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DISPERSION ANALYSIS FOR BASELINE REFERENCE MISSION 3A WITH 400000 FOOT ENTRY INTERFACE ALTITUDE

MISSION PLANNING, MISSION ANALYSIS AND SOFTWARE FORMULATION

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1.0 SUMMARY AND INTRODUCTION

A dispersion analysis considering 3σ uncertainties (or perturbaations) in platform, vehicle, and environmental parameters has been performed for baseline reference mission (BRM) 3A. Powered Explicit Guidance (PEG) as implemented in SVDS Version 3.3 is used to develop closed loop steering commands for this dispersion analysis.

The nominal profile in the dispersion analysis is based on the nominal profile of Reference 1 with the exception that entry interface is an actual altitude of 400000 feet. In previous dispersion analyses such as Reference 2, entry interface conditions were assumed to be achieved when the radius vector magnitude of the navigated state is 21325800 feet. The techniques of this analysis were verified in Reference 3.

The groundrules and assumptions for the analysis are reviewed in Section 2.1. The results presented include dispersion data at specific time slices from liftoff to entry interface, covariance matrices, summary data and exchange ratios.

2.0 DISCUSSION

2.1 Groundrules and Assumptions

The groundrules describing the Reference 1 ascent trajectory are used for this dispersion analysis. In addition, the following assumptions are made:

a. Dispersion analysis simulations are generated using the Space Vehicle Dynamics Simulation (SVDS) program operating in a three-degree-of-freedom flight simulation mode.

b. Dispersion analysis results are based on the nominal mission for BRM 3A.

c. Guidance target switchover occurs at a fixed time from liftoff for all perturbation simulations.

d. First stage steering is defined by vehicle attitude as a function of relative velocity from the nominal profile. This attitude history is used to provide steering commands for all perturbation simulations.

e. The perturbations considered for evaluation in this dispersion analysis are assumed normally distributed about their statistical mean.

f. The perturbations are statistically independent.

g. The perturbations considered include error sources in guidance and propulsion systems, uncertainties in measurements of system properties and perturbations in nominal environmental conditions.

2.2 General

2.2.1 Dispersion Simulation Techniques

A dispersion analysis is based on a nominal trajectory generated without including any of the uncertainties. Performance-optimum first stage steering commands and second stage guidance inputs are determined for the nominal profile. Since perturbations are unplanned occurrences, the nominal steering and guidance inputs are used in simulating trajectories with perturbations.

The perturbation simulations in this analysis are determined by independently simulating 3σ values of the indicated uncertainties. That is, a complete trajectory simulation (liftoff to entry interface) is developed using only one error source. The dispersion results from these independent simulations are then statistically correlated by 1) a root-sum-square (RSS) process and 2) determining a covariance matrix indicative of all error sources.

2.2.2 Error Sources, Symbols and Definitions

A list of the error sources used in this study and their 3σ values is given in Table I. Included in Table I are symbols used in the RSS data tables to identify dispersions resulting from the error sources.

Figure 1 contains the definition of a local horizontal coordinate system (LHS). The RSS data and covariance matrices indicate state vector dispersions in the LHS. Since the LHS is determined from the nominal state, a different LHS is determined at each instance for which RSS or covariance data is required.

Tables II and III contain symbols used to identify elements of the covariance matrices, a definition of the symbols, and the format of the covariance matrices. Although 3σ values of the error sources are used in the trajectory simulations, state vector dispersions are adjusted to a 1σ level for determining the covariance matrices.

2.2.3 Events and Time Slices for Dispersion Analysis

RSS and covariance matrix data are presented for several events and time slices in this analysis. An event is defined as a fixed occurence (sensed by attaining a given target value) and may have a time-from-liftoff dispersion associated with it. A time slice is indicative of a fixed time from liftoff.

The events and time slices for which RSS and covariance matrix data are presented are as follows:

a. Solid Rocket Booster (SRB) Separation (See Tables IV-A, IV-B)
b. Main Engine Cutoff (MECO) (See Tables V-A, V-B)
c. Time slice defined as nominal MECO time plus 25 seconds, 511.5 seconds from liftoff (See Tables VI-A, VI-B)
d. Insertion (See Tables VII-A, VII-B)
e. Time slice defined as nominal insertion time plus 25 seconds, 779.3 seconds from liftoff (See Tables VIII-A, VIII-B)
f. Time slice defined as 10 seconds prior to the end of nominal coast, 3505.6 seconds from liftoff (See Tables IX-A, IX-B)

g. Time slice defined as end of nominal de-orbit burn plus 25 seconds, 3624.4 seconds from liftoff (See Tables X-A, X-B)

h. Time slice defined as 10 minutes prior to nominal entry interface, 3798.4 seconds from liftoff (See Tables XI-A, XI-B)

i. Entry Interface (See Tables XII-A, XII-B)

As previously stated, the LHS in which state vector dispersions (RSS data and covariance matrix data) are calculated is determined by the nominal state at each of the indicated events and time slices. Each event and time slice has its own LHS in which dispersions are presented.

2.3 RSS Data

The RSS technique is the method used in this analysis to statistically combine dispersions in flight parameters to determine the 3-sigma limits in the significant parameters. In actual vehicle flight, there is a 99.73 percent probability that the value of the parameter will be inside the 3-sigma band (the RSS value) if all assumptions required for this method are justified.

Inherent in the RSS method are the assumptions of linearity and normality. These assumptions are as follows:

a. The perturbations are statistically independent; that is, the occurrence of one perturbation will not effect the probability of a second perturbation.

b. A perturbation and its associated flight dispersions are linearly related.

The RSS data presented in this report includes dispersions in altitude, down range and cross range position, and cross range rate computed in the LHS. Speed, flight-path angle, altitude rate, time and total vehicle weight dispersions are also included in the RSS data. The dispersions presented in the RSS data are computed as:

dispersion = (Actual integrated state of perturbed trajectory) - (nominal trajectory state).

RSS data are presented in Tables IV-A through XII-A for the major events and time slices defined in Section 2.2.3. Data are included in the tables to indicate parameter dispersions for each individual error source and the RSS combination of the dispersions. As previously stated, this study assumes all error sources to be normally distributed. Consequently, the RSS data indicated in Tables IV-A through XII-A are computed from the dispersions without regard to sign.

RSS data at SRB separation (Table IV-A) and MECO (Table V-A) contain total vehicle weight dispersions and the resulting penalty in terms of orbiter main engine propellant. The propellant variations will be used to indicate whether the cumulative penalty is within the flight performance reserve requirements.

RSS data Tables VI-A through XII-A contain orbital maneuvering system (OMS) propellant dispersions.

2.4 Covariance Matrix Data

The covariance matrix represents a multrivariate normal distribution of a 6 by 1 vector of dispersions in the actual (integrated) state, a 6 by 1 vector of navigated state deviations, and vehicle weight. The navigated state deviations represented in the covariance matrix are computed as:

deviation = (perturbed navigated state) - (actual integrated state of perturbed trajectory).

Table II defines the parameters presented in the covariance matrices of this paper. The matrices are expressed in the LHS (UVW coordinates) defined by the nominal state vector at each event or time slice. (See Figure 1.) The covariance matrices are indicative of 1σ perturbations. Each diagonal element of the matrix (Table III) represents the variance of the associated parameter. For example, the element in the second row and second column represents the variance of the actual state in the V (or down-range) direction. Each off-diagonal element represents the covariance between the diagonal elements directly above and directly to the right of it. For example, the element in the fourth row and second column represents the covariance between the down-range variance and the $\dot{U}$ variance.

The elements of the matrix are symbolically defined in Table II. The matrices are given in Tables IV-B through XII-B. Since a covariance matrix is symmetrical, only the lower triangle of the matrices is given.

2.5 Exchange Ratios

An exchange ratio is defined as the ratio of a dispersion in a given variable to the magnitude of the error source causing the dispersion. The use of exchange ratios enables a quick-look assessment of the variations from nominal which may be expected to result from the application of error sources of various magnitudes. To use an exchange ratio, multiply a change in a parameter by its corresponding exchange ratio. This defines the predicted performance change at the event or time slice for which the ratio has been calculated.

Table XIII contains exchange ratios indicating space shuttle main engine (SSME) propellant dispersion at MECO for several performance error sources. The exchange ratios are valid for perturbations only within a specified range. The exchange ratios show a sensitivity to an unplanned anomaly; that is, the trajectory is not optimized for the uncertainties. These exchange ratios may be used to predict SSME propellant variations at MECO.

2.6 RSS Summary Data

Summary tables of the RSS data are give in Tables XIV and XV. Table XIV contains the RSS data of Tables IV-A through XII-A. Data are presented for each event and time slice indicated in the tables. The variations indicated by Table XIV are dispersions of the actual (integrated) perturbed state from the nominal state. Table XV is the RSS of navigation deviations computed as defined in Section 2.4. Data are presented in Table XV for each event and time slice indicated by Tables IV-B through XII-B. In considering the data of Tables XIV and XV, it should be noted that uncertainties in atmospheric winds and SSME thrust tailoff are not simulated. These uncertainties are major contributors to position errors at SRB separation and MECO, respectively. Results of these error sources will be included in the dispersion analysis at a later date.

3.0 CONCLUSIONS

Principal error contributors to the covariance matrix at MECO and entry interface are listed in Tables XVI and XVII, respectively. The dispersion data indicate that the largest position error occurs in the down range component. At MECO the vehicle performance uncertainties are the major contributors to down range error, and at entry interface the major contributors are platform errors.

Reference:

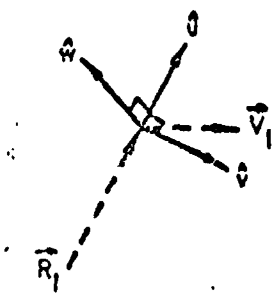
1. JSC Internal Note No. 73-FM-47, "Space Shuttle System Baseline Reference Mission, Volume III - Mission 3A, Revision 2," dated 1 August 1975.
2. Design Note No. 1.4-7-16, "Dispersion Analysis for Baseline Reference Mission 3A Using Powered Explicit Guidance (PEG)." dated 9 December 1975.
3. TM No. 1.4-7-274, "Verfication of SVDS Dispersion Analysis Results," dated 9 August 1976.

