REPLY TO
ATTN OF: FM73 (72-62)                                   April 3, 1972
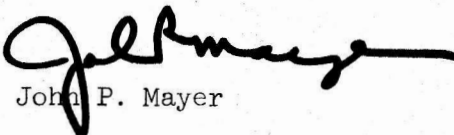
MEMORANDUM

TO:        FS/Chief, Flight Support Division

FROM:      FM/Chief, Mission Planning and Analysis Division

SUBJECT:   Final Prelaunch Erasable Load Parameters for Apollo 16
           Flight Programs Using April 16, 1972, Launch Data

The enclosure to this memorandum defines the final Apollo 16 prelaunch
erasable load parameters for Colossus 3 and Luminary 1E that have been
assigned to the Mission Planning and Analysis Division (MPAD). As
requested by the Flight Support Division (FSD), MPAD is to supply on
computer cards to the Guidance Program Section (GPS) the preliminary
and final engineering values for the specified erasable quantities.
The Guidance and Dynamics Branch (GDB) of the MPAD coordinated with the
appropriate MPAD branches for the definition of those parameters and
ensured that the data was supplied in the correct format and on schedule.

Tables II and III present a listing of these erasable quantities just
as they appear on the computer cards. It should be noted that in some
cases the listing gives both the engineering and octal values; however,
the octal value is supplied to FSD only for the purpose of comparison.
The name, description, and units for each erasable quantity are given
in table I. Certain of the erasable parameters are launch date dependent
variables which are given in tables II and III are valid for an April 16,
1972, launch date. Any questions or comments concerning the erasable load
should be directed to Aldo Bordano or to Harry Miles, ext. 2855.

John P. Mayer

Enclosure

Distribution:
See list attached

FM73:HJMiles:bla:3/29/72:2855

| CMC name | Description | Engineering Units | AGC Units |
|---|---|---|---|
| NO. PASS | Number of passes of P24 before landmark coordinate update | unitless | unitless |
| RTED1 | First coefficient defining high speed V-$\gamma$ target line polynomial | unitless | unitless |
| DVTHRESH | Threshold value of $\Delta V$ which must be sensed in two second period or SPS thrust failure is indicated | fps | m/cs |
| HORIZALT | Horizon altitude | km | m |
| ALTVAR | COAS angular error variance | $(rad)^2$ | $(rad)^2$ |
| EMDOT | SPS mass flow rate | lb/sec | kg/cs |
| UNITW[1] | Polar axis unit vector in reference coordinates | unitless | unitless |
| EIMP1SEC | SPS impulse acquired from a one second burn | lb-sec | kg-m/cs |
| EFIMP01 | SPS minimum impulse constant equal to the slope of the minimum impulse curve from 0 to 1 second. Used to estimate burn time when burn time is less than 1.0 second | lb | kg-m/cs/sec |
| EFIMP16 | SPS thrust used to estimate burn time when the burn is between 1 and 6 sec | lb | kg-m/cs/sec |
| E3J22R2M | Product of J22 lunar potential coeff., $\mu$moon, radius of the moon squared, and 3.0 | $m^5/(cs)^2$ | $m^5/(cs)^2$ |
| E32C31RM | Product of C(3, 1) lunar potential coeff., $\mu$moon, radius of the moon cubed, and 1.5 | $m^6/(cs)^2$ | $m^6/(cs)^2$ |
| WRENDPOS | W-matrix initialization for rendezvous navigation | ft | m |
| WRENDVEL | W-matrix initialization for rendezvous navigation | fps | m/cs |
| RMAX | Rendezvous navigation position update threshold limit | ft | m |
| VMAX | Rendezvous navigation velocity update threshold limit | fps | m/cs |
| WORBPOS | W-matrix initialization for orbital navigation | ft | m |

Table I

| CMC name | Description | Engineering Units | AGC Units |
|---|---|---|---|
| WORBVEL | W-matrix initialization for orbital navigation | ft/sec | m/cs |
| S22WSUBL | W-matrix initialization for orbital navigation | ft | m |
| RPVAR | Primary body radius error variance | $m^2$ | $m^2$ |
| 504LM[1] | Lunar libration correction vector in moon-fixed coordinates | rad | rad |
| EMSALT | EMS initialization altitude | ft | m |
| RLS[4] | Lunar landing site radius vector | ft | m |
| TIMEMO[1] | Time at center of range over which lunar position polynomial is valid | hrs | cs |
| VECOEM[1] | Lunar position polynomial coefficients | $\underline{c}_0 - \underline{c}_9$ $(m/cs^n)$ | $\underline{c}_0 - \underline{c}_9$ $(m/cs^n)$ |
| RESO[1] | Position vector of sun at TIMEMO | ft | m |
| VESO[1] | Velocity vector of sun at TIMEMO | ft/sec | m/cs |
| OMEGAES[1] | Angular velocity of solar position vector at TIMEMO | deg/sec | rev/cs |
| DTF | Value subtracted from SIVB time-to-go in P15 to account for thrust decay | sec | cs |
| HAMDELH | Gives required altitude difference in P31 | n.mi. | m |
| WRDTIME | Used in MINKEY to check if sufficient time has elapsed since the previous W-matrix initialization | sec | cs |
| MINBLKTM | Used in MINKEY to check whether the time since last mark is excessive | sec | cs |
| TBEFCOMP | Used in MINKEY to check if sufficient time remains before the final targeting computation so that W-matrix reinitialization can take place | sec | cs |
| BRNBLKTM | Used in MINKEY to determine the age of W-matrix following next maneuver | sec | cs |

