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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

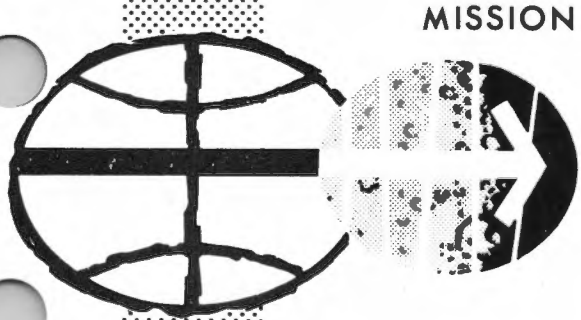
MSC INTERNAL NOTE NO. 71-FM-168

May 10, 1971

APOLLO 15 (MISSION J-1) DEORBIT AND ENTRY SIMULATOR DATA PACKAGE

Mission Planning Support Office

MISSION PLANNING AND ANALYSIS DIVISION



MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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PROJECT APOLLO

APOLLO 15 (MISSION J-1) DEORBIT AND ENTRY SIMULATOR DATA PACKAGE

By Data Management Group
Mission Planning Support Office

May 10, 1971

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

Approved: John R. Gurley Jr
Richard P. Parten, Chief
Mission Planning Support Office

Approved: John P. Mayer
John P. Mayer, Chief
Mission Planning and Analysis Division

TABLES

APOLLO 15 (MISSION J-1) DEORBIT AND ENTRY SIMULATOR DATA PACKAGE

By Data Management Group
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INTRODUCTION

The purpose of this internal note is to provide deorbit and entry simulator data. These data are necessary for Apollo 15 flight crew and flight controller training on the command module simulator at Kennedy Space Center and at the Manned Spacecraft Center, and on the mission evaluator at North American Rockwell, Downey, California. This data package is based on the nominal mission profile as defined in reference 1 and assumes a July 26, 1971, lift-off time of 13:34:00 Greenwich mean time. The dispersed state vectors in this package used reference 1 as a basis.

DATA DESCRIPTION

Simulator data (vector, REFSMMAT, and crew pads) are provided for the following deorbit and entry cases:

a. Earth orbit deorbits

   (1) Area 2-1 service propulsion system (SPS) deorbit

   (2) Area 3-4 reaction control system (RCS) deorbit

   (3) Area 3-4 hybrid deorbit

   (4) Block data deorbit for areas 1-4, 2-1, 2-4, 3-4, and 4-4

b. Lunar return entries

   (1) Nominal entry ($\gamma = -6.5°$) - nominal inclination

   (2) Steep entry ($\gamma = -6.6°$) - nominal inclination

(3) Shallow entry (γ = -5.8°) - nominal inclination

(4) Nominal entry (γ = -6.5°) - 70° entry inclination

(5) Steep entry (γ = -6.6°) - 70° entry inclination

(6) Shallow entry (γ = -6.0°) - 70° entry inclination

Table I contains the launch pad REFSMMAT (to be used for all earth orbit deorbits except the hybrid deorbit), the preferred REFSMMAT for hybrid deorbit, the nominal entry REFSMMAT (to be used for nominal inclination entries), and the high inclination entry REFSMMAT (to be used with 70° inclination entries).

Table II contains the geocentric state vectors in the mean Besselian coordinate system for the CSM at specific times before each deorbit or entry.

Table III contains the crew pads for each deorbit or entry. For the nominal entry (nominal flight-path angle and nominal inclination), pads for entry ranges of 1187, 1500, and 1800 n. mi. are provided. For other entries, pads are provided only for the nominal entry range (1187 n. mi.).

Table IV contains the entry aerodynamics used in the computation of all earth orbit deorbit data.

Tables VIII, IX, and X of reference 2 should be used to obtain erasable load data, propulsion data, aerodynamics (for lunar return entries), mass properties, scale factors, and consumables.

Part of the enclosed data was provided by D. W. Heath, Landing Analysis Branch. Any question concerning this data package should be directed to Mr. Larry Davis, HU3-4901.

TABLE I.- REFSMMATS

(a) Launch pad

$X_I X_E$	-.93615133
$X_I Y_E$	+.31765304
$X_I Z_E$	+.15072214
$Y_I X_E$	+.03076465
$Y_I Y_E$	+.50103907
$Y_I Z_E$	-.86487766
$Z_I X_E$	-.35024871
$Z_I Y_E$	-.80501948
$Z_I Z_E$	-.47882080

TABLE I.- REFSMMATS - Continued

(b) Hybrid

$X_I X_E$	+.89204255
$X_I Y_E$	+.37060227
$X_I Z_E$	+.25867748
$Y_I X_E$	+.04711051
$Y_I Y_E$	+.49299094
$Y_I Z_E$	-.86875804
$Z_I X_E$	-.44948936
$Z_I Y_E$	+.78715557
$Z_I Z_E$	+.42230964