TABLE I

ERROR SOURCE DEFINITIONS

ERROR SOURCE SYMBOLS*	DEFINITION	3-SIGMA VALUES	UNITS
PLATFORM ALINE	INITIAL PLATFORM MISALIGNMENT AZIMUTH TILT,ROLL	 160.000 60.000	 ARC SEC ARC SEC
DRIFT BIAS	FREE GYRO BIAS	.045	DEG/HR
G-SENS IA DRIFT	GYRO INPUT AXIS ACCELERATION SENSITIVE DRIFT	.075	DEG/HR/G
G-SENS SA DRIFT	GYRO SPIN AXIS ACCELERATION SENSITIVE DRIFT	.075	DEG/HR/G
G-SENS OA DRIFT	GYRO OUTPUT AXIS ACCELERATION SENSITIVE DRIFT	.075	DEG/HR/G
G-SENS-SQ DRIFT	GYRO ACCELERATION SQUARED SENSITIVE DRIFT	.075	DEG/HR/G**2
ACCEL BIAS	ACCELEROMETER BIAS	160.000	MICRO-G
ACCEL SCALE FAC	ACCELEROMETER SCALE FACTOR	120.000	PPM
ACCEL IA ALINE - TOWARD SA - TOWARD OA	ACCELEROMETER INPUT AXIS MISALIGNMENT - TOWARD SPIN AXIS - TOWARD OUTPUT AXIS	 45.000 45.000	 ARC SEC ARC SEC
REB ACT	POS. REB ACTION TIME	4.710	PERCENT
S ISP	NEG. SRB SPECIFIC IMPULSE	.500	PERCENT
S PROP	NEG. SRB PROPELLANT LOADING	.210	PERCENT
S INERT	POS. SRB INERT WEIGHT	.850 (2978.230)	PERCENT (LB)
O THRST	NEG. ORBITER THRUST	6000.000 (10392.000)	LB/ENG (LB/3 ENG)
O ISP	NEG. ORBITER SPECIFIC IMPULSE	2.300 (1.328)	SEC-1 ENG (SEC/3 ENG)
O INERT	POS. ORBITER INERT WEIGHT	.810 (1215.000)	PERCENT (LB)
ET I ERT	POS. EXTERNAL TANK INERT WEIGHT	.810 (577.000)	PERCENT (LB)
ET PROP	NEG. EXTERNAL TANK PROPELLANT LOADING	.480 (7422.480)	PERCENT (LB)
AX FR	POS. AXIAL FORCE	ROCKWELL ROCKWELL DOCUMENT NO. SD-72-SH-0 JUNE 1974, AERODYNAMIC DESIGN DATA BOOK, VOL. II	
B DRAG	POS. BASE DRAG	ROCKWELL ROCKWELL DOCUMENT NO. SD-72-SH-0 JUNE 1974, AERODYNAMIC DESIGN DATA BOOK, VOL. II	

* SYMBOLS USED IN TABLES IV-A THROUGH XII-A.



Let R_I be the inertial position vector and V_I be the inertial velocity vector. The LHS coordinate system is defined by the following three vector equations.

$$\hat{u} = \vec{R}_I / |\vec{R}_I|$$

$$\hat{v} = (\vec{R}_I \times \vec{V}_I \times \vec{R}_I)/|\vec{R}_I \times \vec{V}_I \times \vec{R}_I|$$

$$\hat{w} = \hat{u} \times \hat{v}$$

Figure 1 - Local Horizontal Coordinate System

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TABLE II

Covariance Matrix Parameter Definition

State Vector Component	Definition	Units
U ACT V ACT W ACT	Actual state vector position component dispersions in the Local Horizontal Coordinate System (LHS)	FT
U-DOT ACT V-DOT ACT W-DOT ACT	Actual state vector velocity component dispersions in the LHS	FT/SEC
U NAV V NAV W NAV	Navigated state vector position component deviations in a LHS*	FT
U-DOT NAV V-DOT NAV W-DOT NAV	Navigated state vector velocity component deviations in a LHS*	FT/SEC
WT	Vehicle weight	LB

* The navigated state has its own LHS developed from the nominal navigated state vectors similar to the actual state LHS development. Navigated state vector deviations are computed as:

deviation = (perturbed navigated state) - (actual integrated state of perturbed trajectory)

TABLE III

Covariance Matrix Format

U ACT	σ_u^2												
V ACT	$\sigma_u\sigma_v$	σ_v^2											
W ACT	$\sigma_u\sigma_w$	$\sigma_v\sigma_w$	σ_w^2										
U-DOT ACT	$\sigma_u\sigma_{\dot{u}}$	$\sigma_v\sigma_{\dot{u}}$	$\sigma_w\sigma_{\dot{u}}$	$\sigma_{\dot{u}}^2$									
V-DOT ACT	$\sigma_u\sigma_{\dot{v}}$	$\sigma_v\sigma_{\dot{v}}$	$\sigma_w\sigma_{\dot{v}}$	$\sigma_{\dot{u}}\sigma_{\dot{v}}$	$\sigma_{\dot{v}}^2$								
W-DOT ACT	$\sigma_u\sigma_{\dot{w}}$	$\sigma_u\sigma_{\dot{w}}$	$\sigma_w\sigma_{\dot{w}}$	$\sigma_{\dot{u}}\sigma_{\dot{w}}$	$\sigma_{\dot{v}}\sigma_{\dot{w}}$	$\sigma_{\dot{w}}^2$							
U NAV	$\sigma_u\sigma_{u'}$	$\sigma_v\sigma_{u'}$	$\sigma_w\sigma_{u'}$	$\sigma_{\dot{u}}\sigma_{u'}$	$\sigma_{\dot{v}}\sigma_{u'}$	$\sigma_{\dot{w}}\sigma_{u'}$	$\sigma_{u'}^2$						
V NAV	$\sigma_u\sigma_{v'}$	$\sigma_v\sigma_{v'}$	$\sigma_w\sigma_{v'}$	$\sigma_{\dot{u}}\sigma_{v'}$	$\sigma_{\dot{v}}\sigma_{v'}$	$\sigma_{\dot{w}}\sigma_{v'}$	$\sigma_{u'}\sigma_{v'}$	$\sigma_{v'}^2$					
W NAV	$\sigma_u\sigma_{w'}$	$\sigma_v\sigma_{w'}$	$\sigma_w\sigma_{w'}$	$\sigma_{\dot{u}}\sigma_{w'}$	$\sigma_{\dot{v}}\sigma_{w'}$	$\sigma_{\dot{w}}\sigma_{w'}$	$\sigma_{u'}\sigma_{w'}$	$\sigma_{v'}\sigma_{w'}$	$\sigma_{w'}^2$				
U-DOT NAV	$\sigma_u\sigma_{\dot{u}'}$	$\sigma_v\sigma_{\dot{u}'}$	$\sigma_w\sigma_{\dot{u}'}$	$\sigma_{\dot{u}}\sigma_{\dot{u}'}$	$\sigma_{\dot{v}}\sigma_{\dot{u}'}$	$\sigma_{\dot{w}}\sigma_{\dot{u}'}$	$\sigma_{u'}\sigma_{\dot{u}'}$	$\sigma_{v'}\sigma_{\dot{u}'}$	$\sigma_{w'}\sigma_{\dot{u}'}$	$\sigma_{\dot{u}'}^2$			
V-DOT NAV	$\sigma_u\sigma_{\dot{v}'}$	$\sigma_v\sigma_{\dot{v}'}$	$\sigma_w\sigma_{\dot{v}'}$	$\sigma_{\dot{u}}\sigma_{\dot{v}'}$	$\sigma_{\dot{v}}\sigma_{\dot{v}'}$	$\sigma_{\dot{w}}\sigma_{\dot{v}'}$	$\sigma_{u'}\sigma_{\dot{v}'}$	$\sigma_{v'}\sigma_{\dot{v}'}$	$\sigma_{w'}\sigma_{\dot{v}'}$	$\sigma_{\dot{u}'}\sigma_{\dot{v}'}$	$\sigma_{\dot{v}'}^2$		
W-DOT NAV	$\sigma_u\sigma_{\dot{w}'}$	$\sigma_v\sigma_{\dot{w}'}$	$\sigma_w\sigma_{\dot{w}'}$	$\sigma_{\dot{u}}\sigma_{\dot{w}'}$	$\sigma_{\dot{v}}\sigma_{\dot{w}'}$	$\sigma_{\dot{w}}\sigma_{\dot{w}'}$	$\sigma_{u'}\sigma_{\dot{w}'}$	$\sigma_{v'}\sigma_{\dot{w}'}$	$\sigma_{w'}\sigma_{\dot{w}'}$	$\sigma_{\dot{u}'}\sigma_{\dot{w}'}$	$\sigma_{\dot{v}'}\sigma_{\dot{w}'}$	$\sigma_{\dot{w}'}^2$	
WT	$\sigma_u\sigma_{w_t}$	$\sigma_v\sigma_{w_t}$	$\sigma_w\sigma_{w_t}$	$\sigma_{\dot{u}}\sigma_{w_t}$	$\sigma_{\dot{v}}\sigma_{w_t}$	$\sigma_{\dot{w}}\sigma_{w_t}$	$\sigma_{u'}\sigma_{w_t}$	$\sigma_{v'}\sigma_{w_t}$	$\sigma_{w'}\sigma_{w_t}$	$\sigma_{\dot{u}'}\sigma_{w_t}$	$\sigma_{\dot{v}'}\sigma_{w_t}$	$\sigma_{\dot{w}'}\sigma_{w_t}$	$\sigma_{w_t}^2$

Notes:
a. Unprimed symbols represent actual (integrated) state vector errors.
b. Primed symbols represent navigation state vector error.
c. W_t represents total vehicle weight error.

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TABLE IV - A

LINEAR ERROR ANALYSIS

RSS DATA AT SRB SEPARATION (EVENT)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT-PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	SSME PRO LB
PLATFORM ALINE										
AZIMUTH	1.	39.	135.	1.0	-.005	.0	3.7	.0	0.	0.
TILT	46.	-80.	23.	-.6	.020	1.2	.3	.0	0.	0.
ROLL	-1.	-28.	-94.	-.4	.002	-.0	-1.6	.0	0.	-0.
DRIFT BIAS										
X	0.	1.	2.	.0	-.000	.0	.1	.0	0.	0.
Y	2.	-3.	1.	-.0	.001	.1	.0	.0	0.	0.
Z	0.	-1.	-3.	-.0	.000	-.0	-.1	.0	0.	0.
G-SENS IA DRIFT										
X	0.	2.	6.	.1	-.000	.0	.2	.0	0.	0.
Y	0.	0.	0.	.0	.000	.0	.0	.0	0.	0.
Z	0.	-1.	-2.	-.0	.005	-.0	-.1	.0	0.	0.
G-SENS SA DRIFT										
X	0.	0.	0.	.0	.000	.0	.0	.0	0.	0.
Y	3.	-2.	1.	-.0	.002	.1	.0	.0	0.	0.
Z	-0.	-2.	-8.	-.0	.000	-.0	-.2	.0	0.	0.
G-SENS OA DRIFT										
X	0.	1.	2.	-.0	-.000	.0	.1	.0	0.	0.
Y	6.	-8.	2.	-.1	.003	.2	.0	.0	0.	0.
Z	0.	0.	0.	.0	.000	.0	.0	.0	0.	0.
G-SQ SEN DRIFT										
X	0.	0.	0.	.0	.000	.0	.0	.0	0.	0.
Y	0.	0.	0.	.0	.000	.0	.0	.0	0.	0.
Z	0.	-1.	-3.	-.0	.000	-.0	-.1	.0	0.	0.
ACCEL BIAS										
X	-14.	20.	-6.	.1	-.005	-.3	-.1	.0	0.	0.
Y	-0.	0.	-0.	.0	-.000	-.0	-.0	.0	0.	0.
Z	-9.	10.	-3.	.1	-.004	-.2	-.1	.0	0.	0.
ACCEL SCALE FAC										
X	-18.	27.	-8.	.2	-.007	-.4	-.1	.0	0.	0.
Y	0.	0.	0.	.0	.000	.0	.0	.0	0.	0.
Z	-4.	4.	-1.	.0	-.002	-.1	-.0	.0	0.	0.
ACCEL IA ALINE - OA										
X	0.	0.	0.	.0	.000	.0	.0	.0	0.	0.
Y	-0.	0.	-0.	.0	-.000	-.0	-.0	.0	0.	0.
Z	-21.	24.	-7.	.2	-.009	-.6	-.1	.0	0.	0.
- SA										
X	-8.	9.	-3.	.1	-.003	-.2	-.0	.0	0.	0.
Y	-0.	1.	-0.	.0	-.000	-.0	-.0	.0	0.	0.
Z	0.	0.	0.	.0	.000	.0	.0	.0	0.	0.
PERFORMANCE										
REQ ACT	1598.	3671.	5550.	[illegible].7	-.560	-44.8	-4.2	5.5	-18594.	-18594.
S ISP	-863.	-1824.	534.	-.6	.129	-6.9	11.2	.0	.0	0.
S PROP	-210.	-424.	124.	-9.9	.026	-2.4	2.9	-.0	0.	0.
S INERT	-193.	-386.	113.	-9.7	.022	-2.6	2.8	.0	2978.	0.
O THRST	-427.	-853.	250.	-21.3	.051	-5.5	6.1	.0	27[illegible].	2773.
O ISP	33.	60.	-18.	2.2	-.002	.0	-.6	.0	-1199.	-1199.
O INERT	-79.	-158.	96.	-3.9	.009	-1.0	1.1	.0	1215.	0.
ET INERT	-37.	-75.	22.	-1.9	.004	-.5	.5	.0	577.	0.
ET PROP	479.	967.	-283.	24.2	-.057	6.3	-6.9	.0	-7422.	-7422.
AERODYNAMIC										
AA FR	-294.	-586.	171.	-11.5	.037	-2.3	3.4	.0	0.	0.
DRAG	-366.	-709.	225.	-13.8	.065	-2.0	4.2	.0	0.	0.
RSS =	2006.	4697.	5601.	55.5	.585	46.4	17.1	5.5	20510.	20240.

