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NO. 105

POST INJECTION STANDARD TRAJECTORIES RA-5

EPD-105, Vol. II 6 October 1962

Volume II

of

2 Volumes

Approved:

V. C. Clarke

V. C. Clarke

Trajectory and Performance Analysis

Author: W. Kirhofer

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FORWORD

This volume contains a detailed computer listing of the RA-5 JPL Standard trajectories at injection and lunar impact. Trajectories for each launch day and launch azimuths of 93, 102, and 111 degrees are presented. These trajectories differ from those generated by Space Technology Laboratories and an explanation and comparison is presented.

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SECTION I

INTRODUCTION

The information contained in this document is presented to provide a reference for trajectory characteristics in a complete computer program output format. The RA-5 JPL Standard Trajectories differ from the trajectories used for targeting purposes as shown in Tables III-1 to III-4 and explained in Section II.

SECTION II

EXPLANATION OF TABLES III-1 TO III-4

The trajectory conditions tabulated under "JPL" are taken from the RA-5 trajectories designed by the Jet Propulsion Laboratory (JPL) using approximate preinjection trajectory characteristics to achieve the impact conditions outlined in paragraph G, Section I, Reference 1. Impact conditions from these JPL trajectories were specified to Space Technology Laboratories, Incorporated (STL) as design criteria for the STL launch to impact targeting trajectories (ref. 2). These STL trajectories were generated with simulated actual flight conditions. Trajectory conditions from the STL targeting trajectories are tabulated under "STL".

The impact conditions of the STL targeting trajectories are not the exact desired impact conditions. However, the differences are small when compared with those which may result from inaccuracies in the over-all guidance system. For all expected flight conditions, the midcourse maneuver is designed to correct the actual flight trajectory to achieve the desired impact conditions.

The STL targeting trajectories best represent the actual flight injection conditions while the JPL standard trajectories best represent the actual flight impact conditions. Except for inertial speed, the coordinates of injection are all relative to a rotating Earth. Path angle is measured from the geocentric local horizontal plane and azimuth angle is measured in the geocentric local horizontal plane eastward from true north. Geocentric latitude is measured positive north of the Earth's equator and geocentric longitude is measured positive east of Greenwich meridian. Except for inertial speed, the coordinates of impact are relative to a rotating Moon. Path angle is measured from the selenocentric local horizontal plane and azimuth angle is measured in the selenocentric local horizontal plane eastward from the selenocentric north direction. The selenocentric latitude and longitude are defined in figure 35. The geocentric latitude and longitude are as defined above except for the probe at impact. The miss parameters $B \cdot T$ and $B \cdot R$ are defined in the nomenclature.

SECTION III

RA-5 TRAJECTORY CONDITIONS

Table III-1. RA-5 Trajectory Conditions For First Day Launch

	93° LAUNCH AZIMUTH		102° LAUNCH AZIMUTH		111° LAUNCH AZIMUTH	
INJECTION	JPL	STL	JPL	STL	JPL	STL
TIME, GMT (HR.MIN.SEC.)	14 50 34	14 50 19	16 11 19	16 11 16	17 32 07	17 32 08
TIME AFTER LAUNCH (SEC.)	2342.985	2344.0078	2080.199	2080.7579	1825.219	1825.7580
RADIUS (METERS)	6571528.5	6571201.4	6571072.6	6570809.7	6570557.8	6570363.3
SPEED (METERS/SEC)	10530.639	10531.116	10538.481	10538.872	10555.528	10555.799
PATH ANGLE (DEG)	1.6862806	1.7008629	1.6858042	1.7001696	1.6834504	1.6977043
AZIMUTH ANGLE (DEG)	105.98592	106.00441	108.67641	108.71325	113.82240	113.86227
GEOCENTRIC						
LATITUDE (DEG)	-24.232893	-24.257425	-24.703868	-24.721847	-25.604231	-25.625054
LONGITUDE (DEG)	50.962196	51.042675	31.391678	31.438279	11.591792	11.634196
SPEED, INERTIAL (METERS/SEC)	10951.205	10951.540	10951.590	10951.816	10952.024	10952.093
IMPACT (UNRETARDED)						
FLIGHT TIME FROM INJECTION (HR)	66.054844	66.025454	66.172390	66.176942	66.285082	66.335935
TIME, GMT (HR. MIN. SEC.)	08 53 51	8 51 51	10 21 40	10 21 53	11 49 13	11 52 17
GEOCENTRIC						
LATITUDE (DEG)	20.795708	20.800607	20.776234	20.776586	20.751427	20.755621
LONGITUDE (DEG)	303.96588	304.45118	282.80333	282.75431	261.70180	260.96499
SELENOCENTRIC						
LATITUDE (DEG)	-16.465008	-15.587645	-16.940107	-16.987188	-17.717905	-16.666164
LONGITUDE (DEG)	347.01664	346.68100	346.95531	346.10714	346.88482	346.15882
SPEED (METERS/SEC)	2609 3862	2609.7061	2610.4693	2610.7261	2613.3132	2613.1599
PATH ANGLE (DEG)	-66.937180	-67.455656	-66.888876	-67.326672	-66.761662	-67.533487
AZIMUTH ANGLE (DEG)	123.40601	125.17599	123.25186	126.72812	122.89387	124.19300
EARTH-MOON-PROBE ANGLE (DEG)	28.038062	27.732251	28.324560	28.976213	28.818619	28.663820
LIGHTING ANGLE (DEG)	59.121824	58.605203	59.859138	59.074182	60.647815	59.769517
MISS PARAMETERS						
B • T (KM)	1358.2481	1344.6246	1358.0429	1318.4857	1358.1746	1331.7547
B • R (KM)	925.19216	880.94279	925.43700	929.49176	925.22240	872.86498
SPEED, INERTIAL (METERS/SEC)	2610.8427	2610.8127	2611.9275	2611.7921	2614.7787	2614.2532

Table III-2. RA-5 Trajectory Conditions For Second Day Launch

	93° LAUNCH AZIMUTH		102° LAUNCH AZIMUTH		111° LAUNCH AZIMUTH	
	JPL	STL	JPL	STL	JPL	STL
INJECTION						
TIME, GMT (HR. MIN. SEC.)	15 58 16	15 58 03	17 18 06	17 18 05	18 37 05	18 37 11
TIME AFTER LAUNCH (SEC.)	2299.201	2300.0275	2038.442	2038.7776	1788.156	1788.2776
RADIUS (METERS)	6571536.0	6571160.7	6571075.9	6570810.7	6570561.1	6570326.0
SPEED (METERS/SEC)	10532.152	10532.684	10540.011	10540.426	10557.076	10557.458
PATH ANGLE (DEG)	1.6869841	1.7018318	1.6863967	1.7008133	1.6839276	1.6982536
AZIMUTH ANGLE (DEG)	107.30877	107.32922	109.94645	109.98734	114.95796	115.00924
GEOCENTRIC						
LATITUDE (DEG)	-23.412059	-23.438302	-23.799472	-23.818948	-24.600184	-24.621523
LONGITUDE (DEG)	48.014296	48.081490	28.611392	28.640222	9.1910870	9.2014065
SPEED, INERTIAL (METERS/SEC)	10952.596	10952.973	10952.984	10953.215	10953.418	10953.555
IMPACT (UNRETARDED)						
FLIGHT TIME FROM INJECTION (HR)	67.670709	67.629919	67.778808	67.773051	67.882411	67.912641
TIME, GMT (HR. MIN. SEC.)	11 38 31	11 35 51	13 04 50	13 04 28	14 30 02	14 31 57
GEOCENTRIC						
LATITUDE (DEG)	19.861439	19.867222	19.772631	19.772965	19.680480	19.681622
LONGITUDE (DEG)	276.97347	277.61701	256.13433	256.22271	235.56217	235.10086
SELENOCENTRIC						
LATITUDE (DEG)	-11.506836	-11.023003	-11.955196	-12.152318	-12.664957	-12.033807
LONGITUDE (DEG)	338.12429	338.37857	337.97806	337.78519	337.75459	337.42875
SPEED (METERS/SEC)	2609.4130	2609.6936	2610.8803	2609.8663	2614.2316	2613.2521
PATH ANGLE (DEG)	-74.577318	-74.619425	-74.534053	-74.540287	-74.433828	-74.831888
AZIMUTH ANGLE (DEG)	123.65092	121.44359	123.57531	123.31883	123.34880	121.24851
EARTH-MOON-PROBE ANGLE (DEG)	31.751844	31.351019	31.976555	32.224605	32.370272	32.435597
LIGHTING ANGLE (DEG)	62.747519	62.903852	63.374995	63.207696	63.954459	63.562629
MISS PARAMETERS						
B · T (KM)	955.87772	966.20376	955.76712	949.06446	956.22561	943.05218
B · R (KM)	581.25665	555.57076	581.47871	594.23843	581.10670	550.26892
SPEED, INERTIAL (METERS/SEC)	2610.4215	2610.5149	2611.8909	2610.6619	2615.2483	2614.0515

Table III- 3. RA-5 Trajectory Conditions For Third Day Launch

	93° LAUNCH AZIMUTH		102° LAUNCH AZIMUTH		111° LAUNCH AZIMUTH	
INJECTION	JPL	STL	JPL	STL	JPL	STL
TIME, GMT (HR. MIN. SEC.)	17 14 39	17 14 01	18 32 12	18 32 08	19 47 31	19 47 33
TIME AFTER LAUNCH (SEC.)	2209.742	2212.0316	1955.420	1955.7818	1715.771	1716.0318
RADIUS (METERS)	6571540.5	6571184.1	6571074.6	6570831.0	6570561.5	6570345.4
SPEED (METERS/SEC)	10532.962	10533.448	10540.843	10541.254	10557.930	10558.328
PATH ANGLE (DEG)	1.6871284	1.7018528	1.6863404	1.7007360	1.6836570	1.6979980
AZIMUTH ANGLE (DEG)	109.82201	109.83362	112.28431	112.32446	117.00151	117.04997
GEOCENTRIC						
LATITUDE (DEG)	-21.546189	-21.577225	-21.838869	-21.862320	-22.518553	-22.544270
LONGITUDE (DEG)	42.114970	42.285585	23.207263	23.235127	4.6203369	4.6379693
SPEED, INERTIAL (METERS/SEC)	10953.140	10953.481	10953.533	10953.744	10953.965	10954.109
IMPACT (UNRETARDED)						
FLIGHT TIME FROM INJECTION (HR)	69.513785	69.480020	69.604833	69.585698	69.693545	69.703832
TIME, GMT (HR. MIN. SEC.)	14 45 28	14 42 49	16 08 29	16 07 16	17 29 08	17 29 47
GEOCENTRIC						
LATITUDE (DEG)	17.709650	17.719794	17.568562	17.571055	17.427999	17.430845
LONGITUDE (DEG)	243.86357	244.50598	223.78217	224.07204	204.27024	204.11339
SELENOCENTRIC						
LATITUDE (DEG)	-2.5910169	-1.4446147	-2.9590129	-3.2091748	-3.5417066	-2.8181459
LONGITUDE (DEG)	325.2083	325.42426	324.99670	325.67332	324.62411	324.88105
SPEED (METERS/SEC)	2609.8100	2609.8860	2611.5215	2611.4802	2615.1525	2613.8850
PATH ANGLE (DEG)	-85.539599	-85.520275	-85.523742	-85.008095	-85.497966	-85.391031
AZIMUTH ANGLE (DEG)	104.17709	91.925023	104.16951	102.55415	104.17142	95.135510
EARTH-MOON-PROBE ANGLE (DEG)	41.490979	41.257704	41.653325	40.988949	41.987082	41.707957
LIGHTING ANGLE (DEG)	62.746987	62.879203	63.256813	63.930236	63.599828	63.811639
MISS PARAMETERS						
B · T (KM)	328.68412	333.13383	328.79045	363.91736	328.42463	339.49832
B · R (KM)	52.283844	-7.9647306	87.133930	62.110780	52.420646	13.764083
SPEED, INERTIAL (METERS/SEC)	2610.1632	2610.1923	2611.8755	2611.8079	2615.5084	2614.1948

Table III-4. RA-Trajectory Conditions For Fourth Day Launch

	93° LAUNCH AZIMUTH		102° LAUNCH AZIMUTH		111 LAUNCH AZIMUTH	
INJECTION	JPL	STL	JPL	STL	JPL	STL
TIME, GMT (HR. MIN. SEC.)	18 35 08	18 34 53	19 49 50	19 49 42	21 00 36	21 00 32
TIME AFTER LAUNCH (SEC.)	2087.212	2088.5233	1841.336	1842.2733	1615.403	1616.0233
RADIUS (METERS)	6571539.4	6571260.8	6571070.5	6570871.8	6570563.7	6570422.2
SPEED (METERS/SEC)	10533.206	10533.620	10541.103	10541.464	10558.208	10558.525
PATH ANGLE (DEG)	1.6870473	1.7014790	1.6859852	1.7003174	1.6829893	1.6973629
AZIMUTH ANGLE (DEG)	112.82285	112.84338	115.07339	115.10442	119.45150	119.49283
GEOCENTRIC						
LATITUDE (DEG)	-18.624851	-18.660943	-18.833009	-18.866077	-19.400153	-19.427324
LONGITUDE (DEG)	34.307299	34.399776	16.045194	16.109501	358.52687	358.56913
SPEED, INERTIAL (METERS/SEC)	10953.003	10953.246	10953.399	10953.562	10953.826	10953.910
IMPACT (UNRETARDED)						
FLIGHT TIME FROM INJECTION (HR)	71.414113	71.401449	71.486367	71.485436	71.559283	71.567280
TIME, GMT (HR. MIN. SEC.)	17 59 58	17 58 58	19 19 01	19 18 50	20 34 09	20 34 34
GEOCENTRIC						
LATITUDE (DEG)	14.505597	14.517583	14.330375	14.338970	14.161279	14.165119
LONGITUDE (DEG)	208.13117	208.38158	188.97581	189.02500	170.76261	170.66370
SELENOCENTRIC						
LATITUDE (DEG)	-7.6422277	-5.2203920	-7.9502377	-5.8259383	-8.4378260	-7.3678186
LONGITUDE (DEG)	310.26571	310.07087	309.99680	309.48912	309.54120	309.71236
SPEED (METERS/SEC)	2610.4588	2610.2765	2612.2704	2611.6301	2615.9838	2615.1857
PATH ANGLE (DEG)	-83.987330	-84.596639	-83.964384	-84.307024	-83.923199	-84.434002
AZIMUTH ANGLE (DEG)	237.22123	251.95233	237.29757	250.51526	237.36893	241.08174
EARTH-MOON-PROBE ANGLE (DEG)	55.185139	55.312944	55.390003	55.829091	55.791052	55.577887
LIGHTING ANGLE (DEG)	62.041531	61.614958	62.467787	61.758640	62.697078	62.754734
MISS PARAMETERS						
B . T (KM)	-332.16420	-357.44267	-332.40175	-371.46760	-332.43546	-330.06274
B . R (KM)	277.18126	153.28726	277.26136	170.73059	277.34416	221.47260
SPEED, INERTIAL (METERS/SEC)	2610.0593	2609.9496	2611.8694	2611.2907	2615.5803	2614.8827

SECTION IV

RA-5 STANDARD TRAJECTORIES

RA-5 STANDARD TRAJECTORY FIRST DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTICN CONDITIONS 1950.0 MOON JULIAN DATE 2437954.11844558 OCT. 16,1962 14 50 33.698

GEOCENTRIC	XO	.28176536 04	YO	-.52869102 04	ZO	-.27008144 04	DXO	.88827872 01	DYO	.57697056 01	DZO	-.27812765 01
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.53433698 05	GHA	.24728029 03	GHO	.24030339 02		

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437954.11844558 OCT. 16,1962 14 50 33.698

GEOCENTRIC EQUATORIAL COORDINATES

X	.28356646 04	Y	-.52790884 04	Z	-.26972615 04	DX	.88700239 01	DY	.57944019 01	DZ	-.27706474 01
R	.65715285 04	DEC	-.24232893 02	RA	.29824248 03	V	.10951205 02	PTH	.16215040 01	AZ	.10535602 03
R	.65715285 04	LAT	-.24232893 02	LON	.50962196 02	VE	.10530639 02	PTE	.16862806 01	AZE	.10598592 03
XS	-.13748906 09	YS	-.52933247 08	ZS	-.22953538 08	DXS	.12001530 02	DYS	-.25098257 02	DZS	-.10882685 02
XM	.14896180 06	YM	.31855175 06	ZM	.10785468 06	DXM	-.94591299 00	DYM	.43721505 00	DZM	.23598233 00
XT	.14896180 06	YT	.31855175 06	ZT	.10785468 06	DXT	-.94591299 00	DYT	.43721505 00	DZT	.23598233 00
RS	.14910411 09	VS	.29872932 02	RM	.36782804 06	VM	.10684550 01	RT	.36782804 06	VT	.10684550 01
GED	-.24378865 02	ALT	.19695978 03	LOS	.31377640 03	RAS	.20105669 03	RAM	.64938173 02	LOM	.17765788 03
DUT	.34000000 02	DT	.15000000 02	DR	.30988438 00	SHA	.65634661 04	DES	-.88555015 01	DEM	.17050853 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437954.11804815 OCT. 16,1962 14 49 59.361

SMA	.28816067 06	ECC	.97721338 00	INC	.28438425 02	LAN	.62028046 02	APF	.23624920 03	RCA	.65662052 04
VH	.12626010 00	C3	-.13832672 01	C1	.71937343 05	SLR	.12982789 05	APO	.56975513 06	TFP	.34337637 02
TA	.32808313 01	EA	.35229986 00	MA	.80299226-02	DAO	-.23325478 02	RAO	.29479701 03	MTA	.18000000 03
WX	.42058142 00	WY	-.22336309 00	WZ	.87932940 00	PX	.38512694 00	PY	-.83360527 00	PZ	-.39595388 00
QX	.82145509 00	QY	.50518426 00	QZ	-.26457574 00	RX	-.12187755-01	RY	.42441753 00	RZ	-.90538455 00
SXO	.38512694 00	SYO	-.83360527 00	SZO	-.39595388 00	TX	-.92278313 00	TY	-.35351378 00	TZ	-.15329485 00
BX	-.82145513 00	BY	-.50518429 00	BZ	.26457575 00	MX	.79806794 00	MY	.55206354 00	MZ	-.24148167 00
B.T	.54807094 05	B.R	-.27153502 05	B	.61164779 05	PER	.25657260 05	OMD	.11327013-01	NOD	-.69503314-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13749189 09	Y	.52927967 08	Z	.22950841 08	DX	-.31315064 01	DY	.30892659 02	DZ	.81120374 01
R	.14910443 09	LAT	.88544334 01	LON	.21054380 02	V	.32093111 02	PTH	.16895386 02	AZ	.77288739 02
XE	.13748906 09	YE	.52933247 08	ZE	.22953538 08	DXE	-.12001530 02	DYE	.25098257 02	DZE	.10882685 02
XT	.13763802 09	YT	.53251798 08	ZT	.23061393 08	DXT	-.12947443 02	DYT	.25535471 02	DZT	.11118667 02
LTE	.88555015 01	LOE	.21056692 02	LTT	.88814007 01	LOT	.21151328 02	RST	.14937137 09	VST	.30713537 02
EPS	.87159023 02	ESP	.27453512-18	SEP	.92838452 02	EPM	.49333966 02	EMP	.77644706 00	MEP	.12988956 03
MPS	.13579284 03	MSP	.99650790-01	SMP	.44107644 02	SEM	.13655363 03	EMS	.43349338 02	ESM	.97165341-01
EPT	.49333966 02	ETP	.77644706 00	TEP	.12988956 03	TPS	.13579284 03	TSP	.99650790-01	STP	.44107644 02
SET	.13655363 03	STE	.43349338 02	EST	.97165341-01	RPM	.37207659 06	RPT	.37207659 06	SPN	.11098570 02
GCE	.10075755 03	GCT	.11009135 03	SIP	.13552520 03	CPT	.10535286 03	SIN	.10508522 03		
REP	.65715285 04	VEP	.10951205 02								

RA-5 STANDARD TRAJECTORY FIRST DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

2 DAYS 17 HRS. 36 MIN. 32.728 SEC. JULIAN DATE 2437956.85215771 OCT. 19,1962 08 27 06.427
RECTIFICATION .15127762-01 .62606475 02 -.10061130 03 -.37475469 02

