BIF-107W-71014-73
Copy No. 7
Total Pages 307

7 0687

HEXAGON PROGRAM

PRELIMINARY POST FLIGHT REPORT

FOR FLIGHT NO. 5

30 MAY 1973

This document is prepared to support the Program HEXAGON analysis and reporting requirement established by the System Program Director.

This report represents the coordinated inputs from Program HEXAGON Technical Advisor Staff at Sunnyvale, California. The Technical Advisor Staff is composed of the Aerospace Program HEXAGON Sunnyvale Field Office and the Satellite Contractors who provided technical support during the mission. The data contained in this report were collected and analyzed during mission operations and were assembled in sections keyed to injection, each RV recovery and Solo as major mission segments.

SECURITY

This HEXAGON Program Preliminary Post Flight Report for Flight No. 5 has been prepared covertly in accordance with the requirements set forth in the BYEMAN Industrial Facility Security Manual, which establishes procedures and assigns responsibilities for the preparation of security plans for all program operations. Personnel should refer all security problems not covered therein to one of the following:

> The SAFSP Deputy Director has overall responsibility for Program security.
>
> The 6595th ATW is responsible for all security procedures applicable to prelaunch and launch operations at VAFB.
>
> Det No. 1, Hq, AFSCF is responsible for all security procedures applicable to the SCF and retrieval operations.

It is emphasized that security requirements take precedence over all other Program requirements.

FOREWORD

This document presents preliminary evaluation results of vehicle and ground system performances during the fifth Program HEXAGON flight. The evaluation is based upon data gathered during operations at the Satellite Test Center (STC), Sunnyvale, California.

The report was prepared in sections, keyed to major segments, during mission operations and were assembled at the end of the operation.

Preliminary evaluation began as data were gathered at the STC during operations. The Aerospace Corporation and the Associate Contractors maintained close coordination during this period and the contractors submitted formal inputs to The Aerospace Corporation ten calendar days after injection, after each RV recovery event and after completion of the SOLO phase and deboost. The Aerospace Corporation compiled the inputs for each section as they were received and published the report. Throughout the preparation of this report, editorial considerations were minimized in order to provide timely publication of technically useful information.

FLIGHT SUMMARY

SV-5 was launched on the first attempt on 9 March 1973. Liftoff occurred at 1300 PST near the close of the launch window. The delay resulted from multipathing between COOK tracking station and the SV, preventing range lock. The orbit was constrained to keep Beta between +2° and -8° for the 75 day mission. A two day orbit adjust cycle was planned with dual burns scheduled as necessary to control argument of perigee.

Ascent was nominal with the achieved orbit closely matching the desired.

Solar arrays were deployed at Rev 0.9 INDI to supply power for the added load of the Mapping Camera Module first installed on SV-5. The arrays were positioned at -18° to best match the -8.0 degree Beta angle.

An instrumentation failure in the panoramic camera subsystem gave the indication of a pneumatics leak and required generation of an emergency pneumatics isolation message. This delayed SS Health tests and start of mission operations. Diagnostic testing verified the pneumatics as operable and mission photography was started, using estimated consumption rates, on Rev 11.

Normal SV health testing continued until Rev 8 where the Mapping Camera thermal door did not open when commanded. The door again did not open on Rev 13, but performed normally on Rev 16 over COOK. The thermal door problem was isolated to cold temperatures and Mapping Camera operations were restricted to lower than 50°N Lat, i.e., the warm portion of the orbit.

The Doppler Beacon Antenna failed to deploy when commanded on Rev 12; however, acceptable signal was received by the TRANET stations from the non-deployed antenna and this did not affect operations.

Mutual interference between [redacted] and the Doppler Beacon was experienced. The problem was minimized by alternate commanding of the two subsystems to the extent possible with Doppler having the higher priority. (b)(1)
(b)(3)

Normal mission operations continued through the remainder of RV-1, with RV-1 reentered and aerially recovered on Rev 196. The quality of the photography was generally fair, with haze and weather degrading the quality. Operation at high rewind velocities was tried at the end of the segment; however, minor film path disturbances were noted and the decision was made to complete the mission using restricted scans and 5 ips rewind velocity.

Normal mission photography with the panoramic camera was resumed after RV-1 recovery and continued throughout this segment. A 12 micron advance in focal plane setting was accomplished on the aft camera based on analysis of RV-1 photography.

Mapping Camera operations continued normally during this segment with the latitude restriction for thermal door operation raised from an initial 50°N Lat to 57°N Lat by RV-2 recovery.

An ACS-1 pitch error was detected on Rev 230 and again on Revs 253, 269 and 272. Contingency planning had established a 1.0° limit as the criteria to VBE payload and this was used on Rev 272. Payload was reloaded on Rev 273 and by Rev 295 the pitch bias had disappeared.

The RTS experienced difficulty in obtaining range lock after Rev 270; however, using a 0.3 Radian modulation index sufficient tracking data were obtained.

RV-2 was reentered and aerially recovered on Rev 424.

The quality of the achieved photography ranged from fair to very good, with weather again degrading photography.

Mission photography with the panoramic camera resumed after RV-2 recovery and continued normally throughout this segment.

The Mapping Camera did not shut down as commanded on Rev 430; 5 extra frames were transported. All payload was VBE'd, with pan camera operations reloaded on the next rev. Mapping Camera MOPs verified proper operation and photography was resumed. Sequences were modified to provide an emergency stop.

Improper Mapping Camera operations were experienced on Revs 446, 479 and 494, where operations were halted. The failure was attributed to the end-of-tape switch. Mapping Camera operations were resumed on Rev 510 in the backup mode of operation and continued normally.

The leakage rate of RCS-2 had increased significantly and the transfer to ACS-2/RCS-1 was accomplished on Rev 512. On Rev 519 a yaw rate bias was detected on ACS-2 which resulted in yaw attitude errors as great as 1.7 degrees. This bias persisted in varying amounts and a panoramic camera V_y compensation was used to minimize the effect of the yaw error. The pitch error in ACS-1 (non-controlling) returned and remained for the remainder of this segment.

RV-3 was reentered and aerially recovered on Rev 651. Photographic quality from the pan camera was fair with haze and weather degrading quality. The SV yaw error caused a reduction in resolution, which was corrected by the V_y compensation near Nadir.

Mapping Camera mission operations were completed on Rev 657 when the calibration film was reached. Two calibration attempts were unsuccessful, the one on Rev 665 commanded the thermal door open by the normal actuator while on Rev 668 the emergency door open actuator was used. In neither case did the door open under the very cold environment of the calibration location and SV attitude. Film runout was completed on Rev 675, and RV-5 reentered and was aerially recovered on Rev 683. Mapping Camera quality was better than expected while the stellar film exhibited some degree of radiation damage (source not identified).

Mission photography resumed after RV-3 recovery and continued normally throughout the segment. The last 2000 feet of film in the forward camera was color. Film was completely expended on both cameras.

The orbit adjust system bed resistance factor reached the lower limit (acceptable for a 1200 second deboost burn) on Rev 760. OA engine performance remained nominal; however, the OA cycle was changed to 3 days to provide longer more infrequent burns.

The SV ACS-2 yaw bias had disappeared by Rev 785 and the SS V_y compensation was removed on Rev 801. The bias reappeared on Rev 824 and the V_y compensation was used for the remainder of the mission.

The ACS-1 pitch bias continued throughout the segment at varying levels.

RV-4 was reentered and aerially recovered on Rev 1024. The quality of the photography was rated good with less degradation due to haze and weather. The color photography quality was equivalent to the corresponding black and white.

SOLO experiments were started during the RV-4 segment on those tests that were non-interference with the primary mission. These tests involved redundant Mapping Camera subsystems and attempts to open the thermal door, as well as ACS tests and operation of selected SV redundant equipments. Planning in detail for the VAST (Vehicle Atmospheric Survivability Test), training with the VAST sites and calibrations for Turkey Radar site were also accomplished.

After RV-4 recovery on Rev 1024, SOLO testing of redundant systems continued. SGLS2 was commanded ON at Rev 1027; however, the received signal strength ranged from noise to -105 dbm, i.e., approximately 30 db lower than SGLS1. SOLO operations were run using SGLS1 with a series of tests evaluating SGLS2 performance which verified proper antenna and receiver performance.

ACS, redundant subsystems, Thermal and [redacted] tests were continued until successful conduct of the VAST experiment during SV deboost on Rev 1139 18 May 1973. (b)(1)
(b)(3)

SV deboost impact point was close to the predicted location at 44°N Lat and 170° East.

TABLE OF CONTENTS

SECTION 1 INTRODUCTION AND ASCENT
1.1 Readiness, Launch and Ascent
1.2 SV-5 Operational Configuration
1.2.1 SV-5 Changes
1.2.2 Documentation and Software
1.2.3 Satellite Control Facility Performance
1.2.4 Pad Load and Emergency Messages
1.2.5 Expendables
1.3 Launch and Ascent

SECTION 2 ORBIT PHASE REV 1 THROUGH RV-1 RECOVERY
2.1 Summary
2.1.1 Problem Summary
2.2 Command Subsystems Performance
2.2.1 Health
2.3 Sensor System Operations Through RV-1
2.3.1 Mission Operations Performance
2.3.2 Engineering Tests
2.4 RV-1 (S/N 24) Performance
2.4.1 Summary
2.5 Satellite Control Facility Performance
2.5.1 Orbit Determination and Prediction
2.5.2 Telemetry and Mode Processing
2.5.3 Command Message Planning
2.5.4 SCF Support
2.6 Program Command Software Performance
2.6.1 Command Message Summary
2.6.2 'TUNITY Software Problems
2.6.3 Hardware/Software Interface Changes
2.7 Satellite Vehicle Auxiliary Payload Performance
2.7.1 EDAP Performance
2.7.2 TT and C Performance
2.7.3 ACS/RCS Performance
2.7.4 Orbit Adjust System (OAS) Performance
2.7.5 Lifeboat II Performance
2.7.6 Doppler Beacon System
2.7.7 Thermal Performance
2.7.8 Tertiary Payload - [redacted]
2.8 Mapping Camera Operations Through Rev 196
2.8.1 Mission Performance
2.9 RV-5

SECTION 3 ORBIT PHASE REV 197 THROUGH RV-2 RECOVERY
3.1 Summary
3.1.1 Summary of Events
3.1.2 Problem Summary
3.2 Command Subsystems Performance
3.2.1 Health
3.3 Sensor System Operations Through RV-2
3.3.1 Mission Operations Performance
3.3.2 Engineering Tests
3.4 RV-2 (S/N 23) Performance
3.4.1 Summary
3.4.2 Anomaly

(b)(1)
(b)(3)

TABLE OF CONTENTS, Cont'd

SECTION 3.5 Satellite Control Facility Performance
3.5.1 Orbit Determination and Prediction
3.5.2 Telemetry and Mode Processing
3.5.3 Command Message Planning
3.5.4 SCF Support
3.6 Program Command Software Performance
3.6.1 Command Message Summary
3.6.2 'TUNITY Software Problems
3.6.3 Hardware/Software Interface Changes
3.7 Satellite Vehicle and Auxiliary Payload Performance
3.7.1 EDAP Performance
3.7.2 TT and C Performance
3.7.3 ACS/RCS Performance
3.7.4 Orbit Adjust System (OAS) Performance
3.7.5 Lifeboat II Performance
3.7.6 Doppler Beacon System
3.7.7 Thermal Performance
3.7.8 Tertiary Payload Performance
3.8 Mapping Camera Operations (Revs 197 - 424)
3.8.1 Mission Performance
3.9 RV-5 Performance

SECTION 4 ORBIT PHASE REV 425 THROUGH RV-3 AND RV-5 RECOVERIES
4.1 Summary
4.1.1 Summary of Events
4.1.2 Problem Summary
4.2 Command Subsystems Performance
4.2.1 Health
4.3 Sensor System Operations Through RV-3
4.3.1 Mission Operations Performance
4.3.2 Engineering Tests
4.4 RV-3 (S/N 22) Performance
4.4.1 Summary
4.4.2 Anomaly
4.5 Satellite Control Facility Performance
4.5.1 Orbit Determination and Prediction
4.5.2 Telemetry and Mode Processing
4.5.3 Command Message Planning
4.5.4 SCF Support
4.6 Program Command Software Performance
4.6.1 Command Message Summary
4.6.2 'TUNITY Software Problems
4.6.3 Hardware/Software Interface Changes
4.7 Satellite Vehicle and Auxiliary Payload Performance
4.7.1 EDAP Performance
4.7.2 TT and C Performance
4.7.3 ACS/RCS Performance
4.7.4 Orbit Adjust System (OAS) Performance
4.7.5 Lifeboat II Performance
4.7.6 Doppler Beacon System
4.7.7 Tertiary Payload
4.8 Mapping Camera Operations (Revs 425 - 683)
4.9 RV-5 Performance
4.9.1 Weights
4.9.2 PREPS
4.9.3 Recovery Conditions

TABLE OF CONTENTS, Cont'd

SECTION 4.9.4 Miss Distance
4.9.5 Aerial Recovery
4.9.6 Recovery Events

SECTION 5 ORBIT PHASE REV 651 THROUGH RV-4 RECOVERY
5.1 Summary
5.1.1 Summary of Events
5.1.2 Problem Summary
5.2 Command Subsystems Performance
5.2.1 Health
5.3 Sensor System Operations Through RV-4
5.3.1 Mission Operations Performance
5.3.2 Engineering Tests
5.4 RV-4 (S/N 21) Performance
5.4.1 Summary
5.5 Satellite Control Facility Performance
5.5.1 Orbit Determination and Prediction
5.5.2 SCF Support
5.6 Program Command Software Performance
5.6.1 Command Message Summary
5.6.2 'TUNITY Software Problems
5.6.3 Hardware/Software Interface Changes
5.7 Satellite Vehicle and Auxiliary Payload Performance
5.7.1 EDAP Performance
5.7.2 TT and C Performance
5.7.3 ACS/RCS Performance
5.7.4 Orbit Adjust System (OAS) Performance
5.7.5 Lifeboat II Performance
5.7.6 Doppler Beacon System
5.7.7 Tertiary Payloads

SECTION 6 SOLO AND DEBOOST THROUGH REV 1139
6.1 SOLO Summary
6.2 Command Subsystems Performance
6.3 Snesor Subsystem Operations During SOLO Phase
6.4 RV-4/SOLO Recovery Abort Test
6.5 Satellite Control Facility Performance
6.6 Program Command Software Performance
6.7 Satellite Vehicle SOLO Tests
6.8 NEC SOLO Summary

SECTION 1

1.0 READINESS, LAUNCH AND ASCENT

1.1 Readiness Activity

SV-5 was shipped to VAFB on the 21st of February for a scheduled launch on 6 March 1973. Replacement of the Extended Command System and SGLS Transponder No. 1, along with non-availability of the Pacific Test Range, required delaying the launch until 9 March.

1.2 SV-5 Operational Configuration

1.2.1 SV-5 Changes

1.2.1.1 Satellite Vehicle

DESCRIPTION	COMMENT
SGLS 2 Transponder replaced with a Cubic Block II Unit.	GDE back-up unit not available - One and one phase in.
PACS IRA replaced with a Ferrotic Block II Unit.	Improved Gyro restart capability. One and one phase in.
PACS HSA replaced with a Block II Mylar bolometer and improved electronics.	One and one phase in.
Battery Module relocated from Bay 1 to Bay 10.	To provide thermal compatability with 0 degree Beta orbit.
RCS tanks 1 and 2 capped; Primary FCEA connected to redundant RCS valves.	To provide contaminent free propellant to primary RCS thrusters and to use these instrumented primary thrusters last.
Added Amp-Hr Meter.	To improve power management.
No Subsatellite	
Solar Array bumper pads faced with teflon and tip pads removed.	To improve S/A deployment and erection.

1.2.1.2	Sensor Subsystem - Panoramic	
	No hardware changes.	
1.2.1.3	Main Reentry Vehicles (RV 1-4)	
	19 second timer removed.	Permit higher altitude parachute deployment - 58,000 feet.
	Installed Pyro batteries with improved venting.	To minimize chance of electrolyte leakage.
	Relay panel taped.	To minimize epoxy debris.
1.2.1.4	Mapping Camera Module	
	Stellar Terrain Camera installed.	Provide mapping photography.
	RV-5 (Mark V) reentry vehicle installed.	ST film recovery.
	Doppler Beacon System installed.	Provide TRANSIT network tracking data for independent orbit determination.

1.2.1.5 Operational

	DESCRIPTION	
a.	Beta angle controlled between plus 2° and -8° for the 75-day mission.	Optimize sun angle
b.	Orbit adjust every two days with a dual adjust for argument of perigee control every eighth day.	Control of orbit trace spacing.
c.	Orbit parameters (Nominal)	

(1)	Inclination	95.69 degrees
(2)	Period	88.789 minutes
(3)	Perigee Altitude	85.427 n miles
(4)	Argument of Perigee	140.036 degrees

d. Sensor System (Panoramic) Restrictions

(1) 120 degree scans restricted — minimize tracking problems

(2) 30 degree scans at ± 45 degree obliquity restricted

(3) Rewind fixed at 5 ips

1.2.1.6 'TUNITY

MOD 1B replaced by MOD 1BR. Major new functions to support the Mapping Camera mission were implemented.

1.2.2 Documentation and Software

1.2.2.1 Documentation

a. Test Operations Order (TOO) 72-12 with RCS No. 1, OCN No. 2.

b. Test Operating Instructions (TOI), dated 20 February 1973.

c. Flight Profile Addendum (FPA), revision 06 March 1973.

d. Field Test Force (FTF) Profile Flt NOMO 3, dated 6 March 1973.

e. Computer Usage Schedule (CUS) Flt 5-2, dated 7 March 1973.

f. Test Group Operations Plan 2-73.

g. Test Group Operations Order No. 1, dated 26 February 1973.

h. Orbital Requirements Document (ORD), dated 31 August 1972.

i. CDPTO Requirements Letter, dated 26 September 1972.

j. Systems Test Objectives (STO), dated December 1972.

k. Orbital Support Plan (OSP), dated 29 December 1972.

l. Sequence Definition Specification (SDS), dated 6 March 1973.

m. Command Definition Specification (CDS), dated 8 February 1973.

n. Hardware/Software Limitations Specification (HSLS), dated 8 February 1973.

o. MADCOMX, MS-IV, dated 11 June 1971.

p. MOD-IV Training Manual, dated December 1972.

q. Memograms through No. 319 have been issued and are effective for this support. Exceptions are identified in close out Memogram 8410-319.

1.2.2.2 Software

a. 'TUNITY
   (1) Auxiliary Master Tape AMT MBR 15
   (2) Auxiliary COMPOOL COMOCPRJ
   (3) SAFARI Tape 505

b. System II
   (1) System Support Tape (SST) 13.1E
   (2) SST Corrector Tape CT 13.1F.5
   (3) Data Base Flt 5DB (X or Y, depending upon DOX)
   (4) System COMPOOL COMSVSWZ

c. Bird Buffer Master 13.1 BA

d. RTS Master Disk 13.1 RD with Corrector Set 8410, Set 1

1.2.3 SCF

All telemetry modes required for support of SV-5 were generated and validated prior to start of Dress Rehearsal.

1.2.4 Pad Load and Emergency Messages

1. The flight pad load was generated to support the planned 15 February launch and was still valid and used for the 9 March launch with manual time offsets to accommodate the revised launch window. The Pad Load contents are summarized as:

a. Selected station contacts to Rev 15 and operational activities thru Rev 6. [redacted] was deleted except for Rev 1 (b)(1) (b)(3)

b. Rev 0

SV/BV Separation enable
Uncage SS System
ST System out of Ascent Mode
Inhibited SA deploy at INDI

c. Rev 1

ECS Telltales
SA deploy (inhibited)
ACS 2 OFF (inhibited)

d. Rev 2

SA deploy
ACS 2 OFF (inhibited)
CV Test (inhibited)

e. Rev 4

SS Health Test (inhibited)

A set of emergency messages were generated for use as required.

2. Msg 098 SGLS2/PCM2 Emergency contacts - Rev 1 use

3. Msg 068 VBE to Solar Array Deploy - Rev 1 use

4. Msg 990 Emergency PCON - Available throughout the mission. This message obtains PCM Side 2B, PCM Format B, telemetry and tape recorder readout through SGLS 2 in the event of negative acquisition due to malfunction of the primary transponder, PCM 1A telemetry, and/or ECS command system.

5. Msg 992 Recovery Emergency PCON - Available throughout the mission. This message is used in the event of no acquisition at POGO on a recovery pass. It will accomplish a complete switch to SGLS 2, PCM 2 to gain visibility of the vehicle.

6. Msg 084 MCS Rev 1 Emergency Contacts - Rev 1 use.

7. Msg 080 Emergency Orbit Adjust - Rev 1 use.
8. Msg 074 Emergency ACS Message - Rev 1 use.
9. Msg 096 Command Exercise - Early rev use.
10. Msg 994 ECS Clock Reset Protection Message - Available throughout the mission. This message protects against catastrophic loss of shutdown commands for camera and Orbit Adjust operations if the ECS clock should reset to zero time.

1.2.5 Expendables

OA Tank	2910 Pounds Propellant
RCS Tanks 1 and 2	Capped
RCS Tanks 3 and 4	196 pounds Propellant

Panoramic Camera	Camera A	Camera B
Film on RV-1	1,256	1,328
Film on Supply	107,021*	108,656
Pneumatics	16.86 lb	17.14 lb.

*Including 2000 of color

Mapping Camera	Terrain	Stellar
Film on RV	100.1 feet	70.2 feet
Film on Supply	3200 feet	1975 feet
Available operational frames	1986 frames	2169 frames.