TABLE IV - B

COVARIANCE MATRIX
AT SRB SEPARATION

	U ACT	V ACT	W ACT	U-DOT ACT	V-DOT ACT	W-DOT ACT	U NAV
U ACT	4.4717897+05						
V ACT	1.0418278+06	2.4513232+06					
W ACT	8.6703195+05	2.4461022+06	3.4852632+06				
U-DOT ACT	-6.6130139+03	-1.7099609+04	-2.9012340+04	2.4601145+02			
V-DOT ACT	9.3411657+03	2.0103817+04	2.2686201+03	1.2953696+01	3.5255407+02		
W-DOT ACT	-2.0093629+03	-6.2125940+03	-1.1924527+03	1.2707510+00	-1.0304485+02	3.2340207+01	
U NAV	-2.7315600+02	1.0119597+03	1.5038709+02	-1.3407343+01	1.2816854+01	-4.4058664+00	7.5253926+02
V NAV	7.8553897+01	-1.8139656+03	-2.2271373-03	2.1291805+01	-1.0950018+01	-1.9695969+01	-5.5137058+02
W NAV	-5.7141312+01	-5.7827206+02	-2.9931792+03	-4.6206361+00	-1.6569066+01	-7.4032342+01	2.0174646+02
U-DOT NAV	-7.9749591+00	1.5632902+01	-5.6146505+00	-2.5406640-01	2.4600187-01	-6.5634300-02	1.0647137+01
V-DOT NAV	4.9282526+00	-1.6006640+01	-1.7747869+01	1.2606899-01	-2.9742112-01	-4.6234012-01	-6.6045716+00
W-DOT NAV	-1.9964072+00	-1.8356890+01	-7.3655342+01	-5.0311448-02	-4.8904879-01	-1.8250412+00	3.3750600+03
WT	-3.9104832+06	-9.4252600+06	-1.1108284+07	8.6421119+04	-5.2821922+04	1.7406289+04	-2.1500109+03

	V NAV	W NAV	U-DOT NAV	V-DOT NAV	W-DOT NAV	WT
V NAV	2.4005436+03					
W NAV	6.2301104+02	4.3889892+03				
U-DOT NAV	-1.4695638+01	5.0040966+00	3.8712673-01			
V-DOT NAV	4.0565725+01	1.6760856+01	-2.3437979-01	7.1302929-01		
W-DOT NAV	1.7068376+01	9.4106495+01	8.3376057-02	4.6075409-01	2.1717588+00	
WT	4.6977520+03	-6.4092255+02	1.2407188+00	-6.6110981-01	-2.2629462-01	4.0739953+07

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TABLE V - A

LINEAR ERROR ANALYSIS

RSS DATA AT MECO (EVENT)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT-PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	SSME PRO LB
PLATFORM ALINE										
AZIMUTH	114.	119.	4112.	.8	.002	.8	21.8	-.0	0.	0.
TILT	1210.	-1224.	15.	-4.1	.013	5.7	-.0	-.0	11.	11.
ROLL	-21.	-42.	-1013.	-.1	-.000	-.2	-2.6	.0	-0.	-0.
DRIFT BIAS										
X	6.	6.	214.	.1	.000	.0	1.7	.0	-0.	-0.
Y	200.	-123.	-1.	-.6	.003	1.5	-.0	-.0	0.	0.
Z	0.	-3.	-79.	-.0	-.000	-.0	-.3	.0	-0.	-0.
G-SENS IA DRIFT										
X	10.	11.	376.	.1	.000	.0	2.4	.0	-0.	-0.
Y	-3.	1.	-0.	.0	-.000	-.0	.0	.0	0.	0.
Z	1.	-5.	-124.	-.0	-.000	-.1	-.4	.0	-0.	-0.
G-SENS SA DRIFT										
X	1.	0.	-3.	.0	-.000	-.0	-.0	.0	-0.	-0.
Y	395.	-212.	-3.	-1.2	.008	3.5	-.1	-.0	0.	0.
Z	-1.	-7.	-172.	-.0	-.000	-.0	-.5	.0	-0.	-0.
G-SENS OA DRIFT										
X	11.	12.	417.	.2	.000	.1	3.8	.0	-0.	-0.
Y	349.	-248.	-0.	-1.0	.005	2.1	-.0	-.0	1.	1.
Z	-0.	0.	0.	.0	-.000	-.0	.0	.0	-0.	-0.
G-SS SEN DRIFT										
X	-0.	-0.	-1.	-.0	-.000	-.0	-.0	-.0	0.	0.
Y	-5.	1.	-0.	.0	-.000	-.1	-.0	-.0	0.	0.
Z	0.	-7.	-149.	-.0	-.000	-.0	-.5	.0	0.	0.
ACCEL BIAS										
X	-591.	178.	11.	.5	-.006	-2.5	.0	-.0	25.	25.
Y	17.	25.	554.	.1	.000	.1	2.2	.0	-1.	-1.
Z	-123.	-577.	23.	-2.2	-.003	-1.3	.1	-.0	51.	51.
ACCEL SCALE FAC										
X	-457.	168.	8.	.3	-.003	-1.4	.0	-.0	22.	22.
Y	-0.	-0.	-5.	.0	-.000	-.0	-.0	-.0	0.	0.
Z	-127.	-800.	23.	-2.9	-.003	-1.6	.1	-.0	67.	67.
ACCEL IA ALINE - OA										
X	6.	-0.	-0.	.0	-.000	-.0	.0	.0	-0.	-0.
Y	31.	38.	1027.	.2	.000	.2	5.4	.0	-1.	-1.
Z	-169.	-474.	32.	-1.9	-.003	-1.5	.1	-.0	49.	49.
- SA										
X	-1078.	249.	20.	1.2	-.013	-5.8	.1	-.0	39.	39.
Y	23.	43.	759.	.1	.000	.1	2.0	.0	-2.	-2.
Z	0.	-0.	-1.	.0	-.000	-.0	.0	-.0	0.	0.
PERFORMANCE										
REQ ACT	-29.	-33181.	-1.	-.1	-.002	-.9	-.1	1.8	-3558.	-3558.
S ISP	3.	-5320.	1.	.3	.004	1.7	.4	.5	-1096.	-1096.
S PROP	0.	-1497.	0.	.1	.001	.6	.1	.1	-294.	-294.
S INERT	-2.	-1422.	-0.	.1	.001	.4	.1	.1	-288.	-288.
O THRST	-20.	25604.	-1.	-.1	-.004	-1.7	-.3	3.6	-737.	-737.
O ISP	-7.	-7556.	-1.	.1	-.008	-3.3	-.8	-.8	-1438.	-1438.
O INERT	2.	1953.	0.	.2	.003	1.2	.2	.4	72.	-1143.
ET INERT	-1.	929.	-0.	.1	.001	.5	.1	.2	35.	-542.
ET PROP	-6.	-12072.	-1.	-.1	-.001	-.6	-.1	-2.2	-474.	-474.
AERODYNAMIC										
CA FX	1.	-1172.	0.	.1	.001	.5	.1	.2	-338.	-338.
N DRAG	-1.	-2340.	0.	.1	.001	.6	.1	.2	-407.	-407.
RSS =	1094.	44827.	4507.	6.3	.025	11.0	23.3	4.7	4143.	4331.

TABLE V - B

COVARIANCE MATRIX

AT MECO

	U ACT	V ACT	W ACT	U-DOT ACT	V-DOT ACT	W-DOT ACT	U NAV
U ACT	3.9756802+05						
V ACT	-1.4243153+05	2.2327557+06					
W ACT	5.8970767+04	6.6006706+04	2.2569623+06				
U-DOT ACT	2.2270004+03	-2.6629273+05	3.1584053+02	3.3108443+02			
V-DOT ACT	-7.4930370+02	3.3855229+03	4.0941047+02	-7.2011166+00	4.4767618+00		
W-DOT ACT	2.9362219+02	5.4364277+02	1.1502162+04	1.8294495+00	2.2847606+00	6.0372624+01	
U NAV	-3.9720575+05	2.0298757+05	-5.9308084+04	-2.2884948+03	7.5118553+02	-2.9343211+02	3.9710272+05
V NAV	2.0070521+05	-3.2107071+05	-6.0598242+04	1.2608281+03	-1.1913662+03	-3.3561569+02	-2.0696277+05
W NAV	-5.8942602+04	-6.3601387+04	-2.2570045+06	-3.1750200+02	-4.0918037+02	-1.1502214+04	5.9283133+04
U-DOT NAV	-2.2650971+03	1.2890886+03	-3.4953635+02	-1.3696688+01	4.8465089+00	-1.7346918+00	2.2853456+03
V-DOT NAV	7.3262217+02	-1.2125242+03	-4.1326262+02	9.7172579+00	-4.4551310+00	-2.2656461+00	-7.5330945+02
W-DOT NAV	-2.8925915+02	-3.3354809+02	-1.1590315+04	-1.5547628+00	-2.2596101+00	-6.0745274+01	2.9107516+02
WT	5.9914793+03	1.3761377+07	8.2120413+02	-1.5689850+04	7.7654927+01	1.5185189+02	7.7110430+03

	V NAV	W NAV	U-DOT NAV	V-DOT NAV	W-DOT NAV	WT
V NAV	3.3751253+06					
W NAV	6.0550142+04	2.2570409+06				
U-DOT NAV	-1.3271396+03	3.4944400+02	1.3763956+01			
V-DOT NAV	1.1955715+03	4.1308809+02	-4.8628796+00	4.4759214+00		
W-DOT NAV	3.3203303+02	1.1570504+04	1.7263939+00	2.2799597+00	6.1233094+01	
WT	1.1300390+04	-5.4014740+02	3.8061060+01	4.1475652+01	-1.3427222+00	1.9072390+06

