

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY

8621 GEORGIA AVENUE
SILVER SPRING, MARYLAND 20910

TELEPHONE
776-7100
589-7700
AREA CODE 301

12 November 1968

Mr. J. J. Madden, Code 724
AIMP H and J Project Office
Goddard Space Flight Center
Greenbelt, Maryland 20771

Subject: IMP H and J, Charged Particle Measuring Experiment

Reference: (a) Your TWX 001, on 19 September 1968
(b) Letter from APL (S.M. Krimigis) to GSFC (J.J. Madden),
on 15 October 1968

Dear Jerry:

In response to the referenced communications enclosed please find the following:

- (1) A proposed data readout scheme shown in Figures 1 and 2.
- (2) A computation of telemetry requirements using the proposed readout scheme.

As you can see, we are requesting 16, 24-bit accumulators for sectorized data and 24, 24-bit accumulators for spin-averaged data. The total bit rate is 23.4 bps (18.7 bps for sectorized data and 4.7 bps for spin-averaged data). It is assumed that at the 1600 bps rate, all of our readouts will be speeded up by a factor of 4. Further, our proposed data scheme will require no modification for the IMP-J spacecraft, whose spin rate is 24 rpm.

This letter supplements reference (b) above. If there are any questions, please call R.E. Cashion at 776-7100, extension 2757, or S. M. Krimigis at extension 2719.

Yours truly,

Original signed by
R. E. Cashion
R. E. Cashion

REC:mhk

Distribution:

PGMarcotte/GSFC

MMess/GSFC

RECashion/APL

SMKrimigis/APL

TPArmstrong/U Kansas

JAVan Allen/U Iowa

Telemetry Requirements for the
"Charged Particles Measurements Experiment"

APL/JHU

S.M. Krimigis, Principal Investigator

A. Total Number of Accumulators

Two groups of 8, 24-bit accumulators each, are required for the sector readout scheme (total of 16 accumulators).

Twenty-four 24-bit accumulators are required for the spin-averaged data sampling scheme.

Thus, the total number of accumulators is 40.

B. Bit Rate Requirements (at the 400 bps rate)

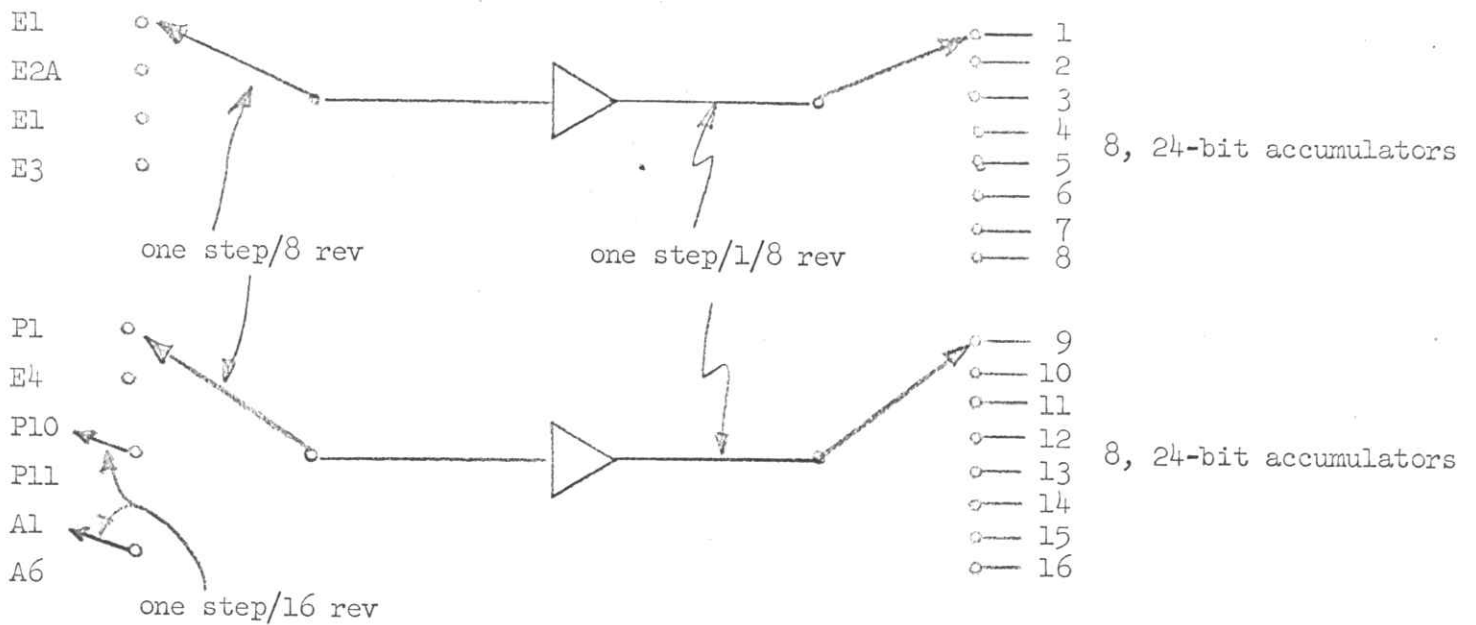
1. Sectors: 16 accumulators of 12-bit equivalent each, read out every 8 revolutions (appropriate address line is $a_1 \Rightarrow 10.24$ secs).