1.3 Launch and Ascent

1.3.1 Launch

The fifth HEXAGON vehicle was launched on the first countdown attempt on 9 March 1973. Liftoff occurred at 1300 PST at the close of the launch window (system time 75601.9). The launch delay was occasioned by added testing to establish whether COOK inability to lock on in range from either side A or B was a vehicle or RTS problem or due to multipathing. Reducing RTS transmitted power provided adequate range lock and the count was resumed. An emergency hold was called at -20 seconds because of yaw gyro out of tolerance data. The data were established to be noisy telemetry and the count was recycled with liftoff near the close of the launch window.

1.3.2 Ascent

Ascent appeared nominal, with a normal BV/SV trajectory and all events verified up to COOK fade 10 seconds prior to BV/SV separation at 475 seconds after liftoff.

1.3.3 Injection Accuracy

Rev 1 tracking data showed the orbit achieved was very close to nominal with the major difference being perigee location 7 degrees north of nominal.

Table 1-1 shows the comparison between the actual and planned injection conditions at the planned injection latitude.

~~SECRET/H~~

MATCH POINT AND INJECTION ACCURACY

ITEM	UNITS	PREDICTED	ACTUAL	(A-P)
Match Point Geod. Lat.	Deg.	20.3539	20.3539 N	0
Radius	NM	3526.3850	3526.7832	.3982
Velocity	fps	25,754.40	25754.35	-.05
Gamma	Deg	.17152	.25170	.08018
Long.	Deg	124.0027	124.0015	-.0012
Rev 0 Orbit Comparisons				
Apogee	NM	153.977	158.008	5.031
Perigee	NM	85.271	85.252	-.019
Arg/Per	Deg	140.859	133.584	-7.275
Period	Min.	88.76800	88.83098	.06298
Eccentricity	nd	.00979412	.01036624	
Inclination	Deg	95.672	95.696	

Table 1-1

~~SECRET/H~~

SECTION 2

2.0 ORBIT PHASE REV 1 THROUGH RV-1 RECOVERY

2.1 Summary

Solar Array deploy was executed at INDI, Rev 1 and the Arrays were positioned to -18 degrees at POGO Rev 1 as required by the orbit Beta angle. An instrumentation power supply failure in the Panoramic Camera subsystem gave the indication of a pneumatics leak and required generation of an emergency message for pneumatics isolation, consequent delay of the planned early rev CV and SS health test and delay in the start of SS photographic operations. Verification test of the pneumatics system, a CV test and camera health test were completed by Rev 10 enabling start of mission photography on Rev 11. Panoramic camera operations continued normally for the remainder of the RV-1 segment.

The Mapping Camera health test on Rev 8 showed the thermal shutter did not open and this effect was repeated on Rev 13 while an engineering test at COOK Rev 16 executed properly and mission operations were started on Rev 20. Recurrence of the problem was noted on Revs 39, 90 and 91. The problem was isolated as a result of cold temperatures and Mapping Camera operation was restricted to below 50° N. Lat.

Normal SV configuration and redundant subsystem testing was achieved except for the failure of the Doppler Beacon Antenna to deploy on Rev 12 when commanded. Successful reception of the beacon signal was obtained by all TRANET stations. Signal strength measurements on high elevation passes showed a deep null in the pattern, characteristic of the radiation pattern of a non-deployed antenna.

The redundant horizon sensor inhibited from Rev 66 through Rev 67 although ACS-1 was controlling the SV attitude. The problem has not repeated and may be a result of temperature.

From Rev 105 to 111 range locking problems were encountered at most RTS. The range modulation index was increased to 0.3 radian from the normal 0.1 radian and has provided acceptable ranging performance.

Normal Lifeboat performance was obtained during the Rev 18 health test. A number of calibration runs were made to establish magnetometer performance as a result of the battery bay change required by the SV-5 Beta angle.

A DBS/[redacted] interference problem was experienced and eventually solved by alternately commanding the two subsystems. Normal [redacted] system performance has been achieved.

(b)(1)
(b)(3)

2.1.1 Problem Summary

a. INDI Search Procedures and Lock-on problems - Rev 1

Statement - System planning for INDI search did not properly reflect anomalous injections and required station widening. INDI acquisition was late because of the search procedure and when lock was finally obtained the antenna was on a side lobe.

Solution - Review the Rev 1 INDI acquisition process for SV-6 to provide higher probability of INDI acquisition to support the Rev 1 Solar Array deployment requirements.

b. Panoramic Camera Instrumentation Power Supply Failure.

Statement - The loss of all thermal and pneumatics status instrumentation caused delay in the constant velocity and SS health tests.

Solution - Verification tests established gas tight integrity of the film path and permitted conduct of the CV and SS health tests and start of mission operations. Pneumatics use rate will be estimated based on previous flight experience.

c. Mapping Camera Thermal Shutter Failure to Open

Statement - Failure of the thermal shutter to open during the health tests on Revs 8 and 13 and later during operations on Rev 39, 90 and 91 delayed and inhibited mapping camera operations.

Solution - The thermal shutter problem was determined to be a result of cold temperatures with the solution being to restrict operations to latitudes where proper operation would result. The initial restriction was at 50° N. Lat. and was to be increased with sun angle changes.

d. Doppler Beacon Antenna did not Deploy

Statement - Telemetry monitor showed the antenna did not deploy when commanded.

Solution - No impact on doppler beacon tracking, however, single strength data verified the antenna had not deployed.

e. Redundant Horizon Sensor Inhibit Rev 66/67.

Statement - H/S inhibited from Rev 66 through 67 and returned to normal operation on Rev 68 although ACS-1 was controlling the SV attitude during this period.

Solution - None. The inhibit has not repeated

f. SGLS-1 Range Lock Problem

Statement - RTS were unable to lock on in range from Rev 105 to Rev 111.

Solution - The ranging modulation index was increased from 0.1 radian to 0.3 radian with improved range lock being achieved.

g. DBS/[redacted] Interference (b)(1) (b)(3)

Statement - Interference was detected between DBS and [redacted] (b)(1) (b)(3)

Solution - Alternate commanding of the subsystems has minimized the times when both subsystems are on simultaneously.

2.2 COMMAND SUBSYSTEMS PERFORMANCE
(Prepared by Command System Contractor)

2.2.1 Health

The health of the Command Systems remained excellent throughout Segment 1 (Revs 0-196). There were no equipment malfunctions. None of the Command Systems were subjected to out of specification temperatures or voltages. There were no power dropouts, relay driver overloads, or clock status errors experienced.

2.2.1.1 EXTENDED COMMAND SUBSYSTEM

2.2.1.1.1 Command Modes

The ECS responded properly in all modes into which it was commanded. There were a total of 137 messages loaded in the ECS for this segment. This resulted in 37,286 SPC's being stored for readout from the PMU's.

Of the 37,286 SPC's loaded, 17,370 were output from the PMU's for processing by the decoders. The remainder were erased out prior to time label matches. In loading the 37,286 SPC's a total of 74 rejects occurred. All of these rejects occurred at Hula on Revs 123 and 140.

2.2.1.1.2 ECS Clock Operation

The accuracy of the ECS clock was .0363 parts in 10^6. This corresponds to an average frequency offset of .037 HZ above the nominal frequency of 1.024×10^6 HZ. The frequency of the clock oscillators changed .0210 HZ in 196 revs. This results in a stability of .166 parts in 10^7 over a 13 day period, or 3.4 parts in 10^{10} for an average 6 hour period. All of these values are well within system specifications. The clock plot is presented in Figure 2.2-1.

2.2.1.1.3 ECS Anomalies

There were no ECS anomalies experienced during this segment.

2.2.1.2 MINIMAL COMMAND SUBSYSTEM

2.2.1.2.1 Command Modes

The MCS health test was performed this segment.

2.2.1.2.2 MCS Anomalies

There were no MCS anomalies during this segment of the operation.

2.2.1.3 REMOTE DECODER/BUD

2.2.1.3.1 Command Modes

The remote decoder was used for the recovery of RV-1 which ended this segment of the flight. The performance of both channels was verified from telemetry to be proper for all commands.

Two commands were issued from the BUD during the health check.

2.2.1.3.2 Remote Decoder/BUD Anomalies

There were no remote decoder or back-up decoder anomalies during this segment.

2.2.1.4 SUMMARY

2.2.1.4.1 Expendables and Environmental Data

Total Command Readouts	PMU-A 8356 PMU-B 9014
ECS Clock Drift Rate	.0363 parts in 10^6
ECS Clock Stability	.166 parts in 10^7 for a 196 rev period
Total Hours On	ECS 294 MCS 4.5 RD 1.5 BUD .05

Secure Words Expended at End of Segment 1 PMU-A 28 PMU-B 24

Environmental Data: See Figure 2.2-1 through 2.2-7.

Clock Accuracy (Avg) $= \frac{\Delta \text{Bias}}{\Delta \text{Time}}$

$= \frac{.0363}{10 \times 10^5} = .0363 \times 10^{-6}$

Average Clock Frequency $= (.0363 \times 10^{-6} \times 1.024 \times 10^6) + 1.024 \times 10^6$

$= 1{,}024{,}000.037$

Frequency 1 (f_1) $= \frac{\Delta \text{Bias}}{\text{ECS Time}}$

$= \frac{5.4 \times 10^{-3} \text{ Sec}}{2.66 \times 10^5 \text{ Sec}} \times 1.024 \times 10^6 + 1.024 \times 10^6$

$= (.0203 \times 10^{-6} \times 1.024 \times 10^6) + 1.024 \times 10^6$

$= 1{,}024{,}000.0208$ HZ

Frequency 2 (f_2) $= \frac{\Delta \text{Bias}}{\text{ECS Time}}$

$= \frac{7.9 \times 10^{-3}}{1.0 \times 10^5 \text{ Sec}} \times 1.024 \times 10^6 + 1.024 \times 10^6$

$= (.0413 \times 10^{-6} \times 1.024 \times 10^6) + 1.024 \times 10^6$

$= 1{,}024{,}000.047$ HZ

Frequency 3 (f_3) $= \frac{\Delta \text{Bias}}{\text{ECS Time}}$

$= \frac{1.33 \times 10^{-2} \text{ Sec}}{2.4 \times 10^5 \text{ Sec}} \times 1.024 \times 10^6 + 1.024 \times 10^6$

$= (.055 \times 10^{-6} \times 1.024 \times 10^6) + 1.024 \times 10^6$

$= 1{,}024{,}000.056$

Clock Stability $= \frac{f_1 - f_2}{\text{Frequency (Avg)}}$

Stability 1 $= \frac{.0210 \text{ HZ}}{1.024 \times 10^6} = .2 \times 10^{-7}$

Stability 2 $= \frac{f_2 - f_3}{\text{Frequency (Avg)}}$

$= \frac{.0137 \text{ HZ}}{1.024 \times 10^6} = .133 \times 10^{-7}$

Stability (Avg) = .166 parts in 10^7 for this 196 rev period

= 3.4 parts in 10^{10} for average 6 hour period

GLOSSARY

ECS - Extended Command Subsystem
MCS - Minimal Command Subsystem
R/D - Remote Decoder
BUD - Back-up Decoder
BOSS - New Boston, N.H. Tracking Station
RTS - Remote Tracking Station
SPC - Stored Program Command
REV - Revolution Around Earth
PMU - Programmable Memory Unit
VT HIST - Vehicle Time History

~~SECRET/H~~

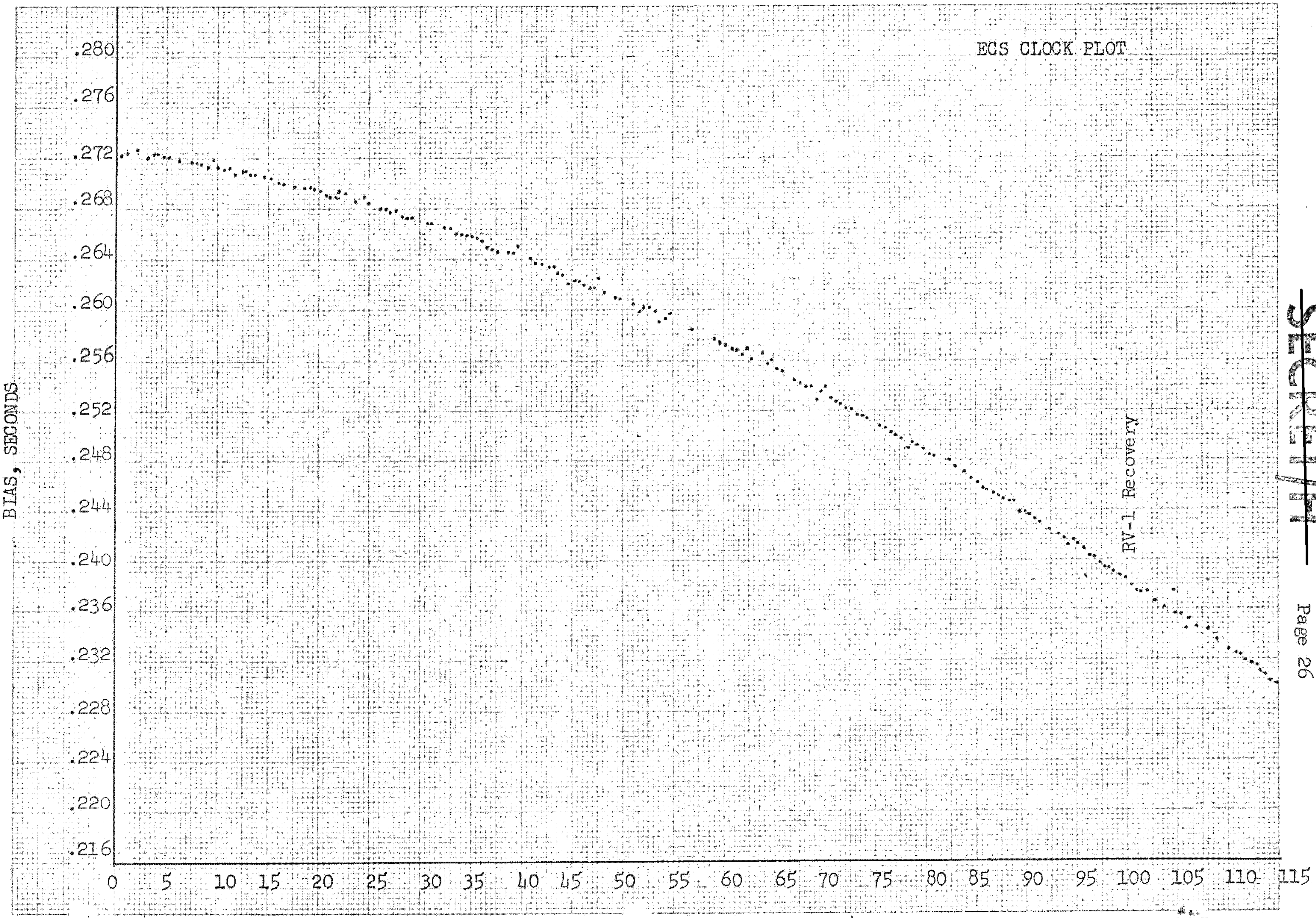


Figure 2.2-1

~~SECRET/H~~

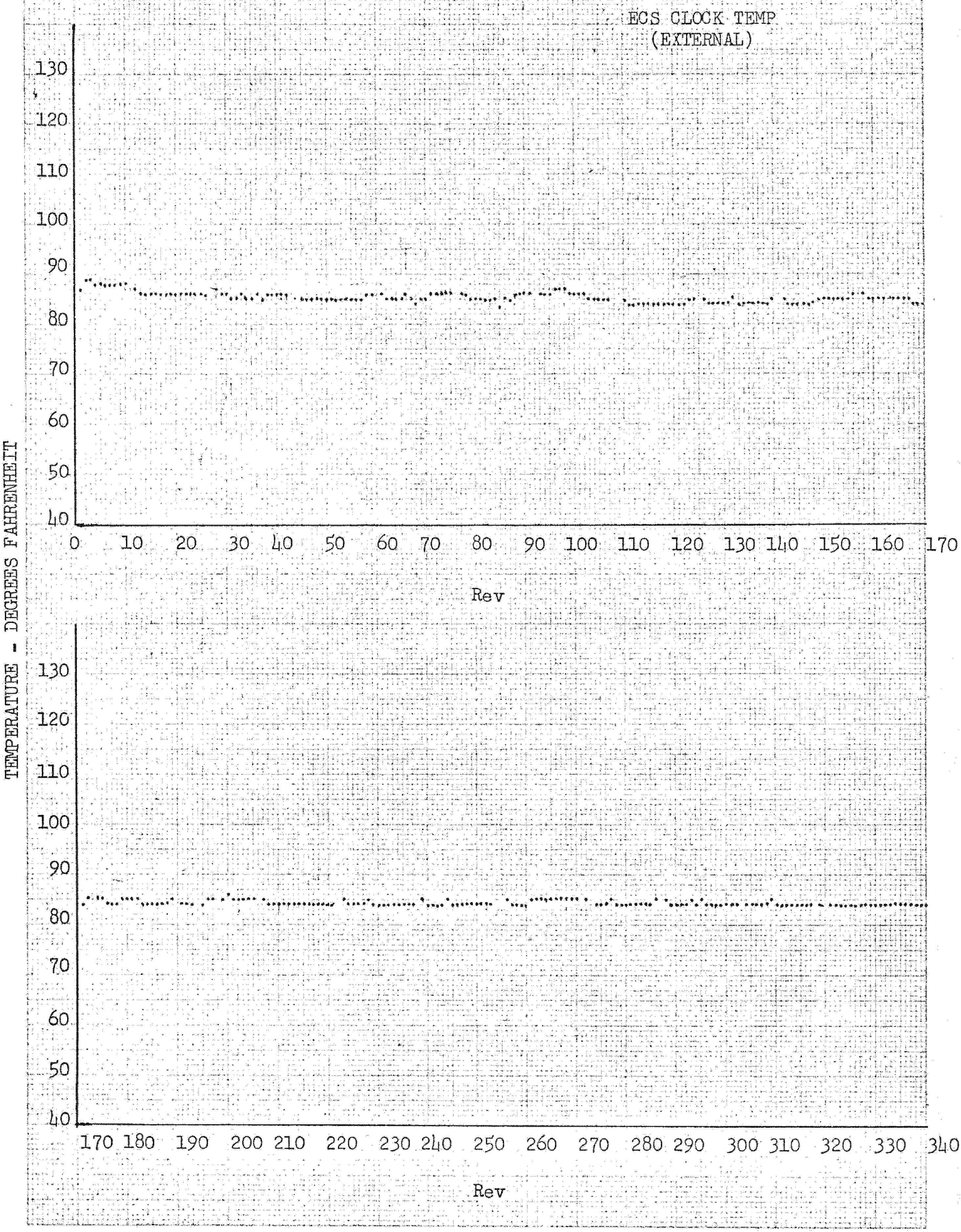

ECS CLOCK TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
Rev
130
120
110
100
90
80
70
60
50
40
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
Rev

Figure 2.2-2

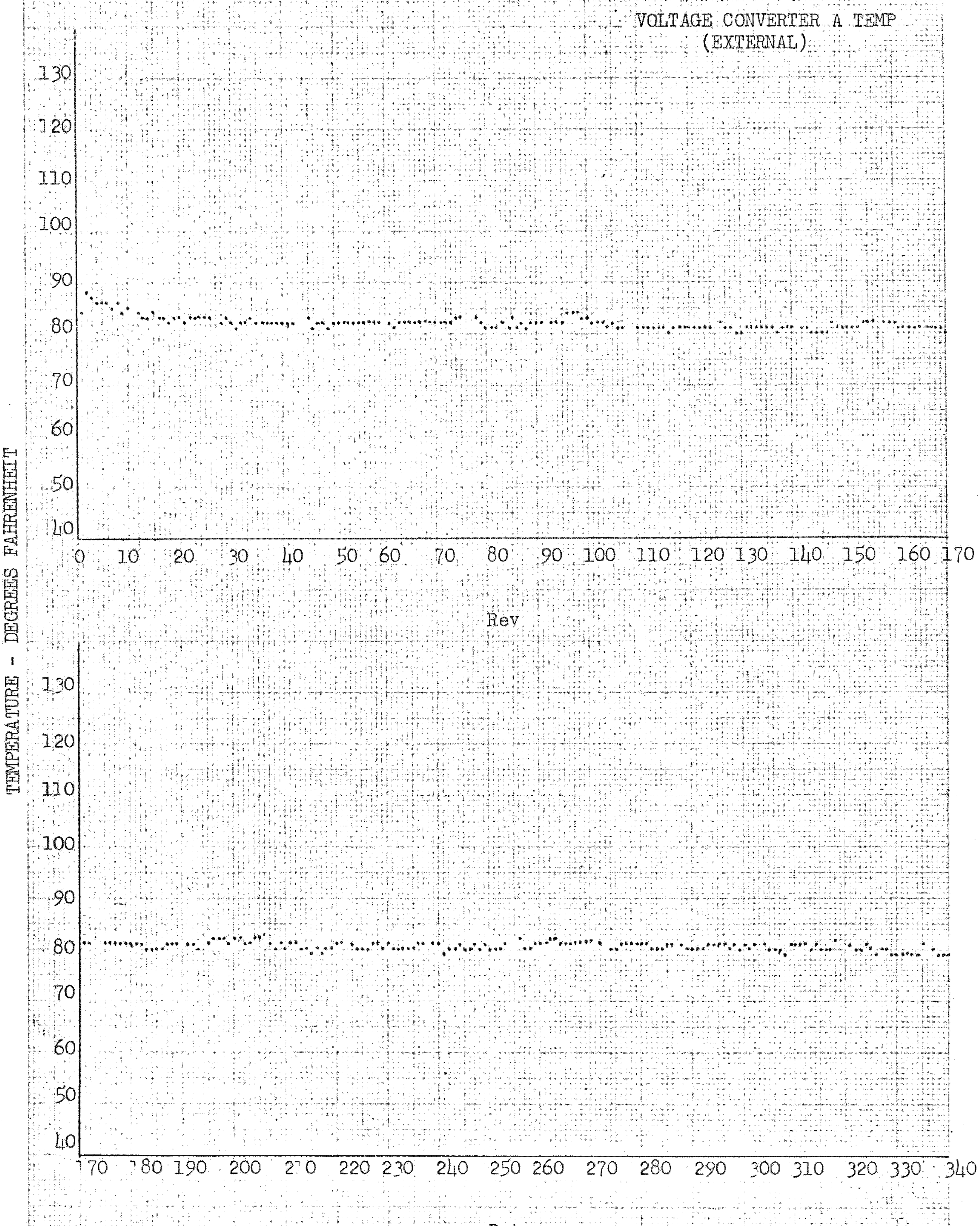

VOLTAGE CONVERTER A TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
Rev
130
120
110
100
90
80
70
60
50
40
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
Rev