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TABLE VI - A

LINEAR ERROR ANALYSIS

RSS DATA AT 511.5 SEC (NOMINAL MECO + 25 SEC)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT-PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	OMS PROP LB
PLATFORM ALINE										
AZIMUTH	133.	137.	4654.	.8	.002	.8	21.6	.0	0.	0.
TILT	1351.	-1235.	14.	-4.3	.012	5.5	-.0	-.0	0.	0.
ROLL	-25.	-44.	-1078.	-.1	-.000	-.2	-2.6	-.0	0.	0.
DRIFT BIAS										
X	7.	8.	255.	.1	.000	.0	1.7	.0	0.	0.
Y	237.	-141.	-1.	-.6	.003	1.5	-.0	-.0	0.	0.
Z	-1.	-4.	-86.	-.0	-.000	-.0	-.2	-.0	0.	0.
G-SENS IA DRIFT										
X	11.	13.	437.	.1	.000	.0	2.4	.0	0.	0.
Y	-4.	1.	-0.	.0	-.000	-.0	.0	-.0	0.	0.
Z	-1.	-6.	-134.	-.0	-.000	-.1	-.4	-.0	0.	0.
G-SENS SA DRIFT										
X	-0.	-0.	-4.	.0	-.000	-.0	-.0	-.0	0.	0.
Y	460.	-254.	-5.	-1.3	.008	3.4	-.1	.0	0.	0.
Z	-2.	-8.	-185.	-.0	-.000	-.0	-.5	.0	0.	0.
G-SENS OA DRIFT										
X	14.	16.	511.	.2	.000	.1	3.7	-.0	0.	0.
Y	401.	-277.	-1.	-1.1	.005	2.1	-.0	.0	0.	0.
Z	-1.	0.	0.	.0	-.000	-.0	.0	-.0	0.	0.
G-SQ SEN DRIFT										
X	-0.	0.	-2.	-.0	-.000	-.0	-.0	.0	0.	0.
Y	-7.	2.	-0.	.0	-.000	-.1	-.0	-.0	0.	0.
Z	-1.	-7.	-161.	-.0	-.000	-.0	-.5	.0	0.	0.
ACCEL BIAS										
X	-652.	525.	12.	.6	-.006	-2.5	.0	.0	0.	0.
Y	19.	13.	609.	.1	.000	.1	2.2	.0	0.	0.
Z	-152.	22.	25.	-2.1	-.003	-1.4	.1	.0	0.	0.
ACCEL SCALE FAC										
X	-490.	467.	9.	.3	-.003	-1.4	.0	-.0	0.	0.
Y	-2.	0.	-5.	.0	-.000	-.0	-.0	.0	0.	0.
Z	-161.	-18.	25.	-2.9	-.004	-1.8	.1	-.0	0.	0.
ACCEL IA ALINE										
- OA										
X	7.	-4.	-0.	.0	-.000	-.0	.0	-.0	0.	0.
Y	36.	26.	1163.	.2	.000	.2	5.4	.0	0.	0.
Z	-204.	136.	34.	-1.9	-.004	-1.6	.1	-.0	0.	0.
- SA										
X	-1219.	805.	23.	1.4	-.013	-5.8	.1	-.0	0.	0.
Y	25.	17.	609.	.1	.000	.1	1.9	.0	0.	0.
Z	-0.	0.	-1.	.0	-.000	-.0	.0	.0	0.	0.
PERFORMANCE										
REQ ACT	-521.	-78634.	-3.	.3	.001	.6	-.1	.0	0.	0.
S ISP	-69.	-19149.	9.	.4	.005	2.2	.4	-.0	0.	0.
S PROP	-17.	-5210.	3.	.1	.001	.6	.1	-.0	0.	0.
S INERT	-20.	-5053.	2.	.1	.001	.5	.1	-.0	0.	0.
O THRST	-849.	-65287.	-8.	.7	.003	1.2	-.3	-.0	0.	0.
O ISP	54.	11845.	-21.	-.0	-.009	-4.0	-.8	.0	0.	0.
O INERT	-40.	-7039.	6.	.2	.003	1.5	.2	-.0	1215.	0.
ET INERT	-21.	-3320.	3.	.1	.002	.7	.1	.0	0.	0.
ET PROP	358.	42708.	-4.	-.5	-.005	-2.4	-.1	.0	0.	0.
AERODYNAMIC										
AX FM	-19.	-5441.	3.	.1	.002	.7	.1	-.0	0.	0.
B DRAG	-26.	-7471.	4.	.1	.002	.8	.1	.0	0.	0.
RSS =	2381.	113920.	5080.	6.5	.026	11.5	23.1	.0	1215.	0.

TABLE VI - B

COVARIANCE MATRIX

AT NOMINAL MECO + 25 SEC

	U ACT	V ACT	W ACT	U-DOT ACT	V-DOT ACT	W-DOT ACT	U NAV
U ACT	6.2473952+05						
V ACT	1.2327777+07	1.4419826+09					
W ACT	7.8150988+04	8.9414606+04	2.8673262+06				
U-DOT ACT	-1.2702459+05	-1.7587477+06	3.7961401+02	2.1585694+03			
V-DOT ACT	-6.7239977+02	5.0951596+03	4.5214546+02	-9.3768749+00	4.6805249+00		
W-DOT ACT	3.6605574+02	1.2959391+03	1.2906146+04	1.0307750+00	2.2033858+00	5.9472413+01	
U NAV	-5.0550725+05	3.5660948+05	-7.8322206+04	-2.7185197+03	9.0220452+02	-3.4321801+02	5.0551933+05
V NAV	2.6404200+05	-2.6180974+05	-7.8174020+04	1.2658934+03	-1.3569703+03	-3.7702155+02	-7.6521864+05
W NAV	-7.7001701+04	-9.7106306+04	-2.0096565+06	-3.5572993+02	-4.5142816+02	-1.2415580+04	7.8232586+04
U-DOT NAV	-2.6016177+03	1.9601660+03	-4.1218243+02	-1.4429111+01	5.1284729+00	-1.6121775+00	2.6058659+03
V-DOT NAV	9.0387431+02	-8.6349423+02	-4.5545660+02	4.3609260+00	-4.6603454+00	-2.2038206+00	-9.0476907+02
W-DOT NAV	-3.3727763+02	-4.0576676+02	-1.3012104+04	-1.6012061+00	-2.1613492+00	-5.4073536+01	3.4059163+02
WT	-5.3344689+03	-9.4621752+05	8.5970694+02	1.3265027+03	2.1198225+01	3.2177210+01	3.0724127+00

	V NAV	W NAV	U-DOT NAV	V-DOT NAV	W-DOT NAV	WT
V NAV	4.1751454+06					
W NAV	7.6526500+04	2.8724691+06				
U-DOT NAV	-1.5037345+03	4.1192751+02	1.3894937+01			
V-DOT NAV	1.3703795+03	4.5511812+02	-5.1460963+00	4.7340671+00		
W-DOT NAV	3.7533704+02	1.3024614+04	1.8055100+00	2.1982462+00	6.0390939+01	
WT	-7.0470433+05	-4.0655639+00	-1.3226465-01	-1.4934728-01	-1.7078635-01	1.6402447+05

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TABLE VII - A

LINEAR ERROR ANALYSIS

RSS DATA AT INSERTION (EVENT)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT-PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	OMS PROP LB
PLATFORM ALINE										
AZIMUTH	393.	502.	9663.	.5	.003	1.3	19.4	.0	-0.	-0.
TILT	2429.	-3152.	3.	-5.6	.007	3.3	-.1	-.0	-0.	-0.
ROLL	-76.	-165.	-1643.	-.0	-.001	-.2	-2.0	-.0	0.	0.
DRIFT BIAS										
X	20.	151.	697.	.1	.000	.1	1.6	.0	-0.	-0.
Y	556.	-465.	-7.	-1.0	.003	1.2	-.0	.0	-0.	-0.
Z	-11.	-109.	-140.	-.0	-.000	-.0	-.2	-.0	0.	0.
G-SENS IA DRIFT										
X	26.	82.	1000.	.1	.000	.1	2.2	.0	-0.	-0.
Y	-15.	-35.	-0.	.0	-.000	-.0	-.0	-.0	0.	0.
Z	-18.	-46.	-221.	.0	-.000	-.1	-.3	-.0	0.	0.
G-SENS SA DRIFT										
X	-12.	67.	-12.	.0	-.000	-.0	-.0	.0	-0.	-0.
Y	1233.	-1030.	-19.	-2.2	.006	2.8	-.1	-.0	0.	0.
Z	-13.	-32.	-299.	-.0	-.000	-.0	-.4	-.0	0.	0.
G-SENS OA DRIFT										
X	51.	152.	1396.	.1	.000	.2	3.5	.0	-0.	-0.
Y	836.	-778.	-8.	-1.6	.003	1.5	-.0	.0	-0.	-0.
Z	-10.	64.	1.	.0	-.000	-.0	.0	.0	-0.	-0.
G-SG SEN DRIFT										
X	-2.	-16.	-6.	.0	-.000	-.0	-.0	-.0	0.	0.
Y	-22.	-78.	-0.	.0	-.000	-.1	-.0	-.0	0.	0.
Z	-14.	-68.	-268.	-.0	-.000	-.1	-.4	-.0	0.	0.
ACCEL BIAS										
X	-1310.	7064.	19.	1.8	-.007	-3.1	.0	.2	-9.	-9.
Y	-48.	686.	1199.	.1	.000	.2	2.8	.0	-1.	-1.
Z	-766.	-18367.	41.	-2.6	-.007	-3.1	.1	-.7	25.	25.
ACCEL SCALE FAC										
X	-629.	381.	9.	.7	-.003	-1.3	-.0	-.0	0.	0.
Y	-14.	94.	-5.	.0	-.000	-.0	-.0	.0	-0.	-0.
Z	-801.	-2246.	42.	-2.2	-.008	-3.4	.1	-.1	1.	1.
ACCEL IA ALINE										
- OA										
X	1.	-82.	1.	.0	-.000	-.0	.0	-.0	0.	0.
Y	103.	46.	2414.	.1	.001	.3	4.8	.0	0.	0.
Z	-737.	71.	45.	-1.2	-.006	-2.7	.0	.0	-1.	-1.
- SA										
X	-2569.	2055.	43.	3.0	-.012	-5.2	.1	.0	-1.	-1.
Y	55.	-0.	1231.	.0	.000	.1	1.5	-.0	0.	0.
Z	-7.	-129.	-0.	.0	-.000	-.0	.0	-.0	0.	0.
PERFORMANCE										
PES ACT	-326.	-30901.	-12.	.5	-.003	-1.2	-.0	1.9	-3.	-3.
S ISP	466.	-13417.	113.	-.8	.009	1.9	.4	.2	12.	12.
S PROP	125.	-3474.	33.	-.2	.001	.5	.1	.1	3.	3.
S INERT	116.	-3461.	32.	-.2	.001	.5	.1	.1	3.	3.
O THRST	-512.	29744.	-62.	.8	-.004	-1.9	-.2	3.7	-6.	-6.
O ISP	-762.	-2913.	-236.	1.6	-.008	-3.6	-.9	-.6	-6.	-6.
O INERT	419.	31391.	79.	-.0	.002	.9	.3	1.5	1171.	-44.
ET INERT	157.	-1110.	35.	-.3	.001	.6	.1	.1	3.	3.
ET PROP	-188.	-9993.	-63.	.3	-.002	-.7	-.2	-2.1	-3.	-3.
AERODYNAMIC										
AA FM	193.	-3279.	38.	-.2	.001	.6	.1	.1	3.	3.
B DRAG	170.	-5110.	44.	-.3	.002	.7	.2	.1	4.	4.
RSS =	4606.	59783.	10419.	8.5	.024	10.8	20.9	5.0	1171.	55.

