.	VBT
*C0NVC0EF, TM(66,74), D'=-0.2972946E=2', D'0.9581011E=2'.	
*C0NVC0EF, TM(66,74), C, D'=-0.1956267E=5', D'0.2212608E=7'.	
*C0NVC0EF, TM(66,74), C, D'=-0.8491970E=10', D'0.1001661E=12'.	
*C0NVC0EF, TM(66,75), 0, D'0.02'.	RAW VOLTS
*C0NVC0EF, TM(66,75), 0, D'0.02'.	AZ COARSE
*C0NVC0EF, TM(66,76), D'8.4375', D'1.3125'.	1 0F 1
*C0NVC0EF, TM(66,77), D'1276.6', D'1.4865'.	1 0F 1
*C0NVC0EF, TM(66,78), D'1.036156', D'1.00274725'.	1 0F 1
*C0NVC0EF, TM(66,79), D'=-.0583', D'1.006667'.	1 0F 1
*C0NVC0EF, TM(66,80), D'188.83', D'=-2.361343', D'1.03703643'.	1 0F 3
*C0NVC0EF, TM(66,80), C, D'=-.3540826E=03', D'1.1878587E=05'.	2 0F 3
*C0NVC0EF, TM(66,80), C, D'=-.5098887E=08', D'1.5499928E=11'.	3 0F 3
*C0NVC0EF, TM(66,81), D'=-0.4053976E02', D'0.8197756'.	TR
*C0NVC0EF, TM(66,81), C, D'=-0.421029E=02', D'0.1402503E=04'.	TR
*C0NVC0EF, TM(66,82), D'=-0.4053976E02', D'0.8197756'.	TR
*C0NVC0EF, TM(66,82), C, D'=-0.421029E=02', D'0.1402503E=04'.	TR
*C0NVC0EF, TM(66,83), 0, D'0.12'.	TR
*C0NVC0EF, TM(66,84), 0, D'0.12'.	TR
*C0NVC0EF, TM(66,85), D'=-1.878125', D'0.3990635E=01'.	TR1 SN05
*C0NVC0EF, TM(66,86), D'=-0.1149998E02', D'0.9319979E=01'.	TR1 SN05
*C0NVC0EF, TM(66,87), D'=-2.46637', D'0.3363424E=01'.	TR2 SN06

*C0NV00EF, TM(66,88), D'=6.620049', D'0.5160018E=01'.	TR2 SN06
*C0NV00EF, TM(66,89), D'9.622108', D'0.3663051'.	TR
*C0NV00EF, TM(66,89), C, D'=0.1677747E=02', D'0.3515917E=05'.	TR
*C0NV00EF, TM(66,90), D'9.622108', D'0.3663051'.	TR
*C0NV00EF, TM(66,90), C, D'=0.1677747E=02', D'0.3515917E=05'.	TR
*C0NV00EF, TM(66,91), D'1.987249', D'0.9739425E=02'.	TR
*C0NV00EF, TM(66,91), C, D'0.2056063E=03', D'=0.2127275E=06'.	TR
*C0NV00EF, TM(66,92), D'1.987249', D'0.9739425E=02'.	TR
*C0NV00EF, TM(66,92), C, D'0.2056063E=03', D'=0.2127275E=06'.	TR
*C0NV00EF, TM(66,93), 0, 10.	TR
*C0NV00EF, TM(66,94), 0, 10.	TR
*C0NV00EF, TM(66,95), 0, D'0.04'.	
*C0NV00EF, TM(66,96), 0, D'0.04'.	
*C0NV00EF, TM(66,97), D'=0.3157637E02', D'0.8654569E00'.	1 0F 3
*C0NV00EF, TM(66,97), C, D'=0.5782057E=02', D'0.2155696E=04'.	2 0F 3
*C0NV00EF, TM(66,97), C, D'=0.2690715E=07'.	3 0F 3
*C0NV00EF, TM(66,98), D'=2.5', D'.56', 0, 0, 0, 0, D'1.E=13', 0.	1 0F 2
*C0NV00EF, TM(66,98), C, 0, 0, 0, 0, 0, 0, D'7.E=33'.	2 0F 2
*C0NV00EF, TM(66,99), D'=2.5', D'.56', 0, 0, 0, 0, D'1.E=13', 0.	1 0F 2
*C0NV00EF, TM(66,99), C, 0, 0, 0, 0, 0, 0, D'7.E=33'.	2 0F 2
*C0NV00EF, TM(66,100), 0, D'0.02'.	1 0F 1
*C0NV00EF, TM(66,101), 0, D'0.02'.	1 0F 1
*C0NV00EF, TM(66,102), 0, D'0.02'.	1 0F 1
*C0NV00EF, TM(66,103), 0, D'0.02'.	1 0F 1
*C0NV00EF, TM(66,104), D'0.6', D'0.05714'.	
*C0NV00EF, TM(66,105), D'0.6', D'0.05714'.	
*C0NV00EF, TM(66,106), 0, D'0.02'.	
*C0NV00EF, TM(66,107), 0, D'0.02'.	
*C0NV00EF, TM(66,108), 0, D'0.02'.	
*C0NV00EF, TM(66,109), 0, D'0.02'.	
*C0NV00EF, TM(66,110), 0, D'0.02'.	
*C0NV00EF, TM(66,111), 0, D'0.02'.	
*C0NV00EF, TM(66,112), 0, D'0.02'.	
*C0NV00EF, TM(66,113), 0, D'0.02'.	
*C0NV00EF, TM(66,114), 0, D'0.02'.	1 0F 1
*C0NV00EF, TM(66,115), 0, D'0.02'.	1 0F 1
*C0NV00EF, TM(66,117), 0, D'0.1777778'.	1 0F 1
*C0NV00EF, TM(66,118), 0, D'0.1777778'.	1 0F 1
*C0NV00EF, TM(66,119), 0, D'0.1777778'.	1 0F 1
*C0NV00EF, TM(66,120), D'=0.1386633E03', D'0.5071243E01'.	1 0F 3
*C0NV00EF, TM(66,120), C, D'=0.7313544E=01', D'0.5781085E=03'.	2 0F 3
*C0NV00EF, TM(66,120), C, D'=0.2301795E=05', D'0.3662884E=08'.	3 0F 3
*C0NV00EF, TM(67,21), 0, D'0.02'.	
*C0NV00EF, TM(67,41), 0, D'0.02'.	
*C0NV00EF, TM(67,43), 0, D'0.02'.	
*C0NV00EF, TM(67,47), D'=65.37970', D'255.4002', D'=654.7483'.	
*C0NV00EF, TM(67,47), C, D'1133.754', D'=1236.781', D'868.3201'.	
*C0NV00EF, TM(67,47), C, D'=398.4587', D'119.4403', D'=22.85947'.	
*C0NV00EF, TM(67,47), C, D'2.635942', D'=0.1608274'.	
*C0NV00EF, TM(67,47), C, D'0.3673624E=2'.	
*C0NV00EF, TM(67,57), D'=27.3', D'1.0074', D'=.00808365'.	10F2
*C0NV00EF, TM(67,57), C, D'.3263188E=04', D'=.4796603E=07'.	20F2
*C0NV00EF, TM(67,59), D'.0045', D'.00064'.	10F1

