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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MSC INTERNAL NOTE MSC-CF-P-69-14

APOLLO ABORT SUMMARY DOCUMENT

MISSION F (AS-505/106)

FINAL

FEBRUARY 3, 1969

[redacted]

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

APOLLO ABORT SUMMARY DOCUMENT

MISSION F (AS-505/106)

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ACKNOWLEDGMENTS

1. Nominal and abort trajectory curves and timelines were furnished by the Flight Analysis Branch of the Mission Planning and Analysis Division.

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1.0 INTRODUCTION

The Abort Summary Document has been prepared to provide a single reference source of Crew Procedures and information to be used during Saturn V nominal flight, abort, and abort entry training. The basic document reflects the control procedures to be used by the crew. Appendices A, B, and C supplement the controlled procedures for training purposes and are not under the control of this document.

Comments or changes should be direct to Mr. M. R. Wash or Mr. M. A. Rahman, Launch and Entry Procedures Section, CF24, utilizing Crew Procedures Change Request, Form 482, Revised.

2.0 APOLLO ABORT MODES

Pad to 42 Sec	Mode IA	LET Low Alt
42 Sec to 100,000 Ft (1 min 56 Sec)	Mode IB	LET Med Alt
100,000 Ft to LET JETT (1 min 56 Sec) (3 min 16 Sec)	Mode IC	LET High Alt
LET JETT to RFL=3200 NM (3 min 16 Sec) (9 min 41 Sec)	Mode II	Full Lift
RFL=3200 NM to RHL=3350 NM (9 min 41 Sec) (10 min 04 Sec)	Mode III CSM NO GO/ SLV Lofted	Half Lift
RHL=3350 NM to Insertion (10 min 04 Sec) (11 min 21 Sec)	Mode III CSM NO GO/ SLV Lofted	SPS Retro Half Lift
COI Capability to Insertion (2 burn) (8 min 37 Sec) (11 min 21 Sec)	Mode IV* CSM GO	SPS to Orbit

* For positive $\dot{h}$ and S-IVB Cutoff beyond the 5 min to apogee line (crew chart) an apogee kick maneuver would be recommended over the Mode IV. Single burn to orbit capability occurs at 9:49.

NOTE: RFL = Full Lift Landing Range (DSKY: ΔR = -400 NM)
RHL = Half Lift Landing Range (DSKY: ΔR = 0 NM)

Contingency Abort Mode Determination

Pad to TWR JETT	Mode I	LET
TWR JETT to 9 min 50 Sec	Mode II	Full Lift
9 min 50 Sec to Insertion	Mode III	SPS Retro (tb=2)GET-9 min 50 Sec Half Lift

3.0 ABORT LIMITS

3.1 Rates

1. Pitch and yaw

L/O to S-IC/S-II staging (Excluding staging)	4° per second
S-IC/S-II staging to S-IVB CO	9° per second

2. Roll

L/O to S-IVB CO	20° per second

3.2 Max Q Region

The following limits represent single cues and are restricted to the time period of 50 sec to 2 min.

1. Angle of Attach ($q\alpha$) - 100%

   Note: The $q\alpha$ abort cue is valid only when preceeded by one ot the following cues.
2. Attitude error (roll, pitch, or yaw) - 5°
3. Single S-IC control engine failure occurring later than 50 sec into flight.

   Note: For control engine failures prior to 50 sec, the $q\alpha$ abort limit is not valid as an abort cue.

3.3 Platform Failure*

1. During S-IC Powered flight the two cues for platform failure requiring an immediate switchover are:
   a. LV GUID LT - ON
   b. LV RATE LT - ON
2. During second and third stage powered flight the primary cue is
   a. LV GUID LT - ON

   secondary cues

   b. FDAI Attitude
   c. LV Rates
   d. Ground conformation

3.4 Automatic Abort Limits (L/O until deactivate at 2 min)

1. Rate	pitch - yaw	4.0° $\pm$ 0.5° per second
	roll	20.0° $\mp$ 0.5° per second

2. Any two engines failures
3. CM to IU breakup

3.5 Engine Failure (S-IC)

1. Single engine failure	Continue Mission
2. Simultaneous loss two or more engines	Abort

*Guidance switchover procedures for boost and TLI phases are included in Section 9.0.

3.6 Engine Failure (S-II)

1. Single engine failure - continue mission
2. Double engine failures - abort if LV control is lost (rates > 9°/sec) otherwise continue mission.
3. Three or more engine failures - abort if prior to S-IVB to Orbit Capability. Upstage immediately if the failures occur after S-IVB to Orbit Capability is achieved.*

*After S-II level sense arm (approx 8:15 GET) upstaging should not be attempted due to a possibility of inhibiting S-IVB engine start.

3.7 Engine Failure (S-IVB) - Abort (Mode II, III, or IV)

3.8 S-II Second Plane Separation Failure — Abort on ground confirmation.

3.9 S-IVB Differential Tank Pressure Limits

ΔP (ORBITAL COAST) LH2>LO = 26 psid
LO2>LH = 36 psid

4.0 BOOST TO ORBIT

PROG TIME	STEP	STA	ACTION/ENTRY *REPORT	V-N DISPLAY	REGISTER DISPLAY	OPTION/EVENT
-00:09		LCC	IGNITION*	02	R1 00000 R1 00000 R3 00000	
+00:01		LCC	LIFT-OFF*	06 62	R1 XXXXX FPS XXXXX FPS XXXX.XFPS	umbilical Disconnect CMC to P11 DET & MET Start
		CDR	Clock Start*			
00:10		LCC	Clear Tower*			Above launch tower
00:12		CDR	Roll & Pitch Start*			Roll and Pitch program Start
00:30		CDR	Roll complete*			Roll program complete
00:42		MCC	Mode IB*			
		CMP	PRPLNT DUMP - RCS CMD			
00:50		CDR	Monitor α to T + 2:00			
00:55		CMP	Monitor Cabin pressure decreasing			No decrease by 17K' dump manually
01:56		MCC	Mode IC* (based on 100,000')		R3 0016.5NM	
02:00		CMP	EDS AUTO - OFF* EDS ENG - OFF EDS RATES - OFF			No auto abort Lt-on
		CMP	α/Pc - Pc			
02:10		MCC	GO/NO Go for Staging*			
		CDR	GO/NO Go for Staging*			Systems status
02:15		CDR	INBOARD OFF*			#5 Eng Lt-on LIFTOFF LT-out NO AUTO ABORT Lt-out
02:40		CDR	OUTBOARD OFF*			#1-4 ENG LT-on
02:41		CDR	SIC/S-II STAGING*			Eng Lts(5)out
02:42			S-II IGNITION Command			Eng Lts(5)-on S-II SEP Lt-ON
02:44		CDR	S-II 65%*			Eng Lts (5)-out
03:11		CDR	Interstage JET*			S-II Sep Lt-out*
03:16		CMP	Key V82E	F 16 44	XXXX.X NM	
		CMP	TWR JETT(2)-ON*(IF TFF>1+20)		XXXX.X NM	Tower Jettison
		MCC	Mode II*		XXBXX M/S	

	CDR	MAN ATT (PITCH) - RATE CMD			
	CMP	Key Proceed	06 62	XXXXX FPS XXXXX FPS XXXX.X NM	
03:21	CDR	Guidance Initiate*			IGM Start
04:00	CDR	Report status*			
	MCC	Trajectory Status*			
05:00	CDR	Report Status*			
05:50	MCC	Upstage Capability*			
06:00	CDR	Report Status* GMBL MOT (4) - START - ON Check GPI (momentarily)			Insure Angles Correct
06:15	LMP	OMNI ANT-D (AZ<96°)			
07:00	CDR	Report Status*			
08:00	CDR	Report Status*			
08:30	MCC	GO/NO GO for Staging*			Systems Status
	CDR	GO/NO GO For Staging			
08:37	MCC	MODE IV (2 burn)			V1≥21,800 FPS
08:49	CDR	S-II OFF*			Eng lts(5)-on
08:50	CDR	S-II/S-IVB Staging*			Eng lts(#1)-off
08:53		S-IVB Ignition			Eng lts(#1)-on
08:55	CDR	S-IVB 65%*			Eng lts(#1)-off
	CDR	Report Status*			
09:49	MCC	Mode IV* (1 burn)			VI ≥ 23400 FPS
	CDR	Mode IV*			
10:00	MCC	GO/NO Go for Orbit*			
	CDR	GO/NO Go for Orbit*			
	CMP	V82E	F 16 44	XXXXX NM XXXX.X NM XXBXX M/S	
11:14	CDR	SECO* INSURE ORBIT Key Proceed	06 62	XXXX.X FPS XXXXX FPS XXXX.X NM	Eng Lt(#1)-on
11:24	MCC	Insertion*			

5.0 POST INSERTION & TLI

PROG TIME	STEP	STA	ACTION/ENTRY	V-N DISPLAY	REGISTER DISPLAY		OPTION/EVENT
	1	CDR	GMBL MTRS (4) - OFF				
		LMP	MN BUS TIES (Both) - OFF				
		CDR	TVC SERVO PWR (Both) - OFF				
		LMP	DSE - OFF				
		CMP	KEY V82E				
			Monitor DSKY Display	F 16 44	XXXX.X	NM	
			HA,HP,& TFF		XXXX.X	NM	
					XXBXX	M/S	
			Record and Report Values				
			PROCEED				
			DSKY Displays	06 62	XXXXX.	FPS	
			VI,HDOT & HPAD		XXXXX.	FPS	
					XXXX.X	NM	
			Key V37E 00E				
			Key V66E				
			(Transfer SV into LM memory)				
			CMC MODE - FREE				
	2	CMP	Key V48E (Load DAP)	F 04 46	XXXXX		Load Desired DAP
			(Load R1 31102, R2 01111)		XXXXX		
					BLANK		
			PROCEED	F 06 47	XXXXX.	LB	Verify/
			CSM Weight		BLANK		Load desired DAP
					BLANK		
			PROCEED	F 06 48	XXX.XX	DEG	Verify/
			P Trim		XXX.XX	DEG	Load desired DAP
			Y Trim		BLANK		
			PROCEED				
			Key V46E (activates DAP)				
			Key V83E (check θ)	F 16 54	XXX.XX	NM	
					XXXX.X	FPS	
					XXX.XX	DEG	
			PROCEED				
			Unstow Checklist				

3 CDR ELS - MAN
CM RCS LOGIC - OFF
CAB PRESS REL vlv(both)-NORMAL/LATCHED
PLSS vlv - OFF
SECS PYRO ARM (both) - SAFE
SECS LOGIC (both) - OFF
SECS ARM cb (2) - OPEN
FLOAT BAT cb (3) - open
ELS Bat cb (2) - open
PL VENT cb - open
DIR O2 - OFF (CW)
ROT CONTR PWR DIRECT - OFF
MONITOR LV TANK PRESS
$\Delta P < 36$ psia (OXID > FUEL)
$\Delta P < 26$ psia (FUEL > OXID)
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x EMERGENCY CSM/LV SEPARATION x
x Coasting x
x LV XLUNAR - SAFE x
x SECS ARM cb (both) - close x
x SECS LOGIC (both) - ON x
x SECS PYRO ARM (both) - ARM x
x ROT CONTR PWR DIRECT (both) - MNA/MNB x
x SC CONT - SCS x
x BMAG MODE (3) - ATT 1/RATE 2 x
x SCS TVC SERVO PWR 1 - AC1/MNA x
x 2 - AC2/MNB x
x (Continue through thrusting) x
x x
x THRUSTING (TLI) x
x TRANS CONTR - CCW (4 Sec) x
x MN BUS TIE (both) - ON x
x GMBL MTRS (4) - ON (LMP Confirm) x
x TRANS CONTR - NEUTRAL & +X x
x ΔV THRUST A&B - NORMAL x
x THRUST ON PB - PUSH x
x TRANS CONTR +X - RELEASE x
x ΔV THRUST A&B - OFF When Clear x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
CMP SM RCS HTRS (4) - PRIM
CM RCS PRPLNT (both) - OFF
CM RCS PRPLNT tb (both) - BP
C/W function - NORMAL
LMP STM/UR DUCT HTR cb (both) - close
TLM INPUTS - LOW
FC REACS vlv - NORM
H2 PURGE LINE HTR - ON
Unstow Checklist

4 CMP SM RCS CHECK
SM RCS SEC PRPLNT TB (4) - GRAY
He 1&2 TB (8) - GRAY
PRIM PRPLNT TB (4) - GRAY
RCS IND SW - SM A,B,C,D
PKG TEMP - 105-195° F
He PRESS - Record _____
MANF PRESS - 178-192 psig
He TK Temp - Record
PRPLNT QTY - Record _____

5 CMP CM RCS CHECK
CM RCS PRPLNT TB (both) - BP
RCS IND SW - CM 1,2
He TEMP - 60-90° F
He PRESS - 4000-4450 psia
FUEL PRESS - 25-125 psia
OXID PRESS - 25-125 psia

6 CMP C&W OPER CHECK
C/W LAMP TEST - 1 (hold)
M/A Pnl 1 - ON
LH C/W lts (16) - ON
C/W LAMP TEST - 2 (hold)
M/A Pnl 1 - OFF
LH C/W lts (16) - OFF
M/A Pnl 3 - ON
RH C/W lts (23) - ON
C/W LAMP TEST - OFF (lts OFF)
C/W CSM - CM
CM RCS lt (both) - ON
M/A Tone & Lts (3) - ON, RESET
M/A tone & lts (3) - OFF
C/W CSM - CSM
CM RCS lts (both) - OFF

7 CMP CMP to LEB for MN REG CHECK
MAIN REG B vlv - CLOSE
EMER CAB PRESS vlv - 1
PUSH TO TEST - PUSH (O2 FLOW INC)
MAIN REG B vlv - OPEN
MAIN REG A vlv - CLOSE
EMER CAB PRESS vlv - 2
PUSH TO TEST - PUSH (O2 FLOW INC)
MAIN REG A vlv - OPEN
EMER CAB PRESS vlv - BOTH (OFF if suited)

	8	ALL	SUIT CKT RET VLV - OPEN (Pulled)
			REMOVE HELMETS & GLOVES
		CDR	DIRECT ULLAGE CB (both) - open
		LMP	Panel 278 cb 1&2 - open
	9		SEC RAD LEAK Ck
		CMP	Notify LMP when ready to commence
			SEC GLY to RAD vlv - NORMAL
			Allow 30 sec for LMP to monitor accum qty
			SEC GLY to RAD vlv - BYPASS
		LMP	Monitor SEC ACCUM QTY while CMP sets
			SEC GLY TO RAD vlv to NORMAL 30 sec
			then back to BYPASS
+20:00	10	ALL	ECS POST INSERTION CONFIG
		CMP	DRINKING WATER TURN ON
			SYS VERIF & MONITORING
	11	LMP	EPS PER VERIF (If req'd)
			Cryogenic Pressure - Quantity Check
			H2 PRESS (both) - 225-260 psia
			O2 PRESS (both) - 865-935 psia
			SURGE TK PRESS - 865-935 psia
			H2 QTY (both) - record
			O2 QTY (both) - record
			CRYO FANS - OFF; ON as req'd
			FC Power Plant Check
			FC IND sw - 1, 2, 3
			H2 FLOW - 0.03-0.15 lb/hr
			O2 FLOW - 0.25-1.2 lb/hr
			MOD SKIN TEMP - 390-450° F
			MOD COND EXH TEMP - 150-175° F
			FC TB (2) - gray
			FC RAD TB (3) - gray
			FC HTRS (3) - gray
			FC REACS & RAD cb (6) - out all others in (Verify)
			D-C Voltage-Amperage Check
			FC MNA TB - 1&2 gray, 3 BP
			FC MNB TB - 1 BP, 2&3 gray
			FC 1,2,&3 (RECORD AMPS)
			MAIN BUS A,B, (26.5-31 vdc-Record)
			BAT BUS A, B, & BAT C (34-38 vdc 3 amp)
			PYRO BAT A, B (37 VDC)
			DC IND - MAIN BUS A
			SYS TEST 4B (BAT RLY BUS - 3.7-4.1 vdc)
			SYS TEST 4A (BAT COMPT PRESS) - <1.5 vdc (NA UNTIL 1st VENT)

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x If >1.5: BAT VENT VLV - x
x VENT (to 0) then CLOSED x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

A-C VOLTS - 115 + 2 all PHASES

12 LMP BAT CHARGING
MAIN BUS TIE A/C (B/C) - OFF
BAT BUS A&B PYRO BUS TIE cb - OPEN
BAT C BAT BUS A&B cb - OPEN
BAT RLY BUS BAT A(B) cb - OPEN
DC IND sw - BAT CHARGER
BAT CHARGE - A(B,C)
DC VOLTS - 37.5-40 vdc
DC AMPS - 2.0-0.4 amps
BAT CHARGE - OFF at 0.4 amps
or 100% re-charge
BAT RLY BUS BAT A(B) cb - closed
SYS TEST 4A (BAT VENT 1.5)
xxxxxxxxxxxxxxxxxxxxxxxxxxx
x If >1.5: BAT VENT VLV -x
x VENT (to 0) then CLOSED x
xxxxxxxxxxxxxxxxxxxxxxxxxxx

13 LMP ECS MON CHECK
GLY EVAP PRIM TEMP OUT - 40-50.5°F
GLY EVAP PRIM STEAM PRESS
.1-.15 boiling
.16 not boiling
PRIM GLY DISCH PRESS - 40-52 psig
SUIT TEMP - 45-55° F
CABIN TEMP - 70-80° F
SUIT PRESS/CABIN PRESS - 4.8-5.2 psia (14.7 for launch)
PART PRESS CO2 <7.6 mm Hg
SUIT COMP ΔP -0.3-0.4 psia
PRIM GLY ACCUM QTY 30-70% (expect 20-50% at insert)
If <30% - PRIM ACCUM FILL vlv - ON (until 40-55%)
POT H2O QTY - 10-100%
WASTE H2O QTY - 25-85%
CABIN ΔP - -1 to -3.5 in H2O
O2 FLOW - 0.2-0.45 lb/hr (after changeover)

14 LMP SPS PERIODIC VERIFICATION
SPS PRPLNT TK TEMP - +45° to +75° F
(If <45° F - SPS LINE HTR-A)
SPS PRPLNT TK PRESS: He - 3900 psia max.
N2A & B - 2900 psia max.

