CORONA CR

MISSION SUMMARY

and

TELEMETRY ANALYSIS

MISSION 1111

AGENA 1654/PAYLOAD CR-12

25 September 1970

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MISSION SUMMARY

1.0 SUMMARY

Mission 1111 utilized a Thorad booster (SLV-2H) S/N 69-046, Agena vehicle 1654, and payload system CR-12. The CR-12 payload system contained panoramic cameras S/N 324 and 325, and DISIC camera S/N 2R. Payload profile and additional component serial numbers are included in Figure 7.1.

Lift-off occurred at 1825 PDT on 22 July 1970 from Vandenberg, SLC 3 west pad. All payload ascent events were normal with In-Flight Reset (door ejection), A/P to Orbit Mode, Instrumentation Switchover, and Panoramic Camera Transfer to Orbit Mode occurring as programmed. The orbit attained was within one sigma of predicted.

This mission was the lowest inclination angle (60°) of any Corona flight and performed ascending/descending photography. Special focus experiments utilizing different thickness filters were performed. This mission was the first to use a full load of new 3414 film.

All systems performed satisfactorily with only minor problems encountered.

The -1 mission recovery capsule was successfully recovered by air catch after seven (7) days on orbit, during rev 112. The -2 mission recovery capsule was successfully recovered by air catch during rev 301, after twelve (12) days on orbit. Total mission length was nineteen (19) days as compared to the planned mission length of eighteen (18) days. This mission was the first to use the new telemetry frequency for the recovery capsules.

The panoramic camera film supply was exhausted during rev 298. The DISIC terrain film supply was exhausted during rev 298. The last titled frame of the DISIC stellar camera occurred during rev 300.

2.0 SUBSYSTEM PERFORMANCE

2.1 Panoramic Cameras

Panoramic camera S/N 324 failed to stow at the normal position during revs 69 through 88 in the -1 mission and from rev 149 throughout the remainder

of the -2 mission. Telemetry from engineering passes verified the instrument stowed near the center of format. An analysis of the shut-down circuit indicates a probable malfunction of the stow switch. The mission performance evaluation letter reported a binary bit image anomaly on the second from last frame of each S/N 324 operation following rev 214. An analysis of the DDSC indicates that if the C/F switch remains actuated following shut-down the binary data head will re-image at the next start-up. The SRV tape recorder data confirmed the double data head interrogate during the periods of stow malfunction.

Both panoramic cameras exhibited normal film transport characteristics and excepting the aforementioned stow problem, operated satisfactorily throughout the flight. Refer to Table 7.2 for engineering pass cycle period data.

For the first time glass filters (0.007 inch) were used in the alternate position. The glass filters were commanded into position during selected engineering operations for comparative evaluation to the 0.004 inch gelatin. The glass filter was utilized on panoramic camera S/N 324 during revs 45, 63 and 126 while panoramic camera S/N 325 utilized it on revs 63, 77, 94, and 126.

Both cameras contained 16,300 feet of standard base type 3414 film. Panoramic camera #324 film depletion occurred on frame 38 during rev 298. The film tag end of panoramic camera #325 wrapped in the transport mechanism during rev 298. The last frame recovered was frame 16 of rev 298.

2.1.1 Film Consumption & Type

	Frames		Length/Type	
	Pan 324	Pan 325	Pan 324	Pan 325
Sample	21	20	16300 ft/3414	16300 ft/3414
Pre-launch	132	138		
-1 Mission	2991	2991		
-2 Mission	3019	3013		
Total	6163	6163		

2.2 DISIC Camera

The DISIC camera performed satisfactorily throughout both the -1 and -2 missions. The terrain instrument passed the tag end into the recovery system with film depletion occurring on frame 19 during rev 298. The stellar payload was not exhausted at -2 mission recovery.

2.2.1 Film Consumption

	Frames		Length/Type	
	Stellar	Terrain	Stellar	Terrain
Sample	44	26	2000 ft/3401	2200 ft/3400
Pre-launch	120	104		
-1 Mission	2980	2433		
-2 Mission	3350	2714		
Total	6494	5277		

2.3 Command and Control

2.3.1 Command System

The Real Time Command (RTC) system operation utilizing both SILO and UNCLE command systems operated satisfactorily throughout the flight.

2.3.2 FMC Match

A satisfactory match to the required FMC was maintained during both the -1 and -2 missions. However, the FMC mismatch error experienced as the orbit period changes from nominal was more pronounced during this mission because of the combined effect of optimizing the FMC parameters for a broad range of anticipated ascending and descending operations and the relatively high eccentric orbit dictated by the 60° orbital inclination. The aft looking panoramic camera had 70.9 percent of the -1 mission

operations less than one percent FMC mismatch and 67.6 percent of the -2 mission operations were less than one percent FMC mismatch. The forward looking panoramic camera had 75.5 percent of the -1 mission operations less than one percent FMC mismatch and 68.6 percent of the -2 mission operations were less than one percent FMC mismatch.

2.3.3 Exposure Control System

The slit width control programmer operated satisfactorily throughout both the -1 and -2 missions. All except five of the operations were taken in the automatic mode. SPC 52 was not punched for rev 41 causing the SPC 51 slit width sequence on rev 42 to be wrong. The slit width control was commanded to fixed slit 4 for rev 41.

The panoramic camera slits were selected assuming that film type 3414 will be processed one half stop faster than film type 3404.

2.4 Data System

2.4.1 Instrumentation

The instrumentation system performed satisfactorily throughout the flight with one exception. S/N 324 rear rail temperature sensor (Channel 11-06) failed 'out of band high' on rev 111. This 'out of band high' condition on Channel 11 Point 6 caused a problem with Points 7, 8, and 9 until rev 205. The problem was caused by the Channel 11 SCO slow response to the high out of band condition.

2.4.2 Clock System

The Mission 1111 vehicle clock was very non-linear and required a fourth order polynomial to attain an acceptable system time to clock time fit. The correlation equation and constants are as follows:

First Order Fit

System Time = $A_0 + A_1$ (Clock time)

A_0 = -0.4973188116620789 D06

A_1 = 0.9999996176525097 D00

Sigma = 0.01061234

Number of points = 317

Second Order Fit

System Time = $A_0 + A_1$ (Clock Time) + A_2 (Clock Time)^2

A_0 = -0.4973188916140692 D06

A_1 = 0.9999997526452726 D00

A_2 = -0.4987307006059397 D-13

Sigma = 0.00240167

Number of points = 317

Fourth Order Fit

System Time = $A_0 + A_1$ (Clock Time) + A_2 (Clock Time)^2
+ A_3 (Clock Time)^3 + A_4 (Clock Time)^4

A_0 = -0.4973189865475547 D06

A_1 = 0.1000000052707250 D01

A_2 = -0.3699563330216768 D-12

A_3 = 0.1388799373922082 D-18

A_4 = -0.2094108029608987 D-25

Sigma = 0.00035566

Number of points = 317

2.4.3 SRV Tape Recorder

The SRV tape recorders for the -1 and -2 missions performed satisfactorily. A total of 235 minutes of data was recorded and processed from the two recorders.

2.5 Recovery

There were no Real Time recovery events acquired by [redacted] Tracking Station due to the 60° orbit inclination angle.

2.5.1 -1 Mission

The -1 recovery capsule was successfully recovered by air catch on rev 112. All re-entry events were within tolerance. The impact was 8 miles east of prediction. The sequence of events is included in Table 7.5.

	Actual	Predicted
Impact Location:	20° 51'N/148° 54'W	20° 25.6'N/149° 1.9'W

2.5.2 -2 Mission

The -2 recovery capsule was successfully recovered by air catch on rev 301. All re-entry events were within tolerance. The impact was near predicted. The sequence of events is included in Table 7.5.

	Actual	Predicted
Impact Location:	23° 08'N/144° 13'W	23° 01'N/144° 08'W

3.0 ORBITAL PERFORMANCE

3.1 Orbital Parameters

Parameter	Predicted	Tolerance	Actual STC	Actual APF
Period (Min.)	89.90	+0.38,-0.37	89.84	89.85
Perigee (N.M.)	88.7	+18,-13	88.8	88.6
Apogee (N.M.)	217.9	+14,-20	215.1	215.9
Eccentricity	0.0180	+0.0030,-0.0044	0.0166	0.0175
Inclination (Deg)	60.00	+0.11,-0.10	59.98	60.02
Arg. of Perigee (Deg)	110	+19,-16	106.5	106
Regression Rate (Deg/Rev)	22.81	----	22.79	22.82
Geodetic Latitude of Perigee (Deg)	55°N	+8,-10	----	56°.41°N

3.2 DMU Operation

Seven DMU rockets were fired during the mission to maintain ground track and period control. The Ground Track Error at the ascending node ranged from 7.5 nautical miles west to 45 nautical miles east. DMU No. 5 was retrofired to achieve a desired ground track 138 nautical miles east of the nominal. The DMU firings programmed were satisfactory for attaining mission objectives. Refer to Figures 7.6.1, 7.6.2, and 7.7.

A summary of DMU firing results follows:

Rocket No	Rev. No.	System Time Sec.	Period Change Sec.	Velocity Change Ft/Sec	Period at Firing Min.	Impulse Lb/Sec
1	6	37319	16.40	25.7	89.84	3514
2	79	85901	14.76	23.10	89.89	3166
3	151	42750	16.00	25.10	89.89	3073
4	215	43270	16.10	25.23	89.92	3074
5	282	59228	-16.40	-25.70	89.92	3120
6	310	35967	18.44	28.83	89.49	3012
7	315	64264	18.13	27.99	89.78	2954

NOTE: All seven rockets had 3000 lb-sec impluse.

4.0 ENVIRONMENTAL CONTROL

4.1 Pressure Make-Up System

The pressure make-up system operated properly throughout the flight. The gas consumption rate was 4.63 lbs/min during the -1 mission and 5.48 lbs/min during the -2 mission with 1678 psia remaining at the end of the -2 mission.

4.2 Thermal Environment

The temperature data obtained during this flight indicated the temperature environment was below the pre-flight predictions following rev 152 (refer to Figure 7.8.1). The averages of the panoramic camera temperatures ranged from 62° to 66° for S/N 324 and 62° to 63° for S/N 325 during the -1 mission and during the -2 mission the averages ranged from 70° to 52° for S/N 324 and 66° to 54° for S/N 325. S/N 324 rear rail temperature sensor failed on rev 111 for the remainder of the flight.

The on-orbit temperature profiles for revs 9, 120, and 277 are included in Figures 7.8.1 through 7.8.10.

The temperature data obtained from the [redacted] tracking station acquisitions are included in Tables 7.9.1 through 7.9.8.

5.0 POST RECOVERY TESTING

The system was enabled on rev 325 [redacted] prior to the end of the programmer tape. Panoramic camera S/N 324 operated satisfactorily (20 frames) and the DISIC operated satisfactorily (5 frames). Panoramic camera S/N 325 did not operate because the film tag end was still wrapped in the transport mechanism.

6.0 HARDWARE DEFINITIONS

6.1 Agena

FTV 1654 was an Agena vehicle (SS-01B) and a Thorad booster (SLV-2H) S/N 69-046. The Agena was oriented nose first in orbit with the following configuration:

1) Seven Thiokol DMU rockets installed in positions 1, 2, 5, 6, 7, 8, and 9. All Thiokol DMU rockets were 3000 lb-sec rockets. Positions 3 and 4 were skipped as they require the most control gas when utilized.
2) -3 control gas mixture (2 spheres).
3) AP-3 payload with digital storage register and capability of accepting both SILO and UNCLE commands.
4) SGLE with all frequencies and the UHF command system (UNCLE).
5) 3/4 Speed Type VIII Programmer (325 subcycles)
6) Battery configuration of 6 IH batteries - last vehicle to have this battery configuration.
7) Quantic Horizon Sensor System installed on left side of the vehicle aft rack.
8) [redacted] experiment on aft rack.
9) LB timer times extended so that enable occurs 2 orbits prior to an LB recovery, due to the station acquisition characteristics for a 60° inclination mission.
10) Both recovery capsules' telemetry frequency changed on this flight (remained in VHF region).

6.2 Payload

The CR-12 payload configuration included the following:

1. Panoramic Camera

   a) Constant rotating type with servo-controlled supply cassette.

   b) Digital Storage Register (DSR)/Cascade system used for camera enable/disable.

   c) Emergency program backup capability available by RTC.
   UHF 116/Silo 316 Emergency Program Select
   UHF 118/Silo 318 Emergency Intermix Select
   UHF 120/Silo 320 Instrument Mode Select

   d) Exposure control
      1) Programmer control by SPC (51, 52, 17) and RTC UHF 105/Silo 305.
      2) Automatic slit width control. Override by RTC UHF 101-126/Silo 301-326.

   e) Filter Selection
      1) Control by RTC UHF 103-104/Silo 303-304.
      2) The automatic filter change capability through the material change detector (MCD), was disconnected prior to launch.

