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68-FM-128

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MSC INTERNAL NOTE NO. 68-FM-128

June 4, 1968

1969

PRELIMINARY DISPERSION ANALYSIS OF FIVE RENDEZVOUS PROFILES FOR AAP MISSION AAP-1/AAP-2

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By Larry Hartley,

Orbital Mission Analysis Branch

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(NASA-TM-X-69692) PRELIMINARY DISPERSION ANALYSIS OF FIVE RENDEZVOUS PROFILES FOR AAP MISSION AAP-1/AAP-2 (NASA) 60 p

N74-70653

Unclas
00/99 16236

MSC INTERNAL NOTE NO. 68-FM-128

PROJECT APOLLO

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By Larry Hartley
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June 4, 1968

MISSION PLANNING AND ANALYSIS DIVISION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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PRELIMINARY DISPERSION ANALYSIS OF FIVE RENDEZVOUS PROFILES FOR AAP MISSION AAP-1/AAP-2

By Larry Hartley

SUMMARY AND INTRODUCTION

The current mission plan for Apollo Applications Mission AAP-1/AAP-2 includes the rendezvous of the manned command and service modules (CSM) with the Saturn IVB orbital workshop (OWS). The McDonnell Astronautics Company was requested to select the best terminal phase rendezvous profile for this mission. As a result of this request, five candidate terminal phase rendezvous profiles were selected; these plans are a coelliptic, a biased-equiperiod, an out-of-plane, a stable orbit, and an elliptic orbit approach. The Orbital Mission Analysis Branch (OMAB) was asked to develop the catch-up logic and perform a preliminary error analysis for each plan in order to facilitate McDonnell's recommendation of a particular plan for the terminal phase portion of this mission.

This report presents the work done by OMAB in support of McDonnell Astronautics Company. First, the catch-up logic is briefly discussed for each plan, and second, the results of the preliminary error analysis are presented.

RENDEZVOUS PROFILES

The terminal phase profiles described in this document are designed to fulfill the objectives published in reference 1, which presents a detailed description of each plan. Only a brief description of each plan is given here.

The coelliptic plan (fig. 1) calls for the OWS to be launched into a 260-n. mi. circular orbit and the CSM to be launched 24 hours later into an 81- by 120-n. mi. orbit. The CSM performs a height adjustment maneuver (NH) at 1^h38^m g.e.t., raising apogee to 249 n. mi. At 2^h23^m g.e.t., a phase maneuver (NC1) is executed to raise perigee to 237 n. mi. A corrective combination maneuver (NCC), which is nominally

zero, is scheduled at 3^h35^m g.e.t. The CSM then performs the coelliptic maneuver (NSR) 20 minutes after NCC creating a 249- by 250-n. mi. orbit; the differential altitude (Δh) is then 10 n. mi. Terminal phase initiation (TPI) is executed on a 26.6° elevation angle 12 minutes into darkness; the target travel angle (ωt) is 140°.

The biased equiperiod plan (fig. 2) is the same as the coelliptic rendezvous plan through the coelliptic maneuver. However, at 5^h01^m g.e.t., the CSM executes a 34-fps equiperiod maneuver (EPM) along the local horizontal. TPI is performed 95 minutes later 12 minutes into darkness, and the ωt to the target is 140°.

The out-of-plane rendezvous plan is presented in figure 3. The CSM insertion targeting is adjusted so that at 35 minutes after CSM lift-off there is a common node and a 0.06° wedge angle between the two vehicles' planes. The NH, NC1, NCC, and NSR maneuvers are planned at approximately the same times as outlined in the coelliptic plan. At 5^h02^m g.e.t., the CSM performs an in-plane TPI_1 maneuver (ωt = 120°) creating a 251- by 261-n. mi. orbit. This maneuver point was chosen so that thrusting is along the line of sight and maximum out-of-plane conditions are established at TPI_2. At 5^h34^m g.e.t., an in-plane TPI_2 maneuver (ωt = 90°) is executed to null in-plane relative velocities. As a result, the line-of-sight rate (change in the angle between the line of sight and the local horizontal) is nominally zero from TPI_2 to intercept.

Figure 4 shows the sequence of events for a stable orbit rendezvous plan. The maneuver times through NSR are the same as for the coelliptic rendezvous plan; however, the ΔV's of the maneuvers are different since the required Δh is zero for this plan. The NH maneuver results in an 81- by 259-n. mi. orbit; NC1, a 248- by 260-n. mi. orbit. The CSM executes the coelliptic maneuver to create a 259- by 260-n. mi. orbit. This series of maneuvers is executed in order to place the CSM 20 n. mi. behind the OWS and to make the Δh equal to zero at TPI. At 4^h45^m g.e.t., TPI is performed 12 minutes prior to darkness; the ωt is 240°.

The elliptic orbit rendezvous plan is presented in figure 5. Again, the maneuver times through NCC are approximately the same as for the coelliptic plan. However, an elliptic maneuver is done instead of the NSR maneuver. The elliptic maneuver places the CSM into a standard approach orbit prior to TPI; i.e., perigee of the CSM orbit is 70 n. mi. below the OWS perigee, and apogee 10 n. mi. below the OWS orbit apogee. When the CSM reaches a point 20 n. mi. behind and 10 n. mi. below the OWS, TPI is executed with a ωt of 140°, 12 minutes into darkness.

ERROR ANALYSIS AND RESULTS

The results of the preliminary error analysis presented in this report were requested by McDonnell Astronautics Company. Coordinate systems and time references of the data were selected based on navigation accuracy considerations and compatibility with existing digital simulations at both MSC and McDonnell.

The following data were requested during the terminal phase portion of the mission.

1. The uncertainty in the ground's knowledge of the relative state.

2. The uncertainty in the relative state between the OWS and CSM.

3. Nominal OWS and CSM state vectors and 30 samples of dispersed CSM state vectors.

4. Nominal CSM relative state vector and 30 samples of dispersed CSM relative state vectors.

The uncertainty in the ground's knowledge of the relative state (item 1) is presented in reference 2. Items 2 through 4 were determined by the following method. The covariance matrices representing Manned Space Flight Network (MSFN) tracking (item 1) of the OWS and CSM at NCC were randomly sampled and applied to the nominal trajectories.

The NCC and NSR maneuvers were then computed based on the dispersed vectors. These maneuvers were randomly dispersed and applied to the nominal trajectories. The error sources used for the maneuver application error model were:

3σ platform error = $\pm 0.5^\circ$ in the pitch axis

3σ attitude error = $\pm 0.5^\circ$ in the pitch and yaw axes

3σ ΔV application = ± 0.5 fps

State vectors, relative state vectors, and covariance matrices representing the dispersions were obtained based on 30 separate runs of this type.

The state vectors are in an earth-centered inertial coordinate system which is oriented at midnight prior to launch with the X-axis through 0° longitude, the Y-axis through the equator, and the Z-axis passing through the north pole. The relative state vectors are in a target-centered, rotating (position), rectilinear system with the following

conventions: R_x is the in-plane distance positive in the direction of motion; R_y is the radial distance positive away from the center of the earth; R_z forms an orthogonal system. The covariance matrices (item 2) were generated by taking the difference between the actual and nominal relative state vectors; that is,

actual relative state - nominal relative state.

The covariance matrices are presented in part (a) of tables I through V, the relative conditions in part (b), and the state vectors in part (c). These data were taken at either 10 minutes after the last catch-up maneuver preceding TPI (EPM and TPI_1 for biased equiperiod and out-of-plane profiles, respectively) or at the ground update time following the last catch-up maneuver prior to TPI. Also, the state vectors for each plan were propagated to the nominal time of TPI, and the relative state vectors were obtained at this point [part (d) of tables I through V].

Additional information was required for the biased equiperiod and out-of-plane rendezvous profiles. For these plans, the EPM and TPI_1 maneuvers were assumed to be ground-computed. Therefore, the trajectories after NSR were propagated to the time of the ground update following the last catch-up maneuver prior to EPM and TPI_1, and the covariance matrices representing the MSFN update were randomly sampled and applied to these trajectories. The EPM and TPI_1 maneuvers were computed based upon these dispersed vectors. These maneuvers were then applied to the trajectories propagated from NSR without the MSFN update. Based on the resulting trajectories, state vectors [tables II(e) and III(e)] and covariance matrices [tables II(f) and III(f)] of the relative state were obtained at 10 minutes after the EPM and TPI_1 maneuvers. Also, the relative state vectors were obtained at the nominal time of TPI for the biased equiperiod plan and at the time of TPI_2 for the out-of-plane plan [part (g) of tables II and III].

CONCLUDING REMARKS

Due to a limited error source capability and recent changes in the mission profile, the data presented in this report is of a preliminary nature. However, the data is representative of what can be expected using the type of terminal phase profiles presented. No attempt was made to make recommendations or conclusions regarding the candidate rendezvous profiles; rather, the data has been presented in order that others may do so.

TABLE I.- COELLIPTIC RENDEZVOUS

(a) Covariance matrix of relative state at NSR + 39 minutes[a]

7252731.125000	-1788961.296875	-318974.277344	1230.201965	-7748.915344	-79.640918
-1788961.296875	547986.609375	81273.804688	-344.772247	1954.040451	-1.452708
-318974.277344	81273.804688	130068.728516	-43.436318	359.321167	108.741603
1230.201965	-344.772247	-43.436318	0.383481	-1.303161	0.025744
-7748.915344	1954.040451	359.321167	-1.303161	8.324950	0.110607
-79.640918	-1.452708	108.741603	0.025744	0.110607	0.159571

[a]Units are feet and feet per second.