2 DAYS 18 HRS. 3 MIN. 17.050 SEC. JULIAN DATE 2437956.87072625 OCT. 19,1962 08 53 50.749

GEOCENTRIC EQUATORIAL COORDINATES

X	-.91406920 05	Y	.34641100 06	Z	.13606238 06	DX	.15778419 00	DY	.18719306 01	DZ	.11183887 01
R	.38323463 06	DEC	.20795697 02	RA	.10478163 03	V	.21862784 01	PTH	.69776621 02	AZ	.30350750 03
R	.38323462 06	LAT	.20795697 02	LON	.30396746 03	VE	.26837235 02	PTE	.43840960 01	AZE	.27089337 03
XS	-.13448051 09	YS	-.58840547 08	ZS	-.25514873 08	DXS	.13297258 02	DYS	-.24572967 02	DZS	-.10654388 02
XM	-.91207395 05	YM	.34771375 06	ZM	.13719552 06	DXM	-.10004957 01	DYM	-.18706763 00	DZM	.68945245-02
XT	-.91207395 05	YT	.34771375 06	ZT	.13719552 06	DXT	-.10004957 01	DYT	-.18706763 00	DZT	.68945245-02
RS	.14899070 09	VS	.29902571 02	RM	.38476779 06	VM	.10178572 01	RT	.38476779 06	VT	.10178572 01
GED	.20925182 02	ALT	.37685914 06	LOS	.42817120 02	RAS	.20363128 03	RAM	.10469790 03	LOM	.30388374 03
DUT	.34000000 02	DT	.59999999 02	DR	.20514989 01	SHA	.37529522 06	DES	-.98605903 01	DEM	.20889516 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13438911 09	Y	.59186958 08	Z	.25650935 08	DX	-.13139473 02	DY	.26444897 02	DZ	.11772777 02
R	.14906877 09	LAT	.99084580 01	LON	.23769406 02	V	.31789568 02	PTH	.12257713 01	AZ	.68143041 02
XE	.13448051 09	YE	.58840547 08	ZE	.25514873 08	DXE	-.13297258 02	DYE	.24572967 02	DZE	.10654388 02
XT	.13438931 09	YT	.59188261 08	ZT	.25652068 08	DXT	-.14297753 02	DYT	.24385899 02	DZT	.10661283 02
LTE	.98605903 01	LOE	.23631282 02	LTT	.99088405 01	LOT	.23769840 02	RST	.14906966 09	VST	.30211931 02
EPS	.78172813 02	ESP	.14452625 00	SEP	.10168294 03	EPM	.15183493 03	EMP	.28042903 02	MEP	.12154476 00
MPS	.12088186 03	MSP	.27453512-18	SMP	.59117562 02	SEM	.10177087 03	EMS	.78084351 02	ESM	.14503307 00
EPT	.15183493 03	ETP	.28042903 02	TEP	.12154476 00	TPS	.12088186 03	TSP	.27453512-18	STP	.59117562 02
SET	.10177087 03	STE	.78084351 02	EST	.14503307 00	RPM	.17380899 04	RPT	.17380899 04	SPN	.77219222 02
GCE	.28589431 03	GCT	.83452433 02	SIP	.31464562 02	CPT	.85796184 02	SIN	-.36211128 01		
REP	.38323463 06	VEP	.21862784 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.19952498 03	Y	-.13027450 04	Z	-.11331380 04	DX	.11582799 01	DY	.20589982 01	DZ	.11114942 01
R	.17380899 04	DEC	-.40688362 02	RA	.26129239 03	V	.26108437 01	PTH	-.66864336 02	AZ	.12568493 03
R	.17380897 04	LAT	-.16466926 02	LON	.34701173 03	VR	.26093875 01	PTR	-.66939263 02	AZR	.12341414 03
LTS	.15141232 01	LNS	.28991563 03	LTE	.23662225 01	LNE	.80493940 01				
ALT	.89874267-01	SHA	-.14916674 04	ALP	.10844734 02	DR	-.24008722 01	DP	.33816126-01	ASD	.89417297 02
HGE	.28182719 03	SVL	-.19124681 02	HNG	.12290535 03	SIA	.62417631 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437956.87718886 OCT. 19,1962 09 03 09.118

SMA	-.41628584 04	ECC	.10750929 01	INC	.51983214 02	LAN	.39059844 02	APF	.15070889 01	RCA	.31260109 03
VH	.10850153 01	C3	.11772581 01	C1	.17829768 04	SLR	.64867631 03	APO	.00000000 00	TFP	-.55836951 03
TA	-.12566240 03	EA	-.44595693 02	MA	-.83385117 01	DAI	.17965486 02	RAI	.53743846 02	MTA	.15845855 03
WX	.49643693 00	WY	-.61174101 00	WZ	.61589231 00	PX	.76601254 00	PY	.64249162 00	PZ	.20720415-01
QX	-.40838115 00	QY	.46149484 00	QZ	.78755782 00	RX	-.37992507-01	RY	.39666880 00	RZ	-.91717523 00
SXO	-.86245526 00	SYO	-.42816599 00	SZO	.26989777 00	DAO	.15658182 02	RAO	.20640210 03	TF	.66209839 02
SXI	.56256122 00	SYI	.76706398 00	SZI	.30844404 00	TX	.82588222 00	TY	-.50424866 00	TZ	-.25229317 00
BX	.66111667 00	BY	-.19335410 00	BZ	-.72494065 00	MX	.62550608 00	MY	.78675000-02	MZ	-.49637161 00
B.T	.13580019 04	B.R	.92529848 03	B	.16432731 04	PER	.27780276 03				
OP1	.11827186 02	OY	-.86499682 01	OP2	-.49304754 02						
BTE	.10639551 04	BRE	.12523363 04	BTO	.13580019 04	BRO	.92529848 03				
CR	.15202123 01	TR	.41821932 04	THA	.34269247 02						

RA-5 STANDARD TRAJECTORY FIRST DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

214540151653	615512335101	614521464076	204434177454	203561205556	602544001571
	621001600		0		220641346626

RA-5 STANDARD TRAJECTORY FIRST DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437954.17452873 OCT. 16,1962 16 11 19.282

GEOCENTRIC	XO	.28686908 04	YO	-.52333477 04	ZO	-.27498515 04	DXO	.85834553 01	DYO	.59994985 01	DZO	-.32043166 01
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.58279282 05	GHA	.26752550 03	GHO	.24030339 02		

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437954.17452873 OCT. 16,1962 16 11 19.282

GEOCENTRIC EQUATORIAL COORDINATES

X	.28866119 04	Y	-.52253848 04	Z	-.27462379 04	DX	.85705652 01	DY	.60233500 01	DZ	-.31940560 01
R	.65710727 04	DEC	-.24703868 02	RA	.29891718 03	V	.10951590 02	PTH	.16221955 01	AZ	.10794680 03
R	.65710726 04	LAT	-.24703868 02	LON	.31391678 02	VE	.10538481 02	PTE	.16858042 01	AZE	.10867641 03
XS	-.13743084 09	YS	-.53054842 08	ZS	-.23006262 08	DXS	.12028129 02	DYS	-.25088127 02	DZS	-.10878277 02
XM	.14436454 06	YM	.32063993 06	ZM	.10898787 06	DXM	-.95155377 00	DYM	.42466859 00	DZM	.23173120 00
XT	.14436454 06	YT	.32063993 06	ZT	.10898787 06	DXT	-.95155377 00	DYT	.42466859 00	DZT	.23173120 00
RS	.14910178 09	VS	.29873515 02	RM	.36814324 06	VM	.10674724 01	RT	.36814324 06	VT	.10674724 01
GED	-.24851941 02	ALT	.19663788 03	LOS	.29358346 03	RAS	.20110896 03	RAM	.65760875 02	LOM	.15823537 03
DUT	.34000000 02	DT	.15000000 02	DR	.31002733 00	SHA	.65602160 04	DES	-.88761467 01	DEM	.17220356 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437954.17413117 OCT. 16,1962 16 10 44.934

SMA	.28816198 06	ECC	.97721508 00	INC	.30199852 02	LAN	.66692767 02	APF	.23290312 03	RCA	.65657452 04
VH	.12625505 00	C3	-.13832609 01	CI	.71934853 05	SLR	.12981891 05	APO	.56975821 06	TFP	.34348635 02
TA	.32822268 01	EA	.35243647 00	MA	.80324399-02	DAO	-.23654184 02	RAO	.29550810 03	MTA	.18000000 03
WX	.46196971 00	WY	-.19902468 00	WZ	.86427610 00	PX	.39445807 00	PY	-.82669763 00	PZ	-.40121544 00
QX	.79434675 00	QY	.52627005 00	QZ	-.30340237 00	RX	-.15477080-01	RY	.43058018 00	RZ	-.90241960 00
SXO	.39445807 00	SYO	-.82669763 00	SZO	-.40121544 00	TX	-.91878360 00	TY	-.36217635 00	TZ	-.15705097 00
BX	-.79434678 00	BY	-.52627007 00	BZ	.30340238 00	MX	.77045932 00	MY	.57273881 00	MZ	-.27993336 00
B.T	.53382020 05	B.R	-.29853781 05	B	.61162802 05	PER	.25657435 05	OMD	.10809786-01	NOD	-.68322472-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13743373 09	Y	.53049617 08	Z	.23003516 08	DX	-.34575642 01	DY	.31111477 02	DZ	.76842213 01
R	.14910216 09	LAT	.88750555 01	LON	.21106662 02	V	.32232374 02	PTH	.16339369 02	AZ	.78131448 02
XE	.13743084 09	YE	.53054842 08	ZE	.23006262 08	DXE	-.12028129 02	DYE	.25088127 02	DZE	.10878277 02
XT	.13757520 09	YT	.53375482 08	ZT	.23115250 08	DXT	-.12979683 02	DYT	.25512796 02	DZT	.11110009 02
LTE	.88761467 01	LOE	.21108962 02	LTT	.89026350 01	LOT	.21204916 02	RST	.14936597 09	VST	.30705165 02
EPS	.86703452 02	ESP	.13988227-01	SEP	.93294025 02	EPM	.49131183 02	EMP	.77335370 00	MEP	.13009542 03
MPS	.13505489 03	MSP	.10111274 00	SMP	.44844183 02	SEM	.13581084 03	EMS	.44090725 02	ESM	.97917601-01
EPT	.49131183 02	ETP	.77335370 00	TEP	.13009542 03	TPS	.13505489 03	TSP	.10111274 00	STP	.44844183 02
SET	.13581084 03	STE	.44090725 02	EST	.97917601-01	RPM	.37240934 06	RPT	.37240934 06	SPN	.10626978 02
GCE	.10017384 03	GCT	.10994474 03	SIP	.13478750 03	CPT	.10542992 03	SIN	.10516253 03		
REP	.65710727 04	VEP	.10951590 02								

RA-5 STANDARD TRAJECTORY FIRST DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

2 DAYS 17 HRS. 44 MIN. 21.675 SEC. JULIAN DATE 2437956.91366848 OCT. 19,1962 09 55 40.957
RECTIFICATION .15201321-01 .63701177 02 -.99061241 02 -.36541750 02

2 DAYS 18 HRS. 10 MIN. 20.424 SEC. JULIAN DATE 2437956.93170957 OCT. 19,1962 10 21 39.707

GEOCENTRIC EQUATORIAL COORDINATES

X	-.96646938 05	Y	.34539792 06	Z	.13607369 06	DX	.13388673 00	DY	.18623160 01	DZ	.11375471 01
R	.38360969 06	DEC	.20776229 02	RA	.10563232 03	V	.21863576 01	PTH	.69401929 02	AZ	.30491130 03
R	.38360969 06	LAT	.20776229 02	LON	.28280407 03	VE	.26866680 02	PTE	.43687750 01	AZE	.27094156 03
XS	-.13441037 09	YS	-.58969995 08	ZS	-.25570999 08	DXS	.13325728 02	DYS	-.24560668 02	DZS	-.10649049 02
XM	-.96469687 05	YM	.34669382 06	ZM	.13721831 06	DXM	-.99693490 00	DYM	-.20006114 00	DZM	.17605251-02
XT	-.96469687 05	YT	.34669382 06	ZT	.13721831 06	DXT	-.99693490 00	DYT	-.20006114 00	DZT	.17605251-02
RS	.14898820 09	VS	.29903238 02	RM	.38513877 06	VM	.10168120 01	RT	.38513877 06	VT	.10168120 01
GED	.20905614 02	ALT	.37723420 06	LOS	.20860292 02	RAS	.20368855 03	RAM	.10554955 03	LOM	.28272129 03
DUT	.34000000 02	DT	.59999999 02	DR	.20465867 01	SHA	.37662426 06	DES	-.98826655 01	DEM	.20872083 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13431372 09	Y	.59315393 08	Z	.25707073 08	DX	-.13191842 02	DY	.26422984 02	DZ	.11786596 02
R	.14906155 09	LAT	.99308482 01	LON	.23827131 02	V	.31798154 02	PTH	.11900682 01	AZ	.68114577 02
XE	.13441037 09	YE	.58969995 08	ZE	.25570999 08	DXE	-.13325728 02	DYE	.24560668 02	DZE	.10649049 02
XT	.13431390 09	YT	.59316690 08	ZT	.25708218 08	DXT	-.14322663 02	DYT	.24360607 02	DZT	.10650809 02
LTE	.98826655 01	LOE	.23688552 02	LTT	.99312366 01	LOT	.23827565 02	RST	.14906242 09	VST	.30199629 02
EPS	.78904314 02	ESP	.14486432 00	SEP	.10095092 03	EPM	.15154970 03	EMP	.28327109 02	MEP	.12254679 00
MPS	.12014266 03	MSP	.27453512-18	SMP	.59856758 02	SEM	.10103863 03	EMS	.78816064 02	ESM	.14536996 00
EPT	.15154970 03	ETP	.28327109 02	TEP	.12254679 00	TPS	.12014266 03	TSP	.27453512-18	STP	.59856758 02
SET	.10103863 03	STE	.78816064 02	EST	.14536996 00	RPM	.17380900 04	RPT	.17380900 04	SPN	.77951656 02
GCE	.28582155 03	GCT	.83071670 02	SIP	.30725659 02	CPT	.85402680 02	SIN	-.40143232 01		
REP	.38360969 06	VEP	.21863576 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.17725195 03	Y	-.12959049 04	Z	-.11446261 04	DX	.11308216 01	DY	.20623771 01	DZ	.11357866 01
R	.17380900 04	DEC	-.41189686 02	RA	.26221149 03	V	.26119280 01	PTH	-.66815270 02	AZ	.12513937 03
R	.17380898 04	LAT	-.16940992 02	LON	.34695260 03	VR	.26104700 01	PTR	-.66890091 02	AZR	.12325612 03
LTS	.15146380 01	LNS	.28917323 03	LTE	.22808998 01	LNE	.80378634 01				
ALT	.89965820-01	SHA	-.15030527 04	ALP	.10824517 02	DR	-.24009895 01	DP	.33897956-01	ASD	.89417003 02
HGE	.28109568 03	SVL	-.19537113 02	HNG	.12219704 03	SIA	.62132701 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437956.93817402 OCT. 19,1962 10 30 58.237

SMA	-.41429288 04	ECC	.10757942 01	INC	.52019918 02	LAN	.39115267 02	APF	.21840934 01	RCA	.31400979 03
VH	.10876219 01	C3	.11829213 01	C1	.17872916 04	SLR	.65181969 03	APO	.00000000 00	TFP	-.55852969 03
TA	-.12551718 03	EA	-.44662808 02	MA	-.84011620 01	DAI	.18562295 02	RAI	.54314215 02	MTA	.15836413 03
WX	.49727722 00	WY	-.61156646 00	WZ	.61538749 00	PX	.76051880 00	PY	.64862061 00	PZ	.30039511-01
QX	-.41752414 00	QY	.45307584 00	QZ	.78765205 00	RX	-.34415058-01	RY	.40285294 00	RZ	-.91461741 00
SXO	-.86088096 00	SYO	-.43587058 00	SZO	.26248934 00	DAO	.15217821 02	RAO	.20685343 03	TF	.66327485 02
SXI	.55299322 00	SYI	.76997460 00	SZI	.31833555 00	TX	.83247467 00	TY	-.49482174 00	TZ	-.24927369 00
BX	.66851612 00	BY	-.18200414 00	BZ	-.72108299 00	MX	.62507526 00	MY	.79441649-02	MZ	-.49721079 00
B.T	.13579088 04	B.R	.92548662 03	B	.16433021 04	PER	.27829402 03				
OP1	.11095685 02	OY	-.92824940 01	OP2	-.49123178 02						
BTE	.10667626 04	BRE	.12499837 04	BTO	.13579088 04	BRO	.92548662 03				
CR	.10909185 01	IR	.41739028 04	THA	.34276497 02						

RA-5 STANDARD TRAJECTORY FIRST DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

214546454155	615507053102	614527566376	204422527252	203577757443	602632116061
	621001600		0		220707235102

RA-5 STANDARD TRAJECTORY FIRST DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437954.23063185 OCT. 16,1962 17 32 06.592

GEOCENTRIC	XO	.28881759 04	YO	-.51717846 04	ZO	-.28431177 04	DXO	.80347111 01	DYO	.62846331 01	DZO	-.39866829 01
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.63126592 05	GHA	.28777792 03	GHO	.24030339 02		

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437954.23063185 OCT. 16,1962 17 32 06.592

GEOCENTRIC EQUATORIAL COORDINATES

X	.29060385 04	Y	-.51637695 04	Z	-.28394819 04	DX	.80219769 01	DY	.63069357 01	DZ	-.39770943 01
R	.65705580 04	DEC	-.25604230 02	RA	.29936970 03	V	.10952024 02	PTH	.16224867 01	AZ	.11290900 03
R	.65705578 04	LAT	-.25604231 02	LON	.11591792 02	VE	.10555528 02	PTE	.16834504 01	AZE	.11382240 03
XS	-.13737247 09	YS	-.53176434 08	ZS	-.23058984 08	DXS	.12054731 02	DYS	-.25077970 02	DZS	-.10873858 02
XM	.13973877 06	YM	.32266792 06	ZM	.11010077 06	DXM	-.95700200 00	DYM	.41206849 00	DZM	.22744510 00
XT	.13973877 06	YT	.32266792 06	ZT	.11010077 06	DXT	-.95700200 00	DYT	.41206849 00	DZT	.22744510 00
RS	.14909945 09	VS	.29874101 02	RM	.36846124 06	VM	.10664823 01	RT	.36846124 06	VT	.10664823 01
GED	-.25756205 02	ALT	.19638434 03	LOS	.27338333 03	RAS	.20116126 03	RAM	.66583862 02	LOM	.13880594 03
DUT	.34000000 02	DT	.15000000 02	DR	.31009528 00	SHA	.65585734 04	DES	-.88967925 01	DEM	.17386282 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437954.23023427 OCT. 16,1962 17 31 32.242

SMA	.28816220 06	ECC	.97721689 00	INC	.33832324 02	LAN	.73729523 02	APF	.22762980 03	RCA	.65652290 04
VH	.12624993 00	C3	-.13832598 01	C1	.71932058 05	SLR	.12980882 05	APO	.56975916 06	TFP	.34350714 02
TA	.32828134 01	EA	.35248514 00	MA	.80329170-02	DAO	-.24289094 02	RAO	.29605212 03	MTA	.18000000 03
WX	.53446583 00	WY	-.15598982 00	WZ	.83067048 00	PX	.40031235 00	PY	-.81887037 00	PZ	-.41134087 00
QX	.74437641 00	QY	.55237528 00	QZ	-.37521358 00	RX	-.20687740-01	RY	.44068644 00	RZ	-.89742266 00
SXO	.40031235 00	SYO	-.81887037 00	SZO	-.41134087 00	TX	-.91614521 00	TY	-.36775910 00	TZ	-.15947166 00
BX	-.74437644 00	BY	-.55237530 00	BZ	.37521360 00	MX	.72023124 00	MY	.59836112 00	MZ	-.35104262 00
B.T	.50473393 05	B.R	-.34540363 05	B	.61160446 05	PER	.25657464 05	OMD	.96855901-02	NOD	-.65676022-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13737537 09	Y	.53171270 08	Z	.23056144 08	DX	-.40327537 01	DY	.31384905 02	DZ	.68967640 01
R	.14909984 09	LAT	.88956647 01	LON	.21158978 02	V	.32385810 02	PTH	.15295301 02	AZ	.79591814 02
XE	.13737247 09	YE	.53176434 08	ZE	.23058984 08	DXE	-.12054731 02	DYE	.25077970 02	DZE	.10873858 02
XT	.13751221 09	YT	.53499101 08	ZT	.23169085 08	DXT	-.13011733 02	DYT	.25490038 02	DZT	.11101303 02
LTE	.88967925 01	LOE	.21161259 02	LTT	.89238656 01	LOT	.21258517 02	RST	.14936052 09	VST	.30696680 02
EPS	.86536381 02	ESP	.27453512-18	SEP	.93461096 02	EPM	.48719264 02	EMP	.76776702 00	MEP	.13051290 03
MPS	.13432229 03	MSP	.10183584 00	SMP	.45575402 02	SEM	.13506909 03	EMS	.44831084 02	ESM	.99650790-01
EPT	.48719264 02	ETP	.76776702 00	TEP	.13051290 03	TPS	.13432229 03	TSP	.10183584 00	STP	.45575402 02
SET	.13506909 03	STE	.44831084 02	EST	.99650790-01	RPM	.37276307 06	RPT	.37276307 06	SPN	.10441791 02
GCE	.99206688 02	GCT	.10979252 03	SIP	.13405515 03	CPT	.10549635 03	SIN	.10522921 03		
REP	.65705580 04	VEP	.10952024 02								

RA-5 STANDARD TRAJECTORY FIRST DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG.