Table I (continued)

| CMC name | Description | Engineering Units | AGC Units |
|---|---|---|---|
| MAXWTIME | Used in MINKEY to determine if W-matrix age will be excessive after next maneuver | sec | cs |
| FINCMPTM | Used in MINKEY to allow for length of time of final targeting computation | sec | cs |
| INTVAR | Coasting integration error variance | $m^2$ | $m^2$ |
| LAUNCHAZ[1] | Desired azimuth of the stable member X-axis east of true north | deg | rev |
| WMIDPOS | W-matrix initialization for cislunar midcourse navigation | ft | m |
| WMIDVEL | W-matrix initialization for cislunar midcourse navigation | fps | m/cs |
| RVAR | VHF range error variance | perc err | perc err |
| RVARMIN | VHF minimum range error variance | $ft^2$ | $m^2$ |
| LADPAD | Reference L/D ratio | unitless | unitless |
| LODPAD | Final phase reference L/D ratio | unitless | unitless |
| ALFAPAD | Hypersonic value of angle of attack $\alpha$ for CM in trimmed flight | deg | rev |
| P37RANGE | Nominal inertial range from 300,000 ft altitude to 25,000 ft altitude | n.mi. | "rev" |
| ETDECAY | Value subtracted from time-to-go which compensates for SPS thrust tailoff | sec | cs |
| PACTOFF | Pitch angle to CSM c.g. at insertion | deg | cdu puls |
| YACTOFF | Yaw angle to CSM c.g. at insertion | deg | cdu puls |
| LEMMASS | LM mass (at transposition and docking) | lb | kg |
| CSMMASS | CSM mass (at transposition and docking) | lb | kg |
| POLYNUM + 0 | Boost monitor pitch polynomial degree information | unitless | unitless |
| POLYNUM + 1 | Boost monitor pitch polynomial coefficients, $A_0 - A_6$ | $A_0 - A_6$ (deg/sec$^n$) | $A_0 - A_6$ (rev/cs$^n$) |

Table I (continued)

| CMC name | Description | Engineering Units | AGC Units |
|----------|-------------|-------------------|-----------|
| SATRLRT | Boost roll rate | deg/sec | rev/cs |
| RPSTART | Time from lift-off to start boost polynomial and booster roll | sec | cs |
| POLYSTOP | Time increment after RPSTART to stop boost polynomial and hold display of attitude error constant | sec | cs |
| HORISLP | Slope of function used for horizon altitude computation | unitless | unitless |
| LAT (SPL) | Entry target data for boost aborts, latitude | deg | rev |
| LNG (SPL) | Entry target data for boost aborts, longitude | deg | rev |

Table I (continued)

| LGC name | Description | Engineering Units | AGC Units |
|---|---|---|---|
| MASS | Total vehicle mass (CSM/LM separation) | lb | kg |
| LEMMASS | LM mass (at CSM/LM separation) | lb | kg |
| CSMMASS | CSM mass (at CSM/LM separation) | lb | kg |
| E3J22R2M | Product of J22 lunar potential coefficient, $\mu$moon, radius of the moon squared, and 3.0 | $m^5/(cs)^2$ | $m^5/(cs)^2$ |
| E32C31RM | Product of C(3,1) lunar potential coefficient, $\mu$moon, radius of the moon cubed, and 1.5 | $m^6/(cs)^2$ | $m^6/(cs)^2$ |
| TOOFEW | Minimum number of consecutive ROD calculations required before bypass the issuing of program alarm in P66 | unitless | unitless |
| X789 | Vector containing the best estimate of bias necessary to offset the rendezvous radar pointing error | rad | rad |
| -AYO[1] | True to mean pole rotation about the -Y-axis | rad | rad |
| AXO[1] | True to mean pole rotation about the +X-axis | rad | rad |
| REFSMMAT | Nominal descent REFSMMAT | unitless | unitless |
| RANGEVAR | Variance expected in measured range | unitless | unitless |
| RATEVAR | Variance expected in measured range rate | unitless | unitless |
| RVARMIN | Minimum rendezvous radar range error variance | $(ft)^2$ | $m^2$ |
| VVARMIN | Minimum rendezvous radar range rate error variance | $ft^2/sec^2$ | $(m/cs)^2$ |
| WRENDPOS | 1st-3rd diagonal components of W-matrix | ft | m |
| WRENDVEL | 4th-6th diagonal components of W-matrix | fps | m/cs |
| WSHAFT | 7th diagonal component of W-matrix | millirad | rad |

Table I (continued)

| name | Description | Engineering Units | AGC Units |
|------|-------------|-------------------|-----------|
| WTRUN | 8th diagonal component of W-matrix | millirad | rad |
| RMAX | Maximum value of rendezvous position update allowed without astronaut approval | ft | m |
| VMAX | Maximum value of rendezvous velocity update allowed without astronaut approval | fps | m/cs |
| WSURFPOS | Initialization of position portion of W-matrix for P22(LM on lunar surface tracking CSM) | ft | m |
| WSURFVEL | Initialization of velocity portion of W-matrix for P22(LM on lunar surface tracking CSM) | fps | m/cs |
| SHAFTVAR | Variance associated with the measured value of the rendezvous radar shaft angle | $(\text{millirad})^2$ | $(\text{rad})^2$ |
| TRUNVAR | Variance associated with the measured value of the rendezvous radar trunnion angle | $(\text{millirad})^2$ | $(\text{rad})^2$ |
| 504LM[1] | Lunar libration correction vector in moon-fixed coordinates | rad | rad |
| RLS[4] | Lunar landing site radius vector | ft | m |
| TLAND | Nominal time of lunar landing | hr(g.e.t.) | cs(g.e.t.) |
| VELBIAS | Velocity portion of LR reasonability test | fps | m/cs |
| RBRFG | High-gate position aimpoint vector in the descent guidance coordinate system | ft | m |
| RAPFG | Low-gate position aimpoint vector in the descent guidance coordinate system | ft | m |
| VBRFG | High-gate velocity aimpoint vector expressed in the descent guidance coordinate system | fps | m/cs |
| VAPFG | Low-gate velocity aimpoint vector expressed in the descent guidance coordinate system | fps | m/cs |