2. DISIC Camera

   a) Mode select controlled by RTC UHF 124/Silo 324.

   b) Both slave and independent modes of operation had 1:1 ratio of stellar to terrain frames.

   c) Operate off provided by RTC UHF 107/Silo 307.

3. FMC Programmer

   a) Eccentricity function
      1) Initiated by SPC 27 and RTC UHF 125/Silo 325.
      2) Ramp profile provided by
      UHF 121/Silo 321 eccentricity start level
      UHF 122/Silo 322 eccentricity half-cycle level

4. Pressure Make-up

   a) Enable/disable controlled by RTC UHF 110/Silo 310.

   b) Two bottle system with dual range capability and the low range disabled.

5. Panoramic "A" to "B" transfer
   Available by RTC KIK-Silo 38

6. DISIC "A" to "B" transfer
   Available by RTC KIK-Silo 39

7. Yaw steering
   Available by RTC UHF 106/Silo 306

8. Agena tape recorder
   Time shared with vehicle data

9. SRV Tape Recorder

10 Payload weight
   EWO = 1783 lbs.

11. Instrumentation
    UHF 127/Silo 127 - operational - diagnostic data select

12. Thermal configuration

    a) The standard paint configuration of 180 degrees black surface 90 degrees both top and bottom) and 180 degrees aluminized surface (90 degrees on each side) was modified. The top black surface was reduced to 67 degrees by extending the aluminized surface 15 degrees on the starboard side and 8 degrees on the port side.

13. Command System
    The command system included a DSR for primary operation of the camera system with a two program/4 rev intermix emergency capability.

The CR-12 payload serial numbers are included in Figure 1.

6.3 Camera & Programmer Settings

6.3.1 Panoramic Cameras

	324	325
Filter Type		
Primary	W/21 Gelatin	W/25 Gelatin
Alternate	W/21 Glass	W/25 Glass
Slit Width (Inches)		
Position 1	.083	.132
Position 2	.114	.176
Position 3	.154	.235
Position 4	.202	.314
Failsafe	.123	.190

Auxiliary Optics

	Pan 324		Pan 325	
	Take-up	Supply	Take-up	Supply
Aperture	f6.3	f8.0	f8.0	f6.3
Filter Type	W-25	W-25	W-25	W-25

6.3.2 DISIC Camera

	Stellar	Terrain
Filter type	None	W-12
Cycle period	9.375	9.375

6.3.3 Exposure Control Settings

	Seconds
T-1 20 sec. increment initial setting	20
T-3 slit width #3 duration	180
T-4 slit width #2 duration	200
T-6 420 sec. increment initial setting	220
T-2 DISIC exposure to 1/500	*200
T-5 DISIC exposure to 1/250	*200

*DISIC exposure time will be constant at 1/500 second for this mission

6.3.4 FMC Control Settings

Eccentricity function

1) Eccentricity function period - 3548 seconds

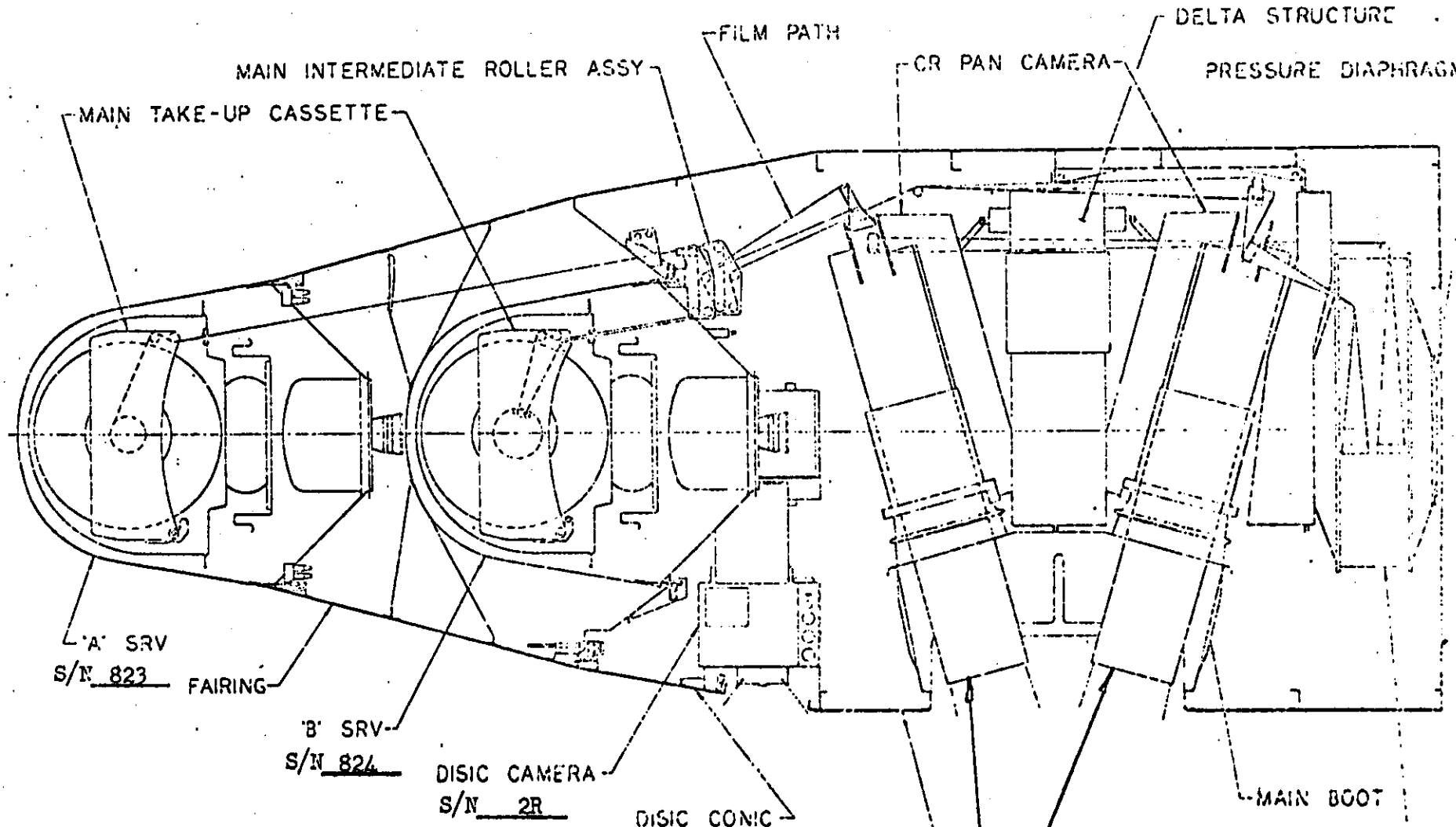
2) Delay step increment - 50 seconds

Oblateness function

1) Oblateness function period - 5244

2) Gain factor - 0.0349

2. PAYLOAD PROFILE AND SERIAL NUMBERS



SYSTEM NO. CR-12

TEST FLIGHT

PMU S/N 101

SLOPE PROGRAMMER S/N 200

CLOCK S/N 625

SWITCH PROGRAMMER S/N 211

FIGURE 7.1

							I---- INST. 324 ----I			I---- INST. 325 ----I				
							I			I				
REV	P R	O P	S	1/2 POS.	SYSTEM CALIB.	OBL TUR	ECC TUR	ACTUAL PERIOD	UNIT DEV.	SYSTEM DEV.	ACTUAL PERIOD	UNIT DEV.	SYSTEM DEV.	324/325 DIFF.
10	0	0	2	11	2.761	1946	812	2.775	0.54S	0.51S	2.770	0.29S	0.33S	0.18
45	0	0	1	8	2.042	3212	2053	2.040	0.07F	0.08F	2.041	0.05F	0.03F	-0.05
63	0	0	2	8	2.051	3266	2090	2.045	0.28F	0.29F	2.042	0.45F	0.44F	0.15
94	0	0	1	9	1.981	3098	1888	1.978	0.15F	0.16F	1.981	0.02F	0.01F	-0.15
108	0	0	1	9	1.982	3215	1931	1.992	0.51S	0.49S	1.993	0.53S	0.55S	-0.05
126	0	0	1	10	1.996	3308	2026	1.993	0.12F	0.13F	1.985	0.54F	0.53F	0.40
189	0	0	1	11	1.998	3346	2063	1.995	0.14F	0.15F	1.990	0.41F	0.40F	0.25
252	0	0	1	12	1.932	3215	1875	1.930	0.09F	0.10F	1.930	0.11F	0.10F	0.0

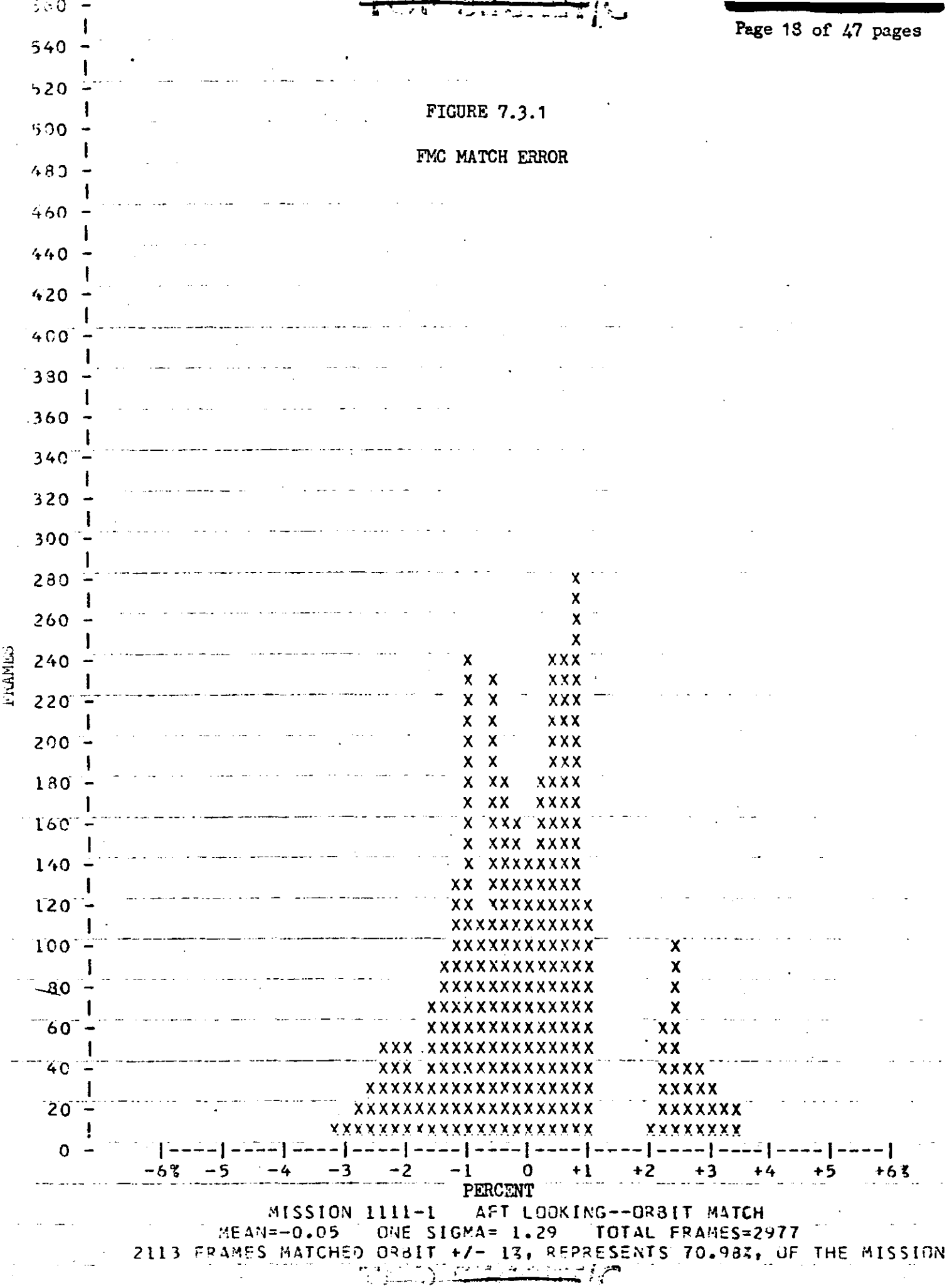
"F" = FAST and "S" = SLOW from the calibrated value.