2. Spin-average: 4 accumulators of 12-bit equivalent each, read out every 8 revolutions.

$$\text{Rate} = \frac{4 \times 12}{10.24} = 4.7 \text{ bps}$$

Total bit rate = 23.4 bps

A. SECTOR READOUT SCHEME



B. SPIN-AVERAGED DATA SAMPLING SCHEME

Channel Designation	Readout Number (every 8 revs)	1	2	3	4	5	6	7	8
GM2B	17		X				X		
GM2C	18		Y				X		
P2	19			X				X	
P3	20	X				Y			
P4	21			X				X	
P5	22	X				X			
P6	23			X				X	
P7	24	X							
P8	25			X				X	
P9	26	X							
P10	27					X			
P11	28					X			
E4	29		X						
E5	30						X		
E6	31		X				X		
A2	32				X				
A3	33				X				
A4	34				X				
A5	35				X				
A6	36								X
A7	37								X
S	38								X
M	39								X
Z	40								X

24, 24-bit accumulators

*Read out every other page (163.84 sec)

Figure 1.

(163.84 seconds)

Spin Averaged Data

Secored Data

Data

1	E1	E1	E1	E1	E1	E1	E1	E1	E1	P1	P1	P1	D1	P1	P1	P1	P1	P1	P1	P3	P5	P7	P9
2	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	GM2B	GM2C	E5	E6
3	E1	E1	E1	E1	E1	E1	E1	E1	E1	P10	P10	P10	P10	P10	P10	P10	P10	P10	P10	P2	P4	P6	P8
4	E3	E3	E3	E3	E3	E3	E3	E3	E3	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	A3	A4	A5
5	E1	E1	E1	E1	E1	E1	E1	E1	E1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P3	P5	P10	P11
6	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	GM2B	GM2C	E5	E6
7	E1	E1	E1	E1	E1	E1	E1	E1	E1	P11	P11	P11	P11	P11	P11	P11	P11	P11	P11	P2	P4	P6	P8
8	E3	E3	E3	E3	E3	E3	E3	E3	E3	A6	A6	A6	A6	A6	A6	A6	A6	A6	A6	A6	A7	S	Z
9	E1	E1	E1	E1	E1	E1	E1	E1	E1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P3	P5	P7	P9
10	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	GM2B	GM2C	E5	E6
11	E1	E1	E1	E1	E1	E1	E1	E1	E1	P10	P10	P10	P10	P10	P10	P10	P10	P10	P10	P2	P4	P6	P8
12	E3	E3	E3	E3	E3	E3	E3	E3	E3	A1	A1	A1	A1	A1	A1	A1	A1	A1	A1	A2	A3	A4	A5
13	E1	E1	E1	E1	E1	E1	E1	E1	E1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P1	P3	P5	P10	P11
14	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E2A	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	GM2B	GM2C	E5	E6
15	E1	E1	E1	E1	E1	E1	E1	E1	E1	P11	P11	P11	P11	P11	P11	P11	P11	P11	P11	P2	P4	P6	P8
16	E3	E3	E3	E3	E3	E3	E3	E3	E3	A6	A6	A6	A6	A6	A6	A6	A6	A6	A6	A6	A7	M	Z