Table I (continued)

| LGC name | Description | Engineering Units | AGC Units |
|---|---|---|---|
| ABRFG | High-gate acceleration aimpoint vector expressed in the descent guidance coordinate system | $ft/(sec)^2$ | $m/(cs)^2$ |
| AAPFG | Low-gate acceleration aimpoint vector expressed in the descent guidance coordinate system | $ft/(sec)^2$ | $m/(cs)^2$ |
| VBRFG*$^2$ | Z component of VBRFG multiplied by 18 | fps | m/cs |
| VAPFG*$^2$ | Z component of VAPFG multiplied by 18 | fps | m/cs |
| ABRFG* | Z component of ABRFG multiplied by 6 | $ft/(sec)^2$ | $m/(cs)^2$ |
| AAPFG* | Z component of AAPFG multiplied by 6 | $ft/(sec)^2$ | $m/(cs)^2$ |
| JBRFG*$^3$ | High-gate jerk aimpoint, Z component only | $ft/(sec)^3$ | $m/(cs)^3$ |
| JAPFG*$^3$ | Low-gate jerk aimpoint, Z component only | $ft/(sec)^3$ | $m/(cs)^3$ |
| GAINBRAK | Gain constant used in the orientation of the descent guidance system in P63 | unitless | unitless |
| GAINAPPR | Gain constant used in the orientation of the descent guidance coordinate system in P64 | unitless | unitless |
| TCGFBRAK | Latest time guidance frame is erected in braking phase | sec | cs |
| TCGIBRAK | Earliest time guidance frame is erected in braking phase | sec | cs |
| TCGFAPPR | Latest time guidance frame is erected in approach phase | sec | cs |
| TCGIAPPR | Earliest time guidance frame is erected in approach phase | sec | cs |
| VIGN | Speed desired at ignition, relative to the rotating moon | fps | m/cs |
| RIGNX | X component of desired position relative to the landing site.  Expressed in the descent guidance coordinate system. | ft | m |
| RIGNZ | Z component of desired position relative to the landing site (desired cross range component is zero) | ft | m |

Table I (continued)

| LGC name | Description | Engineering Units | AGC Units |
|---|---|---|---|
| KIGNX/B4 | Landing site vertical error scale factor used in the ignition-time test quantity | unitless | unitless |
| KIGNY/B8 | Cross-range error scale factor | $ft/ft^2$ | $m^{-1}$ |
| KIGNV/B4 | Speed error scale factor used in the ignition-time test quantity | sec | cs |
| LOWCRIT | Upper limit on the variable throttle region in a situation of decreasing thrust commands | lbf | DPS throttle pulses |
| HIGHCRIT | Upper limit on the variable throttle region in a situation of increasing thrust commands | lbf | DPS throttle pulses |
| TAUHZ | Time constant for nulling horizontal velocity in P66 auto | sec | cs |
| QHZ | Feedback constant for previous acceleration level | unitless | unitless |
| AHZLIM | Maximum horizontal acceleration in auto P66 | $ft/sec^2$ | $m/cs^2$ |
| 2LATE466 | Maximum time after start of servicer cycle for which 2nd ROD calculation will be started | sec | cs |
| DELQFIX | LR data reasonableness test parameter | ft | m |
| LRVMAX | Maximum limit for velocity calculations that are allowed to be updated by the LR | fps | m/cs |
| LRVF | Value at which velocity update coefficients are changed | fps | m/cs |
| LRWVZ | Weighting factor for LR Z-axis velocity update | unitless | unitless |
| LRWVY | Weighting factor for LR Y-axis velocity update | unitless | unitless |
| LRWVX | Weighting factor for LR X-axis velocity update | unitless | unitless |
| LRWVFZ | LR velocity weighting function | unitless | unitless |

Table I (continued)

| LGC name | Description | Engineering Units | AGC Units |
|----------|-------------|-------------------|-----------|
| LRWVFY | LR velocity weighting function | unitless | unitless |
| LRWVFX | LR velocity weighting function | unitless | unitless |
| LRWVFF | Weighting factor used for P66 | unitless | unitless |
| ABSC0-ABSC4 | Range to $I^{th}$ segment of lunar terrain | ft | m |
| SLOPE0-SLOPE4 | Slope of $I^{th}$ segment of lunar terrain model | rad | rad |
| RODSCALE | Click scale factor for rate of descent | fps | m/cs |
| TAUROD | Time constant for rate of descent | sec | cs |
| LAG/TAU | Lag time divided by TAUROD (P66) | unitless | unitless |
| MINFORCE | Minimum thrust P66 will command | lbf | $kg\text{-}m/(cs)^2$ |
| MAXFORCE | Maximum thrust P66 will command | lbf | $kg\text{-}m/(cs)^2$ |
| J1PARM | Parameter used in the computation of insertion velocity for aborts if the LM to CSM phase angle existing at the time of abort is less than THETCRIT | ft | m |
| K1PARM | Same definition as J1PARM | ft/rad | m/rev |
| J2PARM | Parameter used in the computation of insertion velocity for aborts if the LM to CSM phase angle existing at the time of abort is greater or equal to THETCRIT | ft | m |
| K2PARM | Same definition as J2PARM | ft/rad | m/rev |
| THETCRIT | Central angle switching criteria | deg | rev |
| RAMIN | The minimum apolune radius allowed for aborts from powered descent | ft | m |
| YLIM | Maximum cross range distance in aborts | n.mi. | m |
| ABTRDOT | Desired radial velocity for aborts | fps | m/cs |