TABLE I.- REFSMMATS - Continued

(c) Nominal entry

$X_I X_E$	-.79310282
$X_I Y_E$	-.13441632
$X_I Z_E$	+.59407085
$Y_I X_E$	-.60877235
$Y_I Y_E$	+.20632025
$Y_I Z_E$	-.76604711
$Z_I X_E$	-.01959962
$Z_I Y_E$	-.96920805
$Z_I Z_E$	-.24546211

TABLE I.- REFSMMATS - Concluded

(d) 70° inclination entry

$X_I X_E$	-.35752646
$X_I Y_E$	-.22248095
$X_I Z_E$	+.90701550
$Y_I X_E$	-.93369732
$Y_I Y_E$	+.10553695
$Y_I Z_E$	-.34215682
$Z_I X_E$	-.01960028
$Z_I Y_E$	-.96920804
$Z_I Z_E$	-.24546211

TABLE II.- STATE VECTORS

(a) For all earth orbit deorbits

GET = 0 HR 12 MIN .00 SEC

		GEOCENTRIC	SELENOCENTRIC
X	=	-2614681.3	FT
Y	=	18575885.3	FT
Z	=	10448610.3	FT
XDOT	=	-25395.889	FT/SEC
YDOT	=	-2251.411	FT/SEC
ZDOT	=	-2352.864	FT/SEC
X	=	-.12495049	ER
Y	=	.88770520	ER
Z	=	.49931859	ER
XDOT	=	-4.3690312	ER/HR
YDOT	=	-0.3873259	ER/HR
ZDOT	=	-0.4047795	ER/HR

TABLE II.- STATE VECTORS - Continued

(b) Nominal entry ($\gamma = -6.50°$) - nominal inclination

Entry Interface - 20 Minutes		Entry Interface - 5 Minutes	
X = 28853406.0 ft		X = 8787770.2 ft	
Y = 16563603.0 ft		Y = 22013707.0 ft	
Z = -18468238.0 ft	ECI	Z = -1055196.3 ft	ECI
$\dot{X}$ = -18214.622 ft/sec		$\dot{X}$ = -26838.253 ft/sec	
$\dot{Y}$ = 9846.1509 ft/sec		$\dot{Y}$ = -570.64248 ft/sec	
$\dot{Z}$ = 17122.817 ft/sec		$\dot{Z}$ = 21177.028 ft/sec	
t = 1060700.048 sec		t = 1061600.048 sec	
CM WT = 12945.8 lbs		CM WT = 12934.2 lbs	
SM WT = 14060.7 lbs			

TABLE II.- STATE VECTORS - Continued

(c) Shallow entry ($\gamma = -5.80°$) - nominal inclination

Entry Interface - 20 Minutes

X	= 28790531.0 ft	ECI
Y	= 15983589.0 ft	
Z	= -18574339.0 ft	
$\dot{X}$	= -18057.535 ft/sec	
$\dot{Y}$	= 10348.301 ft/sec	
$\dot{Z}$	= 17132.956 ft/sec	

t = 1060700.048 sec

CM WT = 12945.8 lbs

SM WT = 14060.7 lbs

Entry Interface - 5 Minutes

X	= 8794759.7 ft	ECI
Y	= 21885023.0 ft	
Z	= -1095397.4 ft	
$\dot{X}$	= -26848.499 ft/sec	
$\dot{Y}$	= -116.28472 ft/sec	
$\dot{Z}$	= 21307.534 ft/sec	

t = 1061600.048 sec

CM WT = 12934.2 lbs

TABLE II.- STATE VECTORS - Continued

(d) Steep entry ($\gamma = -6.6°$) - nominal inclination

Entry Interface - 20 Minutes

X	= 28862599.0 ft	ECI
Y	= 16653825.0 ft	
Z	= -18451249.0 ft	
$\dot{X}$	= -18238.388 ft/sec	
$\dot{Y}$	= 9767.9762 ft/sec	
$\dot{Z}$	= 17120.691 ft/sec	

t = 1060700.048 sec

CM WT = 12945.8 lbs

SM WT = 14060.7 lbs

Entry Interface - 5 Minutes

X	= 8786584.2 ft	ECI
Y	= 22033738.0 ft	
Z	= -1048844.9 ft	
$\dot{X}$	= -26836.267 ft/sec	
$\dot{Y}$	= -641.33837 ft/sec	
$\dot{Z}$	= 21156.404 ft/sec	

t = 1061600.048 sec

CM WT = 12934.2 lbs

TABLE II.- STATE VECTORS - Continued

(e) Nominal entry (-6.5°) - 70° inclination

Entry Interface - 20 Minutes		Entry Interface - 5 Minutes	
X = 13138720.0 ft		X = 4190197.50 ft	
Y = 19751517.0 ft		Y = 22944643.0 ft	
Z = -29756774.0 ft	ECI	Z = -4357675.50 ft	ECI
$\dot{X}$ = -8070.8336 ft/sec		$\dot{X}$ = -12054.211 ft/sec	
$\dot{Y}$ = 7780.9160 ft/sec		$\dot{Y}$ = -3564.7643 ft/sec	
$\dot{Z}$ = 24413.616 ft/sec		$\dot{Z}$ = 31795.588 ft/sec	
t = 1060700.048 sec		t = 1061600.048 sec	
CM WT = 12945.8 lbs		CM WT = 12934.2 lbs	
SM WT = 14060.7 lbs			