SPS PRESS IND sw - He
FUEL PRESS - 170-195 psia
OXID PRESS - 170-195 psia
SPS ENG INJ VLVS (4) - CLOSE
SPS OX, FUEL & UNBAL QTY - record
OXID FLOW VLV - PRIM
SPS He VLV (both) - AUTO
SPS He VLV TB (both) - BP

15	CDR	ALIGN GDC TO IMU - CHECK GDC DRIFT FDAI SELECT - 1 FDAI SOURCE - ATT SET ATT SET - IMU Null error needles W/3 thbwls FDAI SELECT - 1/2 ATT SET - GDC GDC ALIGN - PRESS Record Drift BMAGS (3) - RATE 2 UNSTOW CAMERA BRACKET & ORDEAL	KEY V16 N20 ATT SET thbwls- adjust to IMU gmbl angs on DSKY ATT SET - GDC GDC ALIGN PB - PUSH, HOLD
16	CDR	MOUNT ORDEAL BOX & Initialize	

ORDEAL INITIALIZATION

(a) CMC - ON (Req)
IMU - ON (Req)
SCS - ON (Req)

(b) ORDEAL panel:
FDAI 2 or 1 - ORB RATE
ORDEAL PWR sw - EARTH (10 watts)
MODE - HOLD/FAST

(c) Obtain altitude setting - V82E
A. or B.
or C. MSFN SUPPLY ALTITUDE
If CMC is in STANDBY

(d) Adjust ALT SET dial to proper altitude

(e) Damp Vehicle Rates

(f) Obtain
A. Rendezvous Parameter Display Routine V83E
or B. FROM MSFN
If CMC is in STANDBY, hold
+X at the horizon

(g) Slew FDAI to proper angle with the
SLEW switch on the ORDEAL panel

(h) Set MODE switch to SLOW/OPR

(i) Adjust FDAI precisely with the SLEW switch

(j) Repeat Steps (f) through (i) as Required

	17	LMP	ECS REDUNDANT COMP CHECK		
	18	LMP	Fuel Cell purge check H2/O2 PURGE (6) - ON (MON) Observe flow rate inc Reset MA (as req'd) H2 PURGE LINE HTR - OFF		
	19	CMP	UNSTOW CAMERAS OPTICS DUST COVER JETT Install Eyepieces OPTICS ZERO - OFF G/N OPT PWR - ON OPT MODE - MAN OPT COUPLING CONT - DIRECT OPT SPEED CONT - HI OHC - MAX RIGHT - OBS EJECT thru eyepiece		
SUNSET CRO AOS		CMP	IMU REFSMMAT Realign Check (P52) Perform P-52, Step - 20 (if req'd) or Go to Step 21		
	20	LEB	IMU REALIGN PROGRAM P-52 Key V37E 52E (a) DSKY displays P-52		Poss prog alarm Key V05 N09E R1 00210 (ISS not on) or R1 00220 (IMU orient unknown) F V37. Perform ISS start-up and/or P-51
			(b) IMU Orien Option Code (preferred is 00001)	F 04 06 00003 0000X BLANK	Poss F 05 09, R1 00215 Key V32E Recycle Step (b)
			PROCEED		Key V22E Load desired option

	(c) DSKY Displays	F 06 22	XXX.XX DEG	
	R,P,Y		XXX.XX DEG	
			XXX.XX DEG	
	PROCEED			Select desired
				ATT CONTROL MODE
				MNVR S/C
				Key V32E
	(d) (Coarse Align Rou R-50)			
	Verify Coarse Align Complt			
	No ATT LT - ON then OFF			
	Monitor Ball Motion			
	(e) Target Acquisition	F 50 25	00015	
			BLANK	
			BLANK	
	CMC Assists in Selection			Crew manually
	select desired Att Control			acquired targ
	Mode			ENTR
	Mnvr S/C			
LEB	PROCEED			
	Possible DSKY display	F 05 09	00405	
	(2 targets not available)			
	Manvr S/C until suitable			
	target acquired			
LEB	PROCEED			Key V32E
				Recycle Step (e)
	(f) Target Code	F 01 70	000XX	
			BLANK	
			BLANK	
LEB	OPT MODE - CMC			KEY V25E
	PROCEED			Load desired code
	<u>If target not a planet</u>			
	<u>go to step (h)</u>			
	(g) Planet only	F 06 88	.XXXXX	
	X,Y,Z PL		.XXXXX	
			.XXXXX	
	PROCEED			KEY V25E
				Load desired data
	(h) <u>Auto Opt Positioning Rou R-52</u>			
	Desired opt angles	06 92	XXX.XX DEG	Poss F 05 09
	SA,TA		XX.XXX DEG	00404(TA>90°)
				Mnvr to reduce TA
				PROCEED
				or Poss Prog alarm
				Key V05 N09E
				00407(TA>50°)
				Key RLSE, Mnvr
				to reduce TA

	When sighting marks are desired				
LEB	OPT MODE - MAN				
	<u>Sighting Mark Rou R-53</u>				
	(i) Please mark center target in SXT MARK (on target)	F 51			
	(j) Terminate marks	F 50 25	00016		
	PROCEED				Mark rej PB-PUSH Ret to step (i)
	(k) Target code (Targ code for PL 00) PROCEED	F 01 71	000XX		Key V21E Load target code
	If target code other than 00, <u>Ret to Step (f)</u> for 2nd target				
	(l) Planet only X,Y,Z PL	F 06 88	.XXXXX .XXXXX .XXXXX		
	PROCEED				KEY V25E Load desired data
	<u>Ret to Step (f)</u> for 2nd target				
	<u>Sighting Data Display Rou R-54</u>				
	(m) Sighting ang diff	F 06 05	XXX.XX BLANK BLANK	DEG	
	PROCEED				Key V32E go to step (o)
	<u>Gyro Torquing Rou R-55</u>				
	(n) Δ GYRO ANG X,Y,Z	F 06 93	XX.XXX XX.XXX XX.XXX	DEG DEG DEG	
	PROCEED Gyros torqued				Key V32E
	(o) Fine Align Check PROCEED <u>Ret to step (f)</u>	F 50 25	00014		ENTR
	(p) DSKY displays	F 37			

			(q) OPT ZERO - ZERO OR MAN RETICLE BRIGHTNESS - DIM G/N OPT PWR - ON (verify) G/N PWR - ON (verify)
	21	LMP	BACKUP COMM CHECK
+01:20:00			S BD XPNDR - OFF (4 sec) - PRIM
US AOS			PWR PMP - AUX S BD AUX - DN VOICE BU UP TLM DATA - UP VOICE BU S BD VOL - UP INITIAL CONTACT ON VHF A RECEIVE GO FOR BU COMM CK ON VHF A VHF VOL - DN PERF BU COMM CK VHF VOL - UP S BD AUX TAPE - OFF UP TLM DATA - DATA PWR PMP - NORM VOICE CK WITH MCCH (VHF VOL UP/DN)
GDS AOS			
	22	CDR	SCS ATT Ref Comp CHECK KEY V16 N20 FDAI SELECT - 1 FDAI SOURCE - ATT SET ATT SET - GDC ATT SET dials - null FDAI 1 err needles Key VERB when nulled (freeze display) Record from DSKY: R___,P___,Y___ Record ATT SET dials: R___,P___,Y___
US AOS			
			COPY TLI PAD
CYI AOS			
			SV UPDATES (MCCH)
	23	CDR	TRANSLUNAR INJECTION (TLI) Preparations Translunar sw-Inject (Verify) EDS Power - On (Verify) EMS cb (2) - Close EMS Func. - Off (Verify) EMS MODE - STBY EMS FUNC - ΔV set EMS MODE - Auto Set ΔV ind. to +1586.8 fps EMS Funct. sw - ΔV Test SPS THRUST LITE - on/off ΔV IND decreases (10 sec) SPS Thrust lite - Off

ΔV ind. Stops at -20.8±20.7 (10 sec)
EMS MODE - STBY
EMS Func - ΔV SET
Set ΔVC _____
EMS FUNC - ΔV
ALIGN GDC TO IMU - CHECK GDC DRIFT
  FDAI SELECT - 1
  FDAI SOURCE - ATT SET
ATT SET - IMU
Null error needles W/3 Thbwls
FDAI SELECT - 1/2
ATT SET - GDC
  GDC ALIGN - PRESS

Key V16 N20
ATT SET thbwls-
-adjust to IMU
gmbl angs on
DSKY
ATT SET - GDC
GDC ALIGN PB -
PUSH, hold

FDAI Scale - 5/1
SECS ARM cb (2) - Close
SECS LOGIC cb (2) - Close
SECS LOGIC (Both) - ON (UP)
MSFN Confirm Go for PYRO ARM (If poss)
SECS PYRO (2) - ON (UP)
TRANS CONTROL PWR - ON (UP)
ROT CONTR PWR NORM (Both) - AC/DC
ROT CONTR PWR DIRECT (Both) - MNA/MNB
LV/SPS Ind - SII/SIVB (Verify)
LV GUID - IU (Verify)
DIRECT ULLAGE CB (2) - CLOSED
Set EVENT TIMER to 51:00
Begin MONITOR For TB6
CMP RTN to Couch

24 ALL Donn Helmets and Gloves
(02:21:46)
25 CDR TB 6 - SII SEP Lite ON (TIG 9 min 38 sec)
FDAI #2 ORB RATE at 180,0,0
SII SEP LITE OUT
51:00 Start DET COUNTING UP
SCS CONT - SCS
LV TANK PRESS (4) - Check
  ΔP<36 psia (OXID>FUEL)
  ΔP<26 psia (FUEL>OXID)

	26	CMP	UP TLM CM - BLOCK			
			UP TLM IU - ACCEPT			
P-47			Key V37E 47E - Thrust Monitor (Check Bias)			
			DSKY - P-47			
			(ΔV COMPONENTS)	F 16 83	XXXX.X	FPS
			ΔVX,Y,Z (CONT)		XXXX.X	FPS
					XXXX.X	FPS
			KEY N62E	F 16 62	XXXXX.	FPS
			VI,HDOT,HPAD		XXXXX.	FPS
					XXXX.X	NM
			Monitor VI at Cutoff			
	27	LMP	MN BUS TIE (2) - ON (UP)			
	28	CDR	EMS MODE - Auto			
			SCS TVC SERVO PWR 1 AC1/MNA			
			SCS TVC SERVO PWR 2 - OFF			
		LMP	START DSE			
		CMP	FLT RCDR - RECORD			
47:00			START 3-MIN COUNT			
58:36			SII SEP lite - ON			
58:38			SIVB ULLAGE Begins			
			xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx			
			x TLI Inhibit Signals will not x			
			x be honored after 59:42 x			
			xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx			
59:42			SII SEP lite-Off (TIG - 18 Sec)			
59:52			SIVB FUEL LEAD			
59:55			SIVB ULLAGE DISCONT			
59:59			LV ENG 1 lite-on (TIG - 1 Sec)			
(02:31:24)						
00:00			SIVB IGNITION (____:____:____GETI)			
00:02			LV ENG 1 lite-Off			
01:00			Report Status			
02:00			Report Status			
03:00			Report Status			
04:00			Report Status			
05:00			Report Status			
			MONITOR BURN THRUST & ATTITUDE			
			LV TK PRESS _______			
05:16			SIVB SHUTDOWN (1t On)			
			xxxxxxxxxxxxxxxxxxxxxxxxx			
			x EMERGENCY SIVB CUTOFF x			
			x SII/SIVB sw - LV STAGE x			
			x or THC - CCW x			
			xxxxxxxxxxxxxxxxxxxxxxxxx			
			SIVB ATT HOLD 20 sec & BEGIN VENTING			
			SIVB MNVR TO ORB RT (HDS DN)(.3°/sec)			

	29	CMP	Record VI______		
			HDOT____		
			HPAD____		
			Key RLSE		
			Record ΔVX_____		
			ΔVY_____		
			ΔVZ_____		
			Key V82E	F 16 44	XXXX.X NM
					XXXX.X NM
					XXBXX M/S
			FLT RCDR - OFF		
			TAPE RCDR - STOP		
			EMS MODE - STBY		
			EMS FUNC - OFF		
			PROCEED	F 37	
08:00			00E		

6.0 POST ABORT PROCEDURES

6.1 LOW ALTITUDE MODE IA

Pad to 42 sec

(Pad to 10,000 feet)