Figure 2

Proposed Charged Particles Measurements Experiment Data Format

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY

8621 GEORGIA AVENUE
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NOV 25 1969

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Please refer to:
TSSD-1712

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

Attention: Mr. Paul Butler, Code 724

Subject: Command Requirements for Charged Particles Measurement
Experiment, IMP H and J.

Dear Sir:

The proposal for the CPME gave a requirement of three (3) commands in addition to power on-off. This requirement was specifically the command functions necessary and did not consider the fact that toggle operations are not permitted because of operational requirements. Since toggling is not permitted, additional commands are required to perform the desired command functions.

This problem has been discussed with Clarence Keene of EMR in an attempt to come up with the minimum number of commands, and he has suggested the following. Five commands could be used to control the CPME configuration with one command used to reset the system.

Command 1	Reset
Command 2	High Voltage 1 ON
Command 3	High Voltage 2 ON
Command 4	Gain 1 UP
Command 5	Gain 2 UP

In addition to the above five (5) commands, we would like to add the function of using the CPME "power on" command to initiate the internal calibration system. The normal calibrate sequence is controlled by the C35 address line. However, during integration and launch operations, it would be very desirable to "calibrate" on command without requiring a test connector installation.

We will require four (4) Digital Performance Parameters (DPP) to verify the state of the command logic and request that these be made available for the CPME.

Further, we would like to request one (1) additional accumulator register (24 to 10 bits compression and readout once per page) that would be used to improve the resolution of the Z channel measurement. This was discussed with Hosea White and he indicated that the data space would be available in IMP H, but could not yet determine the status for IMP J.

We will wait for your reply to this request before making the appropriate changes in our experiment.

If you have any questions, please contact Mr. R. E. Cashion at telephone number 776-7100, extension 2068.

Very truly yours,

~~Original signed by
R. B. Kershner~~

R. B. Kershner
Space Development
Department Head

REC
RBK:REC:ks

Distribution:

BFFerer, GSFC/Code 724

PButler, GSFC/Code 724

TArmstrong, Univ. of Kansas

Internal Distribution:

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THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY

8621 GEORGIA AVENUE
SILVER SPRING, MARYLAND 20910

FEB 13 1970

TELEPHONE
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AREA CODE 301

Please refer to:
TSSD-1805

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

Attention: Mr. Paul Butler, Code 724

Subject: IMP H, J Experiment Requirements Document

Enclosure: (1) Revised IMP H, J Experiment Requirements Document
for the Charged Particles Measurement Experiment.

Dear Sir:

Enclosed are six (6) copies of the IMP H, J Experiment Requirements Document for the Charged Particles Measurement Experiment revised January 1970. This document has been prepared as required in Defense Purchase Request No. S-50008A-G.

Very truly yours,

Original signed by
R. B. Kershner

R. B. Kershner
Space Development
Department Head

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Distribution:
NAVPLANTREPO/SS
PButler, Code 724
TPArmstrong, Univ. of Kansas

THE JOHNS HOPKINS UNIVERSITY
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MAR 5 1970

Please refer to:
TSSD-1831

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

Attention: Mr. Ben Ferer, Code 724

Subject: Command Requirements for the Charged Particle Measurements
Experiment, IMP H and J.

Reference: (a) APL Letter TSSD-1712 dated 25 November 1969.