TABLE I.- COELLIPTIC RENDEZVOUS - Continued

(b) Relative state vector at NSR + 39 minutes

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-49.42	-10.38	-0.09	31.9	335.9	-0.3
1	-49.60	-10.34	-0.14	31.6	336.8	-0.8
2	-48.37	-10.62	-0.13	33.0	329.0	-0.8
3	-49.74	-10.29	-0.07	31.3	337.8	-0.7
4	-49.21	-10.45	-0.02	32.1	334.2	-0.7
5	-49.83	-10.15	-0.02	30.6	339.0	-0.2
6	-49.16	-10.36	-0.01	31.7	334.4	-0.1
7	-50.12	-10.25	-0.06	31.2	340.4	-0.6
8	-48.59	-10.60	-0.26	33.0	330.3	-1.4
9	-49.38	-10.41	-0.09	32.0	335.5	-0.6
10	-49.12	-10.52	0.03	32.6	333.8	0.5
11	-49.15	-10.50	-0.07	32.5	334.0	-0.0
12	-49.32	-10.28	-0.10	31.1	335.1	-0.8
13	-49.28	-10.43	-0.03	32.1	335.0	-0.4

TABLE I.- COELLIPTIC RENDEZVOUS - Continued

(b) Relative state vector at NSR + 39 minutes - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
14	-48.65	-10.52	-0.11	32.6	331.2	-0.1
15	-49.09	-10.52	-0.08	32.6	333.7	0.2
16	-49.49	-10.47	-0.07	32.4	336.1	-0.0
17	-49.09	-10.45	-0.01	32.2	333.9	0.1
18	-49.93	-10.29	-0.05	31.3	339.0	-0.3
19	-49.43	-10.37	-0.02	31.8	336.1	-0.3
20	-49.15	-10.44	-0.13	32.1	334.0	-1.1
21	-49.98	-10.25	-0.09	31.3	339.7	-0.6
22	-48.76	-10.59	-0.13	32.9	331.3	-0.5
23	-48.61	-10.50	-0.11	32.5	331.1	-0.6
24	-49.27	-10.36	-0.06	31.7	334.9	-0.3
25	-48.56	-10.58	0.01	32.9	330.4	0.0
26	-48.83	-10.60	-0.05	33.0	331.9	-0.4
27	-49.03	-10.48	-0.17	32.3	333.1	-0.8
28	-49.73	-10.28	-0.00	31.3	338.1	-0.0
29	-49.12	-10.44	-0.16	32.0	333.7	-0.5
30	-49.50	-10.31	-0.04	31.4	336.3	-0.3

TABLE I.- COELLIPTIC RENDEZVOUS - Continued

(c) State vector at NSR + 39 minutes

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
Nom. OWS	-18738544.	-7388522.4	10000346.9	11149.9	-21904.3	4715.1
Nom. CSM	-18817753.5	-7104187.2	9919549.6	10885.5	-22042.	4873.0
1	-18820193.	-7103846.	9916385.	10883.1	-22042.9	4870.0
2	-18815484.	-7109865.5	9916972.6	10890.2	-22041.6	4866.9
3	-18820968.	-7103331.	9915989.3	10882.2	-22042.9	4870.6
4	-18818848.	-7105934.3	9915926.6	10885.5	-22042.4	4869.1
5	-18822019.5	-7103216.	9916016.4	10881.	-22042.6	4871.4
6	-18819157.	-7106366.	9916148.1	10885.3	-22041.9	4869.6
7	-18822244.	-7101433.	9915615.5	10879.9	-22043.7	4871.8
8	-18815937.	-7108423.	9917483.	10888.9	-22042.2	4866.9
9	-18819364.	-7104963.6	9916157.3	10884.4	-22042.7	4869.7
10	-18818352.	-7106366.	9915551.	10886.4	-22042.3	4870.1
11	-18818336.	-7106052.	9916114.8	10886.1	-22042.4	4869.7
12	-18819859.5	-7105537.	9916649.9	10884.3	-22041.9	4869.3
13	-18819084.	-7105581.	9915924.4	10885.	-22042.6	4869.7
14	-18816757.	-7108591.	9916845.	10888.5	-22041.7	4868.4

TABLE I.- COELLIPTIC RENDEZVOUS - Continued

(c) State vector at NSR + 39 minutes - Concluded

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
15	-18818050.	-7106299.	9916189.9	10886.4	-22042.4	4869.8
16	-18819375.	-7104309.	9915816.9	10884.3	-22043.0	4870.6
17	-18818538.	-7106586.3	9916010.3	10886.1	-22042.2	4869.7
18	-18821571.8	-7102365.8	9915656.3	10881.3	-22043.2	4871.4
19	-18819817.8	-7104945.3	9915840.1	10884.	-22042.7	4870.2
20	-18818499.	-7106043.6	9916614.3	10885.5	-22042.5	4868.7
21	-18821817.8	-7102086.3	9915942.1	10880.6	-22043.4	4871.5
22	-18816684.	-7107813.2	9916587.6	10888.3	-22042.1	4868.1
23	-18816781.	-7108803.8	9916947.	10888.3	-22041.8	4867.9
24	-18819372.5	-7105715.5	9916262.0	10884.9	-22042.1	4869.7
25	-18816442.	-7109187.	9916133.1	10889.3	-22041.6	4868.2
26	-18817014.	-7107593.	9916083.5	10887.9	-22042.3	4868.5
27	-18817862.	-7106505.7	9916836.5	10886.5	-22042.3	4868.6
28	-18821171.	-7103545.4	9915674.	10882.1	-22042.8	4871.3
29	-18818462.	-7106265.2	9916486.4	10885.9	-22042.2	4869.0
30	-18820274.	-7104618.3	9916053.9	10883.6	-22042.3	4870.2

TABLE I.- COELLIPTIC RENDEZVOUS - Continued

(d) Relative state vector at TPI

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-18.83	-10.07	0.15	33.6	127.6	0.3
1	-18.99	-10.11	0.25	33.9	128.6	0.4
2	-17.23	-10.17	0.26	33.8	117.1	0.3
3	-19.27	-10.10	0.20	33.9	130.3	0.0
4	-18.29	-10.19	0.18	34.2	124.0	-0.3
5	-20.01	-9.94	0.12	33.1	134.8	-0.1
6	-18.71	-10.07	0.10	33.5	126.5	-0.1
7	-19.89	-9.98	0.18	33.3	134.7	-0.0
8	-17.45	-10.16	0.38	33.8	118.7	0.8
9	-18.68	-10.10	0.20	33.7	126.7	0.1
10	-18.18	-10.12	0.0	33.7	123.6	-0.1
11	-18.27	-10.11	0.11	33.7	124.2	0.3
12	-18.90	-10.15	0.22	34.0	127.3	0.1
13	-18.59	-10.08	0.14	33.6	126.2	-0.1
14	-17.93	-10.05	0.14	33.2	121.6	0.6

TABLE I.- COELLIPTIC RENDEZVOUS - Concluded

(d) Relative state vector at TPI - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
15	-18.23	-10.08	0.09	33.5	124.0	0.5
16	-18.62	-10.09	0.12	33.7	126.7	0.3
17	-18.46	-10.06	0.07	33.4	125.1	0.0
18	-19.48	-10.07	0.14	33.8	132.0	0.0
19	-18.96	-10.03	0.12	33.4	128.5	-0.1
20	-18.41	-10.11	0.29	33.7	124.8	0.2
21	-19.85	-9.95	0.19	33.1	134.4	0.2
22	-17.56	-10.19	0.20	34.0	119.5	0.4
23	-18.03	-10.02	0.21	33.0	122.2	0.3
24	-18.72	-10.11	0.14	33.8	126.6	0.1
25	-17.55	-10.13	0.07	33.6	119.3	-0.1
26	-17.68	-10.15	0.15	33.8	120.4	0.0
27	-18.11	-10.15	0.26	33.9	122.9	0.6
28	-19.51	-9.99	0.08	33.3	132.0	-0.1
29	-18.29	-10.16	0.19	34.0	123.9	0.3
30	-18.99	-10.12	0.14	33.9	128.3	-0.0

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS

(a) Covariance matrix of relative state at NSR + 10 minutes[a]

1256921.437500	-582500.085938	118058.887695	607.302834	-1317.178116	302.702698
-582500.085938	684385.429688	-45155.461914	-732.476105	1256.631912	-83.812525
118058.887695	-45155.461914	88238.864258	34.506816	-96.595393	83.576990
607.302834	-732.476105	34.506816	0.825745	-1.342648	0.079558
-1317.178116	1256.631912	-96.595393	-1.342648	2.402484	-0.224131
302.702698	-83.812525	83.576990	0.079558	-0.224131	0.151683

[a]Units are feet and feet per second.

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(b) Relative state vector at NSR + 10 minutes

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-78.94	-10.87	-0.07	28.3	535.8	0.2
1	-78.95	-10.83	-0.03	28.1	536.2	0.1
2	-78.91	-10.79	0.00	27.8	536.4	0.2
3	-78.70	-10.85	-0.03	28.2	535.4	1.0
4	-78.99	-10.74	-0.02	27.4	537.2	0.1
5	-78.84	-10.99	-0.09	29.4	534.4	0.2
6	-78.80	-10.94	-0.03	28.9	534.8	0.6
7	-78.78	-10.62	-0.16	26.7	537.4	0.0
8	-78.98	-10.83	-0.08	27.8	536.3	-0.3
9	-79.10	-10.79	-0.12	27.8	536.8	-0.8
10	-79.15	-10.77	-0.17	27.7	537.0	-0.6
11	-79.10	-10.65	-0.05	26.6	538.1	-0.0
12	-78.93	-10.77	-0.11	27.9	536.7	-0.1
13	-78.45	-11.07	-0.04	29.3	532.7	0.6
14	-78.70	-10.89	-0.06	28.2	535.1	0.6
15	-79.00	-10.61	-0.00	26.4	538.3	0.8
16	-78.83	-10.79	-0.04	27.6	536.2	0.0
17	-79.09	-10.65	-0.09	27.2	538.1	-0.1

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(b) Relative state vector at NSR + 10 minutes - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-78.73	-10.85	-0.05	28.0	535.5	0.6
19	-78.57	-11.07	0.05	29.7	533.2	0.9
20	-79.00	-10.72	-0.06	27.2	537.2	0.0
21	-79.20	-10.66	-0.08	26.9	538.3	-0.0
22	-78.88	-10.82	-0.03	28.0	536.2	0.2
23	-78.83	-11.08	-0.07	29.6	533.4	0.0
24	-78.66	-10.85	-0.07	28.2	535.4	0.2
25	-79.05	-10.69	-0.02	27.2	537.6	0.3
26	-79.14	-10.89	-0.04	28.3	535.6	-0.1
27	-78.68	-11.03	-0.06	29.1	533.8	0.2
28	-78.98	-11.01	-0.15	29.4	534.3	-0.4
29	-78.74	-10.92	-0.04	28.6	534.7	0.6
30	-78.69	-10.94	0.01	28.9	534.6	0.4

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(c) State vector at NSR + 10 minutes

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
Nom. OWS	-2 707 070.	21 012 891.5	-7 525 117.6	-23 467.3	103.2	8721.6
Nom. CSM	-2 249 407.	20 949 378.3	-7 669 735.	-23 558.3	604.2	8552.3
1	-2 249 428.7	20 949 520.5	-7 670 084.	-23 558.1	604.5	8552.0
2	-2 249 778.6	20 949 675.5	-7 670 224.6	-23 557.9	604.7	8552.0
3	-2 250 879.9	20 949 435.3	-7 669 499.	-23 557.9	604.1	8553.1
4	-2 249 288.2	20 950 048.5	-7 670 370.9	-23 557.6	605.5	8551.5
5	-2 249 834.2	20 948 738.3	-7 669 202.4	-23 559.1	602.8	8553.1
6	-2 250 192.8	20 948 904.3	-7 669 518.5	-23 558.6	603.4	8553.2
7	-2 250 288.5	20 951 042.5	-7 669 437.3	-23 557.1	605.6	8551.1
8	-2 249 166.7	20 949 610.5	-7 669 874.7	-23 558.0	604.5	8551.5
9	-2 248 441.3	20 949 958.3	-7 669 957.8	-23 558.3	604.7	8551.0
10	-2 248 075.3	20 950 165.8	-7 669 876.7	-23 558.1	605.1	8551.0
11	-2 248 666.3	20 950 593.	-7 670 625.	-23 557.	606.2	8550.8
12	-2 249 478.	20 950 065.	-7 669 722.	-23 558.1	605.0	8551.6
13	-2 252 082.8	20 948 187.8	-7 668 460.	-23 558.7	601.4	8554.1
14	-2 250 759.1	20 949 260.	-7 669 264.6	-23 557.9	603.7	8552.9
15	-2 249 384.4	20 950 729.	-7 670 765.5	-23 556.6	606.7	8551.2
16	-2 250 309.	20 949 789.	-7 669 790.5	-23 557.8	604.5	8551.8
17	-2 248 691.5	20 950 664.	-7 670 400.7	-23 557.7	606.2	8550.9