*CONVCDEF, TM(67,60), D'=10.', D'=77757', D'=.00534345'. 18F2
 *CONVCDEF, TM(67,60), C, D'=2141214E=04', D'=.3176575E=07'. 28F2
 *CONVCDEF, TM(68,13), D'=134.9251', D'=2.666036', D'=4.254973E=2'.
 *CONVCDEF, TM(68,13), C, D'=5.283102E=4', D'=4.356376E=6', D'=2.197680E=8'.
 *CONVCDEF, TM(68,13), C, D'=6.029328E=11', D'=6.877913E=14'.
 *CONVCDEF, TM(68,95), D'=120.3493', D'=4.188673', D'=9.627414E=2'.
 *CONVCDEF, TM(68,95), C, D'=1.390337E=3', D'=1.183831E=5'.
 *CONVCDEF, TM(68,95), C, D'=5.799742E=8', D'=1.506056E=10'.
 *CONVCDEF, TM(68,95), C, D'=1.604117E=13'.
 *CONVCDEF, TM(68,96), D'=120.3493', D'=4.188673', D'=9.627414E=2'.
 *CONVCDEF, TM(68,96), C, D'=1.390337E=3', D'=1.183831E=5'.
 *CONVCDEF, TM(68,96), C, D'=5.799742E=8', D'=1.506056E=10'.
 *CONVCDEF, TM(68,96), C, D'=1.604117E=13'.
 *CONVCDEF, TM(101), O, D'=0.02'.
 *CONVCDEF, TM(107), O, D'=0.02'.
 *CONVCDEF, TM(108), O, D'=0.02'.
 *CONVCDEF, TM(109), O, D'=0.02'.
 *CONVCDEF, TM(127,1), D'=2.402572', D'=9.013122', D'=22.67772'.
 *CONVCDEF, TM(127,1), C, D'=39.19766', D'=42.75365', D'=30.03419'.
 *CONVCDEF, TM(127,1), C, D'=13.79851', D'=4.143284', D'=0.7947779'.
 *CONVCDEF, TM(127,1), C, D'=0.9192497E=1', D'=0.5633943E=2'.
 *CONVCDEF, TM(127,1), C, D'=0.1297912E=3'.
 *CONVCDEF, TM(127,2), D'=65.66205', D'=147.2664', D'=0.9159899'.
 *CONVCDEF, TM(127,2), C, D'=1.167493', D'=0.4745405', D'=0.08511645'.
 *CONVCDEF, TM(127,2), C, D'=0.005871594'.
 *CONVCDEF, TM(127,3), D'=59.79237', D'=149.6019', D'=10.56474'.
 *CONVCDEF, TM(127,3), C, D'=16.39337', D'=11.84696', D'=4.701241'.
 *CONVCDEF, TM(127,3), C, D'=1.050538', D'=0.1239295', D'=0.006007086'.
 *CONVCDEF, TM(127,4), D'=0.4638650E=1', D'=25.55209', D'=0.6198338'.
 *CONVCDEF, TM(127,4), C, D'=0.9263116E=1', D'=0.3000027E=2', D'=0.1956071E=2'.
 *CONVCDEF, TM(127,4), C, D'=0.2042910E=3', D'=0.1016527E=4', D'=0.2516781E=4'.
 *CONVCDEF, TM(127,4), C, D'=0.2057158E=8', D'=0.2887134E=10'.
 *CONVCDEF, TM(127,4), C, D'=0.5031456E=12'.

*CONVCDEF, TM(68,12), DELETE.

DELETE REQUESTED DOES NOT EXIST IN TABLE

*CONVCDEF, TM(65,53), DELETE.

DELETE REQUESTED DOES NOT EXIST IN TABLE

*CONVCDEF, TM(65,54), DELETE.

DELETE REQUESTED DOES NOT EXIST IN TABLE

*CONVCDEF, TM(68,62), DELETE.

DELETE REQUESTED DOES NOT EXIST IN TABLE

*CONVCDEF, TM(68,90), DELETE.

DELETE REQUESTED DOES NOT EXIST IN TABLE

*CONVCDEF, TM(68,106), DELETE.

DELETE REQUESTED DOES NOT EXIST IN TABLE

*PRTCBEFS.