DET			BACKUP PROCEDURE
00:00	1.	ABORT (MANUAL OR AUTOMATIC)	CM/SM SEP SW (2) - ON
		BECO (AFTER T + 00:30)	
		EVENT TIMER RESET	Reset and start manually at LES burnout
		CM RCS PRESSURIZE	CM RCS PRESS SW - ON
		RCS TRANS TO CM	RCS TRANS SW - CM
		ENTRY BAT TO MAIN BUS (IF IN AUTO)	
		CM/SM UMB DEADFACE	CM/SM SEP SW (2) - ON
		RCS OX DUMP	
		CM - RCS ISOLATION VALVES CLOSE	CM RCS PRPLNT SW (2) - ON
00:00.1		CM/SM SEPARATION	CM/SM SEP SW (2)
		LES AND PC MOTORS FIRE	LES MOTOR FIRE PB - press (PC motor will not fire)
00:01.8		CM/SM SEP PYRO DEADFACE	
00:05		CM RCS FUEL DUMP	
00:11		CANARDS DEPLOY	
00:14		TOWER JETT	TWR JETT SW (2) - ON
		DOCKING RING SEP	*CSM/LM FINAL SEP (2) - ON
		ELS ARM AUTO	*ELS LOGIC SW - ON
		RCS AUTO SAFED AT TWR JETT	*RCS CMD SW - OFF
00:14.4		APEX COVER JETT	*APEX COVER JETT PB - press
00:16		DROGUE CHUTES DEPLOY	*DROGUE DEPLOY PB - press
00:18		RCS He PURGE	*CM RCS He DUMP PB - press

```
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x AT 3700 FT INDICATED OR BELOW  x
x DEPLOY MAINS IMMEDIATELY.      x
x                                x
x + ACTUAL MINIMUM ALTITUDE WILL x
x BE SET WITH ALIDADE MARKER ON  x
x LAUNCH DAY.                    x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

00:28		MAIN CHUTES DEPLOY	*MAIN DEPLOY PB - press (If < 10K')
	2.	DIRECT O2 - ON (CCW)	
	3.	CB FLT & PL BAT BUS A, B, AND BAT C (3) - CLOSE	
	4.	CB FLT & PL MN A&B (2) - OPEN ECS RAD HTR OVLD cb (2) - OPEN SPS P&Y cb (4) - open CABIN PRESS REL vlv (RH) - DUMP	
	5.	COMM SET UP FOR LANDING, VOICE CHECK	
	7.	FLOOD SW - POST LDG	
	8.	CM RCS PRPLNT (2) - OFF ROT CONT PWR DIRECT - OFF	
	9.	MAIN BUS TIE SW (2) - OFF	
<800'	10.	CABIN PRESS RELIEF - CLOSE	
	11.	RELEASE MAINS AFTER TOUCHDOWN	
	12.	POST LANDING CHECKLIST	

6.2 MEDIUM ALTITUDE MODE IB

(42 sec to 100,000 ft)

(10,000 ft to 1 min 56 sec)

DET		BACKUP PROCEDURE
00:00	1. ABORT (MANUAL OR AUTOMATIC)	CM/SM SW (2) - ON
	BECO	
	EVENT TIMER RESET	Reset and start manually at LES burnout
	CM RCS PRESSURIZE	CM RCS PRESS SW - ON
	CM/SM UMB DEADFACE	CM/SM SEP SW (2) - ON
00:00.1	CM/SM SEPARATION	CM/SM SEP SW (2) - ON
	LES MOTOR FIRE	LES MOTOR FIRE PB - press
00:01	CM RCS ENABLES	RCS CMD SW - ON
00:01.8	CM/SM SEP PYRO DEADFACE	
00:11	CANARDS DEPLOY	*CANARD DEPLOY PB - press
00:14	ELS ARM AUTO	*ELS LOGIC SW - ON (IF BELOW 24K')
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	
	TWR will jett at 14 sec if alt <37K' (barro's closed)	
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	
24K'	TOWER JETT	*TWR JETT SW (2) - ON
	DOCKING RING SEP	*CSM/LM FINAL SEP (2) - ON
	RCS DISABLED	*RCS CMD SW - OFF
	APEX COVER JETT	*APEX COVER JETT PB - press
24K+.4SEC		
24K+ 2SEC	DROGUE CHUTES DEPLOY	*DROGUE DEPLOY PB - press
23.5K'	2. VERIFY CABIN PRESSURE INCREASE	If not increasing by 17K' cabin press release valve - dump
10K'	MAIN CHUTES DEPLOY	*MAIN DEPLOY PB - press
	CABIN PRESS REL vlv (2) - close	
	3. DIRECT O2 - ON (CCW)	
	4. CM PROP JETT DUMP SW - DUMP	Use 2 RHC to fire all jetts except + pitch (DIRECT RCS - ON)
	5. CM PROP JETT - PURGE (FOR 30 SEC AFTER BURNOFF)	*CM RCS He DUMP PB - press
	CABIN PRESS REL vlv - BOOST/ENTRY	
	6. CB FLT & PL BAT BUS A, B, AND BAT C (3) - CLOSE	
	7. CB FLT & PL MNA & B (2) - OPEN	
	ECS RAD HTR OVLD cb (2) - OPEN	
	SPS P&Y cb (4) - open	
	CABIN PRESS REL (RH) - DUMP	