Table I (continued)

| LGC name | Description | Engineering Units | AGC Units |
|---|---|---|---|
| COSTHET1 | Cosine $90^\circ$. Cosine of cone 1 angle for aborts. Used to determine direction of attitude rotation to preferred abort attitude | unitless | unitless |
| COSTHET2 | Cosine $30^\circ$. Cosine of cone 2 angle for aborts. Used to determine direction of attitude rotation to preferred abort attitude | unitless | unitless |
| HIASCENT | Upper bound on the mass of the ascent stage | lb | kg |
| ROLLTIME | Time to drive the DPS gimbal around the R-axis, starting at the hard stop, to position it prior to PDI | sec | cs |
| PITTIME | Time to drive the DPS gimbal around the Q-axis, starting at the hard stop, to position it prior to PDI | sec | cs |
| IGNAOSQ | Initial DAP estimate of offset acceleration about the Q-axis | $deg/(sec)^2$ | $rev/(sec)^2$ |
| IGNAOSR | Initial DAP estimate of offset acceleration about the R-axis | $deg/(sec)^2$ | $rev/(sec)^2$ |
| LRHMAX | Maximum limit for altitude calculations that are allowed to be updated by the LR | ft | m |
| LRWH | Weighting factor for incorporation of LR altitude measurements into the LM state vector during braking phase | unitless | unitless |
| ZOOMTIME | Time after ignition to raise the DPS to full throttle position | sec | cs |
| TENDBRAK | Controls time of transition from P63 to P64 | sec | cs |
| TENDAPPR | Controls time of transition from P64 to P66 | sec | cs |
| DELTTFAP | Time increment added to $t_{go}$ when switching from P63 to P64 | sec | cs |
| LEADTIME | Time increment specifying how far guidance is projected forward in P63 and P64 | sec | cs |

Table I (continued)

| LGC name | Description | Engineering Units | AGC Units |
|---|---|---|---|
| RPCRTIME | Time from the end of the present descent guidance phase at which the LR may be re-positioned to position 2 | sec | cs |
| RPCRTQSW | Required X component of the X-body axis in platform coordinates at the time of LR reposition to position 2 | unitless | unitless |
| TNEWA | Cycle period at which Lambert solution updates A-steer target parameters | cs | cs |
| LRWH1 | Weighting factor for incorporation of LR altitude measurements into the LM state vector during approach phase | unitless | unitless |

1  These values are valid for a launch date of April 16, 1972.

2  To achieve the proper octal value in the LGC, this number should be scaled B13.

3  To achieve the proper octal value in the LGC, this number should be scaled B-21.

4  Descartes landing site used for April 16, 1972 launch date.

Table I (concluded)

| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| BTC | NO.PASS | + 0 | 0737 | 2 | | 1.6383000000E+04 | | | 37777 |
| DWH | RTEDT | + 0 | 1342 | 1 | 1.6602637000E+00 | | | 06510 | 07025 |
| HJM | DVTHRESH | + 0 | 1344 | 1 | 2.0000000000E+00 | 6.0960000000E-03 | | | |
| BTC | HORIZALT | | 1345 | 2 | | +2.8000000000E+04 | | 00000 | 33260 |
| BTC | ALTVAR | | 1347 | 2 | | +1.5216800000E-05 | | | 37723 |
| HJM | EMDOT | + 0 | 1350 | 1 | 6.5978420000E+01 | 2.9927308190E-01 | | | |
| DAC | UNITW | + 0 | 1711 | 2 | | .5428865552E-04 | | 00000 | 34355 |
| DAC | UNITW | + 2 | 1713 | 2 | | .2460554242E-04 | | 00000 | 14715 |
| DAC | UNITW | + 4 | 1715 | 2 | | .9999999963E+00 | | 37777 | 37777 |
| HJM | EIMP1SEC | + 0 | 1763 | 1 | 1.9286838000E+04 | 8.5792129720E+02 | | | |
| HJM | EFIMP01 | + 0 | 1764 | 1 | 2.4195938000E+04 | 1.0762889446E+03 | | | |
| HJM | EFIMP16 | + 0 | 1765 | 1 | 2.0779000000E+04 | 9.2429614663E+02 | | | |
| BTC | E3J22R2M | | 1766 | 2 | | +9.204790479E+16 | | | 12160 |
| BAC | E32C31RM | | 1767 | 2 | | +1.312892560E+23 | | | 03363 |
| BAC | WRENDPOS | | 2000 | 1 | +1.000000000E+04 | +3.048000000E+03 | | | 00137 |
| BAC | WRENDVEL | | 2001 | 1 | +1.000000000E+01 | +3.048000000E-02 | | | 00763 |

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| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| BTC | RMAX | | 2002 | 1 | +2.000000000E+03 | +6.096000000E+02 | | | 00023 |
| BTC | VMAX | | 2003 | 1 | +2.000000000E+00 | +6.096000000E-03 | | | 00001 |
| BTC | WORBPOS | | 2004 | 2 | | +0.000000000E+00 | | | 00000 |
| BTC | WORBVEL | | 2005 | 2 | | +0.000000000E+00 | | | 00000 |
| BTC | S22WSUBL | | 2006 | 2 | | +1.000000000E+04 | | | 00471 |
| BTC | RPVAR | | 2007 | 2 | | +4.000000000E+06 | | 00364 | 04400 |
| BTC | 504LM | + 0 | 2011 | 2 | | -.4820525646E-05 | | 77777 | 75361 |
| BTC | 504LM | + 2 | 2013 | 2 | | .6953775883E-03 | | 00013 | 14450 |
| BTC | 504LM | + 4 | 2015 | 2 | | .2514459193E-03 | | 00004 | 03651 |
| DWN | EMSALT | + 0 | 2017 | 1 | 2.9000010000E+05 | | | 00002 | 26244 |
| BTC | RLS | | 2025 | 2 | | +1.653875942E+06 | | 00311 | 34350 |
| BTC | RLS | +02 | 2027 | 2 | | +4.591698947E+05 | | 00070 | 01504 |
| BTC | RLS | +04 | 2031 | 2 | | -2.718648303E+05 | | 77736 | 72015 |
| BTC | TIMEMO | + 0 | 2033 | 2 | | .2572555765E+10 | 00011 | 22530 | 12765 |
| BTC | VECOEM | + 0 | 2036 | 2 | | -.3106865846E-64 | | 77771 | 56461 |
| BTC | VECOEM | + 2 | 2040 | 2 | | .3882263800E-64 | | 00010 | 05524 |