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(c) State vector at NSR + 10 minutes - Concluded

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
18	-2 250 660.	20 949 457.	-7 669 471.9	-23 557.8	604.0	8552.6
19	-2 251 617.9	20 948 035.	-7 669 170.	-23 559.0	602.0	8554.2
20	-2 249 180.	20 950 196.8	-7 670 218.	-23 557.5	605.4	8551.3
21	-2 248 063.3	20 950 623.	-7 670 685.7	-23 557.3	606.4	8550.8
22	-2 249 863.	20 949 616.	-7 669 922.	-23 557.9	604.5	8552.1
23	-2 249 858.	20 948 198.	-7 669 117.7	-23 559.3	601.8	8553.4
24	-2 250 982.	20 949 541.	-7 669 194.	-23 558.2	603.8	8552.4
25	-2 248 989.	20 950 292.	-7 670 629.	-23 557.4	605.9	8551.4
26	-2 248 275.6	20 949 213.	-7 670 293.	-23 558.4	603.9	8552.1
27	-2 250 802.	20 948 469.5	-7 668 932.6	-23 558.8	602.4	8553.3
28	-2 248 902.	20 948 754.	-7 669 092.	-23 559.3	602.6	8552.7
29	-2 250 549.	20 949 062.	-7 669 407.	-23 558.3	603.3	8553.1
30	-2 250 932.	20 948 842.	-7 669 502.	-23 558.7	603.1	8553.1

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(d) Relative state vector at EPM

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-24.77	-10.00	0.14	32.9	168.4	0.4
1	-25.07	-10.01	0.10	33.0	170.2	0.4
2	-25.29	-10.07	0.08	33.4	171.4	0.7
3	-25.35	-10.06	0.16	33.3	171.2	1.2
4	-25.44	-10.16	0.10	34.0	172.4	0.5
5	-24.75	-9.71	0.16	31.1	168.3	0.3
6	-24.89	-9.84	0.14	31.9	169.0	0.9
7	-26.32	-10.29	0.21	34.9	177.1	-0.05
8	-24.53	-10.15	0.12	33.7	166.9	-0.0
9	-25.09	-9.97	0.13	32.8	170.8	-0.6
10	-25.12	-9.98	0.18	32.9	171.1	-0.6
11	-25.27	-10.32	0.11	34.9	171.5	0.3
12	-25.92	-9.96	0.16	32.9	175.2	0.0
13	-23.74	-10.06	0.14	32.9	161.0	0.9
14	-24.53	-10.18	0.16	33.9	166.2	0.8
15	-25.74	-10.40	0.12	35.5	174.0	1.0
16	-25.18	-10.20	0.10	34.1	170.3	0.3
17	-26.44	-10.00	0.14	33.2	178.8	0.1

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(d) Relative state vector at EPM - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-24.85	-10.19	0.15	34.0	168.1	0.8
19	-24.48	-9.81	0.09	31.6	165.9	1.3
20	-25.27	-10.19	0.12	34.2	171.4	0.3
21	-25.60	-10.15	0.13	34.0	173.9	0.2
22	-25.21	-10.07	0.11	33.3	170.8	0.6
23	-23.59	-9.76	0.13	31.2	161.4	0.3
24	-25.50	-10.06	0.15	33.3	172.0	0.4
25	-25.65	-10.14	0.10	33.9	173.8	0.6
26	-24.00	-9.91	0.09	32.2	164.6	0.2
27	-23.98	-10.00	0.13	32.6	163.0	0.5
28	-24.13	-9.68	0.18	30.9	165.1	-0.4
29	-24.72	-9.98	0.14	32.7	167.7	0.8
30	-25.12	-9.87	0.09	32.1	170.0	0.9

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(e) State vector at EPM + 10 minutes

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
Nom. CSM	20 139 593	-9 116 748	-3 869 400	7 419.2	21 112.5	-11 331.7
Nom. OWS	20 204 609.	-9 071 675.	-3 910 967.3	7 290.4	21 118.9	-11 286.2
1	20 138 880	-9 117 536	-3 868 579	7 420.4	21 112.6	-11 332.4
2	20 138 105	-9 118 228	-3 868 071	7 421.1	21 112.4	-11 332.9
3	20 137 363	-9 118 126	-3 868 577	7 420.3	21 113.4	-11 333.1
4	20 137 717	-9 118 323	-3 867 866	7 402.0	21 112.5	-11 333.0
5	20 140 379	-9 119 412	-3 868 638	7 420.2	21 110.1	-11 331.0
6	20 139 517	-9 118 668	-3 868 843	7 419.9	21 111.2	-11 331.9
7	20 133 572	-9 118 374	-3 866 560	7 422.0	21 117.5	-11 334.0
8	20 139 867	-9 114 446	-3 870 016	7 417.7	21 113.6	-11 331.3
9	20 139 463	-9 118 718	-3 867 844	7 421.9	21 111.1	-11 331.3
10	20 139 314	-9 118 925	-3 867 983	7 422.2	21 111.1	-11 331.2
11	20 137 802	-9 116 222	-3 868 700	7 420.9	21 113.8	-11 332.9
12	20 136 967	-9 121 977	-3 866 147	7 424.8	21 110.9	-11 332.8
13	20 140 938	-9 111 050	-3 872 497	7 412.2	21 115.7	-11 330.7
14	20 139 030	-9 113 486	-3 870 871	7 416.1	21 115.4	-11 332.0
15	20 136 083	-9 117 327	-3 868 094	7 422.1	21 114.2	-11 334.2
16	20 137 822	-9 116 079	-3 868 737	7 419.6	21 114.4	-11 332.8
17	20 135 894	-9 124 286	-3 864 707	7 427.7	21 109.8	-11 333.5

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(e) State vector at EPM + 10 minutes - Concluded

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
18	20 138 307	-9 114 973	-3 869 907	7 417.7	21 114.6	-11 332.4
19	20 140 057	-9 116 217	-3 870 082	7 411.7	21 113.0	-11 332.1
20	20 137 993	-9 117 211	-3 868 431	7 421.0	21 113.1	-11 332.6
21	20 137 750	-9 119 477	-3 867 400	7 423.8	21 111.6	-11 332.9
22	20 138 299	-9 117 765	-3 868 434	7 420.7	21 112.8	-11 332.7
23	20 143 076	-9 113 882	-3 871 680	7 414.6	21 111.9	-11 329.7
24	20 137 111	-9 118 388	-3 867 804	7 421.1	21 113.8	-11 332.9
25	20 137 313	-9 119 479	-3 867 361	7 423.1	21 111.9	-11 333.3
26	20 142 316	-9 114 918	-3 870 759	7 417.2	21 111.3	-11 330.5
27	20 140 958	-9 112 275	-3 871 698	7 414.1	21 115.3	-11 331.0
28	20 142 309	-9 117 256	-3 869 899	7 418.2	21 110.2	-11 329.5
29	20 139 339	-9 116 244	-3 869 767	7 418.1	21 113.3	-11 332.0
30	20 138 637	-9 118 293	-3 868 388	7 419.9	21 112.8	-11 332.8

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(f) Covariance matrix of the relative state at EPM + 10 minutes[a]

11220527.625000	1774829.421875	147496.923828	558.264023	-10626.952881	326.458912
1774829.421875	2491261.750000	-120118.421875	174.500027	-680.607513	-92.367196
147496.923828	-120118.421875	59870.177734	126.856232	-309.189209	69.093513
588.264023	174.500027	126.856232	2.733714	-0.757837	0.097646
-10626.952881	-680.607513	-309.189209	-0.757837	11.440814	-0.487949
326.458912	-92.367196	69.093513	0.097646	-0.487949	0.183986

[a]Units are feet and feet per second.

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Continued

(g) Relative state vector at TPI

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-23.96	-9.98	0.15	66.6	166.4	0.4
1	-25.07	-10.01	0.10	67.0	173.1	0.4
2	-24.26	-10.06	0.09	67.0	167.4	0.7
3	-24.60	-10.06	0.17	67.1	168.4	1.1
4	-24.50	-10.14	0.10	67.6	169.2	0.5
5	-23.61	-9.68	0.16	64.5	164.5	0.3
6	-23.85	-9.82	0.14	65.5	165.5	0.8
7	-26.24	-10.33	0.21	69.1	174.9	-0.1
8	-22.86	-10.13	0.12	67.4	159.5	0.1
9	-24.14	-9.95	0.12	66.3	168.2	-0.6
10	-24.18	-9.95	0.17	66.4	168.5	-0.6
11	-24.34	-10.30	0.12	68.7	168.4	0.2
12	-24.90	-9.96	0.16	66.3	171.1	-0.0
13	-21.63	-10.03	0.15	66.7	150.4	0.8
14	-23.42	-10.17	0.17	67.8	161.7	0.8
15	-24.79	-10.40	0.12	69.3	170.0	1.0
16	-24.53	-10.20	0.11	68.1	168.6	0.3
17	-25.29	-9.99	0.14	66.4	173.6	0.0

TABLE II.- BIASED EQUIPERIOD RENDEZVOUS - Concluded

(g) Relative state vector at TPI - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-23.34	-10.17	0.15	67.7	160.9	0.7
19	-24.33	-9.81	0.10	65.6	167.8	1.3
20	-24.23	-10.18	0.13	67.9	167.5	0.3
21	-25.15	-10.14	0.14	67.7	174.2	0.1
22	-24.83	-10.06	0.12	67.2	171.2	0.5
23	-22.43	-9.72	0.13	64.8	158.2	0.2
24	-25.17	-10.07	0.15	67.3	171.7	0.3
25	-24.78	-10.13	0.11	67.5	170.9	0.6
26	-23.26	-9.87	0.10	65.9	164.4	0.2
27	-24.17	-9.99	0.14	67.0	167.3	0.4
28	-22.94	-9.64	0.17	64.2	161.7	-0.4
29	-24.18	-9.97	0.15	66.6	167.1	0.8
30	-25.81	-9.88	0.09	66.3	176.8	0.8

TABLE III.- OUT-OF-PLANE RENDEZVOUS

(a) Covariance matrix of relative state at NSR + 10 minutes[a]

1192252.109375	106909.163086	36634.145996	-51.174435	272.226982	-0.870913
106909.163086	341203.453125	37899.329102	-49.424119	113.878820	-0.749388
36634.145996	37899.329102	16671.419434	-21.927996	89.307646	-0.324067
-51.174435	-49.424119	-21.927996	0.187289	-0.474511	0.000400
272.226982	113.878820	89.307646	-0.474511	1.619122	-0.001867
-0.870913	-0.749388	-0.324067	0.000400	-0.001867	0.000007

[a]Units are feet and feet per second.