TABLE VII - B

COVARIANCE MATRIX

AT INSERTION

	U ACT	V ACT	W ACT	U-DOT ACT	V-DOT ACT	W-DOT ACT	U NAV
U ACT	2.3570195+06						
V ACT	-5.5750307+05	3.9710814+06					
W ACT	5.0431849+05	6.7712391+05	1.2061562+07				
U-DOT ACT	5.0277347+03	-4.7855609+05	8.7250800+02	5.8964948+02			
V-DOT ACT	-3.0990163+03	1.2307626+04	5.5288549+02	-1.9613364+01	8.0971414+00		
W-DOT ACT	1.0049055+03	1.3202409+03	2.4045156+04	2.0378344+00	1.0521378+00	4.8331591+01	
U NAV	-2.1344774+06	1.1452745+06	-4.8226444+05	-5.7746228+03	2.7839807+03	-9.5188913+02	2.1558483+06
V NAV	1.3697611+04	-4.7209421+06	-2.6858613+05	7.3737298+03	-3.8891189+03	-5.6553717+02	-1.4037691+06
W NAV	-4.5655249+05	-6.4456033+05	-1.2120163+07	-7.4563585+02	-6.2254856+02	-2.4151573+04	4.7990155+05
U-DOT NAV	-6.0925761+03	3.5025327+03	-1.2879795+03	-1.6497576+01	8.2869387+00	-2.5417410+00	6.1094736+03
V-DOT NAV	2.7274887+03	-1.0575455+04	-5.6274499+02	1.6311028+01	-7.5728252+00	-1.2275453+00	-2.7948104+03
W-DOT NAV	-8.9615195+02	-1.3117691+03	-2.4264792+04	-1.4375843+00	-1.3096802+00	-4.8732214+01	9.4267944+02
WT	5.5403354+04	3.9915626+06	1.0173252+04	-4.6969849+03	-7.1040798+01	3.8596999+01	7.8990851+00

	V NAV	W NAV	U-DOT NAV	V-DOT NAV	W-DOT NAV	WT
V NAV	2.6072570+06					
W NAV	2.6087301+05	1.2189811+07				
U-DOT NAV	-4.2199955+03	1.2824756+03	1.7471436+01			
V-DOT NAV	3.9137001+03	5.8042620+02	-8.3353935+00	7.6085246+00		
W-DOT NAV	5.5760013+02	2.4412299+04	2.5193580+00	1.2178567+00	4.9285937+01	
WT	3.9219255+03	4.7027803+02	7.3003791-01	9.5676597+00	9.2512227-01	1.5242261+05

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE VIII - A

LINEAR ERROR ANALYSIS

RSS DATA AT 779.3 SEC (NOMINAL INSERTION + 25 SEC)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT-PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	OMS P L
PLATFORM ALINE										
AZIMUTH	425.	220.	10193.	.5	.003	1.3	19.0	.0	-0.	-0
TILT	2509.	-3239.	2.	-5.7	.007	3.1	-.1	.0	-0.	-0
ROLL	-81.	-41.	-1694.	-.0	-.001	-.2	-2.0	.0	0.	0
DRIFT BIAS										
X	21.	22.	686.	.1	.000	.1	1.5	-.0	-0.	-0
Y	585.	-507.	-7.	-1.1	.002	1.1	-.0	-.0	-0.	-0
Z	-11.	-1.	-144.	.0	-.000	-.0	-.2	.0	0.	0
G-SENS IA DRIFT										
X	24.	32.	1055.	.1	.000	.1	2.2	.0	-0.	-0
Y	-15.	10.	0.	.0	-.000	-.0	-.0	.0	0.	0
Z	-23.	-0.	-228.	.0	-.000	-.1	-.3	.0	0.	0
G-SENS SA DRIFT										
X	-13.	6.	-13.	.0	-.000	-.0	-.0	.0	-0.	-0
Y	1302.	-1036.	-20.	-2.3	.006	2.7	-.1	.0	0.	0
Z	-14.	-7.	-309.	-.0	-.000	-.0	-.4	.0	0.	0
G-SENS OA DRIFT										
X	56.	47.	1483.	.1	.000	.2	3.5	-.0	-0.	-0
Y	675.	-864.	-8.	-1.7	.003	1.4	-.0	.0	-0.	-0
Z	-11.	5.	1.	.0	-.000	-.0	.0	.0	-0.	-0
G-SQ SEN DRIFT										
X	-2.	1.	-6.	.0	-.000	-.0	-.0	-.0	0.	0
Y	-23.	14.	-0.	.0	-.000	-.1	-.0	.0	0.	0
Z	-15.	-6.	-277.	-.0	-.000	-.1	-.4	.0	0.	0
ACCEL BIAS										
X	-1913.	1195.	20.	2.0	-.007	-3.1	.0	.0	-9.	-9
Y	49.	22.	1269.	.1	.000	.2	2.5	-.0	-1.	-1
Z	-759.	-345.	43.	-2.6	-.007	-3.2	.1	-.0	25.	25
ACCEL SCALE FAC										
X	-860.	835.	9.	.7	-.003	-1.3	-.0	.0	0.	0
Y	-15.	8.	-5.	.0	-.000	-.0	-.0	-.0	-0.	-0
Z	-680.	-513.	43.	-2.1	-.008	-3.6	.1	.0	1.	1
ACCEL IA ALINE										
- OA										
X	1.	-9.	1.	.0	-.000	-.0	.0	-.0	0.	0
Y	112.	44.	2533.	.1	.001	.3	4.8	.0	0.	0
Z	-607.	-138.	46.	-1.1	-.006	-2.8	.0	-.0	-1.	-1
- SA										
X	-2699.	2069.	95.	3.2	-.011	-5.1	.1	-.0	-1.	-1
Y	56.	17.	1266.	.0	.000	.1	1.5	-.0	0.	0
Z	-7.	3.	-0.	.0	-.000	-.0	.0	.0	0.	0
PERFORMANCE										
WED ACT	-700.	-79242.	-12.	.8	-.003	-1.6	-.0	-.0	-3.	-3
S ISP	483.	-19481.	124.	-.6	.004	1.6	.4	-.0	12.	12
S PROP	132.	-5304.	36.	-.2	.001	.5	.1	.0	3.	3
S INERT	120.	-5141.	35.	-.2	.001	.5	.1	.0	3.	3
O THRST	-1676.	-66389.	-67.	1.4	-.005	-2.4	-.2	.0	-6.	-6
O ISP	-986.	12531.	-258.	1.6	-.008	-3.4	-.9	-.0	-6.	-6
O INERT	279.	-7489.	86.	-.4	.001	.7	.3	-.0	1171.	-4
ET INERT	163.	-3435.	39.	-.3	.001	.6	.1	-.0	3.	3
ET PROP	-3.	43553.	-70.	.1	-.001	-.9	-.2	.0	-3.	-3
AERODYNAMIC										
AX FN	146.	-5545.	42.	-.2	.001	.5	.1	-.0	3.	3
B DRAG	183.	-7600.	48.	-.3	.002	.7	.2	.0	4.	4
RSS =	4937.	115544.	10933.	6.7	.024	10.8	20.5	.0	1171.	55

TABLE VIII - B

COVARIANCE MATRIX

AT NOMINAL INSERTION + 25 SEC

	U ACT	V ACT	W AC	U-DOT ACT	V-DOT ACT	W-DOT ACT	U NAV
U ACT	2.7085243+06						
V ACT	9.0395875+06	1.4833730+09					
W ACT	5.7291875+05	-2.6214670+05	1.3282058+07				
U-DOT ACT	-5.4181187+03	-1.7761949+00	2.1442055+03	2.1395910+03			
V-DOT ACT	-3.3773507+03	2.1971003+03	5.2622623+02	-7.4313111+00	8.3975153+00		
W-DOT ACT	1.1270310+03	-1.0622906+03	2.4772000+04	5.6569926+00	9.2775925-01	4.6561859+01	
U NAV	-2.3746960+06	1.4554655+06	-5.4850255+05	-6.9143261+03	3.0084900+03	-1.0138039+03	2.3803974+06
V NAV	1.5660700+06	-2.1151630+00	-2.8138497+05	4.2755839+03	-4.2199492+03	-5.5517278+02	-1.5877222+06
W NAV	-5.1990069+05	-3.0711275+05	-1.3348871+07	-1.2819458+03	-6.0614569+02	-2.4885770+04	5.4572497+05
U-DOT NAV	-6.4660290+03	5.4775580+03	-1.4070239+03	-1.8866772+01	8.6374975+00	-2.5997889+00	6.4943472+03
V-DOT NAV	2.9550876+03	-3.8567772+03	-5.6120126+02	8.1899884+00	-7.7063829+00	-1.1088249+00	-3.0197654+03
W-DOT NAV	-7.5100821+02	-5.7681812+02	-2.4999280+04	-2.3721858+00	-1.1751517+00	-4.6950549+01	1.0038491+03
WT	3.0307089+04	-9.6456063+05	1.1076240+04	1.2530709+03	-7.0421794+01	3.8273791+01	2.2874380+02

	V NAV	W NAV	U-DOT NAV	V-DOT NAV	W-DOT NAV	WT
V NAV	2.3617989+06					
W NAV	2.7956305+05	1.3428865+07				
U-DOT NAV	-4.6074826+03	1.4006383+03	1.7872042+01			
V-DOT NAV	4.2477266+03	5.5676173+02	-6.6870424+00	7.8257189+00		
W-DOT NAV	5.4934621+02	2.5157510+04	2.5765237+00	1.1018693+00	4.7489243+01	
WT	4.1664370+03	5.0533905+02	1.0770442+00	9.4133456+00	6.8384991-01	1.5242261+05

