Dr. Krimigis

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

# *Memorandum*

**TO** : DISTRIBUTION **DATE:** November 30, 1971

**FROM** : Mr. John H. Schmidt
Telemetry Computation Branch, 565.2

**SUBJECT:** Correction to Memo of 11/11/71 - "IMP-H Experimenter Tape Formats"

Please find attached a replacement memorandum, same title as was mailed to experimenters on November 19, 1971. The original contained some significant typographical errors. Please note the following items which were not described in the original memorandum are also available in either format.

1. 24 - bit Spacecraft Clock given once/sequence.

2. 2-bit Data Quality flags as shown in format memorandum where the entire sequence is given the same quality flag as the quarter sequence with the lowest quality (no sequences will contain any fill data).

3. 2-bit Data Quality flags per quarter sequence with each 8-bit field holding all data quality flags for one sequence.

4. Pseudo sequence counters may be given only once per page instead of once per sequence as shown before.

Please call me on 301-982-6408 if I may be of any further assistance.

John H. Schmidt

John H. Schmidt
Project Computation Section

Attachment

565:2754M:JHS:rb

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

# *Memorandum*

**TO** : DISTRIBUTION **DATE:** November 11, 1971

**FROM** : Mr. John H. Schmidt
Telemetry Computation Branch, 565.2

**SUBJECT:** IMP-H Experimenter Tape Formats

Since this is my first communication with most of you, I should introduce myself and let you know how I fit into the GSFC Team. In early June 1971 I was assigned to work with the IMP-H Data Processing Engineer, Mr. William Barnes. My duties involve helping you arrange a digital tape format for the IMP-H data which contains all of your PCM Data in records which are compatible in a record length to your computer and also compatible with the GSFC processing system. My duties not only involve this liaison but it is also my job to acquire the computer programs here at GSFC which will govern the writing of your data tapes.

Attachment 1 contains a suggested data tape format for each experimenter. I believe you will find that the one with your name on it has all of your PCM data included; however, if you see that I overlooked something, please let me know. These format descriptions and the tapes which have already been generated and verified as corresponding to the format descriptions are the natural outcome of the way I prepare for format discussions with experimenters before a satellite launch. I have studied the data channels assigned to each of you and have prepared a format which places your data in convenient arrays when read by your computer programs.

Some of you may find the suggested format to your liking and you may indicate your approval by letter to me with copies to the IMP-H Project Office. Some may approve of the basic data arrangement as read from each page but may prefer some other multiple of pages per record than the suggested six. I would expect that this would be changed by most everyone.

In the past, when I have prepared suggested data tape formats for experimenters there have been a few who felt at first that the basic scheme was unacceptable. If any IMP-H experimenter should feel this way then please contact me. We then can make arrangements for me to communicate with your computer programmers and we can negotiate a format that will both be convenient for you to read and still conform to the GSFC-IPD ground rules as shown in attachment 2.

Subject: IMP-H Experimenter Tape Formats

In order that you may more easily follow the format descriptions in attachment 1, I will give a description of the file label records and also the time and flag fields in the data records.

The file label record will be the same length as your data records thus all records on the data tape will be equal.

| CHARACTERS | DESCRIPTION |
|---|---|
| 1-5 | Satellite ID NUMBER (assigned at launch) |
| 6 | Blank |
| 7-10 | Station ID |
| 11-12 | Blank |
| 13-16 | Analog Tape Numbers |
| 17-18 | Blank |
| 19-20 | Analog file # |
| 21-24 | Blank |
| 25-29 | Record Date (YMMDD) |
| 30-36 | Blank |
| 37-40 | Analog Start time (HHMM)* |
| 41-48 | Blank |
| 49-52 | Analog stop time (HHMM)* |
| 53-60 | Blank |
| 61-64 | Data type 0000 = Normal<br>0001 = Encoder bypass<br>0002 = Encoder failure<br>0003 = Uncoded |
| 65-66 | ~~Blank~~ Experimenter Number |
| 67 | Data rate 0 = Low bit rate<br>1 = High bit rate |
| 68-78 | Blank |
| 79-82 | Master Edit Tape Number |
| 83-84 | Master Edit File Number |
| 85-N | Fill data out to N Characters.<br>N = your data record length. |

*Actual start and stop times will vary as much as a minute.