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(b) Relative state vector at NSR + 10 minutes

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-76.05	-10.94	-5.16	29.2	516.5	19.4
1	-76.12	-10.8	-5.16	28.9	517.1	19.4
2	-75.79	-11.11	-5.10	29.9	514.4	19.4
3	-76.22	-10.80	-5.16	28.5	518.2	19.4
4	-76.18	-10.91	-5.16	29.0	517.0	19.4
5	-76.07	-10.88	-5.16	29.1	517.1	19.4
6	-76.02	-11.0	-5.26	29.6	516.7	18.7
7	-75.95	-10.96	-5.16	29.4	516.1	19.4
8	-75.91	-11.02	-5.16	29.2	515.7	19.4
9	-76.12	-10.90	-5.16	29.1	516.5	19.4
10	-76.30	-10.78	-5.16	28.4	518.1	19.4
11	-76.06	-10.94	-5.16	29.0	516.3	19.4
12	-76.14	-10.87	-5.16	29.2	516.8	19.4
13	-76.30	-10.75	-5.16	28.4	518.7	19.4
14	-76.23	-10.80	-5.16	28.4	518.2	19.4
15	-76.06	-10.92	-5.16	28.9	516.9	19.4
16	-75.94	-11.01	-5.16	29.4	515.5	19.4
17	-75.84	-11.03	-5.16	29.7	515.0	19.4

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(b) Relative state vector at NSR + 10 minutes - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-76.2	-10.81	-5.16	28.7	517.6	19.4
19	-76.29	-10.77	-5.16	28.4	518.5	19.4
20	-75.8	-11.05	-5.16	29.7	514.5	19.4
21	-76.06	-10.87	-5.16	29.0	517.0	19.4
22	-76.26	-10.80	-5.16	28.4	518.1	19.4
23	-76.10	-10.88	-5.16	29.1	516.9	19.4
24	-76.12	-10.86	-5.16	29.0	517.1	19.4
25	-76.27	-10.88	-5.16	28.9	517.4	19.4
26	-76.06	-10.91	-5.16	28.7	516.9	19.4
27	-76.29	-10.84	-5.16	28.6	517.8	19.4
28	-76.44	-10.81	-5.16	28.8	518.9	19.4
29	-76.14	-10.88	-5.16	28.9	517.1	19.4
30	-75.90	-11.0	-5.16	29.7	515.7	19.4

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(c) State vector at NSR + 10 minutes

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
Nom. OWS	-2 939 708.7	21 012 608.0	-7 438 116.63	-23 432.6	-155.1	8813.9
Nom. CSM	-2 488 090.3	20 964 570.0	-7 551 458.5	-23 533.8	320.7	8636.2
1	-2 488 955.7	20 964 066.0	-7 551 470.5	-23 532.0	323.1	8636.1
2	-2 489 429.19	20 963 592.8	-7 550 564.38	-23 534.2	318.8	8637.1
3	-2 487 237.16	20 965 358.8	-7 552 099.3	-23 533.4	322.3	8635.4
4	-2 487 358.2	20 964 706.8	-7 551 790.3	-23 533.7	321.2	8635.9
5	-2 488 042.5	20 964 885.5	-7 551 605.13	-23 533.9	321.3	8635.9
6	-2 488 012.3	20 964 449.3	-7 550 718.8	-23 531.0	321.1	8636.9
7	-2 488 638.19	20 964 400.8	-7 551 187.06	-23 534.0	320.3	8636.4
8	-2 488 799.6	20 964 076.3	-7 550 992.2	-23 533.7	320.0	8636.4
9	-2 487 698.9	20 964 788.5	-7 551 696.8	-23 533.8	320.7	8636.1
10	-2 486 764.7	20 965 462.5	-7 552 319.0	-23 533.3	322.2	8635.4
11	-2 488 025.3	20 964 573.8	-7 551 485.2	-23 533.7	320.6	8636.1
12	-2 487 635.3	20 964 953.3	-7 551 789.4	-23 533.9	320.9	8636.1
13	-2 486 810.8	20 965 656.3	-7 552 380.1	-23 533.3	322.8	8635.2
14	-2 487 193.0	20 965 366.3	-7 552 118.6	-23 533.4	322.3	8635.4
15	-2 488 068.6	20 964 640.0	-7 551 494.2	-23 533.6	321.1	8635.9
16	-2 488 631.6	20 964 118.0	-7 551 074.9	-23 533.9	319.8	8636.6
17	-2 489 206.9	20 964 052.0	-7 550 834.6	-23 534.1	319.3	8636.9

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(c) State vector at NSR + 10 minutes - Concluded

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
18	-2 487 341.5	20 965 303.0	-7 552 038.1	-23 533.5	321.8	8635.6
19	-2 486 837.9	20 965 519.3	-7 552 312.7	-23 533.3	322.6	8635.2
20	-2 489 424.3	20 963 898.5	-7 550 691.5	-23 534.0	318.8	8637.0
21	-2 488 065.2	20 964 970.8	-7 551 634.1	-23 533.7	321.1	8635.9
22	-2 487 015.8	20 965 334.3	-7 552 173.6	-23 533.3	322.2	8635.4
23	-2 487 882.1	20 964 898.0	-7 551 672.8	-23 533.8	321.1	8636.0
24	-2 487 732.0	20 965 019.5	-7 551 778.1	-23 533.7	321.3	8635.9
25	-2 486 908.1	20 964 873.8	-7 552 024.9	-23 533.6	321.5	8635.8
26	-2 488 050.9	20 964 711.8	-7 551 529.9	-23 533.5	321.1	8635.9
27	-2 486 830.1	20 965 126.5	-7 552 156.6	-23 533.5	322.0	8635.5
28	-2 485 966.3	20 965 305.3	-7 552 548.0	-23 533.8	323.0	8635.2
29	-2 487 628.8	20 964 876.2	-7 551 758.8	-23 533.7	321.2	8635.9
30	-2 488 882.5	20 964 210.8	-7 551 017.7	-23 534.2	319.9	8636.6

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(d) Relative state vector at TPI_1

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-19.91	-10.08	2.82	33.5	135.1	-35.1
1	-19.49	-10.08	2.82	33.5	132.3	-35.1
2	-18.68	-10.17	2.82	33.7	127.0	-35.1
3	-20.97	-10.06	2.82	33.6	141.9	-35.1
4	-19.83	-10.07	2.82	33.4	135.0	-35.1
5	-20.87	-9.98	2.82	33.1	141.0	-35.1
6	-20.13	-10.07	2.97	33.4	136.1	-34.9
7	-20.00	-10.07	2.82	33.4	135.4	-35.1
8	-18.78	-10.33	2.82	34.7	127.7	-35.1
9	-19.87	-9.80	2.82	32.8	134.1	-35.1
10	-20.63	-10.03	2.82	33.4	140.3	-35.1
11	-19.53	-10.13	2.82	33.7	132.9	-35.1
12	-20.61	-9.77	2.82	32.2	137.9	-35.1
13	-21.33	-10.00	2.82	33.3	144.4	-35.1
14	-20.76	-10.10	2.82	33.8	140.7	-35.1
15	-19.67	-10.25	2.82	34.4	133.5	-35.1
16	-18.99	-10.20	2.83	33.9	129.3	-35.1
17	-19.70	-10.07	2.91	33.3	133.6	-34.7

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(d) Relative state vector at TPI_1 - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-21.13	-9.97	2.91	33.1	143.3	-34.7
19	-20.99	-10.04	2.82	33.5	142.3	-35.0
20	-18.91	-10.14	2.82	33.6	128.5	-35.1
21	-20.59	-10.03	2.82	33.3	139.4	-35.1
22	-20.56	-10.09	2.82	33.7	139.6	-35.1
23	-20.59	-9.97	2.82	33.0	139.5	-35.1
24	-20.74	-9.95	2.82	32.9	140.5	-35.1
25	-19.95	-10.02	2.82	33.2	136.0	-35.1
26	-19.60	-10.27	2.82	34.5	133.1	-35.1
27	-20.20	-10.07	2.82	33.5	137.5	-35.1
28	-21.18	-9.87	2.82	32.5	143.8	-35.1
29	-20.22	-10.04	2.82	33.3	137.3	-35.1
30	-19.96	-10.03	2.82	33.1	135.1	-35.1

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(e) State vector at TPI_1 + 10 minutes

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
Nom. CSM	20 752 292.	-6 942 865.7	-4 971 379.3	4857.8	22 130.5	-10 736.2
Nom. OWS	20 806 102.8	-6 912 657.8	-5 010 727.5	4752.9	22 108.0	-10 732.6
1	20 747 502.3	-6 952 387.3	-4 970 987.3	4863.4	22 127.9	-10 736.4
2	20 753 545.75	-6 936 735.50	-4 974 325.25	4851.0	22 131.9	-10 734.2
3	20 751 445.00	-6 949 415.57	-4 968 421.13	4865.7	22 127.2	-10 737.8
4	20 750 736.25	-6 942 910.76	-4 970 781.81	4857.0	22 131.5	-10 736.3
5	20 751 412.00	-6 949 219.19	-4 968 484.25	4864.4	22 127.4	-10 737.4
6	20 749 025.00	-6 944 144.00	-4 970 536.88	4857.6	22 132.9	-10 736.5
7	20 752 054.00	-6 944 272.25	-4 970 721.13	4859.4	22 129.3	-10 736.3
8	20 752 414.25	-6 935 704.63	-4 974 320.19	4850.5	22 133.4	-10 734.5
9	20 755 962.25	-6 948 397.56	-4 970 523.31	4864.8	22 122.7	-10 735.6
10	20 750 864.75	-6 947 490.25	-4 968 977.75	4862.7	22 129.0	-10 737.4
11	20 750 393.75	-6 940 404.75	-4 971 662.63	4853.9	22 133.5	-10.735.9
12	20 753 967.00	-6 950 949.25	-4 968 743.75	4866.6	22 124.0	-10 736.8
13	20 750 119.50	-6 951 355.13	-4 967 139.00	4867.1	22 127.5	-10 738.5
14	20 748 089.75	-6 946 800.56	-4 968 220.38	4860.8	22 132.3	-10 738.0
15	20 748 942.25	-6 940 019.75	-4 971 276.00	4853.6	22 135.0	-10 736.4
16	20 754 070.25	-6 938 732.31	-4 973 715.00	4853.9	22 129.9	-10 734.5
17	20 753 661.50	-6 941 456.88	-4 972 465.06	4856.2	22 129.4	-10 735.1