2 DAYS 17 HRS. 51 MIN. 6.650 SEC. JULIAN DATE 2437956.97445882 OCT. 19,1962 11 23 13.243
RECTIFICATION .14558578-01 .64754811 02 -.96126751 02 -.34621757 02

2 DAYS 18 HRS. 17 MIN. 6.297 SEC. JULIAN DATE 2437956.99251029 OCT. 19,1962 11 49 12.890

GEOCENTRIC EQUATORIAL COORDINATES

X	-.10185195 06	Y	.34432644 06	Z	.13605139 06	DX	.11536400 00	DY	.18449228 01	DZ	.11685548 01
R	.38398502 06	DEC	.20751426 02	RA	.10647824 03	V	.21869086 01	PTH	.68720782 02	AZ	.30698836 03
R	.38398501 06	LAT	.20751427 02	LON	.26170180 03	VE	.26899616 02	PTE	.43446705 01	AZE	.27102006 03
XS	-.13434029 09	YS	-.59098991 08	ZS	-.25626929 08	DXS	.13354103 02	DYS	-.24548377 02	DZS	-.10643713 02
XM	-.10169706 06	YM	.34560901 06	ZM	.13721415 06	DXM	-.99320209 00	DYM	-.21294059 00	DZM	-.33442895-02
XT	-.10169706 06	YT	.34560901 06	ZT	.13721415 06	DXT	-.99320209 00	DYT	-.21294059 00	DZT	-.33442895-02
RS	.14898571 09	VS	.29903904 02	RM	.38550694 06	VM	.10157782 01	RT	.38550694 06	VT	.10157782 01
GED	.20880687 02	ALT	.37760952 06	LOS	.35896922 03	RAS	.20374566 03	RAM	.10639676 03	LOM	.26162032 03
DUT	.34000000 02	DT	.59999999 02	DR	.20378115 01	SHA	.37788930 06	DES	-.99046664 01	DEM	.20850557 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13423844 09	Y	.59443317 08	Z	.25762981 08	DX	-.13238739 02	DY	.26393299 02	DZ	.11812268 02
R	.14905434 09	LAT	.99531522 01	LON	.23884669 02	V	.31802518 02	PTH	.11613541 01	AZ	.68060877 02
XE	.13434029 09	YE	.59098991 08	ZE	.25626929 08	DXE	-.13354103 02	DYE	.24548377 02	DZE	.10643713 02
XT	.13423859 09	YT	.59444600 08	ZT	.25764144 08	DXT	-.14347305 02	DYT	.24335436 02	DZT	.10640369 02
LTE	.99046664 01	LOE	.23745660 02	LTT	.99535483 01	LOT	.23885102 02	RST	.14905520 09	VST	.30187349 02
EPS	.79631954 02	ESP	.14503307 00	SEP	.10022279 03	EPM	.15105636 03	EMP	.28818619 02	MEP	.12511453 00
MPS	.11935160 03	MSP	.27453512-18	SMP	.60647815 02	SEM	.10031014 03	EMS	.79544068 02	ESM	.14570608 00
EPT	.15105636 03	ETP	.28818619 02	TEP	.12511453 00	TPS	.11935160 03	TSP	.27453512-18	STP	.60647815 02
SET	.10031014 03	STE	.79544068 02	EST	.14570608 00	RPM	.17380899 04	RPT	.17380899 04	SPN	.78680226 02
GCE	.28575075 03	GCT	.82350933 02	SIP	.29934426 02	CPT	.84704653 02	SIN	-.47125187 01		
REP	.38398502 06	VEP	.21869086 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.15488678 03	Y	-.12825651 04	Z	-.11627525 04	DX	.11085661 01	DY	.20578633 01	DZ	.11718991 01
R	.17380899 04	DEC	-.41988614 02	RA	.26311411 03	V	.26147787 01	PTH	-.66687009 02	AZ	.12439864 03
R	.17380898 04	LAT	-.17717905 02	LON	.34688482 03	VR	.26133132 01	PTR	-.66761662 02	AZR	.12289387 03
LTS	.15151511 01	LNS	.28843302 03	LTE	.21955566 01	LNE	.80247025 01				
ALT	.89920043-01	SHA	-.15149594 04	ALP	.10962719 02	DR	-.24012995 01	DP	.34112243-01	ASD	.89417172 02
HGE	.28036804 03	SVL	-.20252784 02	HNG	.12149805 03	SIA	.61639190 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437956.99897953 OCT. 19,1962 11 58 31.832

SMA	-.40913955 04	ECC	.10776527 01	INC	.52171614 02	LAN	.38778470 02	APF	.30208389 01	RCA	.31770788 03
VH	.10944500 01	C3	.11978209 01	C1	.17985898 04	SLR	.66008663 03	APO	.00000000 00	TFP	-.55894230 03
TA	-.12513686 03	EA	-.44837290 02	MA	-.85667104 01	DAI	.19427364 02	RAI	.54672340 02	MTA	.15811636 03
WX	.49469246 00	WY	-.61574700 00	WZ	.61329845 00	PX	.75824753 00	PY	.65063667 00	PZ	.41624486-01
QX	-.42466457 00	QY	.44444071 00	QZ	.78875367 00	RX	-.27868747-01	RY	.41322866 00	RZ	-.91020074 00
SXO	-.86189245 00	SYO	-.43810042 00	SZO	.25536130 00	DAO	.14794994 02	RAO	.20694425 03	TF	.66440344 02
SXI	.54532815 00	SYI	.76940675 00	SZI	.33261158 00	TX	.83775924 00	TY	-.48708862 00	TZ	-.24678762 00
BX	.67668056 00	BY	-.16990845 00	BZ	-.71640390 00	MX	.62323000 00	MY	.80471967-02	MZ	-.49462403 00
B.T	.13581746 04	B.R	.92522240 03	B	.16433730 04	PER	.27957043 03				
OP1	.10368046 02	OY	-.10337405 02	OP2	-.48770040 02						
BTE	.10687273 04	BRE	.12483977 04	BTO	.13581746 04	BRO	.92522240 03				
CR	-.36445548 00	IR	.41523889 04	THA	.34263664 02						

RA-5 STANDARD TRAJECTORY FIRST DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG.

214551013204	615503171070	614543307422	204401070552	203622156667	602776227177
	621001600		0		220755132275

RA-5 STANDARD TRAJECTORY SECOND DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437955.16546736 OCT. 17,1962 15 58 16.380

GEOCENTRIC	XO	.41168984 04	YO	-.44035752 04	ZO	-.26162495 04	DXO	.70009968 01	DYO	.78683265 01	DZO	-.30058033 01			
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.57496380 05	GHA	.26524013 03	GHO	.25015991 02					

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437955.16546736 OCT. 17,1962 15 58 16.380

GEOCENTRIC EQUATORIAL COORDINATES

X	.41323412 04	Y	-.43921277 04	Z	-.26111410 04	DX	.69826549 01	DY	.78877655 01	DZ	-.29975083 01				
R	.65715361 04	DEC	-.23412059 02	RA	.31325443 03	V	.10952596 02	PTH	.16222066 01	AZ	.10662405 03				
R	.65715360 04	LAT	-.23412059 02	LON	.48014296 02	VE	.10532152 02	PTE	.16869841 01	AZE	.10730877 03				
XS	-.13638089 09	YS	-.55195151 08	ZS	-.23934284 08	DXS	.12496824 02	DYS	-.24905241 02	DZS	-.10798738 02				
XM	.59567929 05	YM	.34732803 06	ZM	.12547205 06	DXM	-.10192026 01	DYM	.19751246 00	DZM	.15209003 00				
XT	.59567929 05	YT	.34732803 06	ZT	.12547205 06	DXT	-.10192026 01	DYT	.19751246 00	DZT	.15209003 00				
RS	.14906073 09	VS	.29884015 02	RM	.37406995 06	VM	.10492457 01	RT	.37406995 06	VT	.10492457 01				
GED	-.23554278 02	ALT	.19673871 03	LOS	.29679369 03	RAS	.20203383 03	RAM	.80268254 02	LOM	.17502812 03				
DUT	.34000000 02	DT	.15000000 02	DR	.31005793 00	SHA	.63383053 04	DES	-.92398286 01	DEM	.19598323 02				

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437955.16506992 OCT. 17,1962 15 57 42.041

SMA	.29467968 06	ECC	.97771746 00	INC	.28440188 02	LAN	.80176357 02	APF	.23326447 03	RCA	.65662095 04				
VH	.12345123 00	C3	-.13526660 01	CI	.71946535 05	SLR	.12986107 05	APO	.58279314 06	TFP	.34339216 02				
TA	.32813961 01	EA	.34839641 00	MA	.77652977-02	DAO	-.22436668 02	RAO	.30985254 03	MTA	.18000000 03				
WX	.46925827 00	WY	-.81254356-01	WZ	.87931474 00	PX	.59230562 00	PY	-.70958309 00	PZ	-.38166200 00				
QX	.65495855 00	QY	.69992110 00	QZ	-.28485031 00	RX	-.40291713-01	RY	.44701606 00	RZ	-.89361803 00				
SXO	.59230562 00	SYO	-.70958309 00	SZO	-.38166200 00	TX	-.80470531 00	TY	-.54467281 00	TZ	-.23617981 00				
BX	-.65495857 00	BY	-.69992112 00	BZ	.28485032 00	MX	.61998125 00	MY	.73939000 00	MZ	-.26253702 00				
B.T	.52024876 05	B.R	-.33468727 05	B	.61860678 05	PER	.26532826 05	OMD	.10947140-01	NOD	-.67174289-02				

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13638502 09	Y	.55190758 08	Z	.23931673 08	DX	-.55141687 01	DY	.32793007 02	DZ	.78012300 01				
R	.14906247 09	LAT	.92387033 01	LON	.22031643 02	V	.34156207 02	PTH	.14148433 02	AZ	.78601232 02				
XE	.13638089 09	YE	.55195151 08	ZE	.23934284 08	DXE	-.12496824 02	DYE	.24905241 02	DZE	.10798738 02				
XT	.13644046 09	YT	.55542479 08	ZT	.24059756 08	DXT	-.13516026 02	DYT	.25102754 02	DZT	.10950828 02				
LTE	.92398286 01	LOE	.22033832 02	LTT	.92759141 01	LOT	.22150364 02	RST	.14926432 09	VST	.30540986 02				
EPS	.74687043 02	ESP	.27453512-18	SEP	.10531052 03	EPM	.48424470 02	EMP	.75283978 00	MEP	.13082252 03				
MPS	.12217675 03	MSP	.12274622 00	SMP	.57700304 02	SEM	.12291333 03	EMS	.56966126 02	ESM	.11992408 00				
EPT	.48424470 02	ETP	.75283978 00	TEP	.13082252 03	TPS	.12217675 03	TSP	.12274622 00	STP	.57700304 02				
SET	.12291333 03	STE	.56966126 02	EST	.11992408 00	RPM	.37839856 06	RPT	.37839856 06	SPN	-.13731470 01				
GCE	.98119482 02	GCT	.10800301 03	SIP	.12191359 03	CPT	.10641493 03	SIN	.10615177 03						
REP	.65715361 04	VEP	.10952596 02												

RA-5 STANDARD TRAJECTORY SECOND DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

2 DAYS 19 HRS. 16 MIN. 32.685 SEC. JULIAN DATE 2437957.96862344 OCT. 20,1962 11 14 49.066
RECTIFICATION .13837729-01 .82371527 02 -.76881602 02 -.29715105 02

2 DAYS 19 HRS. 40 MIN. 14.638 SEC. JULIAN DATE 2437957.98508123 OCT. 20,1962 11 38 31.019

GEOCENTRIC EQUATORIAL COORDINATES

X	-.18357147 06	Y	.31727128 06	Z	.13241063 06	DX	-.26423234 00	DY	.18341663 01	DZ	.10817513 01
R	.38973339 06	DEC	.19861441 02	RA	.12005344 03	V	.21457331 01	PTH	.67690923 02	AZ	.30211946 03
R	.38973340 06	LAT	.19861440 02	LON	.27697313 03	VE	.27494344 02	PTE	.41404248 01	AZE	.27090488 03
XS	-.13317520 09	YS	-.61195590 08	ZS	-.26535976 08	DXS	.13815697 02	DYS	-.24343651 02	DZS	-.10554876 02
XM	-.18353588 06	YM	.31868034 06	ZM	.13342760 06	DXM	-.90801869 00	DYM	-.41100909 00	DZM	-.84021262-01
XT	-.18353588 06	YT	.31868034 06	ZT	.13342760 06	DXT	-.90801869 00	DYT	-.41100909 00	DZT	-.84021262-01
RS	.14894527 09	VS	.29914749 02	RM	.39121030 06	VM	.10002430 01	RT	.39121030 06	VT	.10002430 01
GED	.19986108 02	ALT	.38335768 06	LOS	.15990238 01	RAS	.20467934 03	RAM	.11993870 03	LOM	.27685838 03
DUT	.34000000 02	DT	.59999999 02	DR	.19851241 01	SHA	-.38960012 06	DES	-.10262559 02	DEM	.19941688 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13299163 09	Y	.61512861 08	Z	.26668386 08	DX	-.14079929 02	DY	.26177817 02	DZ	.11636627 02
R	.14893559 09	LAT	.10315005 02	LON	.24822043 02	V	.31920739 02	PTH	.57957655 00	AZ	.68363671 02
XE	.13317520 09	YE	.61195590 08	ZE	.26535976 08	DXE	-.13815697 02	DYE	.24343651 02	DZE	.10554876 02
XT	.13299167 09	YT	.61514270 08	ZT	.26669403 08	DXT	-.14723715 02	DYT	.23932642 02	DZT	.10470855 02
LTE	.10262559 02	LOE	.24679344 02	LTT	.10315348 02	LOT	.24822538 02	RST	.14893638 09	VST	.29986629 02
EPS	.91348513 02	ESP	.15000707 00	SEP	.88501604 02	EPM	.14811513 03	EMP	.31750403 02	MEP	.13453449 00
MPS	.11725057 03	MSP	.27453512-18	SMP	.62748831 02	SEM	.88623282 02	EMS	.91226260 02	ESM	.15049542 00
EPT	.14811513 03	ETP	.31750403 02	TEP	.13453449 00	TPS	.11725057 03	TSP	.27453512-18	STP	.62748831 02
SET	.88623282 02	STE	.91226260 02	EST	.15049542 00	RPM	.17380900 04	RPT	.17380900 04	SPN	.90410823 02
GCE	.28455501 03	GCT	.89908961 02	SIP	.27833692 02	CPT	.91289579 02	SIN	.18727007 01		
REP	.38973339 06	VEP	.21457331 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.35585472 02	Y	-.14090653 04	Z	-.10169689 04	DX	.64378635 00	DY	.22451754 01	DZ	.11657725 01
R	.17380900 04	DEC	-.35810558 02	RA	.26855331 03	V	.26104212 01	PTH	-.74496657 02	AZ	.12274058 03
R	.17380898 04	LAT	-.11506395 02	LON	.33812569 03	VR	.26094127 01	PTR	-.74576668 02	AZR	.12364776 03
LTS	.15234447 01	LNS	.27634596 03	LTE	.77779974 00	LNE	.75934628 01				
ALT	.90011596-01	SHA	-.15451755 04	ALP	.64900184 01	DR	-.25154407 01	DP	.23001226-01	ASD	.89416879 02
HGE	.26865147 03	SVL	-.12990186 02	HNG	.11802835 03	SIA	.58698254 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437957.99100854 OCT. 20,1962 11 47 03.138

SMA	-.41706722 04	ECC	.10353538 01	INC	.46990653 02	LAN	.46251766 02	APF	.16187426 02	RCA	.14744926 03
VH	.10839984 01	C3	.11750525 01	C1	.12127546 04	SLR	.30011142 03	APO	.00000000 00	TFP	-.51211885 03
TA	-.14304253 03	EA	-.47781893 02	MA	-.76263368 01	DAI	.22261908 02	RAI	.68700287 02	MTA	.16498397 03
WX	.52823871 00	WY	-.50564730 00	WZ	.68211766 00	PX	.52670698 00	PY	.82524086 00	PZ	.20385602 00
QX	-.66599057 00	QY	.25159156 00	QZ	.70225214 00	RX	-.46279561-01	RY	.41688950 00	RZ	-.90777825 00
SXO	-.68127269 00	SYO	-.73187702 00	SZO	-.14949079-01	DAO	-.85655011 00	RAO	.22705086 03	TF	.67812987 02
SXI	.33617076 00	SYI	.86224633 00	SZI	.37884098 00	TX	.94066329 00	TY	-.28763590 00	TZ	-.18005044 00
BX	.77971342 00	BY	-.29189566-01	BZ	-.62545579 00	MX	.68925929 00	MY	.75360035-02	MZ	-.52818288 00
B.T	.95594854 03	B.R	.58122955 03	B	.11187785 04	PER	.13367413 03				
OP1	-.13485136 01	OY	-.65043504 01	OP2	-.47369028 02						
BTE	.82460310 03	BRE	.75610522 03	BTO	.95594854 03	BRO	.58122955 03				

RA-5 STANDARD TRAJECTORY SECOND DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

215401234600	615423162321	614507017757	203700040525	203767445246	602600574250
	621001700		0		220701141413

RA-5 STANDARD TRAJECTORY SECOND DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437955.22090378 OCT. 17,1962 17 18 06.087

GEOCENTRIC	XO	.41508259 04	YO	-.43463776 04	ZO	-.26568197 04	DXO	.66662704 01	DYO	.79888666 01	DZO	-.34215074 01			
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.62286087 05	GHA	.28525189 03	GHO	.25015991 02					

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437955.22090378 OCT. 17,1962 17 18 06.087

GEOCENTRIC EQUATORIAL COORDINATES

X	.41661583 04	Y	-.43348362 04	Z	-.26516713 04	DX	.66480976 01	DY	.80073620 01	DZ	-.34136211 01
R	.65710760 04	DEC	-.23799472 02	RA	.31386328 03	V	.10952984 02	PTH	.16227966 01	AZ	.10916373 03
R	.65710759 04	LAT	-.23799472 02	LON	.28611392 02	VE	.10540011 02	PTE	.16863967 01	AZE	.10994645 03
XS	-.13632097 09	YS	-.55314422 08	ZS	-.23985999 08	DXS	.12522970 02	DYS	-.24894791 02	DZS	-.10794195 02
XM	.54681338 05	YM	.34824330 06	ZM	.12618940 06	DXM	-.10212139 01	DYM	.18466588 00	DZM	.14744513 00
XT	.54681338 05	YT	.34824330 06	ZT	.12618940 06	DXT	-.10212139 01	DYT	.18466588 00	DZT	.14744513 00
RS	.14905844 09	VS	.29884611 02	RM	.37441581 06	VM	.10481981 01	RT	.37441581 06	VT	.10481981 01
GED	-.23943477 02	ALT	.19638580 03	LOS	.27683375 03	RAS	.20208564 03	RAM	.81076247 02	LOM	.15582436 03
DUT	.34000000 02	DT	.15000000 02	DR	.31018140 00	SHA	.63268502 04	DES	-.92601117 01	DEM	.19696033 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437955.22050624 OCT. 17,1962 17 17 31.739

SMA	.29467899 06	ECC	.97771899 00	INC	.30201669 02	LAN	.84598406 02	APF	.23005697 03	RCA	.65657460 04
VH	.12344712 00	C3	-.13526692 01	C1	.71944023 05	SLR	.12985200 05	APO	.58279222 06	TFP	.34348012 02
TA	.32825845 01	EA	.34851039 00	MA	.77673142-02	DAO	-.22685733 02	RAO	.31050251 03	MTA	.18000000 03
WX	.50081131 00	WY	-.47354647-01	WZ	.86426014 00	PX	.59923366 00	PY	-.70155024 00	PZ	-.38567631 00
QX	.62458546 00	QY	.71104483 00	QZ	-.32296779 00	RX	-.44916793-01	RY	.45152891 00	RZ	-.89112516 00
SXO	.59923366 00	SYO	-.70155024 00	SZO	-.38567631 00	TX	-.79931313 00	TY	-.55131557 00	TZ	-.23905995 00
BX	-.62458548 00	BY	-.71104486 00	BZ	.32296780 00	MX	.58924824 00	MY	.75004937 00	MZ	-.30035385 00
B.T	.50355290 05	B.R	-.35927853 05	B	.61858435 05	PER	.26532732 05	OMD	.10447323-01	NOD	-.66033662-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13632513 09	Y	.55310086 08	Z	.23983347 08	DX	-.58748723 01	DY	.32902152 02	DZ	.73805738 01
R	.14906022 09	LAT	.92589676 01	LON	.22083472 02	V	.34227746 02	PTH	.13556618 02	AZ	.79313733 02
XE	.13632097 09	YE	.55314422 08	ZE	.23985999 08	DXE	-.12522970 02	DYE	.24894791 02	DZE	.10794195 02
XT	.13637565 09	YT	.55662664 08	ZT	.24112188 08	DXT	-.13544184 02	DYT	.25079456 02	DZT	.10941640 02
LTE	.92601117 01	LOE	.22085646 02	LTT	.92966839 01	LOT	.22203169 02	RST	.14925832 09	VST	.30531025 02
EPS	.74327546 02	ESP	.98911702-02	SEP	.10567002 03	EPM	.48180581 02	EMP	.74935533 00	MEP	.13107000 03
MPS	.12147381 03	MSP	.12413322 00	SMP	.58402181 02	SEM	.12220501 03	EMS	.57673375 02	ESM	.12214696 00
EPT	.48180581 02	ETP	.74935533 00	TEP	.13107000 03	TPS	.12147381 03	TSP	.12413322 00	STP	.58402181 02
SET	.12220501 03	STE	.57673375 02	EST	.12214696 00	RPM	.37876528 06	RPT	.37876528 06	SPN	-.17488108 01
GCE	.97560377 02	GCT	.10790357 03	SIP	.12121090 03	CPT	.10643255 03	SIN	.10616964 03		
REP	.65710760 04	VEP	.10952984 02								

RA-5 STANDARD TRAJECTORY SECOND DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

2 DAYS 19 HRS. 23 MIN. 3.747 SEC. JULIAN DATE 2437958.02858605 OCT. 20,1962 12 41 09.835
RECTIFICATION .13505663-01 .82896166 02 -.74776302 02 -.28536092 02

2 DAYS 19 HRS. 46 MIN. 43.491 SEC. JULIAN DATE 2437958.04501827 OCT. 20,1962 13 04 49.579

GEOCENTRIC EQUATORIAL COORDINATES

X	-.18823759 06	Y	.31512146 06	Z	.13195260 06	DX	-.28410211 00	DY	.18215629 01	DZ	.10972873 01
R	.39005949 06	DEC	.19772627 02	RA	.12085195 03	V	.21454241 01	PTH	.67346624 02	AZ	.30335160 03
R	.39005949 06	LAT	.19772627 02	LON	.25613523 03	VE	.27531901 02	PTE	.41238854 01	AZE	.27094790 03
XS	-.13310358 09	YS	-.61321627 08	ZS	-.26590623 08	DXS	.13843470 02	DYS	-.24331041 02	DZS	-.10549406 02
XM	-.18822133 06	YM	.31652302 06	ZM	.13298038 06	DXM	-.90150741 00	DYM	-.42214797 00	DZM	-.88692986-01
XT	-.18822133 06	YT	.31652302 06	ZT	.13298038 06	DXT	-.90150741 00	DYT	-.42214797 00	DZT	-.88692986-01
RS	.14894283 09	VS	.29915400 02	RM	.39153271 06	VM	.99939529 00	RT	.39153271 06	VT	.99939529 00
GED	.19896830 02	ALT	.38368376 06	LOS	.34001908 03	RAS	.20473581 03	RAM	.12073795 03	LOM	.25602123 03
DUT	.34000000 02	DT	.59999999 02	DR	.19799086 01	SHA	-.38977393 06	DES	-.10284094 02	DEM	.19854975 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13291534 09	Y	.61636749 08	Z	.26722576 08	DX	-.14127572 02	DY	.26152604 02	DZ	.11646693 02
R	.14892842 09	LAT	.10336698 02	LON	.24878540 02	V	.31924793 02	PTH	.54735684 00	AZ	.68339285 02
XE	.13310358 09	YE	.61321627 08	ZE	.26590623 08	DXE	-.13843470 02	DYE	.24331041 02	DZE	.10549406 02
XT	.13291536 09	YT	.61638151 08	ZT	.26723604 08	DXT	-.14744977 02	DYT	.23908893 02	DZT	.10460713 02
LTE	.10284094 02	LOE	.24735811 02	LTT	.10337045 02	LOT	.24879034 02	RST	.14892920 09	VST	.29974590 02
EPS	.92042578 02	ESP	.15000707 00	SEP	.87807465 02	EPM	.14788474 03	EMP	.31980040 02	MEP	.13507880 00
MPS	.11662746 03	MSP	.27453512-18	SMP	.63371936 02	SEM	.87929218 02	EMS	.91920250 02	ESM	.15033281 00
EPT	.14788474 03	ETP	.31980040 02	TEP	.13507880 00	TPS	.11662746 03	TSP	.27453512-18	STP	.63371936 02
SET	.87929218 02	STE	.91920250 02	EST	.15033281 00	RPM	.17380900 04	RPT	.17380900 04	SPN	.91105673 02
GCE	.28448770 03	GCT	.89493698 02	SIP	.27210459 02	CPT	.90895665 02	SIN	.14786615 01		
REP	.39005949 06	VEP	.21454241 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.16262273 02	Y	-.14015562 04	Z	-.10277803 04	DX	.61740530 00	DY	.22437109 01	DZ	.11859803 01
R	.17380900 04	DEC	-.36251265 02	RA	.26933522 03	V	.26118914 01	PTH	-.74455625 02	AZ	.12234692 03
R	.17380897 04	LAT	-.11956480 02	LON	.33797476 03	VR	.26108810 01	PTR	-.74535497 02	AZR	.12358328 03
LTS	.15239398 01	LNS	.27561588 03	LTE	.69153871 00	LNE	.75553647 01				
ALT	.89965820-01	SHA	-.15537391 04	ALP	.65476573 01	DR	-.25163568 01	DP	.23073597-01	ASD	.89417003 02
HGE	.26795741 03	SVL	-.13372341 02	HNG	.11743084 03	SIA	.58467737 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437958.05094656 OCT. 20,1962 13 13 21.784