Dear Sir:

APL has studied the command requirements for the CPME experiment with consideration for the recommendations given at the experiment design review held 7 January 1970. At that time we had proposed that the commands for CPME be as follows:

Command 1	Reset (Used to reset command relays 2 to 5)
Command 2	HV1 on (GT photomultiplier power switch)
Command 3	HV2 on (PET photomultiplier power switch)
Command 4	Gain A down (D1 amplifier gain)
Command 5	Gain B down (D2 amplifier gain)
Command 6	Power on/calibrate
Command 7	Power off

The calibrator is normally initiated by the clock line C35 (46.6 hour period), and since we will have access to this clock signal override from the CPME GSE, the calibrate initiate function included in command 6 of the above list is not essential. The capability for calibrate initiation will not be available on the launch stand after fairing installation, but we feel this is justified in the fact that the system will be more reliable without this command capability.

Further study of system reliability indicates that a command capability for disabling the calibrator would be highly desirable since a failure in which the calibrator did not shut itself off could destroy all data from the Proton Electron Telescope, the primary detector system for the CPME. One method for insuring that such a failure would not

degrade the experiment performance is to add a calibrator disable function via commands. We request that this be incorporated into our experiment.

The reset function which had been listed as a separate command in the referenced letter can be controlled by the power on command by requiring this command to be sent after power has been turned on to get "Reset".

A revised list of commands as requested will be as follows:

Command 1	HV1 on
Command 2	HV2 on
Command 3	Gain A down
Command 4	Gain B down
Command 5	Power on/Reset
Command 6	Power off
Command 7	Calibrator Disable

The calibrator command state will be verified via the sub-commutated analog performance parameter. We still desire to launch in the power off condition.

If these commands cannot be made available for any reason, please let us know. If you concur, please inform us so that necessary changes to the experiment requirements document are made. For any additional information please contact R. E. Cashion at telephone number 776-7100, extension 2068.

Very truly yours,

R. B. Kershner
Space Development
Department Head

RBK:REC:ks
Distribution:
NAVPLANTREPO/SS
WLimberis, GSFC, Code 724
Dr. JTrainer, GSFC, Code 611
Dr. TArmstrong, Univ. of Kansas
Mr. CKeen, EMR

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY

8621 GEORGIA AVENUE
SILVER SPRING, MARYLAND 20910

MAR 5 1970

TELEPHONE
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AREA CODE 301

Please refer to:
TSSD-1826

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

Attention: Mr. B. H. Ferer, Code 724

Subject: Weight of Charged Particle Measurements Experiment (APP)
(APL, Dr. S. M. Krimigis).

Dear Sir:

The Applied Physics Laboratory has requested an increase in the weight increase for the APP package from the original 7 pounds to 8.5 pounds. Your response was a request for more information about the status of the experiment weight and an explanation of why the weight has increased. The following list is a breakdown of components with original and present estimate.

<u>Component</u>	<u>Original</u>	<u>Present</u>
N/S Telescope	250 gms	258.2 actual
PET Telescope	530	637.1 actual
Geiger Telescope	570	719.8 actual
Frame	200	196.0 actual
Covers	200	304.0 est.
Front Plate	150	130.0 est.
Center Shelf	100	170.1 est.
"C" Channels	100	208.4 est.
Supply Covers	75	63.1 est.
Hardware	80	78.3 est.
Motherboard	140	138.0 actual
Connectors	60	80.0 actual
Wiring Harness	100	100.0 est.
Power Supplies	100	200.0 est.
Electronics	300	410.0 60% actual
Resilent Materials	100	123.1 est.
Potting	50	50.0 est.
TOTAL	3105 gms 7.0 lbs	3866 gms 8.5 lbs

This list indicates whether the latest component weight estimate is measured or estimated. The detectors have been fabricated and those are measured weights. Many of the printed circuit assemblies have been built and these are actual weights. The frame to be used here is the same as that for the IMP-I SPME and that weight is measured. The other mechanical parts are fabricated from sheet metal which is easy to estimate so those estimates should be accurate. The other component weights are estimates based on similar experiment packages. We feel the confidence level in these estimates is high.