Each data record and in fact each page of data will begin with time, flags and performance parameters according to the following format.

| CHARACTERS | DESCRIPTION | |
|---|---|---|
| 1-2 | Continuity flags by value = 0 or 1 | |
| | $2^0$ = 0 no fill data in page | |
| | 2 = 0 no time discontinuity following | |
| 3-4 | Zeros | |
| 5-6 | Day count of year January 1 = 1 | |
| 7-12 | Milliseconds of day of first bit of page | |
| 13-14 | | (Sequence 0, 1, 2, 3) |
| 15-16 | Time quality flags | (Sequence 4, 5, 6, 7) |
| 17-18 | | (Sequence 8, 9, 10, 11) |
| 19-20 | | (Sequence 12, 13, 14, 15) |
| 21-22 | | (Sequence 0, 1, 2, 3) |
| 23-24 | Data quality flags | (Sequence 4, 5, 6, 7) |
| 25-26 | | (Sequence 8, 9, 10, 11) |
| 27-28 | | (Sequence 12, 13, 14, 15) |
| 29-30 | Zeros | |
| 31-36 | Pseudo Sequence Counter | (Sequence 0) |
| 37-42 | " " " | (Sequence 1) |
| 43-48 | " " " | (Sequence 2) |
| . | . . . | . |
| . | . . . | . |
| . | . . . | . |
| 121-126 | " " " | (Sequence 15) |
| 127-158 | APP (16, 1-15) | |
| 159-190 | (APP 32, 17-31) or (48, 33-47) | |
| 191-254 | DPP A2, 5-36 | |
| 255-278 | A3, 1-24 | |
| 279-310 | EDP 1-4 | |
| 311-358 | OA (Chan 4-15 S.S.1, S.S.3) | |
| 359-N | Experimenters data. | |

Please note that this format is blocked for a 36-bit computer word which will be standard for 32 or 36-bit computer word equipment. Those of you who have 48 or 60-bit machines will find the above data format written in the word length of your computer words. You will see this in attachment 1..

The time and data Quality flags from the page are grouped four sequences to each 12 bit digital field as follows:

$2^0 - 2^1$ = quality flag from sequence 0
$2^2 - 2^3$ = " " " " 1
$2^4 - 2^5$ = " " " " 2
$2^6 - 2^7$ = " " " " 3
$2^8 - 2^{11}$ = Zeros. (same as high order bits accompanying data channels - 8 bits).

The meaning of the flags is shown in table form:

| Value | Time Quality | Data Quality |
|---|---|---|
| 0 | Analog time unverified | Excellent (PE $< 10^{-6}$) |
| 1 | Analog time verified by S/C clock | Good (PE $< 10^{-4}$) |
| 2 | Analog time in error-S/C clock used | Fill |
| 3 | Time put with fill data-computed | Undetermined |

Those who choose to use the generalized telemetry data tape format will receive also a tape containing the satellite position and attitude along with the positions of sun and moon, etc. See attachment #3 for the list. This tape shall have one set of data points given each 10 minutes. All experimenters who accept formats according to ground rules in attachment 2 would receive the same tape.

Because some IMP-H experimenters had experiments on IMP-I and were expecting nearly the same type of tapes on IMP-H we have relaxed a few of the ground rules shown in attachment 2. According to the relaxed ground rules we will do some limited pre-analysis data manipulation. An additional processing step will have to be added to our data processing system which will accept as input the tapes described in attachment 1 to perform this pre-analysis data manipulation. Our procedure will be to produce the tapes described in attachment 1 for each experiment. This attachment 1 formatted tape will be shipped to you one month after each thermovacuum test and the in-orbit data will also be shipped on schedule after launch if you accept this type format. The Information Processing Division (IPD) will completely verify that the output tapes conform to the formats described in attachment 1 or the finally negotiated formats prepared under the relaxed ground rules. Any experimenter who might desire to change his format from that shown in attachment 1 within the IPD ground rules may do so at any time prior to launch. This may be a telephone call if desired and the only approval required is that of the undersigned. This is one of the purposes of using this system which within the ground rules is easily modified and re-verified. No changes will be allowed after launch, however, without approval of the IMP project.

The IMP-H experimenters may negotiate with IPD for a format within the relaxed ground rules found below. Those of you who negotiate a format under the relaxed ground rules will not receive the output from any of the thermovacuum tests until about May or June 1972. The relaxed IPD ground rules which were established by a joint agreement between IPD, IMP-H Project Scientist and the IMP Project Manager are as follows:

1. The performance parameters and OA data will be converted to engineering units and written in floating point binary on your tapes. These values will be written in IBM 7094 compatible floating point unless otherwise specified. Should you specify some other form then you must send a concise description sufficient for me to write a mock string of bits from our 36-bit word machine such that it satisfies you when you read the tape. This conversion will of course result in increased record length since the information contained in two 6-bit characters on the tape described in attachment 1 now will be written into a whole word in your machine.