Figure 2.2-3

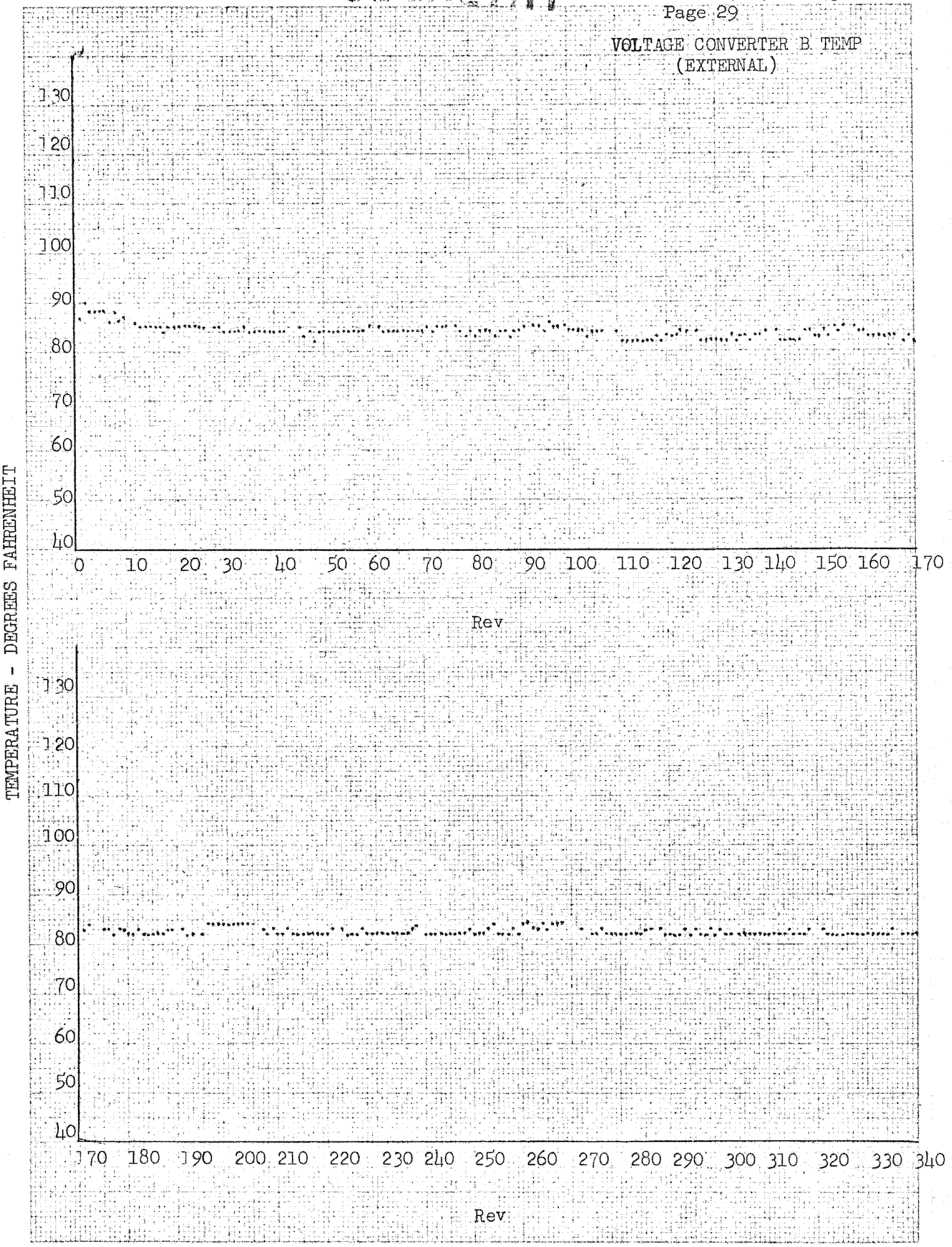

VOLTAGE CONVERTER B TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
Rev
130
120
110
100
90
80
70
60
50
40
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
Rev

Figure 2.2-4

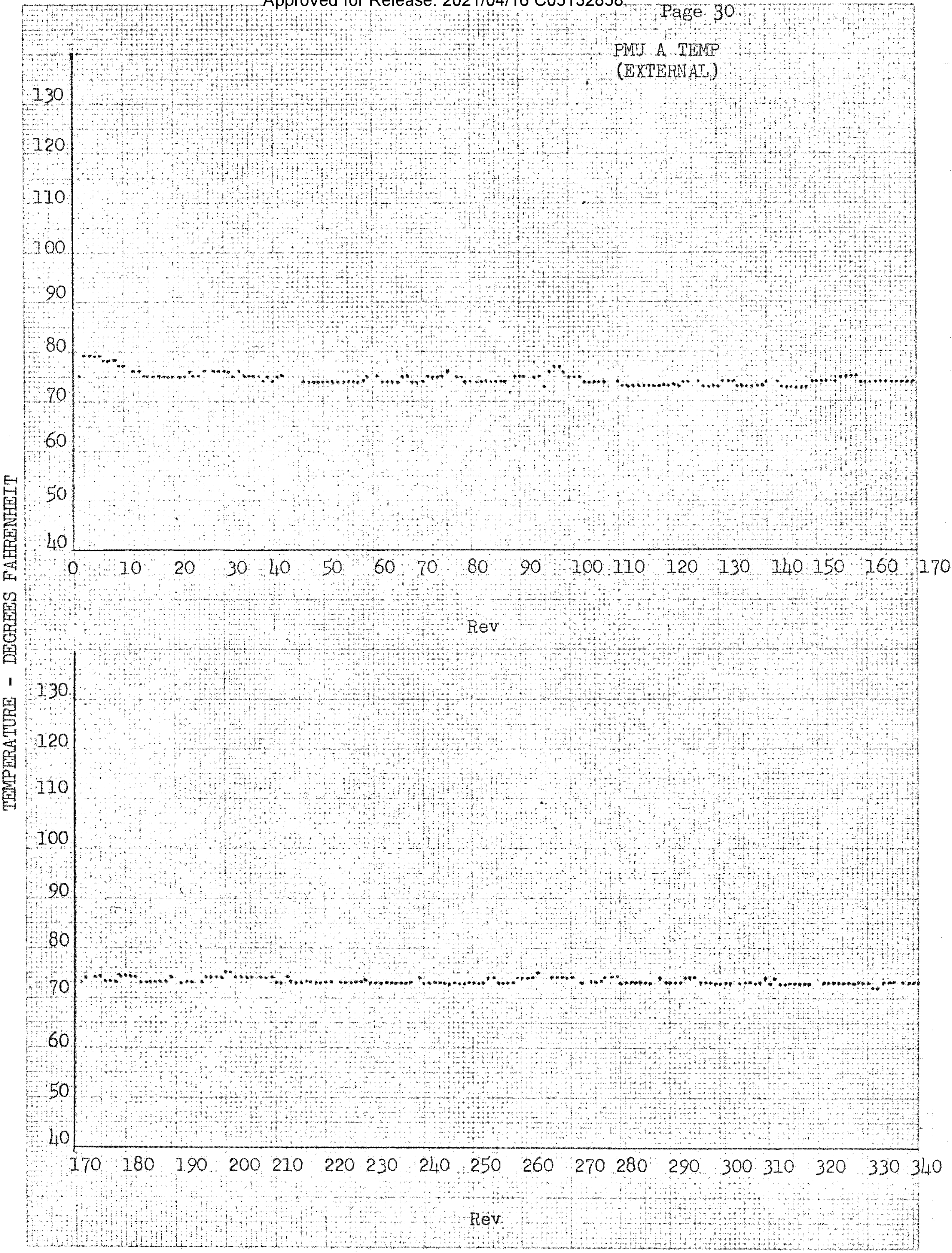

PMU A TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
Rev
130
120
110
100
90
80
70
60
50
40
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
Rev

Figure 2.2-5

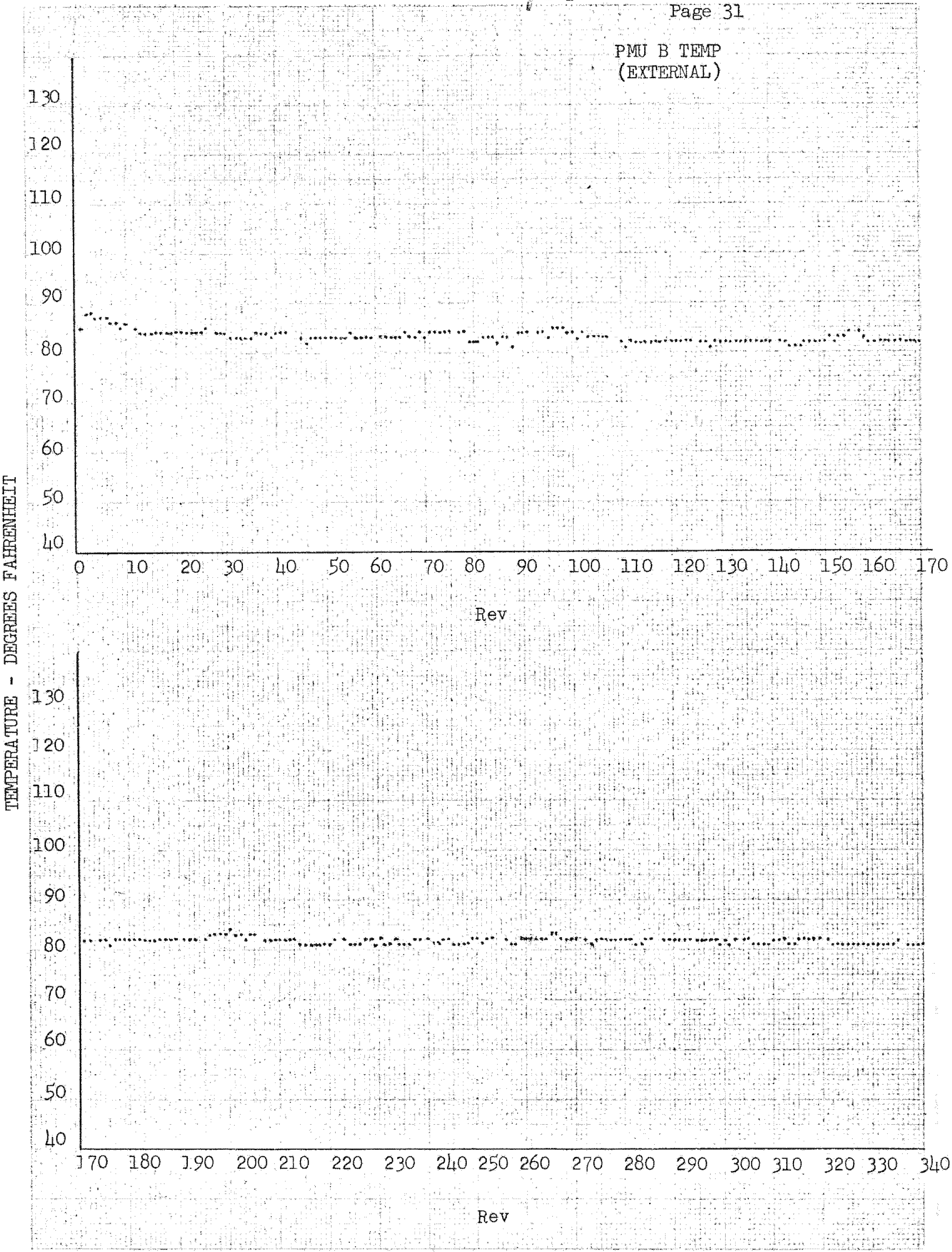

PMU B TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
Rev
130
120
110
100
90
80
70
60
50
40
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
Rev

Figure 2.2-6

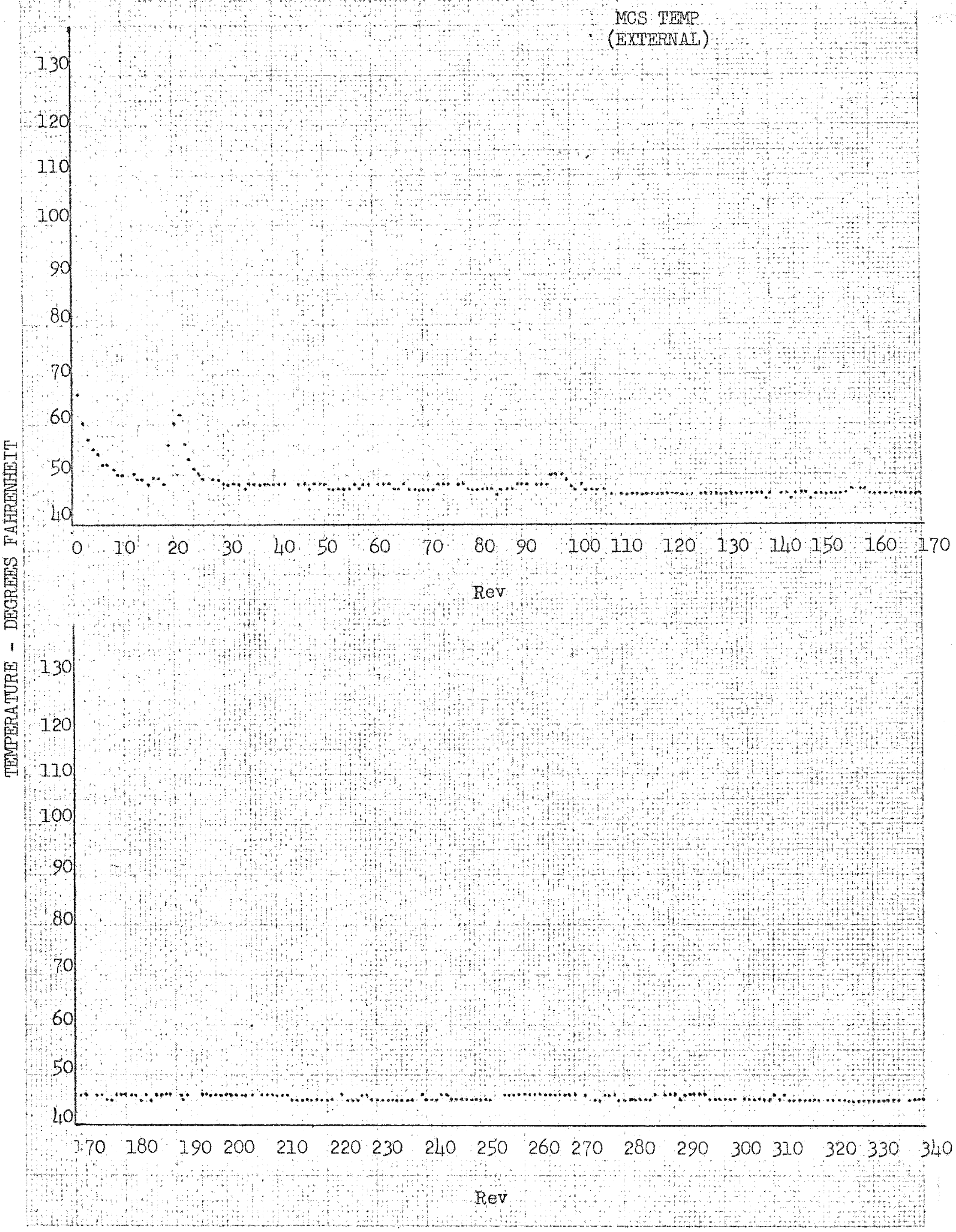


Figure 2.2-7

~~SECRET/H~~

2.3 SENSOR SYSTEM OPERATIONS THROUGH RV-1
(Prepared by Sensor System Contractor)

2.3.1 Mission Operations Performance

The Sensor Subsystem was successfully uncaged and the optical bars stowed just after BV/SV separation. However, at approximately 500 seconds after lift-off an apparent failure in the Instrumentation System Command and Control Unit (ISCCU) caused loss of all thermal and pneumatics status instrumentation with the exception of the film path chute pressure (P711). The constant velocity and health check tests normally performed on Revs 2 and 4, respectively, were delayed until the nature of the instrumentation loss could be analyzed and the availability of pneumatics pressure verified.

Pneumatics verification was achieved in a special sequence on Rev. 6. The regular constant velocity test was performed on Rev 8, and a normal stereo health check was run on Rev 10. The telemetry data from these tests indicated normal SS operation, proper film path tracking and confirmation of the gas tight integrity of the film path enabling operational photography to be initiated on Rev 11.

Photographic operations continued normally without visibility of SS temperatures or pneumatics status. The acceptability of the thermal environment is inferred from SBAC TREF temperature (C700), and the pneumatics consumption is estimated by applying a use rate of 0.024 lb/min to the pneumatics 'ON' time.

All operations throughout RV-1 demonstrated nominal characteristics with no anomalies or malfunctions experienced. Except for 19 photographic operations between Revs 151 and 176, all SS operations ended with a fixed 5 ips rewind. During the ops in which the rewind restriction was raised, there was one instance of a short disturbance on the forward camera metering - capstan summed error, fine tension and film path steerer signals, suggesting a rubbing of the film, during the film startup acceleration period.

The RV-1 mission segment consisted of 122 sensor system operations, consuming 15,324 seconds of camera power on time, 6.9 pounds (estimated) of nitrogen gas, and approximately 27,300 feet of film per camera (includes prelaunch footage on TU1 at liftoff). Consumption profiles through RV-1 are graphically depicted in Figure 1.

The sensor subsystem configuration at lift-off was as follows:

	Forward-Looking Camera	Aft-Looking Camera
Filter Type	Clear	W-12
Focal Length	60.0480	59.9716
Focus Setting	99	27
Film Type	1414/SO255	1414
Film Length	108,127	109,883
Film Weight	856.9	878.8
Spool Number	2081	2073
Pneumatics Loaded	33.99	

The overall quality of the acquired photography ranged from very good to poor, with the majority rated as fair. A significant portion of the poor rated imagery was attributed to haze and weather. The engineering through-focus MOPs during RV-1 provided evaluation data for the optimization of the focal plane position for RV-2. The aft camera was determined to require a focus adjustment of 12 microns. The non-optimum focus condition contributed significantly to the loss of overall photo quality in the aft camera.

2.3.2 Engineering Tests.

The normal uncage/OB stow sequences were executed on Rev 0. Because of the ISCCU anomaly the initial SS constant velocity test was not completed until Rev 8 and the SS Health Check was delayed until Rev 10. In addition to these checks, several engineering tests were performed during this segment of the mission, primarily through-focus photographic operations to aid PFA in determining flight plane of best focus.

Rev 0 - SS uncage/OB stows, sequences 204, 205, 213, 214
Rev 8 - SS constant velocity, sequence 208
Rev 10 - SS Health Check, sequence 203
Rev 47 - Thru focus MOP, focal plane positions +16, +8, 0
Rev 63 - Thru focus MOP, focal plane positions +16, +8, 0, -8, -16
Rev 65 - Thru focus MOP, focal plane positions +8, 0, -8
Rev 80 - Thru focus/OOAA line bias MOP, focal plane positions -16, -8, 0
Rev 81 - Thru focus/OOAA line bias MOP, focal plane positions +16, +8, 0
Rev 97 - OOAA culture/OOAA line bias MOP
Rev 173 - Thru focus MOP, focal plane positions +16, +8, -16, -8, 0
Rev 189 - Thru focus MOP, focal plane positions +16, +8, -16, -8
Rev 193 - Thru focus MOP, focal plane positions +16, +8, 0, -16, -8
Rev 194 - Transfer to takeup 2, Prep 1, sequence 207
Rev 195 - Constant velocity, Prep 2, sequence 49.