8. COMM SET UP FOR LDG, VOICE REPORT
9. FLOOD SW - POST LDG
10. CM RCS PRPLNT (2) - OFF
    ROT CONTR PWR DIRECT - OFF
11. DC MAIN BUS TIE SW (2) - OFF

<800' 12. CABIN PRESS RELIEF - CLOSE

13. RELEASE MAINS AFTER TOUCHDOWN
14. POST LANDING CHECKLIST

*Designates backup function manually performed by crew

6.3 HIGH ALTITUDE MODE IC

100,000 feet to TWR JETT

(1 min 56 sec to 3 min 16 sec)

DET		BACKUP PROCEDURE
00:00	1. ABORT (MANUAL OR AUTOMATIC)	CM/SM SEP SW (2) - ON
	BECO	
	EVENT TIMER RESET	Reset and start manually and LES burnout
	CM RCS PRESSURIZE	*CM RCS PRESS SW - ON
	RCS TRANS TO CM	*RCS TRANS SW - CM
	CM/SM UMB DEADFACE	DM/SM SEP SW (2) - ON
00:00.1	CM/SM SEPARATION	CM/SM SEP SW (2) - ON
	LES MOTOR FIRE	LES MOTOR FIRE PB - press
00:01	CM RCS ENABLED	*RCS CMD SW - ON
00:01.8	CM/SM SEP PYRO DEADFACE	
00:11	CANARDS DEPLOY	*CANARD DEPLOY PB - press
00:14	ELS LOGIC ARM	*ELS LOGIC SW - ON
	G&C No Go or ha<33	<u>Pilot Option</u> G&C Go and ha >33
	2. ESTABLISH 5°/SEC + PITCH RATE	2. TWR JETT SW (2) - ON
	DAMP RATES IN YAW & ROLL	3. DAMP RATES
	DAMP + PITCH RATES BY ROLLING S/C	4. MAN ATT SW(PITCH)-RATE CMD
	90° AND USING YAW THRUSTERS	5. MAN TO ENTRY ATT (R=0°,P=135°,Y=0°)
	ROLL HEADS DOWN & ESTABLISH	6. BMAG MODE SW (3)-ATT 1/ RATE 2
	+5°/sec PITCH RATE	7. EMS ENTRY/NORMAL
		10. At 0.5G LT-0.05G SW - ON
		11. FLY MAX LIFT
		12. PROCEED TO DOCKING RING SEP
24K'	TOWER JETT	*TWR JETT SW (2) - ON
	DOCKING RING SEP	*CSM FINAL SEP SW (2) - ON
	RCS DISABLE	*RCS CMD SW - OFF
	APEX COVER JETT	*APEX COVER JETT PB - press
24K+.4SEC		
24K+ 2SEC	DROGUE CHUTES DEPLOY	*DROGUE DEPLOY PB - press
23.5K'	9. VERIFY CABIN PRESSURE INCREASE	CABIN PRESS RELEASE - dump (If not increasing by 17K')
10K'	10. MAIN CHUTES DEPLOY	*MAIN DEPLOY PB - press
	11. DIRECT O2 - ON (CCW)	
	12. CM PROP JETT DUMP SW - DUMP	Use 2 RHC to fire all jetts except pitch(RCS DIRECT-ON)
	13. CM PROP JETT - PURGE (FOR 30 SEC AFTER BURNOFF)	*CM RCS He DUMP PB press
	CABIN PRESS REL vlv - BOOST/ENTRY	

14. CB FLT & PL BAT BUS A, B, AND BAT C
    (3) - CLOSE
15. CB FLT & PL MNA & B (2) - OPEN
    ECS RAD HTR OVLD cb (2) - OPEN
    SPS P&Y cb (4) - open
    CABIN PRES REL (RH) - DUMP
16. COMM SET UP FOR LDG, VOICE REPORT
17. FLOOD SW - POST LDG
18. CM RCS PRPLNT (2) - OFF
    ROT CONT PWR DIRECT - OFF
19. DC MAIN TIE SW (2) - OFF

<800' 20. CABIN PRESSURE RELIEF - CLOSE

22. RELEASE MAINS AFTER TOUCHDOWN
22. POST LANDING CHECKLIST

*Designates backup functions manually performed by crew

6.4 SPS MODE II

TWR JETT TO RFL <3200 NM (ΔR <-400 NM)

(3 min 16 sec to 9 min 41 sec)

DET		BACKUP PROCEDURE
00:00	1. ABORT THC - CCW	**Warning:** Steps (1) thru (17) must be completed within 1 min 40 seconds elapsed time.
	BECO	
	EVENT TIMER RESET	Reset and start manually
	DIRECT ULLAGE START	DIRECT ULLAGE PB - press
00:03	S-IVB/CSM SEP	CSM/LV SEP PB - press
00:03.8	SCS STABILIZATION ENABLE	*RCS CMD - ON
00:05	2. THC NEUTRAL AND +X TRANS (MAINTAIN FOR 20 SEC)	
00:24	3. TERMINATE +X TRANS (THC - NEUTRAL)	
	4. V82E - N50E	DETERMINE ABORT MODE FROM ΔR DISPLAY
	5. START MANEUVER TO ENTRY ATT R=0°, P=120°, Y=0°	
	6. BMAG SW (3) - ATT 1/RATE 2	
	7. RATE - LOW	
	8. TIME PERMITTING TRANS RCS TO CM AND CHECK	
	9. NOTE TFF, IF >2:00 YAW 45° before CM/SM SEP	
	10. RATE - HIGH	
	11. CM/SM - SEP (2)	
	CM/SM DEADFACE	