TABLE 7.2

PAN CAMERA CYCLE RATE ERRORS

FIGURE 7.3.1

FMC MATCH ERROR



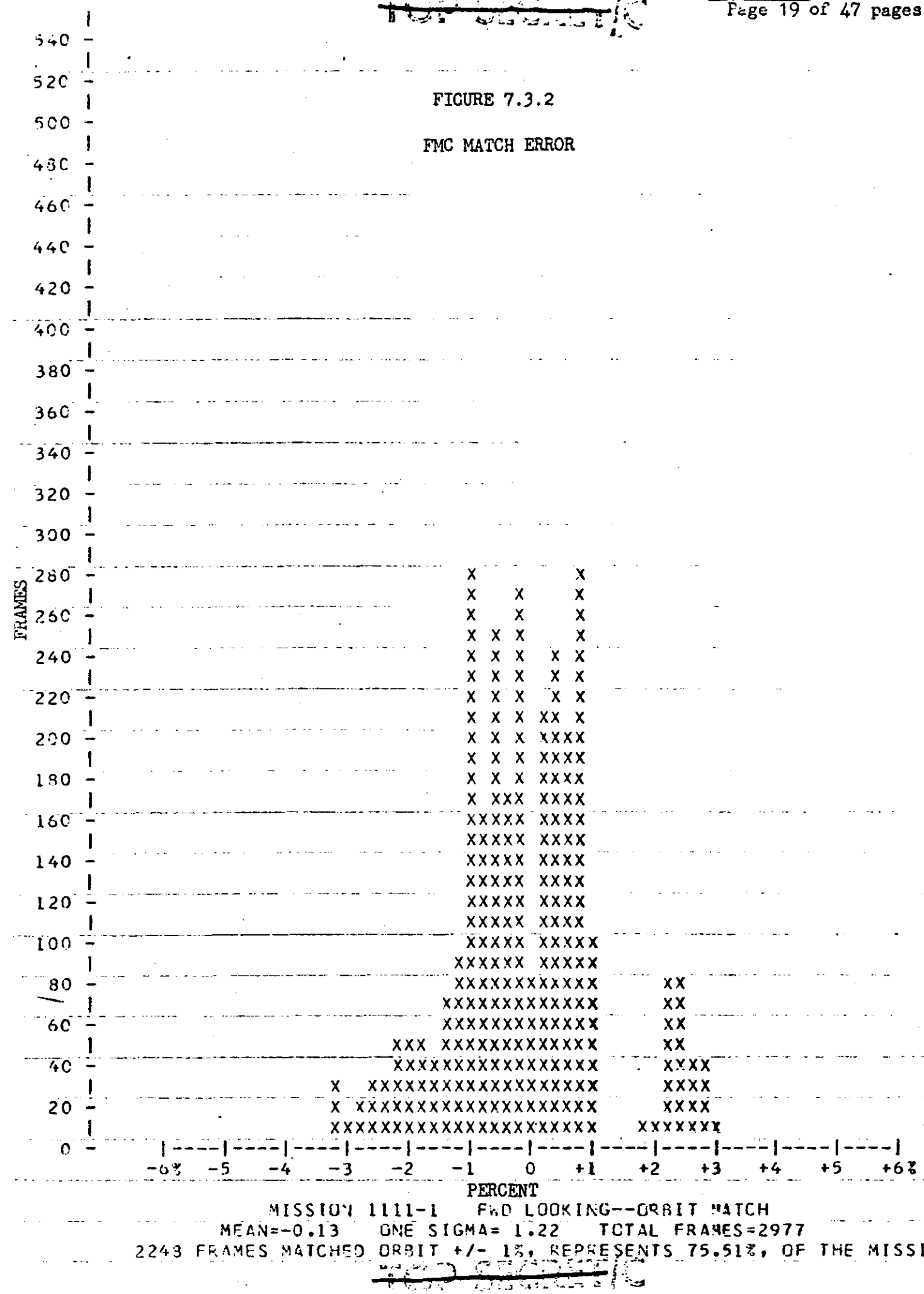
MISSION 1111-1 AFT LOOKING--ORBIT MATCH

MEAN=-0.05 ONE SIGMA= 1.29 TOTAL FRAMES=2977

2113 FRAMES MATCHED ORBIT +/- 1%, REPRESENTS 70.98%, OF THE MISSION

FIGURE 7.3.2

FMC MATCH ERROR



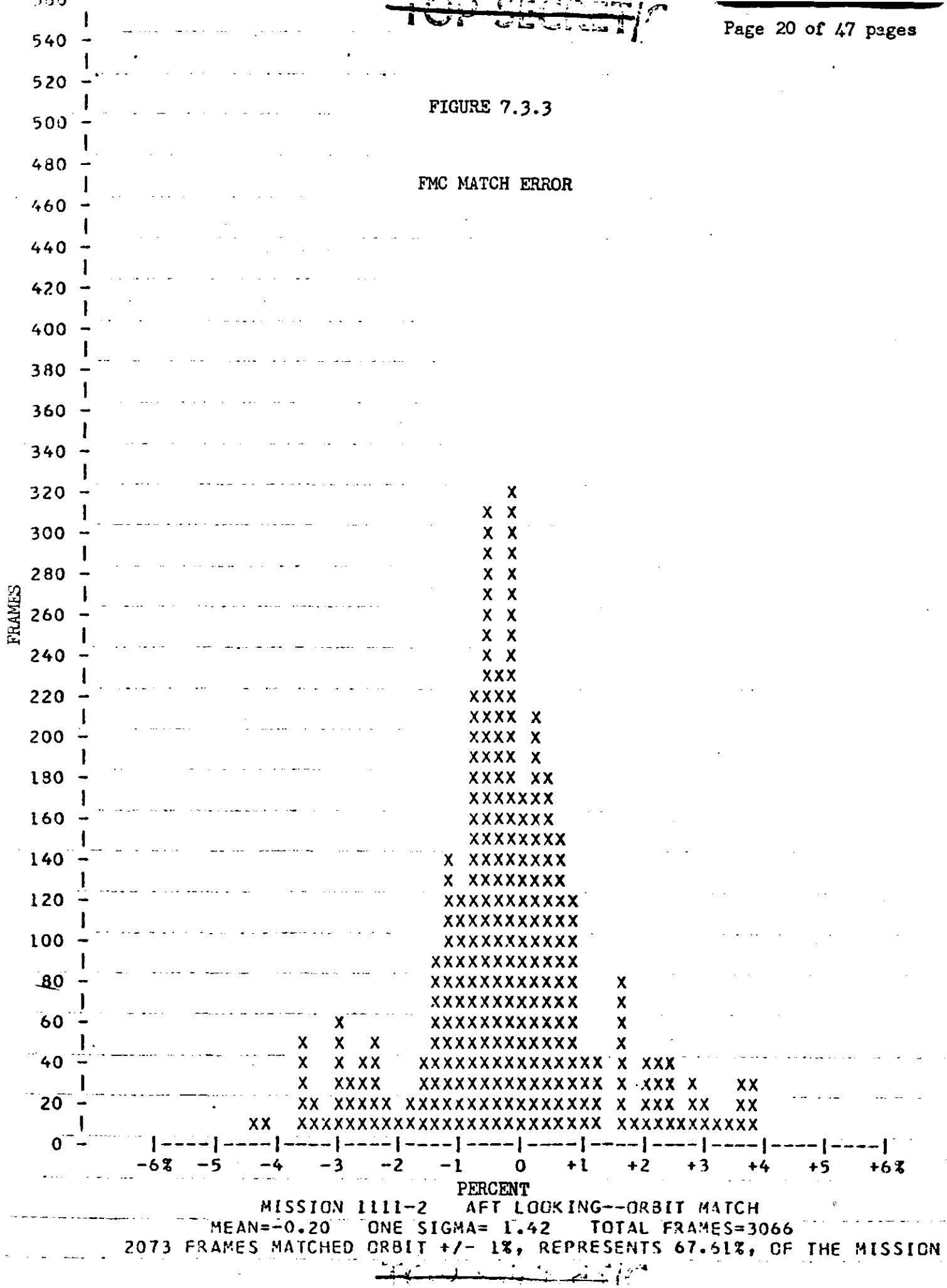
MISSION 1111-1 FWD LOOKING--ORBIT MATCH

MEAN=-0.13 ONE SIGMA= 1.22 TOTAL FRAMES=2977

2248 FRAMES MATCHED ORBIT +/- 1%, REPRESENTS 75.51%, OF THE MISSION

FIGURE 7.3.3

FMC MATCH ERROR



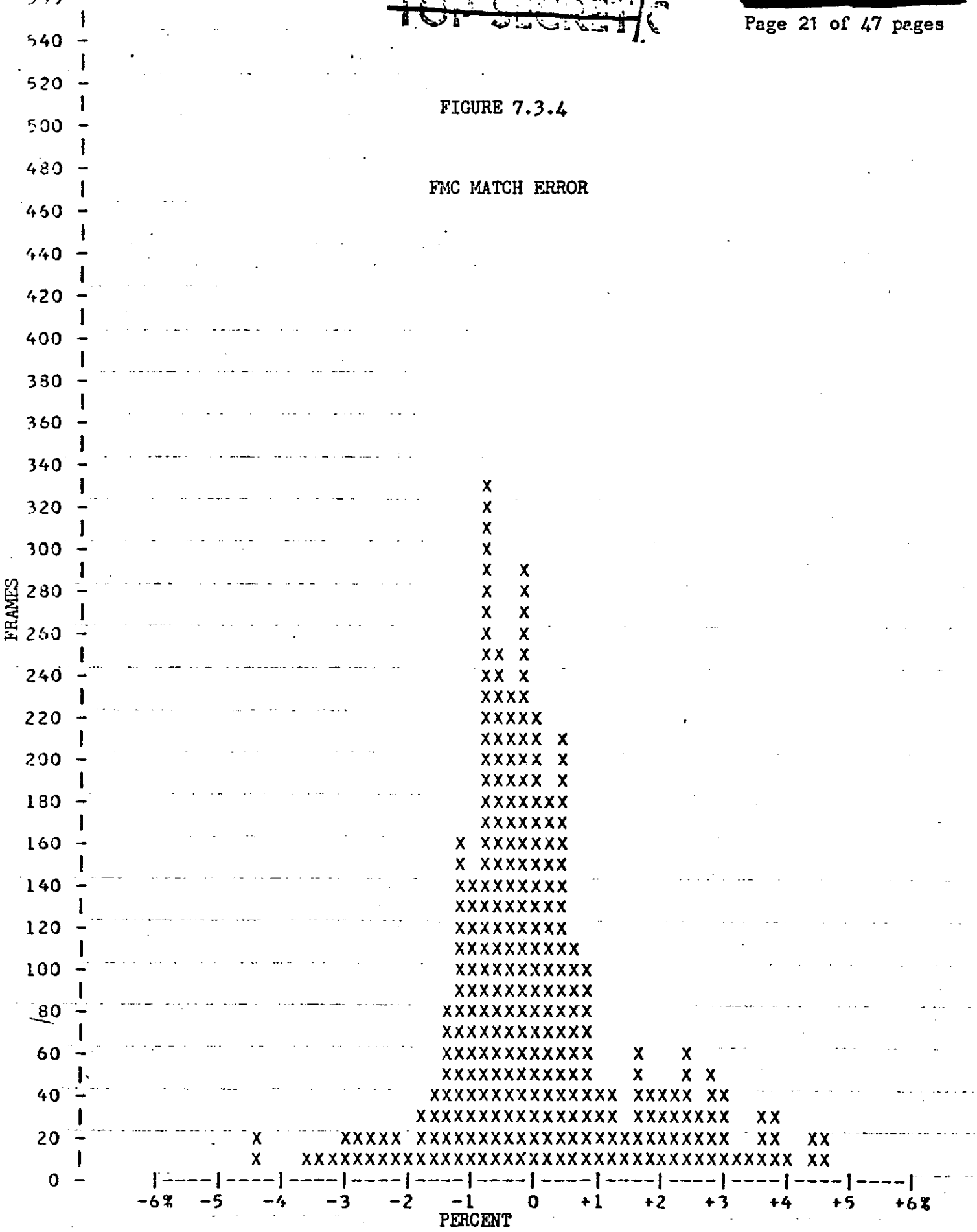
MISSION 1111-2 AFT LOOKING--ORBIT MATCH

MEAN=-0.20 ONE SIGMA= 1.42 TOTAL FRAMES=3066

2073 FRAMES MATCHED ORBIT +/- 1%, REPRESENTS 67.61%, OF THE MISSION

FIGURE 7.3.4

FMC MATCH ERROR



MISSION 1111-2 FWD LOOKING--ORBIT MATCH
MEAN= 0.05 ONE SIGMA= 1.42 TOTAL FRAMES=3075
2109 FRAMES MATCHED ORBIT +/- 1%, REPRESENTS 68.59%, OF THE MISSION