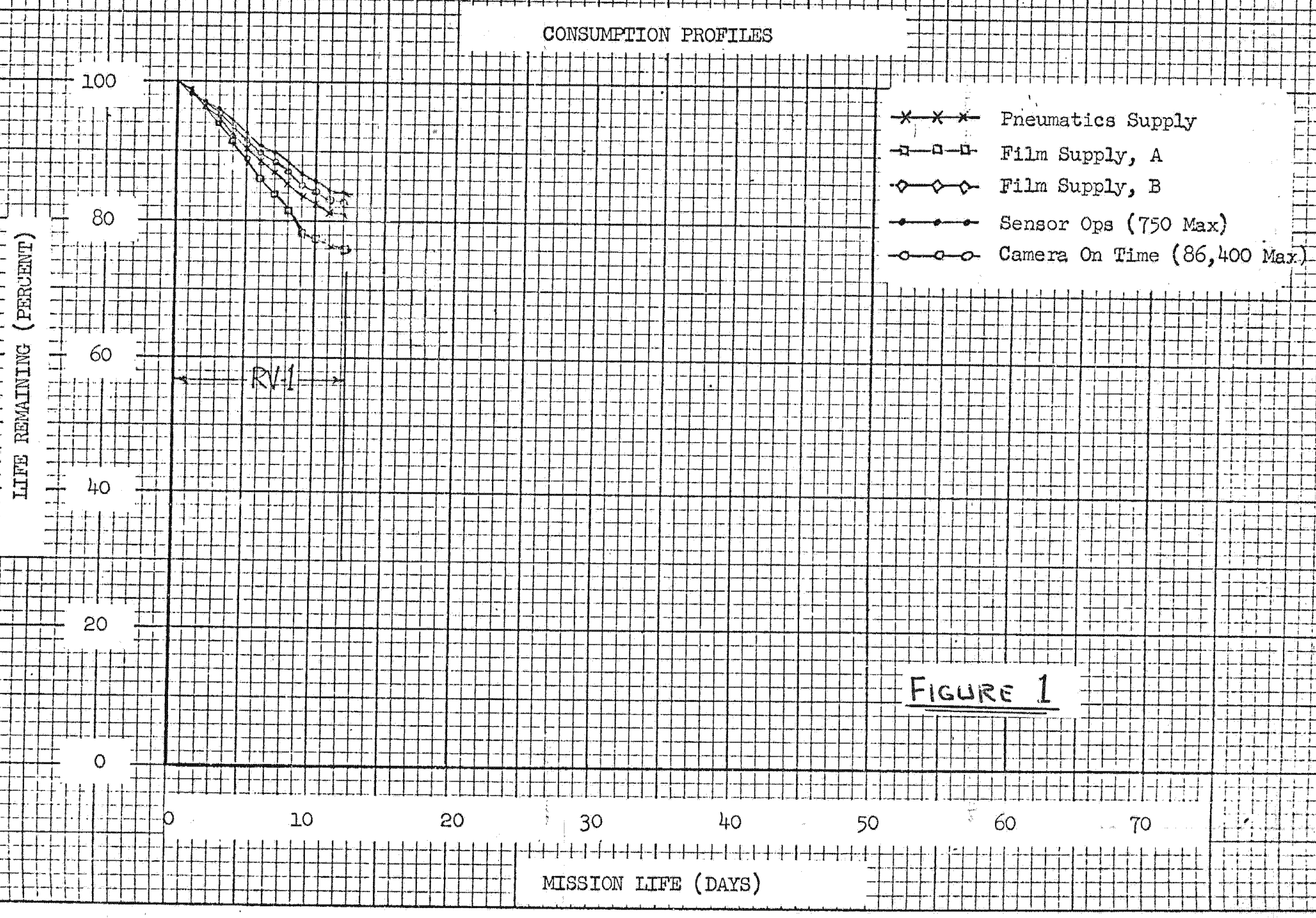

CONSUMPTION PROFILES
100
80
60
40
20
0
LIFE REMAINING (PERCENT)
0
10
20
30
40
50
60
70
MISSION LIFE (DAYS)
RV-1
Pneumatics Supply
Film Supply, A
Film Supply, B
Sensor Ops (750 Max)
Camera On Time (86,400 Max)

FIGURE 1

2.4 RV-1 (S/N 24) PERFORMANCE
(Prepared by MWC)

This report presents an analysis of the RV-1 performance based on evaluation of recovery studies, command message, RV and SV telemetry, voice reports and the recovery test report TWX. Tables 2.4-1 and 2.4-2 list all relevant data. Also included are graphs showing the performance of the RV heaters.

2.4.1 Summary

The RV payload was 93.93% of the maximum I.C.D. weight and was unbalanced 1.07%. The PREP 2 event took place on rev 195 over POGO and separation occurred on rev. 196. Preparation, deorbit, and entry events, and drogue and main parachute deployment conditions were normal and executed as planned. Aerial recovery was accomplished on the second pass at 11,000 feet altitude. The second pass was necessitated by high parachute oscillations with lateral movements up to $\pm 25^{\circ}$.

The recovery location was within 11.92 nautical miles of the predicted impact point. This value is the resultant of in-track and cross-track miss distances. No capsule or parachute damage was reported. The capsule was returned in good condition.

RECOVERY DATA

RV REENTRY PARAMETERS FROM TEAPOT EVALUATION RUN

ORBIT		
REV	196	
APOGEE	144.930	NM
PERIGEE	86.021	NM
ARG OF PERIGEE	126.807	°
INCLINATION	95.687	°
RETRO CONDITION		
TRUE ANOMALY	354.87	°
ALTITUDE	528707.67	FT
LATITUDE	57.733	°N
LONGITUDE	143.15	°W
ENTRY (400K)		
INERTIAL VEL.	25520.98	FT/SEC
γ	-2.1183	°
α_H	104.46	°
LATITUDE	47.582	°N
LONGITUDE	146.65	°W
DROGUE DEPLOY		
VELOCITY	1429.87	FT/SEC
MACH NO.	1.48	
ALTITUDE	64058.45	FT
γ	-31.1836	°
q	189.982	PSF
HEAT SHIELD JETTISON		
ALTITUDE	49726.44	FT
ETPD		
ALTITUDE	46000.	FT
DESCENT VEL @ 15K	28.5	FT/SEC

RV EVENT TIMES (FROM CMDMSG & TLM) IN SYSTEMS TIME

RV n+1 OUTLET T/S	76321.8	
RV n INLET T/S	76325.8	
DT START	80312.8	
PITCH DOWN START	81505.8	
PITCH DOWN STOP	81553.5	
RV PYRO ARM (BAT ACT)	81675.8	
KODI ACQUISITION	81906	(+13.5)
ORB PWR OFF	81917.5	
RV SEPARATION	81927.5	
RV RETRO FIRE	82053.7	(+0.8)
KODI FADE (RV)	82223.3	(+9 .6)
*ENTER IONIZATION	82308	(3.2)
*EXIT IONIZATION	82485	(-8.8)
DROGUE DEPLOY	82547	(+8.1)
ETPD (DISREEF + 3 SEC)	82608.9	(N/A)
HEAT SHIELD JETTISON	82566	(+1.3)

NOTE: TIME IN PARENTHESIS IS THE DELTA FROM THE PREDICTED TIME. TIMES THAT FALL WITHIN THE ONE SECOND PRINTOUT INTERVAL OF SV TLM IS CONSIDERED TO HAVE A ZERO DELTA TIME.

*BASED ON LOS AND AOS AS REPORTED BY UP-RANGE RECOVERY AIRCRAFT.

RV MASS PROPERTIES (FROM UPDATED TEAPOT RUN)

PAYLOAD WEIGHT		
SIDE A	214.82	LBS
SIDE B	217.27	LBS
% UNBAL $\frac{\lvert W_a - W_b \rvert}{230}$	1.07	%
% FULL (460 lb = 100%)	93.93	%
RV WEIGHTS		
SEPARATION	1515.24	LBS
PRE RETRO	1513.55	LBS
ENTRY	1322.74	LBS
RECOVERY	1104.96	LBS

RV PITCH ANGLE (FROM BASIC STUDY)

θRVS	-125.4	°
$-\Delta\theta 1$	-1.9	°
$+\Delta\theta 2$	.01	°
θSV	-33.51	°

PITCH ANGLE USED FOR UPDATED TEAPOT

θRVS -125.518°

RV-1

RECOVERY DATA

EVENT	LATITUDE	LONGITUDE
LOCATION		
NOMINAL PIP	29.000 °N	150.85 °W
UPDATED TEAPOT	29.031 °N	150.85 °W
TEAPOT EVALUATION	29.020 °N	150.85 °W
ACTUAL RECOVERY LOCATION	28.833 °N	150.917 °W
ERROR (ACTUAL-TEAPOT EVAL.)	.187 °	.067 °
ERROR (1° = 60 NM)	11.22 NM	4.02 NM
TOTAL ERROR	11.92 NM	

AERIAL RECOVERY

ALTITUDE	11,000	FT	
PASS NUMBER	2		
AIRSPEED	152	(KTAS)	125 (KIAS)

CHUTE CONDITION No visible damage

CHUTE BEHAVIOR Hi rate oscillation and lateral movement of 25° either side of vertical

TIME 2313Z

RETRIEVAL

CAPSULE CONDITION No visible damage

WINCH SETTINGS	(PTL)
INITIAL	3300 lb.
FINAL	N/A
PAY OUT	Normal
CONTACT	Right pole at top of cone.

RECOVERY AREA WIND DATA (PREDICTED)

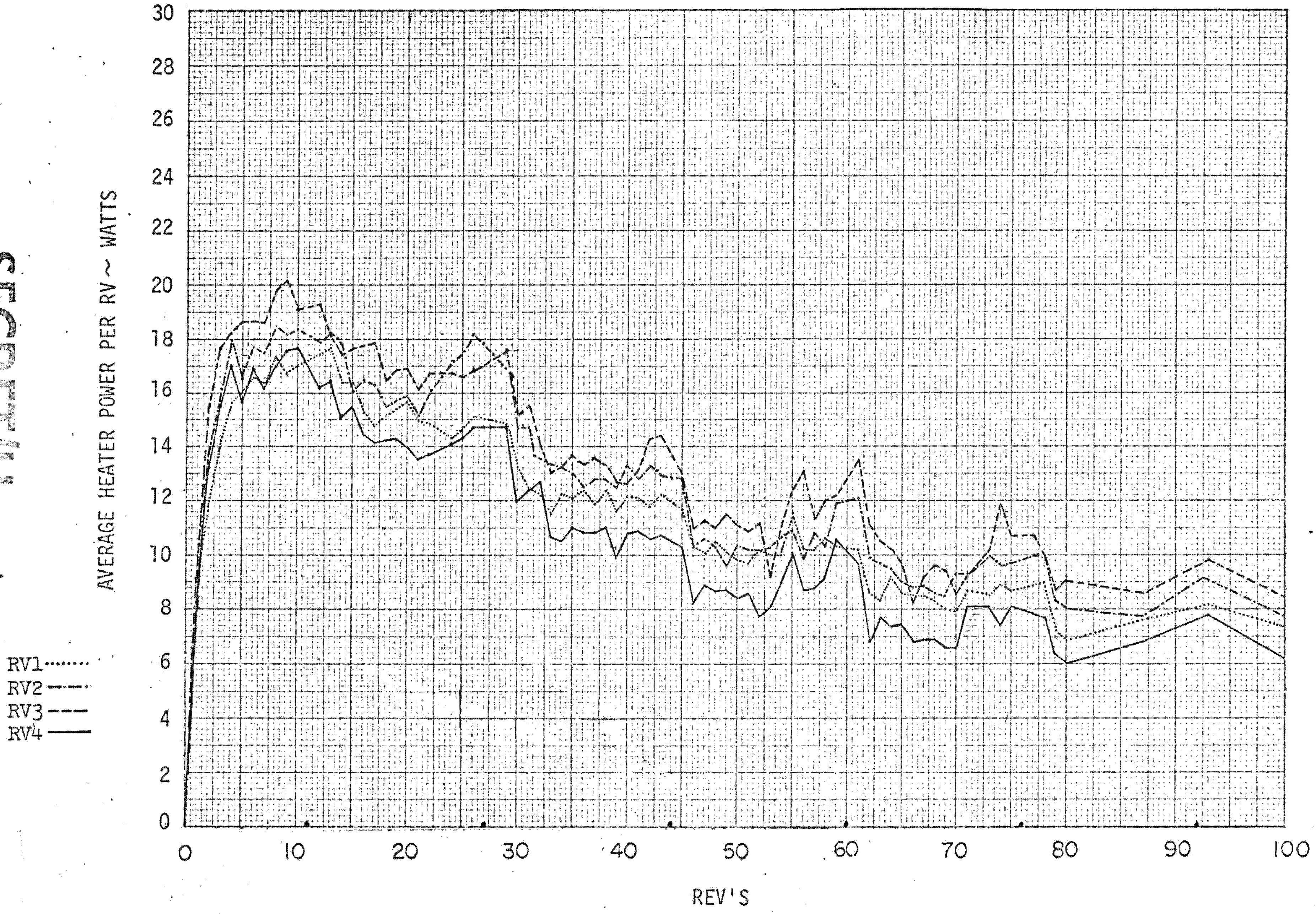
DATA SOURCE: MEMOGRAM 8410-608

ALTITUDE 1000's FT	DIRECTION (DEGREES)	VELOCITY (KNOTS)	ALTITUDE 1000's FT	DIRECTION (DEGREES)	VELOCITY (KNOTS)
60	-	-	20	270	75
55	-	-	15	280	65
50	270	45	10	270	30
45	260	40	8	260	20
40	270	55	6	250	20
35	280	60	4	260	20
30	280	80	2	230	10
25	270	80	SFC	070	15

~~SECRET/H~~

ACTIVE THERMAL CONTROL SYSTEM

RV HEATER POWER CONSUMPTION



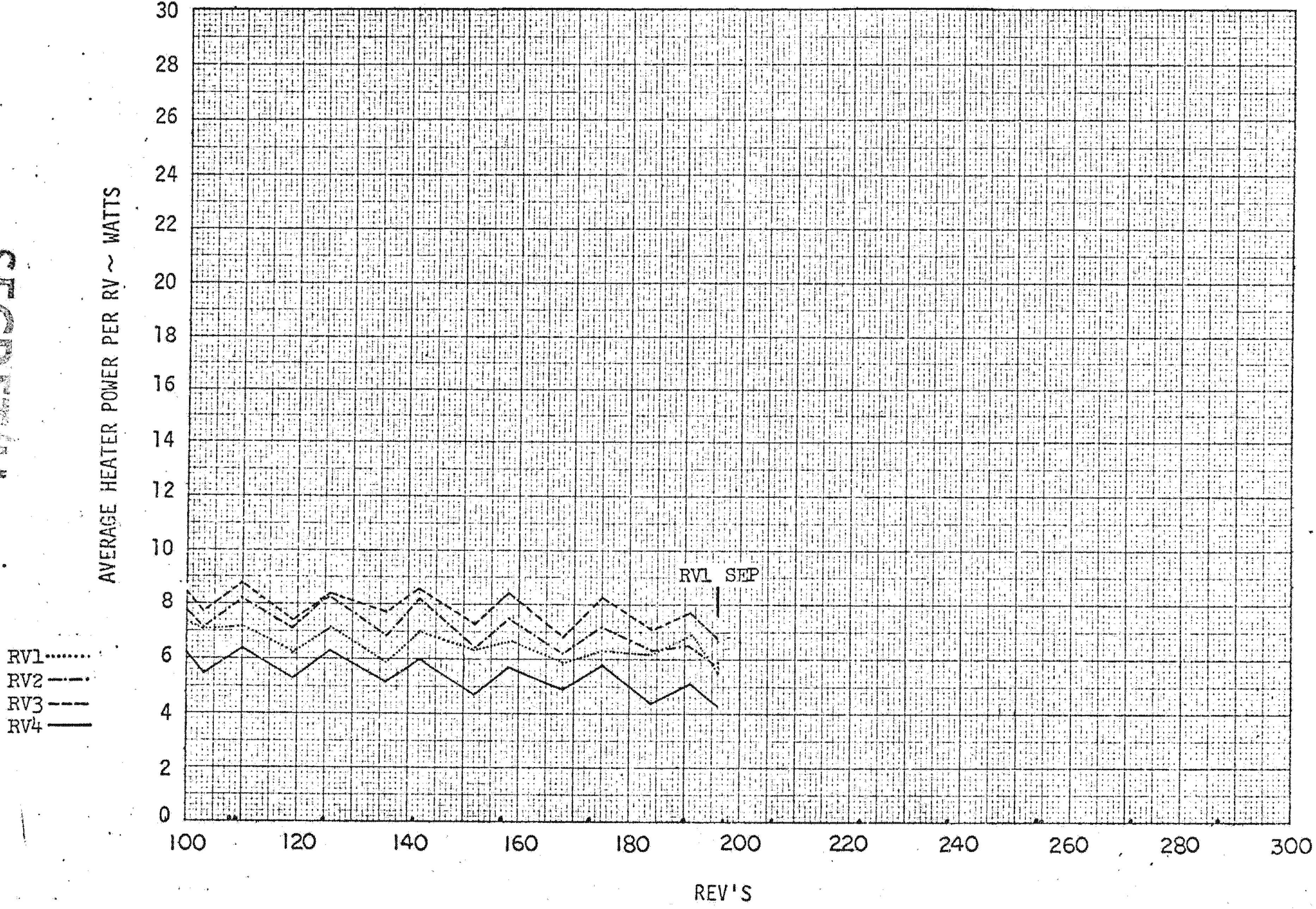
~~SECRET/H~~

BIF-107W-71014-73
Page 40

~~SECRET/H~~

ACTIVE THERMAL CONTROL SYSTEM

RV HEATER POWER CONSUMPTION

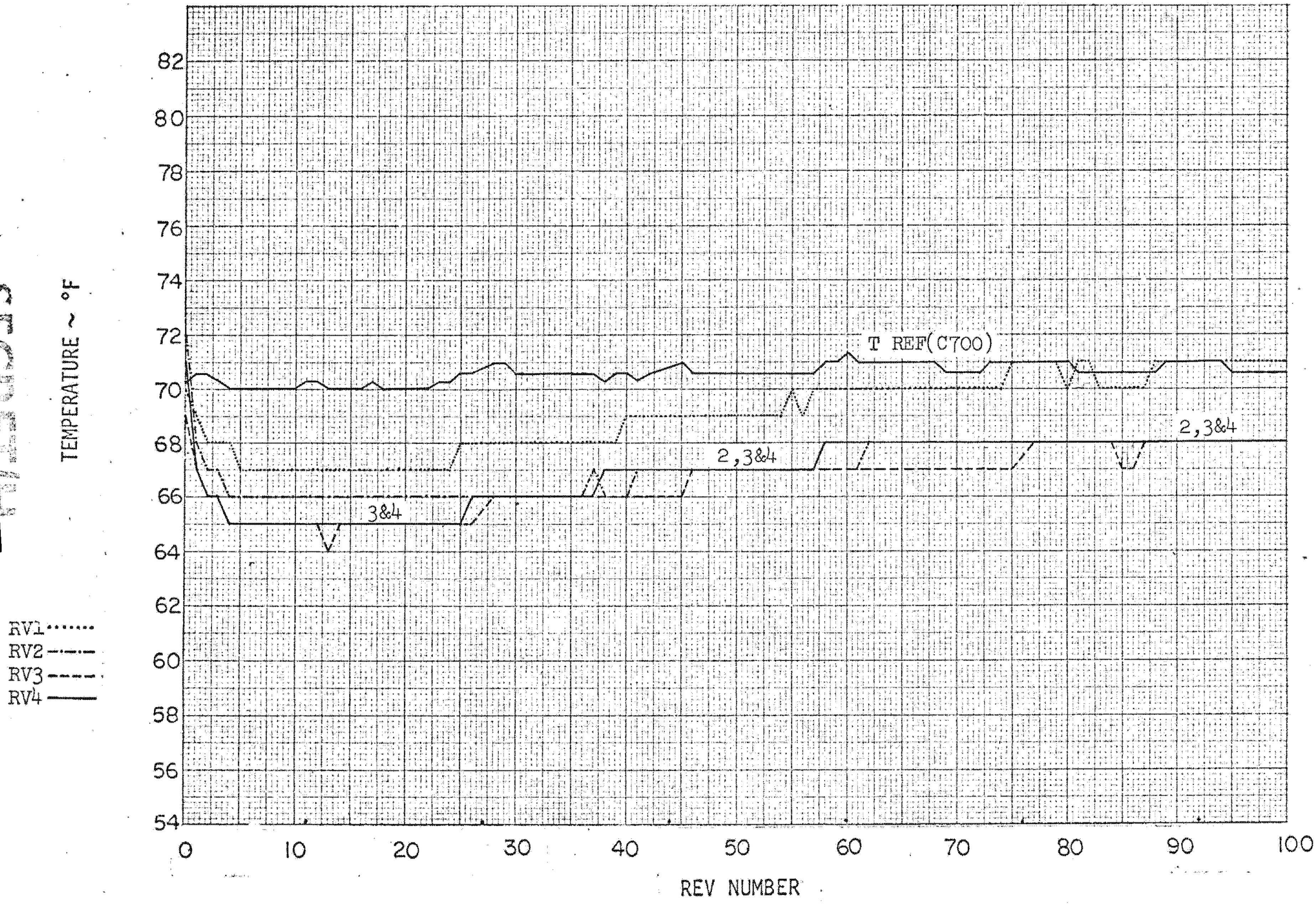


~~SECRET/H~~

ATC PERFORMANCE

PLOT REFERENCE TEMPERATURE IN USE (C700 OR C701).

PLOT ALL RV PAYLOAD TEMPERATURES, RN06.