TABLE II.- STATE VECTORS - Continued

(f) Shallow entry ($\gamma = -6.0°$) - 70° inclination

Entry Interface - 20 Minutes			Entry Interface - 5 Minutes		
X	13114049.0 ft	ECI	X	4191485.0 ft	ECI
Y	19328847.0 ft		Y	22852504.0 ft	
Z	-29819644.0 ft		Z	-4389608.2 ft	
$\dot{X}$	-8016.3607 ft/sec		$\dot{X}$	-12054.089 ft/sec	
$\dot{Y}$	8155.0478 ft/sec		$\dot{Y}$	-3238.3264 ft/sec	
$\dot{Z}$	24380.044 ft/sec		$\dot{Z}$	31895.921 ft/sec	
t	1060700.048 sec		t	1061600.048 sec	
CM WT	12945.8 lbs		CM WT	12934.2 lbs	
SM WT	14060.7 lbs				

TABLE II.- STATE VECTORS - Concluded

(g) Steep entry ($\gamma = -6.6°$) - 70° inclination

Entry Interface - 20 Minutes		Entry Interface - 5 Minutes	
X =	13143457.0 ft	X =	4189904.50 ft
Y =	19835834.0 ft	Y =	22963035.0 ft
Z =	-29743729.0 ft	Z =	-4351203.40 ft
	ECI		ECI
$\dot{X}$ =	-8081.4993 ft/sec	$\dot{X}$ =	-12054.113 ft/sec
$\dot{Y}$ =	7706.2510 ft/sec	$\dot{Y}$ =	-3629.9055 ft/sec
$\dot{Z}$ =	24419.755 ft/sec	$\dot{Z}$ =	31775.234 ft/sec
t =	1060700.048 sec	t =	1061600.048 sec
CM WT =	12945.8 lbs	CM WT =	12934.2 lbs
SM WT =	14060.7 lbs		

TABLE III.- CREW PADS

(a) Area 2-1 maneuver (SPS deorbit)

P30 MANEUVER

SET STARS		2	-	1		D	0	PURPOSE
		S	P	S	G	+	N	PROP/GUID
		+	6	6	9	4	7	WT N47
R ALIGN ___ ___ ___		−	0	0	0	4	3	P_{TRIM} N48
P ALIGN ___ ___ ___		+	0	0	1	9	0	Y_{TRIM}
Y ALIGN ___ ___ ___		+	0	0	0	0	1	HRS GETI
		+	0	0	0	2	0	MIN N33
		+	0	2	5	4	2	SEC
ULLAGE NONE		−	0	2	1	0	7	ΔV_X N81
		+	0	0	0	0	0	ΔV_Y
		+	0	1	3	4	6	ΔV_Z
		X	X	X	1	8	1	R
		X	X	X	2	6	0	P
		X	X	X	0	0	2	Y
		+	0	0	9	8	4	H_A N44
		−	0	0	1	8	0	H_P
		+	0	2	5	0	0	ΔVT
HORIZON/WINDOW ___		X	X	X	0	2	5	BT
		X	0	2	4	2	0	ΔVC
		X	X	X	X	N	A	SXTS
		+					0	SFT
		+				0	0	TRN
		X	X	X		N	A	BSS
		X	X					SPA
		X	X	X				SXP
OTHER SEP MANEUVER		+	0	2	9	1	5	LAT N61
20 MINUTES PRIOR		−	0	6	7	0	0	LONG
TO DEORBIT		+	1	4	1	0	9	RTGO EMS
		+	2	5	6	7	8	V10
	0	0	1	3	5	4	6	GET 0.05G

TABLE III.- CREW PADS - Continued

(b) Area 2-1 entry (SPS)