TABLE IX - A

LINEAR ERROR ANALYSIS

RSS DATA AT 3505.6 SEC (10 SEC PRIOR TO END OF NOMINAL COAST)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT-PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	OMS PR LB
PLATFORM ALINE										
AZIMUTH	2812.	-12598.	-11738.	-2.4	-.003	-1.4	-17.9	.0	-0.	-0.
TILT	-11883.	9991.	2.	11.4	-.005	-2.3	.1	.0	-0.	-0.
ROLL	-310.	1755.	1863.	.3	.001	.2	1.7	.0	0.	0.
DRIFT BIAS										
X	2904	-1333.	-814.	-.3	-.000	-.0	-1.4	.0	-0.	-0.
Y	-1896.	-1017.	9.	1.9	-.002	-1.3	.0	.0	-0.	-0.
Z	-30.	241.	160.	.0	.000	.0	.2	.0	0.	0.
G-SENS IA DRIFT										
X	367.	-1288.	-1237.	-.3	-.009	-.1	-2.0	.0	-0.	-0.
Y	29.	105.	-0.	-.0	.000	.0	.0	.0	0.	0.
Z	-5.	292.	253.	-.0	.000	.1	.3	.0	0.	0.
G-SENS SA DRIFT										
X	51.	63.	15.	-.1	.000	.0	.0	.0	-0.	-0.
Y	-3999.	-3442.	25.	4.0	-.005	-2.4	.1	.0	0.	0.
Z	-42.	305.	3*3.	.0	.000	.0	.4	.0	0.	C.
G-SENS OA DRIFT										
X	612.	-2366.	-1773.	-.5	-.001	-.2	-3.2	.0	-0.	-0.
Y	-3074.	-251.	11.	3.0	-.003	-1.2	.0	.0	-0.	-0.
Z	45.	45.	-1.	-.0	.000	.0	-.0	.0	-0.	-0.
G-SQ SEN DRIFT										
X	-4	47.	7.	.0	.000	.0	.0	.0	0.	0.
Y	35.	170.	0.	-.0	.009	.0	.0	.0	0.	0.
Z	-47.	340.	309.	.0	.000	.1	.3	.0	0.	0.
ACCEL BIAS										
X	2535.	8992.	-23.	-2.8	.006	2.8	-.0	.0	-9.	-9.
Y	447.	-1785.	-1503.	-.4	-.000	-.2	-2.6	.0	-1.	-1.
Z	-11064.	40410.	-50.	9.5	.008	3.6	-.1	.0	25.	25.
ACCEL SCALE FAC										
X	-25.	7501.	-9.	-.3	.003	1.2	.0	.0	0.	0.
Y	60.	63.	5.	-.1	.000	.0	-.0	.0	-0.	-0.
Z	-9471.	37799.	-48.	8.1	.009	3.9	-.1	.0	1.	1.
ACCEL IA ALINE										
- OA										
X	25.	-3.	-1.	-.0	.009	.0	-.0	.0	0.	0.
Y	672.	-3118.	-2933.	-.6	-.001	-.4	-4.4	.0	0.	0.
Z	-5961.	26568.	-50.	5.0	.007	3.0	-.0	.0	-1.	-1.
- SA										
X	2952.	18982.	-1.	-3.6	.011	4.7	-.1	.0	-1.	-1.
Y	457.	-1275.	-1374.	-.2	-.000	-.1	-1.3	.0	0.	0.
Z	-16.	157.	0.	.0	.009	.0	-.0	.0	0.	0.
PERFORMANCE										
AEB ACT	1313.	-76[illegible].	13.	-1.2	.003	1.3	.0	.0	-3.	-3.
S ISP	-1525.	-23490.	-156.	1.5	-.004	-1.7	-.4	.0	12.	12.
S PROP	-416.	-6361.	-47.	.4	-.001	-.5	-.1	.0	3.	3.
S INERT	-419.	-6047.	-45.	.4	-.001	-.4	-.1	.0	3.	3.
U THRST	.656.	-61252.	85.	-2.1	.005	2.2	.2	.0	-6.	-6.
U ISP	2706.	20167.	331.	-2.8	.007	3.2	.8	.0	-6.	-6.
U INERT	-511.	-9252.	-110.	.6	-.001	-.6	-.3	.0	1171.	-44.
ET INERT	-514.	-4710.	-50.	.5	-.001	-.6	-.1	.0	3.	3.
ET PROP	287.	44459.	89.	-.3	.001	.4	.2	.0	-3.	3.
AERODYNAMIC										
A FN	-419.	-6789.	-54.	.4	-.001	-.5	-.1	.0	3.	3.
D DRAG	-582.	-9098.	-62.	.6	-.001	-.6	-.2	.0	4.	4.
RSS =	21400.	131945.	12645.	19.6	.023	10.3	18.8	.0	1171.	55.

TABLE I' - B

COVARIANCE MATRIX

AT 10 SEC PRIOR END OF NOMINAL COAST

	U ACT	V ACT	W ACT	U-DOT ACT	V-DOT ACT	W-DOT ACT	U NAV
U ACT	5.0884680+07						
V ACT	-1.2179154+06	1.9343816+09					
W ACT	-3.9970727+05	1.9570300+07	1.7765186+07				
U-DOT ACT	1.4258615+05	-2.2478742+06	-2.0947147+04	2.6227471+03			
V-DOT ACT	-4.5706311+04	9.6401601+04	3.2332200+03	-1.1482128+02	4.1396261+01		
W-DOT ACT	-5.9597730+03	3.0814941+04	2.6239546+03	-3.2997481+01	4.7776000+00	3.9173668+01	
U NAV	-4.9130590+07	1.1373544+08	4.0071212+06	-1.3131549+05	4.3740902+04	6.1722536+03	4.9121817+07
V NAV	1.1160994+06	-4.9570059+05	-1.0549778+07	5.3357471+05	-9.0583856+04	-2.7623123+03	-1.1120986+06
W NAV	4.1403579+06	-1.6249727+07	-1.7862733+07	1.7506666+04	-3.4918276+03	-2.6421600+04	-4.0460832+06
U-DOT NAV	-1.1658559+05	5.3209091+05	1.9841252+04	-6.7592377+02	-1.0577970+02	2.9784670+01	1.2010353+05
V-DOT NAV	4.3964494+04	-9.2727301+04	-3.3178362+03	1.0838040+02	-3.9704596+01	-5.9473528+00	-4.3969511+04
W-DOT NAV	6.2729473+03	-2.7269491+04	-2.6537004+04	2.9307066+01	-5.1006578+00	-3.9510612+01	-6.1211736+03
RT	-1.0808277+05	-1.1039040+06	-1.4257479+04	1.2292016+03	1.1583306+02	-3.6300109+01	3.2109622+04

	V NAV	W NAV	U-DOT NAV	V-DOT NAV	W-DOT NAV	RT
V NAV	4.8445596+08					
W NAV	1.8457084+07	1.7981936+07				
U-DOT NAV	-5.1992250+05	-1.7742612+04	5.6124994+02			
V-DOT NAV	9.0387168+04	3.3027374+03	-1.0562175+02	3.9753815+01		
W-DOT NAV	2.7574290+04	2.6723254+04	-2.9521719+01	5.0073454+00	3.9982730+01	
RT	-9.8019029+04	-6.1106104+02	1.0902827+02	-2.7621531+01	-7.6901387-01	1.6292261+05

TABLE X - A

LI-CAN ERROR ANALYSIS

RSS DATA AT 3624.4 SEC (END OF NOMINAL DE-ORBIT BURN + 25 SEC)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT-PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	OMS PROP LB
PLATFORM ALINE										
AZIMUTH	2627.	-13236.	-13699.	-2.1	-.004	-1.7	-15.5	-.0	1.	1.
TILT	-12108.	13043.	9.	11.8	-.003	-1.4	.0	-.0	2.	2.
ROLL	-292.	1824.	2052.	.2	.000	.2	1.4	-.0	0.	0.
DRIFT BIAS										
X	471.	-1100.	-971.	-.2	-.000	-.2	-1.2	.0	1.	1.
Y	-2316.	-509.	11.	2.1	-.002	-1.0	.0	.0	1.	1.
Z	-26.	246.	183.	.0	.000	.0	.2	-.0	0.	0.
G-SENS IA DRIFT										
X	344.	-1372.	-1462.	-.3	-.001	-.3	-1.8	-.0	1.	1.
Y	32.	97.	-0.	-.0	.000	.0	-.0	-.0	0.	0.
Z	1.	291.	282.	-.0	.000	.0	.2	-.0	0.	0.
G-SENS SA DRIFT										
X	46.	51.	18.	-.0	-.000	-.1	.0	-.0	1.	1.
Y	-4265.	-2363.	31.	4.4	-.005	-2.1	.0	.0	2.	2.
Z	-38.	314.	383.	.0	.000	.0	.3	-.0	0.	0.
G-SENS OA DRIFT										
X	575.	-2507.	-2140.	-.4	-.001	-.4	-2.9	-.0	1.	1.
Y	-3208.	562.	14.	3.2	-.002	-1.0	.0	.0	1.	1.
Z	49.	35.	-1.	.0	-.000	-.1	-.0	-.0	1.	1.
G-SW SEN DRIFT										
X	-3.	47.	9.	.0	.000	.0	.0	.0	0.	0.
Y	38.	160.	0.	-.0	.000	.0	-.0	-.0	0.	0.
Z	-92.	349.	347.	.0	.000	.0	.3	.0	0.	0.
ACCEL BIAS										
X	2670.	8265.	-27.	-3.6	.006	2.8	-.1	.0	-16.	-16.
Y	415.	-1684.	-1795.	-.3	-.001	-.3	-2.3	-.0	-0.	-0.
Z	-10531.	42695.	-59.	9.0	.012	6.2	-.1	.0	24.	24.
ACCEL SCALE FAC										
X	99.	7447.	-10.	-.4	.002	.9	-.0	-.0	2.	2.
Y	55.	49.	-4.	-.0	-.000	-.1	-.0	.0	1.	1.
Z	-9019.	39965.	-54.	7.6	.009	3.8	-.1	.0	5.	5.
ACCEL IA ALINE - OA										
X	26.	-10.	-1.	-.0	-.000	-.0	.0	-.0	0.	0.
Y	627.	-3270.	-3423.	-.5	-.001	-.4	-3.9	.0	0.	0.
Z	-5625.	27932.	-52.	4.7	.006	2.8	-.1	-.0	1.	1.
- SA										
X	3459.	18057.	-58.	-4.1	.009	3.8	-.1	.0	0.	0.
Y	238.	-1332.	-1536.	-.2	-.000	-.2	-1.1	.0	0.	0.
Z	-16.	140.	-0.	.0	-.000	-.0	-.0	-.0	0.	0.
PERFORMANCE										
WEB ACT	1353.	-76418.	8.	-.6	-.000	-.1	-.0	.0	14.	14.
S ISP	-1395.	-23347.	-167.	.0	.008	3.6	.2	-.0	-29.	-29.
S PROP	-382.	-6239.	-49.	.0	.002	1.0	.1	.0	-8.	-8.
S INERT	-381.	-5926.	-47.	.0	.002	1.0	.1	-.0	-7.	-7.
O THRST	1604.	-61137.	92.	-.6	-.004	-2.0	-.1	.0	32.	32.
O ISP	2563.	19375.	343.	-.2	-.013	-6.9	-.4	-.0	66.	66.
O INERT	-443.	-6636.	-112.	-.0	.003	1.3	.1	.0	1139.	-76.
ET INERT	-475.	-4562.	-52.	.0	.003	1.1	.1	.0	-9.	-9.
ET PROP	417.	44024.	92.	.2	-.004	-1.9	-.1	.0	9.	9.
AERODYNAMIC										
AX FR	-385.	-6662.	-57.	.0	.002	1.0	.1	.0	-8.	-8.
D DRAG	-532.	-6929.	-65.	.0	.003	1.4	.1	-.0	-11.	-11.
RSS =	21100.	133300.	14796.	19.2	.027	12.1	16.6	.0	1192.	111.