MISSION 1111- AFT LOOKING, TOTAL FRAME COUNT- 2977

FRAME FREQUENCY DISTRIBUTION BETWEEN -6% AND +6% ORBIT MATCH

DISTRIBUTION OVER 61 POINTS INCREMENTED AT .2 PERCENT

PERCENT	FRAMES	PERCENT	FRAMES
		0.0	135
-0.2	157	0.2	182
-0.4	183	0.4	237
-0.6	231	0.6	241
-0.8	111	0.8	277
-1.0	239	1.0	120
-1.2	130	1.2	0
-1.4	94	1.4	0
-1.6	73	1.6	0
-1.8	34	1.8	0
-2.0	49	2.0	9
-2.2	52	2.2	63
-2.4	46	2.4	100
-2.6	29	2.6	37
-2.8	17	2.8	37
-3.0	8	3.0	31
-3.2	8	3.2	18
-3.4	4	3.4	17
-3.6	4	3.6	0
-3.8	4	3.8	0
-4.0	0	4.0	0
-4.2	0	4.2	0
-4.4	0	4.4	0
-4.6	0	4.6	0
-4.8	0	4.8	0
-5.0	0	5.0	0
-5.2	0	5.2	0
-5.4	0	5.4	0
-5.6	0	5.6	0
-5.8	0	5.8	0
-6.0	0	6.0	0

TABLE 7.4.1

MISSION 1111- FWD LOCKING, TOTAL FRAME COUNT- 2977

FRAME FREQUENCY DISTRIBUTION BETWEEN -6% AND +6% ORBIT MATCH

DISTRIBUTION OVER 61 POINTS INCREMENTED AT .2 PERCENT

PERCENT	FRAMES	PERCENT	FRAMES
		0.0	77
-0.2	271	0.2	213
-0.4	166	0.4	240
-0.6	254	0.6	204
-0.8	159	0.8	284
-1.0	281	1.0	99
-1.2	92	1.2	0
-1.4	69	1.4	0
-1.6	39	1.6	0
-1.8	45	1.8	7
-2.0	47	2.0	6
-2.2	46	2.2	80
-2.4	30	2.4	79
-2.6	28	2.6	37
-2.8	24	2.8	37
-3.0	8	3.0	13
-3.2	29	3.2	0
-3.4	4	3.4	0
-3.6	3	3.6	0
-3.8	3	3.8	0
-4.0	3	4.0	0
-4.2	0	4.2	0
-4.4	0	4.4	0
-4.6	0	4.6	0
-4.8	0	4.8	0
-5.0	0	5.0	0
-5.2	0	5.2	0
-5.4	0	5.4	0
-5.6	0	5.6	0
-5.8	0	5.8	0
-6.0	0	6.0	0

TABLE 7.4.2

MISSION 1111- AFT LOOKING, TOTAL FRAME COUNT- 3066

FRAME FREQUENCY DISTRIBUTION BETWEEN -6% AND +6% ORBIT MATCH

DISTRIBUTION OVER 61 POINTS INCREMENTED AT .2 PERCENT

PERCENT	FRAMES	PERCENT	FRAMES
		0.0	169
-0.2	322	0.2	203
-0.4	234	0.4	177
-0.6	310	0.6	154
-0.8	218	0.8	121
-1.0	120	1.0	40
-1.2	144	1.2	40
-1.4	92	1.4	0
-1.6	38	1.6	81
-1.8	21	1.8	14
-2.0	6	2.0	42
-2.2	20	2.2	42
-2.4	49	2.4	42
-2.6	36	2.6	13
-2.8	27	2.8	28
-3.0	62	3.0	15
-3.2	7	3.2	14
-3.4	19	3.4	14
-3.6	50	3.6	30
-3.8	0	3.8	29
-4.0	0	4.0	0
-4.2	9	4.2	0
-4.4	9	4.4	0
-4.6	0	4.6	0
-4.8	0	4.8	0
-5.0	0	5.0	0
-5.2	0	5.2	0
-5.4	0	5.4	0
-5.6	0	5.6	0
-5.8	0	5.8	0
-6.0	0	6.0	0

TABLE 7.4.3

MISSION 1111-2 FWD LOOKING, TOTAL FRAME COUNT- 3075

FRAME FREQUENCY DISTRIBUTION BETWEEN -6% AND +6% ORBIT MATCH

DISTRIBUTION OVER 61 POINTS INCREMENTED AT .2 PERCENT

PERCENT	FRAMES	PERCENT	FRAMES
		0.0	223
-0.2	292	0.2	175
-0.4	230	0.4	211
-0.6	252	0.6	113
-0.8	333	0.8	97
-1.0	143	1.0	40
-1.2	164	1.2	40
-1.4	76	1.4	24
-1.6	36	1.6	60
-1.8	26	1.8	37
-2.0	6	2.0	43
-2.2	20	2.2	43
-2.4	15	2.4	55
-2.6	17	2.6	26
-2.8	15	2.8	47
-3.0	15	3.0	35
-3.2	7	3.2	14
-3.4	7	3.4	13
-3.6	7	3.6	29
-3.8	0	3.8	28
-4.0	0	4.0	13
-4.2	0	4.2	0
-4.4	18	4.4	15
-4.6	0	4.6	15
-4.8	0	4.8	0
-5.0	0	5.0	0
-5.2	0	5.2	0
-5.4	0	5.4	0
-5.6	0	5.6	0
-5.8	0	5.8	0
-6.0	0	6.0	0

TABLE 7.4.4

RE-ENTRY SEQUENCE OF EVENTS

Event	Nominal Time	Sys. Time #1	Delta Time #1	Sys. Time #2	Delta Time #2
Arm	77.00 ± 1.0	5210.43	76.77		
Transfer	2.00 ± .25	5285.15	2.05		
Electrical Disconnect	.90 $^{+.43}_{-.40}$	5286.18	1.03		
Separation	- - - - -	5287.20	- -		
Spin	3.40 ± .30	5289.57	3.39		
Retro	7.55 ± .45	5297.15	7.58		
Despin	10.75 ± .54	5307.90	10.75		
T/C Separation	1.50 ± .15	5309.40	1.50		
V/M Close	180.0 ± .42	- - -	- -		
V/M Open	290.0 ± 67	- - -	- -		
"G" Switch Open	Predicted #1 557.7 #2 493.1	5844.37	547.22	75660.44	
Parachute Cover Off	26.0 ± 1.5	5869.38	25.01	75686.63	26.19
Deceleration Chute Deployed	.58 ± .10	5869.93	.55	75687.16	.53
Main Chute Bag Separate	10.25 ± 1.5	5881.04	10.11	75698.35	11.19
Main Chute Deployed	.52 ± .13	5881.54	.50	75698.85	.50
Main Chute Disreef	4.50 ± .80	5886.14	4.60	75703.24	4.39
K-10 Reset	28.0 ± 1.9	5897.43	28.05	75713.64	27.01

