

THE JOHNS HOPKINS UNIVERSITY
APPLIED PHYSICS LABORATORY

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October 5, 1973

TELEPHONE
953-7100
589-7700
AREA CODE 301

Mr. Michael A. Gallucci
Space Environment Laboratory
National Oceanic and Atmospheric Administration
Boulder, Colorado 80302

Dear Mike:

Thank you for the list of items for the archive tapes. I have gone over them again and, although I have a nagging feeling that we might someday wish we had included the lunar position data, I can't really justify including these items routinely. We always have the option of going back to the OA tape for the information if we need it.

Sincerely yours,


Carl O. Bostrom

COB:dl
CC: DJWilliams



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL RESEARCH LABORATORIES
Boulder, Colorado 80302

October 2, 1973

Dr. Carl O. Bostrom
The Applied Physics Laboratory
8621 Georgia Avenue
Silver Spring, Maryland 20910

Dear Dr. Bostrom:

This letter is the follow-up to our phone conversation on Friday, September 28.

Attached are (1) the tentative list of archive tape items that will be included on each record of the archive tape, and (2) a complete list of coordinate information. Those coordinate items on attachment #2 with asterisks beside them have already been agreed to appear on the archive tape.

If you wish to include further coordinate information, or have any questions regarding these items, please contact either Don Williams or me at your earliest convenience. If you wish to contact me by phone, I can be reached at FTS No. (303) 499-3997.

Sincerely,

A handwritten signature in cursive script, reading "Michael A. Gallucci".

Michael A. Gallucci
Space Environment Laboratory

Enclosures

cc: D. J. Williams, w/encl.

IMP-H MCE TAPE DATA RECORD

All words are 36 bits long, IBM 7094 format.

The time interval between records shall be 10 minutes.

| <u>WORD NO.</u> | <u>FORM</u> | <u>IDENTIFICATION</u> | |
|-----------------|--------------|--|----------|
| 0 | Fixed Pt. | Fortran record size indicator (=000117010001) This indicates a total data word count of 79. | |
| 1 | Floating Pt. | Day of year } time of orbit data Milliseconds of day } in this record | |
| 2 | " " | | |
| * 3 | " " | Longitude (deg.) } satellite position in Latitude (deg.) } geocentric coordinates | |
| * 4 | " " | | |
| * 5 | " " | Longitude (deg.) } satellite position in Latitude (deg.) } geomagnetic coordinates | |
| * 6 | " " | | |
| * 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 } Satellite position in Geocentric X } Solar Ecliptic Coordinates (km.) | |
| * 10 | " " | | GSE Y |
| * 11 | " " | | GSE Z |
| * 12 | " " | GSM } Satellite position in Geocentric Solar X } Magnetospheric Coordinates (km.) | |
| * 13 | " " | | GSM Y |
| * 14 | " " | | GSM Z |
| 15 | " " | GSE } Moon position in Geocentric Solar X } Ecliptic Coordinates (km.) | |
| 16 | " " | | GSE Y |
| 17 | " " | | GSE Z |
| 18 | " " | GSM } Moon position in Geocentric Solar X } Magnetospheric Coordinates (km.) | |
| 19 | " " | | GSM Y |
| 20 | " " | | GSM Z |

| <u>WORD NO.</u> | <u>FORM</u> | <u>IDENTIFICATION</u> | |
|-----------------|--------------|--|---|
| 21 | Floating Pt. | GEI | } Satellite position in Geocentric Equatorial Inertial (km.) |
| 22 | " " | X GEI | |
| 23 | " " | Y GEI Z | |
| 24 | " " | GEI | } Sun position in Geocentric Equatorial Inertial (A.U.) |
| 25 | " " | X GEI | |
| 26 | " " | Y GEI Z | |
| 27 | " " | Longitude | } Sub-solar point in geomagnetic coordinates (deg.) |
| * 28 | " " | Latitude | |
| 29 | " " | Distance from the satellite to the Moon (km.) | |
| 30 | " " | Distance parallel to the x-axis (GEI) 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 | |