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| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| | VECOEM | + 4 | 2042 | 2 | | .1641410656E-64 | | 00003 | 16503 |
| | VECOEM | + 6 | 2044 | 2 | | .6325714477E-56 | | 00023 | 33241 |
| | VECOEM | + 8 | 2046 | 2 | | -.1426626252E-57 | | 77777 | 61527 |
| | VECOEM | +10 | 2050 | 2 | | .4608531752E-57 | | 00001 | 16222 |
| | VECOEM | +12 | 2052 | 2 | | -.2267778214E-48 | | 77765 | 54467 |
| | VECOEM | +14 | 2054 | 2 | | -.7438416423E-48 | | 77735 | 46620 |
| | VECOEM | +16 | 2056 | 2 | | -.3828722397E-48 | | 77756 | 43000 |
| | VECOEM | +18 | 2060 | 2 | | -.1410582067E-41 | | 77777 | 40425 |
| | VECOEM | +20 | 2062 | 2 | | .7412106920E-40 | | 00063 | 24751 |
| | VECOEM | +22 | 2064 | 2 | | .3644418223E-40 | | 00031 | 14567 |
| | VECOEM | +24 | 2066 | 2 | | .7483079488E-32 | | 00115 | 26534 |
| | VECOEM | +26 | 2070 | 2 | | -.1965742175E-31 | | 77463 | 73546 |
| | VECOEM | +28 | 2072 | 2 | | -.9021137439E-32 | | 77642 | 52154 |
| | VECOEM | +30 | 2074 | 2 | | -.5938236055E-23 | | 76151 | 43216 |
| | VECOEM | +32 | 2076 | 2 | | .6002446572E-24 | | 00134 | 34211 |
| | VECOEM | +34 | 2100 | 2 | | -.2198476457E-24 | | 77735 | 77273 |

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| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| DAC | VECOEM | +36 | 2102 | 2 | | .2447903777E-15 | | 01064 | 16257 |
| DAC | VECOEM | +38 | 2104 | 2 | | .9020309289E-15 | | 04037 | 36105 |
| DAC | VECOEM | +40 | 2106 | 2 | | .4619401380E-15 | | 02051 | 05125 |
| DAC | VECOEM | +42 | 2110 | 2 | | .1194130768E-06 | | 10007 | 00042 |
| DAC | VECOEM | +44 | 2112 | 2 | | -.4158987110E-07 | | 75152 | 77347 |
| DAC | VECOEM | +46 | 2114 | 2 | | -.1011791007E-07 | | 77244 | 53172 |
| DAC | VECOEM | +48 | 2116 | 2 | | -.3532147765E+01 | | 74357 | 61224 |
| DAC | VECOEM | +50 | 2120 | 2 | | -.8139928222E+01 | | 67670 | 53324 |
| DAC | VECOEM | +52 | 2122 | 2 | | -.4267223120E+01 | | 73567 | 45641 |
| DAC | VECOEM | +54 | 2124 | 2 | | -.3764565440E+09 | | 72307 | 73523 |
| DAC | VECOEM | +56 | 2126 | 2 | | .1276269280E+09 | | 01715 | 26726 |
| DAC | VECOEM | +58 | 2130 | 2 | | .3062934400E+08 | | 00351 | 25674 |
| DAC | RESO | + 0 | 2132 | 2 | | .1252304896E+12 | | 16450 | 12150 |
| DAC | RESO | + 2 | 2134 | 2 | | .7652284723E+11 | | 10721 | 03577 |
| DAC | RESO | + 4 | 2136 | 2 | | .3318243328E+11 | | 03671 | 32360 |
| DAC | VESO | + 0 | 2140 | 2 | | -.1640953331E+03 | | 65574 | 76301 |

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| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| B+C | VESO | + 2 | 2142 | 2 | | .2260438023E+03 | | 16101 | 14665 |
| B+C | VESO | + 4 | 2144 | 2 | | .9801039886E+02 | | 06100 | 12514 |
| B+C | OMEGAES | + 0 | 2146 | 2 | | .3131201409E-09 | | 00530 | 10737 |
| L.G. | DTF | + 0 | 2354 | 1 | 3.0000000000E-01 | 3.0000000000E+01 | | | |
| aß | HAMDELH | + 0 | 2367 | 1 | 1.5000000000E+01 | 2.7780000000E+04 | | | |
| B+C | WRDTIME | | 2371 | 2 | | +2.400000000E+05 | | | 00017 |
| B+C | MINBLKTM | | 2372 | 2 | | +3.288000000E+04 | | | 00002 |
| B+C | YBEFCOMP | | 2373 | 2 | | +8.220000000E+04 | | | 00005 |
| B+C | BRNBLKTM | | 2374 | 2 | | +8.220000000E+04 | | | 00005 |
| B+C | MAXWTIME | | 2375 | 2 | | +3.616800000E+05 | | | 00026 |
| B+Ce | FINCMPTM | | 2376 | 2 | | +4.932000000E+04 | | | 00003 |
| B+& | INTVAR | | 2377 | 2 | | +1.960000000E+02 | | | 00142 |
| L.G. | LAUNCHAZ | | 2633 | 1 | 7.2034439090E+01 | +2.000956643E-01 | | | |
| B+C | WMIDPOS | | 3000 | 2 | +3.000000000E+04 | +9.144000000E+03 | | | 00436 |
| B+C | WMIDVEL | | 3001 | 2 | +3.000000000E+01 | +9.144000000E-02 | | | 02732 |
| B+C | RVAR | | 3002 | 2 | +0.000000000E+00 | +0.000000000E+00 | | 00000 | 00000 |