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(e) State vector at TPI_1 + 10 minutes - Concluded

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
18	20 752 603.00	-6 949 888.44	-4 968 663.44	4866.0	22 125.9	-10 737.4
19	20 748 413.25	-6 948 539.81	-4 967 638.69	4862.9	22 131.1	-10 738.3
20	20 751 340.75	-6 937 314.69	-4 973 268.44	4850.3	22 134.0	-10 734.8
21	20 751 899.25	-6 947 585.38	-4 969 329.00	4863.1	22 127.8	-10 737.1
22	20 750 376.75	-6 946 652.06	-4 969 132.88	4862.0	22 129.7	-10 737.4
23	20 750 734.25	-6 947 653.38	-4 968 864.25	4862.2	22 129.0	-10 737.2
24	20 748 439.75	-6 947 632.38	-4 968 013.88	4860.9	22 132.0	-10 737.9
25	20 751 746.50	-6 944 317.19	-4 970 591.75	4859.0	22 129.7	-10 736.3
26	20 750 300.50	-6 939 599.81	-4 971 954.69	4853.9	22 133.8	-10 736.0
27	20 752 463.00	-6 945 817.63	-4 970 253.94	4861.4	22 127.8	-10 736.4
28	20 750 687.00	-6 951 590.75	-4 967 261.13	4866.5	22 127.1	-10 738.1
29	20 749 254.50	-6 944 550.69	-4 969 565.19	4858.1	22 132.6	-10 737.1
30	20 751 537.25	-6 943 895.00	-4 970 684.88	4858.1	22 130.3	-10 736.2

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(f) Covariance matrix of relative state at TPI_1 + 10 minutes[a]

23094626.500000	-2416444.562500	-123665.003906	1310.288696	-25003.203857	139.313623
-2416444.562500	3861132.843750	29985.788330	-3853.251038	5942.609497	10.354392
-123665.003906	29985.788330	19863.802246	-26.056612	152.774391	-0.574973
1310.288696	-3853.251038	-26.056612	3.917704	-4.841895	-0.016883
-25003.203857	5942.609497	152.774391	-4.841895	30.377167	-0.131304
139.313623	10.354392	-0.574973	-0.016883	-0.131304	0.006238

[a]Units are feet and feet per second.

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Continued

(g) Relative state vector at TPI_2

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	0.08	-.15	-5.90	-12.3	32.3	0.1
1	0.03	-.86	-5.9	-7.9	33.4	0.1
2	1.16	-0.34	-5.90	-12.1	23.1	0.1
3	-1.45	-0.06	-5.90	-13.0	41.9	0.1
4	0.95	-0.68	-5.90	-9.7	25.9	0.1
5	-1.12	-0.28	-5.90	-11.8	39.1	0.1
6	1.49	-0.93	-5.95	-8.0	23.4	-0.8
7	-0.21	-0.28	-5.90	-12.0	32.9	0.1
8	1.74	-0.42	-5.90	-11.7	20.3	0.1
9	-3.13	0.45	-5.90	-16.7	48.7	0.1
10	-0.47	-0.36	-5.90	-11.3	35.6	0.1
11	1.85	-0.83	-5.90	-8.8	20.6	0.1
12	-2.72	0.17	-5.90	-14.4	47.8	0.1
13	-1.21	-0.33	-5.90	-11.3	40.8	0.1
14	1.20	-0.99	-5.90	-7.5	26.2	0.1
15	2.52	-1.03	-5.90	-7.6	17.2	0.1
16	0.21	-0.11	-5.90	-13.6	28.8	0.1
17	-0.12	-0.13	-5.90	-13.0	31.6	0.1

TABLE III.- OUT-OF-PLANE RENDEZVOUS - Concluded

(g) Relative state vector TPI_2 - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-2.02	0.09	-5.90	-13.9	44.8	0.1
19	0.56	-0.82	-5.90	-8.3	30.4	0.1
20	2.28	-0.85	-5.90	-8.9	16.8	0.1
21	-1.02	-0.17	-5.90	-12.5	38.5	0.1
22	-0.10	-0.44	-5.90	-10.9	33.5	0.1
23	-0.28	-0.53	-5.90	-10.3	33.8	0.1
24	1.06	-0.98	-5.90	-7.1	27.1	0.1
25	0.03	-0.41	-5.90	-11.3	31.4	0.1
26	1.84	-0.69	-5.90	-9.6	21.2	0.1
27	-0.86	-0.17	-5.90	-12.8	36.6	0.1
28	-1.29	-0.38	-5.90	-10.9	40.7	0.1
29	1.34	-0.89	-5.90	-8.0	24.7	0.1
30	0.35	-0.51	-5.90	-10.6	29.4	0.1

TABLE IV.- STABLE ORBIT RENDEZVOUS

(a) Covariance matrix of relative state at NSR + 10 minutes[a]

928550.507813	-336430.140625	53525.136719	57.220660	-973.964607	300.936237
-336430.140625	152171.835938	-17866.891357	-35.655522	387.278843	-123.297766
53525.136719	-17866.891357	210304.818359	-1.227622	-51.068340	116.868205
57.220660	-35.655522	-1.227622	0.112408	-0.069501	0.012209
-973.964607	387.278843	-51.068340	-0.069501	1.072923	-0.329329
300.935237	-123.297766	116.868205	0.012209	-0.329329	0.227564

[a]Units are feet and feet per second.

TABLE IV.- STABLE ORBIT RENDEZVOUS - Continued

(b) Relative state vector at NSR + 10 minutes

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-20.98	0.21	0.04	-2.2	144.0	-0.1
1	-21.03	0.29	0.07	-2.4	144.7	-0.4
2	-21.19	0.30	-0.05	-2.7	145.3	-0.5
3	-20.97	0.22	0.06	-2.4	144.0	-0.6
4	-20.72	0.13	0.12	-1.4	142.6	0.3
5	-20.88	0.18	0.01	-1.9	143.7	-0.0
6	-20.90	0.20	0.08	-2.0	143.6	-0.0
7	-20.77	0.15	-0.08	-1.7	142.8	-0.2
8	-20.83	0.15	-0.05	-2.1	142.7	-0.6
9	-20.90	0.16	0.03	-2.3	143.1	0.1
10	-20.81	0.20	0.10	-2.0	143.1	-0.1
11	-20.96	0.14	0.20	-2.2	143.4	0.7
12	-20.91	0.23	-0.02	-2.1	143.9	-0.2
13	-21.10	0.20	0.05	-0.3	144.4	-0.6
14	-20.61	0.06	0.11	-1.4	141.5	1.0
15	-21.40	0.36	0.04	-2.9	146.7	-1.3
16	-21.19	0.28	-0.01	-2.6	145.2	-0.5
17	-20.96	0.22	-0.00	-2.2	144.0	0.1

TABLE IV.- STABLE ORBIT RENDEZVOUS - Continued

(b) Relative state vector at NSR + 10 minutes - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-20.96	0.21	0.04	-2.2	143.9	-0.9
19	-21.06	0.21	0.03	-2.4	144.3	0.0
20	-21.08	0.28	-0.03	-2.5	144.7	-1.0
21	-21.14	0.28	0.15	-2.5	145.1	-0.1
22	-20.94	0.16	-0.04	-2.2	143.3	-0.3
23	-20.82	0.14	-0.03	-1.8	143.0	-0.3
24	-21.10	0.23	-0.14	-2.4	144.7	-1.0
25	-20.97	0.21	-0.09	-2.2	143.9	-0.3
26	-20.97	0.20	0.04	-2.3	143.6	0.2
27	-20.82	0.17	0.01	-2.0	142.9	-0.1
28	-21.16	0.33	0.04	-2.6	145.6	-0.5
29	-20.95	0.24	0.08	-2.2	144.0	-0.0
30	-20.93	0.22	0.14	-2.2	143.9	0.1

TABLE IV.- STABLE ORBIT RENDEZVOUS - Continued

(c) State vector at NSR + 10 minutes

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
Nom. OWS	-4 340 077.	20 956 333.	-6 892 263.7	-23 161.4	-1718.4	9349.1
Nom. CSM	-4 222 503.	20 966 175.	-6 940 488.3	-23 187.2	-1584.2	9304.0
1	-4 222 321.	20 966 597.	-6 940 906.	-23 187.	-1583.5	9303.5
2	-4 221 217.	20 966 979.	-6 940 645.	-23 187.	-1582.9	9303.2
3	-4 222 572.	20 966 215.	-6 940 590.	-23 187.2	-1584.3	9303.6
4	-4 223 993.	20 965 468.	-6 940 158.	-23 187.5	-1585.3	9305.2
5	-4 222 928.	20 966 084.	-6 940 028.	-23 187.4	-1584.4	9304.4
6	-4 223 001.	20 965 996.	-6 940 486.	-23 187.2	-1584.5	9304.3
7	-4 223 328.	20 966 012.	-6 939 226.	-23 187.5	-1585.3	9304.5
8	-4 223 095.	20 965 978.	-6 939 538.	-23 187.2	-1585.5	9304.1
9	-4 222 867.	20 965 898.	-6 940 171.	-23 187.	-1585.0	9304.5
10	-4 223 523.	20 965 929.	-6 940 416	-23 187.2	-1584.9	9304.4
11	-4 222 851.	20 965 466.	-6 941 151.	-23 187.	-1584.4	9305.0
12	-4 222 756.	20 966 392.	-6 940 049.	-23 187.	-1584.2	9304.1
13	-4 221 824.	20 966 151.	-6 940 784.	-23 187.4	-1583.9	9303.5
14	-4 224 541.	20 965 013.	-6 939 736.	-23 187.1	-1586.1	9306.1
15	-4 220 306.	20 967 237.	-6 941 728.	-23 187.5	-1581.9	9301.9
16	-4 221 255.	20 966 784.	-6 940 810.	-23 187.2	-1583.1	9303.2
17	-4 222 525.	20 966 330.	-6 940 215.	-23 187.1	-1584.0	9304.3

TABLE IV.- STABLE ORBIT RENDEZVOUS - Continued

(c) State vector at NSR + 10 minutes - Concluded

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
18	-4 222 595.	20 966 195.	-6 940 447.	-23 187.4	-1584.5	9303.4
19	-4 221 990.	20 966 268.	-6 940 618.	-23 187.1	-1583.7	9304.0
20	-4 221 862.	20 966 793.	-6 940 491.	-23 187.3	-1583.7	9302.9
21	-4 221 882.	20 966 426.	-6 941 539.	-23 187.1	-1583.1	9303.7
22	-4 222 488.	20 966 053.	-6 939 876.	-23 187.0	-1584.8	9304.1
23	-4 223 166.	20 965 880.	-6 939 579.	-23 187.5	-1585.2	9304.4
24	-4 221 481.	20 966 780.	-6 939 814.	-23 187.4	-1583.8	9303.0
25	-4 222 317.	20 966 488.	-6 939 780.	-23 187.2	-1584.3	9303.9
26	-4 222 548.	20 966 110.	-6 940 428.	-23 187.	-1584.3	9304.3
27	-4 223 269.	20 965 977.	-6 939 886.	-23 187.2	-1585.1	9304.5
28	-4 221 584.	20 966 947.	-6 941 115.	-23 187.3	-1582.8	9303.1
29	-4 222 731.	20 966 286.	-6 940 658.	-23 187.1	-1584.1	9304.1
30	-4 222 949.	20 965 986.	-6 940 933.	-23 187.2	-1584.1	9304.3