Appendix B
Component Serial Numbers

APPENDIX B COMPONENT SERIAL NUMBERS

Part Number	Nomenclature	Serial
2271619-501	Battery No. 1	001
2271619-501	Battery No. 2	002
2271619-501	Battery No. 3	003
2271620-501	Power Supply Electronics	001
2271623-501	Pitch Control Electronics No. 1	01
2271623-501	Pitch Control Electronics No. 2	02
2275250-501	Body Horizon Sensor	001
2271630-501	CDU-A	001
2271631-501	LIU-A	001
1972413-1	Dual S-Band Transponder	01P
2270711-1	Beacon Telemetry Transmitter No. 1	01P
2270711-1	Beacon Telemetry Transmitter No. 2	02
2270710-1	Dual PMP	001
196 4670-503	RF Switch	001
2271890-501	RTM-A	001
2271706-501	Dual PCMC	001
1972460-1	DSAI Electronics	101
2271622-501	Momentum Wheel Assembly	001
2276523-501	Nutation Damper & MASC Coil	002
2270716-501	Attitude Control Coil	002
2271621-501	Dual Decoder	001
2271629-501	Dual Programmer	001
2271626-501	CDU-B	001
2271627-501	LIU-B	001
2271632-1	Command Memory Unit No. 1	10003
2271632-1	Command Memory Unit No. 2	10004
2271890-501	RTM-B	002
2260931-1	Tape Recorder No. 1	005
2260931-1	Tape Recorder No. 2	004

Appendix C

History Tape Index

AE HISTORY TAPE LOG

Shelf	Bin	Calendar	GMT		Comment
		Date	Start	Stop	
1	1	4-18-73			NACE S/C Log 1-57
	2	4-18-73			PSA, NACE S/C Log 1 PC 57
	3	4-14-73			OSS S/C Log 1-70
	4	5-14-73			LEE S/C Log 2-1
	5	5-16-73			NATE S/C Log 2-12
	6	5-16-73			RPA S/C Log 2-12
	7	5-16-73			BIMS S/C Log 2-12
	8	5-18-73			MIMS S/C Log 2-27
	9	5-18-73			All Exp, LBP S/C Log 2-27
	10	5-19-73		S/C Log 2-27	PB TR1, All Exp ON
	11	7-18-73			CEP Log 3-1
	12	7-18-73			EUVS S/C Log 5-1
	13	7-17-73			CEP S/C Log 2-94
	14	7-18-73			LIUA S/C Log 3-1
	15	7-17-73			LIUB INTEG S/C Log 2-94
	16	7-17-73			CEP S/C Log 2-94
	17	7-19-73			SPS S/C Log 3-7
	18	7-19-73			SPS S/C Log 3-7
	19	7-19-73			UVNO S/C Log 3-7
2	20	7-18-73		S/C Log 3-1	NATE, NACE ORD TEST, MESA, NATE INTEG, LIUB CMA Ver
	1	7-19-73			NATE, SPS S/C Log 3-7
	2	7-19-73			NATE S/C Log 3-7
	3	7-20-73			SPS, PSE S/C Log 3-17
	4	7-21-73			PWR EPUT S/C Log 3-28
	5	7-23-73			PWR EPUT S/C Log 3-30
	6	7-23-73			SPS S/C Log 3-30
	7	7-23			SPS S/C Log 3-30
	8	7-23		S/C Log 3-30	LIUB T/C, CMD VER TEST
	9	7-23		S/C Log 3-30	CMD VER CHECK
	10	7-24			DSDI S/C Log 3-38
	11	7-24			DSAI S/C Log 3-38
	12	7-25			NACE S/C Log 3-44
	13	7-27			EMI S/C Log 3-47
	14	7-27			EMI S/C Log 3-47
	15	7-27			PBK OF EMI S/C Log 3-47
	16	7-17			TR 1 PBK S/C Log 3-47
	17	7-31	213:01: 30:44		S/C Log 3-60
	18			212:19:18:00	CMD MEM S/C Log 3-60
	19	8-1			UVNO S/C Log 3-66
20	8-1		S/C Log 3-66	PROG TURN-ON	

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
3	1	8-1			UVNO S/C Log 3-60
	2	8-1			PROG/NADIR S/C Log 3-66
	3	8-1	214:04:01:55		S/C Log 3-66
	4	8-2	214:09	214:16	PROG TURN-ON S/C Log 3-70
	5	8-2	215:03:08:40		PROG, PSE S/C Log 3-70
	6	8-3			S/C Log 3-81
	7	8-4			C & DN S/C Log 3-82
	8	8-7			PBS, C&DH S/C Log 3-82
	9	8-7			C&DN, PCE S/C Log 3-82
	10	8-8		220:23:14:31	PCE S/C Log 3-89
	11	8-8-73	220:23:14:39		PCE, MWA S/C Log 3-89
	12	8-8	21:03:10:32		PCE, MWA S/C Log 3-89
	13	8-9			PCE DEBUG S/C Log 3-98
	13	8-9			PCE S/C Log 3-98
	15	8-9			EUVS S/C Log 3-98
	16	8-10			NACE S/C Log 4-4
	17	8-10			PCE S/C Log 4-4
	18	8-10		222:21:24:00	S/C Log 4-4
	19	8-11			PROG 2 S/C Log 4-4
	20	8-11			PROG 2 S/C Log 4-9
4	1	8-11			PROG 2 S/C Log 4-9
	2	8-11			PROG 2 S/C Log 4-9
	3	8-12			PROG TURN-ON S/C Log 4-16
	4	8-12			PROG TURN-ON S/C Log 4-16
	5	8-13			MESA Noise S/C Log 4-24
	6	8-13			PCE S/C Log 4-24
	7	8-13			LEE, MIMS S/C Log 4-24
	8	8-13			MESA, CEP S/C Log 4-24
	9	8-13			PES S/C Log 4-24
	10	8-14		16:10:00	VAE S/C Log 4-31
	11	8-14			ESUM S/C Log 4-31
	12	8-14			Prog Delivery S/C Log 4-31
	13	8-14		23:56:00	RPA S/C Log 4-31
	14	8-14			BIMS S/C Log 4-31
	15	8-15			NACE NATE 1 of 2 S/C Log 4-38
	16	8-15		227	OSS WATE 2 of 2 MAG, PSI, PSB
				14:57:50	End at 16:22:13
	16	8-15		227	OSS, NATE End 14:57 S/C Log 4-38
				16:22:30	PSA, PSB, MAG
	17	8-15			PCE, MWA DEGUG S/C Log 4-38
	18	8-15		S/C Log 4-38	PCE TLM & MWA OSC 1/2 DEBUG
	19	8-15		S/C Log 4-38	MWA OSCIL DEGUG 2/2 S/C Log 4-38
	20	8-20			SBAWD TURN-ON S/C Log 4-48