EARTH ORBIT ENTRY UPDATE L/5-7												
X			-			X			2	1		AREA
X	X	-			.	X	X	-	0	7	.3	ΔV TO
X	X	X				X	X	X	3	5	7	R 0.05G EMS
X	X	X				X	X	X	1	4	9	P 0.05G
X	X	X				X	X	X	0	0	0	Y 0.05G
+					.	+	1	4	1	0	.9	RTGO EMS
+						+	2	5	6	7	8	V10
X	X			:		X	X	1	5	: 2	1	RET 0.05G
	0			.		+	0	2	9	.1	5	LAT N61
				.		−	0	6	7	.0	0	LONG
X	X			:		X	X	1	6	: 2	1	RET 0.2G
					.				N	A	.	DRE (55°) N66
R	R		/			R	R	5	5	/ 5	5	BANK AN
X	X			:		X	X	2	1	: 3	2	RET RB
X	X			:		X	X	2	0	: 0	9	RETBBO
X	X			:		X	X	2	4	: 4	3	RETEBO
X	X			:		X	X	2	5	: 3	0	RETDROG
X	X	X				X	X	X	N	A		(90°/fps) CHART
X	X					X	X		N	A		DRE (90°) UPDATE
POST BURN												
X	X	X				X	X	X				P 0.05G
+					.	+					.	RTGO EMS
+						+						V10
X	X			:		X	X			:		RET 0.05G
X	X			:		X	X			:		RET 0.2G
					.						.	DRE ±100 nm N66
R	R		/			R	R		/			BANK AN
X	X			:		X	X			:		RETRB
X	X			:		X	X			:		RETBBO
X	X			:		X	X			:		RETEBO
X	X			:		X	X			:		RETDROG SEC TO MAIN

TABLE III.- CREW PADS - Continued

(c) Area 3-4 maneuver (SM RCS deorbit)

P30 MANEUVER

SET STARS		3	-	4		D	0	PURPOSE
		R	C	S	G	+	N	PROP/GUID
		+	6	6	9	4	7	WT N47
R_{ALIGN}			0	0	N	A		P_{TRIM} N48
P_{ALIGN}			0	0	N	A		Y_{TRIM}
Y_{ALIGN}		+	0	0	0	0	3	HRS GETI
		+	0	0	0	4	9	MIN N33
		+	0	0	2	4	0	SEC
ULLAGE		−	0	1	2	8	2	ΔV_X N81
		±	0	0	0	0	0	ΔV_Y
		−	0	0	0	4	1	ΔV_Z
		X	X	X	0	0	1	R
		X	X	X	3	1	8	P
		X	X	X	0	0	1	Y
		+	0	0	9	5	2	H_A N44
		+	0	0	3	7	7	H_P
		+	0	1	2	8	2	ΔVT
HORIZON/WINDOW		X	X	X	12	3	0	BT
		X	0	1	2	8	2	ΔVC
		X	X	X	X	N	A	SXTS
		+					0	SFT
		+				0	0	TRN
		X	X	X		N	A	BSS
		X	X					SPA
		X	X	X				SXP
OTHER SEP. MANEUVER		±	0	2	9	4	3	LAT N61
20 MINUTES PRIOR		−	1	4	8	0	0	LONG
TO DEORBIT		+	1	2	5	0	2	RTGO EMS
		+	2	5	7	1	6	V10
	0	0	4	2	3	4	7	GET 0.05G

TABLE III.- CREW PADS - Continued

(d) Area 3-4 entry (SM RCS)

EARTH ORBIT ENTRY UPDATE L/5-7												
X						X			3	4	B	AREA
X	X	-			.	X	X	-	N	A	.	ΔV TO
X	X	X				X	X	X	1	7	8	R 0.05G EMS
X	X	X				X	X	X	2	1	8	P 0.05G
X	X	X				X	X	X	0	0	0	Y 0.05G
+					.	+	1	2	5	0	.2	RTGO EMS
+						+	2	5	7	1	6	V10
X	X			:		X	X	3	4	: 4	5	RET 0.05G
	0			.		+	0	2	9	.4	3	LAT N61
				.		−	1	4	8	.0	0	LONG
X	X			:		X	X	3	6	: 1	2	RET 0.2G
					.				N	A	.	DRE (55°) N66
R	R		/			R	R	5	5	/5	5	BANK AN
X	X			:		X	X	4	0	: 3	7	RET RB
X	X			:		X	X	3	8	: 5	9	RETBBO
X	X			:		X	X	4	3	: 2	6	RETEBO
X	X			:		X	X	4	4	: 1	4	RETDROG
X	X	X				X	X	X	N	A		(90°/fps) CHART
X	X					X	X		N	A		DRE (90°) UPDATE
POST BURN												
X	X	X				X	X	X				P 0.05G
+					.	+					.	RTGO EMS
+						+						V10
X	X			:		X	X			:		RET 0.05G
X	X			:		X	X			:		RET 0.2G
					.						.	DRE ±100 nm N66
R	R		/			R	R		/			BANK AN
X	X			:		X	X			:		RETRB
X	X			:		X	X			:		RETBBO
X	X			:		X	X			:		RETEBO
X	X			:		X	X			:		RETDROG SEC TO MAIN

TABLE III.- CREW PADS - Continued

(e) Area 3-4 maneuver (hybrid - SM RCS)

