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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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APOLLO ABORT SUMMARY DOCUMENT

MISSION D

FINAL

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APOLLO ABORT SUMMARY DOCUMENT

MISSION "D" (AS-504/104)

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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.

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, Launch and Entry Procedures Section, CF24, utilizing Crew Procedures Change Request, For, 482, Revised.

2.0 APOLLO ABORT LIMITS

Pad to 42 Sec		Mode IA	LET Low Alt
42 Sec to 100,000 Ft	(1 min 54 Sec)	Mode IB	LET Med Alt
100,000 Ft to LET JETT (1 min 54 Sec)	(3 min 16 Sec)	Mode IC	LET High Alt
LET JETT to RFL>3200 NM (3 min 16 Sec)	(9 min 31 Sec)	Mode II	Full Lift
RFL 3200 NM to RHL>3350 NM (9 min 31 Sec)	(9 min 49 Sec)	Mode III CSM NO GO/ SLV Lofted	Half Lift
RHL 3350 NM to Insertion (9 min 54 Sec)	(10 min 49 Sec)	Mode III CSM NO GO/ SLV Lofted	SPS Retro Half Lift
COI Capability to Insertion (9 min 22 Sec)	(10 min 49 Sec)	Mode IV* CSM GO	SPS to Orbit

* For positive 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.

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 30 Sec	Mode II	Full Lift
9 min 30 Sec to Insertion	Mode III	SPS Retro (tb=2(GET-9 min 30 Sec)) Half Lift

3.0 ABORT LIMITS

3.1 Rates

1. Pitch and yaw
   - L/O to S-IC/S-II staging — 4° per second
   - (Excluding staging)
   - 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 Attack ($q\alpha$) - 100%
   Note: The $q\alpha$ abort cue is valid only when preceeded by one of 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. 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 Max Q (50 sec to 2 min) the two cues for platform failure requiring an immediate manual abort are:
   a. LV GUID LT - ON
   b. LV RATE LT - ON
2. During other portions of 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 — $20.0° \pm 0.5°$ 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

3.6 Engine Failure (S-II)

1. Single engine failure - continue mission
2. Double engine failures - abort if LV control is lost (rates $> 9^{\circ}$/sec)

   Note: If S-IVB to Orbit Capability has been achieved upstaging can be accomplished* at ground supplied times. Attempts to upstage with vehicle rates in excess of 3.5°/sec will result in loss of control on the S-IVB.
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 8:13 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-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.X FPS	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 St.
00:30			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 18K - dump manually
01:54		MCC	Mode IC* (based on 100,000')		R3 0016.5 NM	
02:00		CMP	EDS AUTO - OFF*			No auto abort lt - ON
			EDS ENG - OFF			
			EDS RATES - OFF			
		CMP	α/Pc - Pc			
02:10		MCC	GO/NO Go for Staging*			
		CDR	GO/NO Go for Staging*			Systems status report
02:14			INBOARD OFF			#5 Eng Lt - ON LIFTOFF LT - OFF
02:40			OUTBOARD OFF			#1-4 ENG LTS - ON
02:41			SIC/S-II STAGING			Eng Lts(5) - OFF
02:42			S-II IGNITION Command			Eng Lts(5) - ON S-II SEP Lt - ON
02:44		CDR	S-II 65%*			Eng Lts(5) - OFF
			FDAI SCALE - 50/10			
			GMBL Mot (4) - START - ON			
			CHECK GPI (momentarily)			INSURE ANGLES CORRECT

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.X FPS	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 St.
00:30			Roll Complete			Roll program complete
00:42		MCC	Mode IB*			
		CMP	PRPINT DUMP - RCS CMD			
00:50		CDR	Monitor α to T + 2:00			
00:55		CMP	Monitor Cabin pressure decreasing			No decrease by 18K - dump manually
01:54		MCC	Mode IC* (based on 100,000')		R3 0016.5 NM	
02:00		CMP	EDS AUTO - OFF*			No auto abort lt - ON
			EDS ENG - OFF			
			EDS RATES - OFF			
		CMP	α/Pc - Pc			
02:10		MCC	GO/NO Go for Staging*			
		CDR	GO/NO Go for Staging*			Systems status report
02:14			INBOARD OFF			#5 Eng Lt - ON LIFTOFF LT - OFF
02:40			OUTBOARD OFF			#1-4 ENG LTS - ON
02:41			SIC/S-II STAGING			Eng Lts(5) - OFF
02:42			S-II IGNITION Command			Eng Lts(5) - ON S-II SEP Lt - ON
02:44		CDR	S-II 65%*			Eng Lts(5) - OFF
			FDAI SCALE - 50/10			
			GMBL Mot (4) - START - ON			
			CHECK GPI (momentarily)			INSURE ANGLES CORRECT

03:10	CDR	S-II Sep Lt - OUT*		Interstage Jettisoned
03:16	CMP	Key V82E	F 16 44 XXXX.X NM	
	CMP	TWR JETT(2) - ON*(IF TFF>1+20)	XXXX.X NM	
	MCC	Mode II*	XXBXX M/S	
				Tower Jettisoned
	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
03:15	LMP	Sec Cool Loop EVAP - OFF		
04:00	CDR	Report status*		
	MCC	TRAJECTORY STATUS*		
05:00	CDR	Report Status*		
05:50	MCC	Upstage Capability*		
06:00	CDR	Report Status*		
06:15	LMP	OMNI ANT-D		
07:00	CDR	Report Status*		
08:00	CDR	Report Status*		
08:30	MCC	GO/NO Go for Staging*		Systems Status Report
	CDR	GO/NO Go For Staging		
08:53		S-II OFF		Eng lts(5) - ON
08:54		S-II/S-IVB Staging		Eng lts(#1) - ON
08:57		S-IVB Ignition		Eng lts(#1) - OFF
09:00	CDR	S-IVB 65%*		Eng lts(#1) - OFF
	CDR	Report Status*		
09:18	MCC	Mode IV*		VI≥ 23400 FPS
	CDR	Mode IV*		ḣ≈0 FPS
				h ≥ 103 NM
10:00	MCC	GO/NO Go for Orbit*		
	CDR	GO/NO Go for Orbit*		Trajectory & S/C GO/NO Go
	CMP	V82E	F 16 44 XXXXX NM	
			XXXX.X NM	
			XXBXX M/S	
10:49	CDR	SECO*		Eng Lt(#1) - ON
		INSURE ORBIT		
		Key Proceed	06 62 XXXX.X FPS	
			XXXXX FPS	
			XXXX.X NM	
10:58	MCC	Insertion*		