TABLE IV.- STABLE ORBIT RENDEZVOUS - Continued

(d) Relative state vector at TPI

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-22.45	-0.07	-0.03	-0.4	149.2	-0.4
1	-23.01	0.05	-0.04	-1.0	152.7	-0.7
2	-22.79	-0.11	0.07	-0.1	151.2	-0.3
3	-22.41	-0.12	-0.01	-0.1	148.7	-0.8
4	-22.44	0.15	-0.14	-1.7	149.4	-0.3
5	-22.64	0.07	-0.01	-1.2	150.4	0.2
6	-22.47	-0.01	-0.08	-0.7	149.3	-0.4
7	-22.30	0.03	0.08	-1.0	148.3	+0.1
8	-21.85	-0.20	0.08	0.2	145.2	-0.4
9	-21.82	-0.27	-0.05	0.6	144.8	-0.1
10	-22.48	0.02	-0.09	-0.9	149.3	-0.6
11	-21.77	-0.27	-0.23	0.6	144.7	-0.3
12	-22.75	0.06	0.02	-1.1	151.0	-0.1
13	-22.26	-0.16	0.00	0.1	148.0	-0.8
14	-21.70	-0.08	-0.19	-0.5	144.3	+0.3
15	-23.29	0.00	0.06	-0.5	154.8	-1.3
16	-22.67	-0.10	0.05	-0.1	150.6	-0.5
17	-22.56	-0.03	-0.01	-0.6	149.8	-0.0

TABLE IV.- STABLE ORBIT RENDEZVOUS - Concluded

(d) Relative state vector at TPI - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-22.45	-0.06	0.03	-0.4	149.1	-1.0
19	-22.29	-0.17	-0.03	0.2	148.0	-0.2
20	-22.80	-0.03	0.09	-0.5	151.3	-0.8
21	-22.83	-0.04	-0.13	-0.5	151.6	-0.7
22	-21.81	-0.27	0.04	0.6	144.9	-0.2
23	-22.19	-0.03	0.04	-0.7	147.5	-0.2
24	-22.48	-0.13	0.19	-0.0	149.2	-0.3
25	-22.42	-0.08	0.09	-0.3	148.9	-0.0
26	-22.12	-0.18	-0.06	0.2	146.9	-0.1
27	-22.18	-0.08	-0.01	-0.4	147.3	-0.2
28	-23.30	0.09	-0.00	-1.1	154.6	-0.7
29	-22.66	-0.00	-0.07	-0.7	150.5	-0.4
30	-22.57	-0.02	-0.14	-0.7	149.8	-0.6

TABLE V.- ELLIPTIC RENDEZVOUS

(a) Covariance matrix of relative state at NSR + 64 minutes[a]

4346032.500000	-137761.953125	161698.785156	436.889072	-5167.928833	36.010683
-137761.953125	54022.048340	-49500.550293	-27.490458	173.086016	8.208896
161698.785156	-49500.550293	264047.468750	66.779673	-243.664068	-101.933195
436.889072	-27.490458	66.779673	0.077263	-0.541375	-0.020027
-5167.928833	173.086016	-243.664068	-0.541375	6.174503	-0.022232
36.010683	8.208896	-101.933195	-0.020027	-0.022232	0.077420

[a]Units are feet and feet per second.

TABLE V.- ELLIPTIC RENDEZVOUS - Continued

(b) Relative state vector at NSR + 64 minutes

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-74.98	-50.01	0.83	191.3	717.1	-6.4
1	-75.57	-49.99	0.85	191.1	721.4	-6.7
2	-74.83	-50.01	0.84	191.3	715.9	-6.8
3	-74.78	-50.02	0.73	191.4	715.6	-6.1
4	-75.34	-49.93	0.81	190.7	719.9	-6.5
5	-75.00	-50.01	0.73	191.3	717.4	-6.3
6	-74.96	-49.98	0.70	191.1	717.4	-6.3
7	-75.51	-49.92	0.65	190.6	721.2	-5.9
8	-74.78	-49.99	0.77	191.2	715.6	-6.4
9	-75.09	-49.99	0.98	191.2	717.9	-6.6
10	-74.68	-50.04	0.77	191.5	715.0	-6.5
11	-75.21	-49.98	0.63	191.1	718.8	-6.3
12	-75.15	-49.98	0.81	191.1	718.3	-6.4
13	-75.32	-49.97	0.68	191.0	719.6	-6.2
14	-75.02	-49.99	0.83	191.2	717.5	-6.6
15	-75.69	-49.98	0.89	191.1	722.0	-6.6
16	-74.33	-50.07	0.79	191.8	712.5	-6.0
17	-74.81	-50.09	0.92	191.9	715.6	-6.8

TABLE V.- ELLIPTIC RENDEZVOUS - Continued

(b) Relative state vector at NSR + 64 minutes - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-75.04	-50.02	0.69	191.3	717.6	-6.3
19	-74.54	-50.05	0.83	191.6	714.0	-6.7
20	-74.53	-50.06	0.97	191.7	713.5	-6.8
21	-75.18	-50.02	0.86	191.4	718.4	-6.7
22	-75.11	-49.98	0.70	191.1	718.0	-5.8
23	-75.39	-49.96	0.74	190.9	720.3	-6.2
24	-74.64	-50.00	0.76	191.2	714.8	-6.5
25	-74.85	-50.03	0.82	191.5	716.2	-6.2
26	-75.19	-50.01	0.87	191.3	718.3	-6.5
27	-74.58	-50.02	0.78	191.4	714.3	-5.9
28	-74.80	-50.04	0.82	191.5	715.6	-6.4
29	-74.68	-50.03	0.85	191.5	715.0	-6.5
30	-74.40	-50.05	0.78	191.6	713.2	-6.0

TABLE V.- ELLIPTIC RENDEZVOUS - Continued

(c) State vector at NSR + 64 minutes

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
Nom. OWS	-17 367 812.5	-14 196 569.5	1 650 713.9	13 225.0	-17 566.2	-11 958.1
Nom. CSM	-17 375 649.	-13 683 328.8	1 841 649.	12 770.1	-18 151.0	-12 022.5
1	-17 377 698.8	-13 680 878.3	1 843 305.2	12 766.5	-18 153.5	-12 002.4
2	-17 375 187.	-13 683 980.8	1 841 143.1	12 770.8	-18 150.1	-12 002.9
3	-17 374 762.	-13 684 371.	1 841 618.7	12 771.3	-18 150.2	-12 002.3
4	-17 377 113.	-13 682 147.	1 842 846.5	12 767.6	-18 152.3	-12 002.1
5	-17 375 545.	-13 683 437.	1 842 257.3	12 769.9	-18 151.2	-12 002.3
6	-17 375 441.	-13 683 788.	1 842 282.0	12 769.8	-18 151.0	-12 002.3
7	-17 377 391.	-13 681 782.	1 844 232.5	12 766.7	-18 153.3	-12 001.4
8	-17 374 978.	-13 684 349.	1 841 392.9	12 771.1	-18 149.9	-12 002.5
9	-17 376 391.	-13 682 636.	1 841 188.9	12 769.3	-18 151.3	-12 002.6
10	-17 374 425.	-13 684 612.	1 841 123.2	12 771.8	-18 149.8	-12 002.8
11	-17 376 123.	-13 682 890.	1 843 419.9	12 768.6	-18 151.9	-12 002.1
12	-17 376 285.	-13 682 783.	1 842 291.	12 768.9	-18 151.6	-12 002.3
13	-17 376 646.	-13 682 334.	1 843 461.	12 768.0	-18 152.4	-12 001.9
14	-17 375 861.	-13 683 214.	1 841 819.	12 769.6	-18 151.1	-12 002.6
15	-17 378 199.	-13 680 279.	1 843 433.	12 766.1	-18 153.9	-12 002.2
16	-17 373 204.	-13 685 942.	1 839 948.8	12 773.9	-18 148.5	-12 002.7
17	-17 374 945.	-13 683 592.	1 840 664.	12 771.4	-18 150.3	-12 003.2

TABLE V.- ELLIPTIC RENDEZVOUS - Continued

(c) State vector at NSR + 64 minutes - Concluded

Case no.	X, ft	Y, ft	Z, ft	$\dot{X}$, fps	$\dot{Y}$, fps	$\dot{Z}$, fps
18	-17 375 540.	-13 683 331.	1 842 568.	12 769.7	-18 151.4	-12 002.4
19	-17 374 072.	-13 685 027.	1 840 367.	12 772.5	-18 149.1	-12 003.1
20	-17 374 263.	-13 684 806.	1 839 610.	12 772.8	-18 148.9	-12 003.3
21	-17 376 300.	-13 682 409.	1 842 098.2	12 768.9	-18 151.7	-12 002.7
22	-17 375 917.	-13 683 167.	1 842 769.	12 769.4	-18 151.6	-12 001.8
23	-17 377 042.	-13 681 945.	1 843 374.	12 767.5	-18 152.8	-12 001.9
24	-17 374 461.	-13 684 952.	1 841 044.	12 771.7	-18 149.5	-12 002.7
25	-17 375 100.	-13 683 822.	1 841 332.	12 770.9	-18 150.6	-12 002.5
26	-17 376 399.	-13 682 353.	1 842 073.	12 769.1	-18 151.8	-12 002.5
27	-17 374 210.	-13 685 076.	1 840 778.4	12 772.5	-18 149.4	-12 002.3
28	-17 374 945.	-13 684 002.	1 841 163.	12 771.3	-18 150.2	-12 002.7
29	-17 374 620.	-13 684 489.	1 840 681.	12 771.7	-18 149.7	-12 002.8
30	-17 373 519.	-13 685 765.	1 840 264.9	12 773.3	-18 148.8	-12 002.6