P30 MANEUVER

SET STARS	3	-	4		D	0	PURPOSE	
	R	C	S/G		+	N	PROP/GUID	
	+	6	6	9	4	7	WT	N47
R_{ALIGN} ___ ___ ___		0	0	N.A			P_{TRIM}	N48
P_{ALIGN} ___ ___ ___		0	0	N.A			Y_{TRIM}	
Y_{ALIGN} ___ ___ ___	+	0	0	0	0	3	HRS	GETI
	+	0	0	0	5	2	MIN	N33
	+	0	1	0	4	5	SEC	
[redacted]	−	0	1	3	5	0	ΔV_X	N81
SM ΔV = 68	+	0	0	0	0	0	ΔV_Y	SM+CM ΔV
CM ΔV = 68	+	0	0	1	6	1	ΔV_Z	
	X	X	X	0	0	0	R	
	X	X	X	1	8	0	P	
	X	X	X	0	0	0	Y	
	+						H_A	N44
							H_P	
	+	0	0	6	8	0	ΔVT	
HORIZON/WINDOW ___	X	X	X	6	4	2	BT	
	X	0	0	6	8	0	ΔVC	
	X	X	X	X	N	A	SXTS	
	+					0	SFT	
	+				0	0	TRN	
	X	X	X		N	A	BSS	
	X	X					SPA	
	X	X	X				SXP	
OTHER SM Δt = 6:42		0					LAT	N61
COAST Δt = 1:00							LONG	
CM Δt = 1:32	+						RTGO	EMS
	+						V10	
							GET	0.05G

TABLE III.- CREW PADS - Continued

(f) Area 3-4 maneuver (hybrid - CM RCS)

P30 MANEUVER

SET STARS CM		3	-	4		D	0	PURPOSE
		R	C	S	G	+	N	PROP/GUID
		+			N	A		WT N47
R ALIGN			0	0	N	A		P_{TRIM} N48
P ALIGN			0	0	N	A		Y_{TRIM}
Y ALIGN		+	0	0	0	0	3	HRS GETI
		+	0	0	0	5	9	MIN N33
		+	0	5	2	4	5	SEC
ULLAGE					N	A		ΔV_X N81
					N	A		ΔV_Y
					N	A		ΔV_Z
		X	X	X	0	0	0	R
		X	X	X	2	8	9	P
		X	X	X	0	0	0	Y
		+	0	0	9	6	1	H_A N44
		+	0	0	3	2	8	H_P
		+	0	0	6	8	0	ΔVT
HORIZON/WINDOW		X	X	X	1	3	2	BT
		X	0	0	2	2	2	ΔVC
		X	X	X	X	N	A	SXTS
		+					0	SFT
		+				0	0	TRN
		X	X	X		N	A	BSS
		X	X					SPA
		X	X	X				SXP
OTHER SEP. MANEUVER		+	0	2	9	4	3	LAT N61
20 MINUTES PRIOR		−	1	4	8	0	0	LONG
TO SM MANEUVER		+	1	2	2	6	9	RTGO EMS
		+	2	5	7	2	0	V10
	0	0	4	2	3	5	8	GET 0.05G

TABLE III.- CREW PADS - Continued

(g) Area 3-4 entry (hybrid)

EARTH ORBIT ENTRY UPDATE L/5-7												
X						X			3	4	D	AREA
X	X	-			.	X	X	-	N	A	.	ΔV TO
X	X	X				X	X	X	1	7	8	R 0.05G EMS
X	X	X				X	X	X	0	8	5	P 0.05G
X	X	X				X	X	X	0	0	1	Y 0.05G
+					.	+	1	2	2	6	.9	RTGO EMS
+						+	2	5	7	2	0	V10
X	X			:		X	X	3	1	:4	8	RET 0.05G
	0			.		+	0	2	9	.4	3	LAT N61
				.		−	1	4	8	.0	0	LONG
X	X			:		X	X	3	3	:0	9	RET 0.2G
					.				N	A	.	DRE (55°) N66
R	R		/			R	R	5	5	/5	5	BANK AN
X	X			:		X	X	3	7	:3	3	RET RB
X	X			:		X	X	3	5	:5	5	RETBBO
X	X			:		X	X	4	0	:2	3	RETEBO
X	X			:		X	X	4	1	:1	1	RETDROG
X	X	X				X	X	X	N	A		(90°/fps) CHART
X	X					X	X		N	A		DRE (90°) UPDATE
POST BURN												
X	X	X				X	X	X				P 0.05G
+					.	+					.	RTGO EMS
+						+						V10
X	X			:		X	X			:		RET 0.05G
X	X			:		X	X			:		RET 0.2G
					.						.	DRE ±100 nm N66
R	R		/			R	R		/			BANK AN
X	X			:		X	X			:		RETRB
X	X			:		X	X			:		RETBBO
X	X			:		X	X			:		RETEBO
X	X			:		X	X			:		RETDROG SEC TO MAIN