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

```
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x                               x
xAT 3700 FT INDICATED OR BELOW  x
xDEPLOY MAINS IMMEDIATELY.      x
x                               x
x+ ACTUAL MINIMUM ALTITUDE WILL x
xBE SET WITH ALIDADE MARKER ON  x
xLAUNCH DAY.                    x
x                               x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

00:28	MAIN CHUTES DEPLOY	*MAIN DEPLOY PB - press (If < 10 K')
	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 54 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
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	
	TWR will jett at 14 sec	
	if alt >37K' (barro's closed)	
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	
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 MN A & 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 54 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 at LES burnout
	CM RCS PRESSURIZE	*CM RCS PRESS SW - ON
	RCS TRANS TO CM	*RCS TRANS SW - CM
	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 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
		Pilot Option if FDAI attitude reference is good:
	2. ESTABLISH 5°/SEC + PITCH RATE	2. TWR JETT SW (2) - ON
	x DAMP RATES IN YAW & ROLL x	3. DAMP RATES
	x DAMP + PITCH RATES BY ROLLING S/C x	4. MAN TO ENTRY ATT
	x 90° AND USING YAW THRUSTERS x	(R=0°,P=135°,Y=0°)
	x ROLL HEADS DOWN & ESTABLISH x	5. BMAG MODE SW (3)-ATT 1/
	x +5°/sec PITCH RATE x	RATE 2
		6. MAN ATT SW(PITCH)-RATE CMD
		7. EMS ENTRY/AUTO
		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)
    CABIN PRESS REL vlv - BOOST/ENTRY
14. CB FLT & PL BAT BUS A, B, AND BAT C (3) - CLOSE
15. CB FLT & PL MN A & 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
19. CM RCS PRPLNT (2) - OFF
    ROT CONT PWR DIRECT - OFF
20. DC MAIN TIE SW (2) - OFF

<800' 21. CABIN PRESSURE RELIEF - CLOSE

22. RELEASE MAINS AFTER TOUCHDOWN
23. POST LANDING CHECKLIST

*CM RCS He DUMP PB press

*Designates backup functions manually performed by crew

6.4 SPS MODE II

TWR JETT TO RFL < 3350 NM (ΔR < -400 NM)

(3 min 16 sec to 9 min 31 sec)

DET			BACKUP PROCEDURE
00:00	1.	ABORT THC - CCW	Warning: Steps (1) thru (14) 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.	START MANEUVER TO ENTRY ATT R=0°, P=120°, Y=0°	
	5.	BMAG SW (3) - ATT 1/RATE 2	
	6.	RATE - LOW	
	7.	TIME PERMITTING TRANS RCS TO CM AND CHECK	
	8.	CM/SM - SEP (2)	
		CM/SM DEADFACE	
		CM - RCS PRESS	*CM RCS PRESS SW - press
		CM/SM SEP	
		RCS TRANS - CM	
		CSM/LM FINAL SEP SW(2) - ON	
	9.	CAUT & WARN - CM	
	10.	EMS - ENTRY	
	11.	EMS MODE - AUTO	
	12.	CALL UP V82E N50E	
	13.	NOTE TFF (FOR ENTRY ATT TIME)	