2. Raw (uncalibrated), rectified (flipped, etc.), packed telemetry data will be provided on an album basis or larger. This can be done by packing time and data per page into albums or giving time once per album with data from the album. As an example, suppose you have outputs from two counters A and B which each read out twice per page. You could receive $Time_1$ AABB $Time_2$ AABB $Time_3$ AABB $Time_4$ AABB or $Time_1 AA_1 AA_2 AA_3 AA_4 BB_1 BB_2 BB_3 BB_4$. In the second format you would receive time only once per album. I have excluded from the example the APP and DPP and attitude/orbit items which would appear (blocked) in between the time and sensor data.

3. Orbit/attitude data will be merged with telemetry data. There are 79 items of information (see attachment 3) all or none of which will be provided to the experimenters. The time of these orbit/attitude data items will be on the minute. The interval between data items will be a matter of experimenter's choice, and will be merged either within data records or written in records between data records. The main argument for relaxing the ground rules was the requirement for merging telemetry data with attitude/orbit/ephemeris data for the experimenters. Those experimenters choosing their tapes written under the relaxed ground rules will not receive a copy of the tape listed in attachment 3 which is prepared to accompany attachment 1 type formats.

4. After formats have been agreed upon no changes will be accepted by IPD unless approved by both the IMP Project Manager, the IMP Project Scientist and the undersigned who must all agree the changes lie within either the original ground rules or the relaxed ground rules as interpreted by each. It would be impossible at this time to say if such approved changes would alter your delivery schedule. It should be noticed that each experimenter's delivery schedule is independent in our new IMP processing system. Should one experimenter have justifiable need for a massive change in his format the remainder of the experimenters delivery schedules will not be affected.

5. The experimenter requesting output tapes under the relaxed ground rules must prepare detailed written specifications to IPD to serve as a basis for our working together to provide you with an output tape. Any changes to the original specification must also be requested in writing.

John H. Schmidt

John H. Schmidt
Project Computation Section

Attachments

565:2753M:JHS:rb

ATTACHMENT 1

This attachment contains suggested experimenter tape formats which conform to the IPD ground rules as found in Attachment 2.

The decom matrix used is one page of telemetry data. This matrix is scanned once for each line in your format.

IMP-H TELEMETRY DATA TAPE FORMAT DESCRIPTION

EXPERIMENT NUMBER: X25

EXPERIMENTER: Dr. Krimigis

TAPE DENSITY 800 BPI 6 PAGES PER RECORD

7-TRACK DIGITAL TAPES 36 BIT WORD FORMAT

| TAPE CHARACTERS | | DATA LINE DESCRIPTION | CHANNELS | FRAMES | SEQUENCES |
|---|---|---|---|---|---|
| RECORD TOTAL | THIS LINE | | (0-15) | (0-15) | (0-15) |
| 2 | 2 | Continuity flags | | | |
| 4 | 2 | Day of Year January 1 = 1 | | | |
| 12 | 6 | Milliseconds of Day | | | |
| 28 | 16 | Time and Data Quality Flags | | | |
| 30 | 2 | Zeros | | | |
| 36 | 6 | Pseudo Sequence Counter (Sequence 0) | | | |
| 42 | 6 | " " " ( " 1) | | | |
| 48 | 6 | " " " ( " 2) | | | |
| . | . | . . . . . | | | |
| . | . | . . . . . | | | |
| . | . | . . . . . | | | |
| 126 | 6 | " " " ( " 15) | | | |
| 158 | 32 | APP (16, 1-15) | | | |
| 190 | 32 | APP (32, 17-31) or(48, 33-47) | | | |
| 254 | 64 | DPP A2 (5-36) | | | |
| 278 | 24 | A3 (1-24) | | | |
| 310 | 32 | EDP | | | |
| 358 | 48 | OA (Channels 4-15 S.S.1,S.S.3) | | | |
| 438 | 80 | Se-1 | 0-4, 11-15 | 2 | 2,6,10,14 |
| 518 | 80 | Se-2 | 0-4, 11-15 | 10 | 2,6,10,14 |
| 598 | 80 | Se-3 | 0-4, 11-15 | 2 | 3,7,11,15 |
| 678 | 80 | Se-4 | 0-4, 11-15 | 10 | 3,7,11,15 |
| 694 | 16 | R1 | 6,7 | 2 | 1,5,9,13 |
| 710 | 16 | R2 | 6,7 | 10 | 1,5,9,13 |
| 726 | 16 | R3 | 6,7 | 2 | 2,6,10,14 |
| 742 | 16 | R4 | 6,7 | 10 | 2,6,10,14 |
| 758 | 16 | R5 | 9,10 | 10 | 2,6,10,14 |
| 774 | 16 | R6 | 6,7 | 2 | 3,7,11,15 |