	CM - RCS PRESS	*CM RCS PRESS SW - press
	CM/SM SEP	
	RCS TRANS - CM	
	12. CSM/LM FINAL SEP SW (2) - ON	
	13. CAUT & WARN - CM	
	14. EMS - ENTRY	
	15. EMS MODE - NORMAL	
	16. NOTE TFF (FOR ENTRY ATT TIME)	
01:40	17. COMPLETE MANEUVER CM TO FDAI ENTRY ATTITUDE R=0°, P=120° Y=0° (BEF, HEADS DOWN, LIFT VECTOR UP)	
	18. OBTAIN PITCH UPDATE	
	19. SET UP FOR SINGLE RING RCS	
	20. AT 0.05G LIGHT 0.05G SW - 0.05G	
	21. EMS ROLL SW - ON (ALIGN)	
	22. FLY MAX LIFT	
<30K'	23. ELS LOGIC SW - LOGIC	

24K'		APEX COVER JETT	*APEX COVER JETT PB - press
APEX JETT + 1.6 SEC		DROGUE CHUTES DEPLOY	*DROGUE DEPLOY PB - press
23.5K'	24.	VERIFY CABIN PRESSURE INCREASE	CABIN PRESS RELEASE - on (If not increasing by 17K')
10K'		MAIN CHUTES DEPLOY	*MAIN DEPLOY PB - press
	25.	CABIN PRESS Relf vlv (2)-close	
	26.	DIRECT O2 - ON (CCW)	
	27.	CM PROP DUMP SW - DUMP	Fire all jetts except pitch (DIRECT RCS ON)
	28.	CM PROP JETT PURGE - (FOR 30 SEC AFTER BURNOFF)	
	29.	Cabin Press Relf vlv - BOOST/ENTRY	
	30.	CB FLT & PL BAT BUS A, B, AND BAT C (3) - CLOSE	
	31.	CB FLT & PL MNA & B (2) - OPEN	
	32.	ECS RAD HTR OVLD cb (2) - open	
	33.	SPS P&Y cb (4) - open	
	34.	Cabin Press Relf vlv - DUMP	
	35.	COMM SET UP FOR LDG, VOICE REPORT	
	36.	FLOOD SW - POST LDG	
	37.	CM RCS PRPLNT (2) - OFF	
	38.	ROT CONTR PWR DIRECT - OFF	
	39.	DC MAIN TIE SW (2) - OFF	
<800'	40.	CABIN PRESSURE RELIEF (2) - CLOSE	
	41.	RELEASE MAINS AFTER TOUCHDOWN	
	42.	POST LANDING CHECKLIST	

*Designates backup function manually performed by crew

6.5 SPS MODE III

RETROGRADE**

RFL >3200 NM (ΔR >-400 NM) to insertion

(9 min 41 sec) (11 min 24 sec)

DET		BACKUP PROCEDURE
00:00	1. ABORT THC - CCW	Warning: Steps (1) thru (14) must be completed within 2 min 05 sec elapsed time
	BECO	
	EVENT TIMER RESET	Reset and start manually
	DIRECT ULLAGE START	DIRECT ULLAGE PB - press
00:03	S-IVB/CSM SEP	CSM/LV SEP PB - press
00:03.8	SCS STABILIZATION ENABLE	*RCS CMD - ON
	2. LV/SPS IND SW - GPI	
00:05	3. THC NEUTRAL AND +X TRANS (MAINTAIN FOR 20 SEC)	DIRECT ULLAGE PB - press
00:24	4. TERMINATE +X TRANS (THC - NEUTRAL)	
	5. V82E N50E	
	**NOTE: IF -400 NM<ΔR<ONM, No Retro burn required; substitute entry attitudes (step 27) for retro attitude (step 6) and proceed to step 17.	
	6. MANEUVER CSM TO RETRO ATTITUDE (FDAI APPROX R=180°, P=194°, Y=0°) SCRIBE LINE ON HORIZON, BEF, HEADS UP	
	7. OBTAIN RETRO UPDATE	
	8. BMAG MODE SW (3) - ATT 1/RATE 2	
	9. RATE - LOW	
	10. CHECK MTVC AND GIMBAL ANGLES	
	11. EMS MODE - NORMAL	
	12. ΔV THRUST SWITCH (A) - NORMAL	
01:50	13. START ULLAGE (THC)	DIRECT ULLAGE PG - press
02:05	14. SPS THRUST - Push	
02:06	15. STOP ULLAGE (THC-NEUTRAL)	DIRECT ULLAGE PB - release
	16. THRUST TERMINATE AT ΔV REMAINING = DESIRED VALUE	Burn ΔR = 0 on DSKY
	ΔV THRUST SW (2) - OFF	
	17. SET UP FOR SINGLE RING RCS	
	18. TIME PERMITTING TRANS RCS TO CM AND CHECK	
	19. NOTE TFF, IF >2:00 YAW 45° before CM/SM SEP	
	20. RATE - HIGH	

	21. CM/SM SEP (2) - ON	
	CM/SM DEADFACE	
	CM/RCS PRESS	*CM RCS PRESS SW - ON
	CM/SM SEP	
	RCS CONTROL TRANS TO CM	*RCS TRANS - CM
	22. CSM/LM FINAL SEP SW (2) - ON	
	23. CAUT AND WARN - CM	
	24. EMS MODE STBY	
	25. EMS FUNCTION - ENTRY	
	26. EMS MODE - NORMAL	
	27. MANEUVER CM TO FDAI ENTRY ATTITUDE R=0°, P=105°, Y=0° (BEF, HEADS DOWN, FULL LIFT)	
	28. OBTAIN ROLL, PITCH, AND YAW UPDATE	
	29. AT 0.05G LIGHT, 0.05G SW - ON	