TABLE III.- CREW PADS - Continued

(h) Block 1

EARTH ORBIT BLOCK DATA

X	X						X	X		1	-	4			AREA
X	X	X					X	X	X	+	2	0	.	1	LAT
X	X						X	X	-	1	4	8	.	0	LONG
							0	0	1	0	3	4	3		GETI
X	X	X					X	X	X	2	4	2	.	0	ΔV_C
X	X						X	X		2	-	1			AREA
X	X	X					X	X	X	+	2	9	.	2	LAT
X	X						X	X	-	0	6	7	.	0	LONG
							0	0	1	2	1	5	4		GETI
X	X	X					X	X	X	2	4	2	.	0	ΔV_C
X	X						X	X		2	-	4			AREA
X	X	X					X	X	X	+	2	4	.	1	LAT
X	X						X	X	-	1	4	8	.	0	LONG
							0	0	2	3	5	5	2		GETI
X	X	X					X	X	X	2	4	2	.	0	ΔV_C
X	X						X	X		3	-	4			AREA
X	X	X					X	X	X	+	2	9	.	5	LAT
X	X						X	X	-	1	4	8	.	0	LONG
							0	0	4	0	8	2	6		GETI
X	X	X					X	X	X	2	4	2	.	0	ΔV_C
X	X						X	X		4	-	4			AREA
X	X	X					X	X	X	+	3	0	.	6	LAT
X	X						X	X	-	1	4	8	.	0	LONG
							0	0	5	4	1	2	2		GETI
X	X	X					X	X	X	2	4	2	.	0	ΔV_C

REMARKS: 1) ROLL RT. 90° ENTRY
2) SEP. MANEUVER 20 MINUTES PRIOR TO DEORBIT
3) 15° LINE USED

TABLE III.- CREW PADS - Continued

(i) Nominal entry ($\gamma = -6.5°$) - nominal inclination, range = 1187 n. mi.

ENTRY							
	M	I	D	P	A	C	AREA
	X	X	X	0	0	0	R 0.05 G
	X	X	X	1	5	2	P 0.05 G
	X	X	X	0	0	0	Y 0.05 G
2	9	4	4	1	2	0	GET HOR
	X	X	X	2	6	5	P CK
	+	0	2	6	1	2	LAT N61
	-	1	5	8	0	0	LONG
	X	X	X	0	6	1	MAX G
	+	3	6	0	9	7	V_{400K} N60
	-	0	0	6	5	0	γ_{400K}
	+	1	0	8	9	9	RTGO EMS
	+	3	6	1	7	9	VIO
2	9	4	5	8	2	0	RRT
	X	X	0	0	3	0	RET 0.05 G
	+	0	0				D_L MAX N69
	+	0	0				D_L MIN
	+						V_L MAX
	+						V_L MIN
	X	X	X	4	0	0	D_O
	X	X	0	2	1	0	RET V_{CIRC}
	X	X	0	0	1	8	RETBBO
	X	X	0	3	3	6	RETEBO
	X	X	0	7	4	7	RETDRO
	X	X	X	X			SXTS
	+					0	SFT
	+				0	0	TRN
	X	X	X				BSS
	X	X					SPA
	X	X	X				SXP
	X	X	X	X	U	P	LIFT VECTOR

TABLE III.- CREW PADS - Continued

(j) Nominal entry (γ = -6.5°) - nominal inclination, range = 1500 n. mi.

ENTRY							
	M	I	D	P	A	C	AREA
	X	X	X	0	0	0	R 0.05 G
	X	X	X	1	5	2	P 0.05 G
	X	X	X	0	0	0	Y 0.05 G
2	9	4	4	1	2	0	GET HOR
	X	X	X	2	6	5	P CK
	+	0	2	8	7	4	LAT N61
	-	1	5	2	9	1	LONG
	X	X	X	0	6	2	MAX G
	+	3	6	0	9	7	V_{400K} N60
	-	0	0	6	5	0	γ_{400K}
	+	1	4	2	1	6	RTGO EMS
	+	3	6	1	7	9	VIO
2	9	4	5	8	2	0	RRT
	X	X	0	0	3	0	RET 0.05 G
	+	0	0	1	4	8	D_L MAX N69
	+	0	0	0	2	8	D_L MIN
	+	2	2	4	0	0	V_L MAX
	+	1	8	0	0	0	V_L MIN
	X	X	X	4	0	0	D_O
	X	X	0	2	1	0	RET V_{CIRC}
	X	X	0	0	1	8	RETBBO
	X	X	0	3	4	6	RETEBO
	X	X	0	9	1	2	RETDRO
	X	X	X	X			SXTS
	+					0	SFT
	+				0	0	TRN
	X	X	X				BSS
	X	X					SPA
	X	X	X				SXP
	X	X	X	X	U	P	LIFT VECTOR

SECOND S-BAND BLACKOUT:

RETBBO = 5 : 14

RETEBO = 5 : 38

TABLE III.- CREW PADS - Continued

(k) Nominal entry (γ = -6.5°) - nominal inclination, range = 1800 n. mi.