TABLE X - B

C VARIANCE MATRIX

AT END OF NOMINAL DE-ORBIT BURN + 28 SEC

	U ACT	V ACT	W ACT	U-DOT ACT	V-DOT ACT	W-DOT ACT	U NAV
U ACT	4.9465941+07						
V ACT	-1.2820791+06	1.9743326+07					
W ACT	-4.3993500+06	2.3787556+07	2.4158969+07				
U-DOT ACT	1.9212388+05	-2.2698307+06	-2.5587200+04	2.6712300+03			
V-DOT ACT	-4.3392437+04	9.7224273+04	3.4753657+03	-1.1067021+02	3.9440409+01		
W-DOT ACT	-5.3152573+03	2.3425673+04	2.7114071+04	-2.4011870+01	3.9683826+00	3.0734439+01	
U NAV	-4.7937261+07	1.1879252+06	4.4567946+05	-1.3408274+05	4.3162866+04	4.9727873+03	4.7945044+07
V NAV	1.1001661+06	-5.4974710+06	-2.2701806+07	6.0760765+05	-9.3220404+04	-2.5172197+04	-1.1649766+06
W NAV	4.5450707+06	-2.2454424+07	-2.4202631+07	2.3643886+04	-3.4803782+03	-2.7310302+04	-4.4402866+06
U-DOT NAV	-1.3150859+05	5.6660805+05	2.4216875+04	-6.2724532+02	1.0650062+02	2.6621519+01	1.3121761+05
V-DOT NAV	4.3179655+04	-9.5257773+04	-3.4875997+03	1.0761730+02	-3.9425036+01	-3.9222230+00	-4.3170201+04
W-DOT NAV	5.1303380+03	-2.5004972+04	-2.6955843+04	2.6446923+01	-3.9471010+00	-3.0405037+01	-5.0049731+03
WT	-7.3662562+04	-1.0588400+06	-1.2447246+04	1.3689031+04	3.9494154+01	1.0714657+01	3.9017193+04

	V NAV	W NAV	U-DOT NAV	V-DOT NAV	W-DOT NAV	WT
V NAV	5.3830787+06					
W NAV	2.2665734+07	2.4429834+07				
U-DOT NAV	-5.7440472+05	-2.4115945+04	6.1514603+02			
V-DOT NAV	9.3256666+04	3.4754578+03	-1.0654690+02	3.9450836+01		
W-DOT NAV	2.5270856+04	2.7122714+04	-2.6910936+01	3.9341602+00	3.0272269+01	
WT	-1.1612256+06	1.7676755+03	1.2867773+02	-3.4792575+01	2.3641747+00	1.4484243+06

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TABLE XI - A

LINEAR ERROR ANALYSIS

RSS DATA AT 3798.4 SEC (10 MIN PRIOR TO NOMINAL ENTRY INTERFACE)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT-PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	OMS PROP LB
PLATFORM ALINE										
AZIMUTH	2322.	-14061.	-16077.	-1.7	-.004	-1.8	-11.8	.0	1.	1.
TILT	-12204.	17584.	15.	11.9	.001	.4	.0	.0	2.	2.
ROLL	-254.	1912.	2256.	.2	.001	.2	.9	.0	0.	0.
DRIFT BIAS										
X	233.	-1160.	-1161.	-.2	-.001	-.2	-1.0	.0	1.	1.
Y	-2157.	296.	14.	2.2	-.001	-.6	.0	.0	1.	1.
Z	-20.	252.	217.	.0	.000	.0	.2	.0	0.	0.
G-SENS IA DRIFT										
X	299.	-1476.	-1790.	-.2	-.001	-.3	-1.9	.0	1.	1.
Y	33.	65.	-1.	-.0	.000	.0	-.0	.0	0.	0.
Z	6.	208.	316.	-.0	.000	.0	.2	.0	0.	0.
G-SENS SA DRIFT										
X	29.	45.	22.	.0	-.000	-.1	.0	.0	1.	1.
Y	-4564.	-655.	38.	4.8	-.003	-1.3	.0	.0	2.	2.
Z	-32.	326.	427.	.0	.000	.0	.2	.0	0.	0.
G-SENS OA DRIFT										
X	505.	-2663.	-2603.	-.4	-.001	-.4	-2.4	.0	1.	1.
Y	-3390.	1813.	17.	3.4	-.001	-.5	.0	.0	1.	1.
Z	24.	30.	-2.	.0	-.000	-.1	-.0	.0	1.	1.
G-SQ SEN DRIFT										
X	-3.	48.	10.	.0	.000	.0	.0	.0	0.	0.
Y	39.	145.	0.	-.0	.000	.0	-.0	.0	0.	0.
Z	-37.	362.	390.	.0	.000	.0	.2	.0	0.	0.
ACCEL BIAS										
X	3295.	6967.	-36.	-4.0	.005	2.1	-.1	.0	-16.	-16.
Y	355.	-2009.	-2162.	-.2	-.001	-.4	-1.9	.0	-0.	-0.
Z	-9551.	46357.	-78.	7.8	.014	6.1	-.1	.0	24.	24.
ACCEL SCALE FAC										
X	240.	7324.	-13.	-.5	.002	.7	-.0	.0	2.	2.
Y	38.	40.	3.	.0	-.000	-.1	-.0	.0	1.	1.
Z	-6284.	42956.	-73.	6.8	.011	4.7	-.1	.0	5.	5.
ACCEL IA ALINE										
- OA										
X	24.	-18.	-1.	-.0	-.000	-.0	.0	.0	0.	0.
Y	556.	-3468.	-4018.	-.4	-.001	-.4	-2.9	.0	0.	0.
Z	-5106.	29753.	-61.	4.1	.007	3.2	-.0	.0	1.	1.
- SA										
X	4353.	16472.	-72.	-4.9	.007	2.9	-.1	.0	0.	0.
Y	209.	-1405.	-1689.	-.1	-.000	-.2	-.7	.0	0.	0.
Z	-18.	147.	-0.	.0	-.000	-.0	-.0	.0	0.	0.
PERFORMANCE										
AEB ACT	1342.	-76651.	6.	-.6	-.000	-.0	-.0	.0	.4.	19.
S ISP	-795.	-22896.	-128.	-.7	.007	3.2	.2	.0	-29.	-29.
S PROP	-220.	-6182.	-38.	-.2	.002	.9	.1	.0	-8.	-8.
S INERT	-220.	-5869.	-36.	-.2	.002	.9	.1	.0	-7.	-7.
D THRST	1474.	-61476.	70.	-.3	-.004	-1.7	-.1	.0	32.	32.
D ISP	1536.	18992.	262.	1.0	-.012	-5.2	-.1	.0	66.	56.
D INERT	-272.	-8768.	-86.	-.3	.003	1.2	.	.0	1139.	-76.
ET INERT	-290.	-4490.	-40.	-.2	.002	1.0		.0	-9.	-9.
ET PROP	-96.	44037.	69.	.6	-.004	-1.7		.0	9.	9.
AERODYNAMIC										
AX FN	-221.	-6605.	-43.	-.8	.002	.9	.1	.0	-8.	-8.
D DRAG	-337.	-6649.	-50.	-.3	.003	1.2	.1	.0	-11.	-11.
RSS =	20293.	136246.	17291.	18.7	.027	11.8	12.7	.0	1142.	111.

TABLE XI - B

COVARIANCE MATRIX

AT 10 MIN PRIOR TO NOMINAL ENTRY INTERFACE

	U ACT	V ACT	W ACT	U-DOT ACT	V-DOT ACT	W-DOT ACT	U NAV
U ACT	4.5756326+07						
V ACT	-1.3694222+06	2.0625309+09					
W ACT	-4.0560661+06	2.8962904+07	3.3220524+07				
U-DOT ACT	1.4995501+05	-2.3854575+06	-3.0073377+04	2.7728191+03			
V-DOT ACT	-3.9605627+04	9.5009899+04	3.3153906+03	-1.0641338+02	3.6619431+01		
W-DOT ACT	-3.5930315+03	1.0830579+04	2.4228343+04	-1.8598093+01	2.3418534+00	1.7891129+01	
U NAV	-4.5023692+07	1.2263106+06	4.6513234+06	-1.3567921+05	4.0048361+04	-3.3676242+03	4.5009878+07
V NAV	1.2767729+06	-6.3201597+09	-2.8286017+07	6.7361213+05	-9.2163867+04	-2.0275670+04	-1.2155741+06
W NAV	4.7215866+06	-2.7974704+07	-3.3337435+07	2.9430618+04	-3.2738416+03	-2.4359780+04	-4.6400538+06
U-DOT NAV	-1.2362632+05	6.7231305+05	3.0020252+04	-7.1740002+02	1.0218866+02	2.1529860+01	1.3330461+05
V-DOT NAV	4.0057713+04	-9.4602731+04	-3.3200047+03	1.0446755+02	-3.6531120+01	-2.4356849+00	-4.0069605+04
W-DOT NAV	3.4640271+03	-2.0260506+04	-2.3495973+04	2.1321806+01	-2.4166571+00	-1.7650079+01	-3.4040378+03
WT	-5.3809183+04	-1.0406039+06	-1.0287414+04	1.3422926+03	1.9607724+01	1.3736743+01	3.7190015+04

	V NAV	W NAV	U-DOT NAV	V-DOT NAV	W-DOT NAV	WT
V NAV	6.1980462+08					
W NAV	2.6207730+07	3.3468042+07				
U-DOT NAV	-6.5934422+05	-2.9937801+04	7.0219434+02			
V-DOT NAV	9.2337661+04	3.3127901+03	-1.0233643+02	3.6642297+01		
W-DOT NAV	2.0407150+04	2.4092100+04	-2.1667095+01	2.4454435+00	1.7459606+01	
WT	-1.2985960+05	2.0931433+03	1.4049732+02	-3.1930046+01	1.8526330+00	1.4464243+05