	30. AT 0.2G LIGHT, ROLL LEFT 55°	
	31. EMS ROLL - ON (ALIGN)	
	32. FLY HALF LIFT	
<30K'	33. ELS LOGIC SWITCH	
24K'	APEX COVER JETT	*APEX COVER JETT PB - push
	RCS DISABLED	*RCS CMD - OFF
TWR JETT + 1.6 SEC	DROGUE CHUTES DEPLOY	*DROGUE DEPLOY PB - press
23.5K'	34. VERIFY CABIN PRESSURE INCREASE	CABIN PRESS RELEASE - press (If not increasing by 17K)
10K'	MAIN CHUTES DEPLOY	*MAIN DEPLOY PB - press
	35. CABIN PRESS RELF vlv (2) - close	
	36. DIRECT O2 - ON (CCW)	
	37. CM PROP JETT DUMP SW - DUMP	Rotate RHC to fire all except pitch (RCS DIRECT ON)
	38. CM PROP JETT PURGE - PURGE (FOR 30 SEC AFTER BURNOFF)	*CM RCS He DUMP PB - press
	39. Cabin press relf vlv - BOOST/ENTRY	
	40. CB FLT & PL BAT BUS A, B, AND BAT C (3) - CLOSE	
	41. CB FLT & PL MNA & B (2) - OPEN	
	42. ECS RAD HTR OVLD cb (2) - OPEN	
	43. SPS P&Y cb(4) - OPEN	
	44. CABIN PRESS RELF vlv - DUMP	
	45. COMM SET UP FOR LDG, VOICE REPORT	
	46. FLOOD SW - POST LDG	
	47. CM RCS PRPLNT (2) - OFF	
	48. ROT PWR DIRECT - OFF	
	49. DC MAIN TIE SW (2) - OFF	
<800'	50. CABIN PRESSURE RELIEF (2) - CLOSE	
	51. RELEASE MAINS AFTER TOUCHDOWN	
	52. POST LANDING CHECKLIST	

*Designates backup functions manually performed by crew

6.6 SPS MODE IV**

POSIGRADE

21,800 fps, h ∿ 103 to insertion

(8 min 37 sec to 11 min 21 sec)

DET		BACKUP PROCEDURE
00:00	1. ABORT THC - CCW	<u>Warning</u>: Steps (1) thru (14) must be completed as soon as possible
	BECO	
	EVENT TIMER RESET	Reset and start manually
	DIRECT ULLAGE START	DIRECT ULLAGE PB - press
00:03	S-IVB/CSM SEP	CSM/LV SEP PB - press
00:03.8	SCS STABILIZATION ENABLE	*RCS CMD - ON
	2. LV/SPS IND SW - GPI	
00:05	3. EMS MODE - AUTO	DIRECT ULLAGE PB - press
	4. THC NEUTRAL AND +X TRANS (MAINTAIN FOR 20 SEC)	
00:24	5. TERMINATE +X TRANS (THC - NEUTRAL)	
	6. V82E	
	7. MANEUVER CSM TO INSERTION ATTITUDE (FDAI APPROX R=180°, P=356°, Y=0°) SCRIBE LINE ON HORIZON, SEF, HEADS DOWN	
	8. OBTAIN INSERTION UPDATE	
	9. BMAG MODE SW (3) - ATT 1/RATE 2	
	10. RATE - LOW	
	11. CHECK MTVC AND GIMBAL ANGLES	
	12. ΔV THRUST SWITCH (A) - NORMAL	
	13. START ULLAGE (THC)	DIRECT ULLAGE PB - press
	14. SPS THRUST - PUSH	
	15. STOP ULLAGE (THC - CENTER)	DIRECT ULLAGE PB - Release
	16. ΔV THRUST SW (2) - OFF at ΔV = DESIRED VALUE	*Burn Hp > 75 NM or HA=200 NM
	17. EMS MODE STBY	
	18. GIMBAL MTRS (4) - OFF	*Designates backup functions manually performed by crew
	19. TVC SERVO PWR (2) - OFF	
	20. INSERTION CHECKLIST	

**FOR G&N GO the two burn Mode IV may be employed. The first burn is performed as a normal Mode IV with the first burn starting as soon as possible. The burn is terminated when hA - 200 NM. The second burn is then a normal Apogee kick maneuver performed when $\dot{h} = 0$.

6.7 APOGEE KICK

(Positive $\dot{h}$ and Beyond 5 min to Apogee Line)

DET		BACKUP PROCEDURE
00:00	1. Abort THC - CCW	
	BECO	
	EVENT TIMER RESET	
00:03	S-IVB/CSM SEP	CSM/LV Sep PB - PRESS
00:03.8	SCS STABILIZATION ENABLE	*RCS CMD - ON
	2. LV/SPS IND sw - GPI	
00:05	3. THC Neutral and (+)X TRANS (maintain for 20 sec)	DIRECT ULLAGE PB - press
00:24	4. TERMINATE +X TRANS (THC-Neutral)	
	5. Maneuver to INSERTION ATTITUDE (FDAI APPROX R=180°, P=347°, Y=0°) SCRIBE LINE ON HORIZON, SEF, HEADS DOWN	
	6. OBTAIN INSERTION UPDATE	
	7. BMAG MODE (3) - ATT 1/RATE 2	
	8. RATE - LOW	
	9. CHECK MTVC AND GIMBAL ANGLES	