EXPERIMENT NUMBER: X25 (Continued)
EXPERIMENTER: Dr. Krimigis

| TAPE CHARACTERS | | DATA LINE DESCRIPTION | CHANNELS | FRAMES | SEQUENCES |
|---|---|---|---|---|---|
| 790 | 16 | R7 | 6,7 | 10 | 3,7,11,15 |
| 798 | 8 | R8 | 6,7 | 4 | 1,9 |
| 806 | 8 | R9 | 6,7 | 8 | 4,12 |
| 814 | 8 | R10 | 6,7 | 8 | 0,8 |
| 822 | 8 | R11 | 6,7 | 4 | 5,13 |
| 830 | 8 | R12 | 11,12 | 4 | 0,8 |
| 838 | 8 | R13 | 12,13 | 4 | 0,8 |
| 846 | 8 | R14 | 11,12 | 4 | 1,9 |
| 854 | 8 | R15 | 12,13 | 4 | 1,9 |
| 862 | 8 | R16 | 11,12 | 8 | 4,12 |
| 870 | 8 | R17 | 12,13 | 8 | 4,12 |
| 878 | 8 | R18 | 11,12 | 8 | 0,8 |
| 886 | 8 | R19 | 12,13 | 8 | 0,8 |
| 894 | 8 | R20 | 11,12 | 4 | 5,13 |
| 910 | 8 | R22 | 11,12 | 12 | 0,8 |
| 918 | 8 | R23 | 12,13 | 12 | 0,8 |
| 926 | 8 | R24 | 11,12 | 12 | 4,12 |
| 934 | 8 | R25 | 12,13 | 12 | 4,12 |
| 936 | 2 | Fill at End of Each Page | | | |

R21

936 Characters/Page
5616 Characters/Record
40 Files Maximum/Tape

ATTACHMENT #2

GROUND RULES CONSERNING IMP-H EXPERIMENTER TAPES

The IMP-H experimenter tape decom system was built around the following ground-rules:

1. The tapes will not contain a tape header record.

2. Each file shall contain all of the processible data from one analog tape recorded at a ground station.

3. Each file shall consist of (1) a file label, (2) an undetermined number of data records, and (3) an end-of-file mark. I know that a few IBM 360 users prefer that no EOF marks appear on their tapes except at the end. The GSFC IBM 360 users have access to the FTIO routine which enables them to read multi-file tapes, but since some non-GSFC users don't have this routine and may not have availed themselves of one of the many other such routines floating around I will provide a sentinel record instead of EOF marks at the end of each file. Any experimenter who received more than one output tape per run will however find EOF marks ending all of the tapes in the run. My checkout of any formats not including the normal file termination mark will be seriously hampered since all of my utility programs operate on a file by file basis.

4. The file label will be indentical in content to the Housekeeping tape file labels described in the IMP-I Data Processing Plan (X563-70-337) on page 9-19. The label record length will be equal to the data records which follow.

5. The 8-bit telemetry channels will be presented to experimenters in 12-bit fields. This will be 2 tape characters on the 7-track decom tapes with the four highorder bits equal to zero. Each 36-bit field on tape will contain three 8-bit data channels.

6. The raw telemetry channels will be given to the experimenters on the basis of requested channels.

7. The decom matrix from which the program will decom the experimenter's data will be equal to one page. The experimenter's formats will be based upon one page where the smallest record they may receive is their information from one page with the ground time given once per page. The most they could receive would be limited by the maximum record size they prefer to read-in by their computer.

8. The page from which our program will decom the data shall begin with ground time and data from sequence 0, or if sequence 0 is not available then time and fill data in its place, and so on.... This assures that the ground time which refers to channel 0 of frame 0 of a page can be used to compute the relative time anywhere within the page. Those who choose more than one page per output record should treat each page as a unit because we will not decom any complete pages of fill data. This means there can be time discontinuity between pages but not within pages.

9. Our program does not recognize page numbers. If the experimenters want to process their data from odd pages differently than from even pages, it is incumbent upon them to make the determination.

10. All housekeeping channels will be provided to all experimenters.

11. The data records will contain ground time once per page and the telemetered data from that page. No other forms of data will be merged in.

12. A second type of tape will be sent to each experimenter in addition to the PCM data tape. These tapes will have identical formats but will have record lengths compatible with the users computer. They will contain all of the coordinate transformation being computed for IMP-I plus attitude and orbital position data. The data item interval shall be once per minute on the minute unless this is found to be a higher frequency than required.

ATTACHMENT 3

## ATTITUDE/ORBIT/EPHEMERIS TAPE FORMAT

All words are 36 bits long, IBM 7094 format.