SECRET

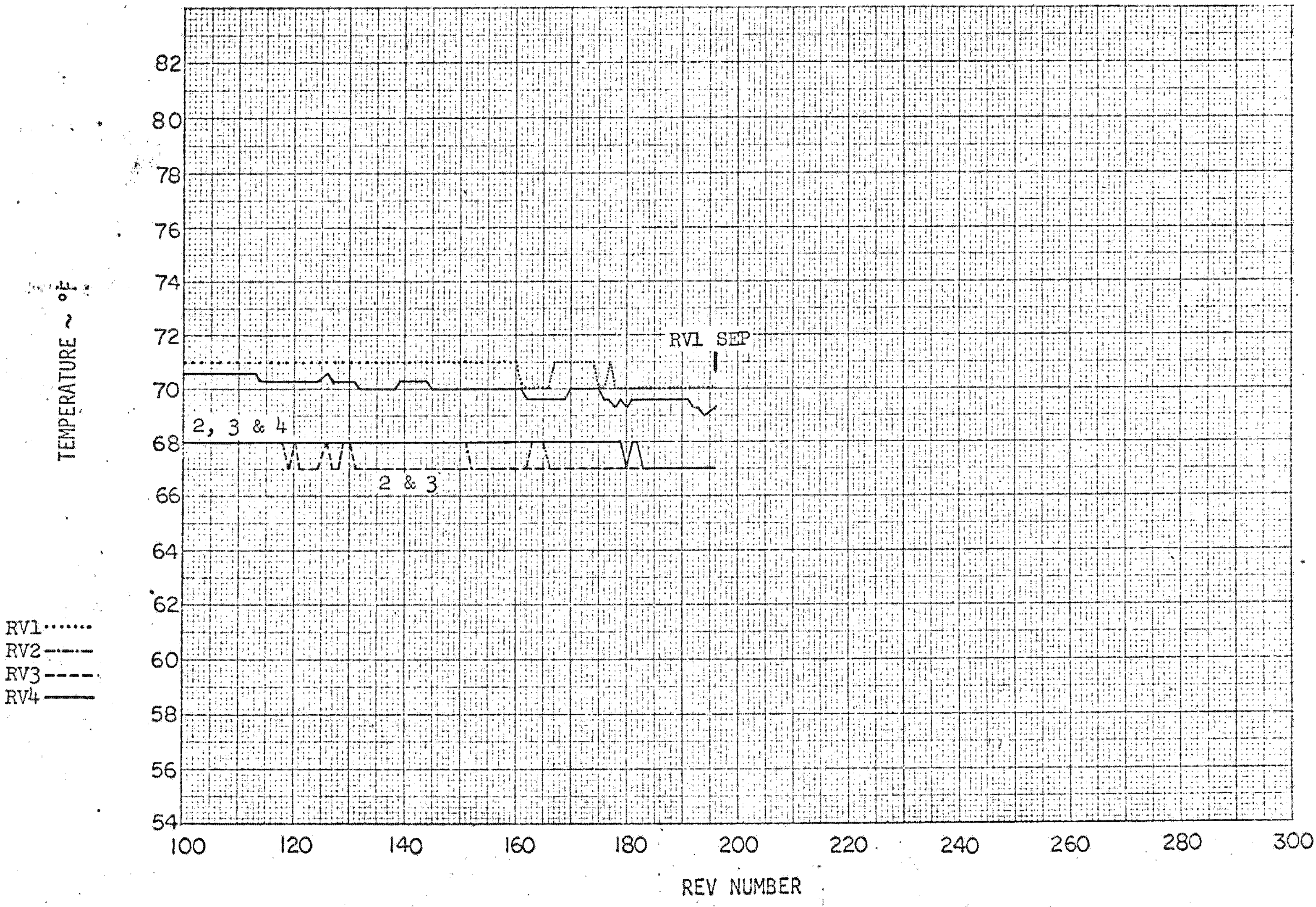
SECRET

ATC PERFORMANCE

PLOT REFERENCE TEMPERATURE IN USE (C700 OR C701).

PLOT ALL RV PAYLOAD TEMPERATURES, RN06.

~~SECRET/H~~



~~SECRET/H~~

2.5 SATELLITE CONTROL FACILITY PERFORMANCE

2.5.1 Orbit Determination and Prediction

2.5.1.1 Orbit Determination

Table 2.5-1 shows a summary of the orbital conditions computed from each tracking reduction from Rev 1 to RV-1 recovery on Rev 196. Significant events affecting the orbit included an orbit adjust every two days with the fourth orbit adjust a dual positive/negative to provide tighter control on orbit characteristics, including the location of Argument of Perigee. The events during the RV-1 segment were:

1. Positive orbit adjust on Rev 30.
2. Positive orbit adjust on Rev. 62.
3. Positive orbit adjust on Rev 94 followed by a negative orbit adjust on Rev 96.
4. Positive orbit adjust on Rev 127.
5. Positive orbit adjust on Rev 159.

2.5.1.2 Prediction Accuracy

Table 2.5-2 contains a summary of prediction accuracies over a ten rev span from each tracking reduction epoch rev. Accuracies are determined by comparing the nodal crossing differences between the Best Fit Ephemeris and the tracking reduction ephemeris predictions. Prediction accuracies were within acceptable limits throughout the RV-1 segment.

Table 2.5-1

TRACKING REDUCTION
SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
000	.0097	.2495	88:48.0	155.72	83.75	140.8	.3810	180/30		
001	.0104	.2547	88:50.2	160.12	83.59	133.2	.3810	189/32		
002	.0103	.2589	88:49.1	159.40	83.46	132.9	.3810	185/31		
003	.0103	.2830	88:48.9	159.28	83.40	132.7	.4149	169/29		
004	.0105	.2960	88:48.6	159.14	83.34	132.4	.4304	162/27		
005	.0103	.2734	88:48.4	158.96	83.36	132.3	.3974	175/30		
008	.0102	.2851	88:47.6	158.41	83.46	131.2	.4144	167/28		
012	.0101	.2914	88:46.3	157.70	83.36	130.4	.4156	163/27		
015	.0100	.2941	88:45.5	157.17	83.39	129.6	.4183	160/27		
018	.0099	.3040	88:44.5	156.64	83.27	128.9	.4250	155/26		
020	.0099	.3107	88:43.9	156.37	83.14	128.3	.4279	151/26		
023	.0099	.2977	88:43.2	155.81	83.25	127.6	.4108	157/27		
026	.0097	.3152	88:42.1	155.11	83.27	126.6	.4301	148/25		
030	.0098	.2878	88:45.6	156.68	84.12	128.9	.4294	165/28	OA #1	
032	.0098	.2899	88:45.3	156.45	84.18	128.7	.4329	164/28		
034	.0098	.2948	88:44.6	156.14	84.06	128.1	.4346	161/27		
037	.0098	.3097	88:43.7	155.65	83.91	127.5	.4476	153/26		
042	.0096	.2975	88:42.3	154.66	84.07	125.9	.4283	158/27		

~~SECRET/H~~

~~SECRET/H~~

Table 2.5-1

SECRET/H

TRACKING REDUCTION
SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
045	.0095	.3098	88:41.3	154.15	83.90	125.5	.4382	151/26		
048	.0094	.3245	88:40.4	153.46	83.96	124.6	.4599	143/24		
051	.0094	.3408	88:39.2	152.92	83.76	123.86	.4679	135/23		
053	.0094	.3428	88:38.5	152.57	83.64	123.3	.4645	134/23		
057	.0092	.3298	88:37.4	151.68	83.79	122.1	.4429	138/23		
061	.0091	.3284	88:36.0	150.90	83.63	121.3	.4356	138/23		
064	.0106	.2944	88:49.7	161.53	83.90	125.9	.4368	169/29	OA #2	
067	.0106	.3041	88:48.6	161.02	83.74	125.1	.4435	163/28		
070	.0105	.2990	88:47.7	160.49	83.70	124.4	.4315	165/28		
073	.0104	.3073	88:46.9	159.90	83.76	123.5	.4411	160/27		
077	.0103	.3039	88:45.6	159.18	83.64	122.6	.4280	160/27		
80	.0102	.3087	88:44.8	158.5	83.70	121.9	.4341	157/26		
83	.0101	.3195	88:43.7	157.9	83.60	121.1	.4400	150/25		
86	.0101	.3166	88:42.8	157.42	83.50	120.5	.4304	151/26		
89	.0100	.3161	88:41.9	159.82	83.57	119.5	.4267	151/26		
92	.0099	.3178	88:40.5	155.95	83.51	118.6	.4231	148/25		
97	.0095	.2747	88:46.9	154.60	84.02	140.2	.4244	162/27	OA's #3 & #4	
101	.0096	.2972	88:45.6	154.10	83.73	139.0	.4424	151/26		

SECRET/H

TRACKING REDUCTION SUMMARY

Table 2.5-1

~~SECRET/H~~

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	D WEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
105	.0094	.2822	88:44.6	153.41	83.81	137.8	.4220	158/27		
110	.0093	.2977	88:43.3	152.64	83.73	136.9	.4380	148/25		
113	.0092	.3183	88:42.1	151.88	83.70	135.9	.4631	138/23		
117	.0092	.3249	88:40.8	151.29	83.43	134.8	.4593	135/23		
121	.0091	.3057	88:39.7	150.57	83.47	133.6	.4290	143/24		
126	.0090	.3208	88:37.9	149.59	83.33	132.4	.4395	136/23		
129	.0093	.2648	88:47.2	153.94	85.27	139.0	.4434	170/29	OA #5	
133	.0092	.2697	88:46.1	153.46	85.08	137.9	.4424	167/28		
138	.0091	.2665	88:44.8	152.67	85.11	136.4	.4329	169/29		
143	.0091	.2754	88:43.4	152.04	84.83	135.5	.4343	163/28		
145	.0090	.2906	88:42.8	151.50	84.98	134.9	.4610	154/26		
150	.0089	.3227	88:41.0	150.62	84.71	133.5	.4955	138/23		
154	.0088	.3276	88:39.8	149.76	84.76	132.2	.4990	135/23		
160	.0095	.3475	88:46.9	154.94	84.85	136.1	.5624	132.22	OA #6	
162	.0094	.3473	88:46.4	154.52	84.95	135.7	.5624	132/22		
165	.0094	.3717	88:45.2	153.95	84.71	134.8	.5880	123/21		
169	.0093	.3676	88:43.9	153.09	84.64	133.9	.5729	123/21		
172	.0092	.3567	88:42.7	152.40	84.61	132.9	.5493	127/22		

~~SECRET/H~~

TRACKING REDUCTION SUMMARY

Table 2.5-1

~~SECRET/H~~

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
176	.0091	.3570	88:41.5	151.69	84.37	132.1	.5347	125/21		
179	.0090	.3576	88:40.4	150.92	84.43	131.2	.5333	125/21		
182	.0089	.3781	88:39.1	150.36	84.15	130.4	.5479	118/20		
185	.0088	.3490	88:38.3	149.66	84.28	129.7	.5052	127/21		
187	.0087	.3463	88:37.5	149.17	84.31	128.8	.4995	127/21		
192	.0087	.3570	88:35.8	148.20	84.02	127.9	.4977	123/21		
195	.0085	.3857	88:34.6	147.40	84.05	127.1	.5330	113.19		

~~SECRET/H~~

PREDICTION [illegible]ACY SUMMARY

(BFE - Tracking Reduction Predictions)

Table 2.5-2

Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch	Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch
0	01	14.455	22.400	67	05	.041	.245
1	01	-3.671	-8.142	70	05	-.171	-.287
2	01	- .338	-1.253	73	05/06	.161	.370
3	01	- .042	- .048	78	06	-.141	-.305
4	01/02	.205	.711	80	06	-.079	-.008
5	01/02	- .265	- .817	83	06	.127	.602
8	02	- .009	- .117	86	06	.042	.280
12	02	- .002	- .149	89	06/07	.054	1.387
15	02	- .067	- .177	93	07	1.148	2.345
18	02	.053	.135	97	07	- .232	-.450
20	02	.000	.321	101	07	.280	.605
23	02/03	- .354	- .965	105	07/08	-.239	-.037
26	03	.026	.270	110	08	-.324	-.832
30	03	.182	.375	113	08	.147	-.687
32	03	- .117	- .246	117	08/09	.383	.995
34	03	- .082	- .144	121	08/09	-.166	-.007
37	03	.276	.691	126	09	.561	1.488
42	04	- .242	-1.141	129	09	.038	.199
45	04	- .367	-1.063	133	09	.061	.166
48	04	- .087	- .023	138	09/10	-.074	-.865
51	04	.278	1.088	143	10	-.692	-2.428
53	04	.414	1.357	145	10	-.505	-1.840
57	04/05	.189	1.707	150	10	-.225	3.282
61	05	.873	2.072	154	10/11	-.848	-1.768
64	05	- .092	- .227	159	11	.833	1.785

SECRET

SECRET

BIF-107W-71014-73
Page 49

PREDICTION ACCURACY SUMMARY

(BFE - Tracking Reduction Predictions)

Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch	Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch
162	11	-.383	- .518				
165	11	.200	1.190				
169	11/12	.385	1.227				
172	12	.156	.444				
176	12	-.212	.103				
179	12	.016	.722				
182	12	.220	2.389				
185	12/13	.159	.084				
187	13	----	- .866				
192	13	-.685	- .035				
195	13	.437	3.781				
198	13	---	7.353				
200	13	.761	1.261				

SECRET

2.5.1.3 B Factor

Figure 2.5-1 shows a plot of B-factor for this segment of the mission. The B-factors shown are from the individual tracking reductions and from the BFE for comparison. Maneuvers are indicated as to the rev of occurrence.

2.5.1.4 Orbit Adjust Summary

Table 2.5-3 reflects a summary of each orbit adjust during this segment. For each orbit adjust or set of orbit adjusts occurring on the same or adjacent revs, orbital conditions are provided which describe the orbit prior to the first orbit adjust. In addition, the predicted velocity change and orbit resulting from each orbit adjust or set of orbit adjusts is provided and compared with the actual orbit and velocity change obtained. The actual orbit and velocity change was determined from the Best Fit Ephemeris. All orbit adjusts were close to nominal.

Figure 2.5-2 reflects perigee altitude and perigee locations prior to and after each positive Orbit Adjust and prior to and after the positive/negative pair of Orbit Adjusts Nos. 3 and 4.

2.5.1.5 Best Fit Ephemeris

Table 2.5-4 shows the orbital conditions for each day of this segment of the mission.

SECRET

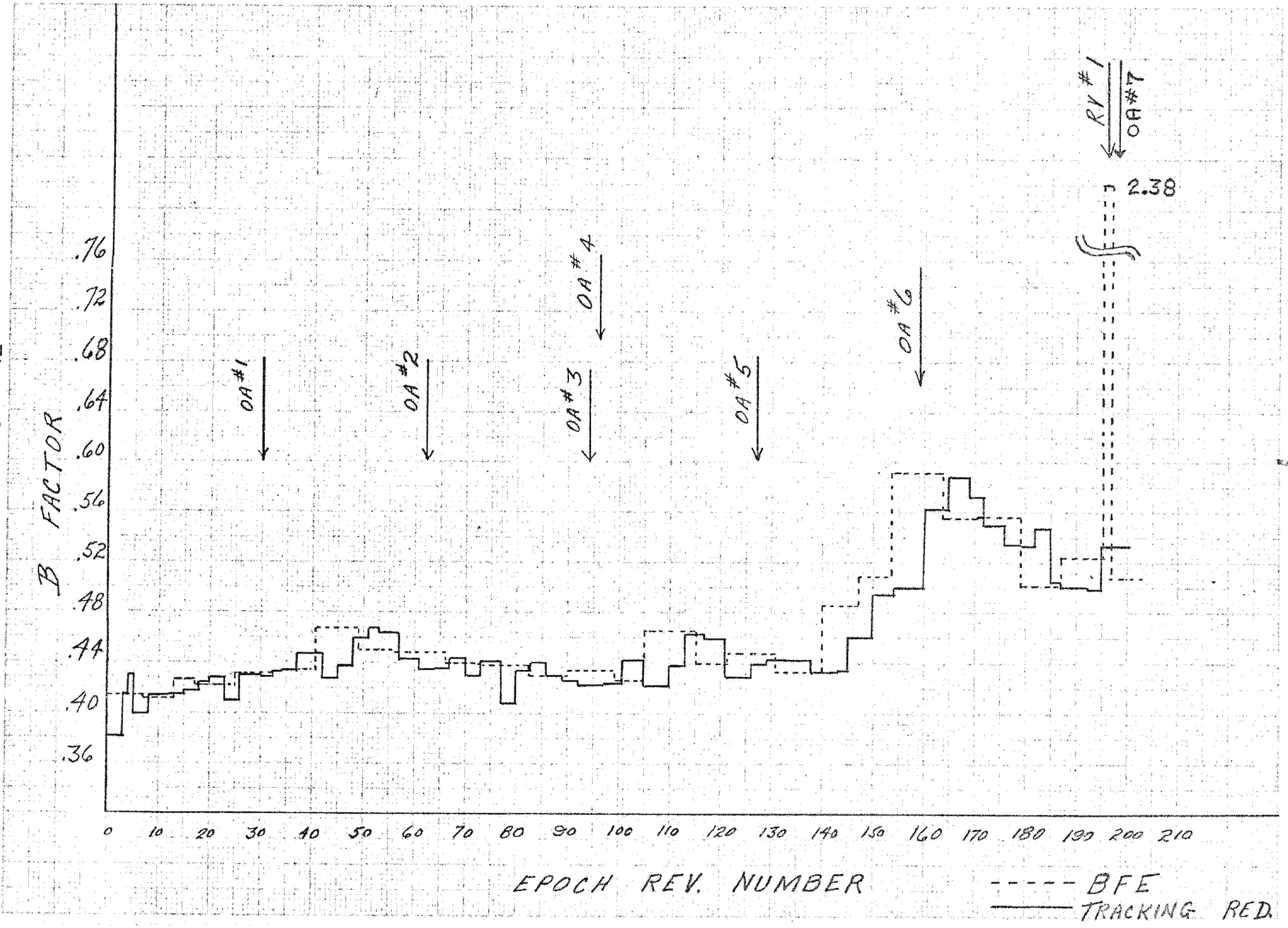


Figure 2.5-1

SECRET

SECRET/H

OA No. 1 Rev. No. 30	Period Min.Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur. Sec. XX.X	Delta Velocity XX.XX
Orbit at Rev 29	88:41.2	84.94	153.04	126.137	--	--
Predicted 31	88:45.6	85.94	155.04	128.910	21.8	7.88
Actual	88:45.7	85.99	155.03	128.985	21.8	8.04
Delta (A-P)	+.069	+.047	-.011	+.075	0	+.16
OA No. 2 Rev. No. 62						
Orbit at Rev 61	88:36.0	85.52	149.44	121.316	--	--
Predicted 63	88:49.8	85.53	160.13	126.097	61.6	22.90
Actual	88:50.0	85.53	160.35	126.159	61.6	22.90
Delta (A-P)	+.271	0	+.223	+.062	0	+.42
OA No. 3 Rev. No. 94						
Orbit at Rev 93	88:40.6	85.17	154.73	118.695	--	--
Predicted					83.2	+29.98
Actual					83.2	+30.64
Delta (A-P)					0	+.66
OA No. 4 Rev. No. 96						
Orbit at Rev						
Predicted at Rev 97	88:46.6	85.51	152.78	139.754	52.8	-18.86
Actual	88:46.9	85.59	152.82	140.203	52.8	-19.04
Delta (A-P)	+.294	+.084	+.035	+.449	0	-.18

Table 2.5-3

SECRET/H

SECRET

	Period Min. Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur. Sec. XX.X	Delta Velocity XX.XX
OA No. 5 Rev. No. 127						
Orbit at Rev 126	88:38.0	85.26	147.69	132.447	--	--
Predicted 128	88:47.4	86.83	152.25	139.171	45.0	15.68
Actual	88:47.6	86.89	152.31	139.286	45.0	15.97
Delta (A-P)	+.18 sec	+.06	+.06	+.115	0	+.29
OA No. 6 Rev. No. 159						
Orbit at Rev 158	88:38.2	86.50	146.89	131.493	--	--
Predicted 160	88:47.0	86.59	153.11	136.096	43.0	14.82
Actual	88:47.2	86.64	153.21	136.230	43.0	15.18
Delta (A-P)	+.2	+.05	+.10	+.144	0	+ .36
OA No.____ Rev. No.____						
Orbit at Rev						
Predicted						
Actual						
Delta (A-P)						
OA No.____ Rev. No.____						
Orbit at Rev						
Predicted						
Actual						
Delta (A-P)						

SECRET

Table 2.5-3

SECRET/H

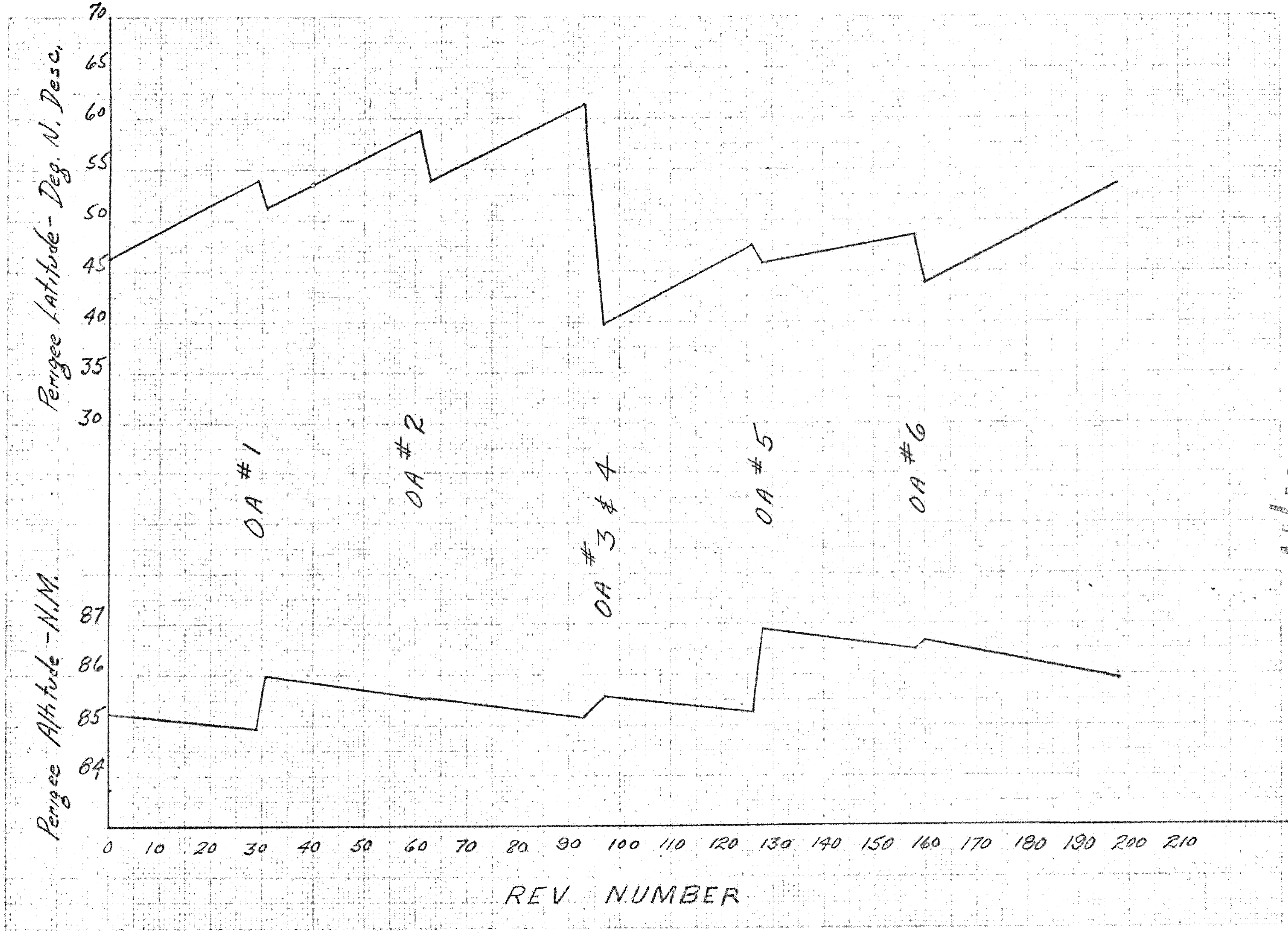


Figure 2.5-2

SECRET/H

~~SECRET/H~~

BEST FIT EPHEMERIS
SUMMARY

Table 2.5-4

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
1	1	.0103	95.69	88:49.5	159.54	83.51	133.3	.4147	0 - 7
								.4116	8 -
2	13	.0101	95.69	88:46.1	157.54	83.34	130.3	.4265	13 - 17
								.4222	17 - 25
								.4358	25 -
3	25	.0097	95.69	88:42.4	155.14	83.46	126.8	.4317	25 - 32
								.4361	32 - 39
								.4409	39 -
4	41	.0096	95.69	88:42.6	154.85	84.14	126.0	.4689	41 - 49
								.4500	49 - 56
								.4335	56 -
5	58	.0092	95.69	88:37.0	151.44	83.80	121.8	.4483	58 - 66
								.4407	66 - 72
								.4272	72 -