TABLE V.- ELLIPTIC RENDEZVOUS - Continued

(d) Relative state vector at TPI

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
Nom. CSM	-21.97	-10.11	0.31	-67.5	99.7	-8.5
1	-22.83	-10.01	0.34	-68.0	105.5	-8.7
2	-21.76	-10.14	0.35	-67.3	98.2	-8.7
3	-21.67	-10.15	0.32	-67.3	97.6	-7.7
4	-22.68	-10.07	0.33	-67.7	103.9	-8.3
5	-22.09	-10.08	0.34	-67.6	100.4	-7.8
6	-22.19	-10.07	0.36	-67.7	100.7	-7.6
7	-22.97	-10.04	0.34	-67.8	105.8	7.1
8	-21.71	-10.17	0.33	-67.1	97.7	-8.1
9	-22.16	-10.10	0.25	-67.5	100.8	-9.4
10	-21.55	-10.13	0.34	-67.4	96.9	-8.1
11	-22.37	-10.08	0.39	-67.6	102.2	-7.2
12	-22.25	-10.10	0.32	-67.5	101.4	-8.3
13	-22.53	-10.07	0.35	-67.7	103.2	-7.4
14	-22.12	-10.09	0.33	-67.6	100.5	-8.5
15	-22.88	-10.14	0.30	-67.9	106.0	-8.9
16	-21.06	-10.16	0.28	-67.2	93.7	-8.0
17	-21.50	-10.11	0.30	-67.4	97.1	-9.1

TABLE V.- ELLIPTIC RENDEZVOUS - Concluded

(d) Relative state vector at TPI - Concluded

Case no.	R_x, n. mi.	R_y, n. mi.	R_z, n. mi.	$\dot{R}_x$, fps	$\dot{R}_y$, fps	$\dot{R}_z$, fps
18	-22.08	-10.08	0.37	-67.6	100.4	-7.6
19	-21.36	-10.14	0.34	-67.3	95.6	-8.6
20	-21.16	-10.19	0.28	-67.0	94.5	-9.4
21	-22.17	-10.08	0.33	-67.6	101.2	-8.7
22	-22.21	-10.10	0.31	-67.5	101.1	-7.3
23	-22.71	-10.04	0.33	-67.8	104.3	-7.8
24	-21.61	-10.16	0.35	-67.2	96.9	-8.1
25	-21.78	-10.10	0.29	-67.5	98.5	-8.3
26	-22.12	-10.10	0.29	-67.4	100.9	-8.7
27	-21.43	-10.17	0.26	-67.2	96.0	-7.8
28	-21.62	-10.14	0.30	-67.3	97.5	-8.4
29	-21.57	-10.13	0.31	-67.4	97.0	-8.6
30	-21.27	-10.15	0.29	-67.3	94.9	-7.9

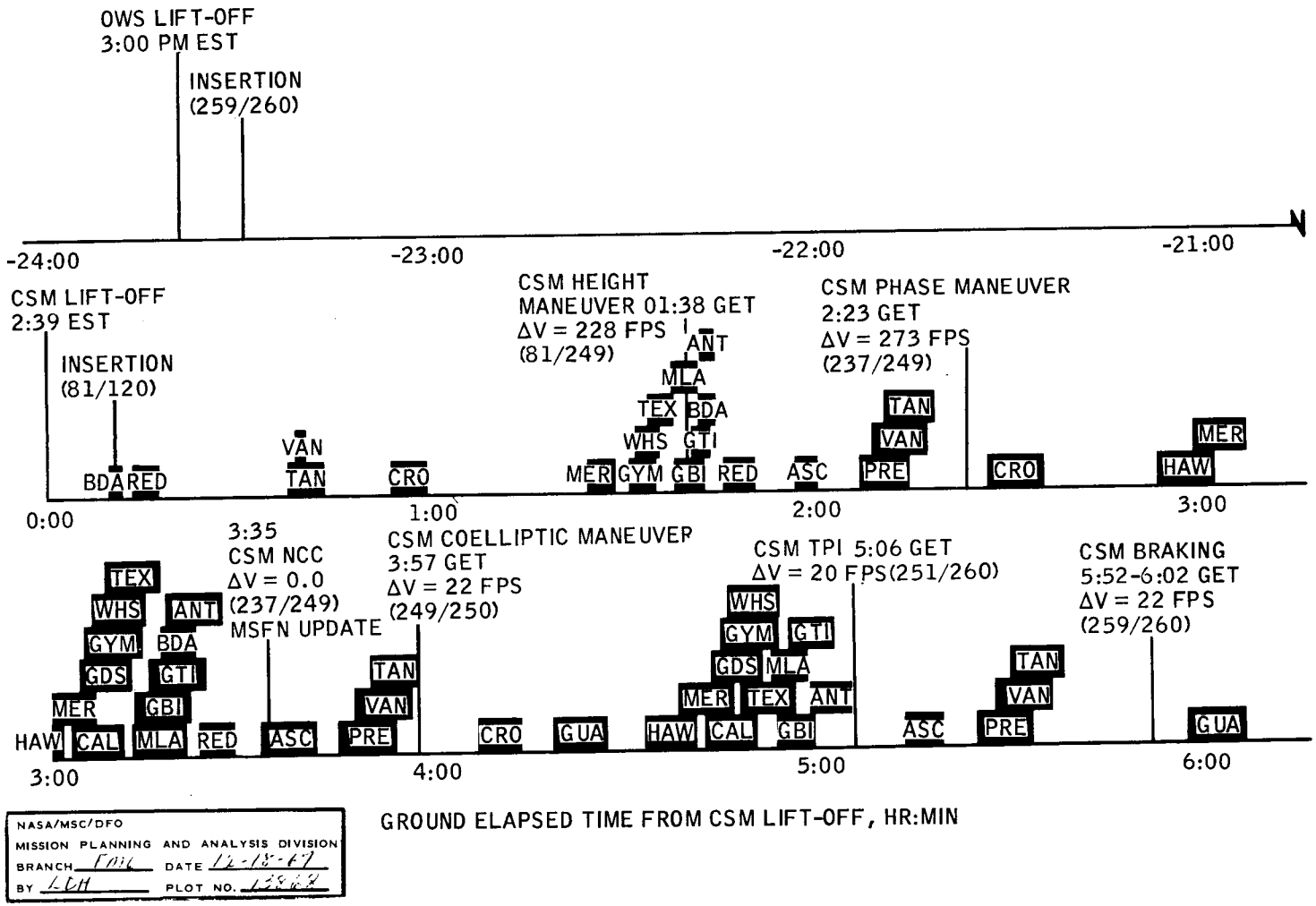

Figure 1.- Coelliptic rendezvous profile for AAP 1/2.

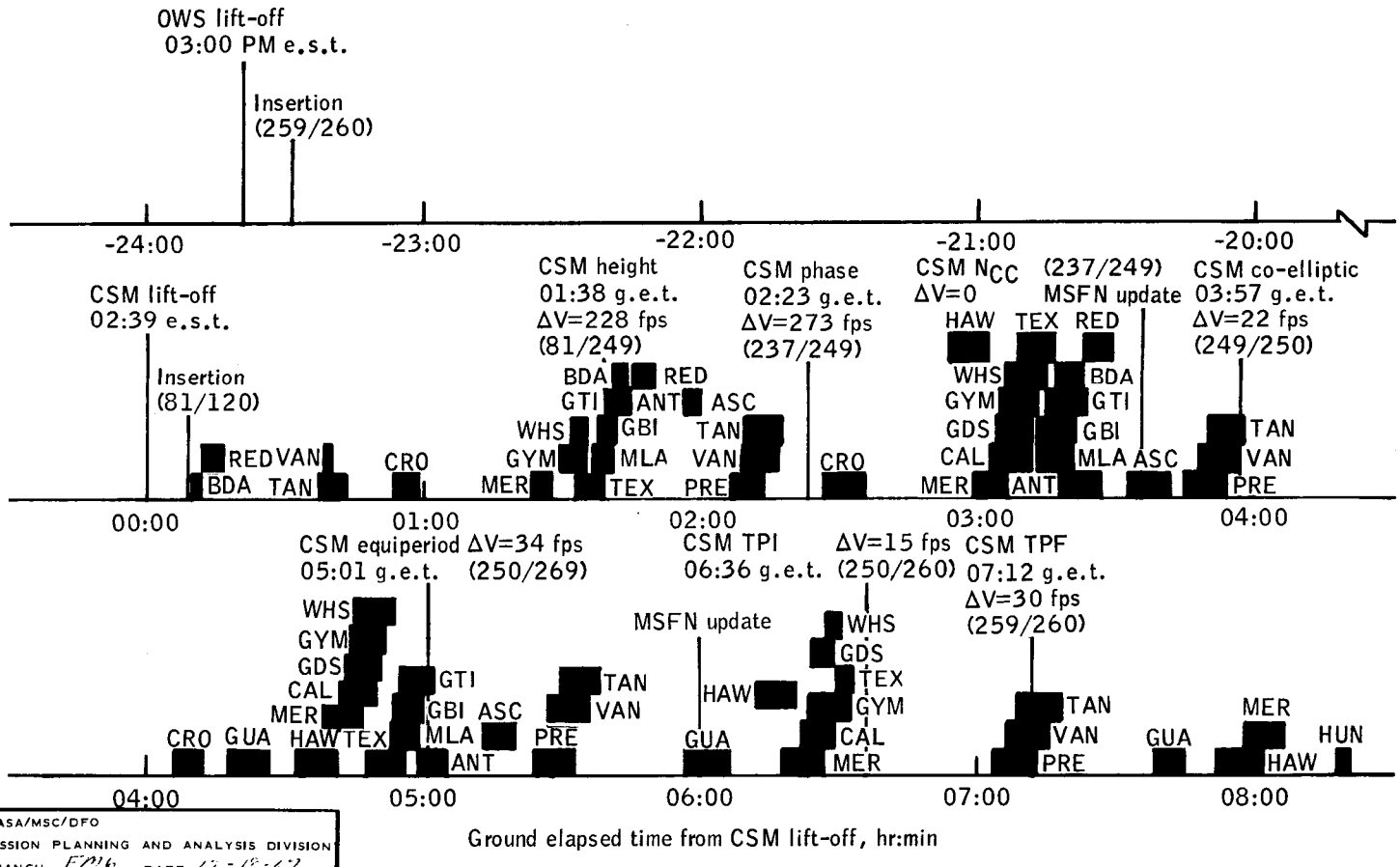

Figure 2.- Biased equiperiod profile for AAP 1/2.