The time interval between records shall be 10 minutes.

| WORD NO. | FORM | IDENTIFICATION |
|---|---|---|
| 0 | Fixed Pt. | Fortran record size indicator (=000117010001 ) This indicates a total data word count of 75 . |
| 1 | Floating Pt. | Day of year } time of orbit data |
| 2 | " " | Milliseconds of day } in this record |
| 3 | " " | Longitude (deg.) } satellite position in |
| 4 | " " | Latitude (deg.) } geocentric coordinates |
| 5 | " " | Longitude (deg.) } satellite position in |
| 6 | " " | Latitude (deg.) } geomagnetic coordinates |
| 7 | " " | R (earth radii) a geomagnetic coordinate of the satellite position, C.U.L. |
| 8 | " " | r, radial distance of the satellite from the center of the earth (km.) |
| 9 | " " | GSE X } Satellite position in Geocentric Solar |
| 10 | " " | GSE Y } Ecliptic Coordinates (km.) |
| 11 | " " | GSE Z } |
| 12 | " " | GSM X } Satellite position in Geocentric Solar |
| 13 | " " | GSM Y } Magnetospheric Coordinates (km.) |
| 14 | " " | GSM Z } |
| 15 | " " | GSE X } Moon position in Geocentric Solar |
| 16 | " " | GSE Y } Ecliptic Coordinates (km.) |
| 17 | " " | GSE Z } |
| 18 | " " | GSM X } Moon position in Geocentric Solar |
| 19 | " " | GSM Y } Magnetospheric Coordinates (km.) |
| 20 | " " | GSM Z } |

| WORD NO. | FORM | IDENTIFICATION |
|---|---|---|
| 21 | Floating Pt. | GEI X — Satellite position in Geocentric Equatorial Inertial (km.) |
| 22 | " " | GEI Y — Satellite position in Geocentric Equatorial Inertial (km.) |
| 23 | " " | GEI Z — Satellite position in Geocentric Equatorial Inertial (km.) |
| 24 | " " | GEI X — Sun position in Geocentric Equatorial Inertial (A.U.) |
| 25 | " " | GEI Y — Sun position in Geocentric Equatorial Inertial (A.U.) |
| 26 | " " | GEI Z — Sun position in Geocentric Equatorial Inertial (A.U.) |
| 27 | " " | Longitude — Sub-solar point in geomagnetic coordinates (deg.) |
| 28 | " " | Latitude — Sub-solar point in geomagnetic coordinates (deg.) |
| 29 | " " | Distance from the satellite to the Moon (km.) |
| 30 | " " | Distance parallel to the x-axis from the satellite to the moon (km.) |
| 31 | " " | 1st row, 1st column — Geocentric Solar Ecliptic to Geocentric Solar Magnetospheric transformation matrix. |
| 32 | " " | 1st row, 2nd column |
| 33 | " " | 1st row, 3rd column |
| 34 | " " | 2nd row, 1st column |
| 35 | " " | 2nd row, 3rd column |
| 36 | " " | 2nd row, 3rd column |
| 37 | " " | 3rd row, 1st column |
| 38 | " " | 3rd row, 2nd column |
| 39 | " " | 3rd row, 3rd column |
| 40 | " " | 1st row, 1st column — Geocentric Equatorial Inertial-to-Geocentric Solar Ecliptic transformation matrix. |
| 41 | " " | 1st row, 2nd column |
| 42 | " " | 1st row, 3rd column |
| 43 | " " | 2nd row, 1st column |
| 44 | " " | 2nd row, 2nd column |
| 45 | " " | 2nd row, 3rd column |
| 46 | " " | 3rd row, 1st column |
| 47 | " " | 3rd row, 2nd column |
| 48 | " " | 3rd row, 3rd column |

$$\begin{pmatrix} X_{SE} \\ Y_{SE} \\ Z_{SE} \end{pmatrix} = \begin{pmatrix} \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \end{pmatrix} \begin{pmatrix} X_I \\ Y_I \\ Z \end{pmatrix}$$

| WORD NO. | FORM | IDENTIFICATION |
|---|---|---|
| 49 | Floating Pt. | Right Ascension } Satellite position in |
| 50 | " " | Declination } celestial inertial (deg.) |
| 51 | " " | Right Ascension } Velocity vector in |
| 52 | " " | Declination } celestial inertial (deg.) |
| 53 | " " | Magnitude of the velocity (km./sec.) |
| 54 | " " | L McIlwain parameter (earth radii) |
| 55 | " " | B Magnetic field strength (Gamma) |
| 56 | " " | $B/B_o$ Ratio of the magnetic field strength at the satellite-to-the-field strength at the invarient equator |
| 57 | " " | Satellite-earth-sun- angle, Lsep (deg.) |
| 58 | " " | Satellite-earth-moon angle (deg.) |
| 59 | " " | Right ascension } Magnetic vector in |
| 60 | " " | Declination } celestial inertial (deg.) |
| 61 | " " | Longitude } Sub-solar point in (deg.) |
| 62 | " " | Latitude } Geocentric Equatorial Inertial |
| 63 | " " | GSE X } Theoretical geomagnetic field in |
| 64 | " " | GSE Y } Geocentric Solar Ecliptic coordinates |
| 65 | " " | GSE Z } (in gamma) |
| 66 | " " | Type of data item indicator:<br>1 = regular satellite data item<br>2 = ascending node crossing data item<br>3 = North point data item<br>4 = descending node data item<br>5 = south point data item<br>6 = sunlight entrance data item<br>7 = sunlight exit data item |
| 67 | " " | Date of data (YR MO DA) |