~~SECRET/H~~

SECRET/H

Table 2.5-4

BEST FIT EPHEMERIS SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
6	74	.0104	95.69	88:46.6	159.63	83.82	123.3	.4387	74 - 82
								.4296	82 - 88
								.4202	88 -
7	90	.0099	95.69	88:41.6	156.45	83.75	119.2	.4359	90 - 98
								.4244	98 - 105
								.4496	105 -
8	106	.0094	95.69	88:44.3	153.04	84.02	137.4	.4653	106 - 115
								.4404	115 - 121
								.4468	121 -
9	122	.0090	95.69	88:39.4	150.21	83.67	133.1	.4476	122 - 131
								.4364	131 - 137
								.4440	137 -

SECRET/H

BEST FIT EPHEMERIS
SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
10	139	.0090	95.69	88:44.5	152.35	85.23	136.3	.4853	139 - 147
								.5117	147 - 153
								.5698	153 -
11	155	.0087	95.69	88:39.4	149.34	84.77	132.4	.5943	155 - 163
								.5576	163 - 170
								.5432	170 -
12	171	.0091	95.69	88:43.2	152.43	84.84	133.2	.5581	171 - 179
								.5031	179 - 186
								.5146	186 -
13	188	.0087	95.69	88:37.2	148.95	84.27	128.7	.5239	188 - 196
								2.3771	196
								.5085	196 - 203
								.5227	203 -

Table 2.5-4

~~SECRET/H~~

~~SECRET/H~~

BIF-107W-71014-73

2.5.2 Telemetry and Mode Processing

2.5.2.1 Transponder

The transponder pre-emphasis was changed to improve the real time subcarrier at the expense of the tape recorder. To protect against loss of recorded data, the recorder readout is delayed until the RTS real time signal strength is above -100 dbm. Improved acquisition of real time and satisfactory tape recorder readout has been obtained.

A number of RTS contacts where inability to lock on in range at the nominal 0.1 radian modulation index resulted in general use of the 0.3 radian mod index for ranging.

2.5.2.2 Mode Processing

The telemetry modes to support SV-5 operations had been validated prior to the Dress Rehearsal. Modifications to selected series of Modes were started to provide improved diagnostic capability.

1. The 17 X series Modes (170, 171, 172, 173) have been merged into the 1X7 modes (117, 127, 147, 157) to provide an improved attitude control diagnostic capability in one mode. Only mode 127 has been validated and sent to the RTS.

2. The 16X series modes (160, 161, 162, 163) have been merged into the 1X6 modes, deleting the ACS dump and adding the Lifeboat and Orbit Adjust diagnostic and dump capability to block 3. Only mode 126 has been validated and sent to the RTS.

3. Mode 148 was changed to incorporate ECS monitors in Block 4, however, this was difficult to read. A new mode 115 was made to provide this function and mode 148 block 4 (ECS monitors) will not be used.

2.5.2.3 VHIST

An occasional 1 millisecond time offset in mode 11 was noted. Investigation of the problem is in process.

2.5.2.4 RMT's

Three times during the RMT commanding after command message loading an incomplete was experienced. The problem was determined to be a RTS problem and was fixed by octal correctors.

2.5.3 Command Message Planning

Modifications to the FPA were made during this segment only to clarify existing FPA pages so that message generation would be easily facilitated.

2.5.4 SCF Support

SCF operations during the RV 1 segment provided excellent support including rapid response to anomaly situations. The major shortcoming was the Rev 1 INDI contact where search procedures and eventual side lobe lock-on provided marginal support for telemetry reception and commanding and resulted in no tracking data for early orbit determination.

2.6 PROGRAM COMMAND SOFTWARE PERFORMANCE
(Prepared by Computer Program Associate Contractor - HTC)

2.6.1 Command Message Summary

This section summarizes pertinent command message data from Mission 1205 IRON 8410. The command messages discussed cover the period from the pad load to the RV 1 recovery message (Rev. 192 load).

One hundred forty six command messages were received by the Technical Advisor (TA) Staff. One hundred thirty nine were accepted and seven were rejected. The rejected messages were subsequently altered or regenerated and loaded into the vehicle. The reasons for rejection of the seven messages are summarized below:

Rev No. and Load Station	Reason for Rejection
15 POGO	A command was not properly set from status. NOTE: SPR 5099
22 BOSS	TT/C+ command within 1.8 seconds of TT/C-.
23 POGO	TT/C+ command within 1.8 seconds of TT/C-.
45 GUAM	The duration of the specified MOP was too short.
57 COOK	A command conflict between STI+ and OB+ caused the OB+ command to be moved. The new execution time for OB+ resulted in a constraint violation.
65 POGO	A manual station contact did not contain redundant decoder commands because sequence 104 had not been manually requested.
110 GUAM	ES records were inadvertently omitted from the message.

One hundred thirty six command messages were loaded and ten were not for the reasons stated below:

1. The seven messages requiring alters were not loaded.
2. An FA engineering test was rescheduled, therefore the Rev 15 POGO message was not loaded.
3. An RV1 recovery message was generated for loading on Rev 176 POGO. However, the recovery was delayed, thus the message was not loaded.
4. One contingency VBE message was generated, not needed therefore not loaded.

A one rev load cycle was employed while the vehicle was over the area of interest. The add-on message generation and loading philosophy was in effect. This resulted in the generation of ninety add-on messages.

2.6.2 'TUNITY Software Problems

The Flight 5 'TUNITY software problems itemized below pertain only to the period from launch through RV1. They have been grouped into the following categories to demonstrate their impact on the flight. The disposition of these software problems will be specified by the Configuration Control Board.

Category	No. of SPR's	Comments
Flight Critical	4	Software corrections were made and incorporated during this flight period.
Non-Flight Critical (Requiring Work-Around)	3	Work-around procedures were developed and implemented
Non-Flight Critical (Minor)	2	Work-around procedures were not required.
Product Improvement or New Requirements	1	To be considered during future development.
Documentation Error	1	Milestone 7 affected.

SPR MBR-5099 ('TFUNOPT) FLIGHT CRITICAL

- Problem Description: In message 180, sequence 159 was executed and command number 7440 executed rather than 7450,the difference being that an expected status fill did not occur. Part of the command in question was T THERM(-) which should have been T THERM(+) because it was commanded (+) immediately prior to the sequence via an SPC.

- Solution or Work Around: The problem was determined to be flight critical because of its potential effect on other commands that are status filled. An alter to the message was required. A change was made to 'TRANS correcting the problem and was incorporated on the Flight Aux Master.

- Operational Impact: The message had to be altered when it was discovered that the command in question was in error. With the implementation of the new mod of 'TRANS, the problem has been solved.

SPR MBR-5100 ('TLIST/'TOREP) FLIGHT CRITICAL

- Problem Description: The 'CFC that is output in CMG differs by approximately one second from the 'CFC that is output by both CMU and MPR. 'CFC is only used as a display and 'TUNITY does not use the output 'CFC in its calculations. However the 'CFC output by MPR on the transmission tape is used by the customer in their processing.

- Solution or Work Around: The problem was determined to be flight critical because the MPR TT tape header had to be manually changed before it could be used by the customer. Changes were made to 'TLIST and 'TOREP correcting this problem and were incorporated on the Flight Aux Master.

- Operational Impact: The TT tape header was manually changed to advise the customer that the values were incorrect. With the implementation of the new mods of 'TLIST and 'TOREP the problem has been solved.

SPR MBR-5101 ('TBALL)

- Problem Description: In message number 510 for Rev 56 cook the verified WX request message did not accurately reflect a merged weather request. This occurred in 2 of 3 possible cases for that message.

- Solution or Work-Around: Cells missed by the reduced weather request should not be counted down because they are not photographed with the desired overlap. For this reason the requests were allowed to remain unchanged. This problem is being worked with its full implications to be delivered at a later date.

- Operational Impact: None

- Comment: It is a software problem, the solution is known and should be fixed at the first opportunity not involving a flight.

SPR MBR-5102 ('TFCOM)

- Problem Description: 'TBAT builds DEA's based upon vehicle altitude as a filter item, 'CAMMHT. MPR recomputes a value ('TYMALT) for each WAC cell, that is defined as vertical altitude at cell acquisition time, for MPE for countdown purposes. The value calculated by MPR is not in total agreement with what would be expected based on 'TBAT acquisitions.

- Solution or Work-Around: The use of altitude as an acquisition filter was being used to prohibit ascending photography. The time of year has made it possible to use a sun elevation angle to accomplish the same effect. A solution is being pursued by the SOST and in the interval the sun filter is used as an alternate to prevent ascending photography at the south pole.

- Operational Impact: If altitude is used for a filter, WAC cells that were taken and should be counted down will not be counted down properly.

SPR MBR-5103 ('TFIELD) FLIGHT CRITICAL

- Problem Description: When SL data cards are input in multiples of 5 (5, 10, 15 etc.) the last four cards do not take affect causing the possibility of commanding the improper slits.

- Solution or Work-Around: The problem was determined to be flight critical. A change was made to 'TFIELD correcting the problem and was incorporated on the Flight Aux Master.

- Operational Impact: When the problem occurred the message was regenerated duplicating the 5th card making a total of 6 cards for the rev. With the implementation of the new mod of 'TFILED the problem has been solved.

SPR MBR-5104 (Data Base Handbook)

- Problem Description: After investigation of the Data Base Handbook, data blocks 'CBS and 'TDO are missing making this document incomplete.

- Solution or Work Around: None

- Operational Impact: None

- Comment: The Data Base handbook should be updated to include the missing data blocks.

SPR MBR-5105 ('TFUNOPT/'TBLOCK)

- Problem Description: Sequence 90 was inadvertently called out to execute inside the 134 POGO cone which also happened to be the loading station. The complete sequence was assembled when called and 'TBLOCK gave no alarm that the commands were within the station cone nor did 'TFUNOPT attempt to deconflict the commands out of the station cone.

- Solution or Work-Around: Care should be taken so that sequences are not manually called out in a load station cone.

- Operational Impact: The message that contained the sequence in the station cone had to be altered to remove the offending commands.

- Comment: This SPR should be considered as a product improvement item for a future software delivery. No provisions exist to conflict the commands out of the cone because the on commands for that station are deleted since they are before load time.

SPR MBR-5106 ('TOTEM)

- Problem Description: When sequence 256 contains biases from reference time for [redacted] "ON" and [redacted] "OFF" (it normally does), the conflicting logic between Beacon and [redacted] fails to work properly. Data base items comparable to 'COXSIB and 'COXEIB are necessary, plus a piece of logic in 'TOTEM to check for these items and set "OFF" and "ON" times accordingly.

(b)(1)
(b)(3)

- Solution or Work-Around: Do not use the conflict logic in 'TOTEM and construct the Beacon Circles so that they do not conflict with 'TOTEM or 'TSTAGEN.

- Operational Impact: None

- Comment: It is a software problem, the solution is known and should be fixed at the first opportunity not involving a flight.

SPR MBR-5107 ('TFRTFIX)

- Problem Description: Abort 50 percent of the ST FRT times entered in the 'TMHTAB over rev span 128-144 were in error (different from the raw 'TMB Data) by one clock step (.2 of a second). 'TFRTFIX appears to have dropped one bit from the 22-bit octal frame times, thus passing incorrect ST frame times to the MPR.

- Solution or Work-Around: It was discovered that 'TELOP was subtracting one clock step from the 22-bit octal frame time if the 8-bit vernier time was of greater than a data base item. The data base item was set to a value such that the 8-bit vernier would never be larger and the problem was solved.

- Operational Impact: The user had to be informed of which ST FRT times were in error so that the bad times could be adjusted manually.

- Comment: The logic in 'TELOP that caused this problem was a special request for MOD1BR software. It appears that this logic is no longer required but the problem is still under investigation.

SPR MBR-5108 ('TAPOUT)

- Problem Description: 'TAPOUT read-in summary for Rev. 150, message number 370 was incorrect. The read-in showed a total of 35 repeats plus a read-in of one repeat (Seq. 90). This should have been processed as 36 repeats.

- Solution or Work Around: None.

- Operational Impact: There was no operational impact other than confusion for the user. All of the required data is there but it is in two lines instead of just one.

- Comment: It is a software problem, the solution is known and should be fixed at the first opportunity not involving a flight.

SPR MBR-5109 ('TPURR) FLIGHT CRITICAL

- Problem Description: CHG aborted attempting to read record 2 of the 'TAE data block.

- Solution or Work Around: The problem was determined to be flight critical because 'TPURR was purging the 'TAE improperly causing a load add of the 'TAE from a previous data base. A change was made to 'TPURR correcting the problem and was incorporated in the Flight Aux Master.

- Operational Impact: The 'TAE data block had to be load added from a data base prior to 'TPURR thus causing a delay in the running of the daily runs. With the implementation of the new mod of 'TPURR the problem has been solved.

2.6.3 Hardware/Software Interface Changes

For IRON 8410, five change requests were processed from launch day through the RV1 recovery message (as shown in Table 2.6.3-1).

These changes were implemented via requests SV5-284 through SV5-288 and have been incorporated in the (2) in-flight data base and hardware/software interface documentation.

Table 2.6.3-1. Summary of Hardware/Software Interface Changes

Request No.	Identification	Effectivity
SV5-284 and SV5-285	I+ and I- commands were deleted from all sequences. These commands were no longer desirable due to an instrumentation malfunction in the pneumatics of the primary camera system. These two requests involved 22 sequences and were applicable to all three files.	SV-5 only.
SV5-286	Decreases the priority of the STI+ command from 1 to 5. The purpose of this change is to resolve command conflicts between STI+ and SSC commands by moving the STI+ command. In command message 520 (57 COOK), an STI+ command bumped an OB+ command resulting in a hardware constraint violation. The above priority change will prevent this from occurring.	SV-5 and nominal data base.
SV5-287	Changes the time bias of the ACS MSTCLR1- command in sequence 300 because it conflicted with the ACS MSTCLR2- command in sequence 299. Sequence 299 is required for SV attitude recovery after RV-5 separate abort with sequence 300 being considered redundant.	SV-5 and nominal data base.
SV5-288	This request concerned a documentation change to the HSLS. It related to ECS and MCS commanding of RV-5 Battery Heater operation and was incorporated into the OOPS policy. It was rejected as an input to the HSLS.	

2.7 SATELLITE VEHICLE AUXILIARY PAYLOAD PERFORMANCE (Prepared by Satellite Basic Assembly Contractor)

2.7.1 EDAP Performance

Solar Arrays were deployed at Rev 0 INDI. Deployment and erection were nominal, and both arrays were positioned to -18° at Rev 1 POGO. (Ref. Figures 2.7-1 and 2.7-2.)

The early deployment offset the additional early rev loads on the electrical system, and K-2's were observed on Revs 3, 6, 7 and 9 thru 20. The main battery/solar array power system performed in a nominal manner throughout Segment 1. (Ref. Figure 2.7-3).

Figures 2.7-4 and 2.7-5 illustrate the main battery discharge load sharing throughout Segment 1. The load sharing was almost equal, with Battery #4 carrying a slightly heavier load.

Figures 2.7-6 and 2.7-7 indicate the predicted power usage per rev, and the battery voltages observed at sunrise. The average voltage throughout Segment 1 was about 28.6, and the average per rev power usage was 21.9 amp-hours.

Figures 2.7-8 and 2.7-9 show the main battery temperatures as observed real time each rev. Battery heater duty cycles during Segment 1 were: Battery #1 - 48%, Battery #2 - 45%, Battery #3 - 16% and Battery #4 - 16%.

2.7.1.1 Main Bus Current and PXXX Monitor

Investigation of Main Bus Current and PXXX Monitors covered from launch through 4455 seconds after launch. C42 current fluctuations were observed and then related to events that were commanded during the fluctuations.

RESULTS

A. Bus Currents After BV/SV Separation

- Bus currents appeared normal from launch to 563 seconds. ECS Clock time.
- At 563 seconds C42 changed from 24 amps to 28.8 amps.
- At 569 seconds C42 changed from 28.8 amps to 33 and then to 35.4 amps.
- At 570 seconds C42 dropped back to 28.8 amps.

These changes in current occurred during a period of no commands and cannot be attributed to heater cycling. Primary payload had I+ throughout this period.

2.7.1.1 Main Bus Current and PXXX Monitor (Cont.)

B. PXXX Monitors

The P200 monitors (pressure) started decreasing rapidly at 564 seconds and the P500 monitors (temperature) started to fluctuate at 564 seconds. These conditions persisted until 2218 seconds when the P500 monitors went to FFFF (high voltage) and then at 2309 seconds when they dropped to zero and stayed there. The P200 Monitors continued to decrease until 4455 seconds when they reached zero.

C. High Bus Currents with I+

It appeared that the bus current level shifted +7 amps when I (Instrumentation Power) and MFA were commanded on. A level shift of about 1.5 amps is normal. The 7 amps continued from 564 seconds to 6159 seconds when it no longer appeared when I was turned on.

2.7.2 TT & C Performance

The SGLS, PCM Telemetry Systems and Tape Recorders have demonstrated satisfactory performance throughout the Segment 1 period. The primary systems have been utilized during this segment with the exception of redundant system use for back up or health checks. The redundant systems were employed in the following instances:

Ascent - Read In Tape Recorder #2, Read Out to BOT on Rev 4

Rev 9 - SGLS 2, PCM 2B - Health Check

Rev 18 - SGLS 2, PCM 2B - MCS Test

Rev 18-21 - Time Word Power Supply #2 - MCS Test

A test of the back-up timer (BUT) was conducted on Rev. 25. The timer period was 546 sec. Spec value is 540 ± 54 sec.

From Rev 105 through Rev 111 range locking problems were encountered at COOK, POGO, GUAM, and BOSS. The RTS's were authorized to change from 0.1 radian to a 0.3 radian mod index, as long as VCTS #1 was in use, provided up-link commanding or downlink telemetry was not downgraded. Range lock thereafter was achieved without further problems.

At Rev 123 HULA and Rev 140 HULA, command rejects were encountered. An RTS uplink problem is suspected since the problem occurred only at HULA.