SMA	-.41435980 04	ECC	.10358012 01	INC	.47055258 02	LAN	.46299123 02	APF	.16792441 02	RCA	.14834592 03
VH	.10875340 01	C3	.11827303 01	C1	.12165702 04	SLR	.30200281 03	APO	.00000000 00	TFP	-.51220497 03
TA	-.14290973 03	EA	-.47906697 02	MA	-.77024994 01	DAI	.22757250 02	RAI	.69279700 02	MTA	.16489198 03
WX	.52921230 00	WY	-.50574172 00	WZ	.68129271 00	PX	.51913313 00	PY	.82811603 00	PZ	.21148206 00
QX	-.67114467 00	QY	.24176267 00	QZ	.70079641 00	RX	-.44884817-01	RY	.42289448 00	RZ	-.90506662 00
SXO	-.67611672 00	SYO	-.73648028 00	SZO	-.21517210-01	DAO	-.12329396 01	RAO	.22744689 03	TF	.67921026 02
SXI	.32626310 00	SYI	.86250608 00	SZI	.38682766 00	TX	.94421276 00	TY	-.27792716 00	TZ	-.17668829 00
BX	.78325398 00	BY	-.17566687-01	BZ	-.62145366 00	MX	.68850464 00	MY	.76233670-02	MZ	-.52915533 00
B.T	.95560038 03	B.R	.58155472 03	B	.11186501 04	PER	.13402066 03				
OP1	-.20425787 01	OY	-.70333393 01	OP2	-.47183185 02						
BTE	.82646687 03	BRE	.75387697 03	BTO	.95560038 03	BRO	.58155472 03				

RA-5 STANDARD TRAJECTORY SECOND DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

215403332333	615417514053	614514064353	203652510263	203777223136	602665747723
	621001700		0		220746470263

RA-5 STANDARD TRAJECTORY SECOND DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437955.27575308 OCT. 17,1962 18 37 05.066

GEOCENTRIC	XO	.41529073 04	YO	-.42913898 04	ZO	-.27403671 04	DXO	.60869479 01	DYO	.80878614 01	DZO	-.41848456 01
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.67025066 05	GHA	.30505169 03	GHO	.25015991 02		

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437955.27575308 OCT. 17,1962 18 37 05.066

GEOCENTRIC EQUATORIAL COORDINATES

X	.41681880 04	Y	-.42798446 04	Z	-.27352174 04	DX	.60694273 01	DY	.81047233 01	DZ	-.41776640 01
R	.65705612 04	DEC	-.24600183 02	RA	.31424277 03	V	.10953418 02	PTH	.16229784 01	AZ	.11399598 03
R	.65705611 04	LAT	-.24600184 02	LON	.91910870 01	VE	.10557076 02	PTE	.16839276 01	AZE	.11495796 03
XS	-.13626156 09	YS	-.55432379 08	ZS	-.24037144 08	DXS	.12548831 02	DYS	-.24884427 02	DZS	-.10789690 02
XM	.49837451 05	YM	.34908831 06	ZM	.12687722 06	DXM	-.10230221 01	DYM	.17195746 00	DZM	.14283608 00
XT	.49837451 05	YT	.34908831 06	ZT	.12687722 06	DXT	-.10230221 01	DYT	.17195746 00	DZT	.14283608 00
RS	.14905618 09	VS	.29885202 02	RM	.37475892 06	VM	.10471608 01	RT	.37475892 06	VT	.10471608 01
GED	-.24747797 02	ALT	.19609674 03	LOS	.25708522 03	RAS	.20213692 03	RAM	.81875090 02	LOM	.13682340 03
DUT	.34000000 02	DT	.15000000 02	DR	.31022885 00	SHA	.63255126 04	DES	-.92801736 01	DEM	.19788975 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437955.27535553 OCT. 17,1962 18 36 30.719

SMA	.29467947 06	ECC	.97772077 00	INC	.33834099 02	LAN	.91161674 02	APF	.22510419 03	RCA	.65652303 04
VH	.12344201 00	C3	-.13526670 01	C1	.71941230 05	SLR	.12984193 05	APO	.58279371 06	TFP	.34347822 02
TA	.32829534 01	EA	.34853643 00	MA	.77672517-02	DAO	-.23230143 02	RAO	.31097897 03	MTA	.18000000 03
WX	.55667567 00	WY	.11288182-01	WZ	.83065324 00	PX	.60261635 00	PY	-.69374496 00	PZ	-.39442542 00
QX	.57180914 00	QY	.72013225 00	QZ	-.39299338 00	RX	-.51944423-01	RY	.45910121 00	RZ	-.88686401 00
SXO	.60261635 00	SYO	-.69374496 00	SZO	-.39442542 00	TX	-.79633868 00	TY	-.55492698 00	TZ	-.24062572 00
BX	-.57180916 00	BY	-.72013228 00	BZ	.39299339 00	MX	.53636073 00	MY	.75867914 00	MZ	-.36976089 00
B.T	.47036009 05	B.R	-.40172007 05	B	.61856095 05	PER	.26532798 05	OMD	.93607332-02	NOD	-.63475627-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13626572 09	Y	.55428100 08	Z	.24034408 08	DX	-.64794041 01	DY	.32989150 02	DZ	.66120260 01
R	.14905796 09	LAT	.92789972 01	LON	.22134762 02	V	.34263473 02	PTH	.12489790 02	AZ	.80555958 02
XE	.13626156 09	YE	.55432379 08	ZE	.24037144 08	DXE	-.12548831 02	DYE	.24884427 02	DZE	.10789690 02
XT	.13631139 09	YT	.55781467 08	ZT	.24164020 08	DXT	-.13571853 02	DYT	.25056385 02	DZT	.10932526 02
LTE	.92801736 01	LOE	.22136918 02	LTT	.93172213 01	LOT	.22255404 02	RST	.14925236 09	VST	.30521103 02
EPS	.74300387 02	ESP	.27453512-18	SEP	.10569718 03	EPM	.47703215 02	EMP	.74299604 00	MEP	.13155372 03
MPS	.12078422 03	MSP	.12472294 00	SMP	.59090734 02	SEM	.12150559 03	EMS	.58371745 02	ESM	.12274622 00
EPT	.47703215 02	ETP	.74299604 00	TEP	.13155372 03	TPS	.12078422 03	TSP	.12472294 00	STP	.59090734 02
SET	.12150559 03	STE	.58371745 02	EST	.12274622 00	RPM	.37914919 06	RPT	.37914919 06	SPN	-.17940903 01
GCE	.96657959 02	GCT	.10779973 03	SIP	.12052158 03	CPT	.10644050 03	SIN	.10617785 03		
REP	.65705612 04	VEP	.10953418 02								

RA-5 STANDARD TRAJECTORY SECOND DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG

2 DAYS 19 HRS. 30 MIN. 37.727 SEC. JULIAN DATE 2437958.08868973 OCT. 20,1962 14 07 42.793
RECTIFICATION .13528842-01 .82773581 02 -.72395755 02 -.27023184 02

2 DAYS 19 HRS. 52 MIN. 56.818 SEC. JULIAN DATE 2437958.10418848 OCT. 20,1962 14 30 01.885

GEOCENTRIC EQUATORIAL COORDINATES

X	-.19281250 06	Y	.31294790 06	Z	.13147049 06	DX	-.29697906 00	DY	.18034486 01	DZ	.11233024 01
R	.39038127 06	DEC	.19680485 02	RA	.12163792 03	V	.21453279 01	PTH	.66722981 02	AZ	.30515382 03
R	.39038126 06	LAT	.19680485 02	LON	.23556160 03	VE	.27572162 02	PTE	.40986863 01	AZE	.27101700 03
XS	-.13303274 09	YS	-.61445988 08	ZS	-.26644544 08	DXS	.13870876 02	DYS	-.24318567 02	DZS	-.10543995 02
XM	-.19281339 06	YM	.31433696 06	ZM	.13251522 06	DXM	-.89493746 00	DYM	-.43304385 00	DZM	-.93278515-01
XT	-.19281339 06	YT	.31433696 06	ZT	.13251522 06	DXT	-.89493746 00	DYT	-.43304385 00	DZT	-.93278515-01
RS	.14894043 09	VS	.29916044 02	RM	.39184820 06	VM	.99856943 00	RT	.39184820 06	VT	.99856943 00
GED	.19804204 02	ALT	.38400551 06	LOS	.31871524 03	RAS	.20479156 03	RAM	.12152483 03	LOM	.23544851 03
DUT	.34000000 02	DT	.59999999 02	DR	.19707089 01	SHA	-.38988933 06	DES	-.10305344 02	DEM	.19766027 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13283993 09	Y	.61758935 08	Z	.26776014 08	DX	-.14167855 02	DY	.26122015 02	DZ	.11667297 02
R	.14892134 09	LAT	.10358094 02	LON	.24934303 02	V	.31925125 02	PTH	.52562062 00	AZ	.68293542 02
XE	.13303274 09	YE	.61445988 08	ZE	.26644544 08	DXE	-.13870876 02	DYE	.24318567 02	DZE	.10543995 02
XT	.13283993 09	YT	.61760325 08	ZT	.26777059 08	DXT	-.14765813 02	DYT	.23885523 02	DZT	.10450717 02
LTE	.10305344 02	LOE	.24791565 02	LTT	.10358449 02	LOT	.24934796 02	RST	.14892211 09	VST	.29962725 02
EPS	.92726665 02	ESP	.15000707 00	SEP	.87123327 02	EPM	.14749551 03	EMP	.32367918 02	MEP	.13634040 00
MPS	.11604301 03	MSP	.27453512-18	SMP	.63956383 02	SEM	.87245243 02	EMS	.92604171 02	ESM	.15049542 00
EPT	.14749551 03	ETP	.32367918 02	TEP	.13634040 00	TPS	.11604301 03	TSP	.27453512-18	STP	.63956383 02
SET	.87245243 02	STE	.92604171 02	EST	.15049542 00	RPM	.17380900 04	RPT	.17380900 04	SPN	.91790533 02
GCE	.28442243 03	GCT	.88786284 02	SIP	.26626009 02	CPT	.90237349 02	SIN	.82034588 00		
REP	.39038127 06	VEP	.21453279 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	.89336497 00	Y	-.13890618 04	Z	-.10447312 04	DX	.59795840 00	DY	.22364925 01	DZ	.12165809 01
R	.17380900 04	DEC	-.36947288 02	RA	.27003685 03	V	.26152480 01	PTH	-.74353272 02	AZ	.12181104 03
R	.17380898 04	LAT	-.12663831 02	LON	.33775672 03	VR	.26142313 01	PTR	-.74433010 02	AZR	.12334305 03
LTS	.15244282 01	LNS	.27489512 03	LTE	.60639529 00	LNE	.75165197 01				
ALT	.89965820-01	SHA	-.15616044 04	ALP	.67413796 01	DR	-.25183346 01	DP	.23251583-01	ASD	.89417003 02
HGE	.26727332 03	SVL	-.14014110 02	HNG	.11690512 03	SIA	.58078508 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437958.11011965 OCT. 20,1962 14 38 34.338

SMA	-.40830287 04	ECC	.10368755 01	INC	.47223252 02	LAN	.45938082 02	APF	.17561072 02	RCA	.15056396 03
VH	.10955708 01	C3	.12002754 01	C1	.12259547 04	SLR	.30668005 03	APO	.00000000 00	TFP	-.51245289 03
TA	-.14258584 03	EA	-.48185836 02	MA	-.78783379 01	DAI	.23488055 02	RAI	.69646587 02	MTA	.16467363 03
WX	.52744804 00	WY	-.51045329 00	WZ	.67914347 00	PX	.51577720 00	PY	.82760300 00	PZ	.22146576 00
QX	-.67510910 00	QY	.23347514 00	QZ	.69979779 00	RX	-.41899691-01	RY	.43291086 00	RZ	-.90046242 00
SXO	-.67587675 00	SYO	-.73645863 00	SZO	-.28621187-01	DAO	-.16400966 01	RAO	.22745618 03	TF	.68024797 02
SXI	.31899134 00	SYI	.85988145 00	SZI	.39855787 00	TX	.94683100 00	TY	-.27054027 00	TZ	-.17412359 00
BX	.78742812 00	BY	-.64223960-02	BZ	-.61637302 00	MX	.68654884 00	MY	.77300397-02	MZ	-.52738931 00
B.T	.95633251 03	B.R	.58104291 03	B	.11190097 04	PER	.13495628 03				
OP1	-.27266655 01	OY	-.79108436 01	OP2	-.46826258 02						
BTE	.82862549 03	BRE	.75203890 03	BTO	.95633251 03	BRO	.58104291 03				

RA-5 STANDARD TRAJECTORY SECOND DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG

215403435022	615414154363	614526427375	203605441070	204402637413	603413651013
	621001700		0		221405642104

RA-5 STANDARD TRAJECTORY THIRD DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437956.21850307 OCT. 18,1962 17 14 38.666

GEOCENTRIC	XO	.51421572 04	YO	-.32997370 04	ZO	-.24197323 04	DXO	.47226667 01	DYO	.92646403 01	DZO	-.34400799 01
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.62078665 05	GHA	.28537092 03	GHO	.26001651 02		

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437956.21850307 OCT. 18,1962 17 14 38.666

GEOCENTRIC EQUATORIAL COORDINATES

X	.51542806 04	Y	-.32854240 04	Z	-.24134059 04	DX	.47009587 01	DY	.92777105 01	DZ	-.34345830 01
R	.65715406 04	DEC	-.21546188 02	RA	.32748589 03	V	.10953140 02	PTH	.16223910 01	AZ	.10903104 03
R	.65715405 04	LAT	-.21546189 02	LON	.42114970 02	VE	.10532962 02	PTE	.16871284 01	AZE	.10982201 03
XS	-.13522129 09	YS	-.57452064 08	ZS	-.24912850 08	DXS	.12992074 02	DYS	-.24702702 02	DZS	-.10710725 02
XM	-.33985932 05	YM	.35425592 06	ZM	.13524662 06	DXM	-.10266468 01	DYM	-.43941580-01	DZM	.62426146-01
XT	-.33985932 05	YT	.35425592 06	ZT	.13524662 06	DXT	-.10266468 01	DYT	-.43941580-01	DZT	.62426146-01
RS	.14901740 09	VS	.29895436 02	RM	.38071505 06	VM	.10294811 01	RT	.38071505 06	VT	.10294811 01
GED	-.21679442 02	ALT	.19624640 03	LOS	.27764848 03	RAS	.20301940 03	RAM	.95479960 02	LOM	.17010904 03
DUT	.34000000 02	DT	.15000000 02	DR	.31010846 00	SHA	.58432306 04	DES	-.96239464 01	DEM	.20808380 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437956.21810564 OCT. 18,1962 17 14 04.328

SMA	.29731779 06	ECC	.97791517 00	INC	.28443974 02	LAN	.10069102 03	APF	.22716695 03	RCA	.65662134 04
VH	.12234977 00	C3	-.13406638 01	C1	.71950152 05	SLR	.12987413 05	APO	.58806936 06	TFP	.34337914 02
TA	.32814319 01	EA	.34683401 00	MA	.76618841-02	DAO	-.20443789 02	RAO	.32417526 03	MTA	.18000000 03
WX	.46803156 00	WY	.88359551-01	WZ	.87928327 00	PX	.75974250 00	PY	-.54844236 00	PZ	-.34928829 00
QX	.45137323 00	QY	.83150680 00	QZ	-.32381884 00	RX	-.78115189-01	RY	.45630575 00	RZ	-.88638765 00
SXO	.75974250 00	SYO	-.54844236 00	SZO	-.34928829 00	TX	-.64551480 00	TY	-.70071109 00	TZ	-.30383319 00
BX	-.45137324 00	BY	-.83150680 00	BZ	.32381884 00	MX	.40714514 00	MY	.86153660 00	MZ	-.30329448 00
B.T	.48197536 05	B.R	-.39222272 05	B	.62140077 05	PER	.26889924 05	OMD	.10798547-01	NOD	-.66266513-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13522644 09	Y	.57448779 08	Z	.24910437 08	DX	-.82911149 01	DY	.33980412 02	DZ	.72761424 01
R	.14902041 09	LAT	.96228101 01	LON	.23017433 02	V	.35726086 02	PTH	.10960054 02	AZ	.79771443 02
XE	.13522129 09	YE	.57452064 08	ZE	.24912850 08	DXE	-.12992074 02	DYE	.24702702 02	DZE	.10710725 02
XT	.13518730 09	YT	.57806320 08	ZT	.25048096 08	DXT	-.14018720 02	DYT	.24658760 02	DZT	.10773152 02
LTE	.96239464 01	LOE	.23019399 02	LTT	.96682590 01	LOT	.23151636 02	RST	.14914618 09	VST	.30342046 02
EPS	.62767147 02	ESP	.27453512-18	SEP	.11723060 03	EPM	.47535755 02	EMP	.72960865 00	MEP	.13173465 03
MPS	.10899161 03	MSP	.13970734 00	SMP	.70868493 02	SEM	.10970215 03	EMS	.70160151 02	ESM	.13741256 00
EPT	.47535755 02	ETP	.72960865 00	TEP	.13173465 03	TPS	.10899161 03	TSP	.13970734 00	STP	.70868493 02
SET	.10970215 03	STE	.70160151 02	EST	.13741256 00	RPM	.38512082 06	RPT	.38512082 06	SPN	-.13292881 02
GCE	.95016090 02	GCT	.10645666 03	SIP	.10873304 03	CPT	.10637941 03	SIN	.10612084 03		
REP	.65715406 04	VEP	.10953140 02								

RA-5 STANDARD TRAJECTORY THIRD DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

2 DAYS 21 HRS. 10 MIN. 56.203 SEC. JULIAN DATE 2437959.10109802 OCT. 21,1962 14 25 34.870

RECTIFICATION	.11288072-01	.94021489 02	-.49242705 02	-.19954905 02							

2 DAYS 21 HRS. 30 MIN. 49.461 SEC. JULIAN DATE 2437959.11490887 OCT. 21,1962 14 45 28.127

GEOCENTRIC EQUATORIAL COORDINATES

X	-.26543539 06	Y	.26733121 06	Z	.12029827 06	DX	-.58600299 00	DY	.17406262 01	DZ	.96918853 00
R	.39546630 06	DEC	.17709647 02	RA	.13479611 03	V	.20766573 01	PTH	.63893341 02	AZ	.29749801 03
R	.39546630 06	LAT	.17709647 02	LON	.24386425 03	VE	.28346373 02	PTE	.37719736 01	AZE	.27085471 03
XS	-.13180102 09	YS	-.63560282 08	ZS	-.27561263 08	DXS	.14337191 02	DYS	-.24101244 02	DZS	-.10449763 02
XM	-.26545258 06	YM	.26888166 06	ZM	.12108364 06	DXM	-.76262834 00	DYM	-.60262587 00	DZM	-.16700164 00
XT	-.26545258 06	YT	.26888166 06	ZT	.12108364 06	DXT	-.76262834 00	DYT	-.60262587 00	DZT	-.16700164 00
RS	.14889943 09	VS	.29926953 02	RM	.39676651 06	VM	.98622992 00	RT	.39676651 06	VT	.98622992 00
GED	.17822722 02	ALT	.38909009 06	LOS	.31481355 03	RAS	.20574542 03	RAM	.13463231 03	LOM	.24370044 03
DUT	.34000000 02	DT	.59999999 02	DR	.18647893 01	SHA	-.38298432 06	DES	-.10666955 02	DEM	.17768755 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13153558 09	Y	.63827614 08	Z	.27681561 08	DX	-.14923194 02	DY	.25841870 02	DZ	.11418951 02
R	.14880135 09	LAT	.10721208 02	LON	.25884970 02	V	.31951469 02	PTH	.31192619-01	AZ	.68676667 02
XE	.13180102 09	YE	.63560282 08	ZE	.27561263 08	DXE	-.14337191 02	DYE	.24101244 02	DZE	.10449763 02
XT	.13153557 09	YT	.63829164 08	ZT	.27682346 08	DXT	-.15099819 02	DYT	.23498618 02	DZT	.10282761 02
LTE	.10666955 02	LOE	.25745421 02	LTT	.10721458 02	LOT	.25885519 02	RST	.14880215 09	VST	.29764488 02
EPS	.10428609 03	ESP	.14737516 00	SEP	.75566441 02	EPM	.13833970 03	EMP	.41493459 02	MEP	.16668902 00
MPS	.11725482 03	MSP	.27453512-18	SMP	.62744584 02	SEM	.75732799 02	EMS	.10411914 03	ESM	.14770671 00
EPT	.13833970 03	ETP	.41493459 02	TEP	.16668902 00	TPS	.11725482 03	TSP	.27453512-18	STP	.62744584 02
SET	.75732799 02	STE	.10411914 03	EST	.14770671 00	RPM	.17380900 04	RPT	.17380900 04	SPN	.10336199 03
GCE	.28319772 03	GCT	.99950190 02	SIP	.27837814 02	CPT	.10033437 03	SIN	.10917371 02		
REP	.39546630 06	VEP	.20766573 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	.17194346 02	Y	-.15504406 04	Z	-.78536296 03	DX	.17662535 00	DY	.23432521 01	DZ	.11361902 01
R	.17380900 04	DEC	-.26862700 02	RA	.27063538 03	V	.26101637 01	PTH	-.85442983 02	AZ	.10232643 03
R	.17380896 04	LAT	-.25921839 01	LON	.32520587 03	VR	.26098107 01	PTR	-.85541120 02	AZR	.10419312 03
LTS	.15326406 01	LNS	.26258021 03	LTE	-.83317891 00	LNE	.66830549 01				
ALT	.89965820-01	SHA	-.15451165 04	ALP	.17630718 01	DR	-.26019124 01	DP	.68362449-02	ASD	.89417003 02
HGE	.25571391 03	SVL	-.28866650 01	HNG	.11729232 03	SIA	.48922697 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437959.12029668 OCT. 21,1962 14 53 13.633