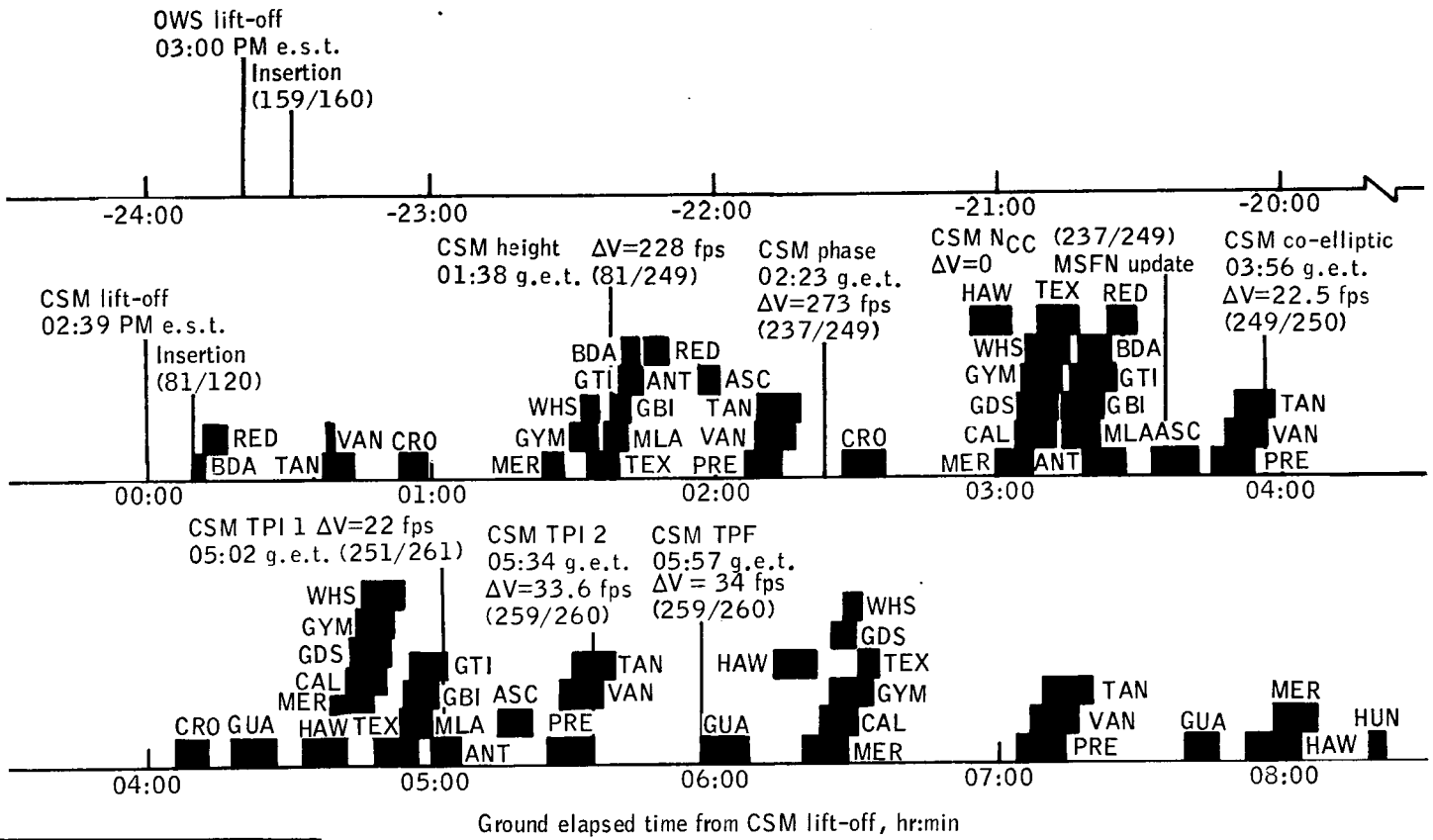

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Figure 3.- Out-of-plane rendezvous profile for AAP 1/2.

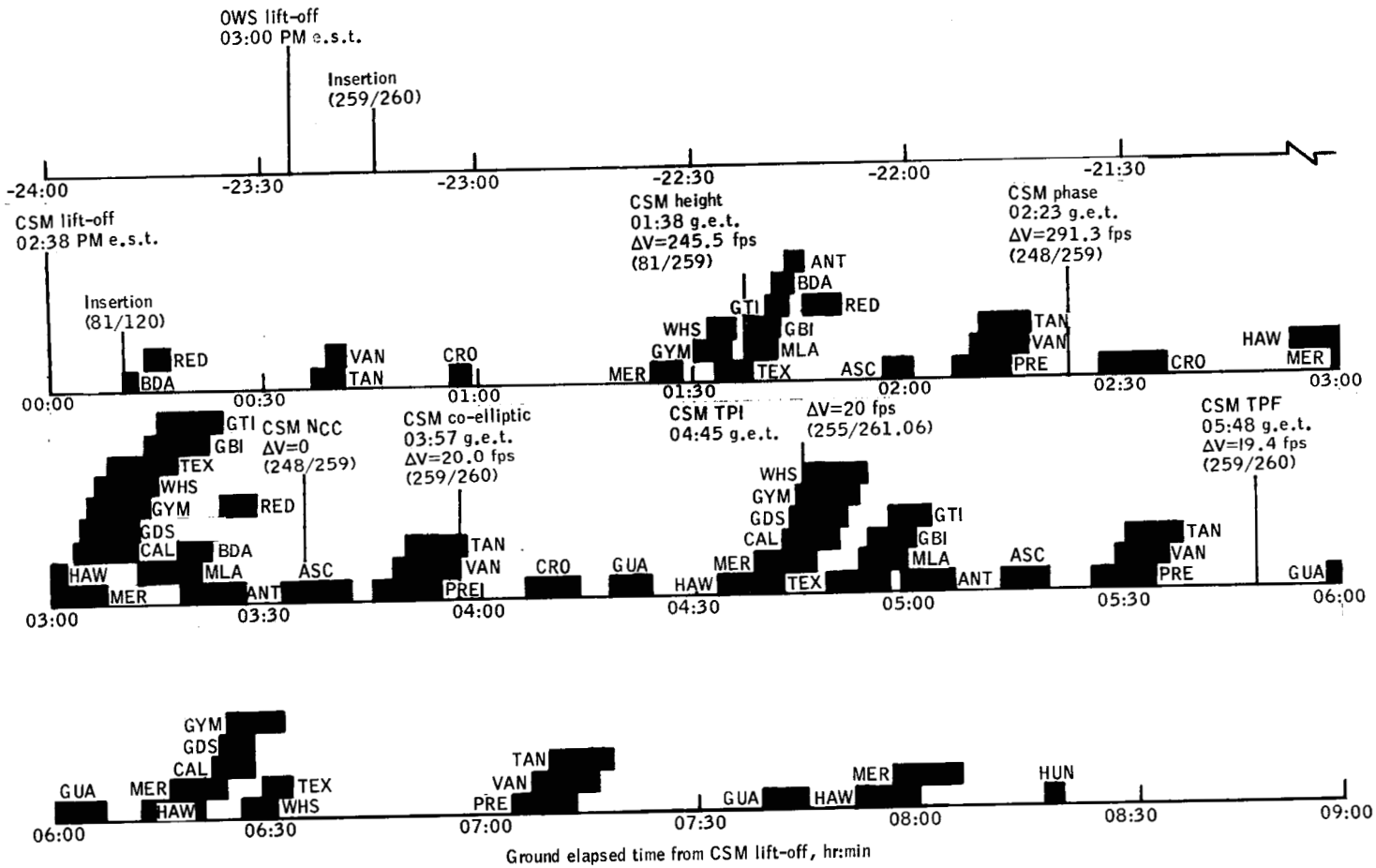

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Figure 4.- Stable orbit rendezvous profile for AAP 1/2.

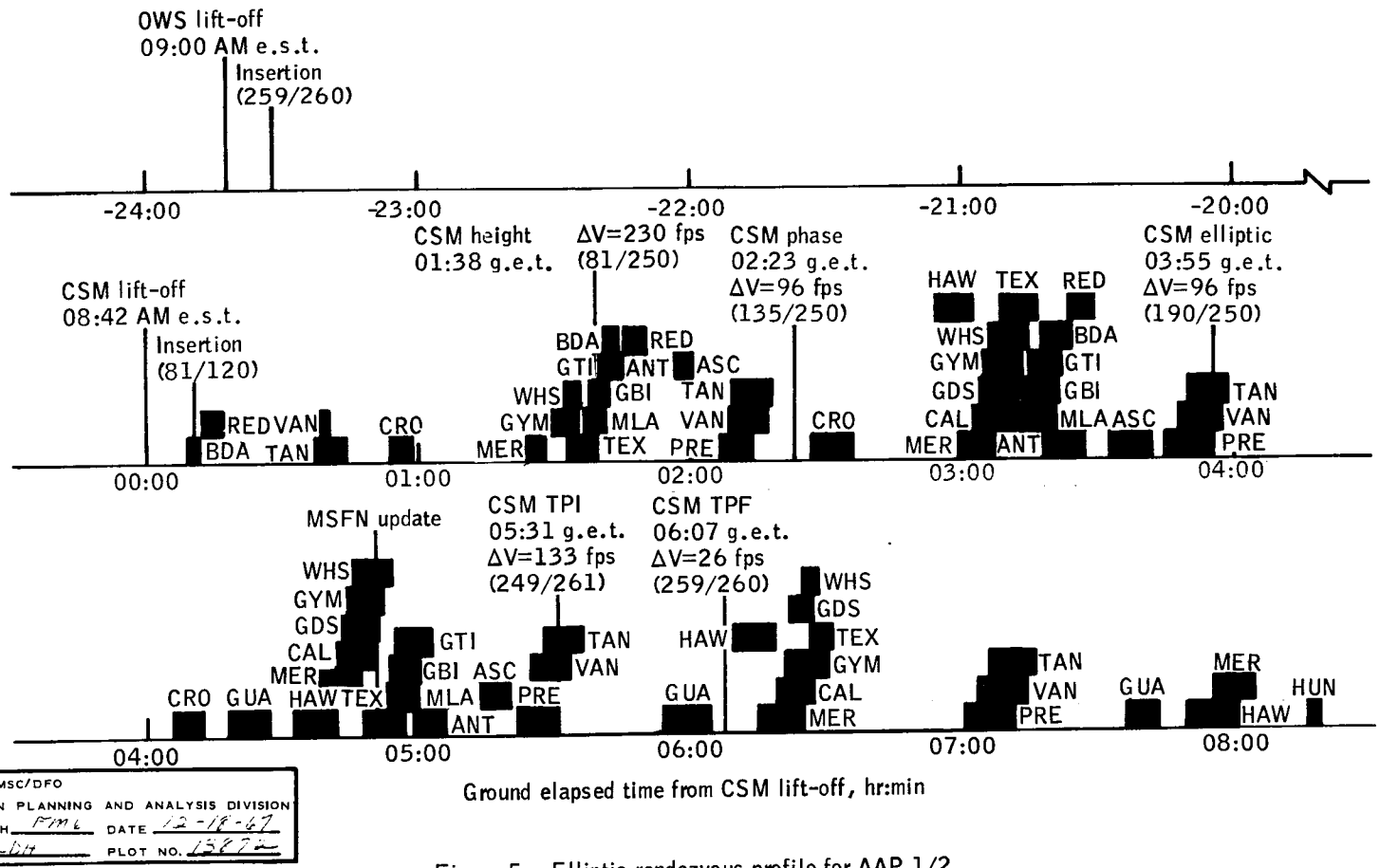

Figure 5.- Elliptic rendezvous profile for AAP 1/2.

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2. Kauffman, Carol: Preliminary Error Analysis for AAP Mission A. MSC Memorandum 68-FM46-144, April 29, 1968.