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
5	1	8-20-73			C&DH EPET S/C Log 4-48
	2	8-21	S/C Log 4-54	233:17:00	SBAND XPNDR PES 13:35/15/:19
	3	8-21		233:20:00	S-B XNDR BIMS SPECIAL S/C Log 4-54 TEST
	4	8-21	233:19:59	S/C Log 4-34	BIMS SPECIAL TEST PCE + PCMC/ PROG DEBUG
	5	8-21	234:01:35		COMM EPET S/C Log 4-54
	6	8-21			COMM EPET S/C Log 4-54
	7	8-12	S/C Log 4-61	234:16:54	RANGING DEALY TEST
	8	8-22		S/C Log 4-61	SPS EPET PART 2
	9	8-22			SPS EPET S/C Log 4-61
	10	8-23	235:13:15	235:18:03	COMM EPET 1 of 2 S/C Log 4-69
	11	8-23	235:18:03	235:20:20	COMM EPET 2 of 2 S/C Log 4-69
	12	8-24	236:14:39	236:14:47	4 ft Dish Test HT S/C Log 4-69
	13	8-24	237:00:40	237:03:22	ACS EPET S/C Log 4-68
	14	8-25			SPECIAL PC TEST S/C Log 4-74
	15	8-25			PCE EPET S/C Log 4-74
	16	8-25		S/C Log 4-84	PCE AIR EPET 2 of 2
	17	8-26	238:10:34	238:18:53	PROG TURN ON S/C Log 4-78
	18	8-26	238:18:53	238:21:55	PROG TURN ON 2 of 5 S/C Log 4-78
	19	8-26	238:21:57	S/C Log 4-78	PROG TURN ON 3 of 5
	20	8-26		S/C Log 4-98	PROG TURN ON 4 of 5
6	1	8/26/73		S/C Log 4-78	PROG TURN ON 5 of 5
	2	8/27		S/C Log 4-34	PROG EPET 1 of 3
	3	8/27		S/C Log 4-84	PROG TROUBLE SHOOT 2 of 3
	4	8/27		S/C Log 4-84	PROG TROUBLE SHOOT 3 of 3
	5	8/28	240:13:22	240:15:15	TR TURN ON S/C Log 4-88
	6	8/28	240:16:15	240:19:39	PROG EPET UVNO TLM
					TR TURN ON PROG DEB S/C 4-89
	7	8/29	241:18:03	S/C Log 4-98	CEP NOISE TEST 1/2
	8	8/29		241:22:41	CEP NOISE TEST 2/2 S/C Log 4-98
	9	8/29		242:01:10	CEP CHK, PCE CHK S/C Log 4-98
	10	8/29	242:01:10	242:02:43	PCS SPECIAL TEST S/C Log 4-98
	11	8/29	242:02:43	242:06:55	POWER EPET 1 of 3 S/C Log 4-98
	12	8/30	242:07:00	242:09:30	POWER EPET 2 of 3 S/C Log 5-5
	13	8/30	242:09:30	242:09:48	POWER EPET 1 of 2 S/C Log 5-5
	14	8/30	242:13:26	242:	POWER EPET 2 of 2 S/C Log 5-5
	15	8/30	242:17:24	242:23:25	PCE SPEC TEST START ORD TEST S/C Log 5-6
	16	8/31	242:23:30		PROG END ORD TEST S/C Log 5-14
	17	8/31	243:0	243:08:42	PROG No. 2 S/C Log 5-14
	18	8/31	243:08:43	243:10:52	PROG No. 3 S/C Log 5-14
	19	8/31	243:10:52	243:14:42	PROG No. 4 GROSS STRAP
					PROG DEBUG (1) MSM TEST 5-14
	20	8/31	243:14:42		PROG DEBUG (2) S/C Log 5-14