	10. EMS MODE - AUTO	
	11. ΔV THRUST sw (2) - NORMAL	
$\dot{h}=0$	12. ULLAGE AND SPS THRUST PB - PRESS	
	13. V82E	
$h_p>75$	14. ΔV THRUST sw (A) - OFF	
	15. EMS MODE - STBY	
	16. GIMBAL MTRS (4) - OFF	
	17. TVC SERVO PWR (2) - OFF	
	18. INSERTION CHECKLIST	

*Designates backup functions manually performed by the crew

7.0 TWR JETT FAILURE PROCEDURE

7.1 TWR CUT/NO JETT MOTOR FIRE (AUDIENCE)

1. Fire Main LES Motor Manually - LES Motor Fire PB - Press

   (a) If tower jettisons - continue mission
   (b) No response - carry LET into orbit

7.2 NO RESPONSE TO TWR JETT SWITCHES

1. Insure MESC & PYRO Arm Switches - ON (4)

2. Insure EDS Power Switch - ON (1)

3. Insure EDS CB's - ON (3)

4. Insure MESC Arm & Logic CB's - ON (4)

5. Attempt TWR JETT

   (a) TWR JETT Successful - Continue Mission
   (b) Not Successful - Carry LET Into Orbit

8.0 ORBITAL COAST ABORT PROCEDURES

(ABORT FROM S-IVB)

BACKUP PROCEDURE

ASSUME: S/C SWITCH POSITIONS ARE IN THE BOOST CONFIGURATION. VEHICLE STABILITY IS CONTROLLED BY S-IVB ATTITUDE CONTROL SYSTEM (IU).

	1.	ADAPT SEP PB - PUSH	THC - CCW
	2.	RCS CMD - ON	
	3.	THC UNLOCK AND +X START	DIRECT ULLAGE PB - push
	4.	S-IVB/GPI SW - GPI	
ABORT + 2 SEC	5.	ΔV THRUST SW (A) - NORMAL	
	6.	SPS THRUST - DIRECT ON	
	7.	STOP +X	Release DIRECT ULLAGE PB
GND SUPPLIED	8.	ΔV THRUST SW (2) - OFF	
	9.	SPS THRUST - NORMAL	

9.0 BACKUP GUIDANCE PROCEDURES

9.1. Boost Phase - Switchover can only be accomplished when the SC LV GUID Lt has been illuminated.

a) S-IC - LV GUID IV/CMC - CMC (error signal display continues)

b) S-II/S-IVB - Key V46E
LV GUID IU/CMC - CMC
Steer LV by use of onboard charts, FDAI, and DSKY

<u>Note</u>: Crew initiated cutoff command is required for all backup guidance cases.

9.2. TLI Phase

<u>Note</u>: A good IU state vector is required to start TB6. The state vector can be ground updated if necessary.

TIG - 15:00 Initialize ORDEAL
Set ORDEAL Alt - 211 NM
Set ORDEAL θ - $+20^{\circ}$

TIG - 5:20 Start ORDEAL

Key V37E 47E (FL 16 62) V_x
V_y
V_z

Key N62E (FL 16 62) V_i
$\dot{H}$
H

Key V46E
GUID IU/CMC - CMC

Fly 0° ORDEAL Pitch
0° Roll
4° Yaw

Monitor DSKY ____ (V_i CO = 35,598)
Record V_i
$\dot{H}$
H

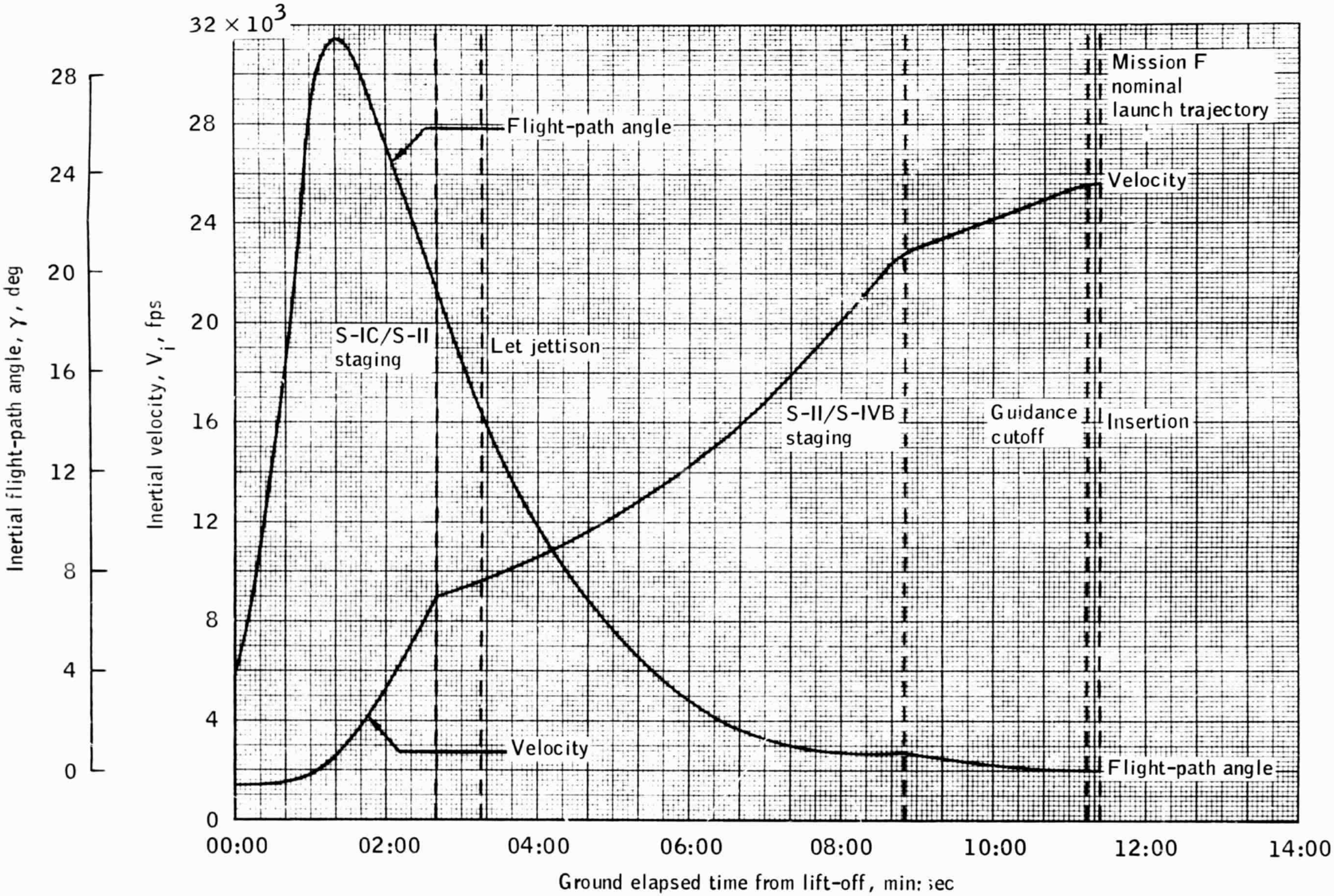
Appendix A

AS 505 Launch - 5/17/69 72° AZ

Time	Θ	V_i	$\dot{H}$	H
00:00	90	1,341	0	0
00:30	86	1,391	295	0.7
01:00	69	1,847	825	3.3
01:30	47	3,050	1,485	9.0
02:00	32	5,125	2,198	18.1
02:15 CECO	27	6,559	2,511	24.0
02:30	23	7,915	2,814	30.7
02:40 OCO	22	9,032	3,009	35.7
03:00	22	9,266	2,632	44.8
03:30	28	9,840	2,161	56.6
04:00	25	10,492	1,809	66.4
04:30	22	11,248	1,482	74.6
05:00	19	12,105	1,185	81.2
05:30	16	13,071	921	86.4
06:00	12	14,157	693	90.4
06:30	9	15,379	506	93.4
07:00	5	16,759	366	95.6
07:30	2	18,327	283	97.2
08:00	358	20,124	274	98.6
08:30	355	21,708	274	100.0
08:49 ECO	353	22,795	303	100.9
09:00	352	22,897	252	101.4
09:30	347	23,443	155	102.4
10:00	343	24,018	74	103.0
10:30	340	24,622	21	103.3
11:00	338	25,256	-8	103.3
11:14 ECO	338	25,562	0	103.3
Time	Θ	V_i	$\dot{H}$	H

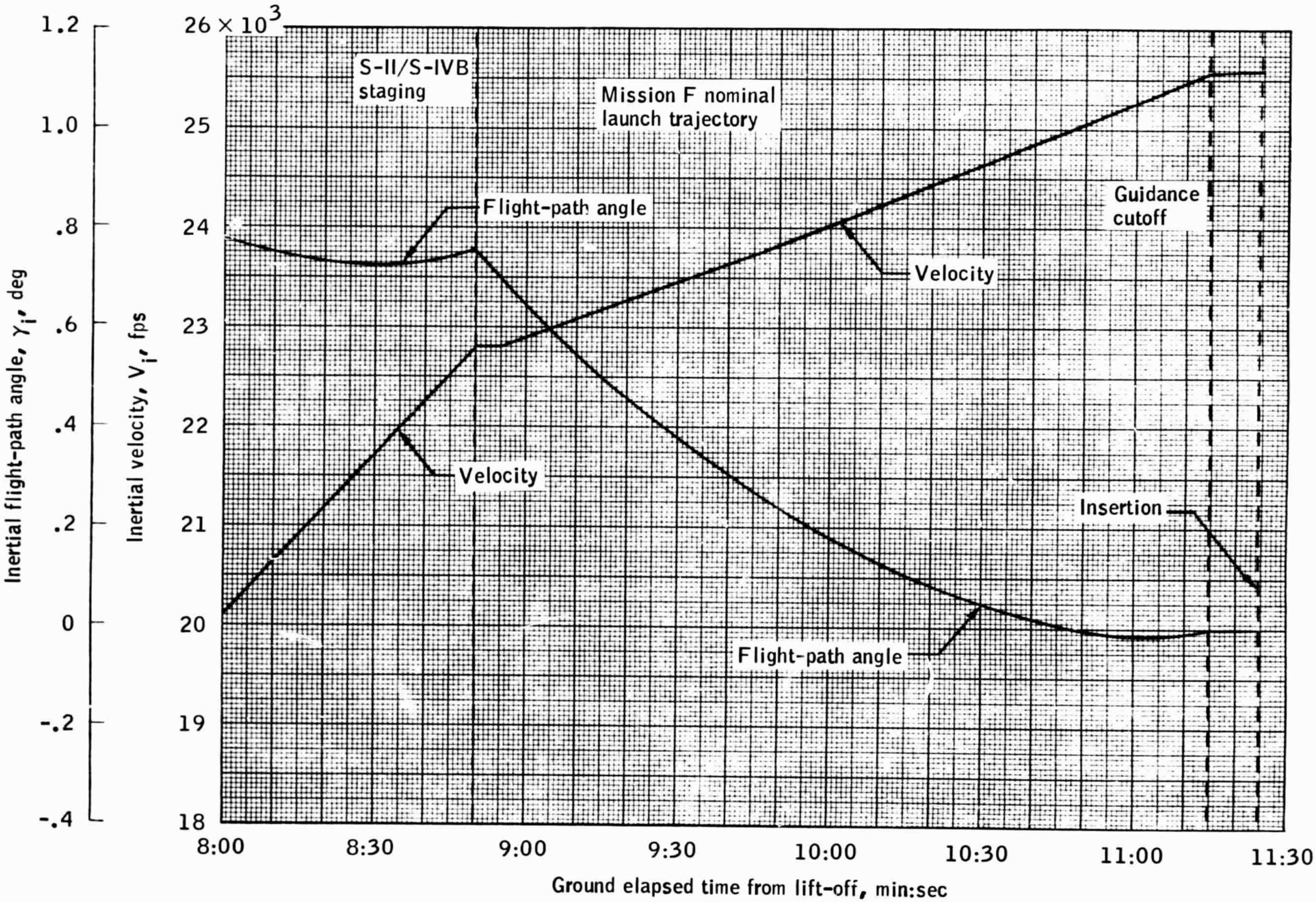
AS 505 TLI - 5/17/69 72° AZ 1st Opportunity

Time	Θ	Ψ	V_i	H
00:00	0	0	25,594	105.7
00:10	- 5	0	25,796	105.7
00:20	- 6	1	26,001	105.7
00:40	- 7	1	26,421	105.6
01:00	- 8	2	26,853	105.6
01:20	- 9	2	27,298	105.8
01:40	- 9	3	27,757	106.1
02:00	-10	3	28,230	106.7