SMA	-.41754495 04	ECC	.10031695 01	INC	.29363406 02	LAN	.26443981 02	APF	.56148524 02	RCA	.13234193 02
VH	.10833781 01	C3	.11737081 01	C1	.36044521 03	SLR	.26510332 02	APO	.00000000 00	TFP	-.46550675 03
TA	-.16900268 03	EA	-.50359856 02	MA	-.69203083 01	DAI	.25317593 02	RAI	.83671169 02	MTA	.17544424 03
WX	.21836322 00	WY	-.43904328 00	WZ	.87152716 00	PX	.17643901 00	PY	.89612276 00	PZ	.40722642 00
QX	-.95978533 00	QY	.64847816-01	QZ	.27314445 00	RX	-.62879375-01	RY	.43460131 00	RZ	-.89842524 00
SXO	-.25211655 00	SYO	-.88814066 00	SZO	-.38424414 00	DAO	-.22596823 02	RAO	.25415234 03	TF	.69643045 02
SXI	.99646553-01	SYI	.89844228 00	SZI	.42763544 00	TX	.99303412 00	TY	-.62635527-01	TZ	-.99800009-01
BX	.97076680 00	BY	.65353954-02	BZ	-.23993566 00	MX	.87629808 00	MY	.24008925-02	MZ	-.21834910 00
B.T	.32855880 03	B.R	.52355413 02	B	.33270403 03	PER	.12196219 02				
OP1	-.14286089 02	OY	-.26496853 01	OP2	-.43936376 02						
BTE	.32076998 03	BRE	.88309622 02	BTO	.32855880 03	BRO	.52355413 02				
CP	.17073637 01	TR	.41874224 04	THA	.90538895 01						

RA-5 STANDARD TRAJECTORY THIRD DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

215501305021	614634357126	614456356673	203456200260	204450357674	602670251047
	621001800		0		220744772523

RA-5 STANDARD TRAJECTORY THIRD DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437956.27235604 OCT. 18,1962 18 32 11.563

GEOCENTRIC XO .51616890 04 YO-.32449504 04 ZO-.24507729 04 DXO .44041014 01 DYO .92693778 01 DZO-.38291538 01
CARTESIAN GMC .00000000 00 SGC .00000000 00 TO .66731562 05 GHA .30481107 03 GHO .26001651 02

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437956.27235604 OCT. 18,1962 18 32 11.563

GEOCENTRIC EQUATORIAL COORDINATES

X	.51736972 04	Y	-.32305835 04	Z	-.24444241 04	DX	.43828535 01	DY	.92815503 01	DZ	-.38240433 01
R	.65710746 04	DEC	-.21838869 02	RA	.32801833 03	V	.10953533 02	PTH	.16227880 01	AZ	.11140168 03
R	.65710746 04	LAT	-.21838869 02	LON	.23207263 02	VE	.10540843 02	PTE	.16863404 01	AZE	.11228431 03
XS	-.13516078 09	YS	-.57566985 08	ZS	-.24962678 08	DXS	.13017319 02	DYS	-.24692115 02	DZS	-.10706127 02
XM	-.38759854 05	YM	.35402337 06	ZM	.13552635 06	DXM	-.10253400 01	DYM	-.56012397-01	DZM	.57812890-01
XT	-.38759854 05	YT	.35402337 06	ZT	.13552635 06	DXT	-.10253400 01	DYT	-.56012397-01	DZT	.57812890-01
RS	.14901520 09	VS	.29896025 02	RM	.38105414 06	VM	.10284949 01	RT	.38105414 06	VT	.10284949 01
GED	-.21973567 02	ALT	.19585620 03	LOS	.25825880 03	RAS	.20306988 03	RAM	.96248078 02	LOM	.15143701 03
DUT	.34000000 02	DT	.15000000 02	DR	.31019548 00	SHA	.58281008 04	DES	-.96435234 01	DEM	.20834001 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437956.27195856 OCT. 18,1962 18 31 37.220

SMA	.29731700 06	ECC	.97791668 00	INC	.30205391 02	LAN	.10451291 03	APF	.22439886 03	RCA	.65657452 04
VH	.12234568 00	C3	-.13406673 01	C1	.71947614 05	SLR	.12986497 05	APO	.58806825 06	TFP	.34342617 02
TA	.32822336 01	EA	.34690658 00	MA	.76629639-02	DAO	-.20609349 02	RAO	.32475350 03	MTA	.18000000 03
WX	.48704792 00	WY	.12607631 00	WZ	.86422747 00	PX	.76441123 00	PY	-.54016240 00	PZ	-.35199438 00
QX	.42244502 00	QY	.83206329 00	QZ	-.35945910 00	RX	-.83085438-01	RY	.45887283 00	RZ	-.88460869 00
SXO	.76441123 00	SYO	-.54016240 00	SZO	-.35199438 00	TX	-.63935302 00	TY	-.70545043 00	TZ	-.30588792 00
BX	-.42244503 00	BY	-.83206331 00	BZ	.35945911 00	MX	.37798612 00	MY	.86162510 00	MZ	-.33871622 00
B.T	.46424195 05	B.R	-.41302557 05	B	.62137806 05	PER	.26889817 05	OMD	.10305465-01	NOD	-.65141293-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13516595 09	Y	.57563754 08	Z	.24960234 08	DX	-.86344653 01	DY	.33973666 02	DZ	.68820836 01
R	.14901823 09	LAT	.96423718 01	LON	.23067928 02	V	.35722920 02	PTH	.10393160 02	AZ	.80356866 02
XE	.13516078 09	YE	.57566985 08	ZE	.24962678 08	DXE	-.13017319 02	DYE	.24692115 02	DZE	.10706127 02
XT	.13512202 09	YT	.57921008 08	ZT	.25098204 08	DXT	-.14042659 02	DYT	.24636103 02	DZT	.10763940 02
LTE	.96435234 01	LOE	.23069878 02	LTT	.96881954 01	LOT	.23202737 02	RST	.14913994 09	VST	.30331439 02
EPS	.62488059 02	ESP	.27453512-18	SEP	.11750970 03	EPM	.47272397 02	EMP	.72577684 00	MEP	.13200178 03
MPS	.10833509 03	MSP	.14092752 00	SMP	.71524332 02	SEM	.10904019 03	EMS	.70821426 02	ESM	.13829968 00
EPT	.47272397 02	ETP	.72577684 00	TEP	.13200178 03	TPS	.10833509 03	TSP	.14092752 00	STP	.71524332 02
SET	.10904019 03	STE	.70821426 02	EST	.13829968 00	RPM	.38548213 06	RPT	.38548213 06	SPN	-.13588348 02
GCE	.94489709 02	GCT	.10637971 03	SIP	.10807676 03	CPT	.10634384 03	SIN	.10608551 03		
REP	.65710746 04	VEP	.10953533 02								

RA-5 STANDARD TRAJECTORY THIRD DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

2 DAYS 21 HRS. 16 MIN. 36.757 SEC. JULIAN DATE 2437959.15889259 OCT. 21,1962 15 48 48.320
RECTIFICATION .11047216-01 .93865792 02 -.47348496 02 -.18912340 02

2 DAYS 21 HRS. 36 MIN. 17.289 SEC. JULIAN DATE 2437959.17255615 OCT. 21,1962 16 08 28.852

GEOCENTRIC EQUATORIAL COORDINATES

X	-.26919561 06	Y	.26431317 06	Z	.11944722 06	DX	-.60188199 00	DY	.17278670 01	DZ	.98105968 00
R	.39572132 06	DEC	.17568560 02	RA	.13552433 03	V	.20761176 01	PTH	.63603494 02	AZ	.29848902 03
R	.39572132 06	LAT	.17568560 02	LON	.22378262 03	VE	.28386122 02	PTE	.37563060 01	AZE	.27089059 03
XS	-.13172954 09	YS	-.63680296 08	ZS	-.27613299 08	DXS	.14363681 02	DYS	-.24088607 02	DZS	-.10444285 02
XM	-.26922967 06	YM	.26585849 06	ZM	.12024208 06	DXM	-.75403445 00	DYM	-.61129911 00	DZM	-.17091537 00
XT	-.26922967 06	YT	.26585849 06	ZT	.12024208 06	DXT	-.75403445 00	DYT	-.61129911 00	DZT	-.17091537 00
RS	.14889710 09	VS	.29927570 02	RM	.39701827 06	VM	.98563006 00	RT	.39701827 06	VT	.98563006 00
GED	.17680852 02	ALT	.38934508 06	LOS	.29405820 03	RAS	.20579991 03	RAM	.13536097 03	LOM	.22361926 03
DUT	.34000000 02	DT	.59999999 02	DR	.18596593 01	SHA	-.38209114 06	DES	-.10687500 02	DEM	.17629632 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13146034 09	Y	.63944609 08	Z	.27732746 08	DX	-.14965563 02	DY	.25816474 02	DZ	.11425345 02
R	.14879462 09	LAT	.10741760 02	LON	.25939098 02	V	.31953042 02	PTH	.36449857-02	AZ	.68658126 02
XE	.13172954 09	YE	.63680296 08	ZE	.27613299 08	DXE	-.14363681 02	DYE	.24088607 02	DZE	.10444285 02
XT	.13146031 09	YT	.63946155 08	ZT	.27733541 08	DXT	-.15117715 02	DYT	.23477308 02	DZT	.10273370 02
LTE	.10687500 02	LOE	.25799911 02	LTT	.10742013 02	LOT	.25939649 02	RST	.14879541 09	VST	.29753511 02
EPS	.10493449 03	ESP	.14687642 00	SEP	.74918371 02	EPM	.13817767 03	EMP	.41655069 02	MEP	.16712864 00
MPS	.11674427 03	MSP	.27453512-18	SMP	.63255125 02	SEM	.75085053 02	EMS	.10476722 03	ESM	.14770671 00
EPT	.13817767 03	ETP	.41655069 02	TEP	.16712864 00	TPS	.11674427 03	TSP	.27453512-18	STP	.63255125 02
SET	.75085053 02	STE	.10476722 03	EST	.14770671 00	RPM	.17380899 04	RPT	.17380899 04	SPN	.10401099 03
GCE	.28313019 03	GCT	.99566567 02	SIP	.27327229 02	CPT	.10001228 03	SIN	.10595236 02		
REP	.39572132 06	VEP	.20761176 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	.34059227 02	Y	-.15453127 04	Z	-.79486180 03	DX	.15215246 00	DY	.23391661 01	DZ	.11519750 01
R	.17380899 04	DEC	-.27214251 02	RA	.27126261 03	V	.26118757 01	PTH	-.85426774 02	AZ	.10205622 03
R	.17380897 04	LAT	-.29597719 01	LON	.32499499 03	VR	.26115216 01	PTR	-.85524826 02	AZR	.10418020 03
LTS	.15330983 01	LNS	.26187764 03	LTE	-.91376916 00	LNE	.66269094 01				
ALT	.89950561-01	SHA	-.15521477 04	ALP	.19042214 01	DR	-.26035602 01	DP	.68649986-02	ASD	.89417046 02
HGE	.25506550 03	SVL	-.31819870 01	HNG	.11678886 03	SIA	.48760622 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437959.17794222 OCT. 21,1962 16 16 14.209

SMA	-.41438857 04	ECC	.10032205 01	INC	.29577627 02	LAN	.26296662 02	APF	.56843747 02	RCA	.13345420 02
VH	.10874963 01	C3	.11826482 01	C1	.36196132 03	SLR	.26733818 02	APO	.00000000 00	TFP	-.46535645 03
TA	-.16894933 03	EA	-.50537048 02	MA	-.69972662 01	DAI	.25691345 02	RAI	.84251019 02	MTA	.17540783 03
WX	.21867553 00	WY	-.44252119 00	WZ	.86968773 00	PX	.16776790 00	PY	.89503650 00	PZ	.41323555 00
QX	-.96126775 00	QY	.55541050-01	QZ	.26996335 00	RX	-.63283573-01	RY	.43958429 00	RZ	-.89596920 00
SXO	-.24419090 00	SYO	-.88771652 00	SZO	-.39029504 00	DAO	-.22972859 02	RAO	.25461961 03	TF	.69734067 02
SXI	.90267770-01	SYI	.89661004 00	SZI	.43352296 00	TX	.99390489 00	TY	-.53442261-01	TZ	-.96420983-01
BX	.97161351 00	BY	.16296161-01	BZ	-.23601194 00	MX	.87456422 00	MY	.24382640-02	MZ	-.21866102 00
B.T	.32870385 03	B.R	.52300873 02	B	.33283870 03	PER	.12251922 02				
OP1	-.14934495 02	OY	-.30499058 01	OP2	-.43764066 02						
BTE	.32122070 03	BRE	.87171472 02	BTO	.32870385 03	BRO	.52300873 02				
CR	.20331953 01	IR	.41743011 04	THA	.90406884 01						

RA-5 STANDARD TRAJECTORY THIRD DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

215502466031	614625474646	614462261356	203431671461	204450475371	602752103331
	621001800		0		221404527100

RA-5 STANDARD TRAJECTORY THIRD DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437956.32466659 OCT. 18,1962 19 47 31.193

GEOCENTRIC	XO	.51529217 04	YO	-.32024091 04	ZO	-.25227478 04	DXO	.38738909 01	DYO	.91807344 01	DZO	-.45493354 01
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.71251193 05	GHA	.32369443 03	GHO	.26001651 02		

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437956.32466659 OCT. 18,1962 19 47 31.193

GEOCENTRIC EQUATORIAL COORDINATES

X	.51648988 04	Y	-.31880683 04	Z	-.25164106 04	DX	.38537666 01	DY	.91914114 01	DZ	-.45448654 01
R	.65705617 04	DEC	-.22518553 02	RA	.32831476 03	V	.10953965 02	PTH	.16227684 01	AZ	.11594995 03
R	.65705615 04	LAT	-.22518553 02	LON	.46203369 01	VE	.10557930 02	PTE	.16836570 01	AZE	.11700151 03
XS	-.13510188 09	YS	-.57678568 08	ZS	-.25011058 08	DXS	.13041833 02	DYS	-.24681810 02	DZS	-.10701651 02
XM	-.43390878 05	YM	.35374379 06	ZM	.13577752 06	DXM	-.10239201 01	DYM	-.67699097-01	DZM	.53334376-01
XT	-.43390878 05	YT	.35374379 06	ZT	.13577752 06	DXT	-.10239201 01	DYT	-.67699097-01	DZT	.53334376-01
RS	.14901305 09	VS	.29896596 02	RM	.38138297 06	VM	.10275408 01	RT	.38138297 06	VT	.10275408 01
GED	-.22656552 02	ALT	.19552228 03	LOS	.23942449 03	RAS	.20311892 03	RAM	.96993075 02	LOM	.13329865 03
DUT	.34000000 02	DT	.15000000 02	DR	.31020401 00	SHA	.58321061 04	DES	-.96625328 01	DEM	.20855577 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437956.32426915 OCT. 18,1962 19 46 56.855

SMA	.29731806 06	ECC	.97791848 00	INC	.33837581 02	LAN	.11011292 03	APF	.22017226 03	RCA	.65652327 04
VH	.12234042 00	C3	-.13406626 01	C1	.71944840 05	SLR	.12985495 05	APO	.58807087 06	TFP	.34338138 02
TA	.32821910 01	EA	.34688779 00	MA	.76619237-02	DAO	-.21051754 02	RAO	.32515255 03	MTA	.18000000 03
WX	.52288261 00	WY	.19148156 00	WZ	.83061940 00	PX	.76590134 00	PY	-.53325647 00	PZ	-.35921110 00
QX	.37415086 00	QY	.82399774 00	QZ	-.42548652 00	RX	-.90561852-01	RY	.46364301 00	RZ	-.88138167 00
SXO	.76590134 00	SYO	-.53325647 00	SZO	-.35921110 00	TX	-.63654824 00	TY	-.70758227 00	TZ	-.30681213 00
BX	-.37415088 00	BY	-.82399777 00	BZ	.42548654 00	MX	.32968645 00	MY	.85317706 00	MZ	-.40422242 00
B.T	.42914945 05	B.R	-.44934732 05	B	.62135520 05	PER	.26889960 05	OMD	.92334881-02	NOD	-.62617405-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13510705 09	Y	.57675380 08	Z	.25008541 08	DX	-.91880663 01	DY	.33873221 02	DZ	.61567856 01
R	.14901607 09	LAT	.96613529 01	LON	.23116985 02	V	.35633154 02	PTH	.93891075 01	AZ	.81402122 02
XE	.13510188 09	YE	.57678568 08	ZE	.25011058 08	DXE	-.13041833 02	DYE	.24681810 02	DZE	.10701651 02
XT	.13505849 09	YT	.58032311 08	ZT	.25146835 08	DXT	-.14065753 02	DYT	.24614111 02	DZT	.10754985 02
LTE	.96625328 01	LOE	.23118920 02	LTT	.97075480 01	LOT	.23252366 02	RST	.14913386 09	VST	.30321107 02
EPS	.62572383 02	ESP	.27453512-18	SEP	.11742537 03	EPM	.46762888 02	EMP	.71910708 00	MEP	.13251796 03
MPS	.10770320 03	MSP	.14110097 00	SMP	.72155580 02	SEM	.10839843 03	EMS	.71462537 02	ESM	.13882922 00
EPT	.46762888 02	ETP	.71910708 00	TEP	.13251796 03	TPS	.10770320 03	TSP	.14110097 00	STP	.72155580 02
SET	.10839843 03	STE	.71462537 02	EST	.13882922 00	RPM	.38585389 06	RPT	.38585389 06	SPN	-.13522078 02
GCE	.93666781 02	GCT	.10630014 03	SIP	.10744512 03	CPT	.10630149 03	SIN	.10604341 03		
REP	.65705617 04	VEP	.10953965 02								

RA-5 STANDARD TRAJECTORY THIRD DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG.

2 DAYS 21 HRS. 22 MIN. 28.894 SEC. JULIAN DATE 2437959.21527878 OCT. 21,1962 17 10 00.088
RECTIFICATION .10632858-01 .92995702 02 -.44824482 02 -.17352941 02

2 DAYS 21 HRS. 41 MIN. 36.775 SEC. JULIAN DATE 2437959.22856446 OCT. 21,1962 17 29 07.970

GEOCENTRIC EQUATORIAL COORDINATES

X	-.27281257 06	Y	.26134313 06	Z	.11859568 06	DX	-.60933165 00	DY	.17120716 01	DZ	.10024074 01
R	.39596952 06	DEC	.17427998 02	RA	.13623007 03	V	.20754023 01	PTH	.63050260 02	AZ	.29997100 03
R	.39596951 06	LAT	.17427999 02	LON	.20427017 03	VE	.28428005 02	PTE	.37313007 01	AZE	.27094909 03
XS	-.13165997 09	YS	-.63796837 08	ZS	-.27663829 08	DXS	.14389406 02	DYS	-.24076306 02	DZS	-.10438953 02
XM	-.27285814 06	YM	.26288016 06	ZM	.11940587 06	DXM	-.74558653 00	DYM	-.61961722 00	DZM	-.17468499 00
XT	-.27285814 06	YT	.26288016 06	ZT	.11940587 06	DXT	-.74558653 00	DYT	-.61961722 00	DZT	-.17468499 00
RS	.14889483 09	VS	.29928168 02	RM	.39725975 06	VM	.98505817 00	RT	.39725975 06	VT	.98505817 00
GED	.17539507 02	ALT	.38959325 06	LOS	.27389295 03	RAS	.20585286 03	RAM	.13606699 03	LOM	.20410709 03
DUT	.34000000 02	DT	.59999999 02	DR	.18500228 01	SHA	-.38117617 06	DES	-.10707453 02	DEM	.17492068 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13138715 09	Y	.64058179 08	Z	.27782425 08	DX	-.14998738 02	DY	.25788377 02	DZ	.11441360 02
R	.14878809 09	LAT	.10761708 02	LON	.25991679 02	V	.31951639 02	PTH	-.98372655-02	AZ	.68621524 02
XE	.13165997 09	YE	.63796837 08	ZE	.27663829 08	DXE	-.14389406 02	DYE	.24076306 02	DZE	.10438953 02
XT	.13138711 09	YT	.64059717 08	ZT	.27783235 08	DXT	-.15134993 02	DYT	.23456689 02	DZT	.10264268 02
LTE	.10707453 02	LOE	.25852860 02	LTT	.10761970 02	LOT	.25992228 02	RST	.14878887 09	VST	.29742888 02
EPS	.10556412 03	ESP	.14720910 00	SEP	.74289089 02	EPM	.13784527 03	EMP	.41986482 02	MEP	.16829535 00
MPS	.11639896 03	MSP	.27453512-18	SMP	.63600436 02	SEM	.74456551 02	EMS	.10539606 03	ESM	.14737516 00
EPT	.13784527 03	ETP	.41986482 02	TEP	.16829535 00	TPS	.11639896 03	TSP	.27453512-18	STP	.63600436 02
SET	.74456551 02	STE	.10539606 03	EST	.14737516 00	RPM	.17380899 04	RPT	.17380899 04	SPN	.10464120 03
GCE	.28306533 03	GCT	.98935469 02	SIP	.26981748 02	CPT	.99461006 02	SIN	.10043792 02		
REP	.39596952 06	VEP	.20754023 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	.45567583 02	Y	-.15370330 04	Z	-.81019118 03	DX	.13625488 00	DY	.23316888 01	DZ	.11770924 01
R	.17380899 04	DEC	-.27783951 02	RA	.27169812 03	V	.26155084 01	PTH	-.85399666 02	AZ	.10186855 03
R	.17380897 04	LAT	-.35417655 01	LON	.32462472 03	VR	.26151525 01	PTR	-.85497516 02	AZR	.10417054 03
LTS	.15335439 01	LNS	.26119503 03	LTE	-.99184591 00	LNE	.65715785 01				
ALT	.89904784-01	SHA	-.15568334 04	ALP	.21619204 01	DR	-.26070824 01	DP	.69152089-02	ASD	.89417214 02
HGE	.25443587 03	SVL	-.36985688 01	HNG	.11645834 03	SIA	.48428059 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437959.23394666 OCT. 21,1962 17 36 52.992

SMA	-.40783998 04	ECC	.10033201 01	INC	.30025990 02	LAN	.25966486 02	APF	.57530274 02	RCA	.13540676 02
VH	.10961924 01	C3	.12016377 01	C1	.36460869 03	SLR	.27126308 02	APO	.00000000 00	TFP	-.46502237 03
TA	-.16885334 03	EA	-.50911511 02	MA	-.71613260 01	DAI	.26270442 02	RAI	.84618706 02	MTA	.17533757 03
WX	.21909496 00	WY	-.44987889 00	WZ	.86579850 00	PX	.16283341 00	PY	.89177255 00	PZ	.42216943 00
QX	-.96202044 00	QY	.48485582-01	QZ	.26863807 00	RX	-.63154681-01	RY	.44806443 00	RZ	-.89176776 00
SXO	-.24049230 00	SYO	-.88488045 00	SZO	-.39893622 00	DAO	-.23511693 02	RAO	.25479544 03	TF	.69822720 02
SXI	.84096865-01	SYI	.89276274 00	SZI	.44260864 00	TX	.99445423 00	TY	-.47042065-01	TZ	-.94062961-01
BX	.97207263 00	BY	.24162480-01	BZ	-.23343306 00	MX	.87085429 00	MY	.24912347-02	MZ	-.21907988 00
B.T	.32845615 03	B.R	.52420966 02	B	.33261298 03	PER	.12331877 02				
OP1	-.15564124 02	OY	-.37378632 01	OP2	-.43415738 02						
BTE	.32114526 03	BRE	.86585922 02	BTO	.32845615 03	BRO	.52420966 02				
CR	.25589344 01	IR	.41669460 04	THA	.90678230 01						

RA-5 STANDARD TRAJECTORY THIRD DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG.