	ENTRY						
	M	I	D	P	A	C	AREA
	X	X	X	0	0	0	R 0.05 G
	X	X	X	1	5	2	P 0.05 G
	X	X	X	0	0	0	Y 0.05 G
2	9	4	4	1	2	0	GET HOR
	X	X	X	2	6	5	P CK
	+	0	3	1	2	2	LAT N61
	-	1	4	7	9	0	LONG
	X	X	X	0	6	2	MAX G
	+	3	6	0	9	7	V_{400K} N60
	-	0	0	6	5	0	γ_{400K}
	+	1	7	3	8	1	RTGO EMS
	+	3	6	1	7	9	VIO
2	9	4	5	8	2	0	RRT
	X	X	0	0	3	0	RET 0.05 G
	+	0	0	0	6	8	D_L MAX N69
	+	0	0	0	1	8	D_L MIN
	+	2	2	6	5	8	V_L MAX
	+	2	1	9	0	3	V_L MIN
	X	X	X	4	0	0	D_O
	X	X	0	2	1	2	RET V_{CIRC}
	X	X	0	0	1	8	RETBBO
	X	X	0	3	3	6	RETEBO
	X	X	1	0	3	2	RETDRO
	X	X	X	X			SXTS
	+					0	SFT
	+				0	0	TRN
	X	X	X				BSS
	X	X					SPA
	X	X	X				SXP
	X	X	X	X	U	P	LIFT VECTOR

SECOND S-BAND BLACKOUT

RETBBO = 6 : 03

RETEBO = 7 : 06

TABLE III.- CREW PADS - Continued

(l) Shallow entry ($\gamma = -5.8°$) - nominal inclination, range = 1187 n. mi.

ENTRY							
	M	I	D	P	A	C	AREA
	X	X	X	0	0	0	R 0.05 G
	X	X	X	1	5	2	P 0.05 G
	X	X	X	0	0	0	Y 0.05 G
2	9	4	4	1	2	0	GET HOR
	X	X	X	2	6	5	P CK
	+	0	2	6	1	2	LAT N61
	-	1	5	8	0	0	LONG
	X	X	X	0	4	6	MAX G
	+	3	6	0	9	7	V_{400K} N60
	-	0	0	5	8	0	γ_{400K}
	+	1	0	5	8	0	RTGO EMS
	+	3	6	1	7	8	VIO
2	9	4	5	8	2	0	RRT
	X	X	0	0	3	4	RET 0.05 G
	+	0	0				D_L MAX N69
	+	0	0				D_L MIN
	+						V_L MAX
	+						V_L MIN
	X	X	X	4	0	0	D_O
	X	X	0	2	3	4	RET V_{CIRC}
	X	X	0	0	2	1	RETBBO
	X	X	0	3	4	4	RETEBO
	X	X	0	7	2	1	RETDRO
	X	X	X	X			SXTS
	+					0	SFT
	+				0	0	TRN
	X	X	X				BSS
	X	X					SPA
	X	X	X				SXP
	X	X	X	X	D	N	LIFT VECTOR

TABLE III.- CREW PADS - Continued

(m) Steep entry ($\gamma = -6.6°$) - nominal inclination, range = 1187 n. mi.

ENTRY							
	M	I	D	P	A	C	AREA
	X	X	X	0	0	0	R 0.05 G
	X	X	X	1	5	2	P 0.05 G
	X	X	X	0	0	0	Y 0.05 G
2	9	4	4	1	2	0	GET HOR
	X	X	X	2	6	5	P CK
	+	0	2	6	1	2	LAT N61
	−	1	5	8	0	0	LONG
	X	X	X	0	6	6	MAX G
	+	3	6	0	9	7	V_{400K} N60
	−	0	0	6	6	0	γ_{400K}
	+	1	0	9	3	6	RTGO EMS
	+	3	6	1	8	0	VIO
2	9	4	5	8	2	0	RRT
	X	X	0	0	3	0	RET 0.05 G
	+	0	0				D_L MAX N69
	+	0	0				D_L MIN
	+						V_L MAX
	+						V_L MIN
	X	X	X	4	0	0	D_O
	X	X	0	2	0	4	RET V_{CIRC}
	X	X	0	0	1	8	RETBBO
	X	X	0	3	3	2	RETEBO
	X	X	0	7	5	2	RETDRO
	X	X	X	X			SXTS
	+					0	SFT
	+				0	0	TRN
	X	X	X				BSS
	X	X					SPA
	X	X	X				SXP
	X	X	X	X	U	P	LIFT VECTOR

TABLE III.- CREW PADS - Continued

(n) Nominal entry (γ = -6.5°) - 70° inclination, range = 1187 n. mi.