TABLE II    PAGE 5

| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| | RVARMIN | | 3004 | 2 | -4.0000000000E+04 | -3.7161216000E+03 | 77777 | 77777 | 42757 |
| DWH | LADPAD | + 0 | 3007 | 1 | 2.7000000000E-01 | | | | 10510 |
| DWH | LODPAD | + 0 | 3010 | 1 | 2.0700000000E-01 | | | | 06477 |
| DWH | ALFAPAD | + 0 | 3011 | 1 | -1.8510000000E+01 | | | | 74552 |
| DWH | P37RANGE | + 0 | 3012 | 1 | 1.0865330000E+03 | | | | 01470 |
| HJM | ETDECAY | + 0 | 3013 | 1 | 6.5550000000E-01 | 6.5550000000E+01 | | | |
| HJM | PACTOFF | + 0 | 3023 | 1 | -.5270000000E-00 | -.2221285657E+02 | | | |
| HJM | YACTOFF | + 0 | 3024 | 1 | 1.8980000000E+00 | 8.0000000000E+01 | | | |
| HJM | LEMMASS | + 0 | 3072 | 1 | 3.6208300000E+04 | 1.6423808773E+04 | | | |
| HJM | CSMMASS | + 0 | 3073 | 1 | 6.6887600000E+04 | 3.0339705308E+04 | | | |
| HJM | POLYNUM | + 0 | 3261 | 1 | 5.0000000000E+00 | 5.0000000000E+00 | | | |
| HJM | POLYNUM | +01 | 3262 | 1 | -.9520749700E-01 | -.2644652695E-03 | | | |
| HJM | POLYNUM | +03 | 3264 | 1 | 1.9666296000E-01 | 5.4628600000E-06 | | | |
| HJM | POLYNUM | +05 | 3266 | 1 | 9.5150055000E-03 | 2.6430570840E-09 | | | |
| HJM | POLYNUM | +07 | 3270 | 1 | -.1449852400E-03 | -.4027367778E-12 | | | |
| HJM | POLYNUM | +09 | 3272 | 1 | 1.9137262000E-06 | 5.3159061120E-17 | | | |

TABLE II     PAGE 6

| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| HJM | POLYNUM | +11 | 3274 | 1 | -.1512142600E-07 | -.4200396111E-21 | | | |
| HJM | POLYNUM | +13 | 3276 | 1 | 4.3469835000E-11 | 1.2074954170E-25 | | | |
| HJM | SATRLRT | + 0 | 3300 | 1 | 1.0000000000E+00 | 2.7777777778E-05 | | | |
| HJM | RPSTART | + 0 | 3302 | 1 | 1.1850000000E+01 | 1.1850000000E+03 | | | |
| HJM | POLYSTOP | + 0 | 3303 | 1 | -.1470000000E+03 | -.1470000000E+05 | | | |
| BFC | HORISLP | | 3375 | 2 | | +0.000000000E+00 | | 00000 | 00000 |
| | LAT(SPL) | + 0 | 3400 | 1 | 2.6500000000E+01 | 7.3611111120E-02 | | | |
| | LNG(SPL) | + 0 | 3402 | 1 | -.1700000000E+02 | -.4722222223E-01 | | | |

TABLE II     PAGE   7

| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| HJM | MASS | + 0 | 1243 | 1 | 3.6685200000E+04 | 1.6640126972E+04 | | | |
| JHq | LRWH1 | | 1315 | 1 | 3.5000000000E-01 | | | | 13146 |
| HJM | LEMMASS | + 0 | 1326 | 1 | 3.6685200000E+04 | 1.6640126972E+04 | | | |
| HJM | CSMMASS | + 0 | 1327 | 1 | 3.9354100000E+04 | 1.7850719665E+04 | | | |
| RAC | E3J22R2M | | 1347 | 2 | | +9.204790479E+16 | | | 12160 |
| RAC | E32C31RM | | 1350 | 2 | | +1.312892560E+23 | | | 03363 |
| JHq | TOOFEW | | 1354 | 1 | 3.0000000000E+00 | | | | 00003 |
| RAC | X789 | | 1700 | 2 | | 0.0000000000E+00 | | 00000 | 00000 |
| RAC | X789 | + 2 | 1702 | 2 | | 0.0000000000E+00 | | 00000 | 00000 |
| RAC | X789 | + 4 | 1704 | 2 | | 0.0000000000E+00 | | 00000 | 00000 |
| RAC | -AYO | + 0 | 1711 | 2 | | .5428865552E-04 | | 00000 | 34355 |
| RAC | AXO | + 0 | 1713 | 2 | | .2460554242E-04 | | 00000 | 14715 |
| GM | REFSMMAT | | 1731 | 1 | 6.7000809000E-01 | | | 12560 | 26464 |
| GM | REFSMMAT | +02 | 1733 | 1 | -5.9984904000E-01 | | | 66316 | 41130 |
| GM | REFSMMAT | +04 | 1735 | 1 | -4.3734347000E-01 | | | 71001 | 51020 |
| JHq | REFSMMAT | +06 | 1737 | 1 | 1.2951155000E-01 | | | 02044 | 36532 |

TABLE III    PAGE 1

FINAL E-LOAD LUMINARY 210 APOLLO 16

| | MNEMONIC | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|
| | REFSMMAT +08 | 1741 | 1 | -4.856443700E-01 | | | 70165 | 63173 |
| | REFSMMAT +10 | 1743 | 1 | 8.6450928000E-01 | | | 15652 | 01727 |
| | REFSMMAT +12 | 1745 | 1 | -7.309691600E-01 | | | 64233 | 74643 |
| | REFSMMAT +14 | 1747 | 1 | -6.358692600E-01 | | | 65646 | 76540 |
| | REFSMMAT +16 | 1751 | 1 | -2.476981900E-01 | | | 74022 | 73317 |
| | RANGEVAR | 1766 | 2 | | +1.111111111E-05 | | 01351 | 24734 |
| | RATEVAR | 1770 | 2 | | +1.877777778E-05 | | 02354 | 04761 |
| | RVARMIN | 1772 | 2 | | +6.600000000E+01 | | | 00410 |
| | VVARMIN | 1773 | 2 | | +1.744500000E-06 | | | 00165 |
| | WRENDPOS | 2000 | 2 | | +3.048000000E+03 | | | 05750 |
| | WRENDVEL | 2001 | 2 | | +0.304800000E-01 | | | 00763 |
| | WSHAFT | 2002 | 2 | | +0.015000000E+00 | | | 17270 |
| | WTRUN | 2003 | 2 | | +0.015000000E+00 | | | 17270 |
| | RMAX | 2004 | 2 | | +6.096000000E+02 | | | 00023 |
| | VMAX | 2005 | 2 | | +0.006096000E+00 | | | 00001 |
| | WSURFPOS | 2006 | 1 | +0.000000000E+00 | +0.000000000E+00 | | | 00000 |