TABLE XII - A

LINEAR ERROR ANALYSIS

RSS DATA AT ENTRY INTERFACE (EVENT)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT-PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	OMS PROP LB
PLATFORM ALINE										
AZIMUTH	-318.	69461.	-18564.	1.3	-.005	-2.3	4.0	3.3	1.	1.
TILT	-10417.	-721449.	31.	-9.9	.024	10.6	.0	-29.4	2.	2.
ROLL	16.	-6272.	2191.	-.1	.001	.3	-1.1	-.3	0.	0.
DRIFT BIAS										
X	-21.	6236.	-1399.	.2	-.001	-.2	.2	.3	1.	1.
Y	-167.	-151461.	17.	-.8	.004	1.7	-.0	-6.0	1.	1.
Z	0.	-41.	256.	-.0	.000	.0	-.0	-.0	0.	0.
G-SENS IA DRIFT										
X	-32.	9030.	-2076.	.2	-.001	-.3	.3	.4	1.	1.
Y	-10.	2599.	-2.	.0	-.000	-.0	-.0	.1	0.	0.
Z	-4.	1633.	324.	-.0	.000	.0	-.1	.1	0.	0.
G-SENS SA DRIFT										
X	-4.	-138.	25.	.1	-.000	-.0	-.0	-.0	1.	1.
Y	-1649.	-322864.	50.	-1.7	.008	3.6	-.0	-12.8	2.	2.
Z	1.	-470.	433.	-.0	.000	.0	-.2	-.0	0.	0.
G-SENS OA DRIFT										
X	-50.	15307.	-3254.	.3	-.001	-.5	.3	.7	1.	1.
Y	-561.	-215738.	22.	-1.2	.006	2.6	-.0	-8.6	1.	1.
Z	-4.	-256.	-2.	.1	-.000	-.0	-.0	-.0	1.	1.
G-SQ SEN DRIFT										
X	-1.	20.	13.	-.0	.000	.0	-.0	-.0	0.	0.
Y	-10.	2645.	-1.	.0	-.000	-.0	-.0	.1	0.	0.
Z	1.	-742.	403.	-.0	.000	.0	-.2	-.0	0.	0.
ACCEL BIAS										
X	-2264.	263839.	-55.	.7	-.006	-2.6	-.0	10.2	-16.	-16.
Y	-32.	8646.	-2648.	.2	-.001	-.4	.3	.4	-0.	-0.
Z	-1710.	-327499.	-112.	-4.5	.022	9.8	-.0	-14.9	24.	24.
ACCEL SCALE FAC										
X	-154.	43826.	-21.	-.1	-.000	-.2	-.0	1.5	2.	2.
Y	-1.	-179.	-3.	.1	-.000	-.0	-.0	-.0	1.	1.
Z	-1455.	-307020.	-109.	-4.0	.018	8.1	-.0	-13.9	5.	5.
ACCEL IA ALINE										
- OA										
X	-4.	1254.	-0.	.0	-.000	-.0	.0	.1	0.	0.
Y	-55.	16545.	-4694.	.3	-.001	-.6	1.0	.8	0.	0.
Z	-280.	-173542.	-71.	-2.5	.011	5.0	.0	-8.1	1.	1.
- SA										
X	-3762.	351594.	-94.	1.0	-.007	-3.0	.0	13.3	0.	0.
Y	-20.	6322.	-1643.	.1	-.000	-.2	.8	.3	0.	0.
Z	1.	-1091.	-1.	-.0	.000	.0	-.0	-.0	0.	0.
PERFORMANCE										
REQ ACT	6.	-4268.	-3.	.8	-.001	-.9	-.0	2.8	19.	19.
S ISP	-32.	11038.	37.	-1.6	.002	.7	.3	1.3	-29.	-29.
S PROP	-7.	2440.	10.	-.4	.000	.2	.1	.3	-8.	-8.
S INERT	-5.	2721.	10.	-.4	.000	.2	.1	.3	-7.	-7.
D THRST	15.	-7918.	-22.	1.6	-.002	-.7	-.2	2.1	32.	32.
D ISP	33.	-16680.	-78.	2.7	-.003	-1.3	-.6	-1.9	56.	56.
D INERT	-16.	5091.	23.	-.6	.001	.3	.2	.5	1139.	-76.
ST INERT	-10.	3522.	12.	-.5	.001	.2	.1	.3	-9.	-9.
ST PROP	4.	-2101.	-23.	.5	-.001	-.3	-.2	-1.8	9.	9.
AERODYNAMIC										
AX FR	-7.	2296.	12.	-.4	.000	.2	.1	.9	-8.	-8.
D DRAG	-13.	3315.	14.	-.6	.001	.3	.1	.6	-11.	-11.
RSS =	11670.	1061665.	19854.	9.6	.042	18.8	4.4	44.0	1142.	111.

TABLE XII - B

COVARIANCE MATRIX

AT ENTRY INTERFACE

	U ACT	V ACT	W ACT	U-DOT ACT	V-DOT ACT	W-DOT ACT	U NAV
U ACT	1.5133101+07						
V ACT	8.1019835+06	1.2523699+11					
W ACT	7.7717149-05	-1.0670215+06	4.4239083+07				
U-DOT ACT	-9.7199991+05	-1.5310143+08	2.0656842+05	1.8717136+05			
V-DOT ACT	1.2257290+04	-1.6639346+05	6.1109443+02	1.9708015+02	2.1469117+01		
W-DOT ACT	-1.7077222+02	3.6501624+04	-9.4291567+03	-4.5156833+01	-4.4773943-01	2.1781772+00	
U NAV	-1.3406575+07	-1.6621963+09	2.9595204+06	2.0323431+06	2.2765522+03	-6.1984625+02	2.2120813+07
V NAV	6.9047795+07	6.9225205+09	-3.6659083+07	-8.5161932+06	-3.9200650+04	8.2245630+03	-9.4409040+07
W NAV	-7.7427434+05	1.6627976+08	-4.4106615+07	-2.0676372+05	-6.5176482+02	9.4276927+03	-2.9577797+06
U-DOT NAV	-6.2569932+04	-7.0426596+06	4.0049846+04	8.6685208+03	-4.3763599+01	-8.9959555+00	9.6295210+04
V-DOT NAV	1.3249672+04	1.0945207+00	-2.9664563+02	-2.0673882+03	-4.1764022+00	3.1113384-02	-2.2366657+04
W-DOT NAV	1.9777492+02	-3.4039464+04	9.7823243+03	4.2230141+01	1.5110767-01	-2.1789275+03	6.1606226+02
AT	-5.4319766+03	-1.2864871+00	-1.6629454+02	1.6081932+03	-4.1773615+01	1.8455886+01	2.2207909+04

	V NAV	W NAV	U-DOT NAV	V-DOT NAV	W-DOT NAV	AT
V NAV	8.8093088+08					
W NAV	3.6665611+07	4.4135401+07				
U-DOT NAV	-9.3950356+05	-4.0057074+09	1.0036824+03			
V-DOT NAV	7.2249104+04	2.9579904+02	-7.1632881+01	2.3913800+01		
W-DOT NAV	-8.0420549+03	-9.7716095+03	6.7981216+00	-2.3675799-02	2.2810261+00	
AT	-1.6759487+05	2.5983408+03	1.7636825+02	-2.0291892+01	-2.6177163-01	1.4984243+05

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TABLE XIII

Exchange Ratio at Nominal MECO

Parameter Varied	Δ ET Propellant / Δ Parameter	
Web Action Time (constant ISP)	-755.	lb/%
SRB Vacuum ISP (constant $\dot{W}$)	2192.	lb/%
SRB Propellant Loading	1400.	lb/%
SRB Inert Weight	-.10	lb/lb
Orbiter Thrust (constant ISP)	.07	lb/lb*
Orbiter ISP (constant $\dot{W}$)	1083.	lb/sec**
Orbiter Insert Weight	-.06	lb/lb
External Tank Inert Weight	-.06	lb/lb
External Tank Propellant Loading	.06	lb/lb

* Trade factor based on total system thrust variation (LB/3 ENG).

** Trade factor based on total system ISP variation (SEC/3 ENG).

TABLE XIV

RSS SUMMARY DATA (ACTUAL PERTURBED STATE - NOMINAL STATE)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	SSME PROP LB	OMS PROP LB
SRB SEPARATION	2006.	4697.	5601.	55.5	.585	46.4	17.1	5.5	20510.	20248.	-
MECO	1392.	44827.	4507.	6.3	.025	11.0	23.3	4.7	4143.	4331.	-
MECO + 25 SEC	2381.	113920.	5080.	6.5	.026	11.5	23.1	.0	1215.	-	0.
INSERTION	4606.	59783.	10419.	8.5	.024	10.8	20.9	5.0	1171.	-	55.
INSERTION + 25 SEC	4937.	115544.	10933.	8.7	.024	10.8	20.5	.0	1171	-	55.
10 SEC PRIOR TO END OF NOMINAL COAST	21400.	131945.	12645.	19.6	[illegible]	10.3	18.8	.0	1171.	-	55.
END OF NOMINAL DE-ORBIT BURN + 25 SEC	21100.	133300.	14746.	19.2	.027	12.1	16.6	.0	1142.	-	111.
10 MIN PRIOR TO NOMINAL ENTRY INTERFACE	20293.	136246.	17291.	18.7	.027	11.8	12.7	.0	1142.	-	111.
ENTRY INTERFACE	11670.	1061665.	19954.	9.6	.042	18.8	4.4	44.0	1142.	-	111.

NOTE: THESE DISPERSIONS ARE INDICATIVE OF 3σ EVALUATIONS OF THE SIMULATED UNCERTAINTIES.

TABLE XV

RSS SUMMARY DATA (PERTURBED NAVIGATED STATE - ACTUAL PERTURBED STATE)

	ALTITUDE FT	DOWN RANGE FT	CROSS RANGE FT	SPEED FPS	FLIGHT PATH ANGLE-DEG	ALTITUDE RATE-FPS	CROSS RANGE RATE-FPS	TIME SEC	WEIGHT LB	SSME PROP LB	OMS PROP LB
SRB SEPARATION	82.	147.	199.	2.1	.029	1.9	4.4	5.5	20510.	20248.	-
MECO	1890.	1748.	4507.	6.3	.023	10.0	23.5	4.7	4143.	4331.	-
MECO + 25 SEC	2133.	1938.	5085.	6.5	.022	9.9	23.3	.0	1215.	-	0.
INSERTION	4405.	4313.	10474.	8.2	.021	9.6	21.1	5.0	1171.	-	55.
INSERTION + 25 SEC	4629.	4611.	10994.	8.3	.021	9.6	20.7	.0	1171.	-	55.
10 SEC PRIOR TO END OF NOMINAL COAST	21026.	66031.	12722.	19.2	.021	9.2	19.0	.0	1171.	-	55.
END OF NOMINAL DE-ORBIT BURN + 25 SEC	20773.	69608.	14828.	19.2	.020	9.1	16.5	.0	1142.	-	111.
10 MIN PRIOR TO NOMINAL ENTRY INTERFACE	20127.	74688.	17355.	18.6	.021	9.4	12.5	.0	1142.	-	111.
ENTRY INTERFACE	14110.	89041.	19930.	14.2	.028	12.5	4.5	44.0	1142.	-	111.

NOTE: THESE DISPERSIONS ARE INDICATIVE OF 3σ EVALUATIONS OF THE SIMULATED UNCERTAINTIES.

TABLE XVI

Principal Error Contributors To Covariance Matrix at MECO

State Vector Component*	Principal Error Sources
u	Platform misalignment (tilt), and accelerometer input axis misalignment toward spin axis (X).
v	Web action time, orbiter thrust and external tank propellant loading.
w	Platform misalignment (azimuth and roll) and accelerometer input axis misalignment toward output axis (Y).
$\dot{u}$	Web action time and orbiter thrust.
$\dot{v}$	Platform misalignment (tilt), accelerometer bias (Z), accelerometer scale factor (Z) and accelerometer input axis misalignment toward output axis (Z).
$\dot{w}$	Platform misalignment (azimuth).

*Both the actual and navigated state vectors.

TABLE XVII

Principal Error Contributions to Covariance Matrix at Entry Interface

State Vector Component *	Principal Error Source
u	Platform misalignment (tilt) and accelerometer input axis misalignment toward spin axis (X)
v	Platform misalignment (tilt), gyro spin axis acceleration sensitive drift (Y), accelerometer bias (Z), accelermoter scale factor (Z) and accelerometer input axis misalignment toward spin axis (X)
w	Platform misalignment (azimuth)
$\dot{u}$	Platform misalignment (tilt), accelerometer bias (Z), accelerometer scale factor (Z) and accelerometer input axis misalignment toward spin axis (X)
$\dot{v}$	Platform misalignment (tilt) and accelerometer input axis misalignment toward spin axis (X)
$\dot{w}$	Platform misalignment (azimuth)

*Both the actual and navigated state vectors.