TABLE 7.5

FIGURE 7.6.1

SECRET/C

FIGURE 7.6.2

~~SECRET/C~~

1111/CR-12 OPERATIONS

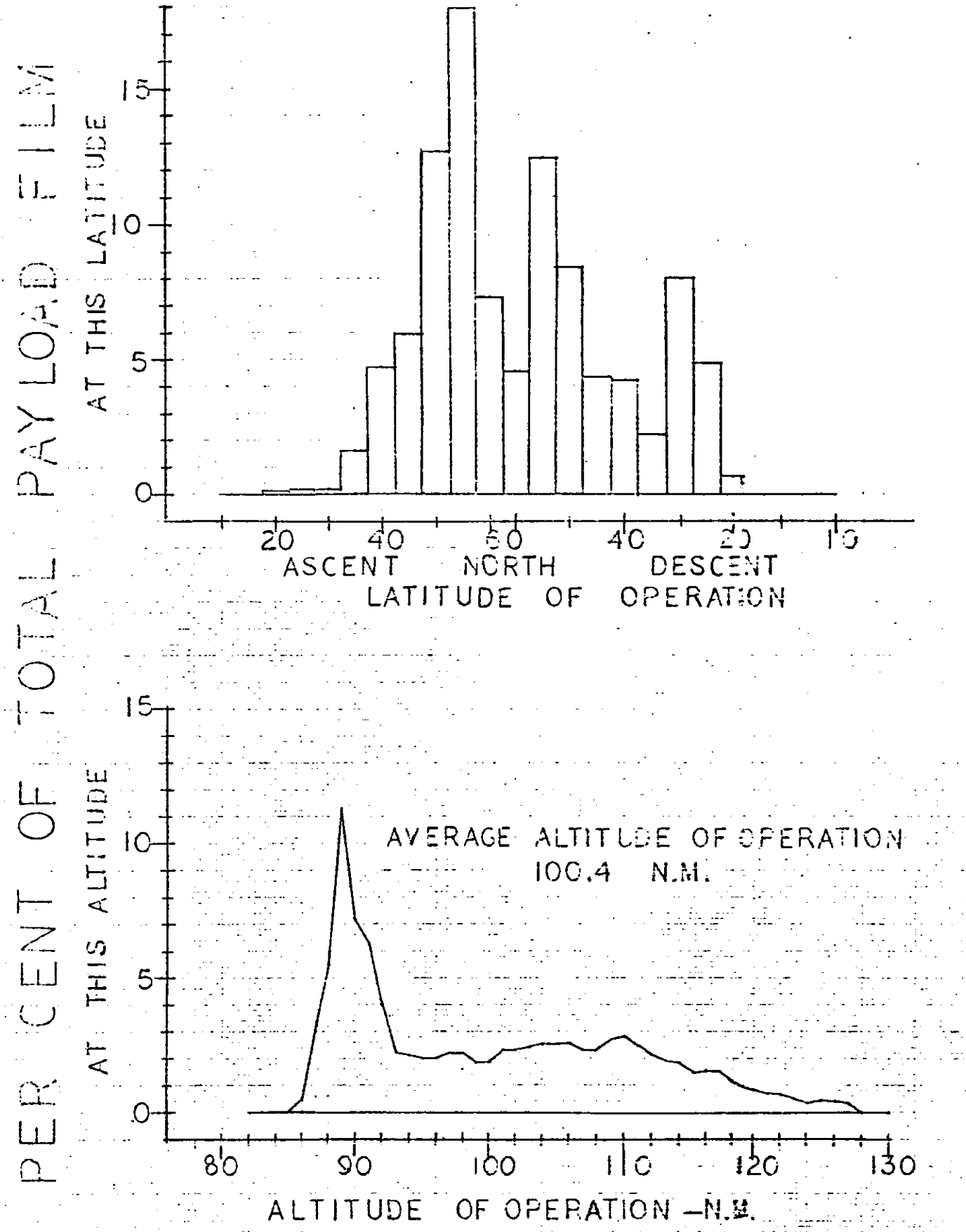


FIGURE 7.7

~~SECRET~~/C

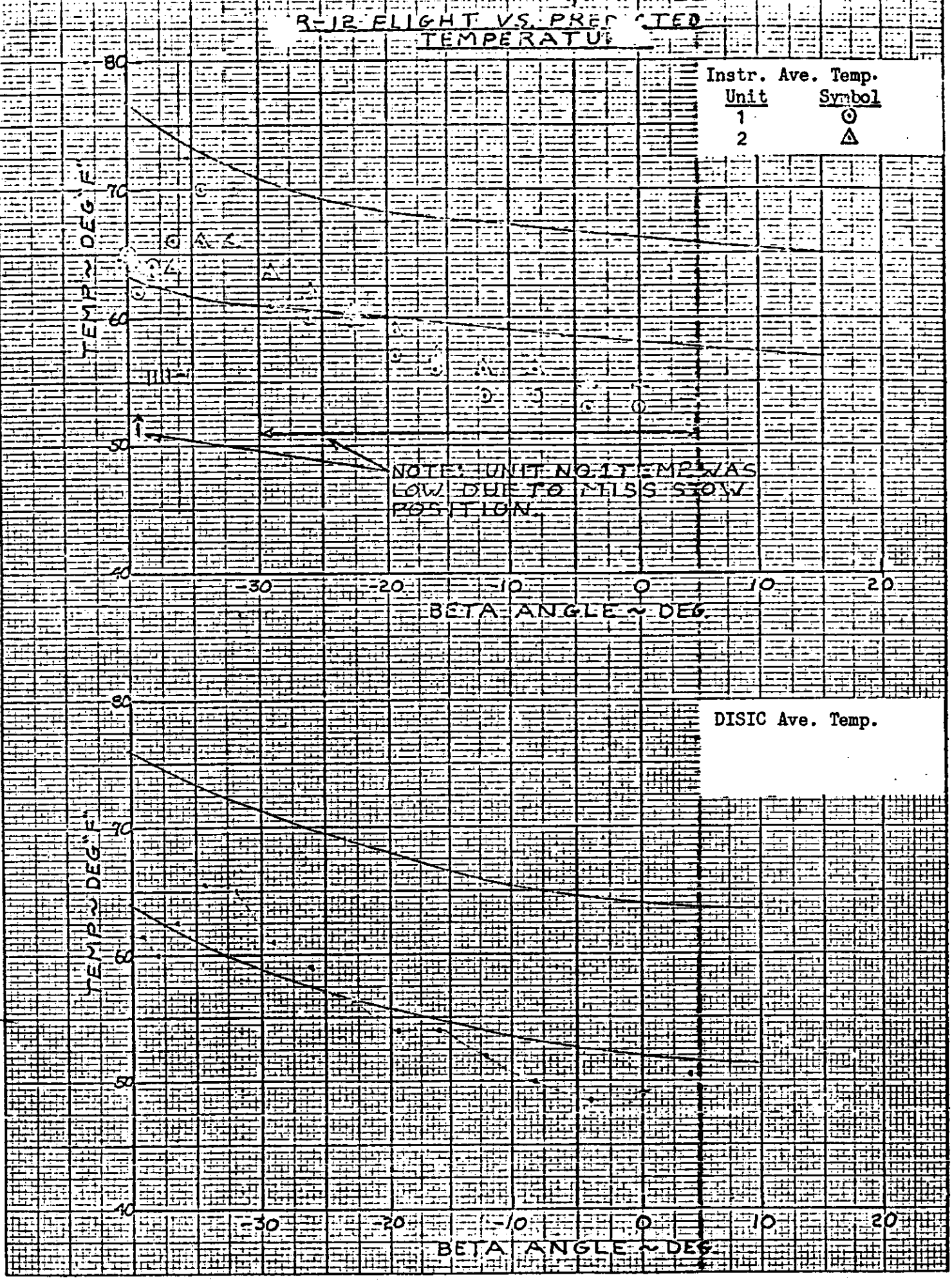


FIGURE 7.8.1 ~~TOP SECRET~~

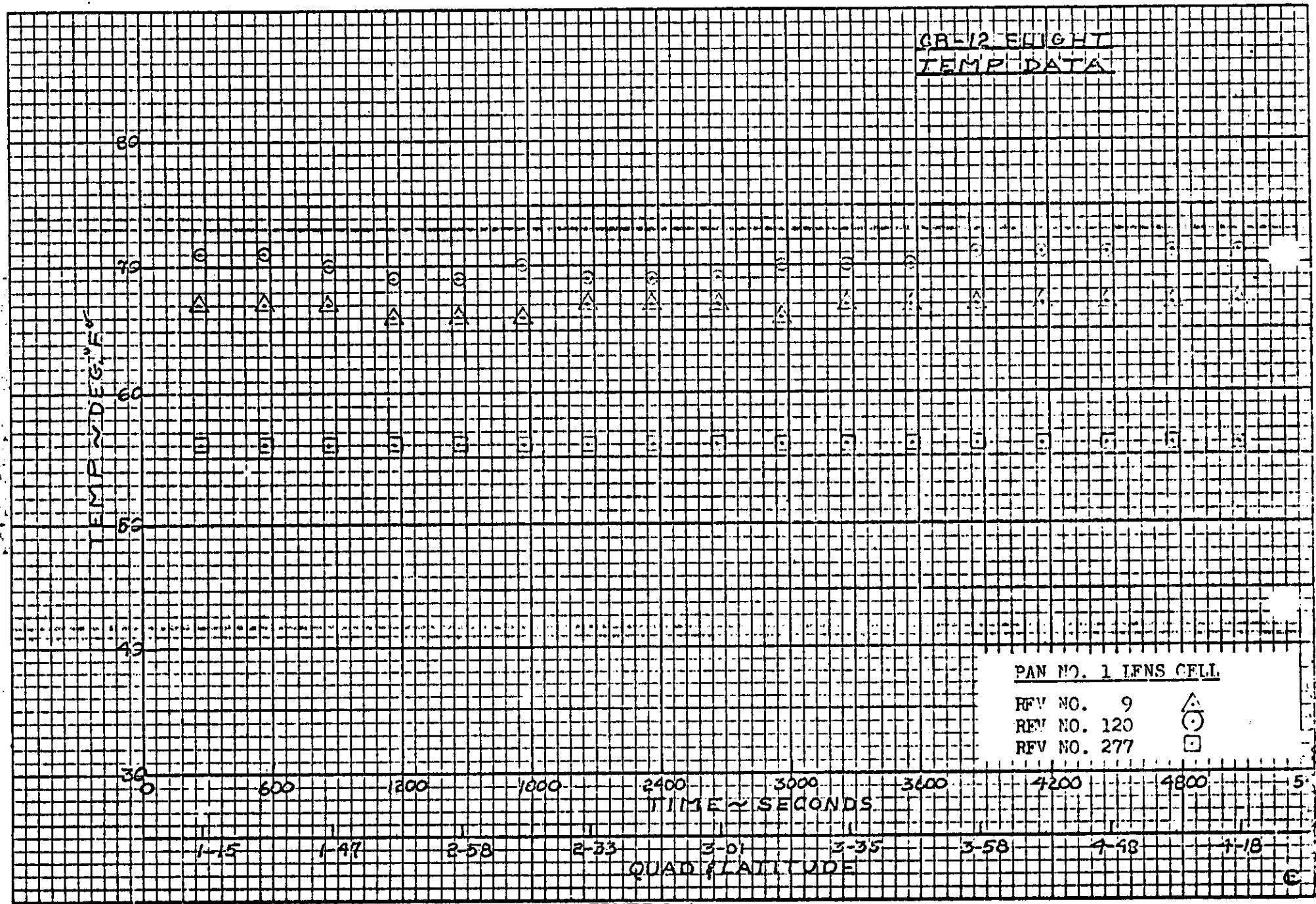


FIGURE 7.8.2

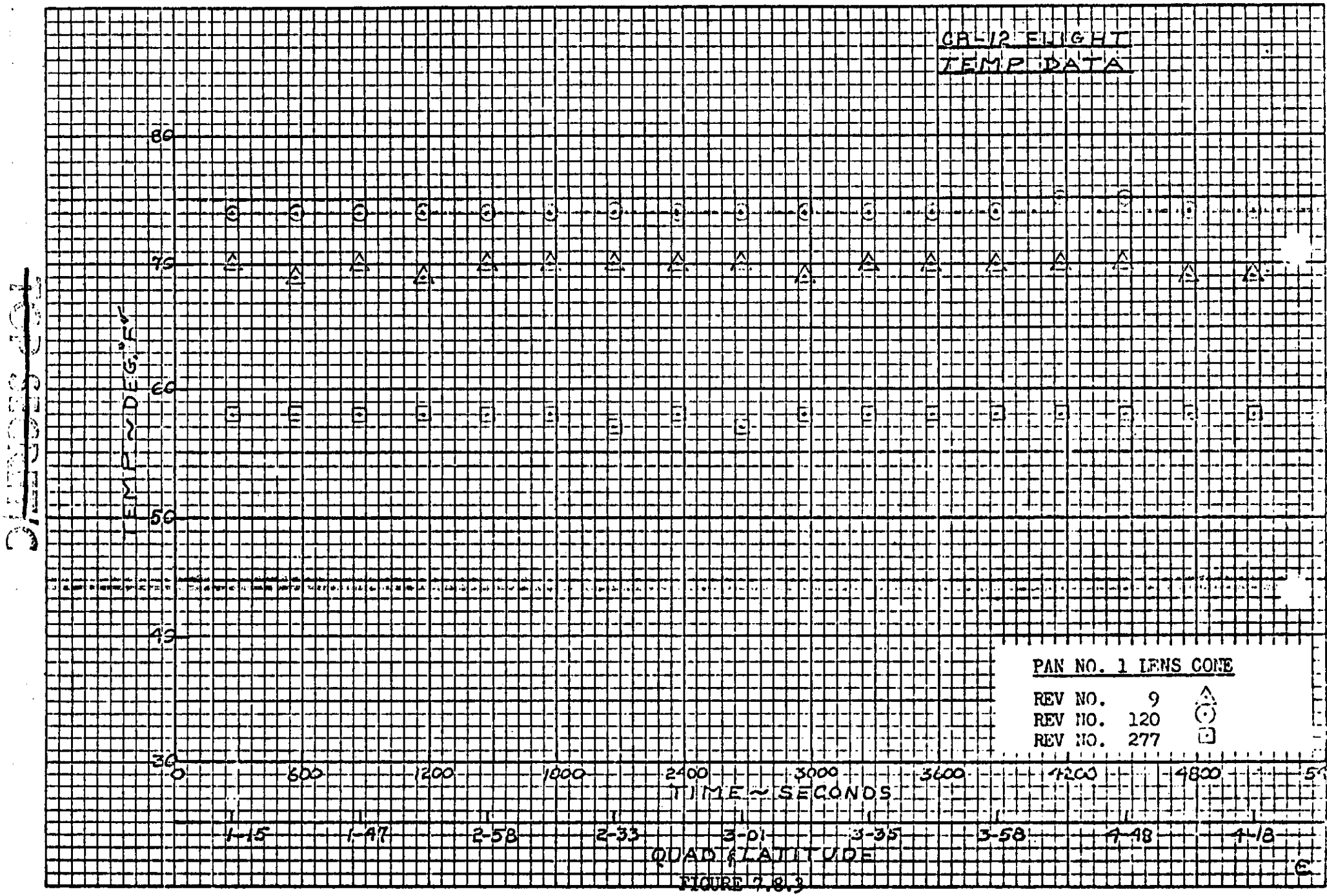


FIGURE 7.8.3

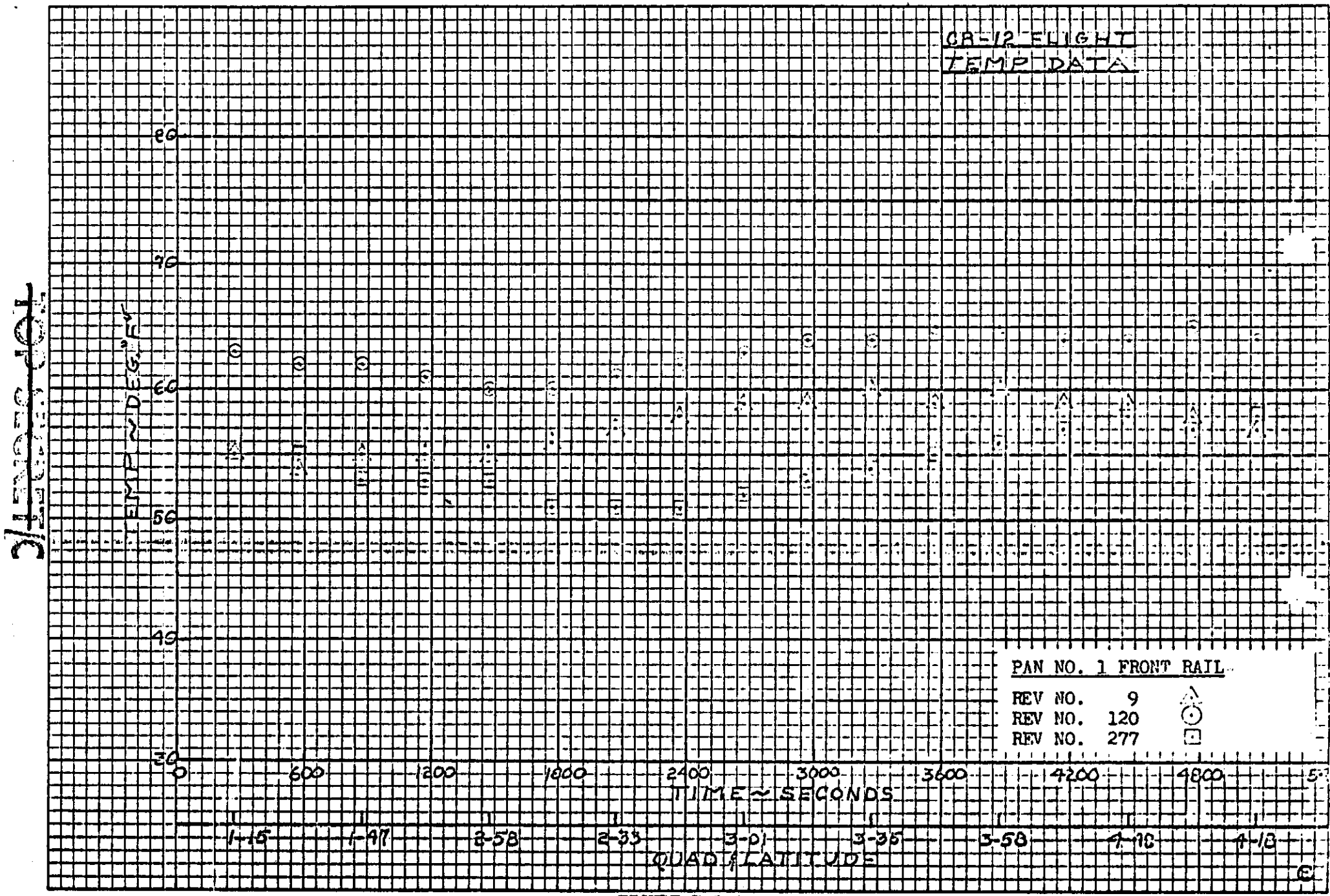


FIGURE 7.8.4

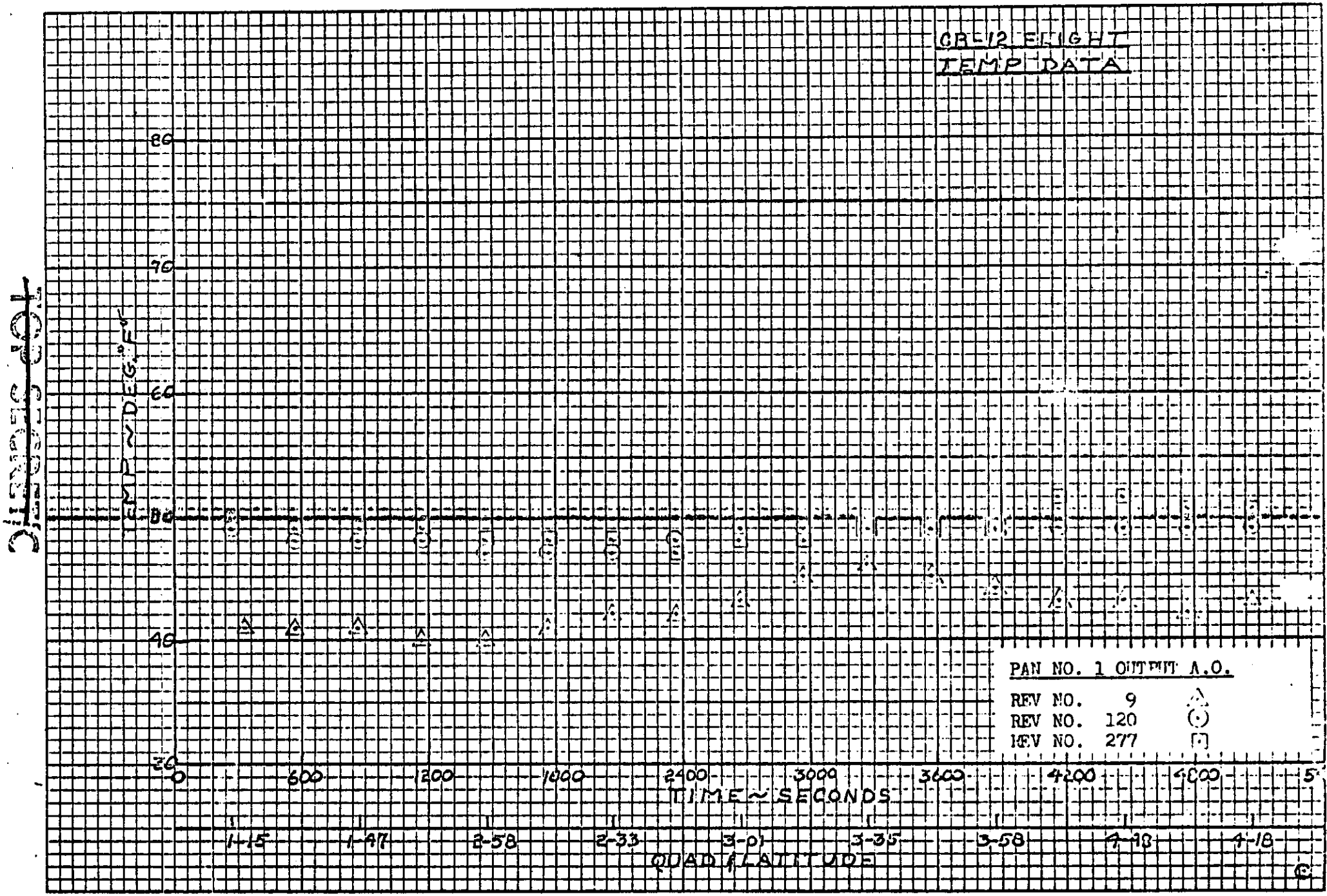


FIGURE 7.8.5

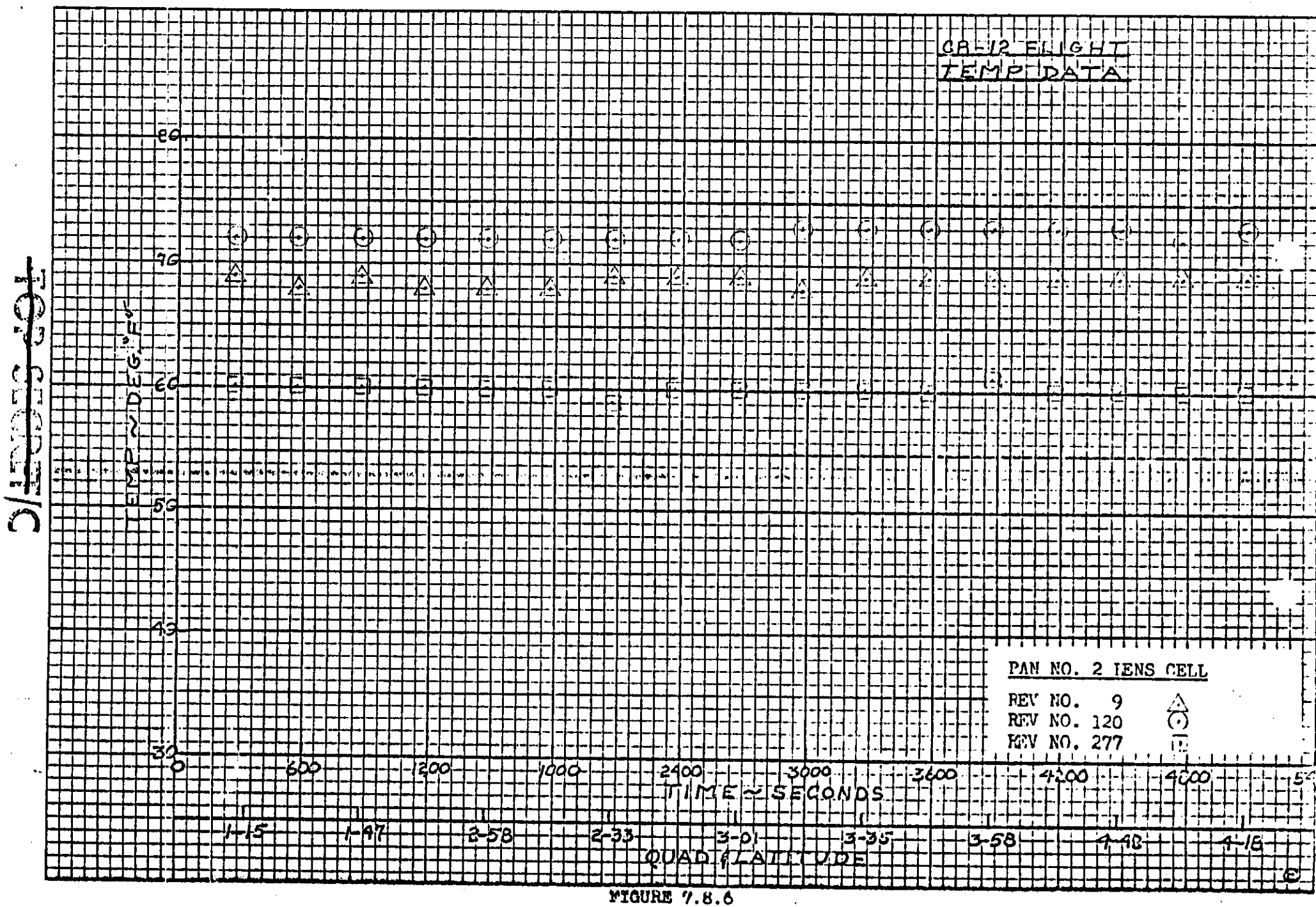


FIGURE 7.8.6

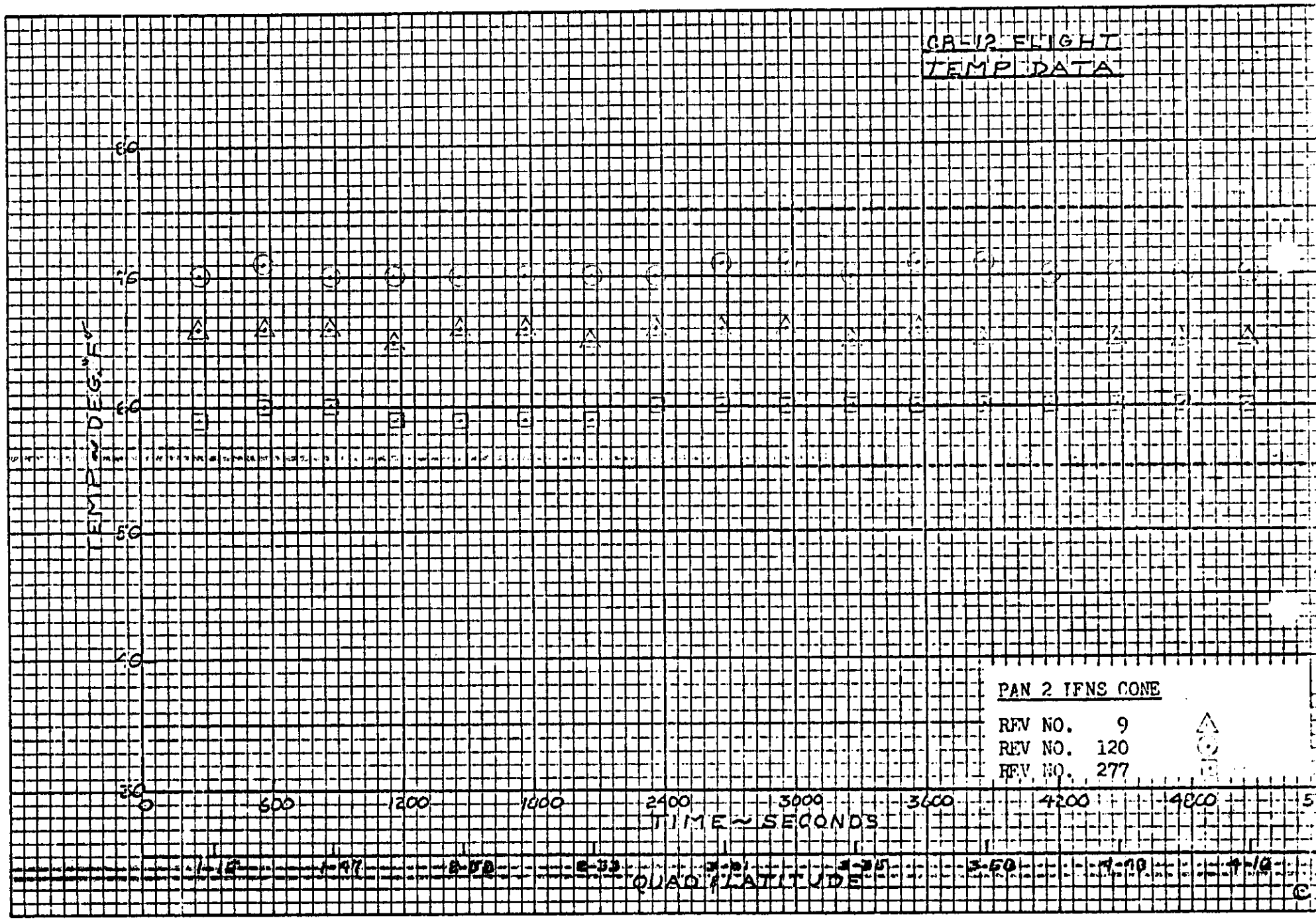


FIGURE 7.8.7

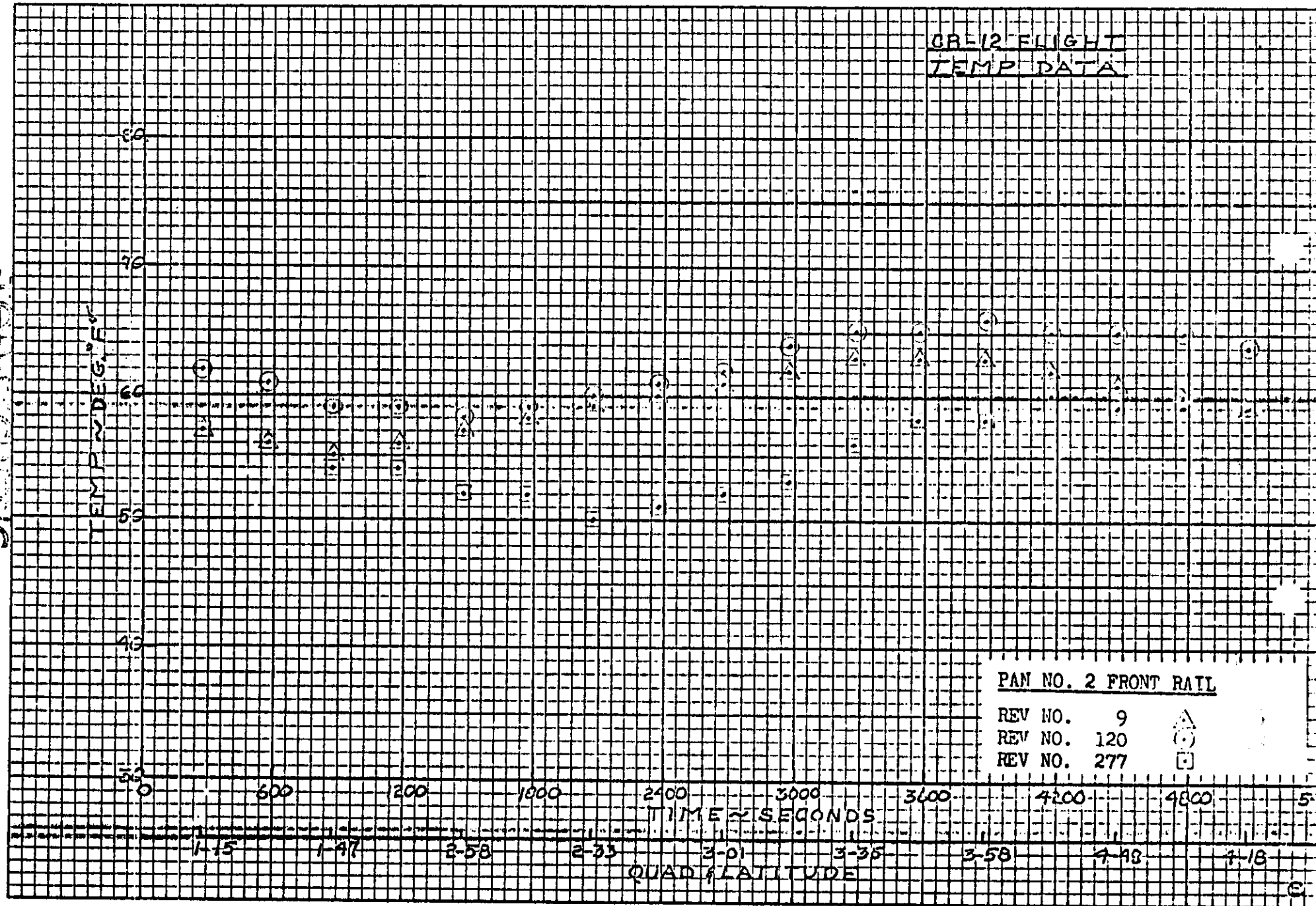


FIGURE 7.8.8