215502035375	614620232140	614473257671	202757667243	204445621116	603443120476
	621001800		0		221426246306

RA-5 STANDARD TRAJECTORY FOURTH DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437957.27439507 OCT. 19,1962 18 35 07.734

GEOCENTRIC	XO	.58741476 04	YO	-.20602285 04	ZO	-.21059399 04	DXO	.24025118 01	DYO	.99207724 01	DZO	-.39717129 01			
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.66907734 05	GHA	.30653279 03	GHO	.26987313 02					

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437957.27439507 OCT. 19,1962 18 35 07.734

GEOCENTRIC EQUATORIAL COORDINATES

X	.58824295 04	Y	-.20438650 04	Z	-.20987550 04	DX	.23796210 01	DY	.99273539 01	DZ	-.39690470 01
R	.65715395 04	DEC	-.18624851 02	RA	.34084008 03	V	.10953003 02	PTH	.16223697 01	AZ	.11190104 03
R	.65715394 04	LAT	-.18624851 02	LON	.34307299 02	VE	.10533206 02	PTE	.16870473 01	AZE	.11282285 03
XS	-.13401344 09	YS	-.59696197 08	ZS	-.25885867 08	DXS	.13485507 02	DYS	-.24491017 02	DZS	-.10618816 02
XM	-.12565500 06	YM	.33970477 06	ZM	.13684626 06	DXM	-.97356387 00	DYM	-.27161617 00	DZM	-.26806266-01
XT	-.12565500 06	YT	.33970477 06	ZT	.13684626 06	DXT	-.97356387 00	DYT	-.27161617 00	DZT	-.26806266-01
RS	.14897421 09	VS	.29906990 02	RM	.38718911 06	VM	.10110987 01	RT	.38718911 06	VT	.10110987 01
GED	-.18742938 02	ALT	.19553534 03	LOS	.25747775 03	RAS	.20401055 03	RAM	.11029917 03	LOM	.16376638 03
DUT	.34000000 02	DT	.15000000 02	DR	.31010069 00	SHA	.51292785 04	DES	-.10006549 02	DEM	.20697571 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437957.27399763 OCT. 19,1962 18 34 33.396

SMA	.29664984 06	ECC	.97786544 00	INC	.28449295 02	LAN	.12237585 03	APF	.21881721 03	RCA	.65662123 04
VH	.12262679 00	C3	-.13436825 01	C1	.71949242 05	SLR	.12987085 05	APO	.58673347 06	TFP	.34338788 02
TA	.32814755 01	EA	.34723357 00	MA	.76879721-02	DAO	-.17374351 02	RAO	.33764997 03	MTA	.18000000 03
WX	.40232918 00	WY	.25508813 00	WZ	.87923904 00	PX	.88267967 00	PY	-.36291388 00	PZ	-.29861363 00
QX	.24291526 00	QY	.89622737 00	QZ	-.37117194 00	RX	-.11536508 00	RY	.44862803 00	RZ	-.88624138 00
SXO	.88267967 00	SYO	-.36291388 00	SZO	-.29861363 00	TX	-.45559575 00	TY	-.81671685 00	TZ	-.35412725 00
BX	-.24291527 00	BY	-.89622740 00	BZ	.37117195 00	MX	.19199130 00	MY	.91553158 00	MZ	-.35347036 00
B.T	.44143365 05	B.R	-.43634622 05	B	.62069453 05	PER	.26799359 05	OMD	.10834117-01	NOD	-.66490473-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13401932 09	Y	.59694153 08	Z	.25883768 08	DX	-.11105886 02	DY	.34418371 02	DZ	.66497695 01
R	.14897832 09	LAT	.10005451 02	LON	.24008887 02	V	.36772059 02	PTH	.77452252 01	AZ	.80716149 02
XE	.13401344 09	YE	.59696197 08	ZE	.25885867 08	DXE	-.13485507 02	DYE	.24491017 02	DZE	.10618816 02
XT	.13388779 09	YT	.60035902 08	ZT	.26022713 08	DXT	-.14459071 02	DYT	.24219401 02	DZT	.10592010 02
LTE	.10006549 02	LOE	.24010551 02	LTT	.10056766 02	LOT	.24151685 02	RST	.14902158 09	VST	.30130296 02
EPS	.51307078 02	ESP	.27453512-18	SEP	.12869094 03	EPM	.46740364 02	EMP	.70813907 00	MEP	.13255142 03
MPS	.96265758 02	MSP	.14968061 00	SMP	.83584552 02	SEM	.96952405 02	EMS	.82899822 02	ESM	.14787221 00
EPT	.46740364 02	ETP	.70813907 00	TEP	.13255142 03	TPS	.96265758 02	TSP	.14968061 00	STP	.83584552 02
SET	.96952405 02	STE	.82899822 02	EST	.14787221 00	RPM	.39166304 06	RPT	.39166304 06	SPN	-.24752989 02
GCE	.91374511 02	GCT	.10514840 03	SIP	.96011507 02	CPT	.10535259 03	SIN	.10509833 03		
REP	.65715395 04	VEP	.10953003 02								

RA-5 STANDARD TRAJECTORY FOURTH DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

2 DAYS 23 HRS. 7 MIN. 45.901 SEC. JULIAN DATE 2437960.23812079 OCT. 22,1962 17 42 53.637
RECTIFICATION .68856380-02 .97232609 02 -.20491552 02 -.82801783 01

2 DAYS 23 HRS. 24 MIN. 50.847 SEC. JULIAN DATE 2437960.24998358 OCT. 22,1962 17 59 58.582

GEOCENTRIC EQUATORIAL COORDINATES

X	-.33136404 06	Y	.20061363 06	Z	.10021855 06	DX	-.82977032 00	DY	.15301142 01	DZ	.10040259 01
R	.40011462 06	DEC	.14505597 02	RA	.14880855 03	V	.20094368 01	PTH	.58094915 02	AZ	.30412179 03
R	.40011461 06	LAT	.14505597 02	LON	.20813101 03	VE	.29181932 02	PTE	.33511956 01	AZE	.27117176 03
XS	-.13036942 09	YS	-.65911609 08	ZS	-.28580758 08	DXS	.14856547 02	DYS	-.23847655 02	DZS	-.10339871 02
XM	-.33138511 06	YM	.20208883 06	ZM	.10113742 06	DXM	-.57622697 00	DYM	-.75180055 00	DZM	-.23734017 00
XT	-.33138511 06	YT	.20208883 06	ZT	.10113742 06	DXT	-.57622697 00	DYT	-.75180055 00	DZT	-.23734017 00
RS	.14885357 09	VS	.29938948 02	RM	.40110442 06	VM	.97651008 00	RT	.40110442 06	VT	.97651008 00
GED	.14600239 02	ALT	.39373777 06	LOS	.26614251 03	RAS	.20682005 03	RAM	.14862388 03	LOM	.20794634 03
DUT	.34000000 02	DT	.59999999 02	DR	.17058607 01	SHA	-.35625216 06	DES	-.11069868 02	DEM	.14604616 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13003805 09	Y	.66112223 08	Z	.28680976 08	DX	-.15686318 02	DY	.25377769 02	DZ	.11343897 02
R	.14867185 09	LAT	.11122929 02	LON	.26949089 02	V	.31918266 02	PTH	-.44292410 00	AZ	.68669987 02
XE	.13036942 09	YE	.65911609 08	ZE	.28580758 08	DXE	-.14856547 02	DYE	.23847655 02	DZE	.10339871 02
XT	.13003803 09	YT	.66113698 08	ZT	.28681896 08	DXT	-.15432774 02	DYT	.23095855 02	DZT	.10102531 02
LTE	.11069868 02	LOE	.26820051 02	LTT	.11123227 02	LOT	.26949609 02	RST	.14867267 09	VST	.29557574 02
EPS	.11694226 03	ESP	.13687753 00	SEP	.62920440 02	EPM	.12461133 03	EMP	.55184329 02	MEP	.20415156 00
MPS	.11795711 03	MSP	.27453512-18	SMP	.62042297 02	SEM	.63122687 02	EMS	.11673943 03	ESM	.13776809 00
EPT	.12461133 03	ETP	.55184329 02	TEP	.20415156 00	TPS	.11795711 03	TSP	.27453512-18	STP	.62042297 02
SET	.63122687 02	STE	.11673943 03	EST	.13776809 00	RPM	.17380899 04	RPT	.17380899 04	SPN	.11602890 03
GCE	.28178184 03	GCT	.94132186 02	SIP	.28540063 02	CPT	.95297635 02	SIN	.58805895 01		
REP	.40011462 06	VEP	.20094368 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	.21065431 02	Y	-.14751921 04	Z	-.91886947 03	DX	-.25354335 00	DY	.22819148 01	DZ	.12413660 01
R	.17380899 04	DEC	-.31915382 02	RA	.27081811 03	V	.26100592 01	PTH	-.84071825 02	AZ	.23504301 03
R	.17380898 04	LAT	-.76419058 01	LON	.31026651 03	VR	.26104585 01	PTR	-.83987946 02	AZR	.23721999 03
LTS	.15413893 01	LNS	.24874326 03	LTE	-.23666460 01	LNE	.54464564 01				
ALT	.89950561-01	SHA	-.15352443 04	ALP	.45304235 01	DR	-.25961009 01	DP	.88863494-02	ASD	.89417046 02
HGE	.24305773 03	SVL	-.67524949 01	HNG	.11816973 03	SIA	.35194283 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437960.25541107 OCT. 22,1962 18 07 47.517

SMA	-.41773920 04	ECC	.10053473 01	INC	.13408188 03	LAN	.12791546 03	APF	.33094481 02	RCA	.22337675 02
VH	.10831262 01	C3	.11731623 01	C1	.46853868 03	SLR	.44794796 02	APO	.00000000 00	TFP	-.46893495 03
TA	-.16570698 03	EA	-.50172529 02	MA	-.69664104 01	DAI	.26880640 02	RAI	.98514793 02	MTA	.17408795 03
WX	.56671608 00	WY	.44142210 00	WZ	-.69568564 00	PX	-.21513103 00	PY	.89435598 00	PZ	.39223215 00
QX	.79533051 00	QY	-.72620601-01	QZ	.60180953 00	RX	-.85955915-01	RY	.44421896 00	RZ	-.89178535 00
SXO	.29590718 00	SYO	-.89707910 00	SZO	-.32815853 00	DAO	-.19157043 02	RAO	.28825546 03	TF	.71544383 02
SXI	-.13206640 00	SYI	.88211901 00	SZI	.45213333 00	TX	.98750699 00	TY	.15663841 00	TZ	-.17156947-01
BX	-.81325953 00	BY	.16435460 00	BZ	-.55820830 00	MX	-.70129465 00	MY	.72750384-02	MZ	-.56666915 00
B.T	-.33212471 03	B.R	.27716026 03	B	.43257905 03	PER	.20568266 02				
OP1	-.26942264 02	OY	-.42679692 01	OP2	-.39637734 02						
BTE	-.33739452 03	BRE	.27072046 03	BTO	-.33212471 03	BRO	.27716026 03				
CP	.31400889 01	IP	.41882385 04	THA	.14015478 03						

RA-5 STANDARD TRAJECTORY FOURTH DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 93 DEG.

215557104563	614401416501	614407174120	202463413006	204475355737	602774302132
	621001900		0		221405267360

RA-5 STANDARD TRAJECTORY FOURTH DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437957.32627129 OCT. 19,1962 19 49 49.840

GEOCENTRIC	XO	.58829539 04	YO	-.20099010 04	ZO	-.21284085 04	DXO	.21393702 01	DYO	.98317578 01	DZO	-.43285776 01
CARTESIAN	GMC	.00000000 00	SGC	.00000000 00	TO	.71389840 05	GHA	.32525936 03	GHO	.26987313 02		

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437957.32627129 OCT. 19,1962 19 49 49.840

GEOCENTRIC EQUATORIAL COORDINATES

X	.58911227 04	Y	-.19935133 04	Z	-.21212141 04	DX	.21171621 01	DY	.98375972 01	DZ	-.43262285 01
R	.65710706 04	DEC	-.18833008 02	RA	.34130455 03	V	.10953399 02	PTH	.16225054 01	AZ	.11406761 03
R	.65710705 04	LAT	-.18833009 02	LON	.16045194 02	VE	.10541103 02	PTE	.16859852 01	AZE	.11507339 03
XS	-.13395294 09	YS	-.59805950 08	ZS	-.25933454 08	DXS	.13509663 02	DYS	-.24480393 02	DZS	-.10614206 02
XM	-.13000966 06	YM	.33846357 06	ZM	.13671652 06	DXM	-.96954081 00	DYM	-.28221927 00	DZM	-.31083087-01
XT	-.13000966 06	YT	.33846357 06	ZT	.13671652 06	DXT	-.96954081 00	DYT	-.28221927 00	DZT	-.31083087-01
RS	.14897210 09	VS	.29907557 02	RM	.38749388 06	VM	.10102590 01	RT	.38749388 06	VT	.10102590 01
GED	-.18952221 02	ALT	.19511420 03	LOS	.23879996 03	RAS	.20405932 03	RAM	.11101264 03	LOM	.14575328 03
DUT	.34000000 02	DT	.15000000 02	DR	.31013785 00	SHA	.51129053 04	DES	-.10025277 02	DEM	.20660042 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437957.32587385 OCT. 19,1962 19 49 15.502

SMA	.29665099 06	ECC	.97786710 00	INC	.30210508 02	LAN	.12544706 03	APF	.21662528 03	RCA	.65657430 04
VH	.12262188 00	C3	-.13436773 01	C1	.71946701 05	SLR	.12986167 05	APO	.58673622 06	TFP	.34337943 02
TA	.32817478 01	EA	.34724894 00	MA	.76877385-02	DAO	-.17468760 02	RAO	.33816336 03	MTA	.18000000 03
WX	.40991516 00	WY	.29181864 00	WZ	.86418253 00	PX	.88543814 00	PY	-.35480673 00	PZ	-.30018576 00
QX	.21901798 00	QY	.88823085 00	QZ	-.40382801 00	RX	-.11996879 00	RY	.44952004 00	RZ	-.88517750 00
SXO	.88543814 00	SYO	-.35480673 00	SZO	-.30018576 00	TX	-.44900646 00	TY	-.81978285 00	TZ	-.35545645 00
BX	-.21901798 00	BY	-.88823087 00	BZ	.40382802 00	MX	.16797104 00	MY	.90708552 00	MZ	-.38598134 00
B.T	.42389150 05	B.R	-.45337852 05	B	.62067389 05	PER	.26799514 05	OMD	.10339247-01	NOD	-.65360713-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13395883 09	Y	.59803956 08	Z	.25931333 08	DX	-.11392501 02	DY	.34317990 02	DZ	.62879774 01
R	.14897623 09	LAT	.10024169 02	LON	.24057673 02	V	.36702209 02	PTH	.72421400 01	AZ	.81203990 02
XE	.13395294 09	YE	.59805950 08	ZE	.25933454 08	DXE	-.13509663 02	DYE	.24480393 02	DZE	.10614206 02
XT	.13382293 09	YT	.60144413 08	ZT	.26070170 08	DXT	-.14479204 02	DYT	.24198173 02	DZT	.10583123 02
LTE	.10025277 02	LOE	.24059322 02	LTT	.10075722 02	LOT	.24200714 02	RST	.14901537 09	VST	.30119784 02
EPS	.51084350 02	ESP	.13988227-01	SEP	.12891368 03	EPM	.46476690 02	EMP	.70450299 00	MEP	.13281878 03
MPS	.95656445 02	MSP	.15000707 00	SMP	.84193567 02	SEM	.96337938 02	EMS	.83513980 02	ESM	.14803752 00
EPT	.46476690 02	ETP	.70450299 00	TEP	.13281878 03	TPS	.95656445 02	TSP	.15000707 00	STP	.84193567 02
SET	.96337938 02	STE	.83513980 02	EST	.14803752 00	RPM	.39198975 06	RPT	.39198975 06	SPN	-.24992197 02
GCE	.90864318 02	GCT	.10508251 03	SIP	.95402405 02	CPT	.10527471 03	SIN	.10502067 03		
REP	.65710706 04	VEP	.10953399 02								

RA-5 STANDARD TRAJECTORY FOURTH DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

2 DAYS 23 HRS. 12 MIN. 23.143 SEC. JULIAN DATE 2437960.29320581 OCT. 22,1962 19 02 12.982
RECTIFICATION .66458081-02 .96554988 02 -.18898246 02 -.73748819 01

2 DAYS 23 HRS. 29 MIN. 11.109 SEC. JULIAN DATE 2437960.30487210 OCT. 22,1962 19 19 00.950

GEOCENTRIC EQUATORIAL COORDINATES

X	-.33405950 06	Y	.19703897 06	Z	.99078283 05	DX	-.84206614 00	DY	.15172856 01	DZ	.10125398 01
R	.40029566 06	DEC	.14330379 02	RA	.14946654 03	V	.20090962 01	PTH	.57806583 02	AZ	.30478862 03
R	.40029564 06	LAT	.14330379 02	LON	.18897505 03	VE	.29216749 02	PTE	.33360889 01	AZE	.27119978 03
XS	-.13029890 09	YS	-.66024676 08	ZS	-.28629783 08	DXS	.14881540 02	DYS	-.23835137 02	DZS	-.10334448 02
XM	-.33409451 06	YM	.19850918 06	ZM	.10000469 06	DXM	-.56639589 00	DYM	-.75782049 00	DZM	-.24035962 00
XT	-.33409451 06	YT	.19850918 06	ZT	.10000469 06	DXT	-.56639589 00	DYT	-.75782049 00	DZT	-.24035962 00
RS	.14885135 09	VS	.29939519 02	RM	.40128041 06	VM	.97615005 00	RT	.40128041 06	VT	.97615005 00
GED	.14423976 02	ALT	.39391877 06	LOS	.24638061 03	RAS	.20687211 03	RAM	.14928246 03	LOM	.18879096 03
DUT	.34000000 02	DT	.59999999 02	DR	.17002065 01	SHA	-.35447507 06	DES	-.11089264 02	DEM	.14431003 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.12996484 09	Y	.66221716 08	Z	.28728861 08	DX	-.15723606 02	DY	.25352423 02	DZ	.11346988 02
R	.14866581 09	LAT	.11142195 02	LON	.27000460 02	V	.31917570 02	PTH	-.46668633 00	AZ	.68656690 02
XE	.13029890 09	YE	.66024676 08	ZE	.28629783 08	DXE	-.14881540 02	DYE	.23835137 02	DZE	.10334448 02
XT	.12996481 09	YT	.66223186 08	ZT	.28729787 08	DXT	-.15447936 02	DYT	.23077317 02	DZT	.10094088 02
LTE	.11089264 02	LOE	.26872109 02	LTT	.11142498 02	LOT	.27000982 02	RST	.14866661 09	VST	.29548128 02
EPS	.11754618 03	ESP	.13634040 00	SEP	.62317202 02	EPM	.12440908 03	EMP	.55386169 02	MEP	.20463023 00
MPS	.11752800 03	MSP	.27453512-18	SMP	.62471402 02	SEM	.62519718 02	EMS	.11734308 03	ESM	.13723445 00
EPT	.12440908 03	ETP	.55386169 02	TEP	.20463023 00	TPS	.11752800 03	TSP	.27453512-18	STP	.62471402 02
SET	.62519718 02	STE	.11734308 03	EST	.13723445 00	RPM	.17380900 04	RPT	.17380900 04	SPN	.11663324 03
GCE	.28170801 03	GCT	.93831613 02	SIP	.28110999 02	CPT	.95027976 02	SIN	.56109723 01		
REP	.40029566 06	VEP	.20090962 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	.35000315 02	Y	-.14702072 04	Z	-.92640298 03	DX	-.27567025 00	DY	.22751061 01	DZ	.12528994 01
R	.17380900 04	DEC	-.32208418 02	RA	.27136375 03	V	.26118688 01	PTH	-.84051100 02	AZ	.23489046 03
R	.17380897 04	LAT	-.79487171 01	LON	.31000059 03	VR	.26122695 01	PTR	-.83967264 02	AZR	.23729176 03
LTS	.15417939 01	LNS	.24807398 03	LTE	-.24373461 01	LNE	.53807329 01				
ALT	.89965820-01	SHA	-.15413038 04	ALP	.46070175 01	DR	-.25978032 01	DP	.89234986-02	ASD	.89417003 02
HGE	.24245382 03	SVL	-.69799410 01	HNG	.11775119 03	SIA	.34992079 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437960.31029800 OCT. 22,1962 19 26 49.748

SMA	-.41440121 04	ECC	.10054353 01	INC	.13380190 03	LAN	.12853006 03	APF	.33241196 02	RCA	.22523861 02
VH	.10874797 01	C3	.11826121 01	C1	.47049761 03	SLR	.45170146 02	APO	.00000000 00	TFP	-.46879862 03
TA	-.16563762 03	EA	-.50357516 02	MA	-.70487013 01	DAI	.27140437 02	RAI	.99083260 02	MTA	.17403971 03
WX	.56460077 00	WY	.44958755 00	WZ	-.69216710 00	PX	-.22418151 00	PY	.89062846 00	PZ	.39563048 00
QX	.79433423 00	QY	-.68201852-01	QZ	.60363898 00	RX	-.87488244-01	RY	.44792221 00	RZ	-.88978168 00
SXO	.30545253 00	SYO	-.89289585 00	SZO	-.33081045 00	DAO	-.19317972 02	RAO	.28888541 03	TF	.71616641 02
SXI	-.14048670 00	SYI	.87873181 00	SZI	.45617305 00	TX	.98620956 00	TY	.16491228 00	TZ	-.13951592-01
BX	-.81331963 00	BY	.16031532 00	BZ	-.55929436 00	MX	-.69793763 00	MY	.73202195-02	MZ	-.56455304 00
B.T	-.33221481 03	B.R	.27716111 03	B	.43264879 03	PER	.20655745 02				
OP1	-.27546182 02	OY	-.45403461 01	OP2	-.39462909 02						
BTE	-.33651928 03	BRE	.27191863 03	BTO	-.33221481 03	BRO	.27716111 03				

RA-5 STANDARD TRAJECTORY FOURTH DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 102 DEG.