TABLE III     PAGE  2

| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| AHC | WSURFVEL | | 2007 | 1 | +0.000000000E+00 | +0.000000000E+00 | | | 00000 |
| PHC | SHAFTVAR | | 2010 | 2 | | +1.000000000E-06 | | | 00103 |
| DHC | TRUNVAR | | 2011 | 2 | | +1.000000000E-06 | | | 00103 |
| DHC | 504LM | + 0 | 2012 | 2 | | -.4820525646E-05 | | 77777 | 75361 |
| DHC | 504LM | + 2 | 2014 | 2 | | .6953775883E-03 | | 00013 | 14450 |
| DHC | 504LM | + 4 | 2016 | 2 | | .2514459193E-03 | | 00004 | 03651 |
| RHC | RLS | | 2025 2 2020 | | | +1.653875942E+06 | | 00311 | 34350 |
| DHC | RLS | +02 | 2027 2 2022 | | | +4.591698947E+05 | | 00070 | 01504 |
| DHC | RLS | +04 | 2031 2 2024 | | | -2.718648303E+05 | | 77736 | 72015 |
| JHL | TLAND | | 2026 | 2 | | 3.5560224000E+07 | | 04172 | 15440 |
| JHL | VELBIAS | | 2400 | 1 | 2.5000000000E+00 | | | 00001 | 36331 |
| JHL | RBRFGX | | 2402 | 1 | -3.1183588000E+03 | | | 77777 | 42227 |
| JHL | RAPFGX | | 2404 | 1 | 1.5850000000E+02 | | | 00000 | 01405 |
| JHL | RBRFGZ | | 2406 | 1 | -1.1741441000E+04 | | | 77774 | 60122 |
| JHL | RAPFGZ | | 2410 | 1 | -2.7355400000E+01 | | | 77777 | 77572 |
| JHL | VBRFGX | | 2412 | 1 | -1.9646916000E+02 | | | 77766 | 55311 |

TABLE III    PAGE  3

| | MNEMONIC | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|
| *JHa* | VAPFGX | 2414 | I | -3.534760000E+00 | | | 77777 | 72367 |
| *JHa* | VBRFGZ | 2416 | I | -1.667599700E+02 | | | 77767 | 73603 |
| *JHa* | VAPFGZ | 2420 | I | 2.49505000000E-02 | | | 00000 | 00024 |
| *JHa* | ABRFGX | 2422 | I | -7.182481400E-01 | | | 77772 | 50265 |
| *JHa* | AAPFGX | 2424 | I | 7.71783000000E-02 | | | 00000 | 23567 |
| *JHa* | ABRFGZ | 2426 | I | -8.302450300E+00 | | | 77675 | 65140 |
| *JHa* | AAPFGZ | 2430 | I | -5.896270000E-01 | | | 77773 | 51173 |
| *JHa* | VBRFG* | 2432 | I | -3.001680000E+03 | | | 77755 | 66351 |
| *JHa* | VAPFG* | 2434 | I | 4.49109000000E-01 | | | 00000 | 00055 |
| *JHa* | ABRFG* | 2436 | I | -4.981470200E+01 | | | 77161 | 77106 |
| *JHa* | AAPFG* | 2440 | I | -3.537762000E+00 | | | 77743 | 67344 |
| *JHa* | JBRFG* | 2442 | I | -1.512365900E-02 | | | 77541 | 63456 |
| *JHa* | JAPFG* | 2444 | I | 4.31736000000E-02 | | | 00704 | 04643 |
| *JHa* | GAINBRAK | 2446 | I | 9.9999999963E-01 | | | 37777 | 37777 |
| *JHa* | GAINAPPR | 2450 | I | 0.0000000000E+00 | | | 00000 | 00000 |
| *JHa* | TCGFBRAK | 2452 | I | 3.0000000000E+01 | | | | 00567 |

TABLE III      PAGE  4

| MNEMONIC | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|
| TCGIBRAK | 2453 | 1 | $9.0000000000E+02$ | | | | 25762 |
| TCGFAPPR | 2454 | 1 | $6.0000000000E+00$ | | | | 00113 |
| TCGIAPPR | 2455 | 1 | $2.0000000000E+02$ | | | | 04704 |
| VIGN | 2456 | 1 | $5.5434605000+<03$ | | | 00416 | 12774 |
| RIGNX | 2460 | 1 | $-1.5954872000E+05$ | | | 77720 | 60230 |
| RIGNZ | 2462 | 1 | $-1.5476233000E+06$ | | | 77063 | 52706 |
| KIGNX/B4 | 2464 | 1 | $-3.3400000000E-01$ | | | 77251 | 77371 |
| KIGNY/B8 | 2466 | 1 | $-2.2070000000E-07$ | | | 76366 | 60601 |
| KIGNV/B4 | 2470 | 1 | $-4.9800000000E+02$ | | | 71727 | 57777 |
| LOWCRIT | 2472 | 1 | $5.9850000000E+03$ | | | | 04114 |
| HIGHCRIT | 2473 | 1 | $6.6150000000E+03$ | | | | 04454 |
| TAUHZ | 2474 | 1 | $5.0000000000E+00$ | | | | 07640 |
| QHZ | 2475 | 1 | $4.0000000000E-01$ | | | | 14632 |
| AHZLIM | 2476 | 1 | $1.9389800000E+00$ | | | | 00017 |
| PLATE466 | 2477 | 1 | $1.5000000000E+00$ | | | 00000 | 00226 |
| DELQFIX | 2503 | 1 | $1.0000000000E+02$ | | | 00000 | 00750 |