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
7	1	8/31		244:00:05	PROG No. 2 S/C Log 5-26
	2	8/31	244:00:05	244:03:46	PROG No. 3 S/C Log 5-26
	3	9/1	244:03:46	244:04:33	PROG No. 4 S/C Log 5-26
	4	9/4	247:12:15	247:14:30	Recheck Prog S/C Log 5-26
	5	9/4		247:16:13	C&DH EPET ABORT @ 17.30 Log 5-28
	6	9/4		247:20:16	COMM EPET 1/2 Log 5-29
	7	9/4	247:20:16		COMM EPET 2/2 Log 5-29
	8	9/4	248:01:52	248:03:27	EUVS/SPS ADJUST Log 5-29
	9	9/4	248:03:22		PWR EPET 1 of 3 Log 5-29
	10	9/4			PWR EPET 2 of 3 Log 5-29
	11	9/5			PWR EPET 3 of 3 Log 5-34
	12	9/5			UVNO EPET DUMP ON B1 Log 5-34
	13	9/5		248:15:22	PSA, PSB, TAL, MAG, UVNC, BIMS Log 5-34 1/2
	14	9/5	248:15:23		BIM 2/2, OSS Log 5-34
	15	9/5	248:18:28	248:20:28	CEP, ESUM Log 5-34
	16	9/5	248:21:03		EUVS VAE (Part of) Log 5-37
	17	9/5	248:23:18		VAE (Part of and ON) Log 5-38
	18	9/6	248:02:20		RPA and ON Log 5-39
	19	9/6			Exp Real Time Aliveness Log 5-39
	20	9/6			ACS EPET 1 of Log 5-41
8	1	9/6			ACS EPET Log 5-41
	2	9/6		249:18:08	ACS DEBUG Log 5-41
	3	9/6	249:18		EMI (ESUM MTR FLAG 249, 23:05:59)
	4		249:23:51		EMI Log 5-41
	5		249:02:13		EMI Log 5-41
	6	9/7	250:04:43		EMI Log 5-50
	7		250:06:00		EMI Log 5-50
	8	9/7			Ord Test Log 5-56
	9	9/7		250:20:20	ACS Special, OAPS Load
					UVNO Stat. Log 5-57
	10		250:21:39	251:00:00	SPS ETET Log 5-58
	11	9/7		251:01:07	NATE BAFEL NACE/NATE
					ORD Log 5-60
	12				Real Time Most Side 1 Pre Vib Log 5-60
	13			251:16:59	Real Time Most Side 1 Pre Vib Log 5-60
	14			251:21:10	Real Time Most Side 1 Pre Vib Log 5-60
	15		251:21:10		Real Time Most Side 1 Pre Vib Log 5-60
	16	9-8-73			VIB Log 5-60

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
8	17		252:04:52		VIB 1st Post Lat RTMO Side 2 XX Log 5-60
	18	9-9-73			VIB Pre YY Log 5-67
	19	9-9			YY Sine Log 5-67
	20	9-9		Log 5-71	Post YY, Most Side 1 & 2
9	1	9-9		252:22:30	PRE, POST THRUST Log 5-71
	2	9-9	252:22:30		Thrust & Most Log 5-71
	3	9-9	253:02:28	253:05:10	Thrust & Most Log 5-71
	4	9-10	253:05:10		Z Z Most Log 5-75
	5	9-10			Prog Test Log 5-75
	6	9-10	253:13:30		Post Shock Log 5-78
	7	9-10	253:16:12		Post Shock Log 5-78
	8	9-10			ATC Test, Ant. Gain Log 5-81
	9	9-10	254:06:35		Prog Test Log 5-84
	10	9-11	254:08:26		Prog Test Log 5-84
	11	9-11			Pyro Test Log 5-89
	12	9-11	255:02:11		AOS & MESA EPET Log 5-96
	13	9-11	255:03:55		ACS & MESA EPET Log 5-96
	14	9-12	255:14:15		MWA Noise Troubleshoot
	15	9-12			
	16	9-14	257:19:06		TR2, OAPS, SBT S/C Log 6-6
	17	7-30			1st C&Dif EPET TR/DATA From S Band Down Link Prob
	18	9-20			Prog Checkout, X Strap ESUM Flag Search S/C Log 6-10
	19	9-20		264:03:44	ESOM Flag Search Prog EPET S/C Log 6-10
	20	9-20	264:03:44		Prog EPET, Comm EPET S/C 6-10
10	1	9-21		264:08:33	Comm, Prog EPET S/C Log 6-18
	2	9-21		264:11:00	Pwr EPET S/C Log 6-18
	3		S/C Log 6-18		
			264:11:00	264:14:10	Pwr EPET Prog Troubleshoot
	4		264:14:17		Troubleshoot S/C Log 6-18
	5			264:22:50	Troubleshoot S/C Log 6-18
	6		264:22:50		Troubleshoot S/C Log 6-18
	7				PSE Turn On S/C Log 6-18
	8	9-22		265:09:20	COMM EPET S/C Log 6-26
	9		265:09:21		COMM EPET S/C Log 6-26
	10		265:12:09	265:14:43	PROG EPET S/C Log 6-26

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
10	11			265:16:02	Prog EPET S/C Log 6-26
	12	9-22	265:17:45	265:20:07	Exp EPET CEP, BIMS NATE Log 6-32
	13	9-22	265:20:07	265:22:28	Exp EPET NATE MESA PSA PSB, TPL, MAG, OSS
	14	9-22	265:22:28	266:01:09	OSS, NACE, VAE, LEE S/C Log 6-34
	15		266:01:09	266:09:46	LEE, Pwr EPET S/C Log 6-35
	16		266:09:46		Pwr EPET S/C Log 6-36
	17		266:13:00		NATE EPET S/C Log 6-38
	18		266:15:34	S/C Log 6-40	Memory Fail Vol VI PS41 VAE, ESUM, EUVS EPET
	19	9-23	266:19:29	266:21:07	MIMs LEE(2) EUVS (2) S/C Log 6-41
	20			267:05:16	MONE S/C Log 6-24
11	1		267:18:26		VAE EPET S/C Log 6-42
	2	9-24			C&DH S/C Log 6-44
	3			268:00:06	RPA S/C Log 6-45
	4		268:08:59		Most S/C Log 6-46
	5		268:16:00		Most With OAPS S/C Log 6-47
	6	9-25			DSAI DEBUG S/C Log 6-47
	7		268:22:42	269:00:50	PUMP DOWN S/C Log 6-48
	8		269:00:50	269:03:11	PUMP DOWN S/C Log 6-49
	9		269:03:11	269:05:29	Pump Task 1 S/C Log 6-54
	10	9-26	269:05:29	269:07:47	S/C Log 6-56
	11	9-26	269:07:47	269:10:05	T.; Log 6-57
	12		269:10:05	269:12:16	Ston Test Log 6-58
	13		269:12:18	269:14:37	Log 6-58
	14		269:14:38	269:16:37	Log 6-58
	15		269:16:57	269:19:09	Log 6-58
	16		269:19:09	269:21:29	SC Look Log 6-59
	17		269:21:29	269:23:51	VBZ Carrier Stability
	18		269:23:51	270:02:07	S/C Look Log 6-60
	19		270:02:07	270:04:32	Log 6-60
	20		270:04:33	270:07:08	Mone 6-62
12	1		270:07:08	270:09:38	Mone 6-65
	2		270:09:38	270:11:56	Log 6-66
	3		270:12:25	270:14:52	Log 6-70
	4		270:14:52	270:17:13	Log 6-72
	5	9-27	270:17:13	270:19:33	SPS Log 6-73