215557536416	613766363250	614412032113	202421655610	204472473413	603425016652
	621001900		0		221426673534

RA-5 STANDARD TRAJECTORY FOURTH DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG.

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860320 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63781650 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007589 04	GMS	.13271544 12	GMV	.32476950 06	GMA	.42977799 05	GMB	.00000000 00	GMJ	.12671060 09

INJECTION CONDITIONS 1950.0 MOON JULIAN DATE 2437957.37541622 OCT. 19,1962 21 00 35.962

GEOCENTRIC XO .58699953 04 YO-.19800923 04 ZO-.21896807 04 DXO .17184179 01 DYO .95937616 01 DZO-.49993088 01
CARTESIAN GMC .00000000 00 SGC .00000000 00 TO .75635961 05 GHA .34299997 03 GHO .26987313 02

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437957.37541622 OCT. 19,1962 21 00 35.962

GEOCENTRIC EQUATORIAL COORDINATES

X	.58781552 04	Y	-.19637420 04	Z	-.21825025 04	DX	.16976903 01	DY	.95984115 01	DZ	-.49974641 01
R	.65705638 04	DEC	-.19400153 02	RA	.34152684 03	V	.10953826 02	PTH	.16221887 01	AZ	.11828866 03
R	.65705637 04	LAT	-.19400153 02	LON	.35852687 03	VE	.10558208 02	PTE	.16829893 01	AZE	.11945150 03
XS	-.13389553 09	YS	-.59909881 08	ZS	-.25978516 08	DXS	.13532539 02	DYS	-.24470310 02	DZS	-.10609830 02
XM	-.13411817 06	YM	.33724400 06	ZM	.13657596 06	DXM	-.96561483 00	DYM	-.29220561 00	DZM	-.35121846-01
XT	-.13411817 06	YT	.33724400 06	ZT	.13657596 06	DXT	-.96561483 00	DYT	-.29220561 00	DZT	-.35121846-01
RS	.14897009 09	VS	.29908095 02	RM	.38778111 06	VM	.10094700 01	RT	.38778111 06	VT	.10094700 01
GED	-.19522393 02	ALT	.19473956 03	LOS	.22110556 03	RAS	.20410553 03	RAM	.11168716 03	LOM	.12868719 03
DUT	.34000000 02	DT	.15000000 02	DR	.31008926 00	SHA	.51240217 04	DES	-.10043014 02	DEM	.20621848 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437957.37501891 OCT. 19,1962 21 00 01.635

SMA	.29665015 06	ECC	.97786874 00	INC	.33842266 02	LAN	.12984448 03	APF	.21333439 03	RCA	.65652385 04
VH	.12261746 00	C3	-.13436811 01	C1	.71943966 05	SLR	.12985180 05	APO	.58673505 06	TFP	.34327216 02
TA	.32811028 01	EA	.34716783 00	MA	.76853693-02	DAO	-.17820434 02	RAO	.33849221 03	MTA	.18000000 03
WX	.42758676 00	WY	.35681457 00	WZ	.83057386 00	PX	.88572901 00	PY	-.34903683 00	PZ	-.30603487 00
QX	.18070316 00	QY	.86651983 00	QZ	-.46528455 00	RX	-.12699337 00	RY	.45192401 00	RZ	-.88297072 00
SXO	.88572901 00	SYO	-.34903683 00	SZO	-.30603487 00	TX	-.44649384 00	TY	-.82093725 00	TZ	-.35595687 00
BX	-.18070316 00	BY	-.86651985 00	BZ	.46528456 00	MX	.12971247 00	MY	.88507645 00	MZ	-.44700601 00
B.T	.38878724 05	B.R	-.48378733 05	B	.62064943 05	PER	.26799401 05	OMD	.92637090-02	NOD	-.62828605-02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.13390141 09	Y	.59907917 08	Z	.25976333 08	DX	-.11834849 02	DY	.34068721 02	DZ	.56123656 01
R	.14897421 09	LAT	.10041882 02	LON	.24103896 02	V	.36499863 02	PTH	.63571157 01	AZ	.82102933 02
XE	.13389553 09	YE	.59909881 08	ZE	.25978516 08	DXE	-.13532539 02	DYE	.24470310 02	DZE	.10609830 02
XT	.13376141 09	YT	.60247125 08	ZT	.26115092 08	DXT	-.14498154 02	DYT	.24178104 02	DZT	.10574708 02
LTE	.10043014 02	LOE	.24105533 02	LTT	.10093668 02	LOT	.24247154 02	RST	.14900949 09	VST	.30109826 02
EPS	.51244418 02	ESP	.27453512-18	SEP	.12875361 03	EPM	.45962492 02	EMP	.69780516 00	MEP	.13333958 03
MPS	.95084732 02	MSP	.15017003 00	SMP	.84765009 02	SEM	.95756802 02	EMS	.84094843 02	ESM	.14803752 00
EPT	.45962492 02	ETP	.69780516 00	TEP	.13333958 03	TPS	.95084732 02	TSP	.15017003 00	STP	.84765009 02
SET	.95756802 02	STE	.84094843 02	EST	.14803752 00	RPM	.39231972 06	RPT	.39231972 06	SPN	-.24849971 02
GCE	.90108290 02	GCT	.10501586 03	SIP	.94830906 02	CPT	.10519487 03	SIN	.10494104 03		
REP	.65705638 04	VEP	.10953826 02								

RA-5 STANDARD TRAJECTORY FOURTH DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG.

2 DAYS 23 HRS. 17 MIN. 21.502 SEC. JULIAN DATE 2437960.34580398 OCT. 22,1962 20 17 57.464
RECTIFICATION .61786018-02 .95042878 02 -.16862706 02 -.60456791 01

2 DAYS 23 HRS. 33 MIN. 33.438 SEC. JULIAN DATE 2437960.35705324 OCT. 22,1962 20 34 09.401

GEOCENTRIC EQUATORIAL COORDINATES

X	-.33658474 06	Y	.19361769 06	Z	.97975904 05	DX	-.84571616 00	DY	.15033520 01	DZ	.10294235 01
R	.40047019 06	DEC	.14161279 02	RA	.15009068 03	V	.20087348 01	PTH	.57253329 02	AZ	.30578666 03
R	.40047018 06	LAT	.14161279 02	LON	.17076254 03	VE	.29252473 02	PTE	.33109802 01	AZE	.27124671 03
XS	-.13023175 09	YS	-.66132111 08	ZS	-.28676364 08	DXS	.14905288 02	DYS	-.23823215 02	DZS	-.10329283 02
XM	-.33662689 06	YM	.19507988 06	ZM	.98914631 05	DXM	-.55698918 00	DYM	-.76343808 00	DZM	-.24319550 00
XT	-.33662689 06	YT	.19507988 06	ZT	.98914631 05	DXT	-.55698918 00	DYT	-.76343808 00	DZT	-.24319550 00
RS	.14884925 09	VS	.29940062 02	RM	.40144480 06	VM	.97581693 00	RT	.40144480 06	VT	.97581693 00
GED	.14253865 02	ALT	.39409327 06	LOS	.22759347 03	RAS	.20692161 03	RAM	.14990712 03	LOM	.17057899 03
DUT	.34000000 02	DT	.59999999 02	DR	.16894875 01	SHA	-.35275010 06	DES	-.11107694 02	DEM	.14264383 02

HELIOCENTRIC EQUATORIAL COORDINATES

X	.12989517 09	Y	.66325729 08	Z	.28774340 08	DX	-.15751005 02	DY	.25326567 02	DZ	.11358707 02
R	.14866008 09	LAT	.11160496 02	LON	.27049294 02	V	.31914720 02	PTH	-.47505502 00	AZ	.68628304 02
XE	.13023175 09	YE	.66132111 08	ZE	.28676364 08	DXE	-.14905288 02	DYE	.23823215 02	DZE	.10329283 02
XT	.12989513 09	YT	.66327191 08	ZT	.28775279 08	DXT	-.15462278 02	DYT	.23059777 02	DZT	.10086088 02
LTE	.11107694 02	LOE	.26921608 02	LTT	.11160803 02	LOT	.27049813 02	RST	.14866088 09	VST	.29539203 02
EPS	.11812020 03	ESP	.13598114 00	SEP	.61743841 02	EPM	.12400362 03	EMP	.55790724 02	MEP	.20534614 00
MPS	.11730201 03	MSP	.27453512-18	SMP	.62697394 02	SEM	.61946994 02	EMS	.11791646 03	ESM	.13651968 00
EPT	.12400362 03	ETP	.55790724 02	TEP	.20534614 00	TPS	.11730201 03	TSP	.27453512-18	STP	.62697394 02
SET	.61946994 02	STE	.11791646 03	EST	.13651968 00	RPM	.17380900 04	RPT	.17380900 04	SPN	.11720766 03
GCE	.28163819 03	GCT	.93302564 02	SIP	.27885004 02	CPT	.94558067 02	SIN	.51410636 01		
REP	.40047019 06	VEP	.20087348 01								

SELENOCENTRIC EQUATORIAL COORDINATES

X	.42152538 02	Y	-.14621808 04	Z	-.93872641 03	DX	-.28872698 00	DY	.22667900 01	DZ	.12726190 01
R	.17380900 04	DEC	-.32689821 02	RA	.27165130 03	V	.26155801 01	PTH	-.84007116 02	AZ	.23485109 03
R	.17380898 04	LAT	-.84377500 01	LON	.30954152 03	VR	.26159836 01	PTR	-.83923446 02	AZR	.23736812 03
LTS	.15421764 01	LNS	.24743769 03	LTE	-.25042103 01	LNE	.53178418 01				
ALT	.89965820-01	SHA	-.15444604 04	ALP	.48194309 01	DR	-.26012856 01	DP	.90020154-02	ASD	.89417003 02
HGE	.24187979 03	SVL	-.74015114 01	HNG	.11755078 03	SIA	.34586621 02				

SELENOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437960.36247598 OCT. 22,1962 20 41 57.925

SMA	-.40771265 04	ECC	.10056216 01	INC	.13348361 03	LAN	.12914235 03	APF	.33596092 02	RCA	.22919798 02
VH	.10963635 01	C3	.12020130 01	C1	.47463696 03	SLR	.45968441 02	APO	.00000000 00	TFP	-.46852442 03
TA	-.16549140 03	EA	-.50734126 02	MA	-.72186378 01	DAI	.27584372 02	RAI	.99440075 02	MTA	.17393890 03
WX	.56273866 00	WY	.45801641 00	WZ	-.68814716 00	PX	-.23048271 00	PY	.88639072 00	PZ	.40148383 00
QX	.79385343 00	QY	-.67324613-01	QZ	.60437109 00	RX	-.89207227-01	RY	.45453649 00	RZ	-.88624977 00
SXO	.31301631 00	SYO	-.88854441 00	SZO	-.33542467 00	DAO	-.19598363 02	RAO	.28940634 03	TF	.71689434 02
SXI	-.14537226 00	SYI	.87432697 00	SZI	.46305429 00	TX	.98534714 00	TY	.17014392 00	TZ	-.11919292-01
BX	-.81375196 00	BY	.16054116 00	BZ	-.55860029 00	MX	-.69410501 00	MY	.73934878-02	MZ	-.56268979 00
B.T	-.33241900 03	B.R	.27733820 03	B	.43291901 03	PER	.20846674 02				
OP1	-.28120203 02	OY	-.50318483 01	OP2	-.39110494 02						
BTE	-.33611856 03	BRE	.27284278 03	BTO	-.33241900 03	BRO	.27733820 03				
GP	.38341463 01	TR	.41464124 04	THA	.14016165 03						

RA-5 STANDARD TRAJECTORY FOURTH DAY LAUNCH
JPL INJECTION CONDITIONS LAUNCH AZIMUTH = 111 DEG.

215556677663	613757013640	614421553440	201667724361	204463000141	603477751264
	621001900		0		221447347731

Table IV-1. RA-5 Trajectory Constants

The following constants and conversion factors are used in all trajectory computations for RA-5 mission.

GM_{SUN}	$1.32715445 \times 10^{11}$ Km^3/Sec^2
GM_{VENUS}	3.247695×10^5 Km^3/Sec^2
GM_{EARTH}	3.986032×10^5 Km^3/Sec^2
$GM_{EARTH\text{-}MOON}$	4.03503×10^5 Km^3/Sec^2
GM_{MOON}	4.900759×10^3 Km^3/Sec^2
GM_{MARS}	4.297780×10^4 Km^3/Sec^2
$GM_{JUPITER}$	1.267106×10^8 Km^3/Sec^2
$MASS\ \frac{SUN}{VENUS}$	408645
$MASS\ \frac{SUN}{EARTH}$	332951.3
$MASS\ \frac{EARTH}{MOON}$	81.335
$MASS\ \frac{SUN}{EARTH\ MOON}$	328908
$MASS\ \frac{SUN}{MARS}$	3,088,000
$MASS\ \frac{SUN}{JUPITER}$	1047.39
Equatorial Radius of Earth	6378.165 Kilometers
1 a.u.	1.495990×10^8 Kilometers
Ellipticity of Earth	1/298.3
Earth Potential Function:	

$$\Phi(R, \phi) = \frac{GM_E}{R}\left[1 + \frac{JR_E^2}{3R^2}(1-3\sin^2\phi) + \frac{H}{5}\frac{R_E^3}{R^3}(3-5\sin^2\phi)(\sin\phi) + \frac{D}{35}\frac{R_E^4}{R^4}(3-30\sin^2\phi + 35\sin^4\phi)\right]$$

Where R = Geocentric Distance $J = 1.62345 \times 10^{-3}$

ϕ = Geocentric Latitude $H = -.575 \times 10^{-5}$

$D = .7875 \times 10^{-5}$

Conversion from Feet to Meters	.3048
Atmospheric Model	1959 ARDC
Sidereal Rotation Rate of Earth	4.1780742×10^{-3} Deg/Sec
Universal Constant of Gravitation	6.671×10^{-20} Km^3/Kilogram Sec^2
Speed of light	2.997925×10^5 Km/Sec
Mean Moon Radius	1738.09 Kilometers
Moon Moments of Inertia	$A = .88746 \times 10^{29}$ Kg $Kilometers^2$
About Principal Axis	$B = .88764 \times 10^{29}$ Kg $Kilometers^2$
	$C = .88801 \times 10^{29}$ Kg $Kilometers^2$
Lunar and Solar Ephemerides	The moon and sun positions are obtained from the joint JPL-STL ephemerides. For purposes of converting into kilometers, the conversion factors are: 1 a.u. = 1.495990×10^8 Kilometers 1 e.r. = 6378.165 Kilometers
Geometrical Earth Model, used in locating tracking and launching facilities upon the Earth.	Clarke Spheroid of 1866 a = 6378.2064 Km b_2 = 6356.5838 Km e = 0.006768657997291

Table IV-2. RA-5 Trajectory Key

	COLUMN / ROW	1	2	3	4	5	6
	1	GME	J	H	D	RE	REM
GROUP A	2	G	A	B	C	OME	AU
	3	GMM	GMS	GMV	GMA	GMB	GMJ
		INJECTION CONDITIONS	TARGET	JULIAN DATE		MONTH DAY, YEAR	HR. MIN. SEC.
GROUP B	4	GEOCENTRIC	XO	YO	ZO	DXO	DYO	DZO
		CARTESIAN	GMC	SGC	TO	GHA	GHO	
		TIME PAST INJECTION		JULIAN DATE		MONTH DAY, YEAR	HR. MIN. SEC.
		GEOCENTRIC				EQUATORIAL COORDINATES	
	6	X	Y	Z	DX	DY	DZ
	7	R	DEC	RA	V	PTH	AZ
GROUP C	8	R	LAT	LON	VE	PTE	AZE
	9	XS	YS	ZS	DXS	DYS	DZS
	10	XM	YM	ZM	DXM	DYM	DZM
	11	XT	YT	ZT	DXT	DYT	DZT
	12	RS	VS	RM	VM	RT	VT
	13	GED	ALT	LOS	RAS	RAM	LOM
	14	DUT	DT	DR	SHA	DES	DEM
		GEOCENTRIC		CONIC ORBITAL B · T AND B · R		EQUATORIAL COORDINATES	
		EPOCH OF PERICENTER PASSAGE		JULIAN DATE		MONTH DAY, YEAR	HR. MIN. SEC.
	15	SMA	ECC	INC	LAN	APF	RCA
	16	VH	C3	C1	SLR	APO	TFP
GROUP D	17	TA	EA	MA	DAO	RAO	MTA
	18	WX	WY	WZ	PX	PY	PZ
	19	QX	QY	QZ	RX	RY	RZ
	20	SXO	SYO	SZO	TX	TY	TZ
	21	BX	BY	BZ	MX	MY	MZ
	22	B · T	B · R	B	PER	OMD	NOD
		HELIOCENTRIC				EQUATORIAL COORDINATES	
	23	X	Y	Z	DX	DY	DZ
	24	R	LAT	LON	V	PTH	AZ
	25	XE	YE	ZE	DXE	DYE	DZE
GROUP E	26	XT	YT	ZT	DXT	DYT	DZT
	27	LTE	LOE	LTT	LOT	RST	VST
	28	EPS	ESP	SEP	EPM	EMP	MEP
	29	MPS	MSP	SMP	SEM	EMS	ESM
	30	EPT	ETP	TEP	TPS	TSP	STP
	31	SET	STE	EST	RPM	RPT	SPN
	32	GCE	GCT	SIP	CPT	SIN	
	33	REP	VEP				
		SELENOCENTRIC				EQUATORIAL COORDINATES	
	34	X	Y	Z	DX	DY	DZ
	35	R	DEC	RA	V	PTH	AZ
GROUP F	36	R	LAT	LON	VR	PTR	AZR
	37	LTS	LNS	LTE	LNE		
	38	ALT	SHA	ALP	DR	DP	ASD
	39	HGE	SVL	HNG	SIA		
		SELENOCENTRIC		CONIC ORBITAL B · T AND B · R		EQUATORIAL COORDINATES	
		EPOCH OF PERICENTER PASSAGE		JULIAN DATE		MONTH DAY, YEAR	HR. MIN. SEC
	40	SMA	ECC	INC	LAN	APF	RCA
	41	VH	C3	C1	SLR	APO	TFP
GROUP G	42	TA	EA	MA	DAO	RAO	MTA
	43	WX	WY	WZ	PX	PY	PZ
	44	QX	QY	QZ	RX	RY	RZ
	45	SXO	SYO	SZO	DAO	RAO	TF
	46	SXI	SYI	SZI	TX	TY	TZ
	47	BX	BY	BZ	MX	MY	MZ
	48	B · T	B · R	B	PER		
	49	OP1	OY	OP2			
	50	BTE	BRE	BTO	BRO		
	51	GP	IR	THA			
GROUP H	52	XOCTAL	YOCTAL	ZOCTAL	ẊOCTAL	ẎOCTA	ŻOCTAL
	53		YYMMDDDHH	TTSSSSS		SOCTAL	

Table IV-3. RA-5 Trajectory Key Definitions

GROUP A

ROW 1	GEM	Universal gravitational constant times the mass of Earth (Km^3/Sec^2).
	J	Coefficient of the second harmonic in the Earth's potential function.
	H	Coefficient of the third harmonic in the Earth's potential function.
	D	Coefficient of the fourth harmonic in the Earth's potential function.
	RE	Earth radius (Kilometers).
	REM	Conversion factor for converting lunar ephemerides into Kilometers, 1 e.r. = 6378.150 Kilometers.
ROW 2	G	Universal constant of gravitation ($Km^3/Kgm\ Sec^2$).
	A, B, C	Moments of inertia about principal axis for the Moon ($Kg\ Km^2$).
	OME	Sidereal rotation rate of the Earth (Deg/Sec).
	AU	Astronomical unit (Kilometers).
ROW 3	GMM	Universal gravitational constant times the mass of Moon (Km^3/Sec^2).
	GMS	Universal gravitational constant times the mass of Sun (Km^3/Sec^2).
	GMV	Universal gravitational constant times the mass of Venus (Km^3/Sec^2).
	GMA	Universal gravitational constant times the mass of Mars (Km^3/Sec^2).
	GMB	Universal gravitational constant times the mass of Earth-Moon (Km^3/Sec^2).
	GMJ	Universal gravitational constant times the mass of Jupiter (Km^3/Sec^2).