| <u>WORD NO.</u> | <u>FORM</u> | <u>IDENTIFICATION</u> |
|-----------------|--------------|--|
| 49 | Floating Pt. | Right Ascension |
| 50 | " " | Declination |
| 51 | " " | Right Ascension |
| 52 | " " | Declination |
| 53 | " " | Magnitude of the velocity (km./sec.) |
| 54 | " " | L McIlwain parameter (earth radii) |
| 55 | " " | B Magnetic field strength (Gamma) |
| 56 | " " | B/B Ratio of the magnetic field strength at the satellite-to-the-field strength at the invariant equator |
| * 57 | " " | Satellite-earth-sun-angle, Lsep (deg.) |
| 58 | " " | Satellite-earth-moon angle (deg.) |
| 59 | " " | Right ascension |
| 60 | " " | Declination |
| 61 | " " | Longitude |
| 62 | " " | Latitude |
| 63 | " " | GSE |
| 64 | " " | X |
| 65 | " " | Y |
| 65 | " " | Z |
| 66 | " " | Constant = 1.00 |
| 67 | " " | Date of data (YR MO DA) |
| 68 | " " | Longitude |
| 69 | " " | Latitude |
| 70 | " " | Height above spheroid (km.) |
| 71 | " " | Ascending node crossing 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 QA-ST Counter (Seconds). |

| <u>WORD NO.</u> | <u>FORM</u> | <u>IDENTIFICATION</u> |
|-----------------|--------------|---|
| * 77 | Floating Pt. | Spin period (Seconds) |
| * 78 | " " | Right Ascension } Spin vector in celestial Declination } inertial (Deg.) |
| * 79 | " " | |
| 80 | " " | Spare |
| 81 | Fixed Pt. | FORTRAN record size indicator (=000117010001 ₈) This indicates a total data word count of 79 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).

Words 54-56, 59, 60, 63-65 pertaining to magnetic field model will be set =
zero unless the spacecraft fails to achieve the proper orbit and perigee
is close enough to warrant the computation of these values.

TENTATIVE LIST OF ARCHIVE TAPE ITEMS*

| | | | | | | |
|---------|---|---------|------|------|------------|------------|
| 1 | Satellite I.D. ("IMPH") | | | | | |
| 2 | Year | | | | | |
| 3 | Day of year | | | | | |
| 4 | Time of day (in milliseconds) | | | | | |
| 5 | Orbit number | | | | | |
| 6-21 | DPP channel values (16) | | | | | |
| 22-37 | APP channel values** (16) | | | | | |
| 38 | Album number | | | | | |
| 39 | Page number | | | | | |
| 40 | APP change*** | | | | | |
| 41 | Mode (e.g., CAL-RUN, CAL-STBY, CAL-OFF) | | | | | |
| 42 | Satellite clock (in milliseconds) | | | | | |
| 43-58 | L1 counts/sector | sectors | 1-16 | } | SNAPSHOT 1 | |
| 59-74 | L3 | " | " | | | 1-16 |
| 75-82 | L5 | " | " | | | 1-8 |
| 83-90 | L9 | " | " | | | 1-8 |
| 91-106 | L2 | " | " | 1-16 | } | SNAPSHOT 2 |
| 107-122 | L4 | " | " | 1-16 | | |
| 123-130 | L6 | " | " | 1-8 | | |
| 131-138 | L10 | " | " | 1-8 | | |
| 139-154 | F | " | " | 1-16 | } | SNAPSHOT 3 |
| 155-170 | L7 | " | " | 1-16 | | |
| 171-178 | L12 | " | " | 1-8 | | |
| 179-186 | L11 | " | " | 1-8 | | |
| 187-202 | G1 | " | " | 1-16 | } | SNAPSHOT 0 |
| 203-218 | L8 | " | " | 1-16 | | |
| 219-226 | G2 | " | " | 1-8 | | |
| 227-234 | G3 | " | " | 1-8 | | |
| 235-238 | DPP change*** | (4) | | | | |
| 239-242 | DPP force flags | (4) | | | | |

* Each archive tape record will contain items #1-259. Coordinate information will be linearly interpolated to synchronize with the data. One record corresponds to one page (app. 20 seconds) of data.