| WORD NO. | FORM | IDENTIFICATION |
|---|---|---|
| 68 | Floating Pt. | Longitude ? Geodetic satellite position (deg.) |
| 69 | " " | Latitude ⌋ |
| 70 | " " | Height above spheroid (km.) |
| 71 | " " | Ascending node crossing number (pass number) |
| 72 | " " | Year of data (YR) |
| 73-75 | " " | Zero fill for spares |
| 76 | " " | Delta time between time of Ephemeris item and next previous sun pulse which stopped OA - ST Counter (Seconds). |
| 77 | " " | Spin period (Seconds) |
| 78 | " " | Right Ascension ? Spin vector in celestial |
| 79 | " " | Declination ⌋ inertial (Deg.) |
| 80 | Fixed Point | Check sum of data words in words number 1 - 79 |
| 81 | " " | FORTRAN record size indicator (= $000117010001_8$) This indicates a total data word count of $75_{10}$ words. |

Notes:

Longitude is positive east of Greenwich and negative west of Greenwich (-180° to + 180°)
North latitude is positive and south latitude is negative (-90° to +90°)
Date of data (word number 67) equals day + 100 (months + year (100)). Example: February 10, 1967 at 2 hours U.T. is recorded as 670210 in word 67, 41 in day count (word 1), 7200000 in milliseconds of day (word 2), and 67 in year of data (word 72).

ATTACHMENT 4

EXPERIMENTER TAPE FORMAT OUTLINE (Under Relaxed Ground Rules)

- Time once per page (or album)
- Time Quality, Data Quality flags and pseudo sequence counters
- All performance parameters (in floating point if requested)
- Uncalibrated telemetry data (flipped or expanded, etc.)
- Attitude/Orbit/Ephemeris information - either here or blocked in between data records.

Each file will still conform to the data recorded on one analog tape at the gound station and each file on the experimenter tape will consist of a file label, data records and an end-of-file mark. Two consecutive EOF marks will signal the end of a tape.

UNITED STATES GOVERNMENT

# *Memorandum*

TO : Mr. P. Butler
IMP Project Manager, Explorer Office, SA&TD, 701.1

DATE: August 9, 1971

FROM : Mr. J. H. Schmidt
Project Computation Section Telemetry Computation Branch, IPD, M&DO, 565.2

SUBJECT: IPD Milestone Schedule and Experimenter Tape Ground Rules for IMP-H

In my telephone correspondence with Mr. Martin Davis, code 701.1, I mentioned that I intended to provide you with a milestone schedule for the part of IPD Processing of IMP-H data for which I am responsible. The attached milestone schedule in attachment #1 and the set of ground rules in attachment #2 have been reviewed and approved by IPD for implementation. These two attachments really comprise a set because without acceptance of the ground rules in attachment #2 it would be totally impossible for us to meet the schedule shown in attachment #1.

I expect that since the IMP-H experimenters are supported by competent computer programmers, no difficulties should arise out of our imposing these ground rules.

It would be in order for me to explain that the source of these ground rules is the input and output format requirements of a standardized decom program which has been used in IPD for 160 numbered experiment formats to date. These include satellites from the OGO series, the OSO series, and the ATS series of satellites. Some of the IMP-H experimenters have in fact been either principle investigators or co-investigators on one or more of these previous satellites and will be already acquainted with tapes in the type of formats we will be using for IMP-H.

Our confidence in this decom system, gained by years of experience, allows us to show for instance a time lag of only about 10 days (see attachment #1) between the date of format agreements and delivery of tapes conforming to those formats to all experimenters using simulated input telemetry data. When I personally prepared the format coding for all of the experimenters on three satellites, the time required per experimenter never exceeded one-half day including checkout.