ENTRY							
	M	I	D	P	A	C	AREA
	X	X	X	0	0	0	R 0.05 G
	X	X	X	1	5	2	P 0.05 G
	X	X	X	0	0	0	Y 0.05 G
2	9	4	4	1	2	0	GET HOR
	X	X	X	2	6	5	P CK
	+	0	3	2	9	6	LAT N61
	-	1	6	7	5	6	LONG
	X	X	X	0	6	0	MAX G
	+	3	6	0	9	7	V_{400K} N60
	-	0	0	6	4	9	γ_{400K}
	+	1	0	3	9	2	RTGO EMS
	+	3	6	1	7	9	VIO
2	9	4	5	8	2	0	RRT
	X	X	0	0	2	9	RET 0.05 G
	+	0	0				D_L MAX N69
	+	0	0				D_L MIN
	+						V_L MAX
	+						V_L MIN
	X	X	X	4	0	0	D_O
	X	X	0	2	1	2	RET V_{CIRC}
	X	X	0	0	1	8	RETBBO
	X	X	0	3	3	8	RETEBO
	X	X	0	7	3	1	RETDRO
	X	X	X	X			SXTS
	+					0	SFT
	+				0	0	TRN
	X	X	X				BSS
	X	X					SPA
	X	X	X				SXP
	X	X	X	X	U	P	LIFT VECTOR

TABLE III.- CREW PADS - Continued

(o) Shallow entry (γ = -6.0°) - 70° inclination, range = 1187 n. mi.

ENTRY							
	M	I	D	P	A	C	AREA
	X	X	X	0	0	0	R 0.05 G
	X	X	X	1	5	2	P 0.05 G
	X	X	X	0	0	0	Y 0.05 G
2	9	4	4	1	2	0	GET HOR
	X	X	X	2	6	5	P CK
	+	0	3	2	9	6	LAT N61
	-	1	6	7	5	6	LONG
	X	X	X	0	5	6	MAX G
	+	3	6	0	9	7	V_{400K} N60
	-	0	0	6	0	0	γ_{400K}
	+	1	0	1	9	6	RTGO EMS
	+	3	6	1	7	8	VIO
2	9	4	5	8	2	0	RRT
	X	X	0	0	3	2	RET 0.05 G
	+	0	0				D_L MAX N69
	+	0	0				D_L MIN
	+						V_L MAX
	+						V_L MIN
	X	X	X	4	0	0	D_O
	X	X	0	2	2	2	RET V_{CIRC}
	X	X	0	0	1	9	RETBBO
	X	X	0	5	1	2	RETEBO
	X	X	0	7	2	1	RETDRO
	X	X	X	X			SXTS
	+					0	SFT
	+				0	0	TRN
	X	X	X				BSS
	X	X					SPA
	X	X	X				SXP
	X	X	X	X	D	N	LIFT VECTOR

TABLE III.- CREW PADS - Concluded

(p) Steep entry (γ = -6.6°) - 70° inclination, range = 1187 n. mi.

ENTRY							
	M	I	D	P	A	C	AREA
	X	X	X	0	0	0	R 0.05 G
	X	X	X	1	5	2	P 0.05 G
	X	X	X	0	0	0	Y 0.05 G
2	9	4	4	1	2	0	GET HOR
	X	X	X	2	6	5	P CK
	+	0	3	2	9	6	LAT N61
	-	1	6	7	5	6	LONG
	X	X	X	0	6	5	MAX G
	+	3	6	0	9	7	V_{400K} N60
	-	0	0	6	6	0	γ_{400K}
	+	1	0	4	2	2	RTGO EMS
	+	3	6	1	7	6	VIO
2	9	4	5	8	2	0	RRT
	X	X	0	0	2	9	RET 0.05 G
	+	0	0				D_L MAX N69
	+	0	0				D_L MIN
	+						V_L MAX
	+						V_L MIN
	X	X	X	4	0	0	D_O
	X	X	0	2	0	6	RET V_{CIRC}
	X	X	0	0	1	7	RETBBO
	X	X	0	3	3	8	RETEBO
	X	X	0	7	3	8	RETDRO
	X	X	X	X			SXTS
	+					0	SFT
	+				0	0	TRN
	X	X	X				BSS
	X	X					SPA
	X	X	X				SXP
	X	X	X	X	U	P	LIFT VECTOR

TABLE IV.- BEGINNING OF MISSION AERODYNAMICS

Mach no.	Angle of attack	C_D	C_L	L/D
29.50	+161.78	+0.36380	+1.32162	+0.27526
10.00	+158.48	+0.40848	+1.25833	+0.32462
+4.00	+157.91	+0.42034	+1.24714	+0.33704
+3.00	+156.24	+0.45670	+1.25905	+0.36273
+2.40	+155.80	+0.48461	+1.27991	+0.37863
+2.00	+155.17	+0.51236	+1.30836	+0.39160
+1.65	+155.05	+0.52523	+1.28831	+0.40769
+1.35	+155.89	+0.52735	+1.29988	+0.40569
+1.20	+157.07	+0.44838	+1.19459	+0.38002
+1.10	+157.06	+0.45874	+1.9459	+0.38401
+0.90	+163.22	+0.29889	+1.07640	+0.27768
+0.70	+165.81	+0.24732	+0.99278	+0.24912
+0.40	+168.13	+0.22357	+0.85643	+0.26105
+0.20	+171.14	+0.22595	+0.82713	+0.27317
+0.00	+0.00	+0.00000	+0.00000	+0.00000

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