03:00	-12	5	29,912	111.5
04:00	-14	6	31,811	123.5
04:20	-15	6	32,500	129.7
04:40	-17	7	33,222	137.4
05:00	-18	7	33,980	146.5
05:20	-21	8	34,780	157.8
05:39	-20	8	35,598	170.2
Time	Θ	Ψ	V_i	H

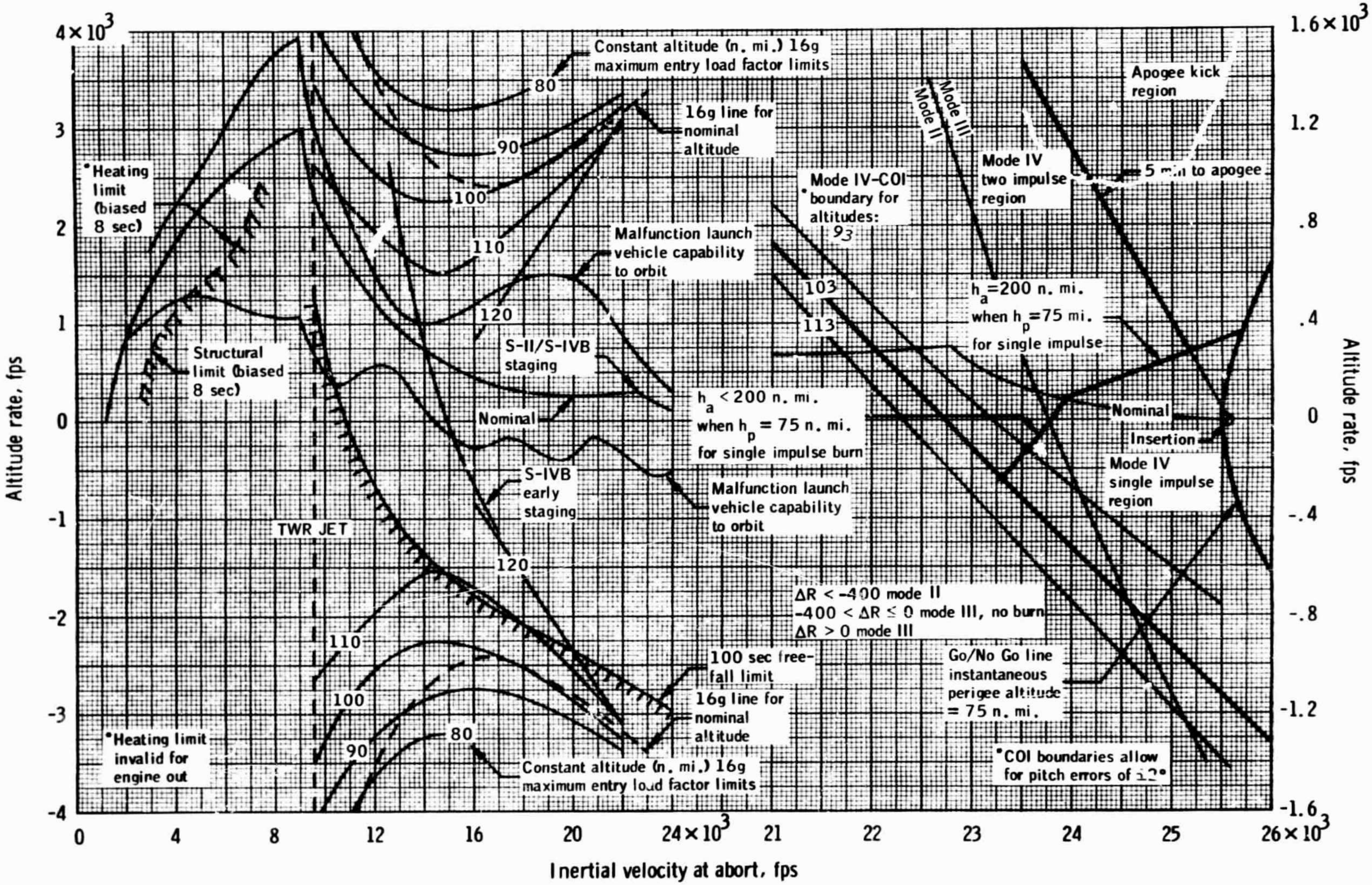


(a) Complete launch.

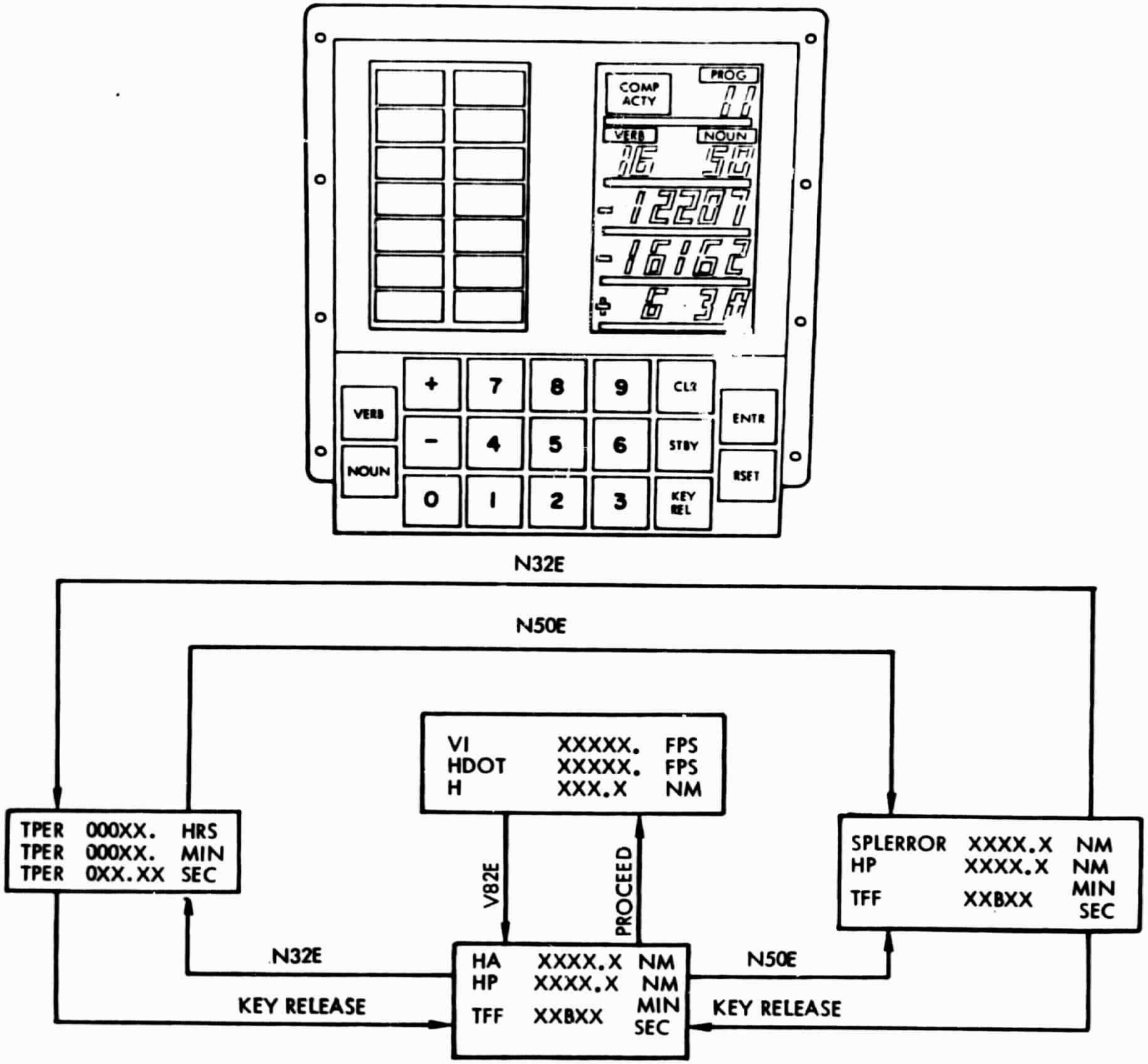
- Inertial velocity and inertial flight-path angle along the nominal launch trajectory.



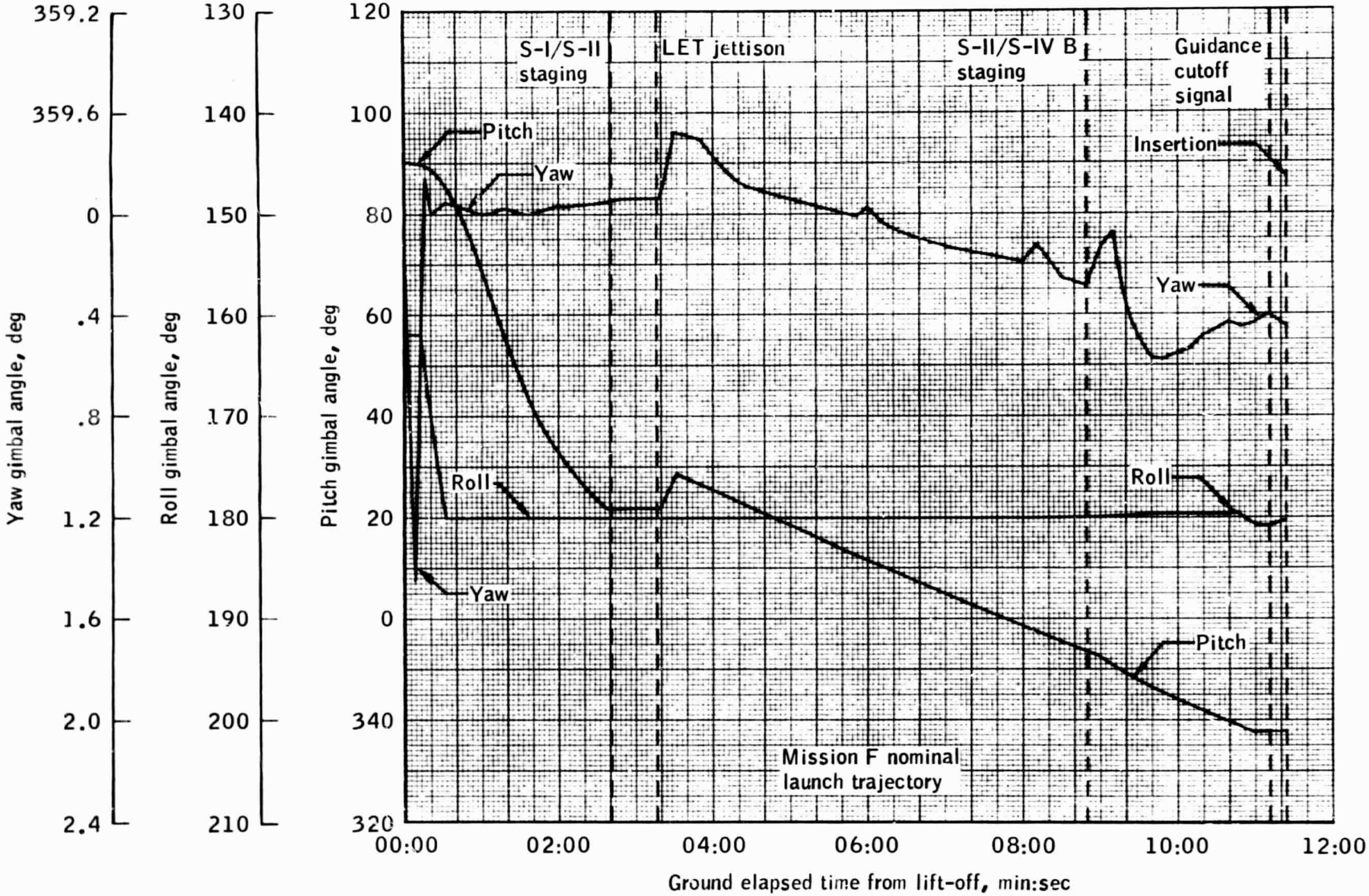
(b) Near insertion.



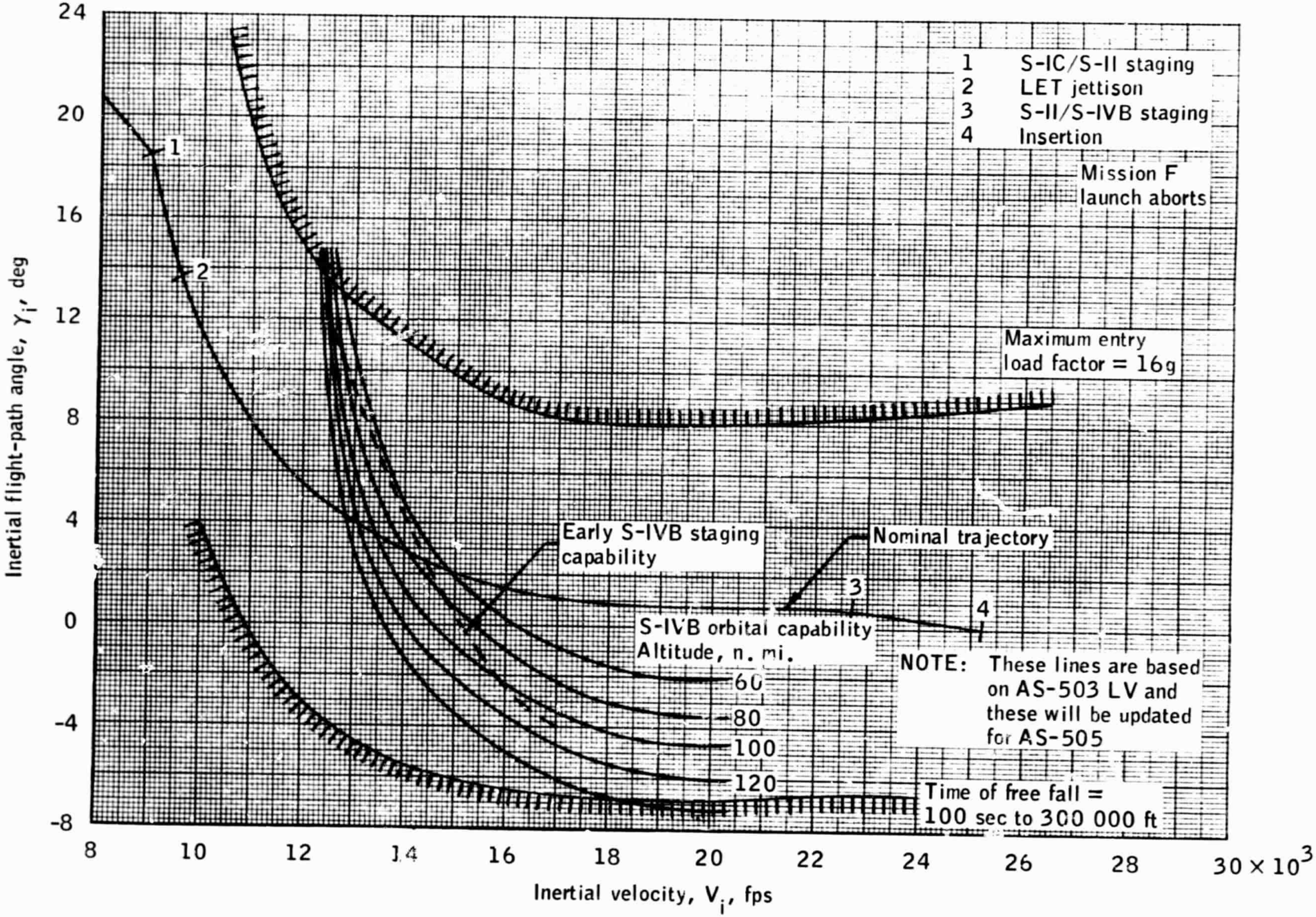
Sample no-voice crew chart for the launch phase.



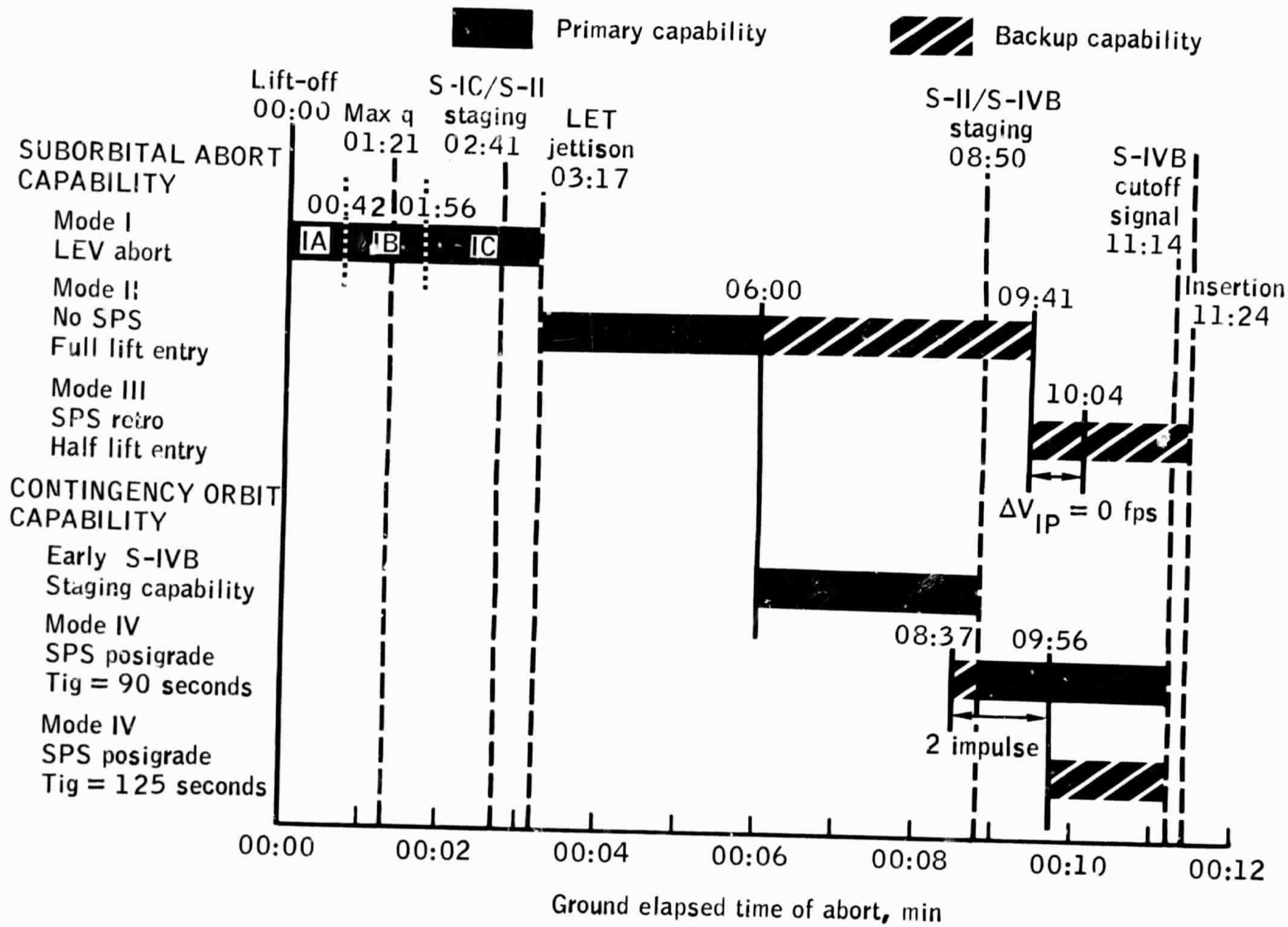
AGC display keyboard and display parameters.



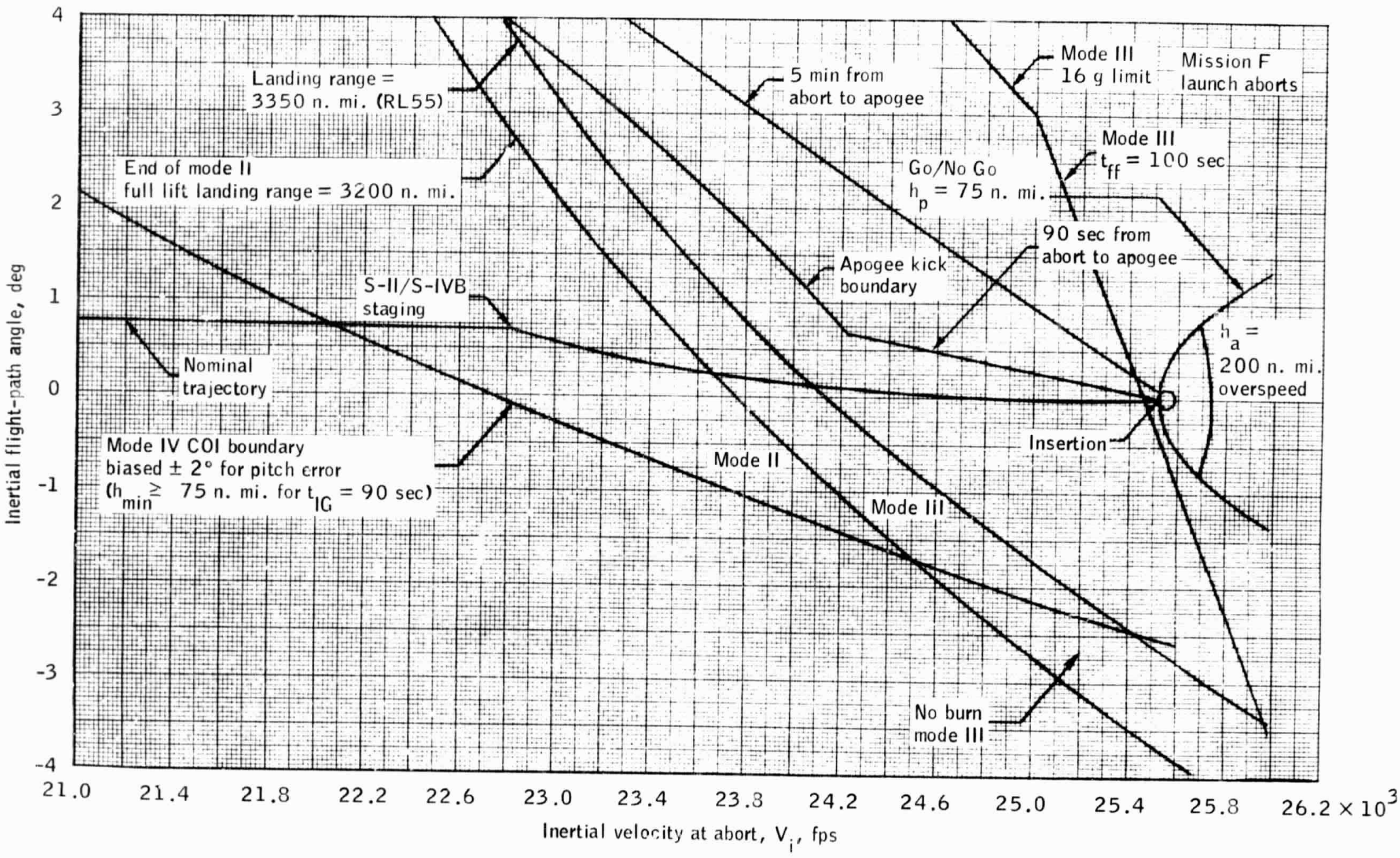
Spacecraft IMU gimbal angle readouts along the nominal launch trajectory.



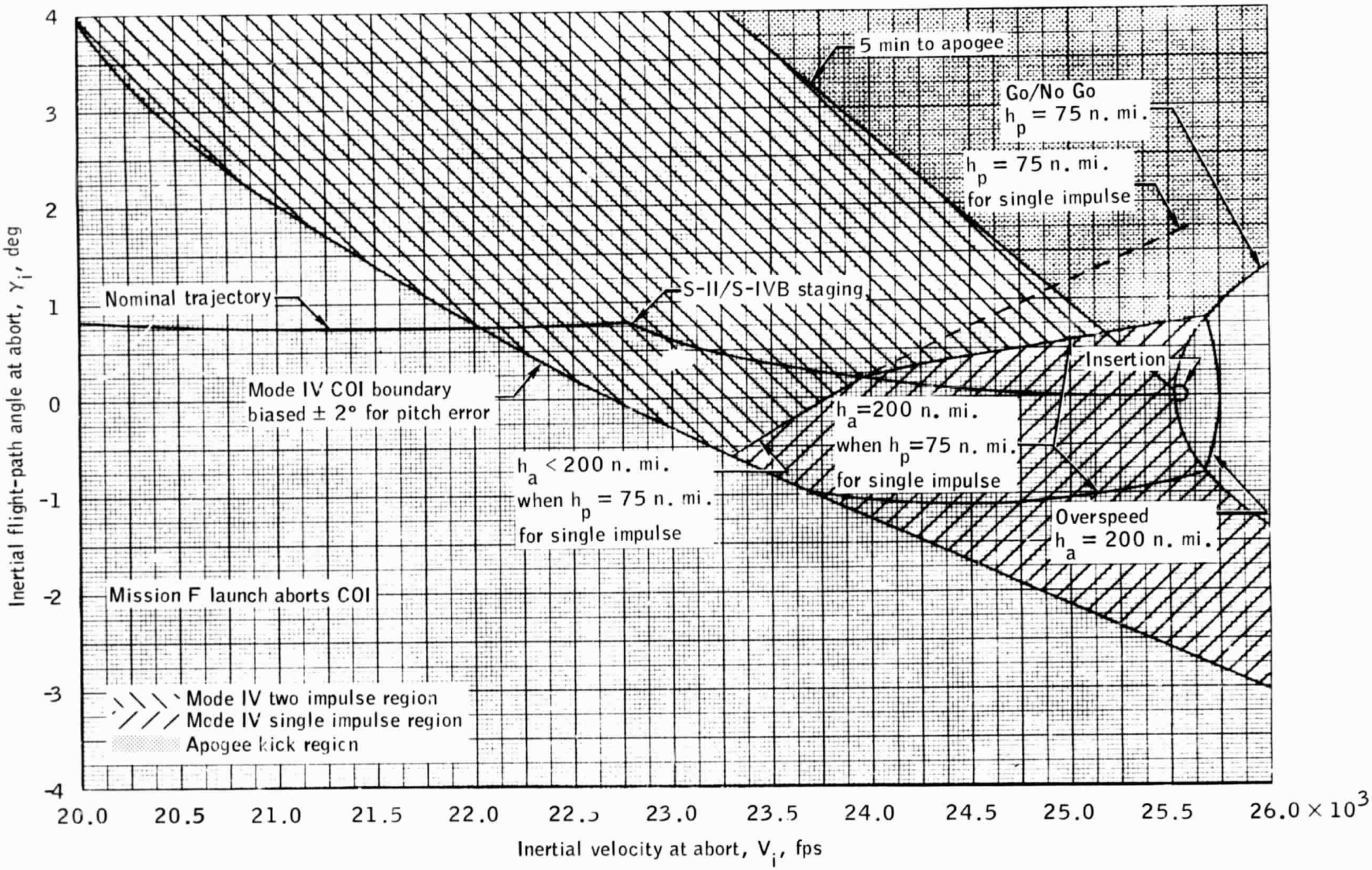
S-IVB early staging to orbit capability variation with altitude.



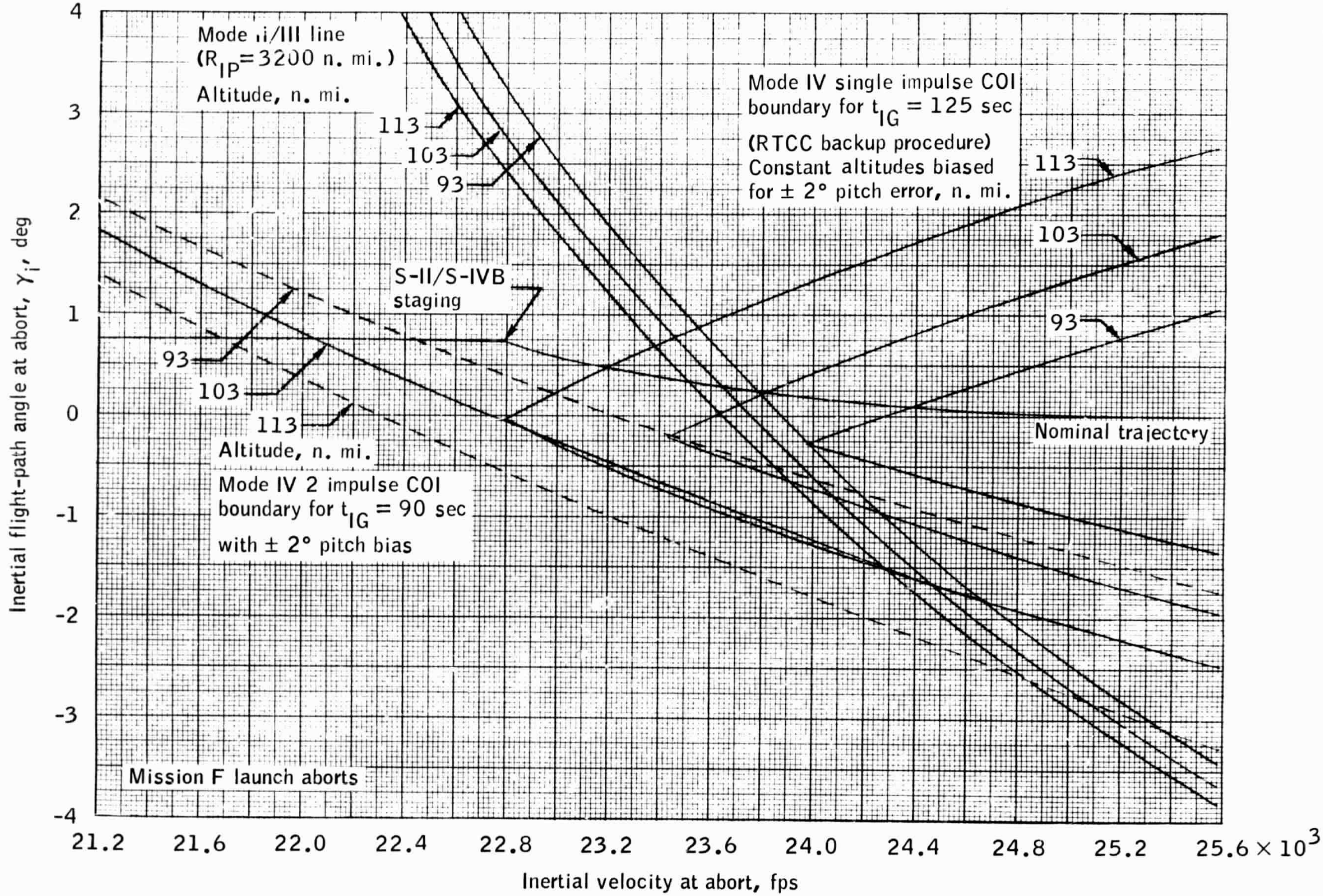
Mission F launch timeline and contingency capability.



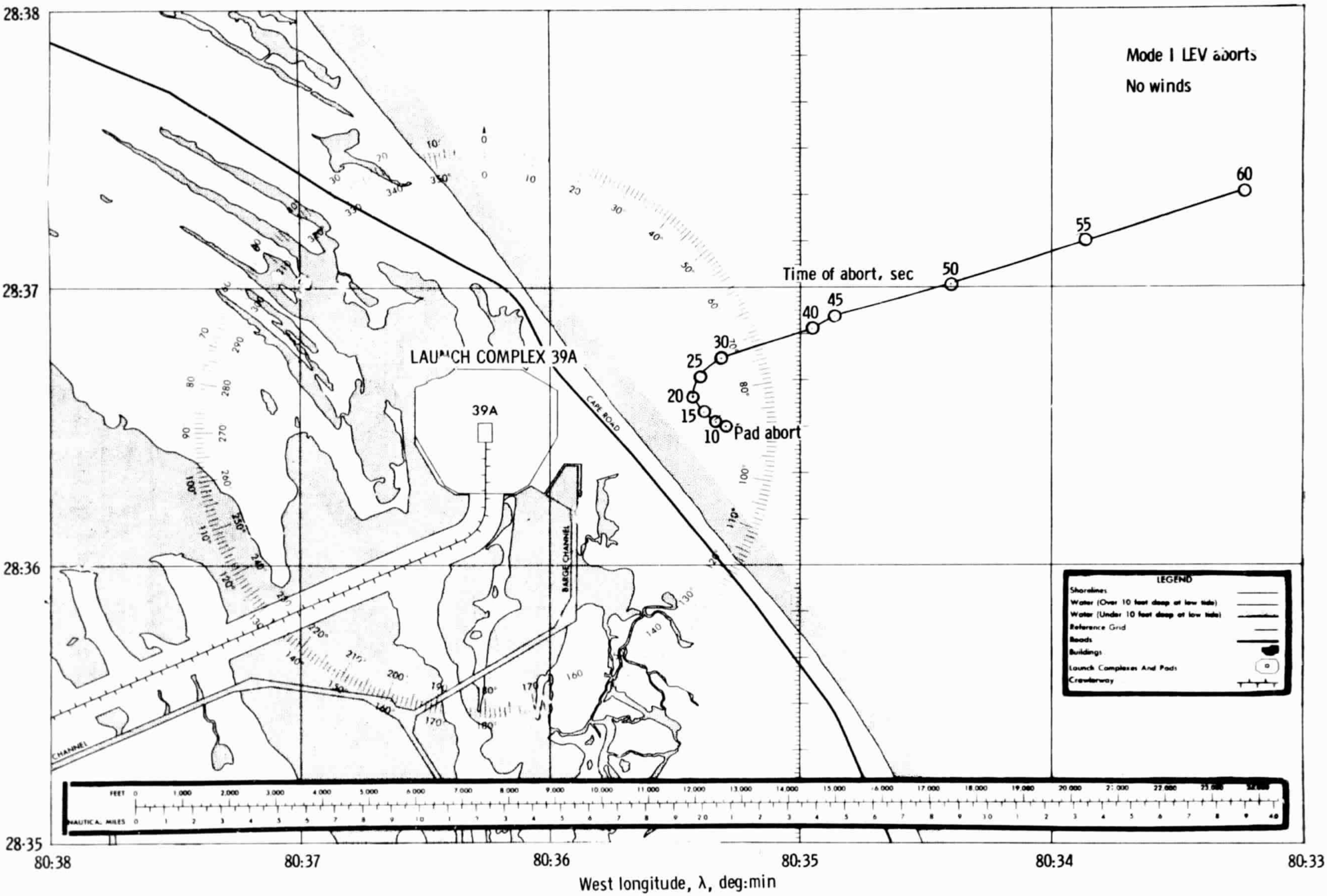
Near-insertion abort mode overlap.



SPS contingency orbital insertion capability.



SPS contingency orbital insertion capability variation with altitude.



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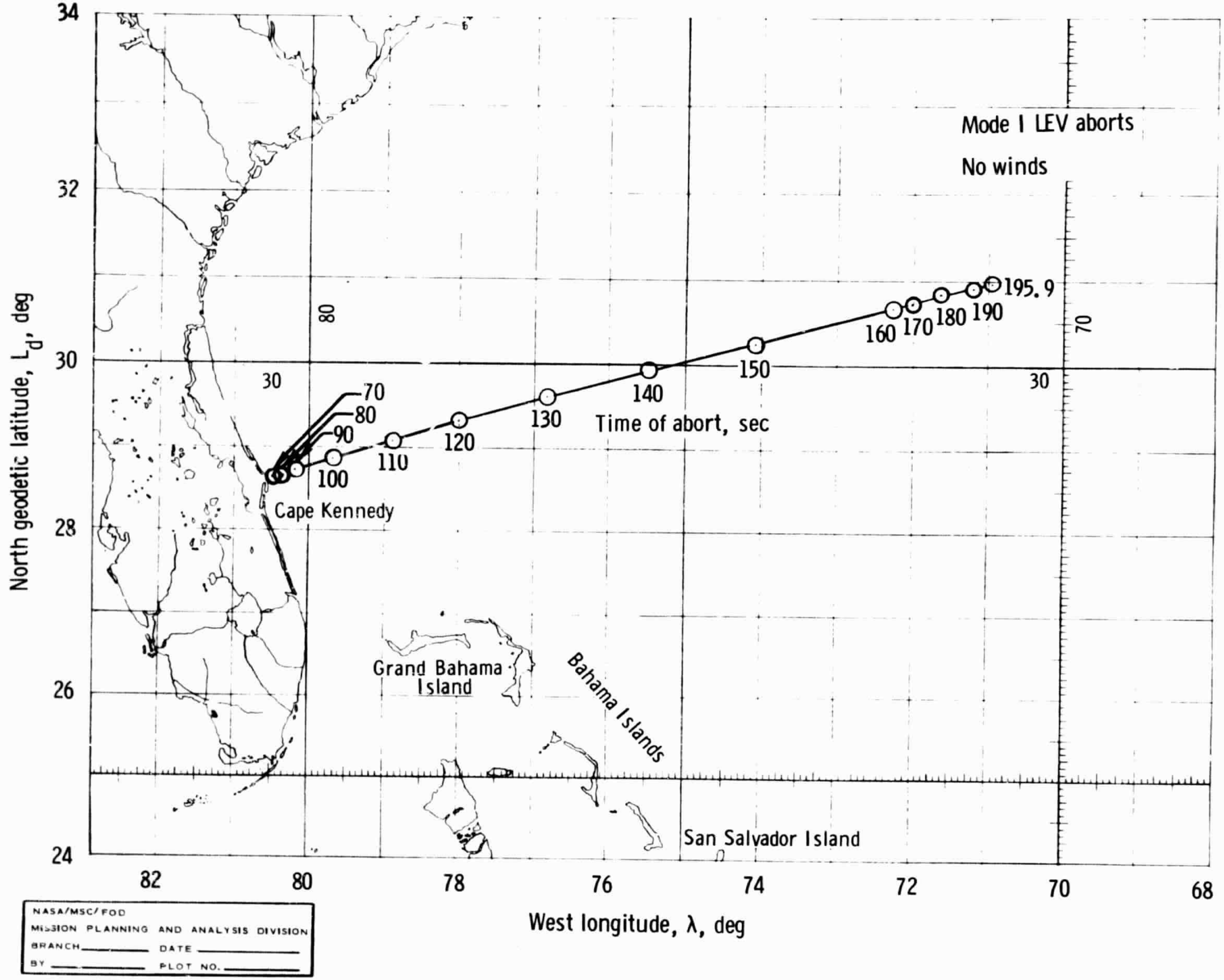
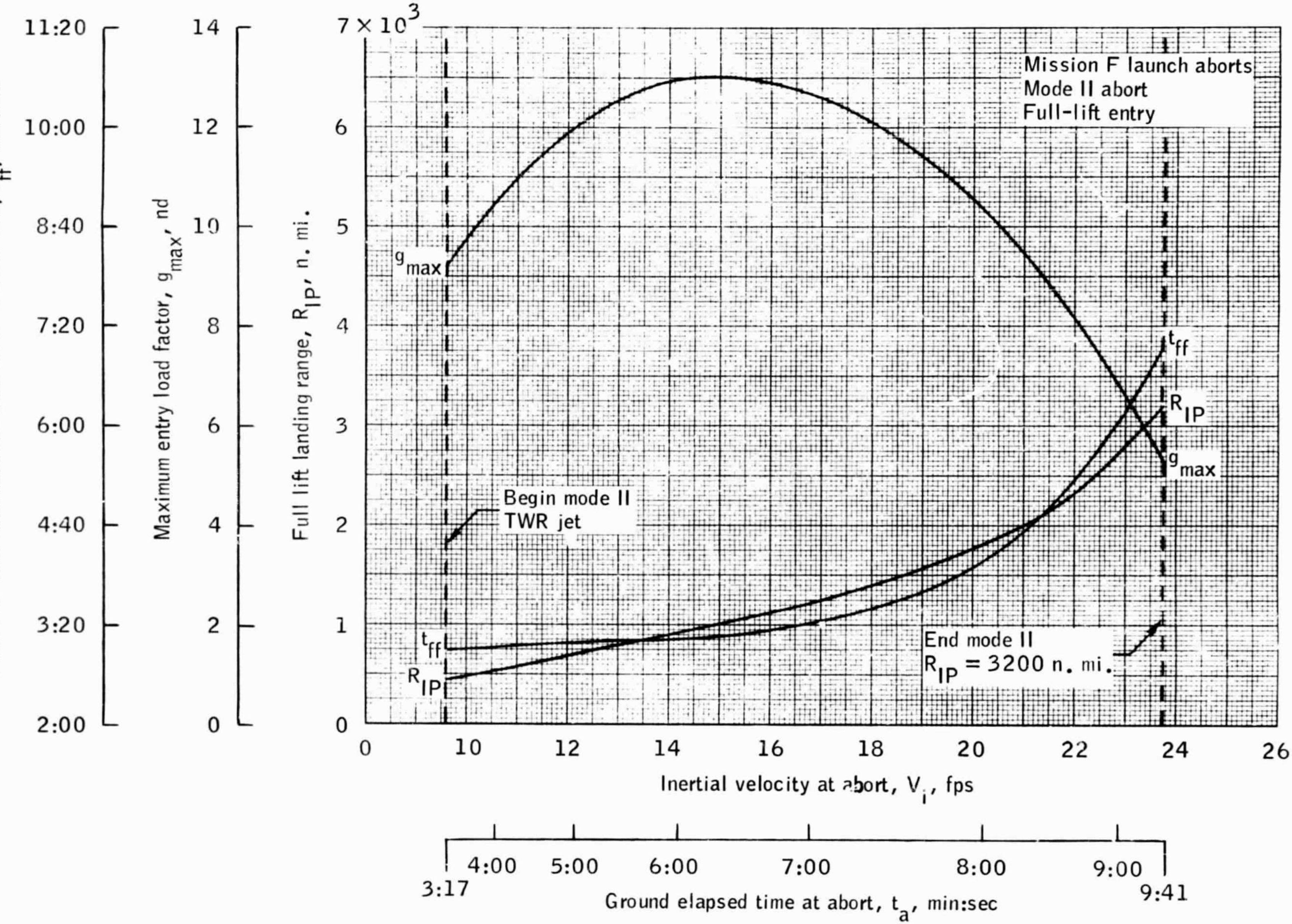
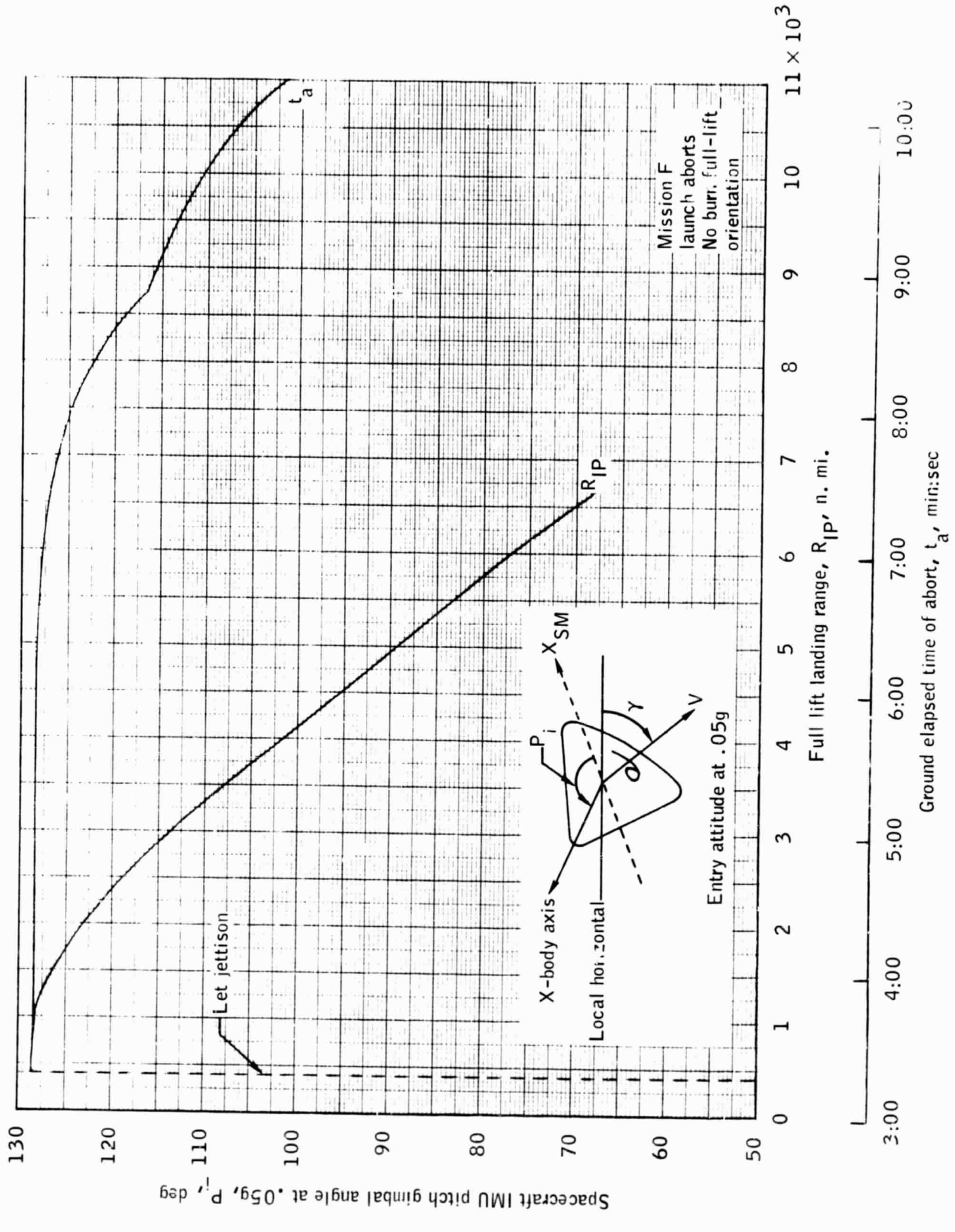
Mode I LEV abort landing points for pad abort through 60 seconds ground elapsed time.

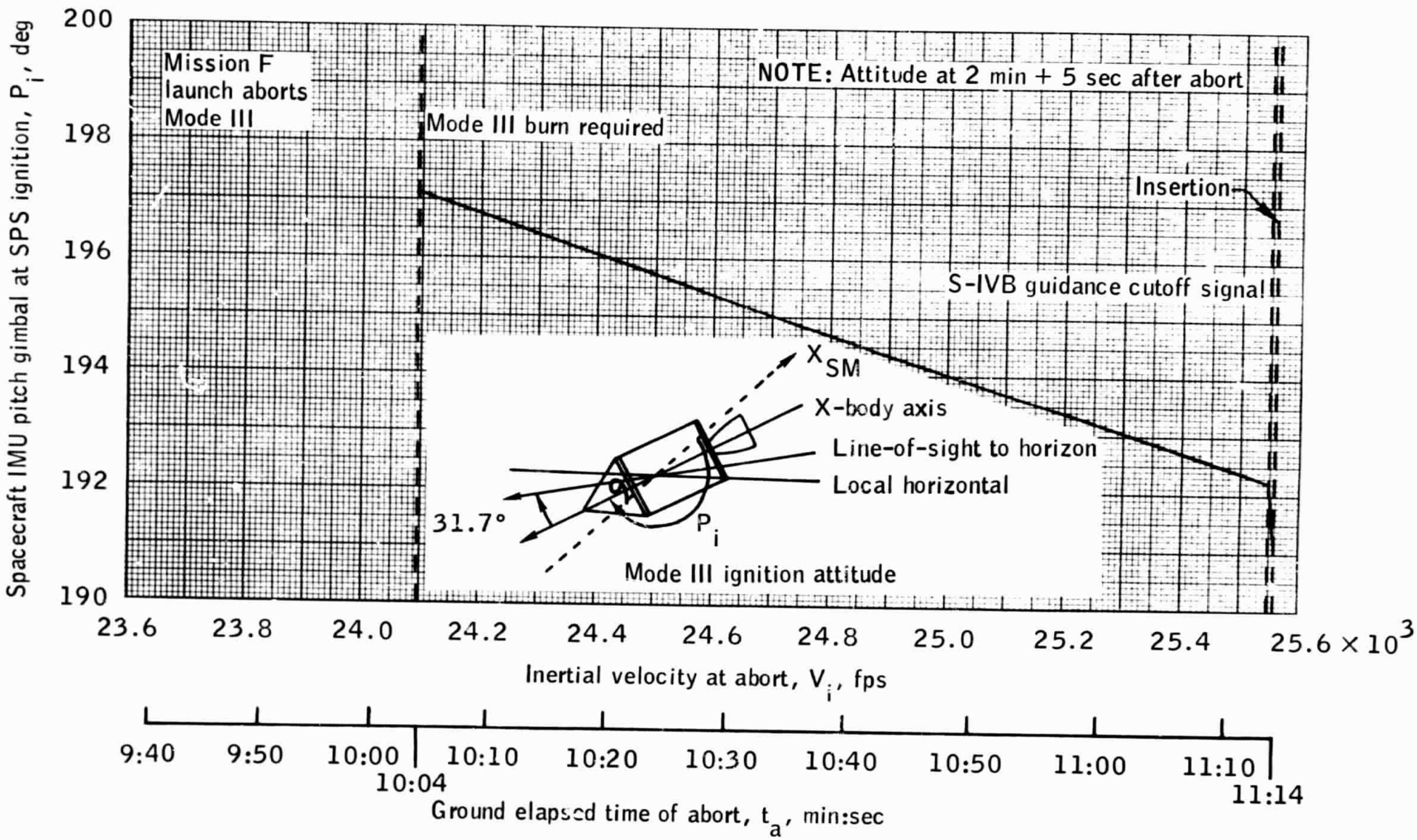


Mode I LEV abort landing points for 70 seconds through 195.9 seconds ground elapsed time.

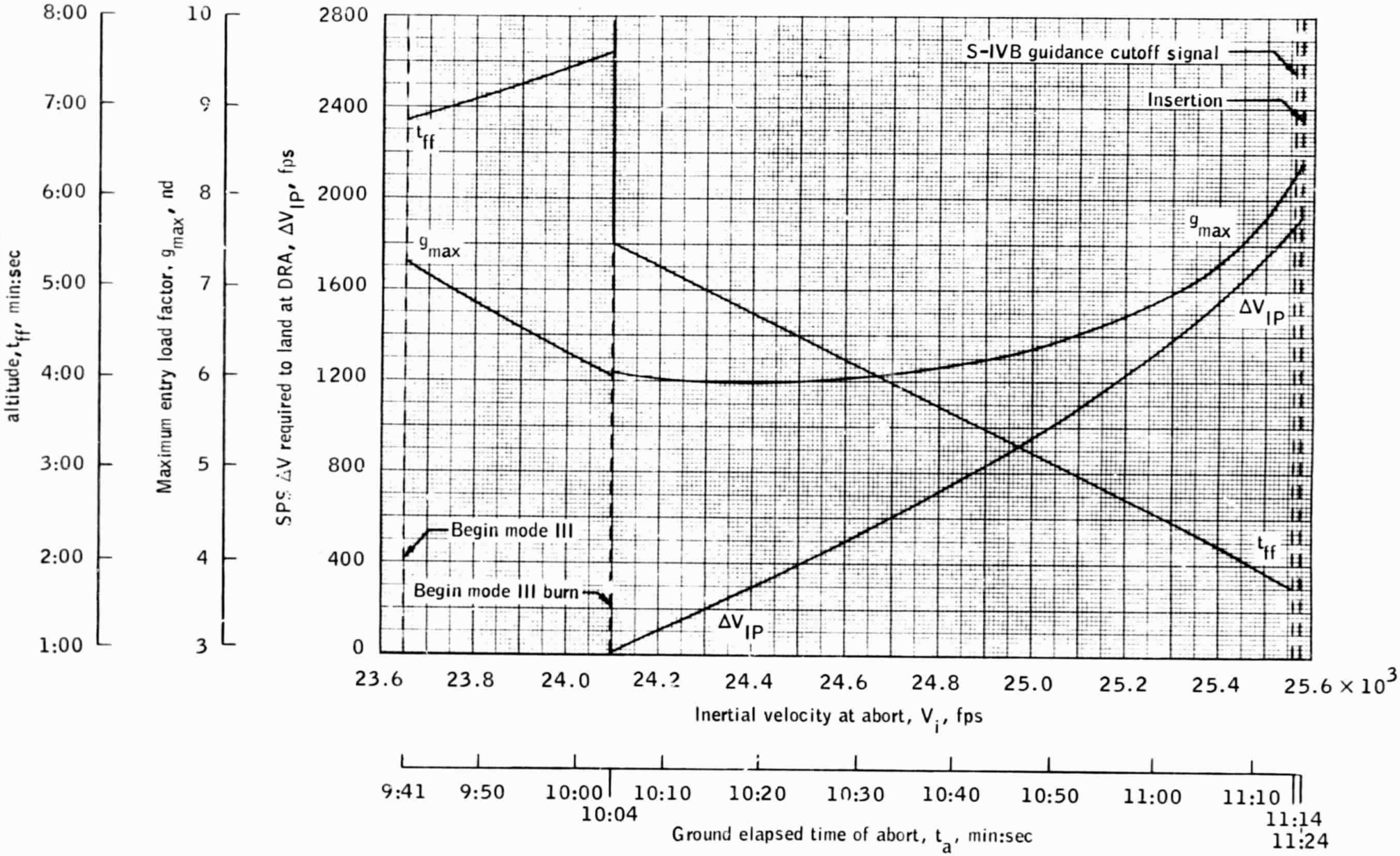


Mode II abort parameters for aborts from the nominal launch trajectory.

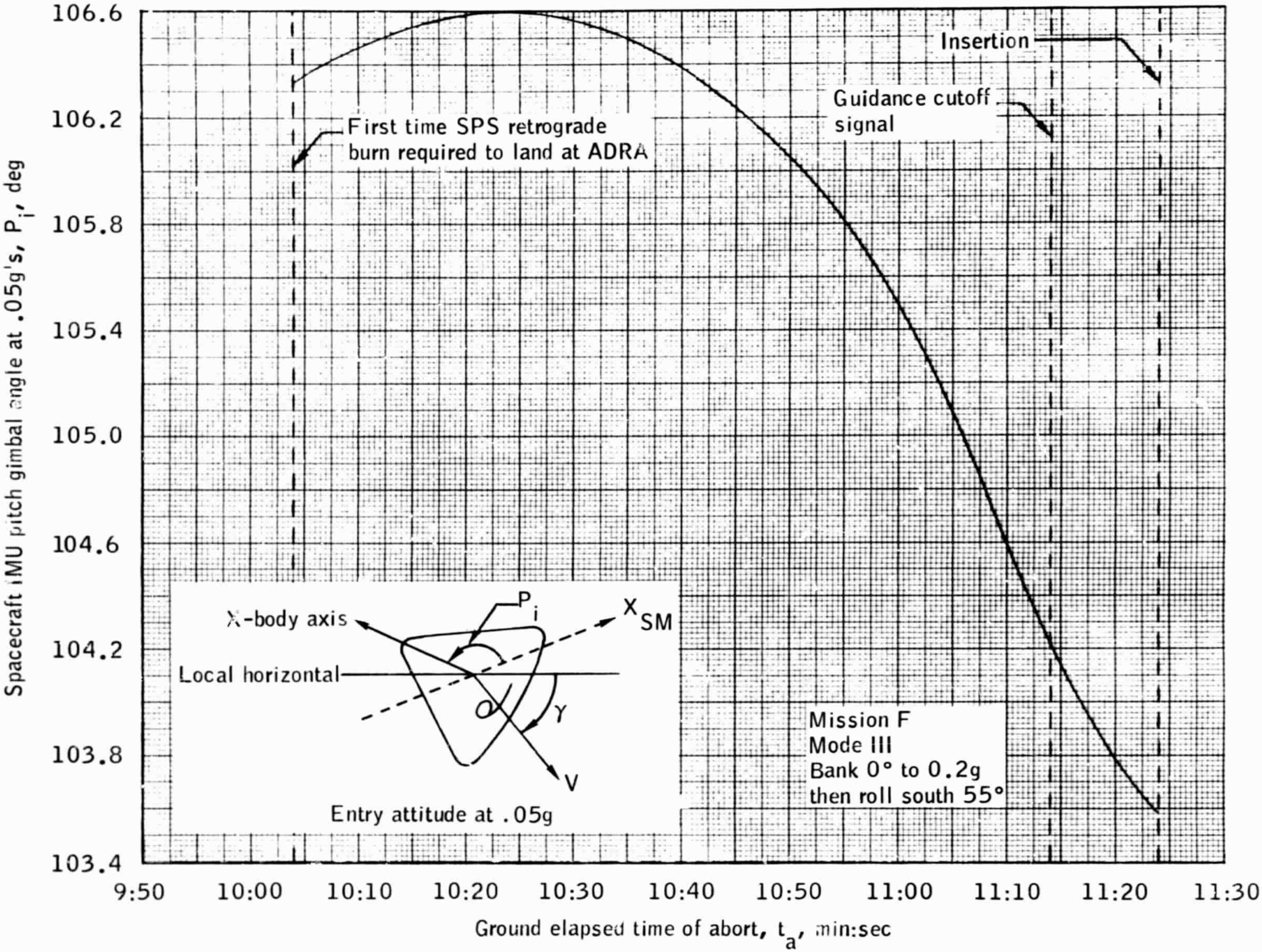

Spacecraft IMU pitch gimbal angle at .05g, P_i, deg
130
120
110
100
90
80
70
60
50
Full lift landing range, R_{IP}, n. mi.
0
1
2
3
4
5
6
7
8
9
10
11×10^3
Ground elapsed time of abort, t_a, min:sec
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
t_a
R_{IP}
Let jettison
Mission F
launch aborts
No burn, full-lift
orientation
Entry attitude at .05g
X-body axis
Local horizontal
X_{SM}
P_i
V
γ
α



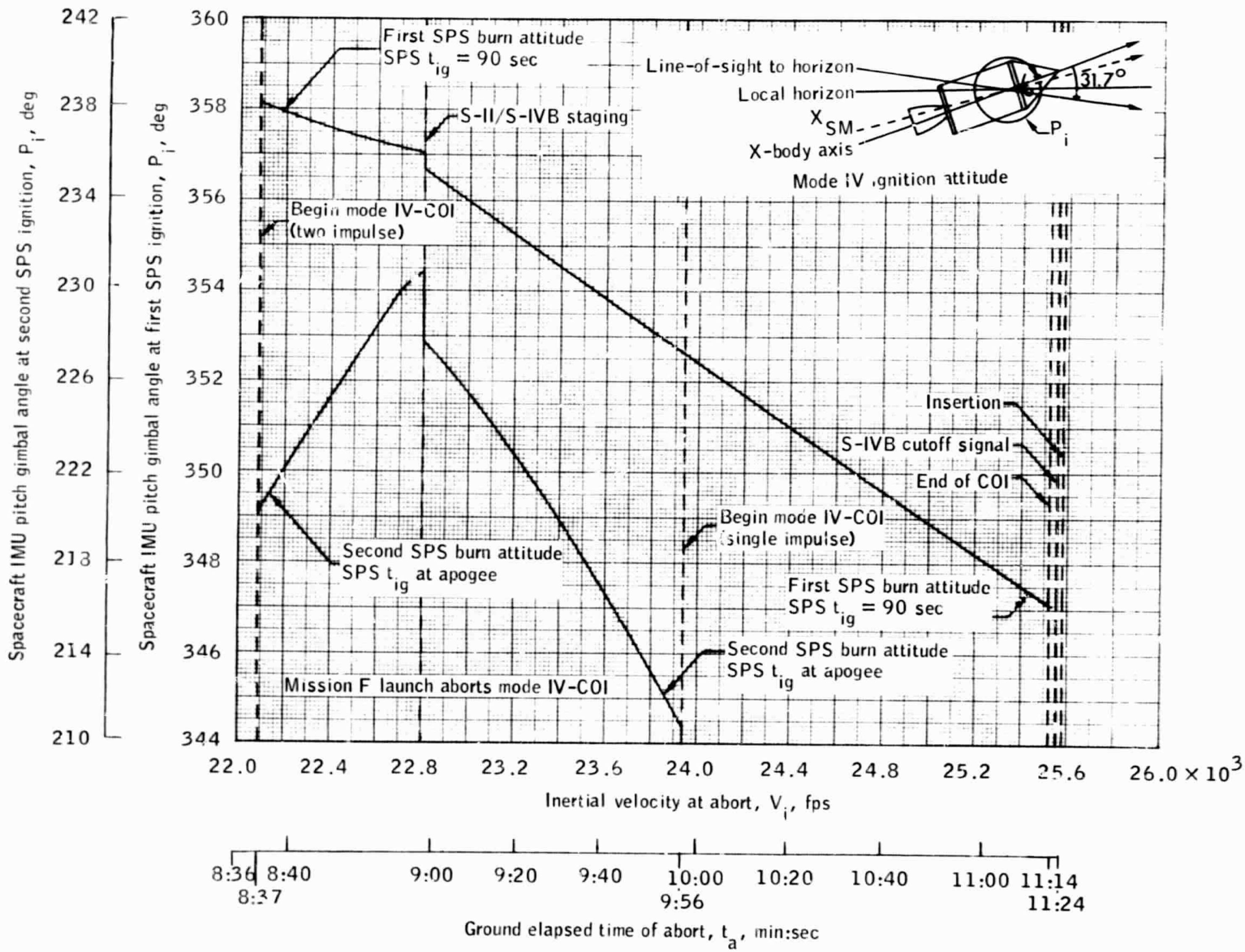
Mode III burn orientation following aborts from the nominai launch trajectory.



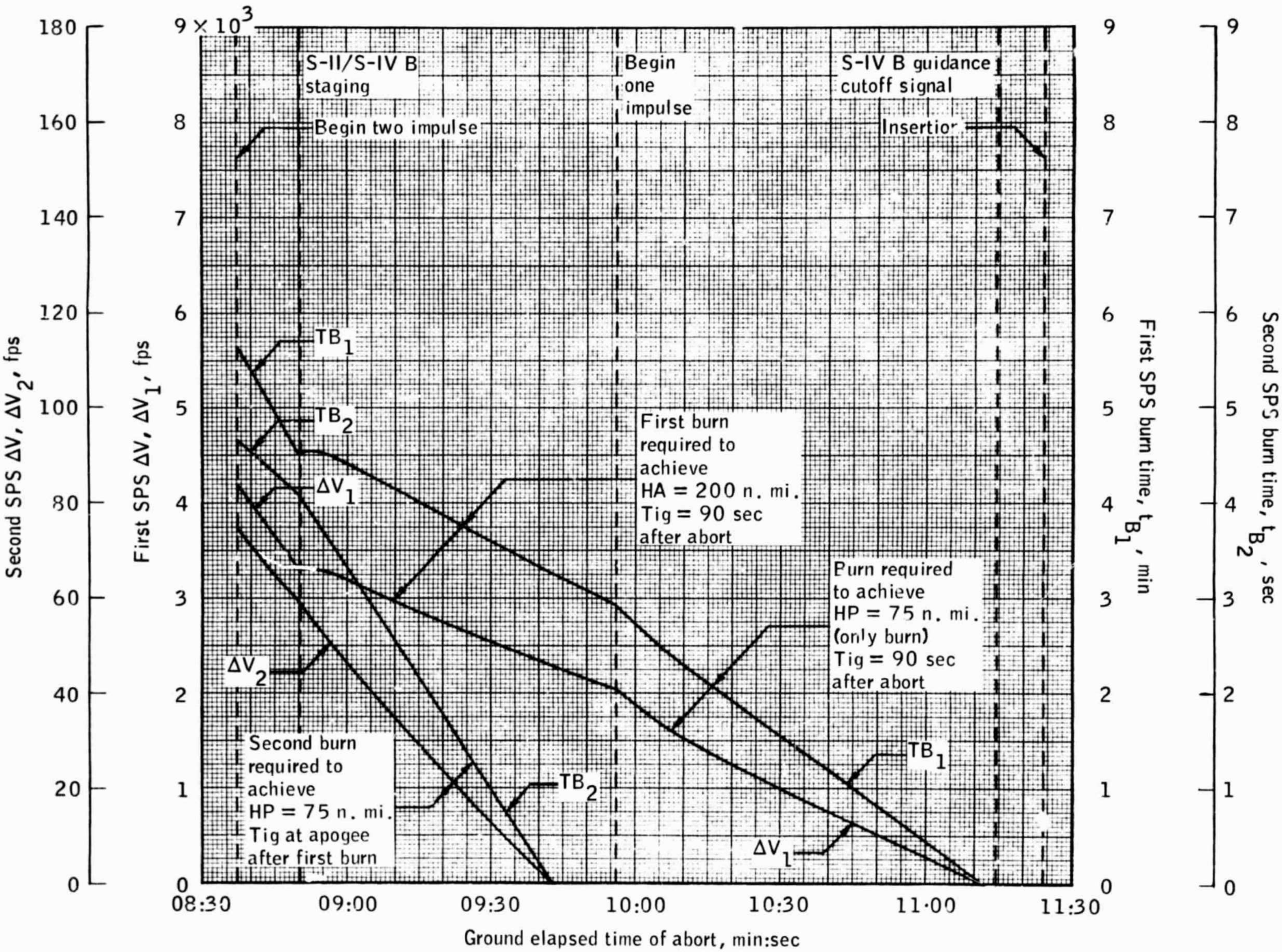
Mode III abort parameters for aborts from the nominal launch trajectory.



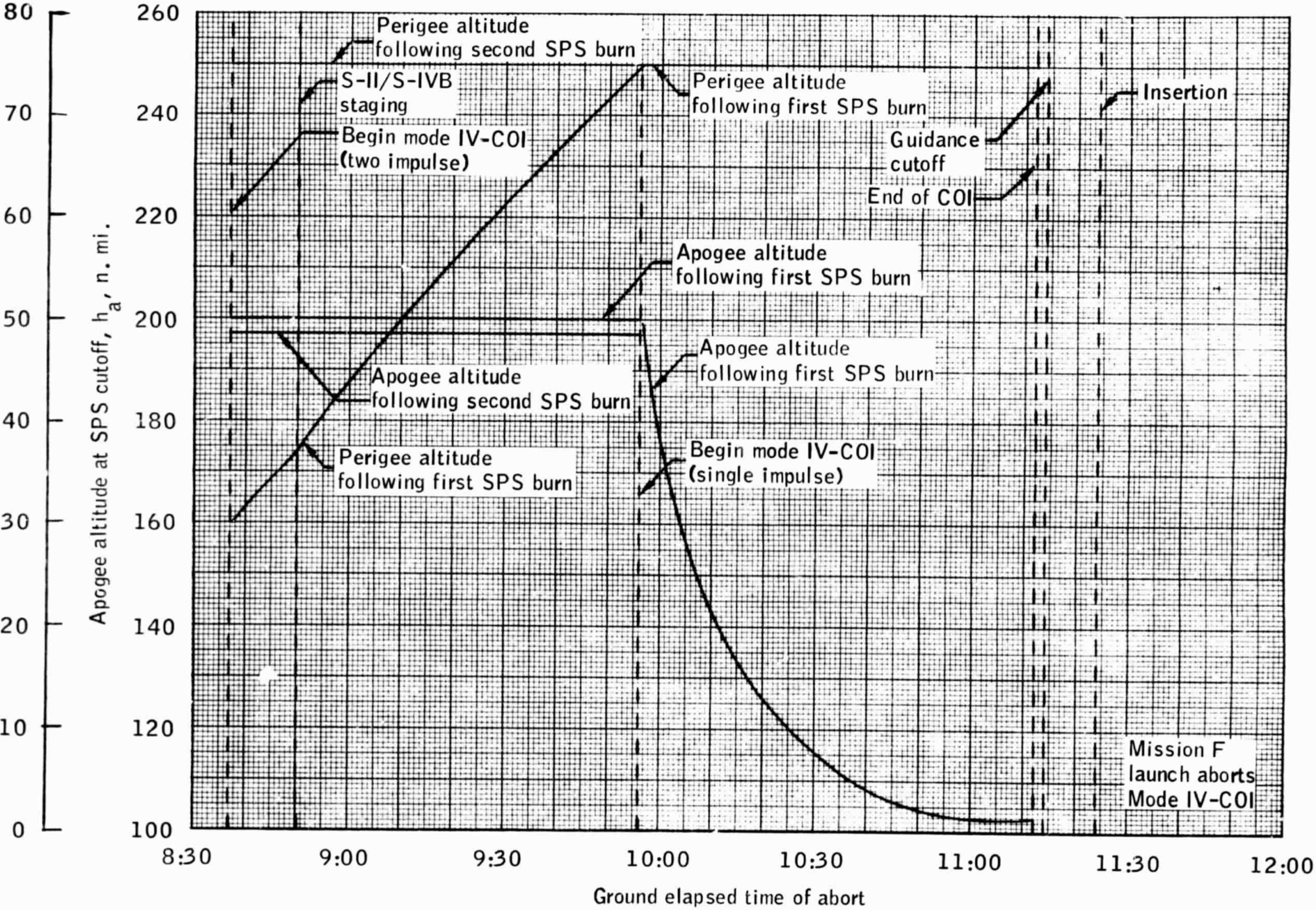
Entry orientation following mode III aborts from the nominal launch trajectory.



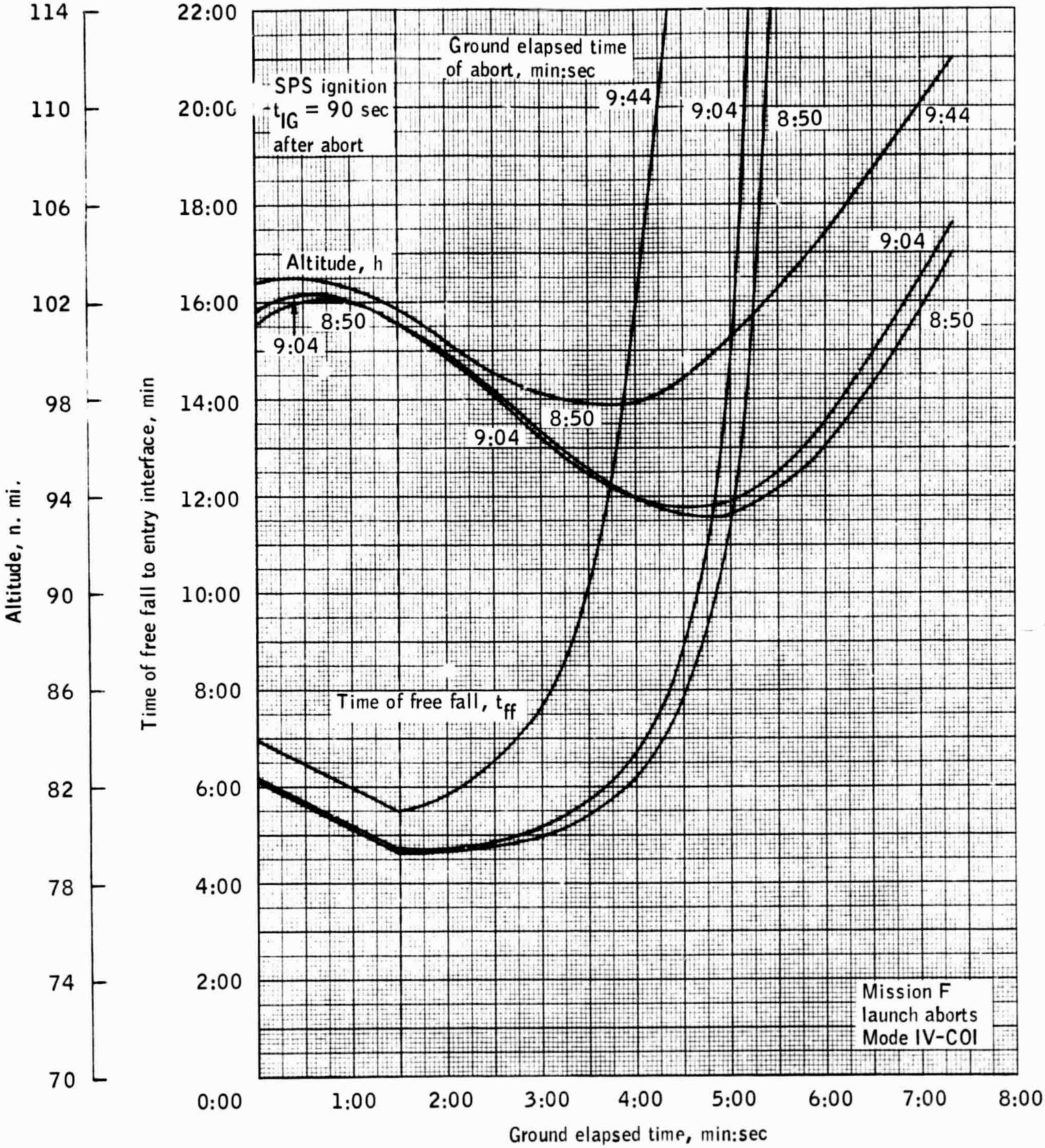
Mode IV burn orientation following aborts from the nominal launch trajectory.



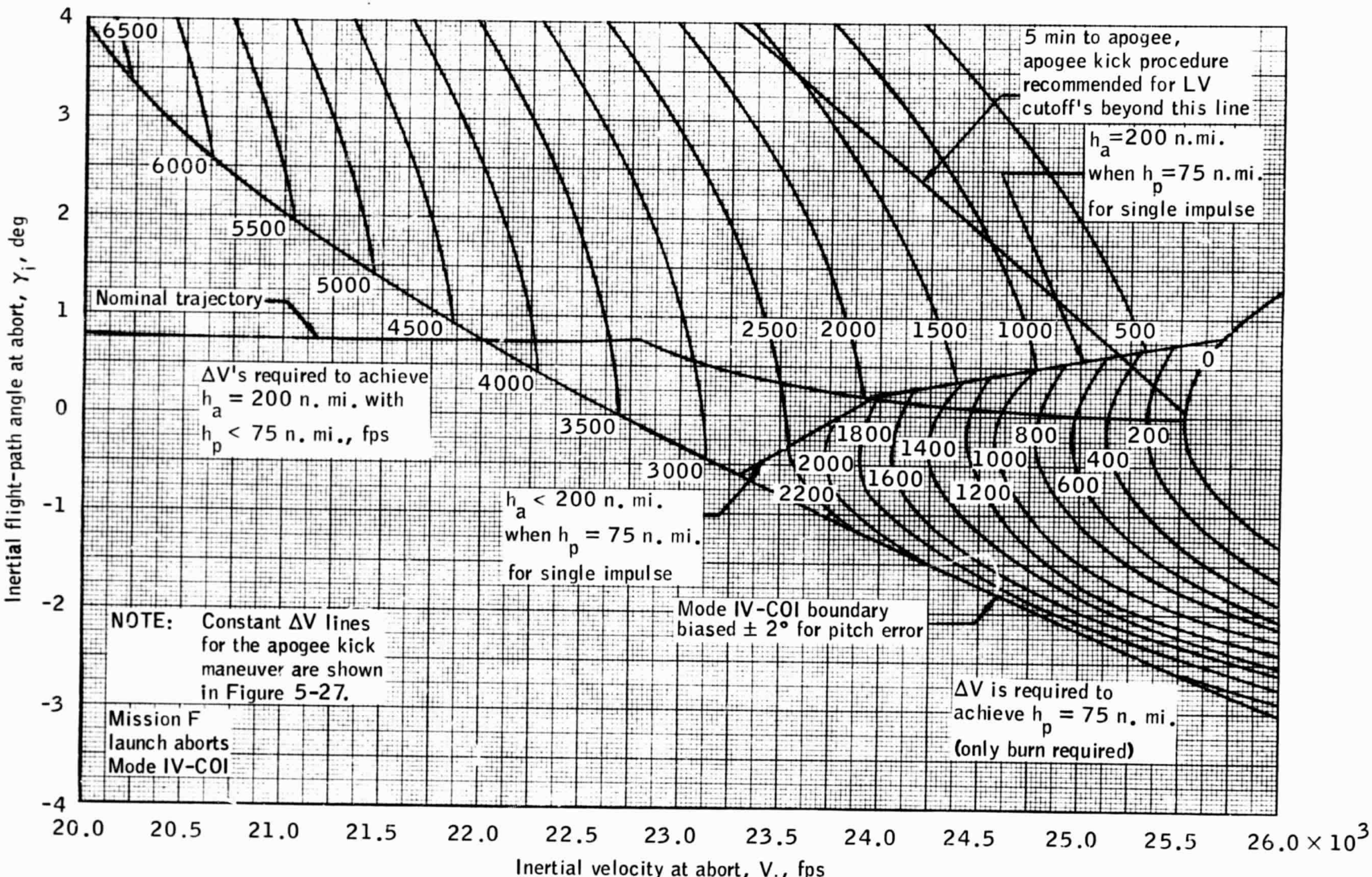
Mode IV abort burn parameters for aborts from the nominal launch trajectory.



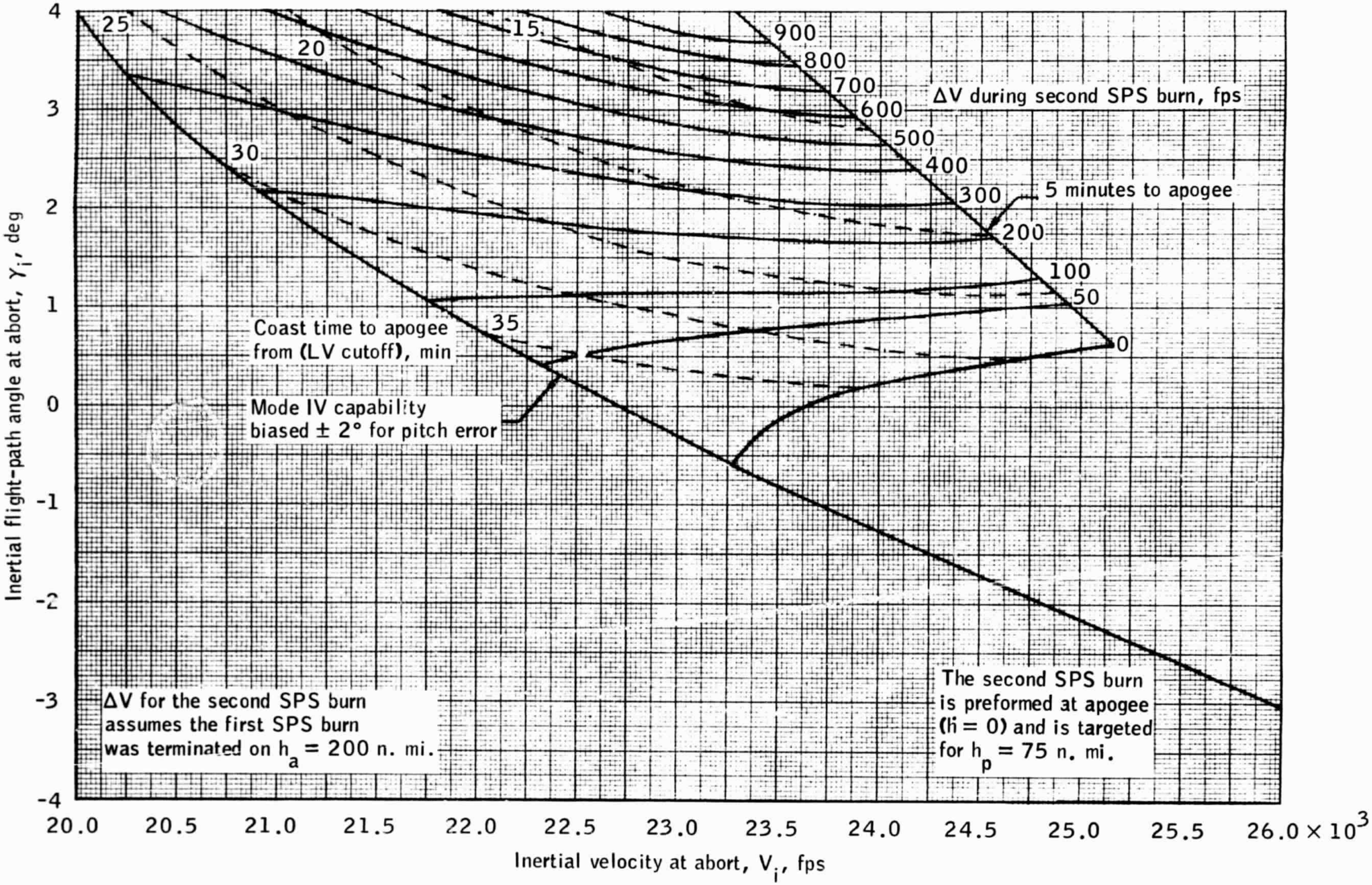
Mode IV abort results for aborts from the nominal launch trajectory.



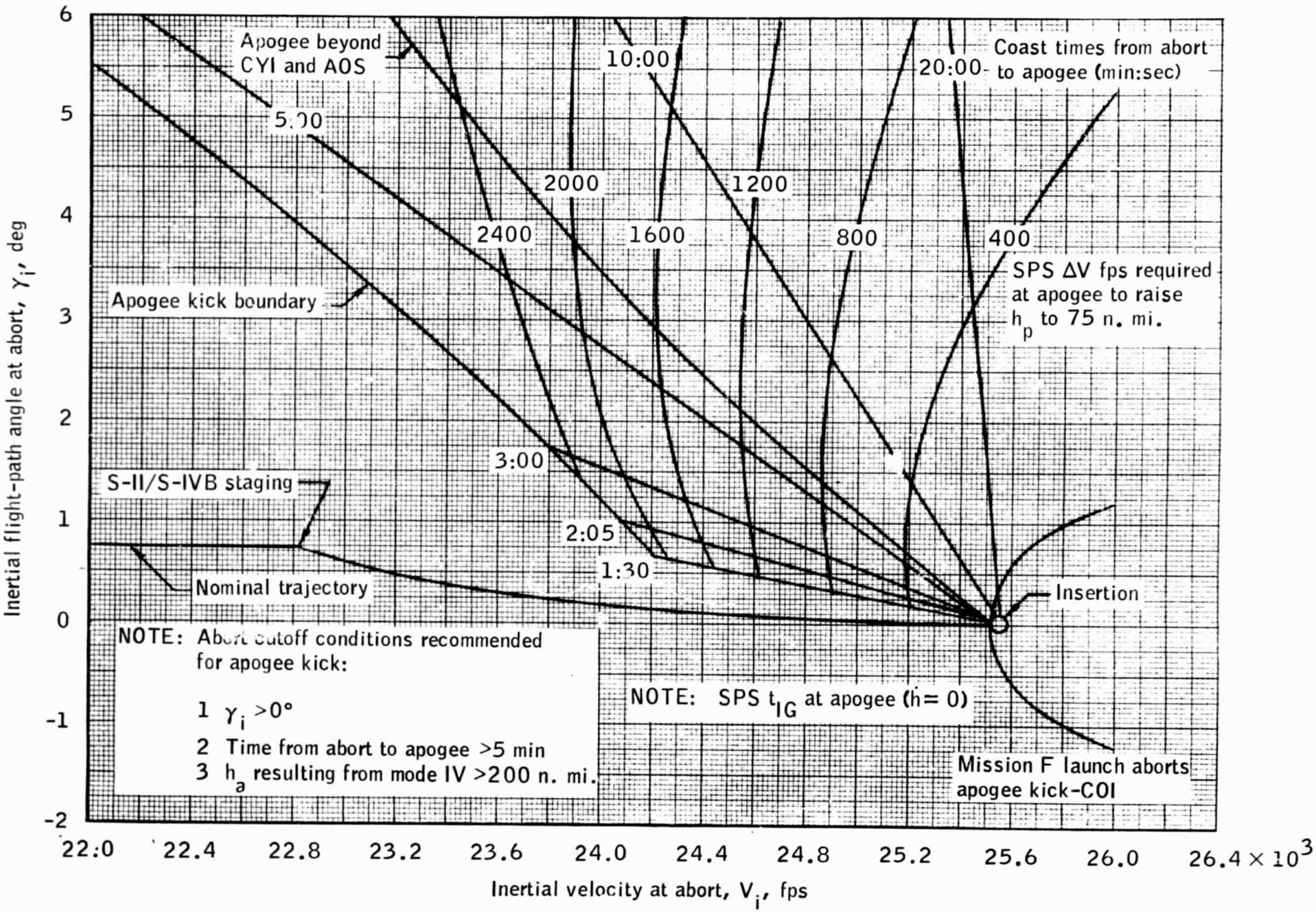
Minimum conditions during typical mode IV abort burns from the nominal trajectory.



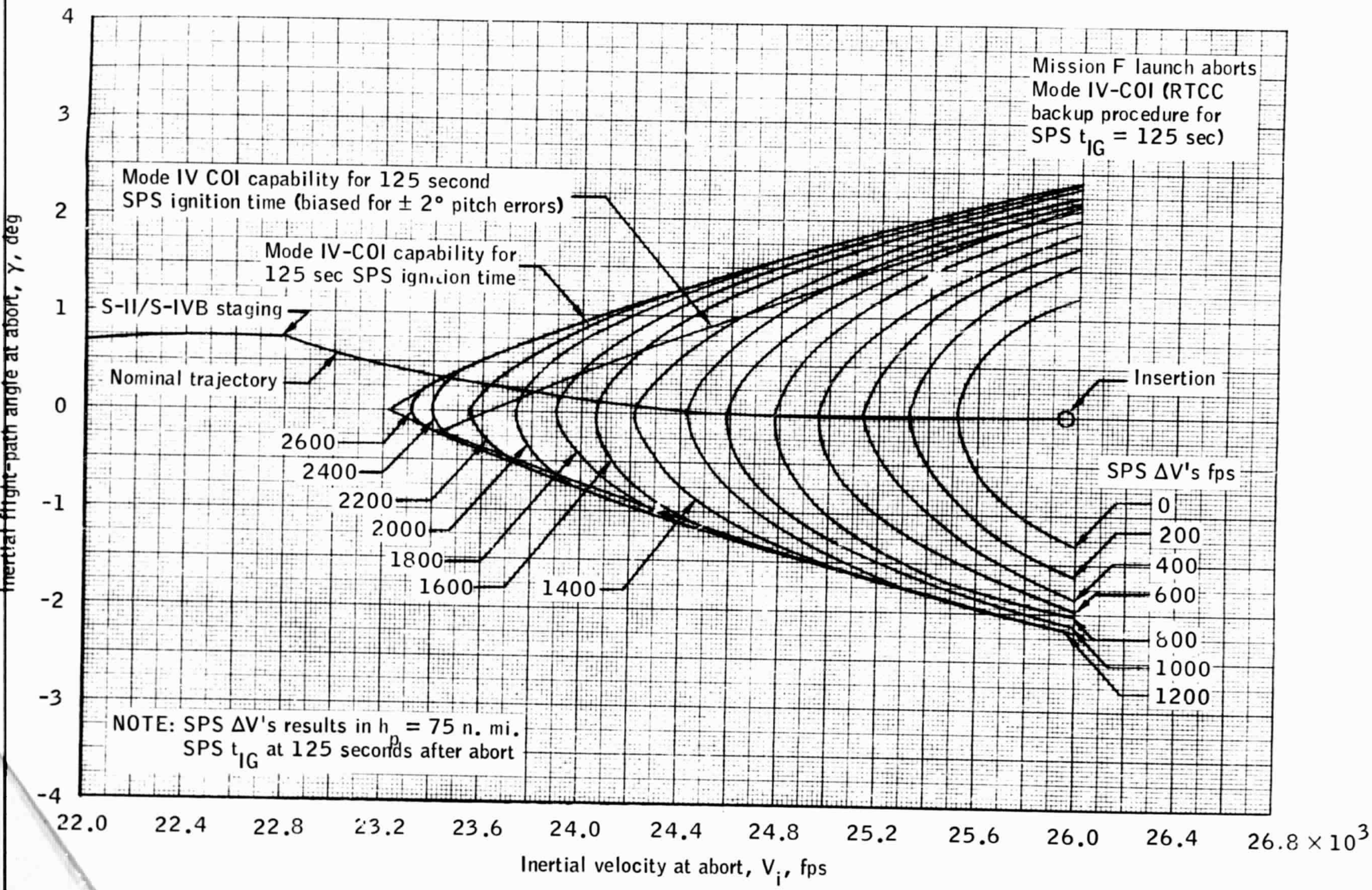
Constant mode IV ΔV contours for the 90 second ignition times, two impulse.



Constant mode IV ΔV contours and ignition times for second impulse.



Constant apogee kick ΔV and time to apogee contours for the apogee kick region.



Constant mode IV ΔV contours for the 125 second ignition time, backup.