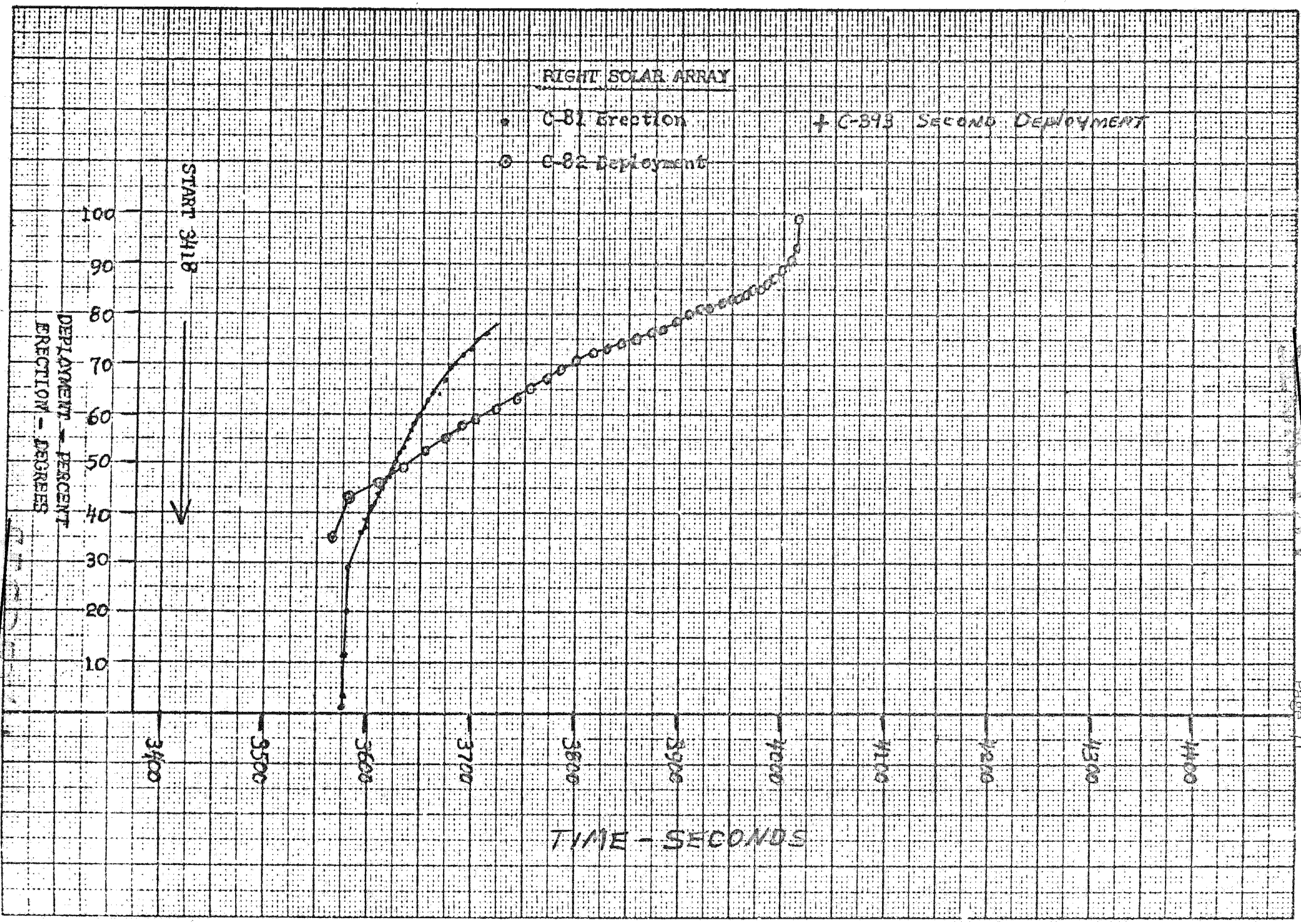

RIGHT SOLAR ARRAY
• C-81 Erection
⊙ C-82 Deployment
+ C-843 Second Deployment
START 3418
DEPLOYMENT - PERCENT
ERECTION - DEGREES
100
90
80
70
60
50
40
30
20
10
3400
3500
3600
3700
3800
3900
4000
4100
4200
4300
4400
TIME - SECONDS

Figure 2.7-1

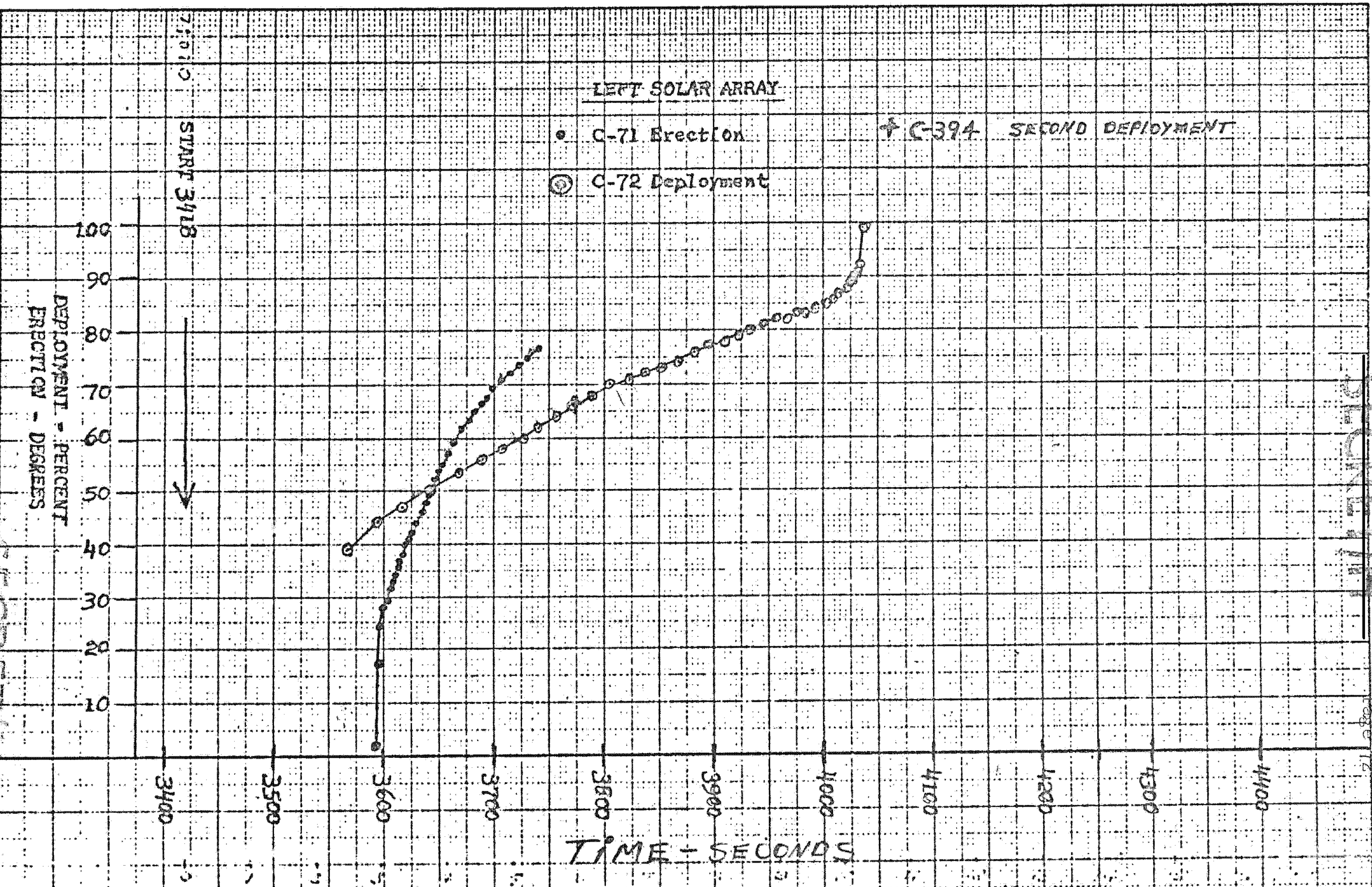

LEFT SOLAR ARRAY
● C-71 Erection
◎ C-72 Deployment
+ C-394 SECOND DEPLOYMENT
START 3418
DEPLOYMENT - PERCENT
ERECTION - DEGREES
100
90
80
70
60
50
40
30
20
10
3400
3500
3600
3700
3800
3900
4000
4100
4200
4300
4400
TIME - SECONDS

Figure 2.7-2

~~SECRET/H~~

POWER CAPACITY

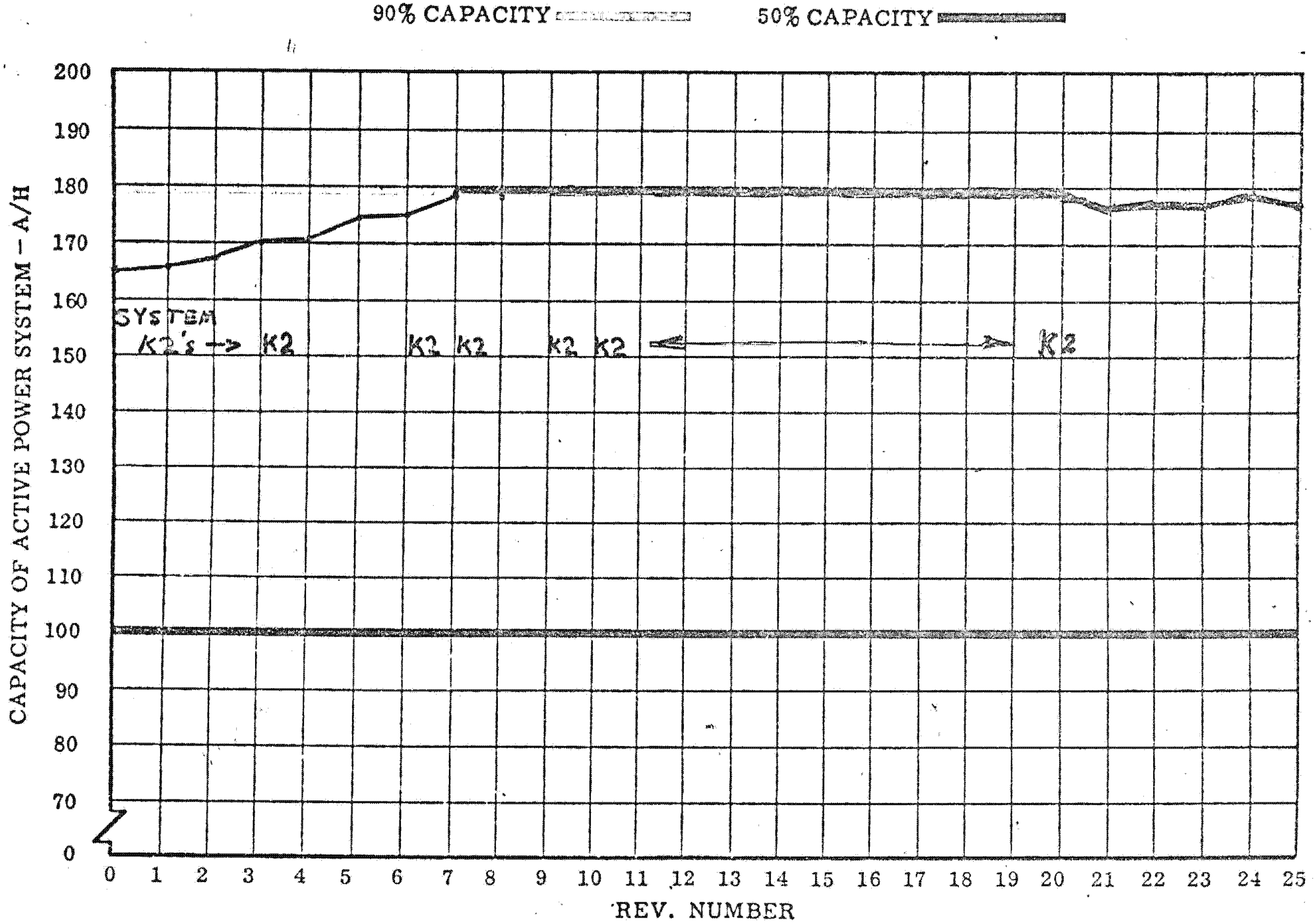


Figure 2.7-3

~~SECRET/H~~

~~SECRET/H~~

POWER CAPACITY

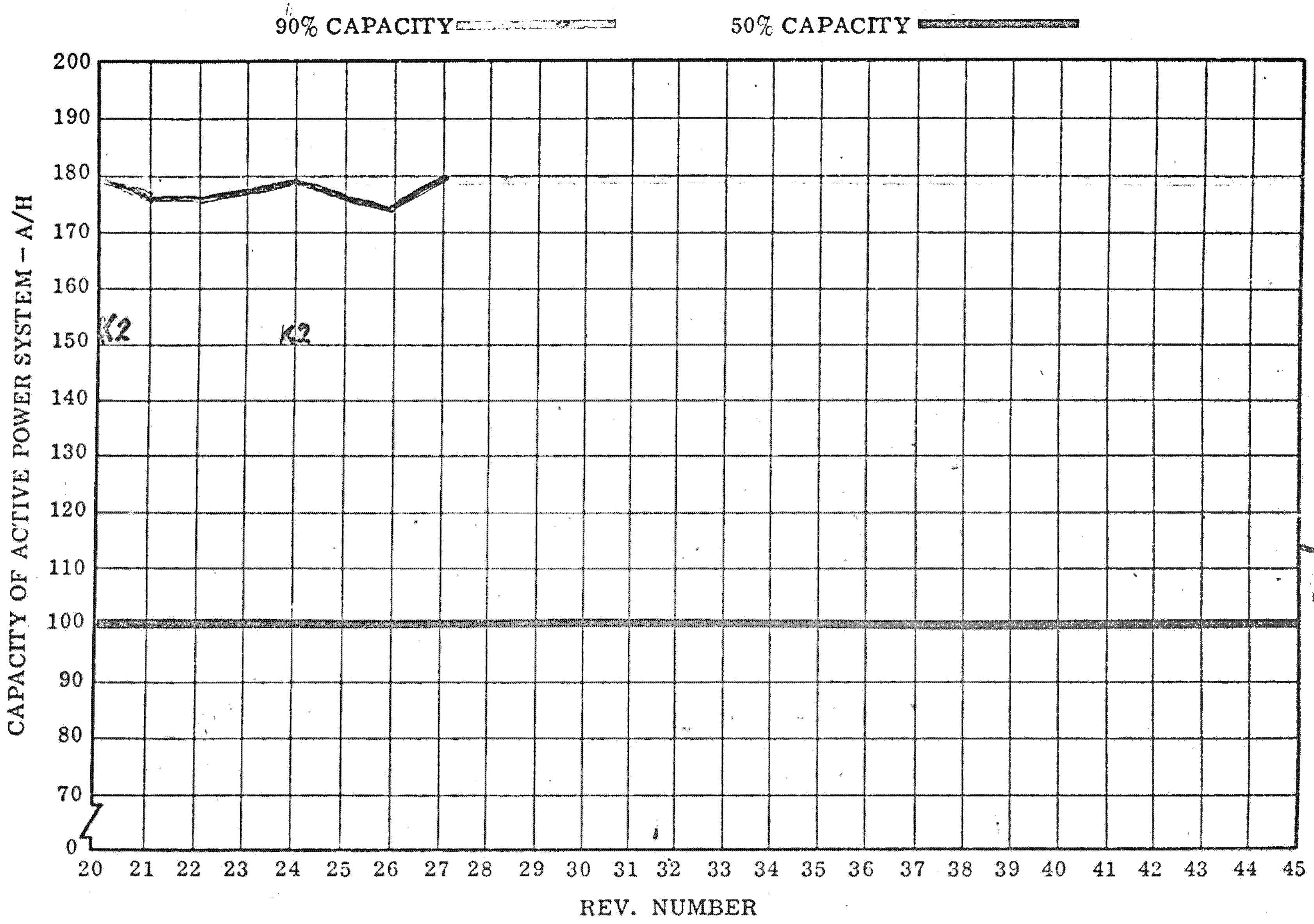
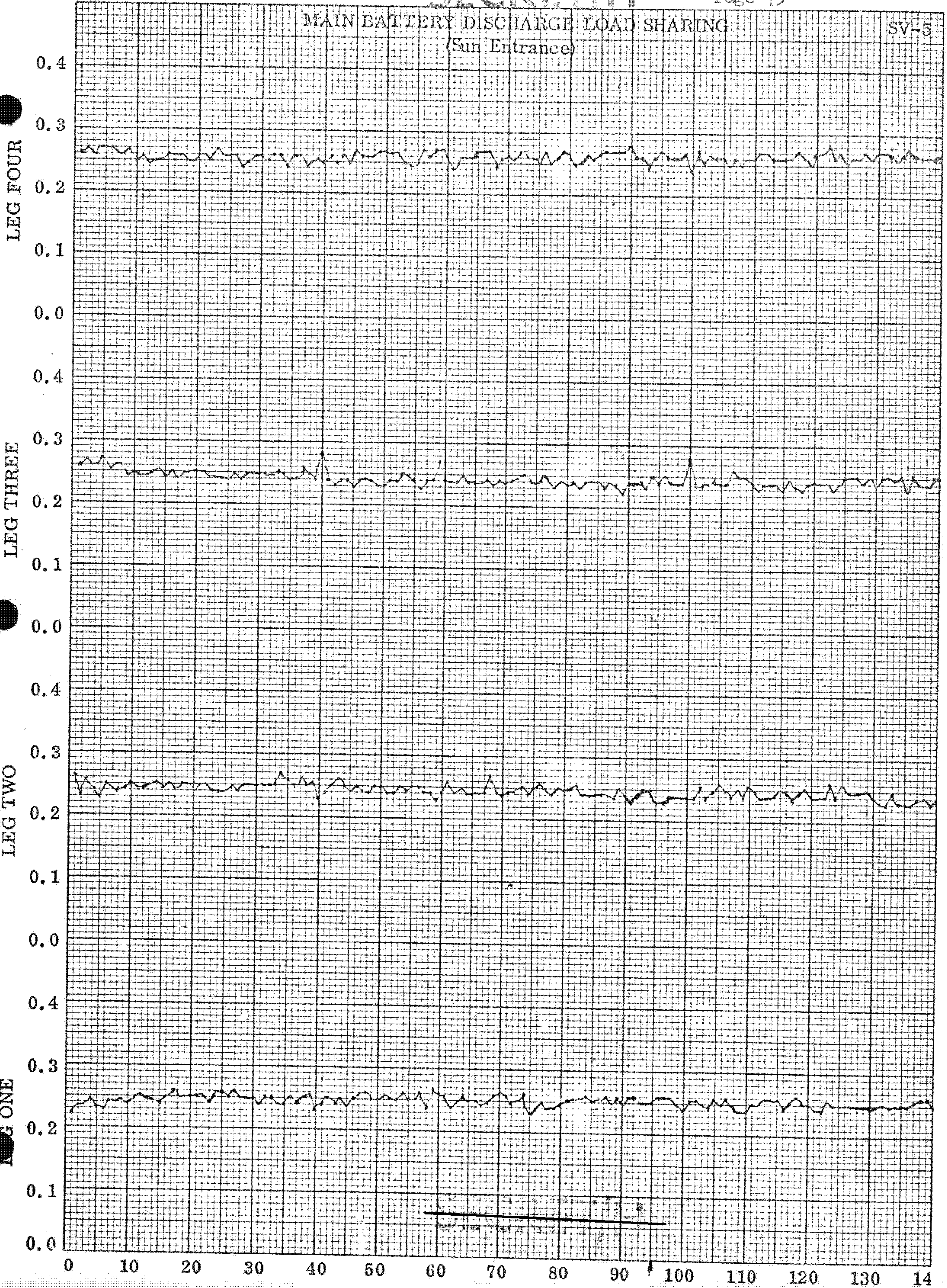


Figure 2.7-3

~~SECRET/H~~



MAIN BATTERY DISCHARGE LOAD SHARING
(Sun Entrance)

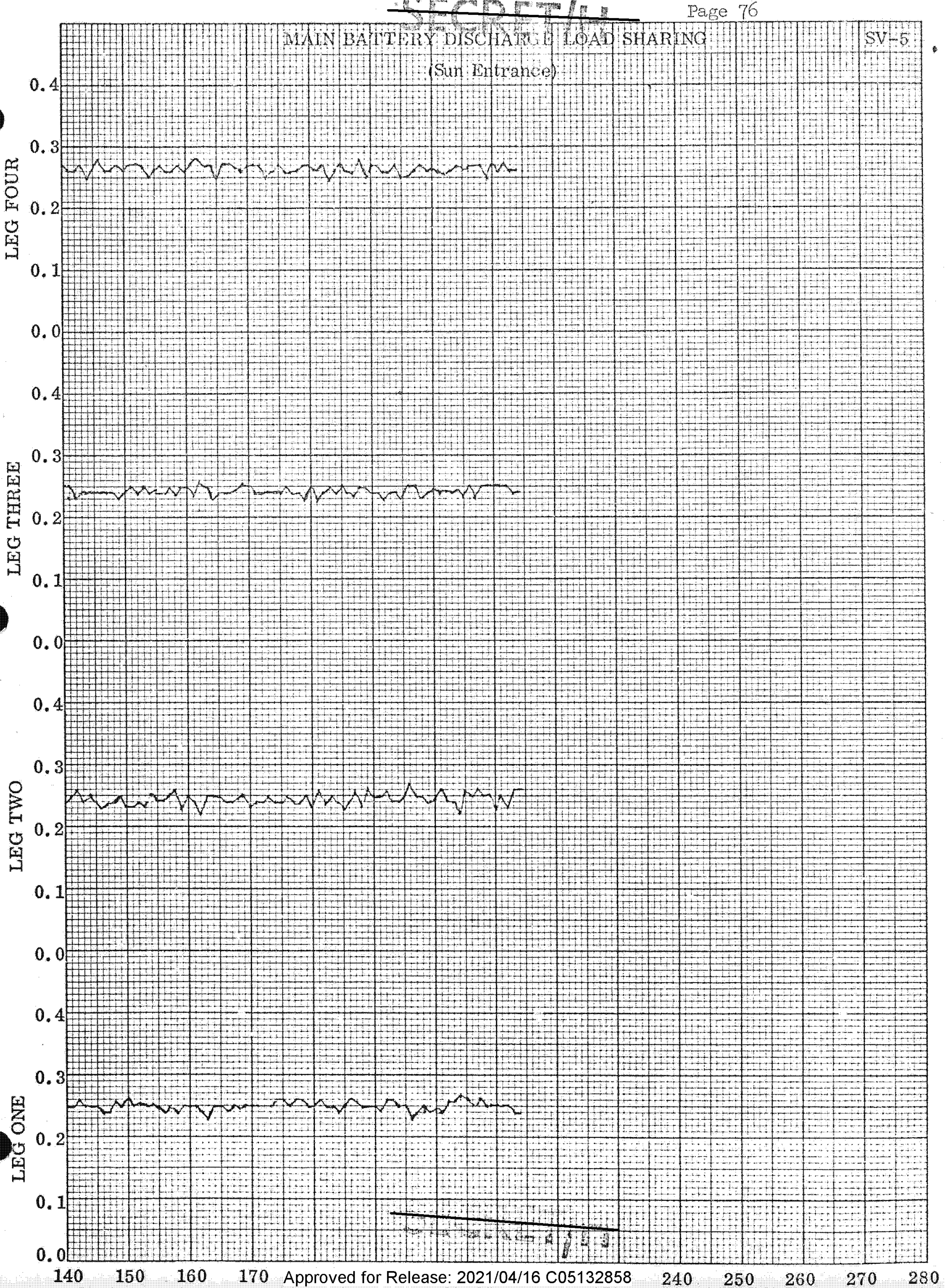
Figure 2.7-4

~~SECRET/H~~

MAIN BATTERY DISCHARGE LOAD SHARING

(Sun Entrance)