01:40	14.	COMPLETE MANEUVER CM TO FDAI ENTRY ATTITUDE R=0°, P=120°, Y=0° (BEF, HEADS DOWN, LIFT VECTOR UP)	
	15.	OBTAIN PITCH UPDATE	
	16.	SET UP FOR SINGLE RING RCS	
	17.	AT 0.05 G LIGHT	
		0.05 G SW - 0.05 G	
	18.	RATE - HIGH	
	19.	EMS ROLL SW - ON (ALIGN)	
	20.	FLY MAX LIFT	
<30K'	21.	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'	22.	VERIFY CABIN PRESSURE INCREASE	CABIN PRESS RELEASE - dump (If not increasing by 17K')
10K'		MAIN CHUTES DEPLOY	*MAIN DEPLOY PB - press
	23.	CABIN PRESS Relf vlv (2)-close	
	24.	DIRECT O2 - ON (CCW)	
	25.	CM PROP DUMP SW - DUMP	Fire all jetts except pitch (DIRECT RCS ON)
	26.	CM PROP JETT PURGE - (FOR 30 SEC AFTER BURNOFF)	
	27.	Cabin Press Relf vlv - BOOST/ENTRY	
	28.	CB FLT & PL BAT BUS A, B, AND BAT C (3) - CLOSE	
	29.	CB FLT & PL MN A & B (2) - OPEN	
	30.	ECS RAD HTR OVLD cb (2) - open	
	31.	SPS P&Y cb (4) - open	
	32.	Cabin Press Relf vlv - DUMP	
	33.	COMM SET UP FOR LDG, VOICE REPORT	
	34.	FLOOD SW - POST LDG	
	35.	CM RCS PRPLNT (2) - OFF	
	36.	ROT CONTR PWR DIRECT - OFF	
	37.	DC MAIN TIE SW (2) - OFF	
<800'	38.	CABIN PRESSURE RELIEF (2) - CLOSE	
	39.	RELEASE MAINS AFTER TOUCHDOWN	
	40.	POST LANDING CHECKLIST	

*Designates backup function manually performed by crew

6.5 SPS MODE III

RETROGRADE**

RFL > 3350 NM (ΔR > -400 NM) to insertion

(9 min 31 sec) (10 min 49 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.	CALL UP V82E N50E	