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
12	6	9-27	270:19:33	270:21:54	Log 6-74
	7	9-27	270:21:54	271:00:17	PCS Log 6-74
	8	9-27	270:00:17	270:02:38	Log 6-74
	9	9-27	270:02:38	271:04:56	Log 6-74
	10	9-28	271:04:56	271:07:16	SPS Log 6-74
	11		271:07:16	271:09:34	Log 6-32
	12		271:09:34	271:11:55	Log 6-83
	13		271:11:55	271:14:19	Log 6-84
	14		271:14:19	271:16:38	Log 6-84
	15		271:16:38	271:19:41	Log 6-84
	16		271:19:41	271:22:03	Task 6 Log 6-84
	17	9-28	271:22:35	271:23:01	SCE Log 6-86
	18		271:22:03	272:00:48	Log 6-86
	19		272:00:48	272:03:07	Task 7 Log 6-88
	20		272:03:07	272:05:29	Task 8 Log 6-89
13	1		272:05:29	272:09:30	Log 6-94
	2		272:09:30	272:11:48	BIMS, OSS ATC Temp Dump Log 6-96
	3		272:11:55		UVNO PLOT EPET Log 6-97
	4		272:11:48	272:14:02	MIMS Log 6-98
	5		272:14:02	272:16:32	NATE Log 6-98
	6	9-29	272:16:32	272:18:42	VAE, LEE Log 6-100
	7		272:18:42	272:21:05	EUVS Log 7-1
	8		272:21:05	273:01:	Log 7-2
	9	9-29	273:01:38	273:04:07	Task 9 MOWE Log 7-4
	10		273:04:07	273:06:26	Task 9 Log 7-6

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
13	11	9-30-73	273:06:28	273:08:42	Orbit 2-3 Log 7-10
	12		273:08:42	273:11:03	Log 7-11
	13		273:11:03	273:13:15	Orbit 4-5 Log 7-16
	14		273:13:15	273:16:29	Orbit 5-6 Log 7-16
	15		273:15:29	273:17:44	Orbit 6 Log 7-18
	16		273:17:44	273:20:03	Orbit 7 Log 7-19
	17		273:20:03	273:22:33	Orbit 8 Log 7-20
	18		273:22:33	274:00:54	Orbit 9 Log 7-21
	19		274:00:54	274:03:16	Orbit 10-11 Log 7-22
	20		274:03:16	274:05:32	Log 7-23
14	1	10-1-73	274:05:32	274:12:03	Orbit 12 Log 7-24
	2		274:12:03	274:22:27	Task 10 Log 7-25
	3		274:22:27	275:15:00	Log 7-25
	4	10-3-73	275:15:01	276:03:07	Log 7-26
	5		276:03:07	276:05:30	MONE Log 7-30
	6		276:05:30	276:07:42	MONE Log 7-37
	7		276:07:44	276:09:56	Log 7-38
	8	10-3-73	276:09:56	276:12:47	Log 7-40
	9		:12:47	:15:09	Orbit 2 Log 7-43
	10	10-3-73	276:15:09	276:17:26	Log 7-44
	11		276:17:26	276:19:46	Log 7-44
	12		276:19:46	276:22:07	TV Log 7-44
	13		276:22:07	277:00:25	TV Log 7-44
	14	10-3-73	277:00:25	277:02:24	TV, PES, PSG, PSP, CEP, TAL Log 7-46
15	15		277:02:24	277:03:27	MIMS Log 7-47
	16	10-4-73	277:03:27	277:05:52	Log 7-48
	17		277:05:55	277:08:10	COMM 1 Log 7-49 (Cold SEPET)
	18	10-4-73	277:08:11	277:10:27	COMM 2 Log 7-49 (Cold SEPET)
	19	10-4-73	277:10:27	277:12:46	PROG EPET Log 7-50 (Cold SEPET)
	20	10-4-73	277:12:47	277:14:44	Experiments Log 7-53 MIMS
	1	10-4-73	277:14:47	277:16:32	Experiments Log 7-54
	2	10-4-73	277:16:34	277:18:36	Experiments Log 7-55
	3	10-4-73	277:18:36	277:20:56	Experiments Log 7-55
	4	10-4-73	277:20:56	277:23:17	TV +5°C ACS Log 7-59
	5		277:23:17	278:01:37	TV +5°C Log 7-59
	6	10-5-73	278:01:37	278:04:01	PCE Log 7-60
	7		278:04:01	278:06:31	SPS Log 7-62
	8		278:06:31	278:08:47	SPS Log 7-66
	9		278:08:47	278:11:06	PWR Log 7-68
	10		278:11:06	278:13:42	PWR & VAE Log 7-71 (Cold)
	11		278:13:42	278:15:56	VAE Log 7-71
	12	10-5-73	278:16:08	278:18:25	NACE, OSS, ESUM Log 7-72
	13	10-5-73	278:18:25	278:20:45	TV +5°C EUVS Log 7-73