John H. Schmidt
IMP-H Assistant DPE

Attachment 2

cc: Mr. T. Moore, M&DOD Manager, 513.2
Dr. Ness, Project Manager, 690.0
Mr. M. Davis, Experiment Manager, 701.1
Mr. Wm. Barnes, IMP-DPE, 564.3
Mr. F. A. Keipert, Chief, Information Processing Division, 560.0

565:2591:JHS:md

Attachment 1

CENTER

RESPONSIBILITY: APPROVAL

ACCOMPLISHMENT

# MILESTONE SCHEDULE

PROJECT IMP-H DECOM PROCESSING

ORIG. SCHED. APPR. JUNE 1, 1971 (DATE)

LAST SCHED. CHG. ▽ 1 AUGUST 4, 1971 (DATE) (NO.) (INITIALS)

STATUS AS OF AUGUST 4, 1971 (DATE) (INITIALS)

| | MILESTONES | 1971 JUNE | JULY | AUGUST | SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER |
|---|---|---|---|---|---|---|---|---|
| 1 | Assistant DPE assigned with instructions to redesign the IMP Decom System for IMP-H. | ▽ | | | | | | |
| 2 | IMP-H Decom System Design. | ▽ | | | | | | |
| 3 | Present proposed System to IPD for approva. | | ▽ | | | | | |
| 4 | IMP-H Decom Processing System Design approved. | | ▽ | | | | | |
| 5 | Implement approved system. | ▽ | | ▽ | | | | |
| 6 | Send Milestone Chart & IPD Ground Rules to Proj | | ▽ | 1 | | | | |
| 7 | Announce meeting with local experimenters. | | ▽ | 1 | | | | |
| 8 | Give presentation to local experimenters. Plan data tape formats after presentation. | | | ▽ | 1 | | | |
| 9 | Begin contacting non-GSFC experimenters. | | ▽ | ▽ | | | | |
| 10 | Deliver decom tapes to experimenters (simulated data) | | | ▽ | ▽ 1 | | | |
| 11 | Thermo-Vac tests and decom formats frozen. | | | | ▽ | ▽ | | |
| 12 | Process Thermo-Vac test data | | | | | ▽ | ▽ | |
| 13 | Ship Thermo-Vac test data to experimenters. | | | | | | ▽ 1 | |
| 14 | Update IMP-I to IMP-H Attitude Determination. | | | ▽ | | | | ▽ |
| 15 | | | | | | | | |
| 16 | | | | | | | | |

GROUND RULES CONCERNING IMP-H EXPERIMENTER TAPE

The IMP-H experimenter tape decom system was built around the following ground-rules:

1. The tapes will not contain a tape header record.

2. Each file shall contain all of the processable data from one analog tape recorded at a ground station.

3. Each file shall consist of (1) a file label, (2) an undetermined number of data records, and (3) an end-of-file mark. I know that a few IBM 360 users prefer that no EOF marks appear on their tapes except at the end. The GSFC IBM 360 users have access to the FT10 routine which enables them to read multi-file tapes, but since some non-GSFC don't have this routine and may not have availed themselves of one of the many other such routines floating around, I will provide a sentinel record instead of EOF marks at the end of each file. Any experimenter who received more than one output tape per run will, however, find EOF marks ending all of the tapes in the run. My checkout of any formats not including the normal file termination mark will be seriously hampered since all of my utility programs operate on a file by file basis.

4. The file label will be identical in content to the Housekeeping tape file labels described in the IMP-I Data Processing Plan (X563-70-337) on page 9-19. The label record length will be equal to the data records which follow.

5. The 8-bit telemetry channels will be presented to experimenters in 12-bit fields. This will be 2 tape characters on the 7-track decom tapes with the four highorder bits equal to zero. Each 36-bit field on tape will contain three 8-bit data channels.

6. The raw telemetry channels will be given to the experimenters on the basis of requested channels.

7. The decom matrix from which the program will decom the experimenters' data will be equal to one page. The experimenters' formats will be based upon one page where the smallest record they may receive is their information from one page with the ground time given once per page. The most they could receive would be limited by the maximum record size they prefer to read-in by their computer.

8. The page from which our program will decom the data shall begin with ground time and data from sequence 0, or if sequence 0 is not available, then time and fill data in its place, and so on .... This assumes that the ground time which refers to channel 0 of frame 0 of a page can be used to compute the relative time anywhere within the page. Those who choose more than one page per output record should treat each page as a unit because we will not decom any complete pages of fill data. This means there can be time discontinuity between pages but not within pages.

9. Our program does not recognize page numbers. If the experimenters want to process their data from odd pages differently than from even pages, it is incumbent upon them to make the determination.

10. All housekeeping channels will be provided to all experimenters.

11. The data records will contain ground time once per page and the telemetered data from that page. No other forms of data will be merged in.

12. A second type of tape will be sent to each experimenter in addition to the PCM data tape. These tapes will have identical formats but will have record lengths compatible with the users computer. They will contain all of the coordinate transformation being computed for IMP-I plus attitude and orbital position data. The data item interval shall be once per minute on the minute unless this is found to be a higher frequency than required.

S1P-768-71
June 24, 1971

To: Roy Cashion

From: S. M. Krimigis

Subject: Possible improvements of the CPME.