	**NOTE:	IF -400 NM<ΔR<0NM, No Retro burn required; substitute entry attitudes (step 26) for retro attitude (step 6) and proceed to step 18.	
	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 - AUTO	
	12.	ΔV THRUST SWTICH (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 ΔV THRUST SW (2) - OFF	Burn ΔR = 0 on DSKY
	17.	SET UP FOR SINGLE RING RCS	
	18.	TIME PERMITTING TRANS RCS TO CM AND CHECK	
	19.	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
		CSM/IM FINAL SEP SW (2) - ON	

	20.	CAUT AND WARN - CM	
	21.	EMS MODE STBY	
	22.	EMS FUNCTION - ENTRY	
	23.	EMS MODE - AUTO	
	24.	NOTE TFF: N50E	
	25.	RATE - HIGH	
	26.	MANEUVER CM TO FDAI ENTRY ATTITUDE R=0°, P=105°, Y=0° (BEF, HEADS DOWN, FULL LIFT)	
	27.	RATE - LOW	
	28.	OBTAIN ROLL, PITCH, AND YAW UPDATE	
	29.	AT 0.05 G LIGHT, 0.05 G SW - ON	
	30.	AT 0.2 G 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 - press
		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 jetts 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 MN A & 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

23,600 fps, $\dot{h} \sim +50$ to insertion

(9 min 22 sec to 10 min 49 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.	CALL UP V82E	
	6.	MANEUVER CSM TO INSERTION ATTITUDE (FDAI APPROX R=180°, P=347°, Y=0° SCRIBE LINE ON HORIZON, SEF, HEADS DOWN	
	7.	OBTAIN INSERTION UPDATE	
	8.	RMAG MODE SW (3) - ATT 1/RATE 2	