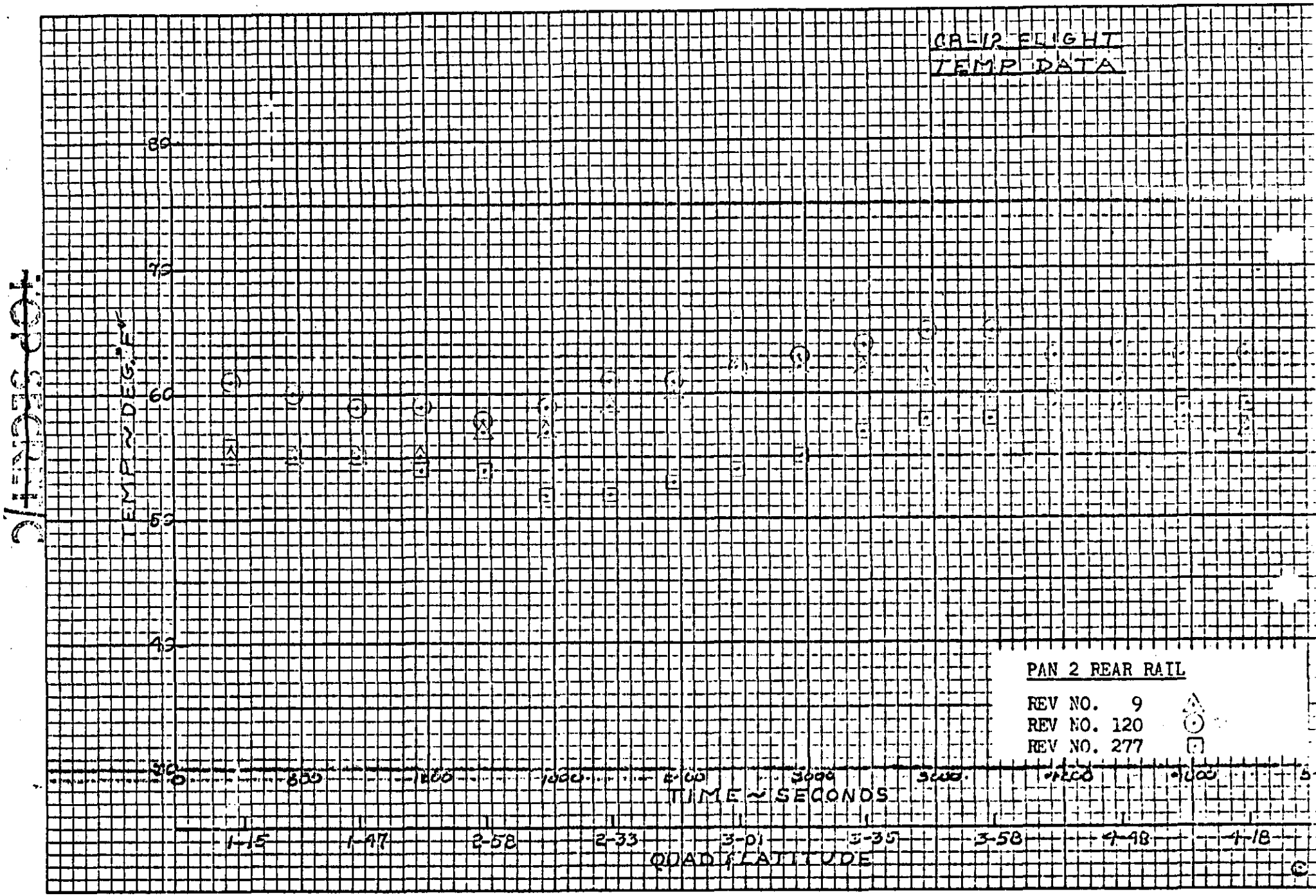


FIGURE 7.8.9

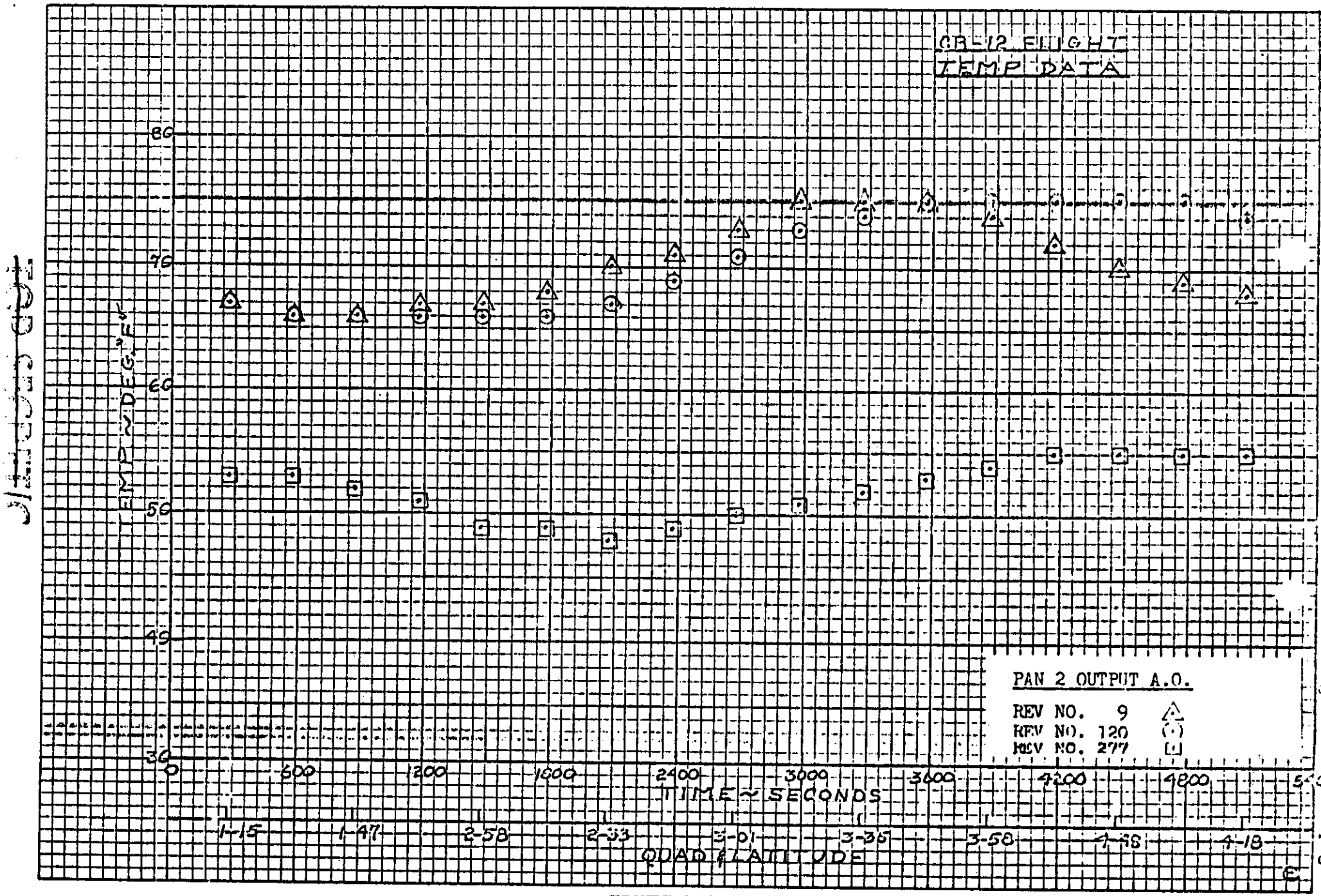


FIGURE 7.8.10

TEMPERATURE SUMMARY (°F) (CR-6 & Up) Payload CR-12

Rev. No. (Ascent)		LK II	NEAR
Beta Angle		~~on~~ APP236	~~FADE~~ APP434
Pan No. 1 Lens Cell	2	61	60
Lens Cone	4	60	59
Rear Rail	6	-	-
Drive Mtr	10	-	-
Front Rail	12	-	-
Average		60.5	59.5
Pan 1 Output AO	8	52	54
Delta Top Left	14	-	-
Drum Support	16	-	-
Pan No. 2 Lens Cell	18	61	61
Lens Cone	20	60	60
Rear Rail	22	60	62
Drive Mtr	26	-	-
Front Rail	28	-	-
Average		60	61
Pan 2 Output AO	24	62	63
Supply Cassette	30	-	-
Aux. Electronic Box	32	-	-
Slope Programmer	34	-	-
~~PIU~~	~~36~~	-	-
Switch Programmer	43	-	-
Aft Power Box	49	-	-
SRV "A" T/U	40	66	66
Retro	42	58	62
SRV "B" T/U	44	-	-
Retro	46	-	-

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TABLE 7.9.1

TEMPERATURE SUMMARY (°F) CR-6 & Up

Payload CR-12

Rev. No. (Ascent)		APP	APP
Beta Angle		236Sec	434Sec
Blast Shield	48	-	-
	50	-	-
DISIC Platen	53	61	61
Lens Cell	55	65	67
Fairing	5	221	221
	7	311	280
	9	310	260
	11	360	235
	13	310	260
	15	224	209
DISICONIC	17	166	158
	19	252	219
	21	332	228
	23	338	227
	25	272	204
	31	179	155
Forward Barrel	33	170	164
	35	262	167
	37	263	167
	39	160	159
Aft Barrel	41	154	138
	45	216	153
	47	218	159
	51	137	137
DSR	38	59	55