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| | MNEMONIC | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|
| | LRVMAX | 2511 | I | 2.5000000000E+03 | | | | 01717 |
| | LRVF | 2512 | I | 2.0000000000E+02 | | | | 00116 |
| | LRWVZ | 2513 | I | 3.0000000000E-01 | | | | 11463 |
| | LRWVY | 2514 | I | 3.0000000000E-01 | | | | 11463 |
| | LRWVX | 2515 | I | 3.0000000000E-01 | | | | 11463 |
| | LRWVFZ | 2516 | I | 2.0000000000E-01 | | | | 06315 |
| | LRWVFY | 2517 | I | 2.0000000000E-01 | | | | 06315 |
| | LRWVFX | 2520 | I | 2.0000000000E-01 | | | | 06315 |
| | LRWVFF | 2521 | I | 1.0000000000E-01 | | | | 03146 |
| | ABSC0 | 2522 | I | -6.9200000000E+05 | | | | 46200 |
| | ABSC1 | 2523 | I | -5.2400000000E+05 | | | | 54401 |
| | ABSC2 | 2524 | I | -2.3400000000E+05 | | | | 67225 |
| | ABSC3 | 2525 | I | -1.6400000000E+05 | | | | 71713 |
| | ABSC4 | 2526 | I | -1.0000000000E+05 | | | | 74216 |
| | SLOPE0 | 2527 | I | 9.8214280000E-02 | | | | 00031 |
| | SLOPE1 | 2530 | I | -5.1724100000E-03 | | | | 77776 |

TABLE III     PAGE   6

| | MNEMONIC | | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|---|
| *gka* | SLOPE2 | | 2531 | I | -6.4285710000E-02 | | | | 77757 |
| *gka* | SLOPE3 | | 2532 | I | 1.5625000000E-02 | | | | 00004 |
| *gka* | SLOPE4 | | 2533 | I | 0.0000000000E+00 | | | | 00000 |
| *gka* | RODSCALE | | 2534 | I | 1.0000000000E+00 | | | | 14370 |
| *gka* | TAUROD | | 2535 | I | 1.5000000000E+00 | | | 11300 | 00000 |
| *gka* | LAG/TAU | | 2537 | I | 2.3333000000E-01 | | | 07356 | 34075 |
| *gka* | MINFORCE | | 2541 | I | 9.8000000000E+02 | | | 00001 | 27631 |
| *gka* | MAXFORCE | | 2543 | I | 6.3000000000E+03 | | | 00013 | 06551 |
| *(m.)* | J1PARM | + 0 | 2545 | I | 6.0513730000E+06 | 1.8444584900E+06 | | | |
| *(.m.)* | K1PARM | + 0 | 2547 | I | -6.0555520000E+05 | -1.1597077775E+06 | | | |
| *(m.)* | J2PARM | + 0 | 2551 | I | 6.0383801000E+06 | 1.8404982540E+06 | | | |
| *(.m.)* | K2PARM | + 0 | 2553 | I | -3.1696236000E+05 | -6.0701933246E+05 | | | |
| *(.m.)* | THETCRIT | + 0 | 2555 | I | 5.6304007300E+00 | 1.5640002029E-02 | | | |
| *(.m.)* | RAMIN | + 0 | 2557 | I | 5.8838246720E+06 | 1.7933897600E+06 | | | |
| *gka* | YLIM | | 2561 | I | 8.2000000000E+00 | | | 00016 | 32446 |
| *gka* | ABTRDOT | | 2563 | I | 1.9500000000E+01 | | | 00007 | 23346 |

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| | MNEMONIC | ADDRESS | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|
| *JMC* | COSTHET1 | 2565 | 1 | 0.0000000000E+00 | | | 00000 | 00000 |
| *JMC* | COSTHET2 | 2567 | 1 | 8.6602540370E-01 | | | 06733 | 07535 |
| HJM | HIASCENT | + 0 | 3000 | 1 | 1.0900000000E+04 | 4.9441568330E+03 | | |
| HJM | ROLLTIME | + 0 | 3001 | 1 | 3.2300000000E+01 | 3.2300000000E+03 | | |
| HJM | PITTIME | + 0 | 3002 | 1 | 3.2410000000E+01 | 3.2410000000E+03 | | |
| HJM | IGNAOSQ | + 0 | 3012 | 1 | 5.4420000000E+00 | 1.5116666667E-02 | | |
| HJM | IGNAOSR | + 0 | 3013 | 1 | 9.4000000000E-02 | 2.6111111111E-04 | | |
| *JMC* | LRHMAX | 3420 | 1 | 5.0000000000E+04 | | | | 35610 |
| *JMC* | LRWH | 3421 | 1 | 3.5000000000E-01 | | | | 13146 |
| *JMC* | ZOOMTIME | 3422 | 1 | 2.6000000000E+01 | | | | 05050 |
| *JMC* | TENDBRAK | 3423 | 1 | 6.2000000000E+01 | | | | 01407 |
| *JMC* | TENDAPPR | 3424 | 1 | 1.2000000000E+01 | | | | 00226 |
| *JMC* | DELTTFAP | 3425 | 1 | -7.0000000000E+01 | | | | 76224 |
| *JMC* | LEADTIME | 3426 | 1 | -2.2000000000E+00 | | | | 77743 |
| *JMC* | RPCRTIME | 3427 | 1 | 6.2000000000E+01 | | | | 01407 |
| *JMC* | RPCRTQSW | 3430 | 1 | -1.000000000E+00 | | | | 57777 |

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| MNEMONIC | ADDRESS | | | ENGINEERING VALUE | AGC VALUE | WORD 3 | WORD 2 | WORD 1 |
|---|---|---|---|---|---|---|---|---|
| HJM TNEWA | + 0 | 3431 | 1 | 1.3421772800E+08 | 1.3421772800E+08 | | | |

LM STATE VECTOR AT LOI IGNITION

| | | | |
|---|---|---|---|
| L.G. | X | -2830280.9 FT | |
| L.G. | Y | 4728937.6 FT | |
| L.G. | Z | 3008921.6 FT | |
| L.G. | DX | 7697.7982 FPS | |
| L.G. | DY | 2452.4478 FPS | |
| L.G. | DZ | 636.01637 FPS | |
| L.G. | T | 74 HR 28 MIN 38.554 SEC G.E.T | |

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