The weight increase is due to changes in the experiment design as well as underestimation in the original weight. The detector telescopes have changed somewhat, a scintillator and photomultiplier have been added to the Geiger Telescope. Additional circuits have been added to enhance properties of data and to increase reliability. Although the final weight is still an estimate, the experiment design is now complete and we are confident that the final package weight will be no more than 8.5 pounds.

If any additional information is desired about package weights, please contact R. E. Cashion at telephone number 776-7100, extension 2068.

Very truly yours,

Original signed by
R. B. Kershner

R. B. Kershner
Space Development
Department Head

RK
RBK:REC:ks

Distribution:

NAVPLANTREPO/SS

NAVAIRSYSCOM/Code ATR-538

Dr. JTrainer, GSFC, Code 611

Dr. NNess, GSFC, Code 616

Mr. WLimberis, GSFC, Code 724

Mr. GLinsey, EMR

Dr. TArmstrong, Univ. of Kansas

J. P. Kerschner

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY

8621 GEORGIA AVENUE
SILVER SPRING, MARYLAND 20910

JUL 13 1970

TELEPHONE
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589-7700
AREA CODE 301

Please refer to:
TSSD-1995

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

Attention: Mr. Martin A. Davis
Code 716

Subject: Use of Butane Gas on IMP H & J

Reference: NASA/GSFC Memo to IMP H & J Experimenters, dated
16 June 1970

Dear Sir:

We have carefully considered the possibility of the presence of Dr. Gloeckler's slow-leak proportional counter detector on the IMP H & J spacecraft. We have no evidence showing that a slow leak of butane gas is detrimental to the solid state detectors, scintillators, and G-M tubes that comprise our experiment. On the other hand, we have no evidence that such gas is harmless.

Thus, our position is that Dr. Gloeckler's experiment may be included on the payload after sufficient testing of the detector has taken place in all possible environments. This testing should include extended thermal vacuum runs as well as quick (~ 100 sec) de-pressurization to simulate launch conditions. After the testing is completed, I suggest that the results be discussed in an experimenter's meeting before final action is taken.

If additional information is required, Dr. S. M. Krimigis can be reached at telephone number 953-7100, Ext. 2626.

Very truly yours,

Original signed by
R. B. Kerschner

R. B. Kerschner
Space Development
Department Head

SMK
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Distribution:
Mr. Martin A. Davis/GSFC
NAVPLANTREPO/SS

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY

8621 GEORGIA AVENUE
SILVER SPRING, MARYLAND 20910

AUG 6 1970

TELEPHONE
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AREA CODE 301

Please refer to:
TSSD-2028

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

Attention: Mr. B. H. Ferer, Code 724

Subject: Data Analysis and Reduction for the Charged Particle
Measurements Experiment (CPME) on IMP H and J,
S. M. Krimigis, Principal Investigator.

References: (a) APL letter TS-1804, dated 11 July 1968.
(b) APL letter TS-2145, dated 22 December 1969.

Enclosures: Executed forms for "Computer Use Request" and
"Computer Use Estimate".

Dear Sir:

As outlined in References (a) and (b), the Goddard
Space Flight Center has agreed to provide computer time for the data
analysis and reduction of the CPME charged particle experiment on the
IMP H and J spacecraft. Enclosed please find the executed forms for
"Sponsor's Computer Use Request" and "Computer Use Estimate". If
additional information is required, Dr. S. M. Krimigis can be reached
at 953-7100, Ext. 2626.