GROUP B

Injection conditions are vernal equinox cartesian coordinates in a geocentric equatorial system. The principal direction ($\vec{X}$) is the vernal equinox direction of date and the principal plane (XY) is the equatorial plane of date. $\vec{Z}$ is along the direction of the Earth's spin axis of date.

ROW 4	XO, XO, XO	Cartesian components of the probe radius vector (Kilometers).
	DXO, DYO, DZO	Cartesian components of the probe space-fixed velocity vector (Kilometers/Second).

Table IV-3 (Cont'd)

ROW 5	GMC	Elevation angle of probe spin axis, $\vec{C}$, measured with respect to local horizontal (Degrees).
	SGC	Azimuth angle of probe spin axis, $\vec{C}$, measured east of true north (Degrees).
	TO	Time of injection in seconds past midnight of day before launch (Seconds).
	GHA	Hour angle of Greenwich at injection epoch (Degrees).
	GHO	Hour angle of Greenwich at midnight of day before launch (Degrees).
GROUP C		Inertial position and velocity of the probe, Sun, Moon and target body in a geocentric equatorial system. The principal direction ($\vec{X}$) is the vernal equinox direction of date and the principal plane (XY) is the equatorial plane of date. $\vec{Z}$ is along the direction of the Earth's spin axis of date. Miscellaneous parameters are also included.
ROW 6	X, Y, Z	Cartesian components of the probe radius vector (Kilometers).
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector (Kilometers/Second).
ROW 7	R	Probe radius distance (Kilometers).
	DEC	Probe declination angle (Degrees).
	RA	Probe right ascension angle (Degrees).
	V	Probe space-fixed velocity (Kilometers/Second).
	PTH	Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal (Degrees).
	AZ	Azimuth angle of the probe space-fixed velocity vector measured east of true north (Degrees).

Table IV-3 (Cont'd)

ROW 8*	R	Probe radius distance (Kilometers).
	LAT	Probe geocentric latitude (Degrees).
	LON	Probe east longitude (Degrees).
	VE	Probe Earth-fixed velocity (Kilometers/Second).
	PTE	Pitch angle of the probe Earth-fixed velocity vector with respect to the local horizontal (Degrees).
	AZE	Azimuth angle of the probe Earth-fixed velocity vector measured east of true north (Degrees)
ROW 9	XS, YS, ZS	Cartesian components of the Sun radius vector (Kilometers).
	DXS, DYS, DZS	Cartesian components of the Sun space-fixed velocity vector (Kilometers/Second).
ROW 10	XM, YM, ZM	Cartesian components of the Moon radius vector (Kilometers).
	DXM, DYM, DZM	Cartesian components of the Moon space-fixed velocity vector (Kilometers/Second).
ROW 11	XT, YT, ZT	Cartesian components of the target radius vector (Kilometers).
	DXT, DYT, DZT	Cartesian components of the target space-fixed velocity vector (Kilometers/Second).

* These are Earth-fixed spherical coordinates in a geocentric equatorial system. The principal direction $\vec{x}$ is directed towards Greenwich and is the intersection of the meridian plane of Greenwich with the equatorial plane. The principal plane is the Earth's geometrical equatorial plane (x y). $\vec{z}$ is along the direction of the Earth's geometrical north direction.

Table IV-3 (Cont'd)

ROW 12	RS	Sun radius distance (Kilometers).
	VS	Sun space-fixed velocity (Kilometers/Second).
	RM	Moon radius distance (Kilometers).
	VM	Moon space-fixed velocity (Kilometers).
	RT	Target radius distance (Kilometers).
	VT	Target space-fixed velocity (Kilometers/Second).
ROW 13	GED	Geodetic latitude of the probe (Degrees).
	ALT	Altitude of the probe above the earth's surface (Kilometers).
	LOS	Longitude of the sun in coordinate system defined in Group B (Degrees).
	RAS	Right ascension of the sun (Degrees).
	RAM	Right ascension of the moon (Degrees).
	LOM	Longitude of the moon in coordinate system defined in Group B (Degrees).
ROW 14	DUT	Ephemeris time minus Universal Time (Seconds).
	DT	Adams-Moulton step size (Seconds).
	DR	Radial velocity of probe (Kilometers/Second).
	SHA	Sun shadow parameter (Kilometers).
	DES	Declination of the sun (Degrees).
	DEM	Declination of the moon (Degrees).
GROUP D		Characteristics of the earth conic in the geocentric equatorial system described under Group B.
ROW 15	SMA	Semi-major axis (Kilometers).
	ECC	Eccentricity.
	INC	Inclination of the orbit plane to the equatorial plane (Degrees).
	LAN	Longitude of the ascending node (Degrees).
	APF	Argument of pericenter (Degrees).
	RCA	Magnitude of the closest approach vector (Kilometers).
ROW 16	VH	Hyperbolic excess speed (Kilometers/Second).
	C3	Twice the energy (vis viva energy integral, Kilometers^2/Second^2).
	C1	Angular momentum (Kilometers^2/Second).
	SLR	Semi-latus rectum (Kilometers).
	APO	Apogee distance (Kilometers).
	TFP	Time from pericenter passage (Seconds).

Table IV-3 (Cont'd)

ROW 17	TA	True anomaly (Degrees).
	EA	Eccentric anomaly (Degrees).
	MA	Mean anomaly (Degrees).
	DAO	Declination of the outgoing asymptote (Degrees). *
	RAO	Right ascension of the outgoing asymptote (Degrees). *
	MTA	Maximum true anomaly (Degrees).
ROW 18	WX, WY, WZ	Components of a unit vector normal to the conic $\overline{W} = \frac{\vec{R} \times \vec{V}}{\vec{R} \times \vec{V}}$
	PX, PY, PZ	Components of a unit vector in the direction of perigee.
ROW 19	QX, QY, QZ	Components of a unit vector perpendicular to the perigee direction, vector $\vec{P}$, and being in the orbit plane $\vec{Q} = \vec{W} \times \vec{P}$.
	RX, RY, RZ	Components of the unit vector $\vec{R}$. *
ROW 20	SXO, SYO, SZO	Components of the unit vector $\vec{S}_o$* along the direction of the outgoing asumptote.
	TX, TY, TZ	Components of the unit vector $\vec{T}$. *
ROW 21	BX, BY, BZ	Components of the impact parameter $\vec{B}$ (Kilometers). *
	MX, MY, MZ	Components of a unit vector which lies in the orbit plane and is normal to the radius vector $\vec{R}$. $\vec{M} = \vec{W} \times \frac{\vec{R}}{\lvert\vec{R}\rvert}$

See nomenclature.

Table IV-3 (Cont'd)

ROW 22	$\vec{B} \bullet \vec{T}$	Projection of the impact parameter $\vec{B}$ upon the vector $\vec{T}$ (Kilometers). *
	$\vec{B} \bullet \vec{R}$	Projection of the impact parameter $\vec{B}$ upon the vector $\vec{R}$ (Kilometers). *
	B	The magnitude of the impact parameter (Kilometers). *
	PER	Period (Minutes).
	OMD	Rate of change of argument of perigee (Degrees/Day).
	NOD	Rate of change of right ascension of the ascending node (Degrees/Day).
GROUP E		Inertial position and velocity of the probe, Sun, Moon, and target body in a heliocentric equatorial system. The principal direction ($\vec{X}$) is the vernal equinox direction of date and the principal plane (XY) is the equatorial plane of date. $\vec{Z}$ is along the direction of the Earth's spin axis of date. Miscellaneous parameters are also included.
ROW 23	X, Y, Z	Cartesian components of the probe radius vector (Kilometers).
	DX, DY, DZ	Cartesian componenets of the probe space-fixed velocity vector (Kilometers/Second).
ROW 24	R	Sun-Probe radius distance (Kilometers).
	LAT	Probe celestial declination (Degrees).
	LON	Probe celestial right ascension (Degrees).
	V	Probe space-fixed velocity (Kilometers/Second).
	PTH	Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal (Degrees).
	AZ	Azimuth angle of the probe space-fixed velocity vector measured east of true north (Degrees).

* See nomenclature.

Table IV-3 (Cont'd)

ROW 25	XE, YE, ZE	Cartesian components of the earth radius vector (Kilometers).
	DXE, DYE, DZE	Cartesian components of the earth space-fixed velocity vector (Kilometers/Second).
ROW 26	XT, YT, ZT	Cartesian components of the target radius vector (Kilometers).
	DXT, DYT, DZT	Cartesian components of the target space-fixed velocity vector (Kilometers/Second).
ROW 27	LTE	Celestial latitude of the earth (Degrees).
	LOE	Celestial longitude of the earth (Degrees).
	LTT	Celestial latitude of the target (Degrees).
	LOT	Celestial longitude of the target (Degrees).
	RST	Sun-Target Range (Kilometers).
	VST	Sun-Target Velocity (Kilometers/Seconds).
ROW 28	EPS	Earth-Probe-Sun angle (Degrees).
	ESP	Earth-Sun-Probe angle (Degrees).
	SEP	Sun-Earth-Probe angle (Degrees).
	EPM	Earth-Probe-Moon angle (Degrees).
	EMP	Earth-Moon-Probe angle (Degrees).
	MEP	Moon-Earth-Probe angle (Degrees).
ROW 29	MPS	Moon-Probe-Sun angle (Degrees).
	MSP	Moon-Sun-Probe angle (Degrees).
	SMP	Sun-Moon-Probe angle (Degrees).
	SEM	Sun-Earth-Moon angle (Degrees).
	EMS	Earth-Moon-Sun angle (Degrees).
	ESM	Earth-Sun-Moon angle (Degrees).

Table IV-3 (Cont'd)

ROW 30	EPT	Earth-Probe-Target angle (Degrees).
	ETP	Earth-Target-Probe angle (Degrees).
	TEP	Target-Earth-Probe angle (Degrees).
	TPS	Target-Probe-Sun angle (Degrees).
	TSP	Target-Sun-Probe angle (Degrees).
	STP	Sun-Target-Probe angle (Degrees).
ROW 31	SET	Sun-Earth-Target angle (Degrees).
	STE	Sun-Target-Earth angle (Degrees).
	EST	Earth-Sun-Target angle (Degrees).
	RPM	Moon-Probe Radius distance (Kilometers).
	RPT	Target-Probe Radius distance (Kilometers).
	SPN	Sun-Probe-near limb of Earth angle (Degrees)
ROW 32	GCE	Clock angle of the Earth (Degrees).
	GCT	Clock angle of the target (Degrees).
	SIP	Sun-Probe-near limb of target angle (Degrees).
	CPT	Canopus-Probe-Target angle (Degrees).
	SIN	Canopus-Probe-near limb of target angle (Degrees).
ROW 33	REP	Earth-Probe-Radius distance (Kilometers).
	VEP	Probe-Space-fixed velocity relative to Earth (Kilometer/Second)

GROUP F

ROW 34, 35	Inertial position of probe in a selecocentric equatorial system. The principal direction ($\vec{X}$) is the vernal equinox direction of date and the principal plane (XY) is the geometric equatorial plane of date. $\vec{Z}$ is along the direction of the Earth's spin axis of date.
ROW 36 through 38	Selenocentric-fixed spherical coordinates of the probe, Sun and Earth in a selenocentric equatorial system. The principal direction $\vec{X}$ is in the direction of the mean Moon-Earth line. The principal plane (XY) is the mean selenocentric equatorial plane. $\vec{Z}$ is along the direction of the Moon's mean spin axis. Miscellaneous parameters are also included.

Table IV-3 (Cont'd)

ROW 34	X, Y, Z	Cartesian components of the probe radius vector (Kilometers).
	DX, DY, DZ	Cartesian components of the probe velocity vector (Kilometers/Second).
ROW 35	R	Probe radius distance (Kilometers).
	DEC	Probe declination angle (Degrees).
	RA	Probe right ascension angle (Degrees).
	V	Probe space-fixed velocity (Kilometers/Second).
	PTH	Pitch angle of the probe space-fixed velocity vector with respect of the local horizontal (Degrees).
	AZ	Azimuth angle of the probe space-fixed velocity vector measured east of true north (Degrees).
ROW 36	R	Probe radius distance (Kilometers).
	LAT	Probe selenocentric latitude (Degrees).
	LON	Probe selenocentric east longitude (Degrees).
	VR	Probe selenocentric-fixed velocity (Kilometers/Second).
	RTR	Pitch angle of the probe selenocentric-fixed velocity vector with respect to the local horizontal (Degrees).
	AZR	Azimuth angle of the probe selenocentric-fixed velocity vector measured east of the Moon's mean spin axis (Degrees).
ROW 37	LTS	Selenocentric latitude of the Sun (Degrees).
	LNS	Selenocentric longitude of the Sun (Degrees).
	LTE	Selenocentric latitude of the Earth (Degrees).
	LNE	Selenocentric longitude of the Earth (Degrees).
ROW 38	ALT	Altitude of the probe above the Moon's surface (Kilometers).
	SHA	Sun shadow parameter (Kilometers).
	ALP	Illuminated crescent orientation viewing angle (Degrees).
	DR	First time derivative of the probe radius distance (Kilometers/Second).
	DP	First time derivative of the probe radius direction (Degrees/Second).
	ASD	Angular semi-diameter of Moon as seen from the probe (Degrees).

Table IV-3 (Cont'd)

ROW 39	HGE	Right ascension of Earth in probe coordinate system** (Degrees).
	SVL	Declination of the Moon in probe coordinate system** (Degrees).
	HNG	Right ascension of the Moon in probe coordinate system** (Degrees).
	SIA	Earth-Probe-Moon angle minus ASD (Degrees).
GROUP G		Characteristics of the selenocentric conic in the geocentric equatorial system described under Group B except centered at the Moon.
ROW 40	SMA	Semi-major axis (Kilometers).
	ECC	Eccentricity.
	INC	Inclination of the orbit plane to the equatorial plane (Degrees).
	LAN	Longitude of the ascending node (Degrees).
	APF	Argument of pericenter (Degrees).
	RCA	Magnitude of the closest approach vector (Kilometers).
ROW 41	VH	Hyperbolic excess speed (Kilometers/Second).
	C3	Twice the energy (Vis viva energy integral, Kilometers^2/Second^2).
	C1	Angular momentum (Kilometers^2/Second).
	SLR	Semi-latus rectum (Kilometers).
	APO	Apogee distance (Kilometers).
	TFP	Time from pericenter passage (Seconds).
ROW 42	TA	True anomaly (Degrees).
	EA	Eccentric anomaly (Degrees).
	MA	Mean anomaly (Degrees).
	DAO	Declination of the outgoing asymptote (Degrees). *
	RAO	Right ascension of the outgoing asymptote (Degrees). *
	MTA	Maximum true anomaly (Degrees).

* See nomenclature.

** Same coordinate system as defined under B except centered at the probe.

Table IV-3 (Cont'd)

ROW 43	WX, WY, WZ	Components of a unit vector normal to the conic $\frac{\vec{R} \times \vec{V}}{\lvert\vec{R} \times \vec{V}\rvert}$
	PX, PY, PZ	Components of a unit vector in the direction of perigee.
ROW 44	QX, QY, QZ	Components of a unit vector perpendicular to the perigee direction, vector $\vec{P}$, and being in the orbit plane $\vec{Q} = \vec{W} \times \vec{P}$
	RX, RY, RZ	Components of the unit vector $\vec{R}$. *
ROW 45	SXO, SYO, SZO	Components of the unit vector $\vec{S}_o$ along the direction of the outgoing asymptote. *
	DAO	Declination of the outgoing asumptote*(Degrees).
	RAO	Right ascension of the outgoing asymptote*(Degrees).
	TF	Time from injection to epoch of pericenter passage (Hours).
ROW 46	SXI, SYI, SZI	Components of the unit vector S_I along the direction of the incoming asymptote.
	TX, TY, TZ	Components of the unit vector T.
ROW 47	BX, BY, BZ	Components of the impact parameter $\vec{B}$ (Kilometers).
	MX, MY, MZ	Components of a unit vector which lies in the orbit plane and is normal to the radius vector $\vec{R}$. $\vec{M} = \vec{W} \times \frac{\vec{R}}{\lvert\vec{R}\rvert}$

* See nomenclature.

Table IV-3 (Cont'd)

ROW 48	$\vec{B} \cdot \vec{T}$	Projection of the impact parameter $\vec{B}$ upon the vector $\vec{T}$ (Kilometers). *
	$\vec{B} \cdot \vec{R}$	Projection of the impact parameter $\vec{B}$ upon the vector $\vec{R}$ (Kilometers). *
	B	The magnitude of the impact parameter (Kilometers). *
	PER	Period (Minutes).
ROW 49	OP1	Approximate first pitch turn during terminal maneuver (Degrees).
	OY	Approximate yaw turn during terminal maneuver (Degrees).
	OP2	Approximate second pitch turn during terminal maneuver (Degrees).
ROW 50	BTE	Component of the B vector parallel to the Earth's equator (Kilometers).
	BRE	Component of the B vector normal to the Earth's equator (Kilometers).
	BTO	= B•T
	BRO	= B•R
ROW 51	GP	Angle between the incoming asymptote direction and the orbital plane of the target (Degrees).
	IR	Captive radius measured from the center of the target to the incoming asymptote (Kilometers).
	THA	Angle between the $\overline{B}$ vector and the $\overline{T}$ direction.
GROUP H		Cartesian coordinates and epoch of injection conditions in the geocentric equatorial system described under Group B.
ROW 47	XOCTAL, YOCTAL, ZOCTAL	Cartesian components of the probe radius vector in octal representation (Kilometers).
	$\dot{X}$OCTAL, $\dot{Y}$OCTAL, $\dot{Z}$OCTAL	Cartesian components of the probe space-fixed velocity vector in octal representation (Kilometers/Second).

* See nomenclature.

Table IV-3 (Cont'd)

ROW 48		Epic of injection.
	YY	Years past 1900
	MM	Month
	DDD	Day of Month
	HH	Hours
	TT	Minutes
	SSSSS	Milliseconds
	SOCTAL	Seconds in octal representation

The time past midnight Greenwich Meridian Time on (DD), month (MM) and year (YY + 1900) at which the injection epoch occurs is the time determined by the sum of HH, TT, SSSSS, and SOCTAL.

SECTION V

NOMENCLATURE

Definition of the Miss Parameter $\overline{B}$

The miss parameter $\overline{B}$ is used at the Jet Propulsion Laboratory to measure miss distance for lunar and interplanetary trajectories and is described by W. Kizner in Reference 3. $\overline{B}$ has the desirable feature of being very nearly a linear function of changes in injection conditions.

The osculating conic at closest approach to the target body is used in defining $\overline{B}$. $\overline{B}$ is the vector from the target's center of mass perpendicular to the incoming asymptote. Let $\overline{S}_I$ be a unit vector in the direction of the incoming asymptote. The orientation of $\overline{B}$ in the plane normal to $\overline{S}_I$ is described in terms of two unit vectors $\overline{R}$ and $\overline{T}$, normal to $\overline{S}_I$. $\overline{T}$ is taken parallel to a fixed reference plane and $\overline{R}$ completes a right-handed orthogonal system. Figure 1 illustrates the situation.

For the RA-5 mission the orbital plane of the moon is used as the reference plane for $\overline{T}$. If $\overline{W}$ is a unit vector normal to the orbital plane ($\overline{W}$ in direction of $\overline{R}_M \times \overline{V}_M$, where $\overline{R}_M$ is radius vector to Moon from Earth and $\overline{V}_M$ is the space-fixed velocity vector of the Moon relative to the Earth's center) then $\overline{T} = \overline{S}_I \times \overline{W}$ defines the coordinate system.

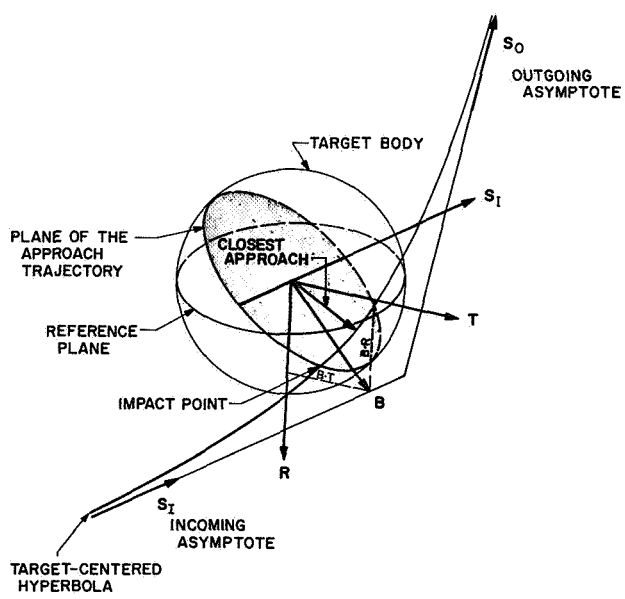

Figure 1. Definition of B · T, B · 4 System

SECTION VI

REFERENCES

1. Jet Propulsion Laboratory, Engineering Planning Document No. 105, Post Injection Standard Trajectories, Ranger P-36(RA-5) Volume I.

2. Space Technology Laboratories, Incorporated, Launch to Impact Targeting Trajectories, Ranger V, Volume 1, STL No. 8990-6011-TC001.

3. Jet Propulsion Laboratory External Publication No. 674, A Method of Describing Miss Distance for Lunar and Interplanetary Trajectories.