	9.	RATE - LOW	
	10.	CHECK MTVC AND GIMBAL ANGLES	
	11.	EMS MODE - AUTO	
	12.	ΔV THRUST SWITCH (A) - NORMAL	
01:50	13.	START ULLAGE (THC)	DIRECT ULLAGE PB - press
02:05	14.	SPS THRUST - PUSH	
02:06	15.	STOP ULLAGE (THC - CENTER)	DIRECT ULLAGE PB - Release
	16.	ΔV THRUST SW (2) - OFF at ΔV = DESIRED VALUE	*Burn Hp > 75 NM on DSKY
	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	

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
00:06			
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.	CALL UP V82E	
hp>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	

APPENDICES

AS0594/104 NOMINAL LAUNCH TRAJECTORY

CHECKPOINTS ON THE DSKY

G.E.T. Min:SEC	R_1 V_1 (ft/sec) XXXXX.	R_2 $\dot{h}$ (ft/sec) XXXXX.	R_3 h (NM) XXXX.X	Pitch Angle (deg)
0:10	1,344	78	0.1	90
0:30	1,403	303	0.7	84
1:00	1,911	839	3.4	68
1:30	3,113	1543	9.3	49
2:00	5,224	2261	18.7	32
2:30	8,043	2868	31.5	23
3:00	9,364	2664	45.8	21
3:30	9,937	2189	57.7	29
4:00	10,567	1883	67.8	28
4:20	11,046	1681	73.7	25
4:30	11,303	1581	76.4	23
5:00	12,145	1292	83.5	19
5:30	13,100	1020	89.3	15
6:00	14,177	771	93.2	12
6:30	15,391	553	97	8
7:00	16,761	574	99.3	4
7:30	18,307	248	100.9	1
8:00	19,877	149	101.9	357
8:30	21,563	116	102.6	354
9:00	23,070	115	103.3	352
9:30	23,701	19	103.6	346
10:00	24,376	-41	103.6	344
10:30	25,086	-41	103.4	343
10:40	25,330	-24	103.4	343