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
15	14		278:20:45	278:23:06	TV +5°C EUVS Log 7-74
	15		278:23:06	279:01:26	TV +5°C EUVS Log 7-75
	16		279:01:26	279:04:00	TV +5°C RTMO Log 7-79
	17	10-6-73	279:04:00	279:06:28	Task 16 Log 7-83
	18		279:06:28	279:09:20	Task 16 Log 7-84
	19		279:09:20	279:11:43	Task 16 Log 7-85
	20		279:11:43	279:14:09	Task 17 +35°C Log 7-87
16	1	10-6-73	279:14:07	279:16:37	+35°C MOST Log 7-87
	2	10-6-73	279:16:37	279:19:11	+35°C MOST VAE Log 7-88
	3	10-6-73	279:19:11	279:21:31	+35°C TV Log 7-89
	4	10-7-73	279:21:31	280:07:18	+35°C → +5°C Log 7-90
	5	10-7-73	280:07:18	280:10:08	ATC Log 7-93
	6	10-7-73	280:10:08	280:12:33	+5 → +35°C Log 7-96
	7	10-7-73	280:12:33	280:15:04	C&DH +5°C Log 7-97
	8	10-7-73	280:15:22	280:17:42	C&DH +5°C Log 8-1
	9	10-7-73	280:17:42	280:19:20	Transition to +35°C Log 8-1
	10	10-7-73	280:19:20	280:22:25	Log 8-2
	11	10-7-73	280:22:27	281:01:02	Log 8-2
	12	10-7-73	281:01:02	281:03:35	Log 8-4
	13	10-8-73	281:03:35	281:06:11	Log 8-4
	14	10-8-73	281:06:11	281:08:40	+35°C EMI Log 8-6
	15	10-8-73	281:08:40	281:10:46	+35°C EMI Log 8-7
	16	10-8-73	281:10:46	281:13:06	Log 8-8
	17		281:14:15	281:19:30	Log 8-9
	18	10-8-73	281:19:30	281:22:16	Attitude Data Log 8-12
	19	10-8-73	281:20:31	282:00:10	Log 8-13
	20	10-8-73	282:00:10	282:02:36	Log 8-17
17	1	10-9-73	282:02:36	282:05:07	+35°C → +5°C Log 8-18
	2	10-9-73	282:05:07	282:07:22	+5°C Log 8-22
	3	10-9-73	282:07:22	282:10:03	+5°C Log 8-24
	4	10-9-73	282:10:03	282:13:09	SPS Log 8-28
	5	10-9-73	282:13:09	282:16:45	AECS Log 8-31
	6	10-9-73	282:16:45	282:19:01	Log 8-32
	7	10-9-73	282:19:01	282:21:19	T VAC EXP Log 8-34
	8		282:21:19	283:00:44	T VAC Prog Log 8-36
	9		283:00:44	283:02:10	RTMO Log 8-39
	10	10-10-73	283:03:02	283:05:15	Log 8-39
	11	10-10-73	283:05:15	283:08:59	JAM SPS Log 8-40
	12	10-10-73	283:09:00	283:11:10	VENT Chamber Log 8-44
	13	10-10-73	283:11:10	283:13:30	PSE, CC3, DIS Log 8-45
	14	10-10-73	283:13:32	283:18:00	Tank Valves Log 8-45
	15	10-10-73	283:15:00	283:17:12	Log 8-45
	16	10-10-73	283:17:12	283:16:28	Task 12 Log 8-47
	17	10-10-73	283:19:28	283:20:26	End of T/V Log 8-47
	18	10-12-73	285:19:33	283:21:23	NACE Test Log 8-52
	19	10-13-73	286:12:45	286:16:11	NACE Test LEE Test Trouble shot Log 8-54
	20	10-13-73		286:20:01	PCM 2 Check PSE I _{RB} Cal

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
18	1	10-26-73	299:12:13:06	300:01:10:00	
	2	10-26-73	300:01:46	300:05:00	TAL, UVNO, NACE, TR2 Turnon
	3	10-27-73	300:05:00		MESA, NATE, MIMS Turnon
	4				
	5	10-27-73	300:19:14	300:21:25	Stabilizing to +35° C
	6	10-27-73	300:21:25	300:23:45	ACS EPET 112
	7	10-27-73	300:23:45	301:02:57	Tenney Test +35 ACS, COMM EPET
	8	10-27-73	301:02:57	301:05:17	Tenney +35 ACS COMM
	9	10-28-73	301:05:19	301:07:52	+35 Tenney COMM EPET & PWR EPET
	10	10-28-73	301:07:53	301:10:05	+35° C Tenney PWR EPET
	11	10-28-73	301:10:05	301:12:37	+35° Tenney C&DH Part 1
	12	10-28-73	301:12:37	301:15:18	+35° C C&DH MIMS
	13	10-28-73	301:15:18	301:19:04	+35° Tenney Exp EPETS RPA
	14	10-28-73	301:19:04	301:21:49	+35° Tenney EXP EPETS
	15	10-28-73	301:21:49	302:00:08	+35° C Tenney Exp EPETS OSS, VAE, NACE 1/2
	16	10-28-73	302:00:08	302:02:10	+35° Tenney Exp EPETS NACE 2/2 NATE,
	17	10-28-73	302:02:10	302:04:57	+35 UVNO, Pyro Test OSS PYRO
	18	10-29	302:07:56	302:09:59	+35 +5° +5° CEP EPET MIMS EPET
	19	10-29	302:09:59	302:11:58	+5° C RPA and MESA EPET
	20	10-29	302:12:35	302:14:34	
19	1	10-29	302:14:34	302:16:50	
	2	10-29	UVNO Plot	302:14:34	
	3	10-29	302:16:50	302:19:08	
	4	10-29	302:19:08	302:23:41	Tenny +5° Start Comm EPET
	5	10-29	302:23:41	303:02:05	+5° Temp Comm EPET
	6	10-30	303:02:05	303:05:18	+5 Tenney ACS EPET
	7	10-30	303:05:19	303:07:52	+5 Tenny ACS EPET
	8	10-30	303:07:52	303:10:08	+5 Tenny ACS EPET
	9	10-30	303:10:08	303:12:00	+5 Tenny ACS EPET
	10	10-30	303:13:50	303:16:41	+5 Tenney Pwr Epet
	11	10-30	303:16:48	303:20:18	+5°
	12	10-31	304:27:48	304:07:43	+5° HT
	13	10-31	304:07:43	304:11:55	MESA NOISE TEST
	14	11-6	310:14:39	310:21:34	PSE Check RPA Turn-on
	15	11-7	311:14:00	311:23:18	SPS Turn ON, SPS EPET 1/2
	16	11-7	311:23:18	312:04:11	2/2 SPS EPET EUVS Turn on 1/2 ESUM Turn on
	17	11-7	312:04:11	312:05:40	2/2 ESUM Turn-on ESUM EPET
	18	11-8	312:14:20	312:16:25	EUVP
	19	11-8	312:16:25	312:21:10	RPA EPET
	20	11-8	312:21:17	313:03:43	OSS Pump Pyro Tests 1/2 MESA EPET