TABLE 7.9.2

TEMPERATURE SUMMARY (°F) (CR-6 & Up) Payload CR-12

Rev. No. [redacted]		10	15	26	31	41	47	57	63	73	79	89	94	104	110	120	126
Beta Angle		-39.0	-39.4	-39.9	-40.1	-40.3	-40.3	-40.2	-40.0	-39.6	-39.2	-38.5	-38.1	-37.0	-36.4	-35.1	-34.2
Pan No. 1 Lens Cell	2	66	65	66	65	66	67	67	67	65	63	65	66	67	66	71	71
Lens Cone	4	70	69	70	69	70	71	71	71	68	66	67	69	71	70	75	75
Rear Rail	6	65	68	65	68	68	68	67	69	69	69	67	68	71	75		
Drive Mtr	10	60	60	60	60	63	62	63	63	62	59	59	61	63	63	69	66
Front Rail	12	53	56	54	55	56	56	56	58	56	55	55	55	58	56	67	63
Average		64	64	63	64	65	65	65	65	64	62	62.5	64	66	66	70	70
Pan 1 Output AO	8	39	41	40	41	42	42	42	44	43	41	41	41	44	43		48
Delta Top Left	14	45	68	46	64	48	64	48	66	49	61	47	58	49	60	51	64
Drum Support	16	59	60	59	59	61	60	61	60	61	59	59	60	61	60	69	64
Pan No. 2 Lens Cell	18	68	68	69	69	70	71	71	71	72	71	71	70	71	70	72	72
Lens Cone	20	65	65	66	66	66	68	68	68	69	67	67	67	67	67	69	70
Rear Rail	22	54	58	55	58	57	59	57	61	58	58	57	58	59	59	61	62
Drive Mtr	26	61	61	62	62	65	64	65	65	65	63	63	63	65	65	66	67
Front Rail	23	55	59	56	59	59	59	59	60	59	59	58	59	59	59	61	61
Average		62	62	62	63	64	64	64	65	64.6	64	63	63.4	64	64	66	66
Pan 2 Output AO	24	67	72	68	72	71	73	71	73	71	71	68	69	69	70	71	71
Supply Cassette	30	50	53	54	56	58	58	58	60	61	60	59	59	61	60	62	62
Aux. Electronic Box	32	66	74	67	75	68	73	68	75	69	71	67	69	69	71	72	75
Slope Programmer	34	86	90	89	92	94	94	93	94	93	93	91	93	93	94	93	93
PMU	36	54	56	54	54	56	56	56	56	56	56	54	54	56	55	65	65
Switch Programmer	43	72	81	75	78	78	78	78	81	78	78	75	78	78	78	78	78
Aft Power Box	49	43	49	43	49	49	49	49	52	52	52	49	52	52	52	52	55
SRV "A" T/U	40	48	45	45	43	43	44	43	47	46	46	46	47	44	43	-	32
Retro	42	52	53	49	51	52	52	52	53	52	52	51	52	52	52	-	33
SRV "B" T/U	44	61	61	60	61	63	62	63	62	63	63	62	63	65	67	68	73
Retro	46	59	59	59	59	63	61	63	63	63	61	60	61	63	63	68	69

TABLE 7.9.3

TEMPERATURE SUMMARY (°F) CR-6 & Up

Payload: CR-12

Rev. No. [redacted]		10	15	26	31	41	47	57	63	73	79	89	94	104	110	120	126
Beta Angle		-39.0	-39.4	-39.9	-40.1	-40.3	-40.3	-40.2	-40.0	-39.6	-39.1	-38.5	-38.1	-37.0	-36.4	-35.1	-34.2
Blast Shield	48	35	45	35	42	42	42	38	45	38	42	35	42	42	45	105	77
	50	44	54	44	50	50	50	47	54	50	50	44	50	50	54	25	70
DISIC Platen	53	57	58	56	58	59	60	60	61	61	61	59	60	60	63	65	65
Lens Cell	55	57	59	56	59	58	61	59	62	61	62	58	60	58	62	63	66
Fairing	5	90	145	90	150	84	156	54	150	50	159	33	159	33	168	16	185
	7	72	112	72	109	75	112	65	115	65	109	55	103	55	106		
	9	73	76	79	79	79	79	84	81	87	84	84	87	81	87		
	11	67	76	76	79	74	79	76	82	79	85	79	85	76	85	33	96
	13	12	38	12	35	18	35	18	41	18	35	15	32	22	38	15	58
	15	8	63	5	66	5	70	-11	70	-11	73	-18	79	-11	85	-15	97
DISICONIC	17	48	103	45	111	38	119	8	114	5	125	- 8	128	- 5	136	-18	139
	19	91	118	94	118	97	118	91	121	88	115	82	112	82	112	103	156
	21	71	75	78	78	78	78	80	80	83	80	83	83	80	83	83	83
	23	31	58	34	58	28	61	21	65	24	65	17	68	17	71	17	68
	25	23	36	23	36	26	36	26	40	26	36	26	36	30	40	33	50
	31	16	56	12	56	12	59	0	59	0	65	- 3	68	0	74	3	80
Forward Barrel	33	69	158	69	155	66	152	45	155	42	146	32	140	35	143	28	146
	35	61	73	70	73	65	73	65	76	68	76	65	79	65	76	70	73
	37	27	53	27	50	23	50	17	53	20	57	13	60	13	60	13	53
	39	-5	78	-11	81	-14	84	-34	84	-34	90	-37	93	-34	99	-34	104
Aft Barrel	41	74	155	74	152	74	149	54	149	51	143	45	132	45	135	35	138
	45	67	77	77	77	73	77	77	80	80	83	77	85	77	83	77	73
	47	36	61	39	61	33	61	30	64	33	67	26	67	26	70	23	61
	51	-23	43	-26	43	-26	43	-29	46	-26	46	-29	43	-26	52	-23	59
DSR	38	60	71	64	72	66	72	67	74	69	73	68	73	69	73	69	74

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TABLE 7.9.4

TEMPERATURE SUMMARY (°F) (CR-6 & Up) Payload CR-12

Rev. No. [redacted]		136	142	152	158	167	173	183	189	199	205	215	220	231	236	247	252
Beta Angle		-32.7	-31.8	-30.1	-29.0	-27.3	-26.1	-24.1	-22.8	-20.6	-19.3	-17.0	-15.9	-13.3	-12.1	-9.4	-8.1
Pan No. 1 Lens Cell	2	72	71	67	65	65	63	63	62	62	60	59	59	58	57	58	56
Lens Cone	4	76	74	71	68	67	66	66	65	65	63	63	62	61	60	60	59
Rear Rail	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Drive Mtr	10	64	73	55	55	54	53	61	58	58	56	56	55	55	53	54	53
Front Rail	12	64	64	62	58	60	57	59	55	58	53	57	51	56	50	55	50
Average		68	70	63	61	61	60	62	60	60	57	58	56	57	54	56	54
Pan 1 Output AO	8											47	43	47	42	48	44
Delta Top Left	14	51	59	53	57	51	52	52	51	51	50	50	45	50	45	50	44
Drum Support	16	65	63	64	60	61	60	60	58	60	57	58	56	57	54	57	54
Pan No. 2 Lens Cell	18	73	72	72	70	68	67	67	66	66	65	64	63	63	62	62	61
Lens Cone	20	70	70	69	67	66	66	65	65	64	63	63	62	62	61	61	60
Rear Rail	22	61	60	62	58	61	57	60	56	59	55	57	53	57	52	56	52
Drive Mtr	26	67	66	66	64	64	63	62	60	60	58	58	57	57	56	57	56
Front Rail	28	61	59	62	58	60	57	60	55	59	54	58	52	58	51	57	51
Average		66	65.4	66	63.4	64	62	63	60	61.6	59	60	57	59.5	56	58	56
Pan 2 Output AO	24	70	68	69	66	67	64	67	60	63	58	60	56	59	53	56	52
Supply Cassette	30	62	61	62	59	61	58	60	56	58	55	57	53	56	52	56	52
Aux. Electronic Box	32	71	71	71	68	68	66	67	63	65	60	62	57	61	54	58	53
Slope Programmer	34	92	91	90	90	88	88	86	84	83	81	80	78	78	76	76	74
PMU	36	63	63	63	59	61	59	61	56	59	54	56	50	54	47	52	47
Switch Programmer	43	75	78	75	75	75	72	72	69	69	66	66	60	63	57	60	57
Aft Power Box	49	52	52	52	49	52	52	52	49	52	52	52	46	52	46	52	49
SRV "A" T/U	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retro	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SRV "B" T/U	44	71	72	73	72	71	71	70	69	68	67	66	66	65	63	62	62
Retro	46	70	70	69	67	67	66	65	63	63	61	61	59	59	57	58	57

TABLE 7.9.5

TEMPERATURE SUMMARY (°F) CR-6 & Up

Payload CR-12

Rev. No. [redacted]		136	142	152	158	167	173	183	189	199	205	215	220	231	236	247	252
Beta Angle		-32.7	-31.8	-30.1	-29.0	-27.3	-26.1	-24.1	-22.8	-20.6	-19.3	-17.0	-15.9	-13.3	-12.1	-9.4	-8.1
Blast Shield	48	112	84	35	80	38	87	8	84	8	87	8	87	8	84	8	87
	50	44	75	12	73	18	85	9	85	9	88	9	100	5	97	5	112
DISIC Platen	53	65	65	64	61	60	59	60	57	57	54	54	54	52	52	52	50
Lens Cell	55	63	65	62	61	58	59	58	56	56	54	52	54	51	52	50	50
Fairing	5	16	179	-12	179	-12	165	-22	162	-22	153	-25	133	-25	139	-25	122
	7											7	97	7	88	7	75
	9											6	73	3	73	6	67
	11	44	74	30	85	37	93	- 3	93	- 3	93	-3	90	-3	90	- 3	85
	13	18	55	18	51	18	45	18	45	18	45	18	35	22	38	22	45
	15	-15	97	-15	100	-15	91	-15	97	-15	97	-15	82	-11	97	-11	94
DISICONIC	17	15	142	-21	145	-21	136	-25	136	-25	136	-25	117	-25	128	-25	117
	19	100	150	76	141	76	132	62	115	55	106	49	91	49	79	46	70
	21	80	89	54	80	51	83	17	75	20	71	17	65	14	61	17	54
	23	21	71	21	65	17	65	11	61	14	58	14	55	11	55	14	51
	25	33	50	33	43	33	43	33	40	33	43	33	36	33	40	36	43
	31	3	83	6	86	6	80	6	86	6	86	6	77	6	86	9	86
Forward Barrel	33	25	132	22	126	18	102	15	93	11	87	8	62	8	59	5	45
	35	68	76	55	70	52	70	27	61	27	58	24	55	24	52	24	46
	37	13	57	13	50	10	50	10	47	13	47	13	43	13	43	13	37
	39	-34	102	-30	107	-30	93	-30	99	-30	99	-30	78	-30	93	-27	87
Aft Barrel	41	35	118	29	115	29	95	26	89	22	83	22	61	19	58	16	48
	45	73	80	57	73	54	77	24	67	24	63	24	60	21	57	21	50
	47	23	67	20	58	17	61	17	55	20	55	17	52	17	52	20	48
	51	-23	52	-20	56	-20	43	-20	49	-16	52	-16	36	-13	49	-13	49
DSR	38	70	73	69	72	68	72	67	71	67	71	66	70	66	69	70	70

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TABLE 7.9.6

TEMPERATURE SUMMARY (°F) (CR-6 & Up) Payload CR-12

Rev. No. [redacted]		263	268	278	284	294	299
Beta Angle		-5.4	-4.1	-1.5	+.1	+2.7	+4.0
Pan No. 1 Lens Cell	2	56	55	56	55	56	55
Lens Cone	4	59	57	58	57	58	57
Rear Rail	6	-	-	-	-	-	-
Drive Mtr	10	53	52	53	52	52	51
Front Rail	12	55	50	55	50	55	49
Average		56	53	55	53	56	52
Pan 1 Output AO	8	48	45	49	46	51	48
Delta Top Left	14	49	45	50	44	50	42
Drum Support	16	56	53	56	53	55	53
Pan No. 2 Lens Cell	18	61	59	60	59	59	58
Lens Cone	20	60	59	59	59	59	59
Rear Rail	22	55	51	55	51	55	50
Drive Mtr	26	55	54	55	54	54	54
Front Rail	28	56	50	56	50	56	50
Average		57	55	57	55	57	54
Pan 2 Output AO	24	54	49	52	48	51	45
Supply Cassette	30	54	52	54	52	54	52
Aux. Electronic Box	32	56	51	55	50	53	49
Slope Programmer	34	75	74	73	73	71	70
PMU	36	50	47	50	45	47	43
Switch Programmer	43	60	57	57	54	54	51
Aft Power Box	49	52	49	55	52	55	52
SRV "A" T/J	40	-	-	-	-	-	-
Retro	42	-	-	-	-	-	-
SRV "B" T/J	44	61	61	60	60	60	61
Retro	46	57	56	57	56	57	56

TABLE 7.9.7

TEMPERATURE SUMMARY (°F) CR-6 & Up

Payload CR-12

Rev. No. [redacted]		263	268	278	284	294	299
Beta Angle		-5.4	-4.1	-1.5	+.1	+2.7	+4.0
Blast Shield	48	8	90	8	90	8	93
	50	5	106	5	112	5	130
DISIC Platen	53	51	49	51	49	50	51
Lens Cell	55	49	48	49	49	48	50
Fairing	5	-29	133	-25	119	-29	96
	7	7	72	7	61	4	38
	9	6	70	3	73	3	57
	11	- 3	90	- 3	96	- 3	82
	13	25	58	28	68	25	68
	15	-11	111	- 5	111	- 8	97
DISICONIC	17	-25	134	-21	128	-25	108
	19	43	64	43	59	36	46
	21	14	58	14	61	10	48
	23	14	58	14	65	14	55
	25	40	50	43	57	43	60
	31	9	100	12	100	12	91
Forward Barrel	33	1	45	1	39	- 2	15
	35	21	46	18	52	18	39
	37	13	43	17	50	13	40
	39	-27	104	-24	104	-24	84
Aft Barrel	41	13	48	16	38	10	22
	45	21	50	18	57	15	44
	47	20	52	20	58	20	48
	51	-13	62	- 6	66	- 6	52
DSR	38	70	71	65	72	67	72

TABLE 7.9.8