10:50	25,567	0	103.3	343
10:59.295*	25,568	0	103.4	343

* Insertion

AS0594/104 NOMINAL LAUNCH TRAJECTORY

CHECKPOINTS ON THE DSKY

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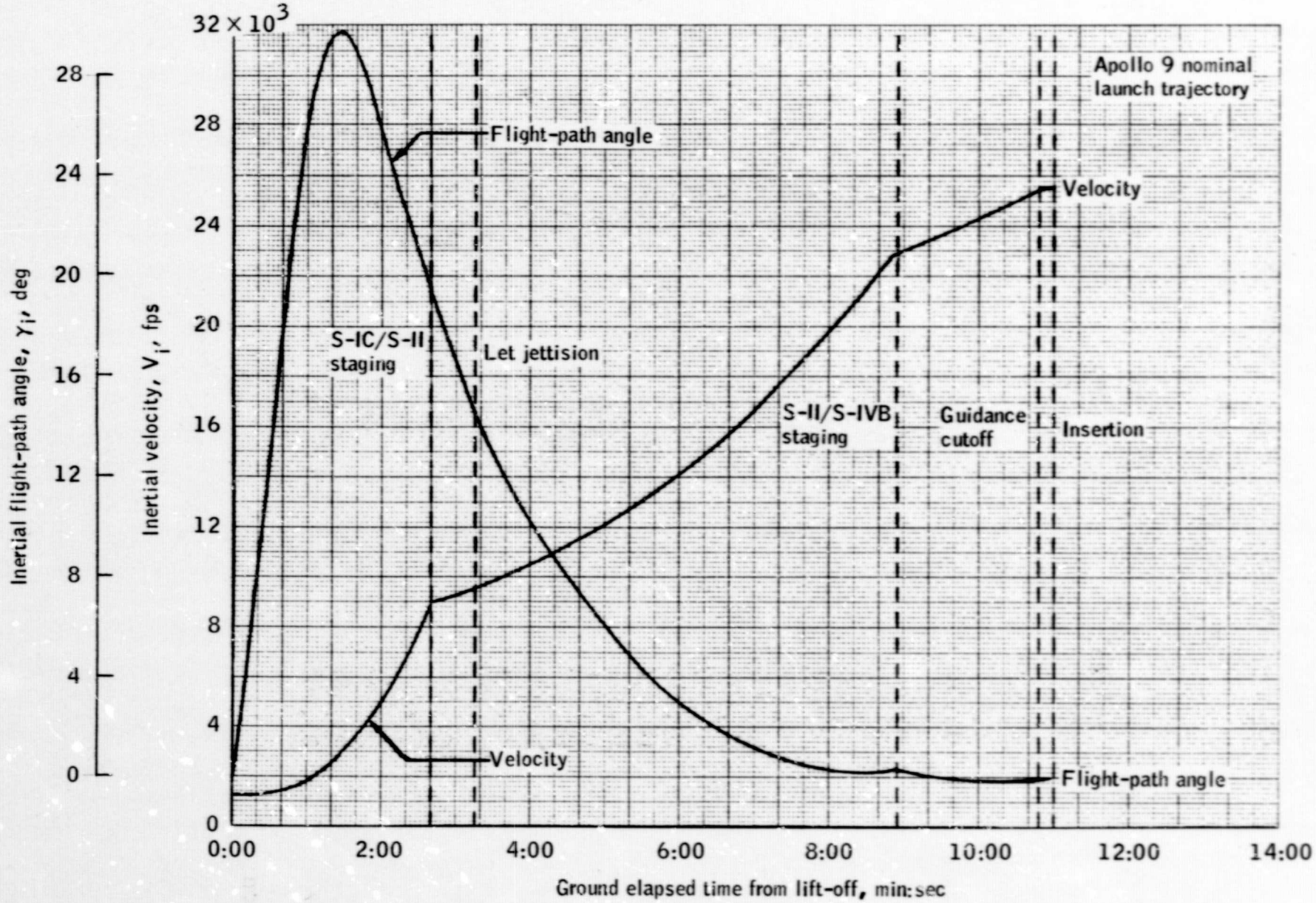
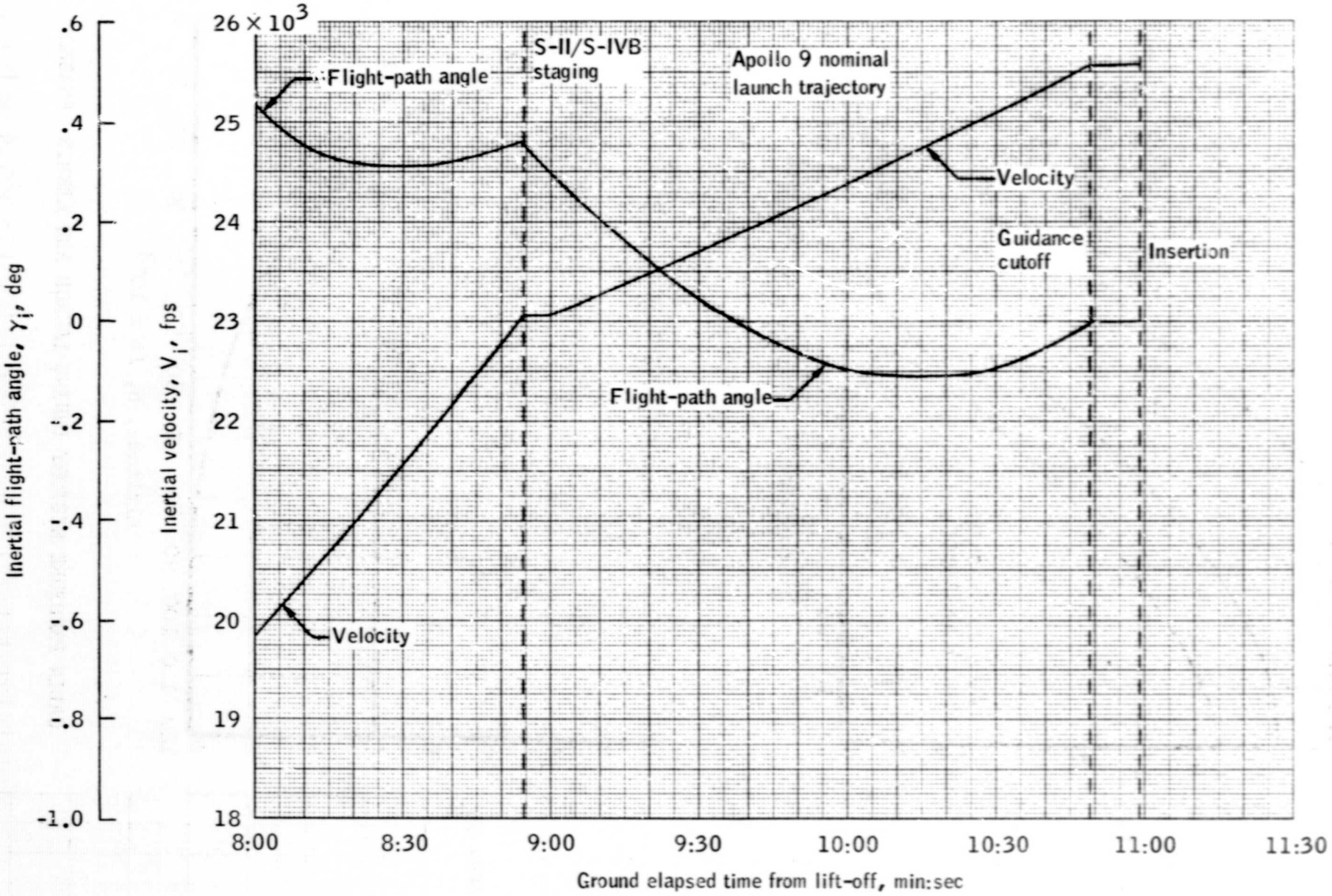
10:50	25,567	0	103.3	343
10:59.295*	25,568	0	103.4	343

* Insertion

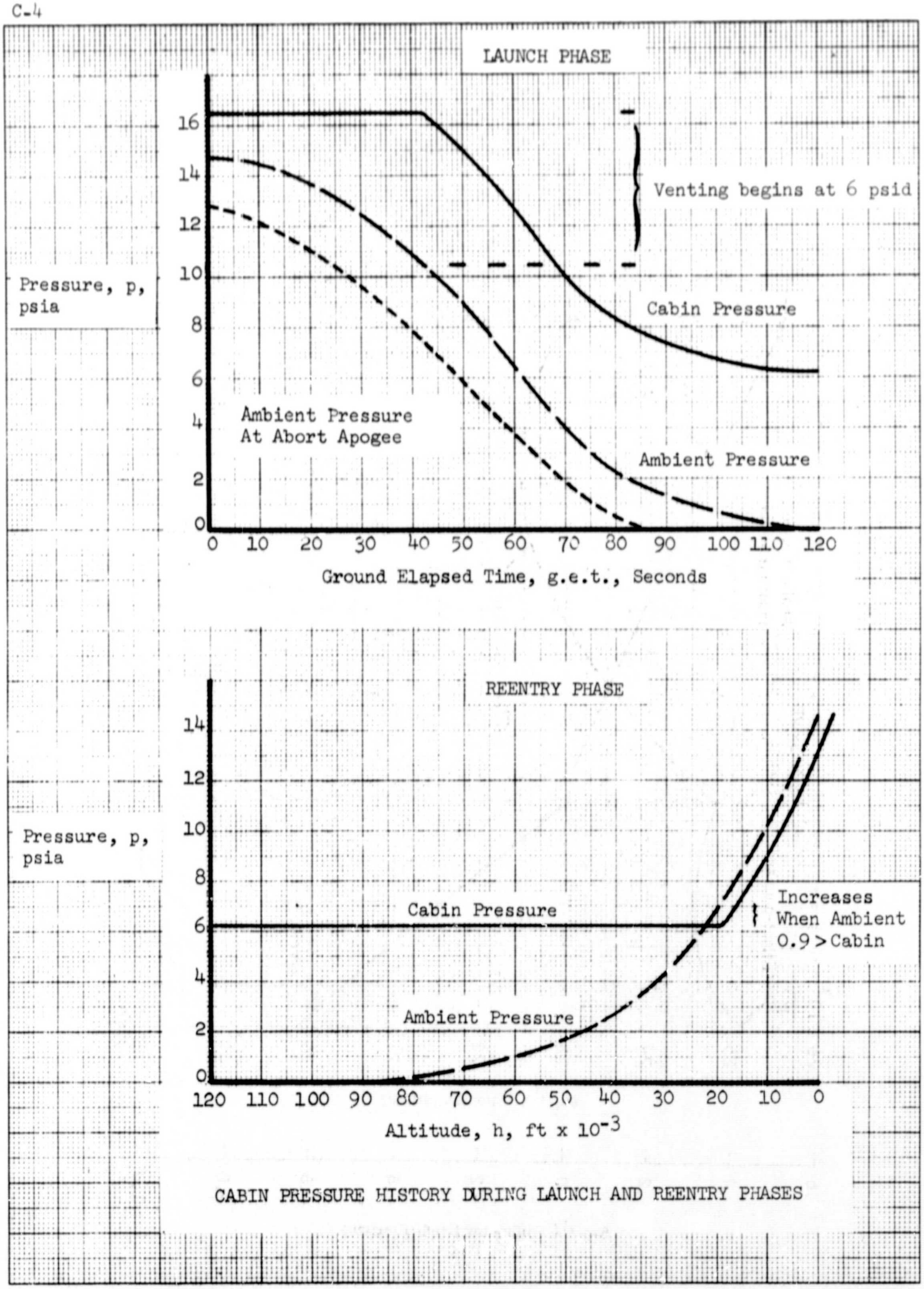


(a) Complete launch.

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



(b) Near insertion.

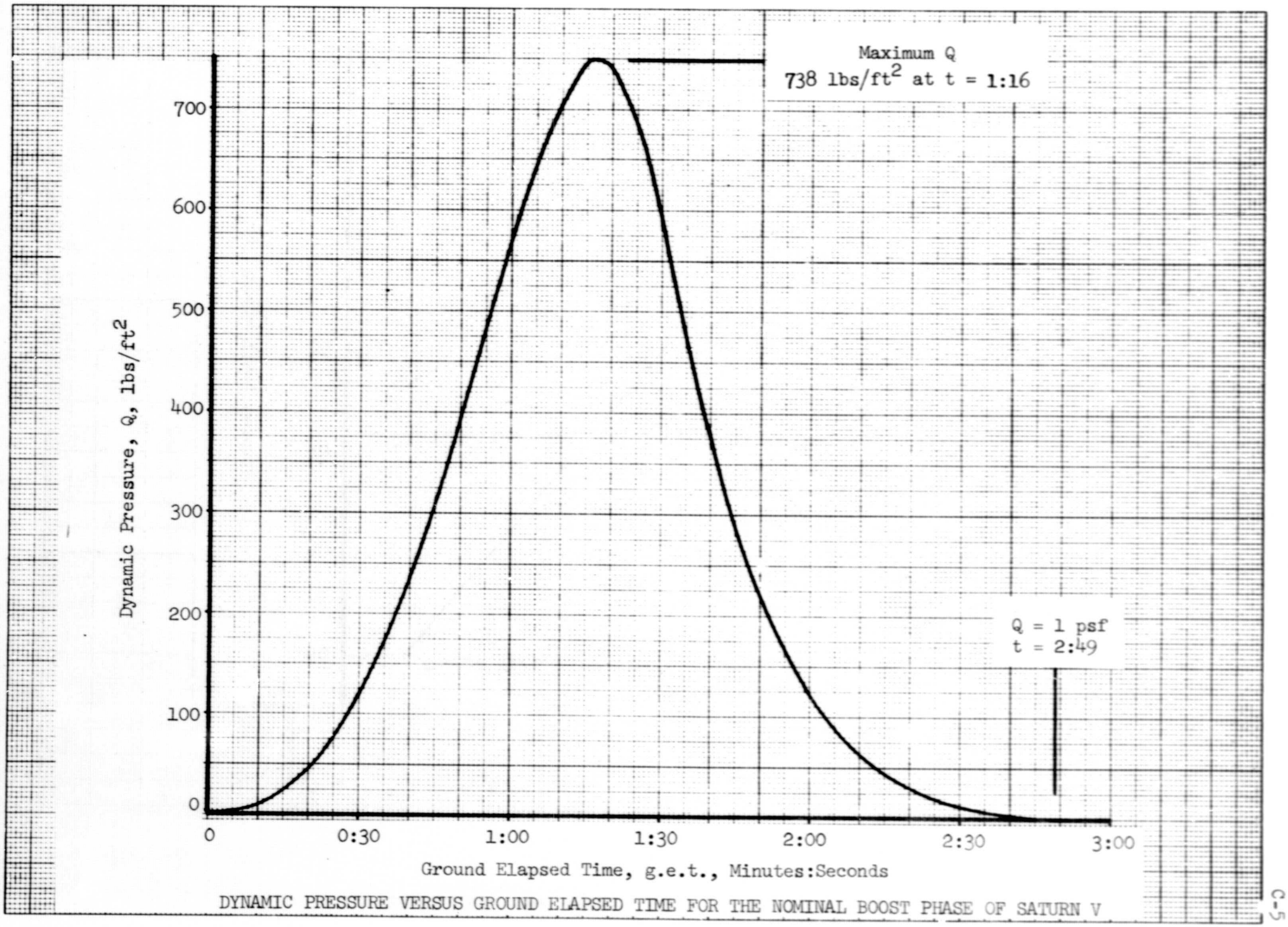


CABIN PRESSURE HISTORY DURING LAUNCH AND REENTRY PHASES

EUGENE DIETZGEN CO.
MADE IN U.S.A.
NO. 340R-M DIETZGEN GRAPH PAPER
MILLIMETER

NO. 340R-M **DIETZGEN** GRAPH PAPER
MILLIMETER

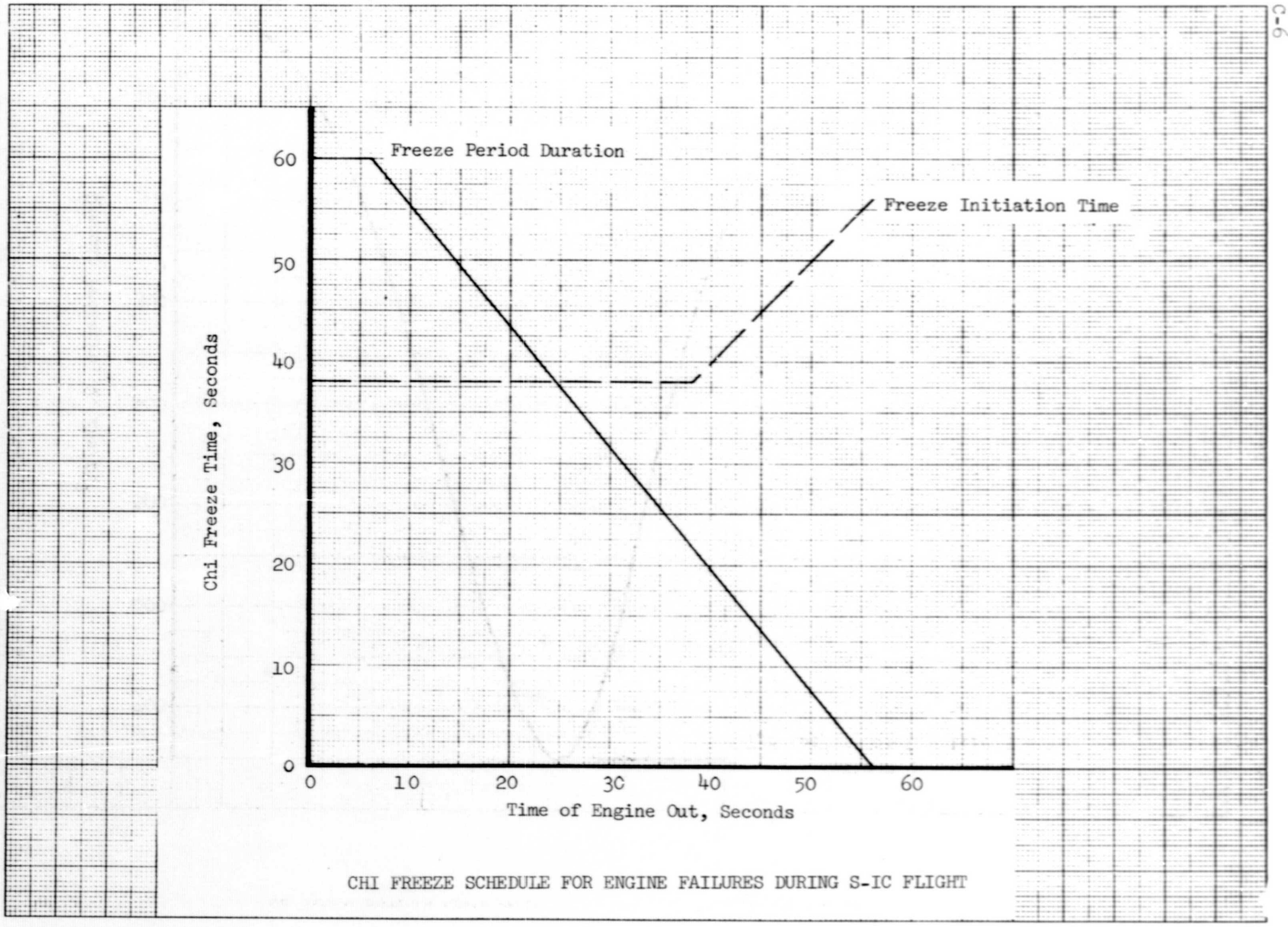
EUGENE DIETZGEN CO.
MADE IN U. S. A.



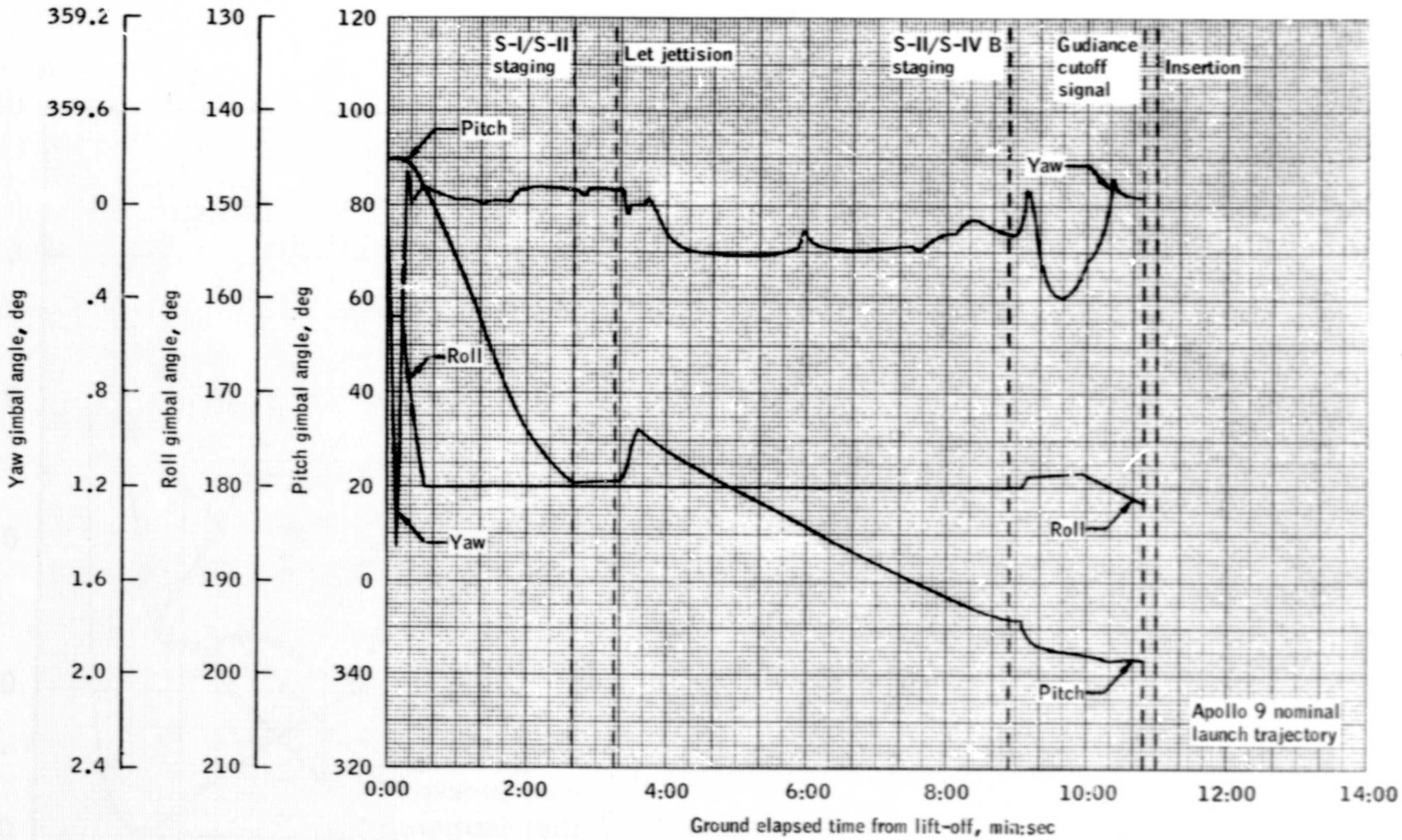
DYNAMIC PRESSURE VERSUS GROUND ELAPSED TIME FOR THE NOMINAL BOOST PHASE OF SATURN V

NO. 340R-M DIETZGEN GRAPH PAPER
MILLIMETER

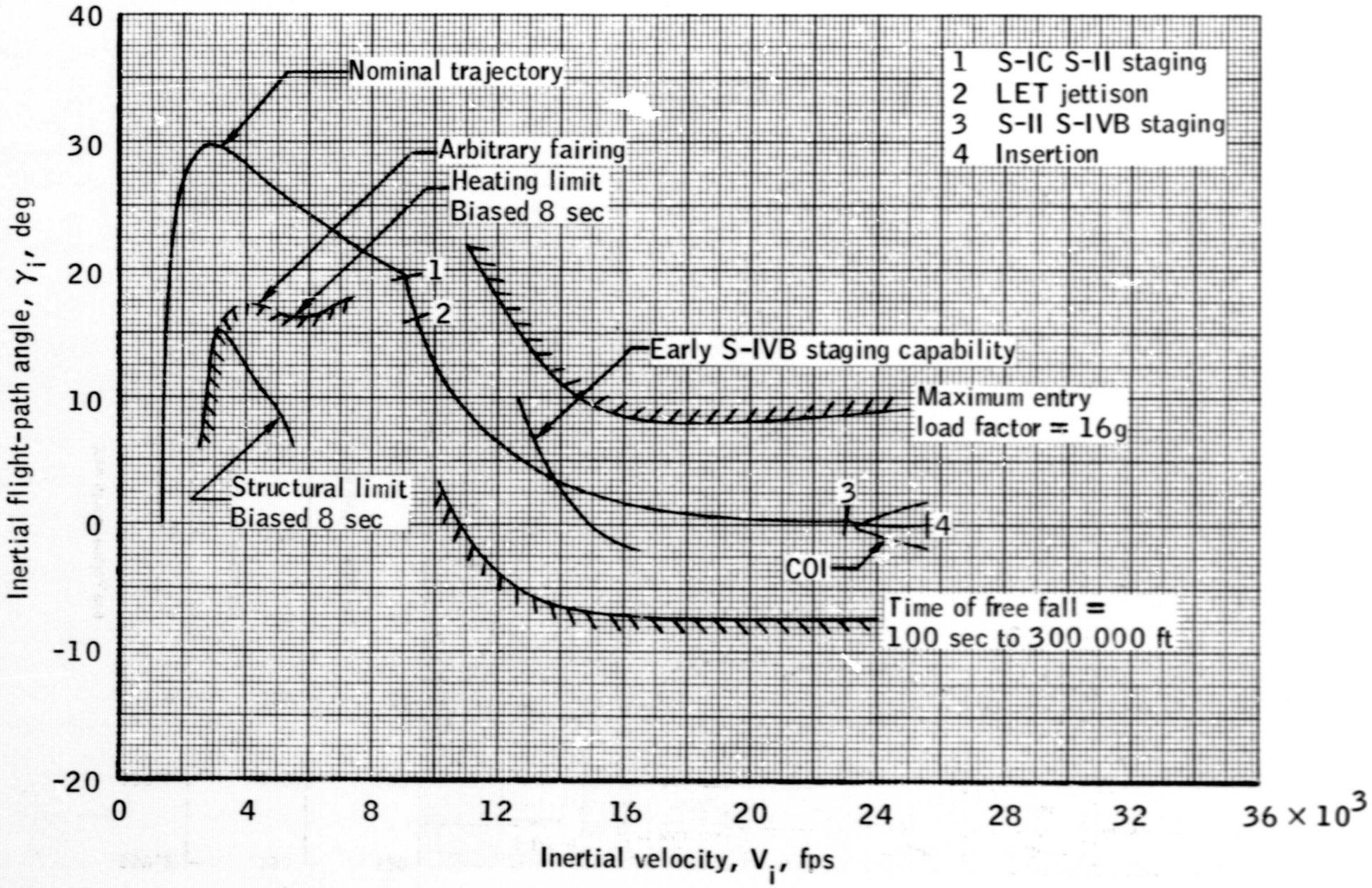
EUGENE DIETZGEN CO.
MADE IN U. S. A



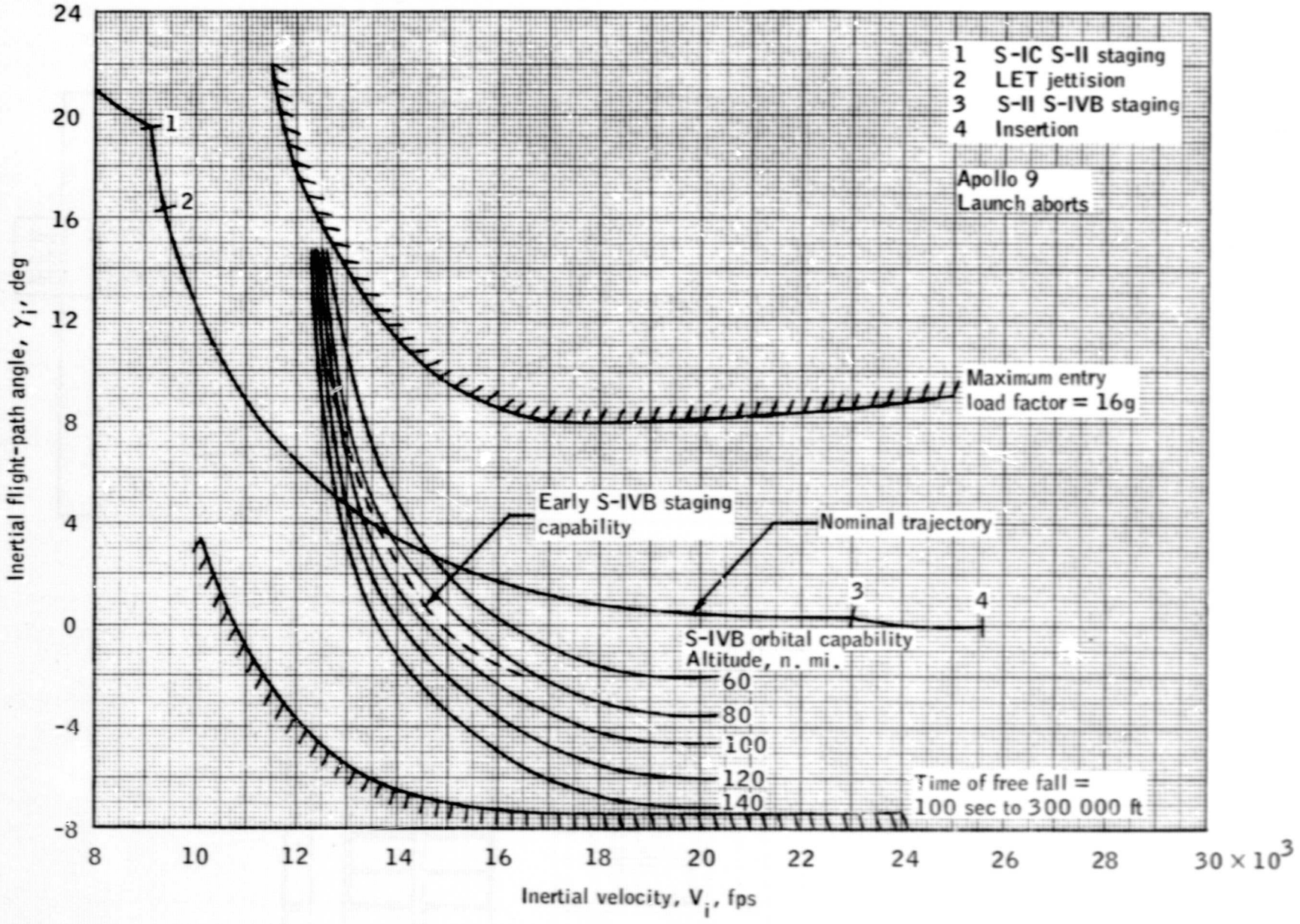
CHI FREEZE SCHEDULE FOR ENGINE FAILURES DURING S-IC FLIGHT



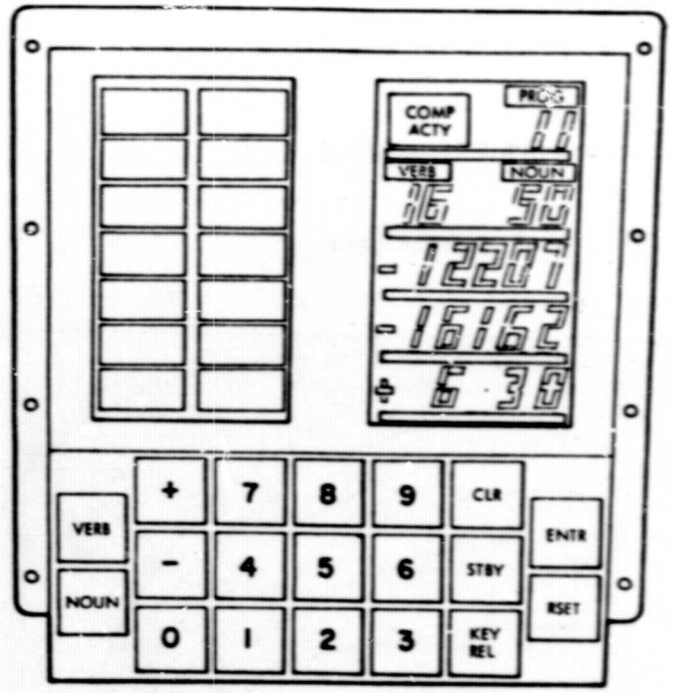
Spacecraft IMU gimbal angle readouts along the nominal launch trajectory.



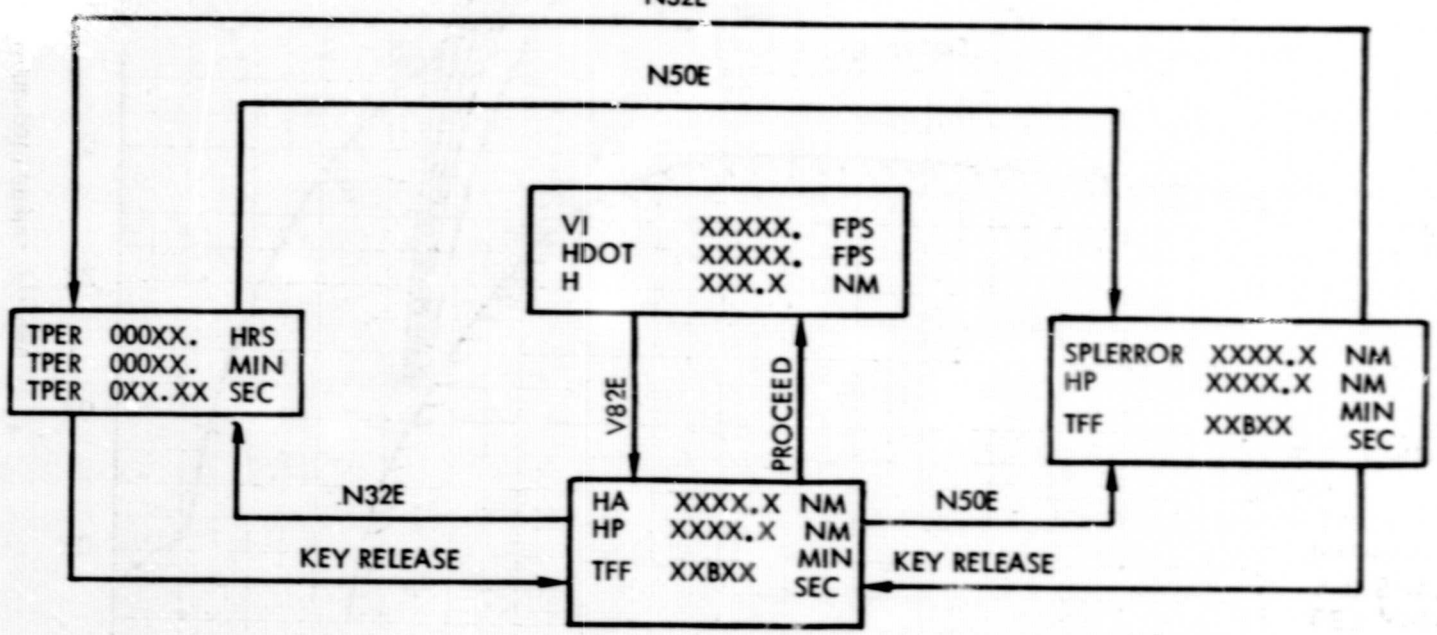
Launch abort and capability limits.



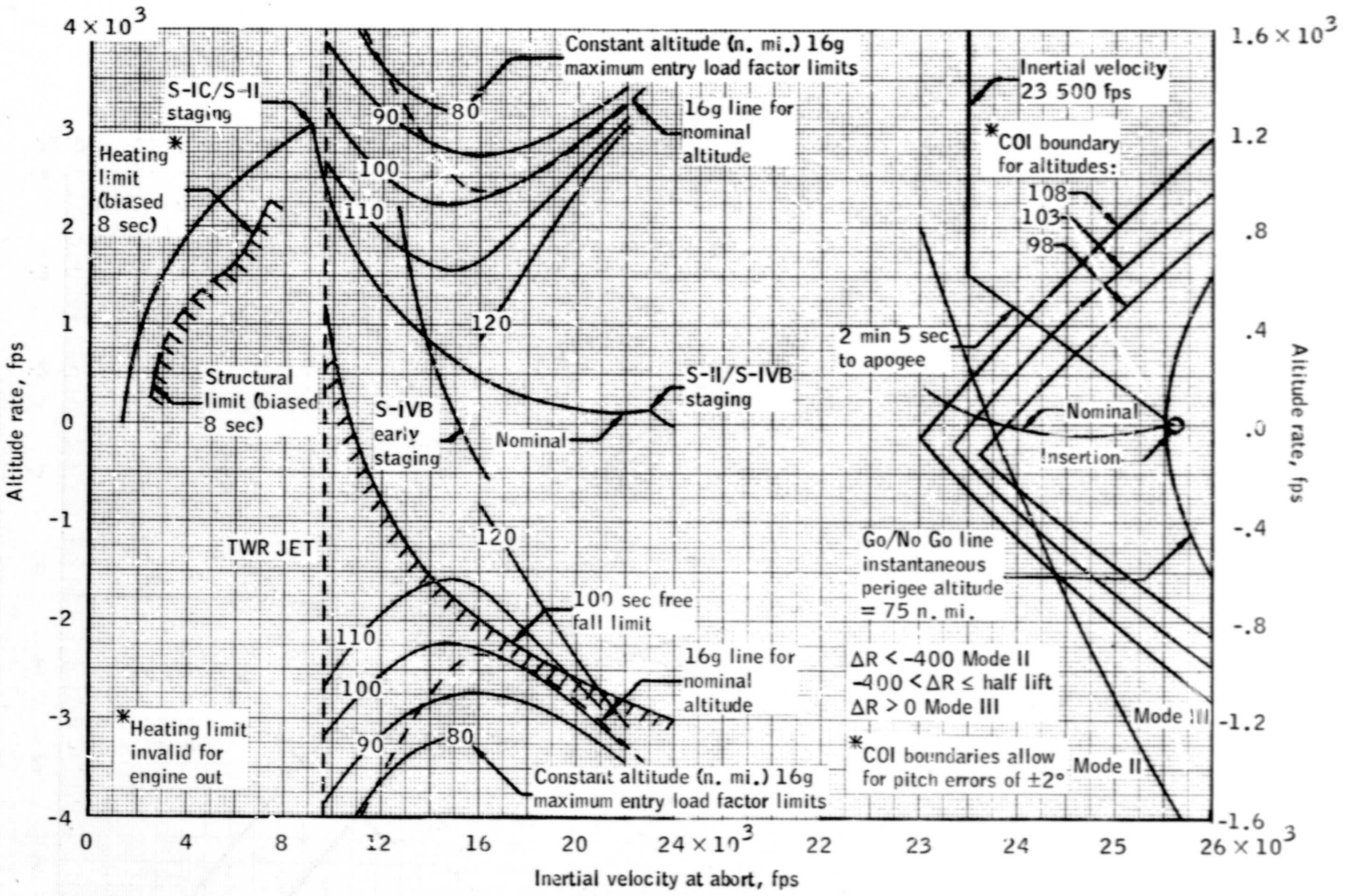