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
20	1	11-8-73	313:03:43	313:06:30	Pyro Tests
	2	11-9	313:06:37	313:10:24	Tests
	3	11-9	313:10:35	313:13:40	HILH TIME CODE + DSAI
	4	11-9	313:18:	314:00:03	Current Measurements
	5	11-10	314:00:03	314:08:16	Prog Memz
	6	11-10	314:08:16	314:16:39	Prog Turn on 1st Prog Epet (Code Fail Octal 0100)
	7	11-10	314:18:35	314:20:54	Prog EPET
	8	11-10	314:20:59	314:03:43	Prog EPET - Move to Environmental
					Prog Tests: MEMX MEMO
	9	11-10	314:16:73	314:18:35	Prog Mem
	10	11-10	315:03:43	315:09:15	
	11	11-11	315:09:18	315:15:10	Prog Memo Tests
	12	11-11	315:15:10	315:18:39	Prog Memo Tests
	13	11-11	315:18:30	315:21:55	Prog Memo Tests
	14	11-11	315:21:57	316:01:22	Prog Memo Tests
	15	11-11	316:01:22	316:03:52	Prog Memo Tests
	16	11-11	316:03:52	316:05:47	Prog Memo Tests
	17	11-12	316:09:33	316:11:46	Prog Test
	18	11-12	316:14:26	316:16:46	Prog EPET to st 1387
	19	11-12	316:16:46	316:19:57	Prog EPET to end MEMO tests
	20	11-12	316:19:57	316:22:19	Prog Memo 50° c
21	1	11-12	316:22:19	317:04:17	Prog Trans to -10° C
	2	11-13	317:04:18	317:06:36	Prog MEMO @ 80°
	3	11-13	317:07:25	317:09:46	Prog EPET -10° Aborted
	4	11-13	317:12:36	317:14:54	Prog EPET Aborted
	5	11-13	317:14:54	317:17:12	Prog EPET Abort/Special Memo Tests
	6	11-13	317:17:12	317:20:40	Special Memo Tests
	7	11-13	317:20:40	317:22:52	Memo Tests
	8	11-13	317:22:52	318:01:14	Memo and Prog EPET 1/2
	9	11-13	318:01:14	318:03:26	Prog EPET2/2 Transition to -15° C 1/2
	10	11-13	318:03:26	318:06:15	Memo Transition to -15° C
	11	11-14	318:08:11	318:08:30	Aborted Prog EPET
	12	11-14	318:13:50	318:16:11	Memory Extention Tests
	13	11-14	318:16:11	318:18:29	Memory Extention tests
	14	11-14	318:18:29	318:20:48	Memory Execution Tests
	15	11-14	318:20:48	318:23:17	Prog Test +35°
	16	11-14	318:23:17	319:01:14	Prog Test +35° C
	17	11-15	319:04:02	319:06:24	Prog Memo Tests + 50° C
	18	11-15	319:06:24	319:08:39	Prog Memo +50 +25° C
	19	11-15	319:08:39	319:11:10	Prog Memo @ +25
	20	11-15	319:11:10	319:14:46	Special Prog Tests

AE HISTORY TAPE LOG (Continued)

Shelf	Bin	Calendar Date	GMT Start	GMT Stop	Comment
22	1	11-15	319:14:46	319:16:18:40	Special Prog Tests
	2	11-15	320:00:48	320:04:32	Special Prog Tests
	3	11-15	320:04:32	320:06:21	Special Prog Tests
	4	11-16	320:06:21	320:10:12	MASC-QUOMAC
	5	11-16	320:11:00	320:21:56	
	6	11-16	320:21:56	321:00:32	Prog Test Sup Time Cov From Prog-1
	7	11-16	321:00:32	321:02:38	Prog Tests OAPS HTR Tests
	8	11-16-17	321:02:38	322:00:36	Prog Test Sup Tme Tests SN
					Before 4 AFTEM Board Romir SAF 103
	9	11-17	322:00:36		Prog Memo Tests
	10	11-18	322:22:04	323:04:05	HICT TCG EXEL Test
	11	11-19		323:19:55	High Time Base Exel Test Memo on
					Prog Mem 1 and 2
	12	11-19-21	323:19:55	325:07:39	CEP EPET PSA EPET OAPS
					Pressurization (Pro Vib)