** Converted to engineering units (e.g., APP-1 = 12.80 means the satellite temperature reads 12.80 C°).

*** During one page of data one APP channel and four DPP channels will change. These data items are the channel numbers which changed for the given page.

| | | | |
|-----|---|---|-------------------------|
| 243 | Longitude (deg.) | } Geocentric Coordinates | } Satellite Position |
| 244 | Latitude (deg.) | | |
| 245 | Longitude (deg.) | } Geomagnetic Coordinates | |
| 246 | Latitude (deg.) | | |
| 247 | R (earth radii) | geomagnetic coordinate of satellite | |
| 248 | r, | radial distances of satellite from center of earth | |
| 249 | GSE _x | } Geocentric Solar Ecliptic Coordinates (km.) | |
| 250 | GSE _y | | |
| 251 | GSE _z | | |
| 252 | GSE _x | } Geocentric Solar Magnetospheric Coordinates (km.) | |
| 253 | GSE _y | | |
| 254 | GSE _z | | |
| 255 | Latitude of sub-solar point in geomagnetic coordinates (deg.) | | |
| 256 | Satellite-earth-sun-angle, Lsep (deg.) | | |
| 257 | Spin period (seconds) | | |
| 258 | Right Ascension | } Spin vector in celestial inertial (deg.) | |
| 259 | Declination | | |

C P M E DECOM Tapes

7/26/72 - Mel Banks said 4 days (approximately) per tape.
(max of 58 files)
9594 bytes / 4 albums = 5.5 minutes

$$9594 \times 8 = 76752 \text{ bits} / 6 = 12792 \text{ frames}$$

$$12792 \text{ frames} / 800 \text{ BPI} = 16 \text{ inches} + .75 \text{ " gap}$$

$$= 16.75 \text{ inches} / 5.5 \text{ minutes}$$

$$2000' / \text{tape} = \frac{24000 \text{ inches} / \text{tape}}{16.75 \text{ inches} / 5.5 \text{ mins.}} = 1432 \times 5.5 \text{ mins} / \text{tape}$$

$$= 7880 \text{ mins} / \text{tape}$$

$$= \boxed{5.4 \text{ days} / \text{tape}}$$

$$2300' / \text{tape} = \frac{27600 \times 5.5}{16.75} = 9062 \text{ mins} / \text{tape} = 6.2 \text{ days}$$

CPME archive tapes

1 LRECL - (2 albums) = 14,508 bytes

1 Phys. Rec (4 albums) = 29,016 "

$$29,016 \text{ frames} / 1600 = 18.135'' + .75' \text{ gap} \\ = \underline{19''} / 5.5 \text{ mins}$$

$$2000' \text{ tape} = \frac{24000' T}{19'' / 5.5 \text{ mins}} = \frac{24000 \times 5.5 \text{ mins} / \text{tape}}{19''}$$

$$= 6947 \text{ mins} / \text{tape}$$

$$= \boxed{4.8 \text{ days} / \text{tape}}$$

Decom tape will
contain 4 days/tape

MST

$$1440 \text{ mins/day} * 4 \text{ days/week} = 5760 \text{ mins/week}$$

$$5760 / 5.5 \text{ min} = 1047 \text{ av. tapes}$$

$$1047 \text{ av. tapes} * 3012 \text{ bytes/AV} = 3,154,385 \text{ bytes/tape}$$

@ 1600 BPI and 10 to 1 blocking

$$100 - 30K \text{ blocks} = \left(\frac{30000 \text{ bytes}}{1600 \text{ Bytes/inch}} + .75'' \right) * 100$$

$$= 19.5 * 100 = \frac{1950''}{12''/ft}$$

$$= 162' \text{ per decom tape}$$

or about 12 Decom tapes/MST
at 1600 bpi & 30K blocks