Reference: S1P-750-71, dated 8 June 1971.

In the referenced memo, the current status of CPME calibrations was discussed and suggestions were made regarding changes in the experiment such as those contained in section II. 2. The present memo supplements and supplants the referenced one as follows:

(1) It is desirable to change channel Z2 into a heavy element one, i.e., to measure nuclei in the iron group $22 \leq Z \leq 28$. This would necessitate setting of the A7 level at ~ 150 Mev. If this requirement cannot be met because of amplifier gain and linearity considerations, the following settings may be used, listed in decreasing order of desirability:

$A7 \approx 100$ Mev $\quad Z \geq 14$

$A7 \approx 60$ Mev $\quad Z \geq 10$

(2) In order to maintain the spectral measurement for medium nuclei, it was decided to make A5 a Z level, sensitive to C, N, O nuclei in the range ~5.5 to 25 Mev/nucleon. This requirement involves the setting of B7 at ~60 Mev. The exact level will depend on the thickness of detector B.

(3) (a) It is desirable to remove the sectoring from P11 and assign it to Z1. If this cannot be done, it may be assigned to P2.
(b) It is also desirable to sector P8 instead of P10 for two reasons: (1) It is likely that a lot more events will be seen and (2) The energy/nucleon interval of P8 matches that of A7, if A7 rather than A6 were to be sectored.
Item 3(b) is clearly on a lower priority than 3(a).

(4) Desired changes, most probably attainable on the IMP J payload.

(a) Assign S1 sectors to E3 rather than E1. This change will increase the duty cycle of E3 by a factor of 2.
(b) Move E1 to the S2 sectoring subcommutator in replacement of E3.
(c) Change opening angle of E3 to 22.5°.

Changes (a) and (c) will increase the duty cycle of E3 per sector from the present 1% to ~ 4%.

Please advise me on the feasibility of the above.

S. M. Krimigis

SMK:las
Distribution: See Page 2

Distribution:
COBostrom
TPArmstrong
CCunningham
AFHogrefe
SAGary
JWKohl
RLMcCutcheon
DPPeletier
S1P File
Archives

Westinghouse Electric Corporation

Defense and Space Center

Mail Stop 825
Friendship International Airport
Box 1897, Baltimore, Md. 21203

October 20, 1971

Dr. S. M. Krimigis
Johns Hopkins University
Applied Physics Laboratory
8621 Georgia Avenue
Silver Spring, Md. 20910

Dear Dr. Krimigis,

Westinghouse is responsible for Control Center software development for IMP-H at the Multi-Satellite Operations Control Center. We need information about your requirements for real-time software support.

Please answer the enclosed questions and send the information to me as soon as possible. If there is any question, I can be reached at Goddard at X. 6446 or at Westinghouse at (301) 765-2240.

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Sincerely,

Mary Ann Long

Mary Ann Long
Engineer

# IMP-H Real Time Experiment Processing

We need to know whether or not you want the real-time quick-look printout for your experiment to be the same as your integration printout. If you want a different format, send us the specifications.

Under the real-time operating system no provisions can be made for operator selected experiment options. Options depending on your data, the bit rate, or other telemetered items are permitted. If your integration program has options typed in, we need to know which option you want.

It is important to remember that in real-time operation there will usually be some loss of synch and that any scheme which assumes good, continuous data will cause trouble.

Information about your experiment data, modes of operation, subcommutators, command verification, etc. is needed. It is necessary that the S/C controller be able to verify your commands with a CRT display or special "control panel" printout without having to run your quick-look program at the time. Therefore, it is necessary to have this information spelled out even if we are going to convert your integration program for real-time use.

A standard header will be used which provides:

Bit rate
Station name
Orbit number
Date
Clock source (GMT, DTS1, DTS2, or DTS3)
Time
Data quality
Monitor PCM unit number
Computer system number
S/C clock (octal)
S/C clock (hours/min/sec)
Telemetry page number
On or off line processing
Experiment title

IMP-H

full-list

1. Do you want to use your integration printout? If not, what form do you want?

2. If you are using your integration printout, does it have any operator specified options? If so, which option do you want?

3. How can we tell if your experiment is on or off? AP

4. a. Where is your data in the telemetry format? Specify page, snapshot, sequence, frame, channel, starting bit, and length (in bits).

   b. Should the data be complemented?

   c. Should the bit order be reversed? If so, how many bits at a time?

   d. Is the data item a 10 or 12 bit accumulator?

5. How can we determine the mode your experiment is in, any warning indications, or other performance parameters which the S/C controller will need to know?

2- "full-list"

3- ~~DPP-1~~ AP 7 - see P VIII - 3 "ERD"

4- ?

5 - calibrate seq. - P IX - 2.
P VIII - 4&5

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