S-IVB early staging to orbit capability.



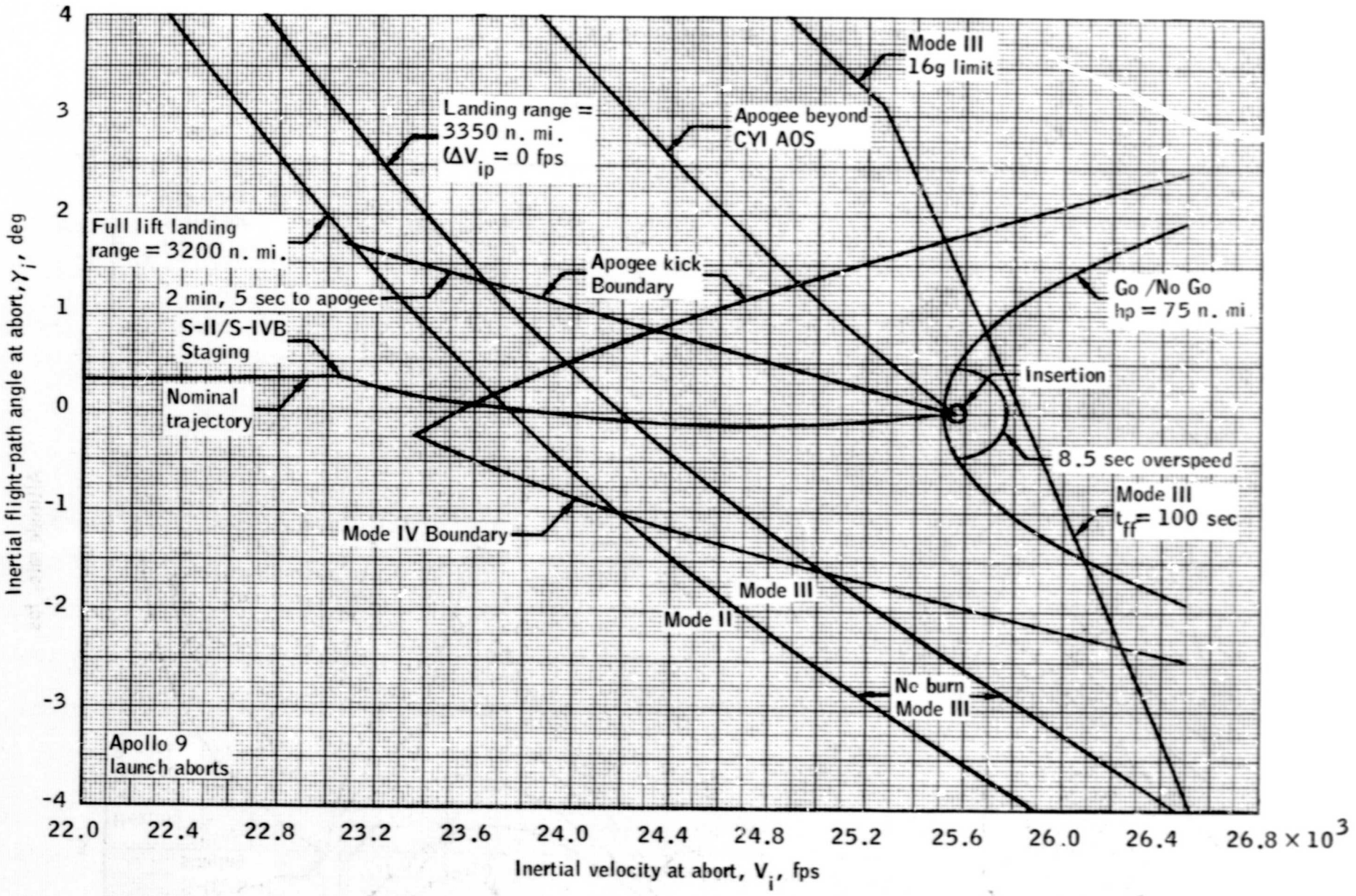
N32E



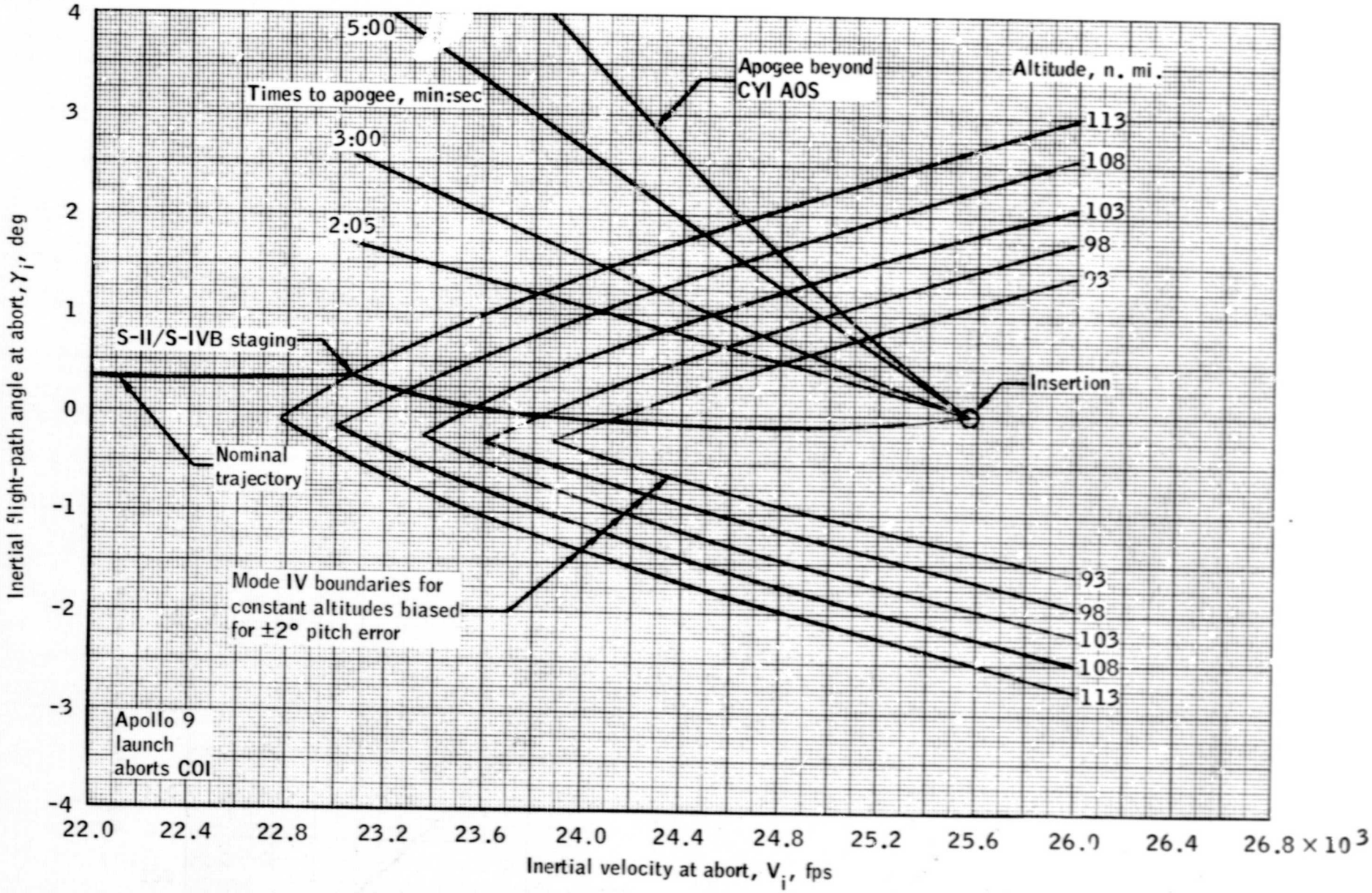
AGC display keyboard and display parameters.



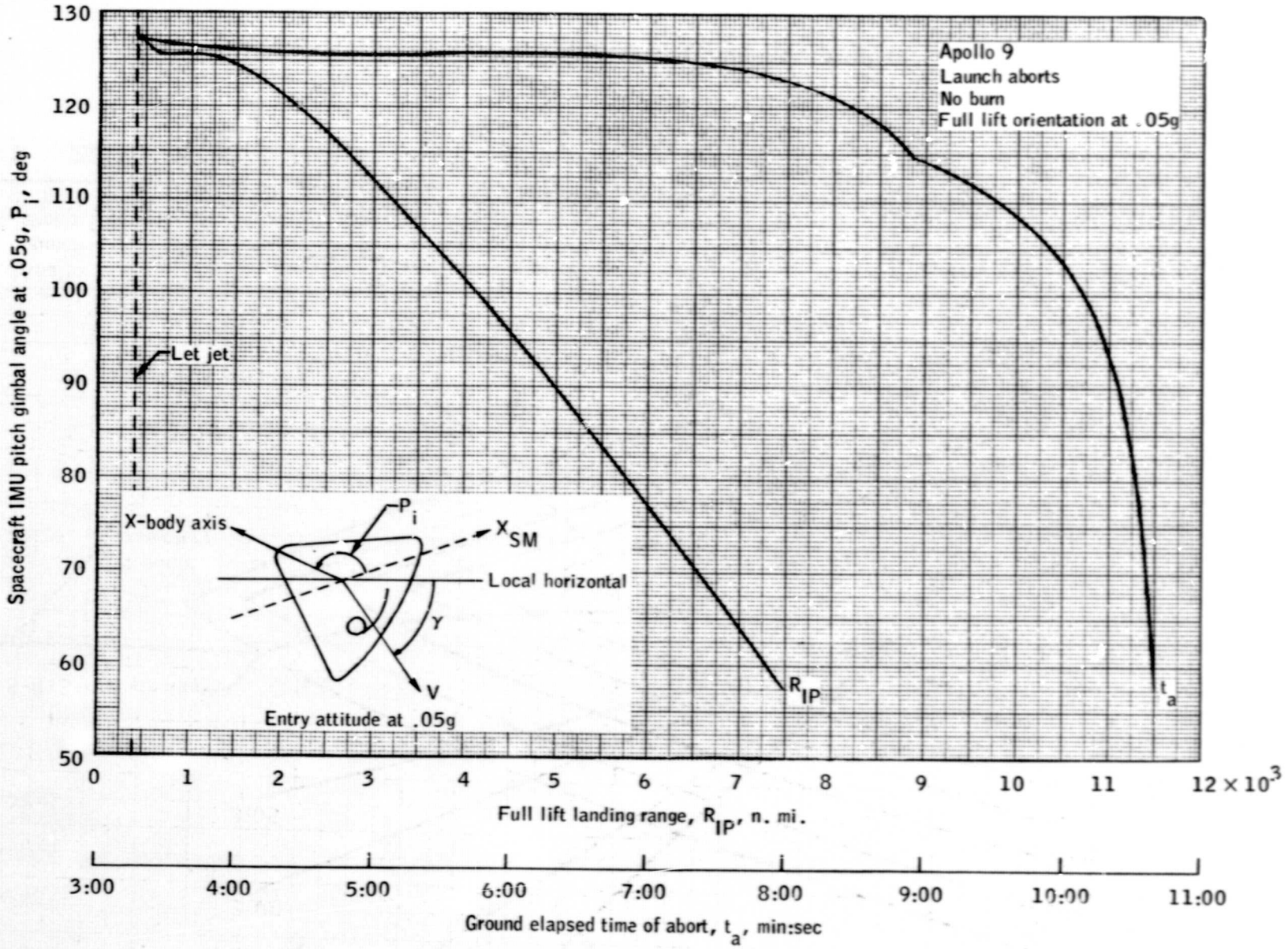
No-voice crew chart for launch phase.



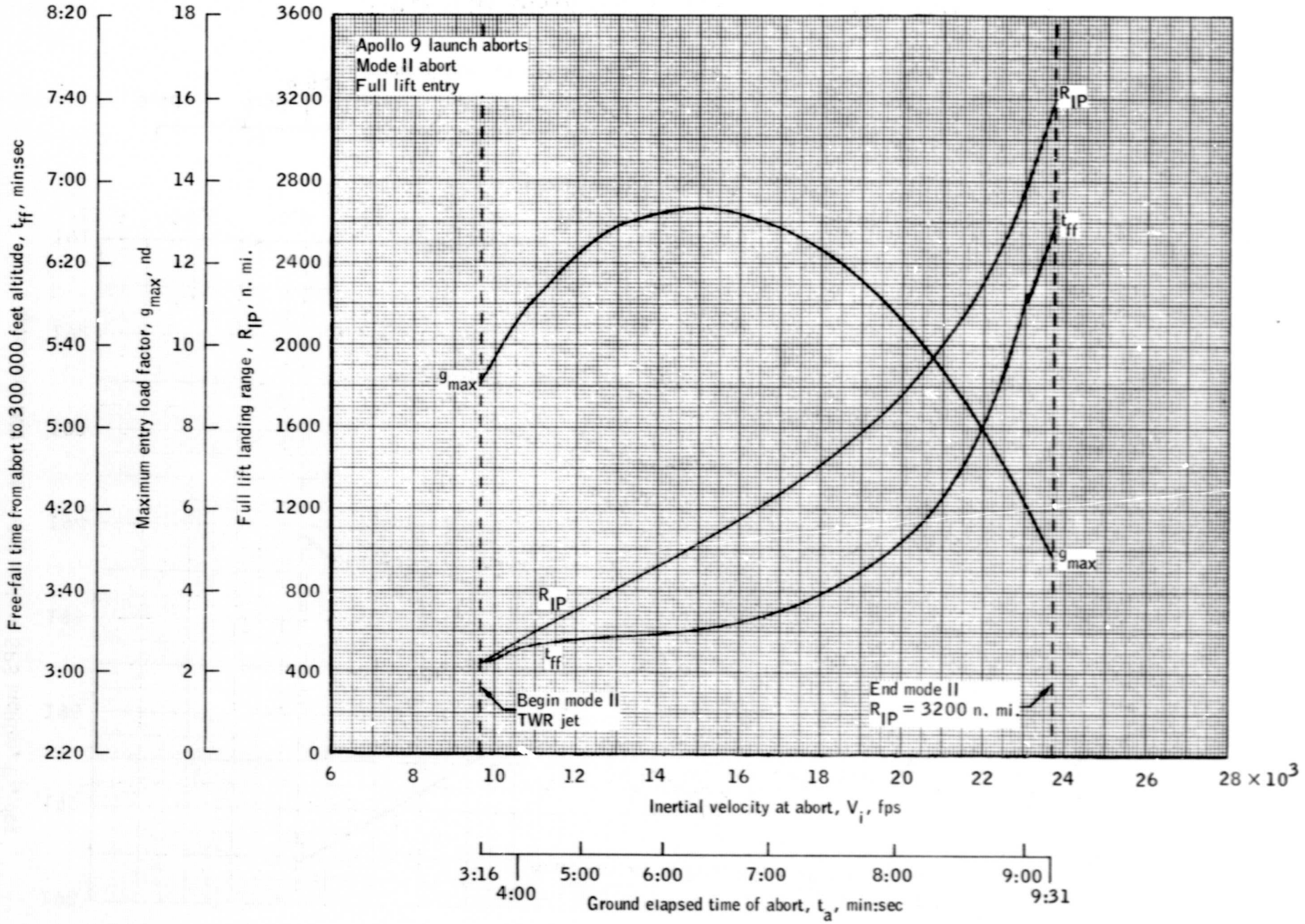
Near-insertion abort mode overlap.



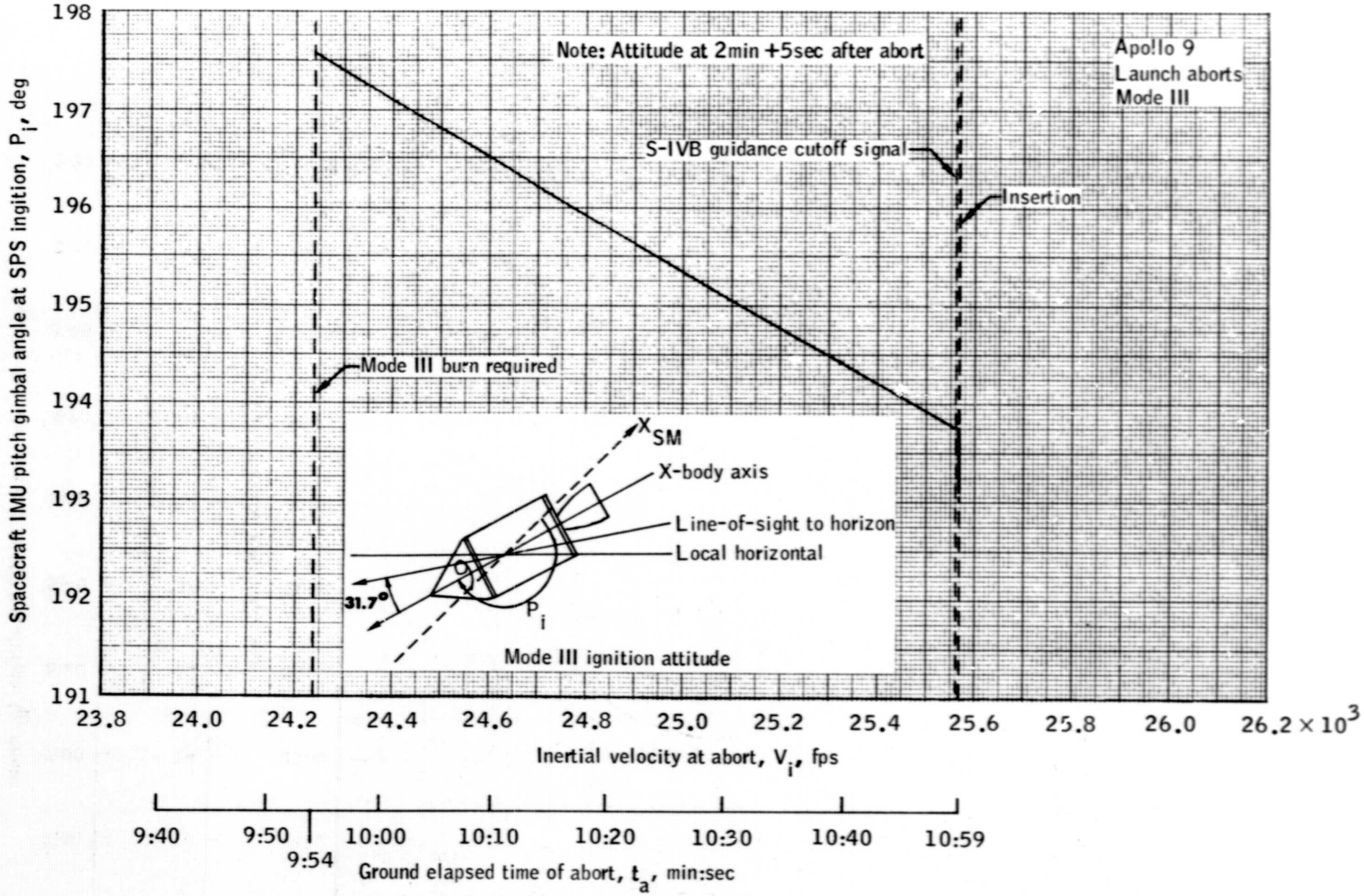
SPS contingency orbital insertion capability.



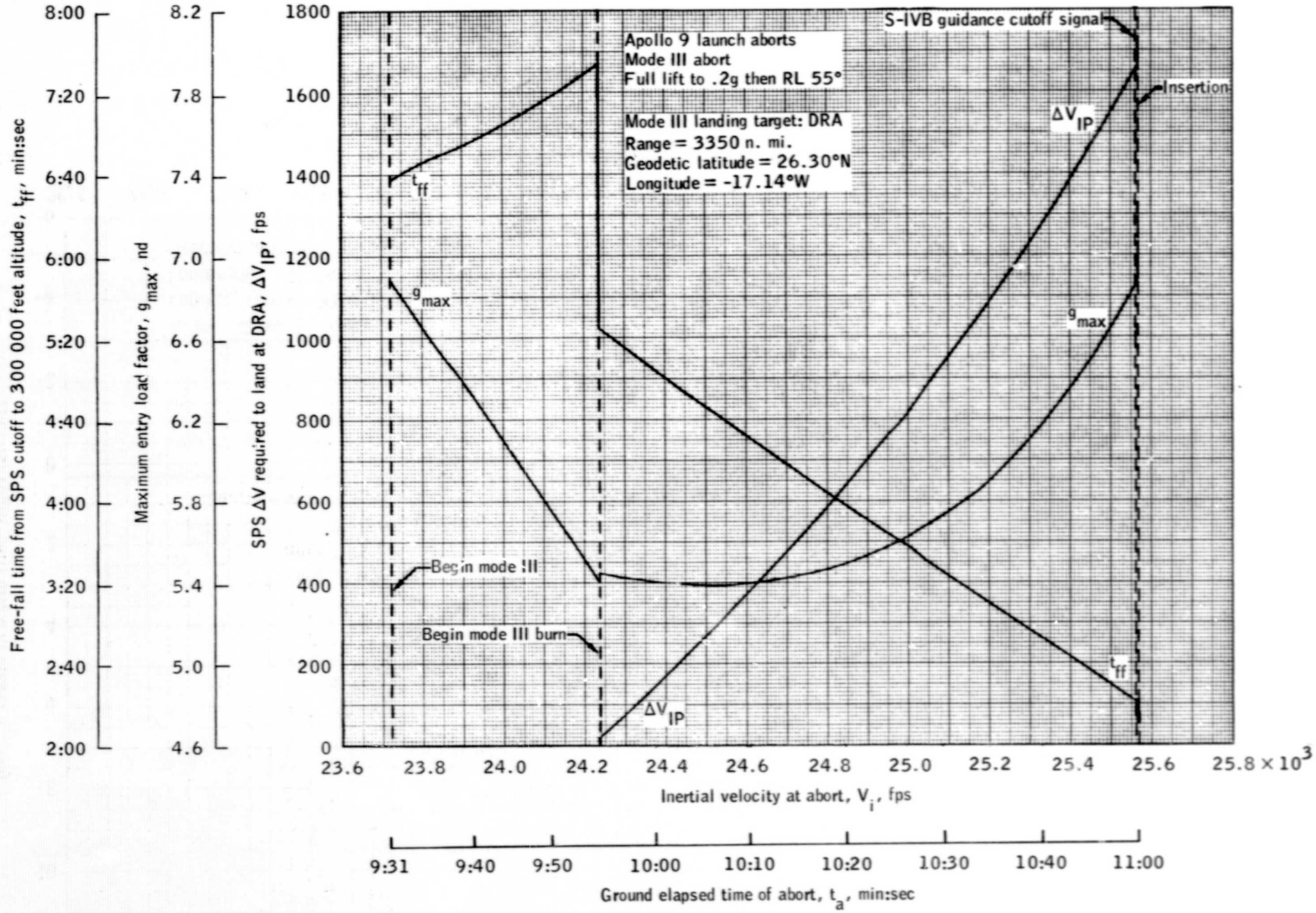
Entry orientation following no burn aborts from the nominal launch trajectory.



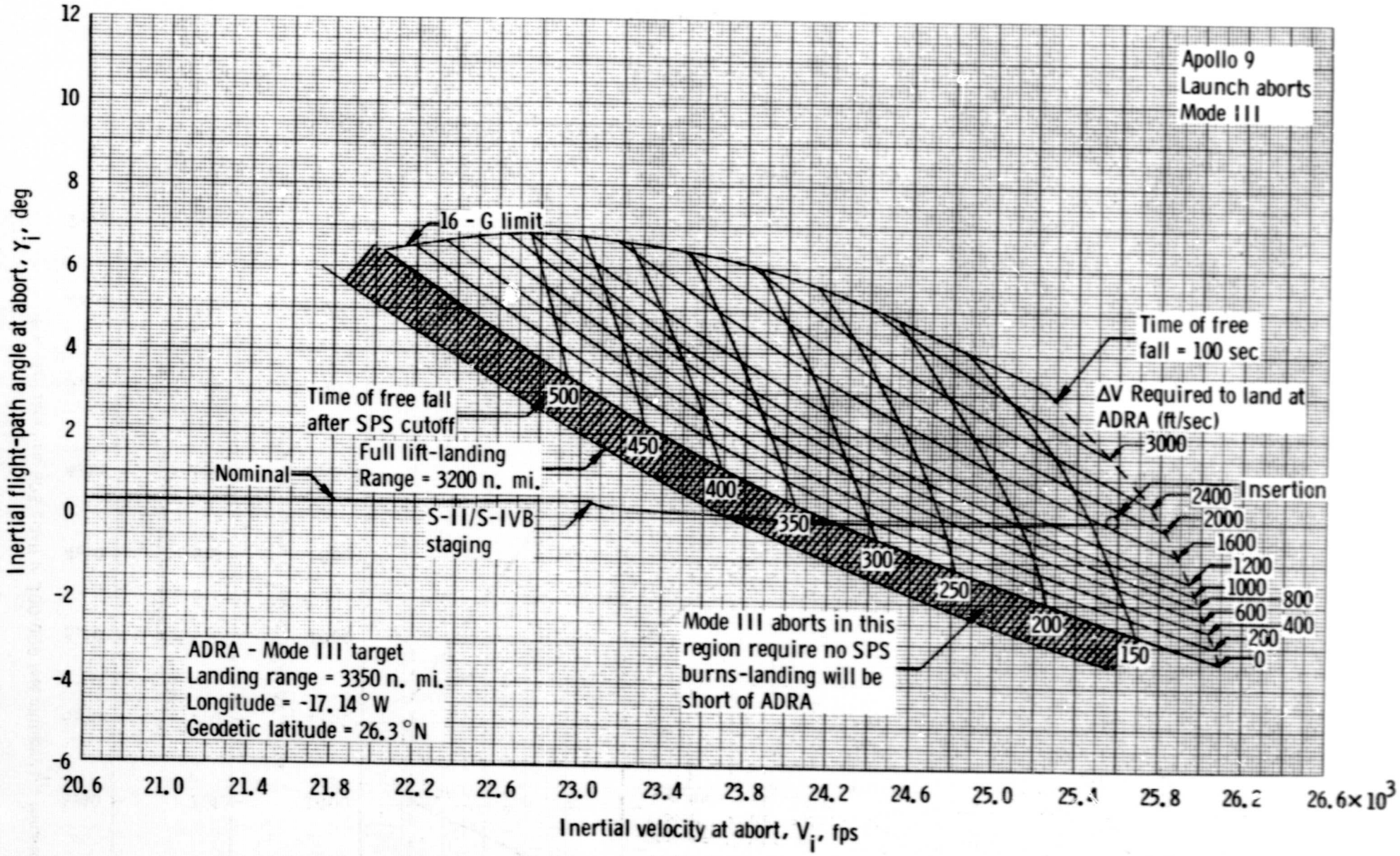
Mode II abort parameters for aborts from the nominal launch trajectory.



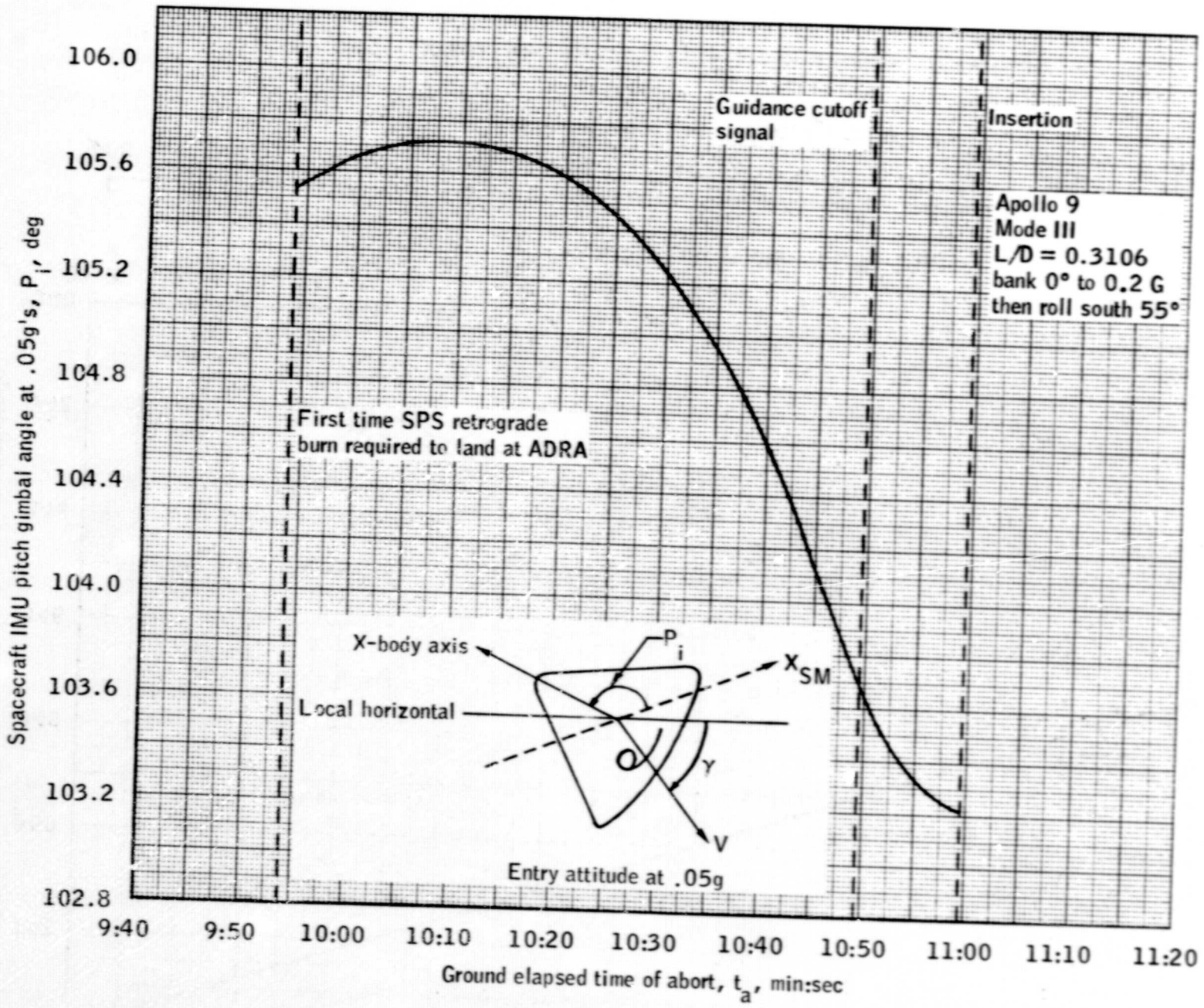
Mode III burn orientation following aborts from the nominal launch trajectory.



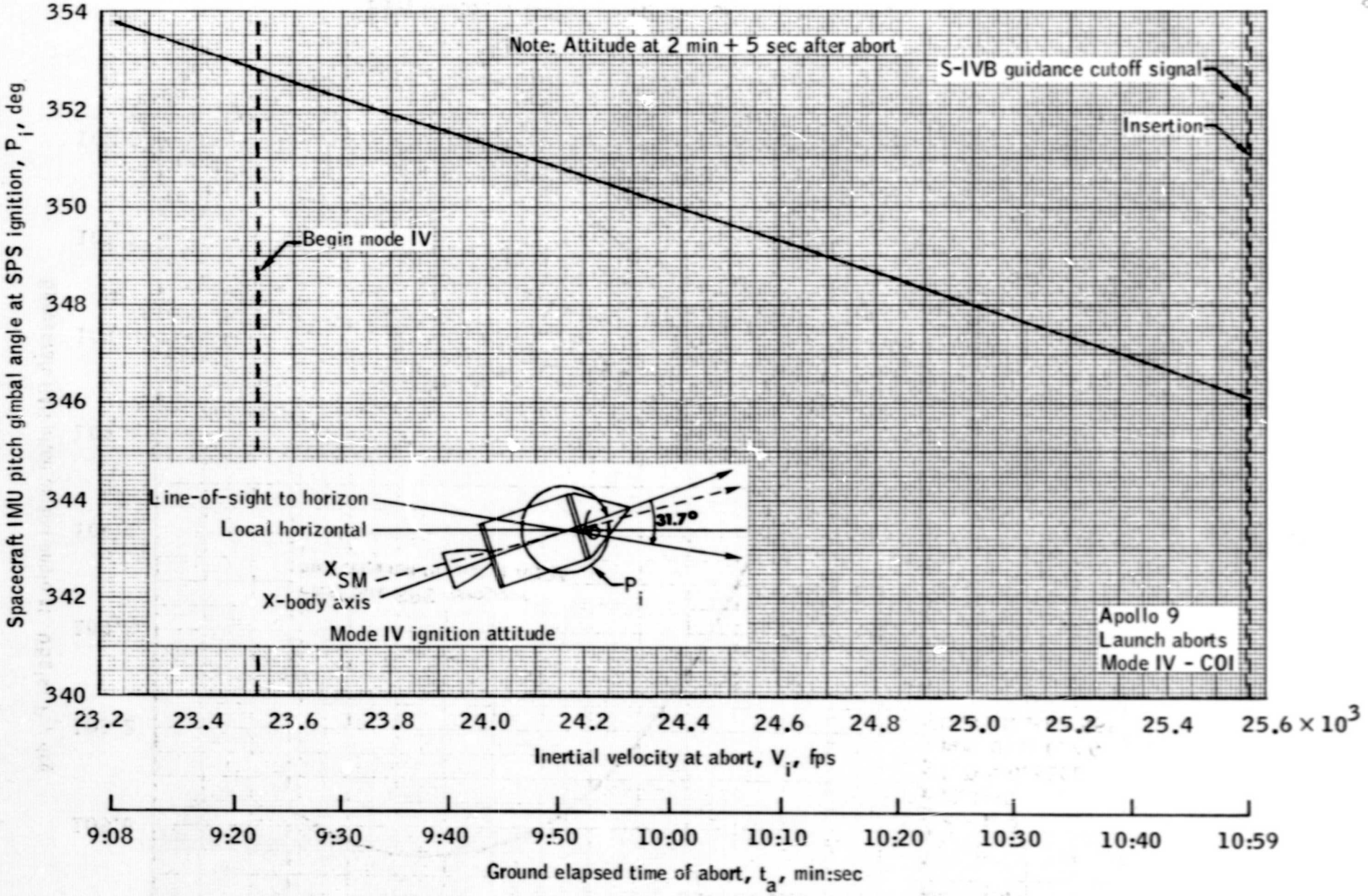
Mode III abort parameters for aborts from the nominal launch trajectory.



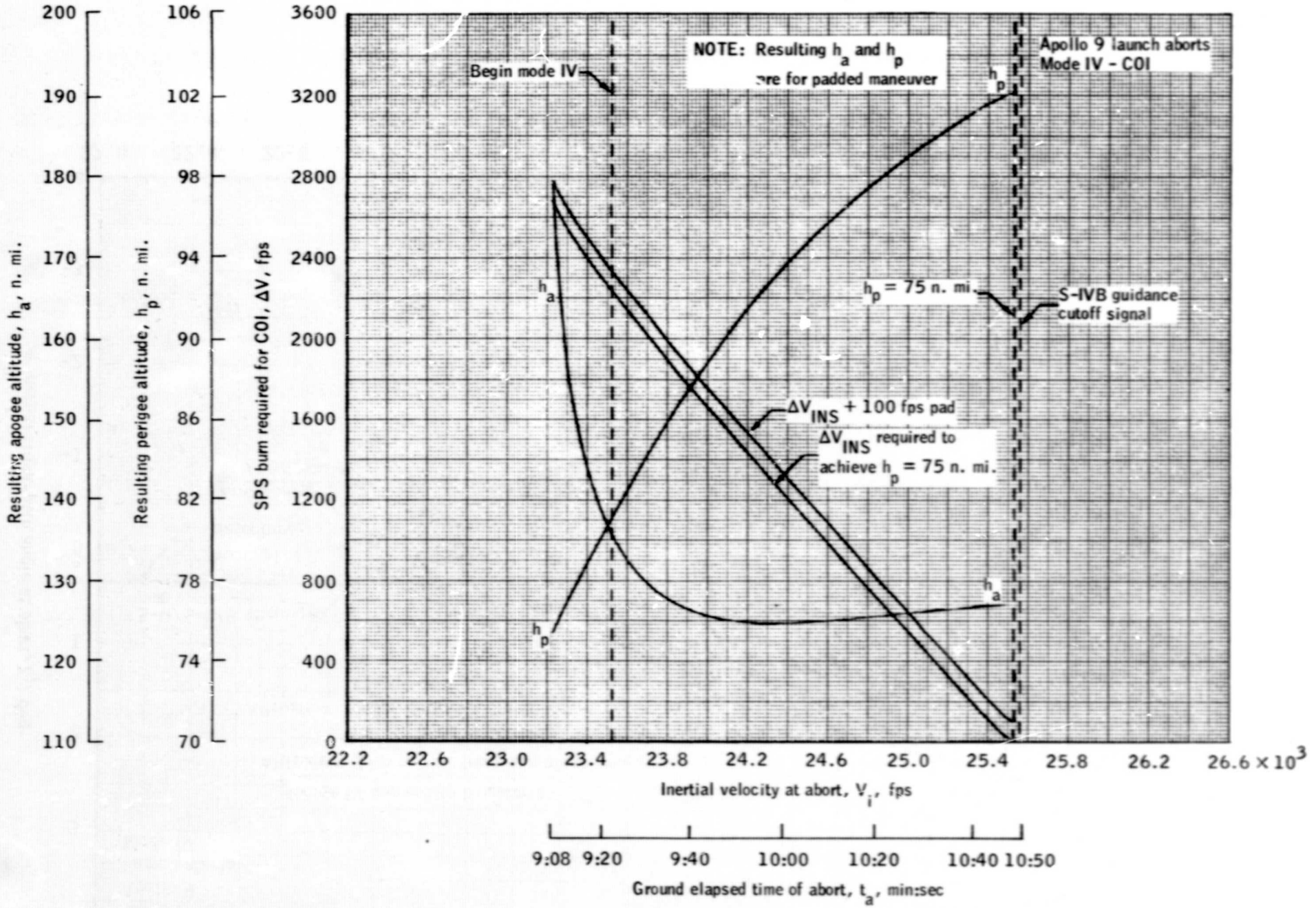
Constant mode III ΔV contours required to land at the Atlantic discrete recovery area.



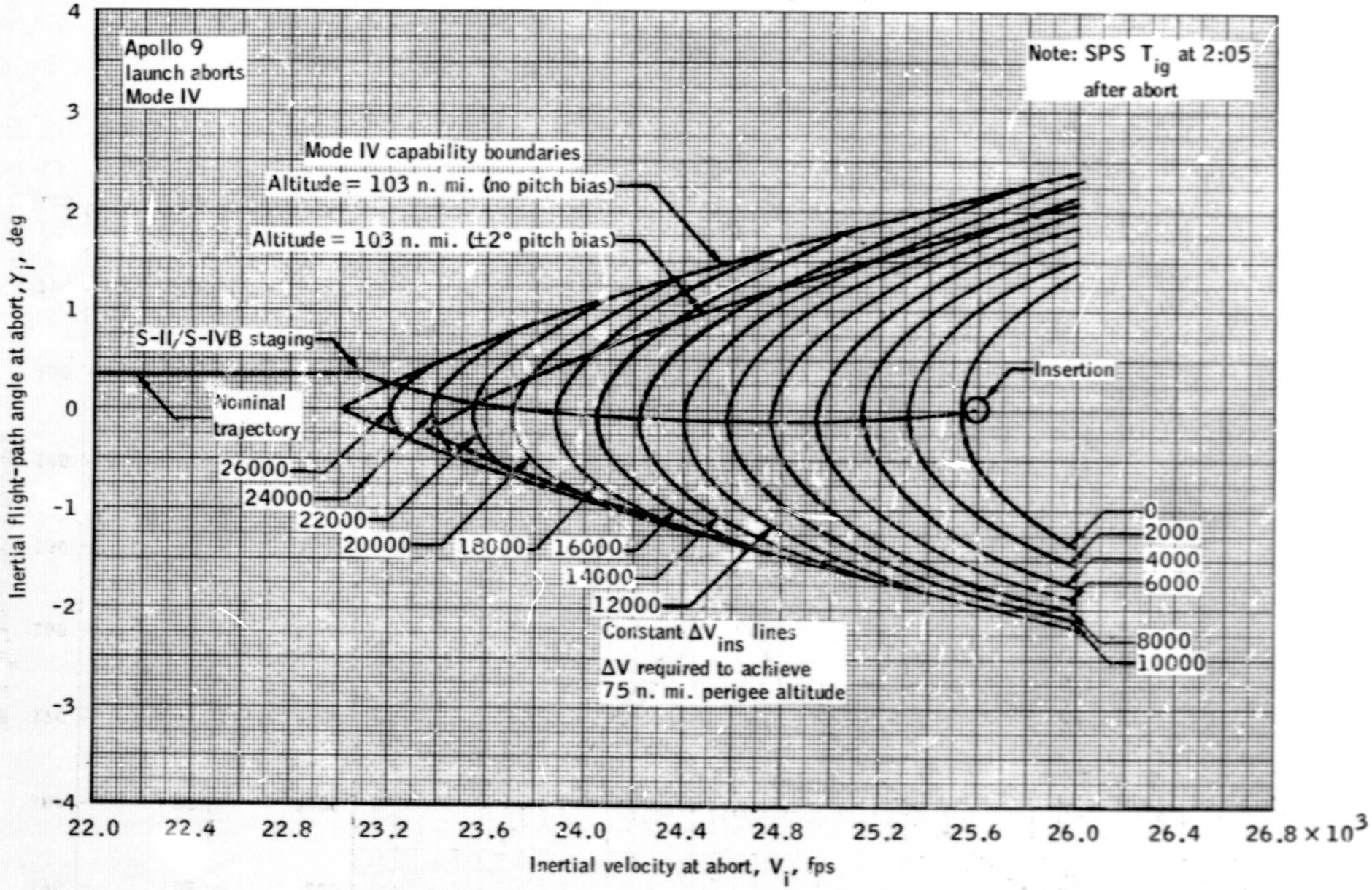
Entry orientation following mode III aborts from the nominal launch trajectory.



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



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



Constant Mode IV ΔV contours required to achieve a 75-nautical mile perigee altitude.