Very truly yours,
Original signed by
R. B. Kershner

R. B. Kershner
Space Development
Department Head

^{SMK}
RBK:SMK:jgs

Distribution:

NASA/GSFC: P. Butler, Code 724

NAVPLANTREPO/SS

NAVAIRSYSCOM/Code AIR-538

Dr. T. P. Armstrong/Univ. Kansas ←

(SEE REVERSE)

GODDARD SPACE FLIGHT CENTER
SPONSOR'S COMPUTER USE REQUEST

REGISTRAR ONLY PROCESSING CODE 1 2 3 4 8 S I	ASSIGNED SPONSOR NUMBER _____	NEW REQUEST <input checked="" type="checkbox"/>	DATE 3 August 1970	Section 1
		UPDATE <input type="checkbox"/>	PREVIOUSLY ASSIGNED NO.	
		DELETE <input type="checkbox"/>		

SPONSOR INITIALS B H F E R E R 9 10 11	LAST NAME _____	TITLE M R 28 29 32
ORGANIZATION CODE 7 2 4 6 33 36	ORGANIZATION NAME I M P R O J E C T O F F I C E 37 60	
BLDG. 1 1 61 62	ROOM E 1 2 1 63 66	EXTENSION 5 5 8 6 67 70

REGISTRAR ONLY S 2 1 2 3	DESCRIPTIVE PROBLEM TITLE C P M E - I M P H & J D A T A 9 32 (TITLE TO APPEAR ON REPORT)	Section 2
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BRIEF NARRATIVE OF PROBLEM P R O C E S S I N G 33 56 (REPORT TITLE CONTINUED)
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Refinement and Processing of Digitized Experimenter's Tapes

REGISTRAR ONLY S 3 1 2 3	COMPUTER USE REQUIRED COMPUTER 3 6 0 9 1 S S A 9 16	TOTAL - HOURS 1 0 0 17 22	EXPIRATION-DATE 7 4 1 2 3 1 23 (YYMMDD) 28
	3 6 0 7 5 S S A 29 36	1 0 0 37 42	7 4 1 2 3 1 43 48
	_____ 49 56	_____ 57 62	_____ 63 68

SPECIAL CONFIGURATION NEEDED (INDICATED: 65K CORE ON 7094; 3-CHANNELS; DISK; ETC.)

REGISTRAR ONLY S 4 1 2 3	PROGRAMMERS AUTHORIZED TO USE ASSIGNED NUMBER ID CODE _____ 9 13	NAME T. P. Armstrong	ID CODE _____ 14 18	NAME _____
	_____ 19 23	(others to be	_____ 24 28	_____
	_____ 29 33	added later)	_____ 34 38	_____
	_____ 39 43	_____	_____ 44 48	_____
	_____ 49 53	_____	_____ 54 58	_____

APPROVAL			
SIGNATURE	TITLE	DATE	REGISTRAR (SIGNATURE)
_____	_____	_____	_____
_____	_____	_____	_____

COMPUTER USE ESTIMATE

BRANCH CODE (1-3) SPONSOR NUMBER (4-8) PROBLEM TITLE CPME IMP H & J Data Processing (9) 44)

CATEGORY (PLEASE CHECK ONE) 1. () SCIENTIFIC AND ENGINEERING 2. (X) DATA REDUCTION
 CAPD COLUMN (45) 3. () MISSION CONTROL 4. () SIMULATION 5. () ADMINISTRATIVE

COMPUTER SYSTEM HCLPS USED PROJECTED USAGE IN HOURS FOR 6 MONTH PERIOD ENDING

CODE (46-47) TITLE 01/01/70-03/31/70 (49-51)

JUN 70 DEC 70 JUN 71 DEC 71 JUN 72
 (52-55) (56-59) (60-63) (64-67) (68-71)

G1 360/95/TDS BLDG. 3

G3 360/75/TDS BLDG. 14

G2 360/45/TDS BLDG. 14

G5 7064-C/TDS BLDG. 3

H1 360/75/WFLT BLDG. 14

M2 360/31/SSA BLDG. 1

K3 360/75/SSA BLDG. 21

K1 7064-E/SSA BLDG. 20

REMARKS

PERSON TO BE CONTACTED REGARDING THIS REPORT

NOTES

EXTENSION

PLEASE ESTIMATE TIME IN 10THS OF AN HOUR IF MORE THAN 9.9 HOURS DESIRED. ESTIMATE TIME IN WHOLE HOURS ***** RETURN THIS FORM TO CODE 502 *****