SV-5



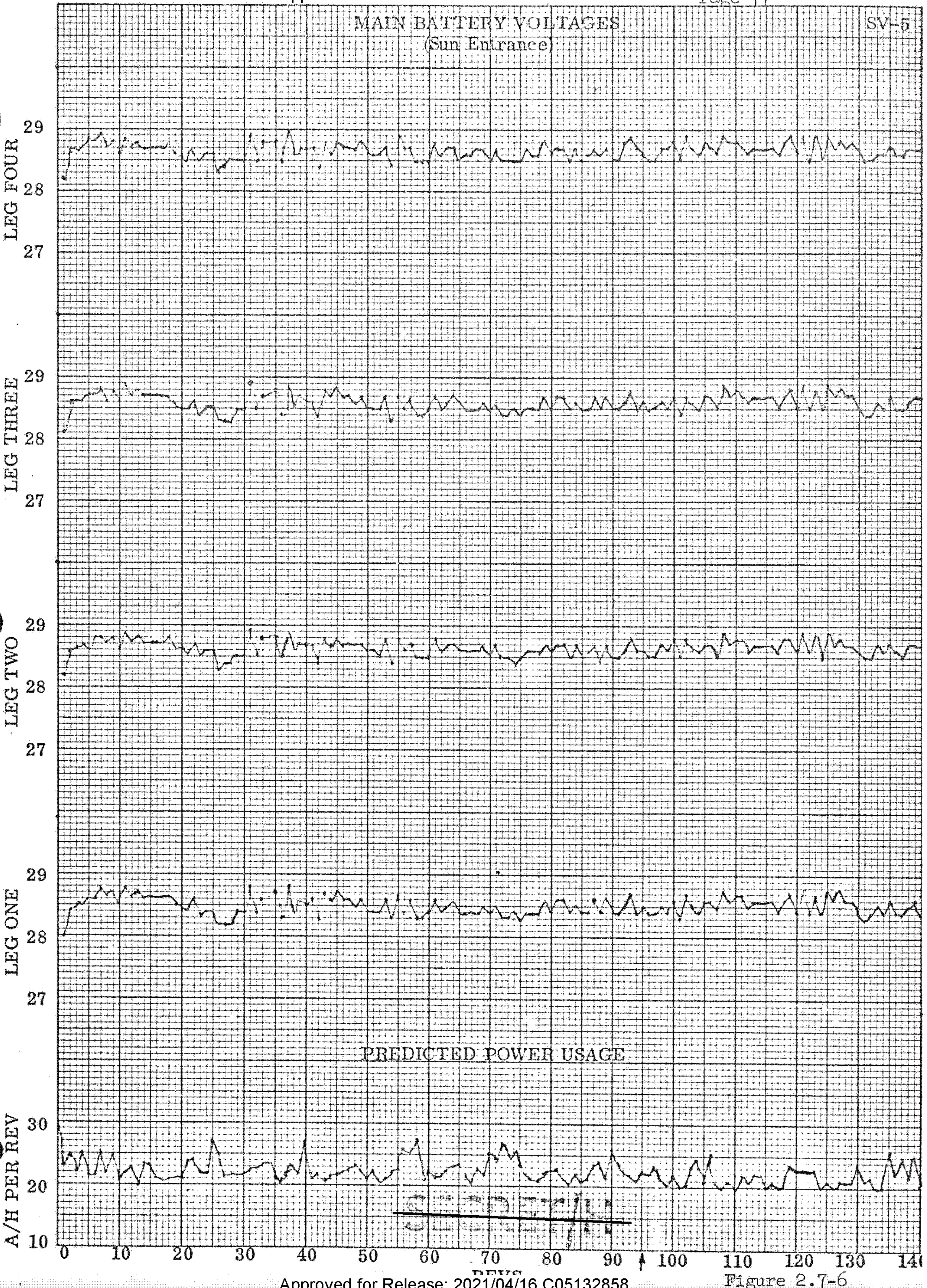

MAIN BATTERY VOLTAGES
(Sun Entrance)
SV-5
LEG FOUR
29
28
27
LEG THREE
29
28
27
LEG TWO
29
28
27
LEG ONE
29
28
27
PREDICTED POWER USAGE
A/H PER REV
30
20
10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
REVS
~~SECRET/H~~

Figure 2.7-6

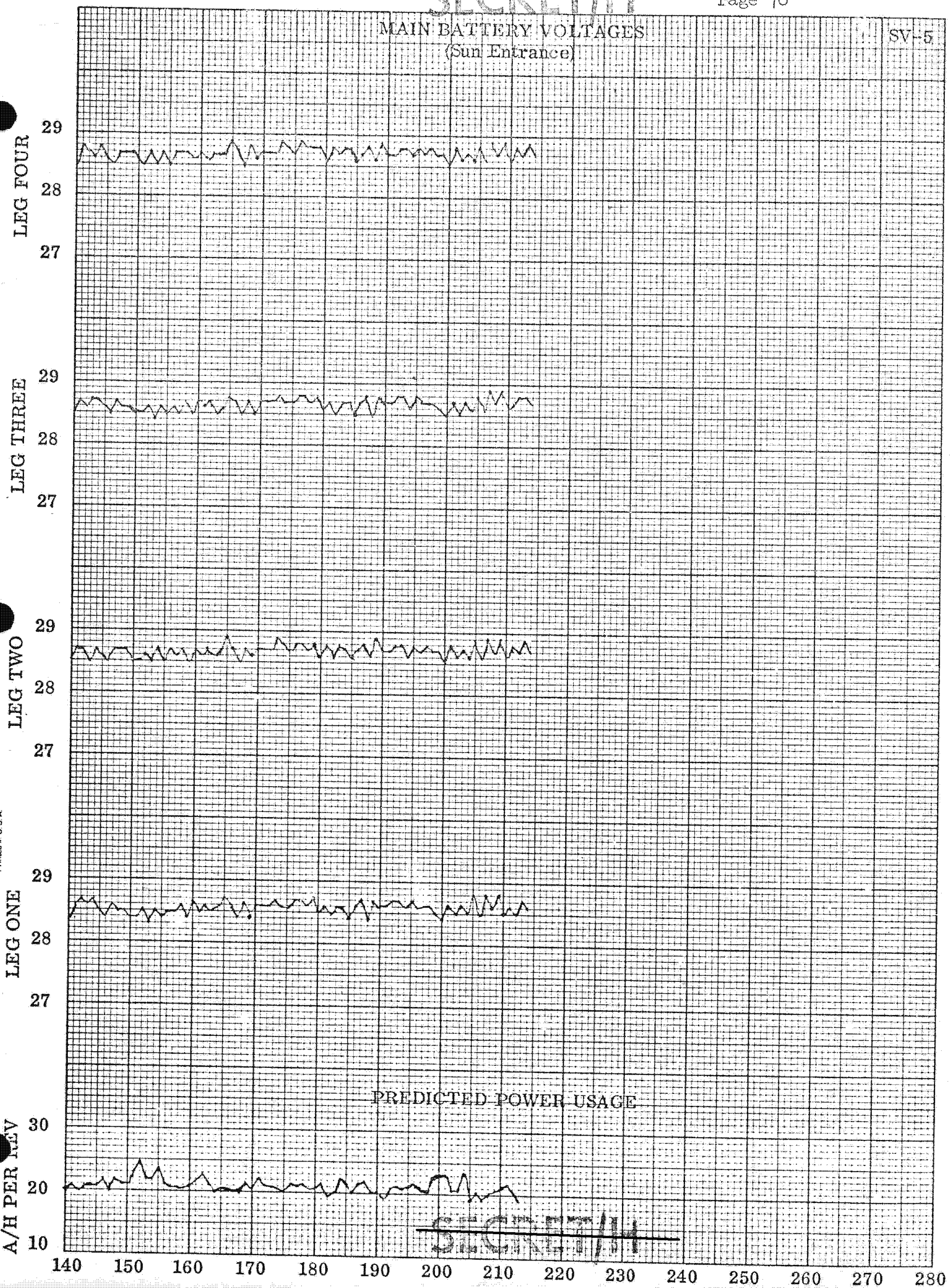
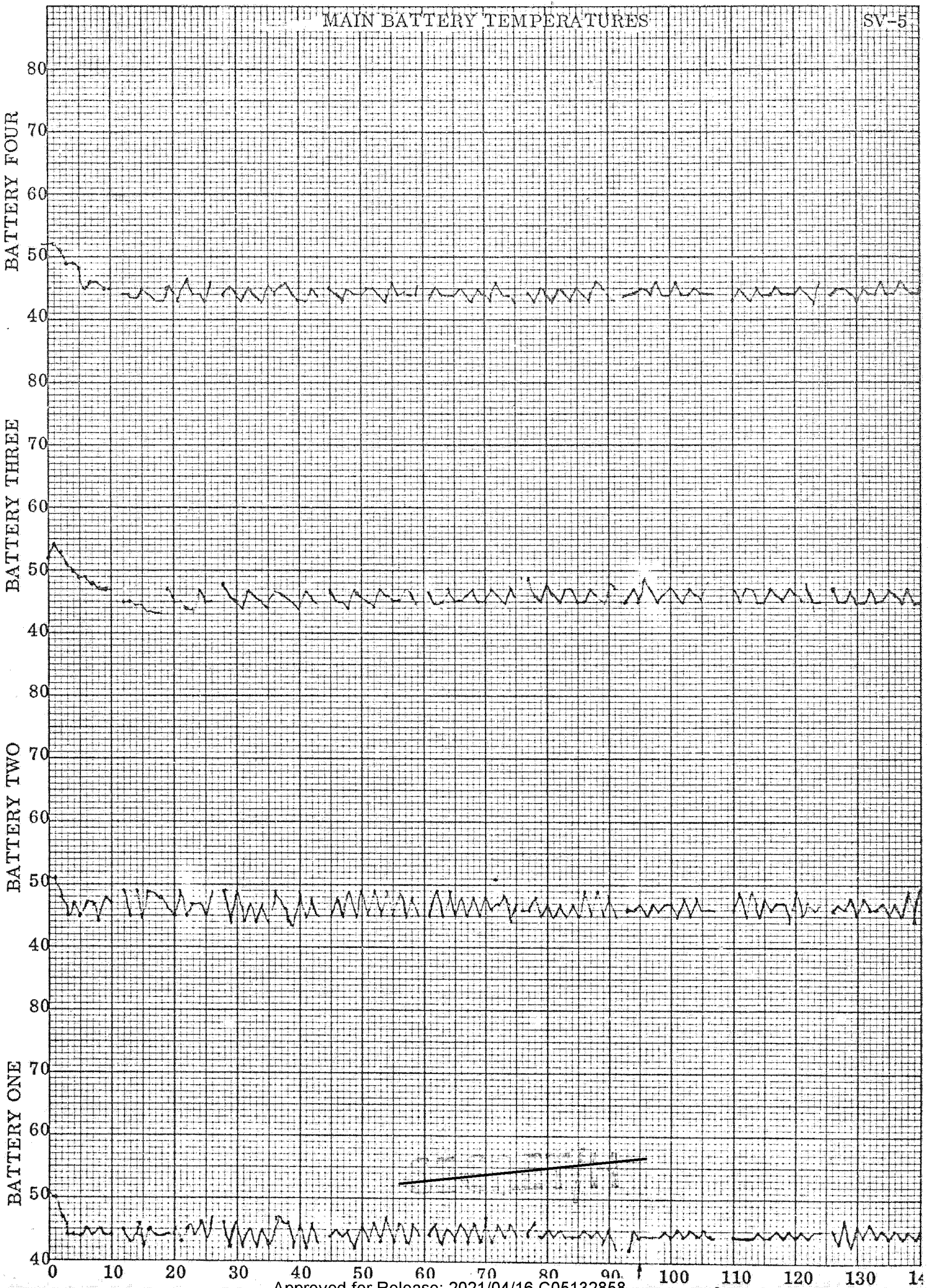

MAIN BATTERY VOLTAGES
(Sun Entrance)
SV-5
LEG FOUR
29
28
27
LEG THREE
29
28
27
LEG TWO
29
28
27
LEG ONE
29
28
27
PREDICTED POWER USAGE
A/H PER REV
30
20
10
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280

Figure 2.7-7


MAIN BATTERY TEMPERATURES
SV-5
BATTERY FOUR
80
70
60
50
40
BATTERY THREE
80
70
60
50
40
BATTERY TWO
80
70
60
50
40
BATTERY ONE
80
70
60
50
40
0
10
20
30
40
50
60
70
80
90
100
110
120
130
14

gure 2.7-8

MAIN BATTERY TEMPERATURES

SV-5

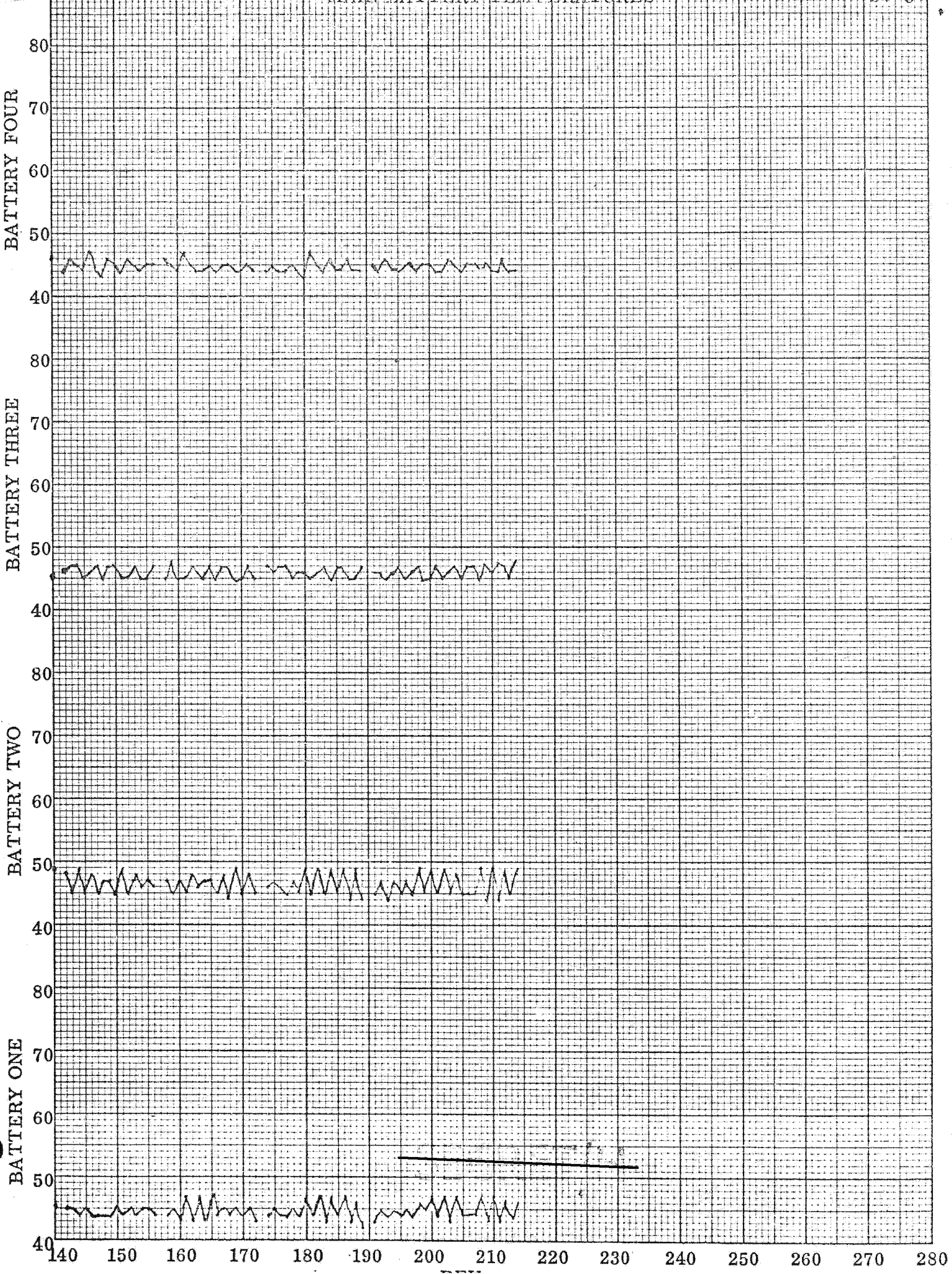


Figure 2.7-9

2.7.3 ACS/RCS Performance.

The Attitude Control System and the Reaction Control System performed within specification throughout Segment One. Both the Primary ACS and the Redundant ACS were on from lift-off with the Primary ACS controlling the SV through the Redundant RCS. Gyro temperatures leveled off approximately 20°F lower than the gyro temperatures seen on SV-4, primarily due to the change in Beta Angle.

One anomalous condition was exhibited with the Redundant ACS. The H/S inhibit monitor (D153) showed inhibit "on" following Rev 66 (P) through Rev 67 (P) with normal inhibit "off" on Rev 68 (P). The normal inhibit "off" has been noted on all subsequent Revs. The absence of data during the changes of state and subsequent normal performances indicates the anomalous condition was random in nature.

The RCS performance was nominal throughout segment one. Propellant Consumption was 52.3 lbs. Figure 2.7-10 shows that consumption rate followed very closely a prediction of 4 lbs. per day.

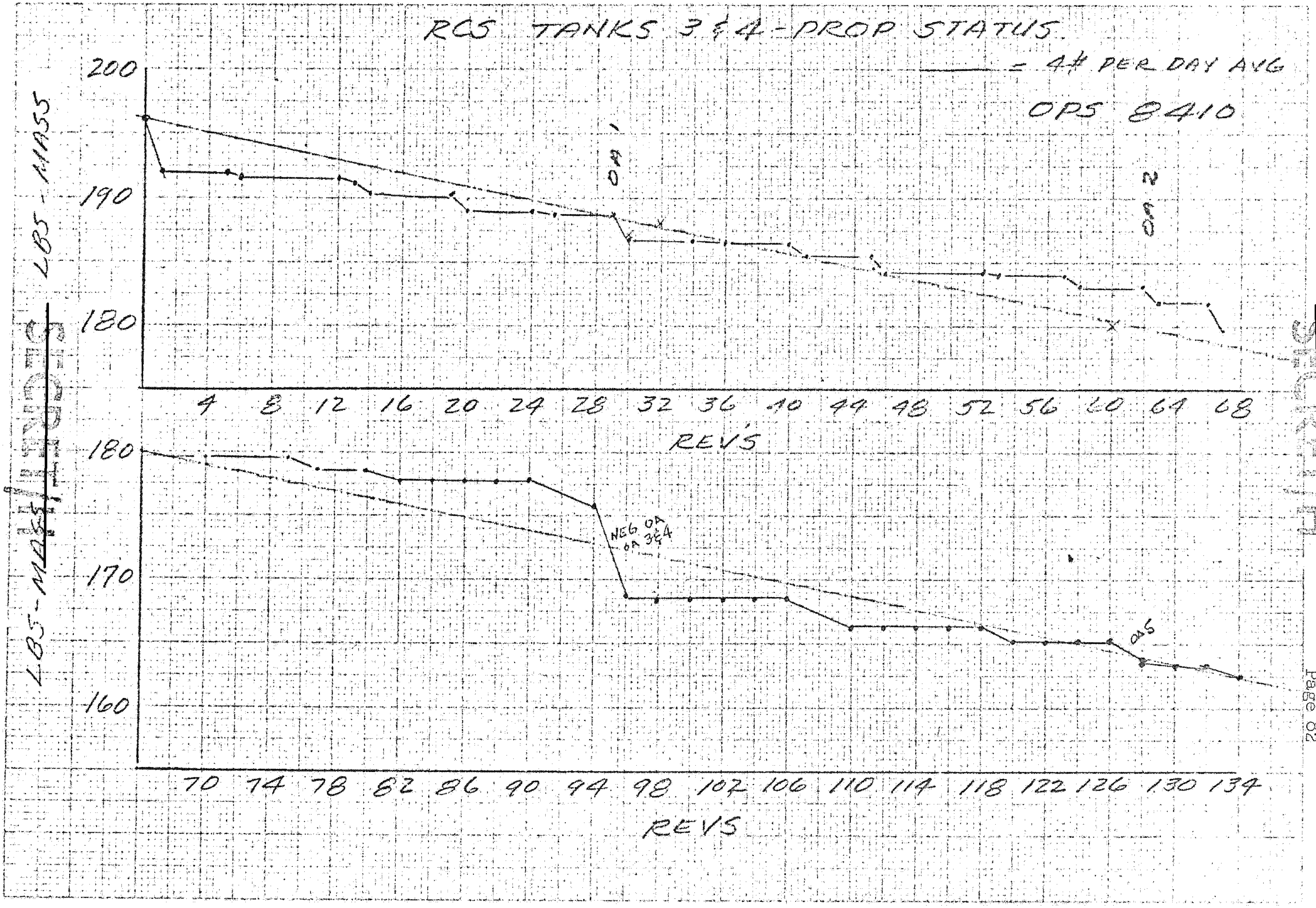
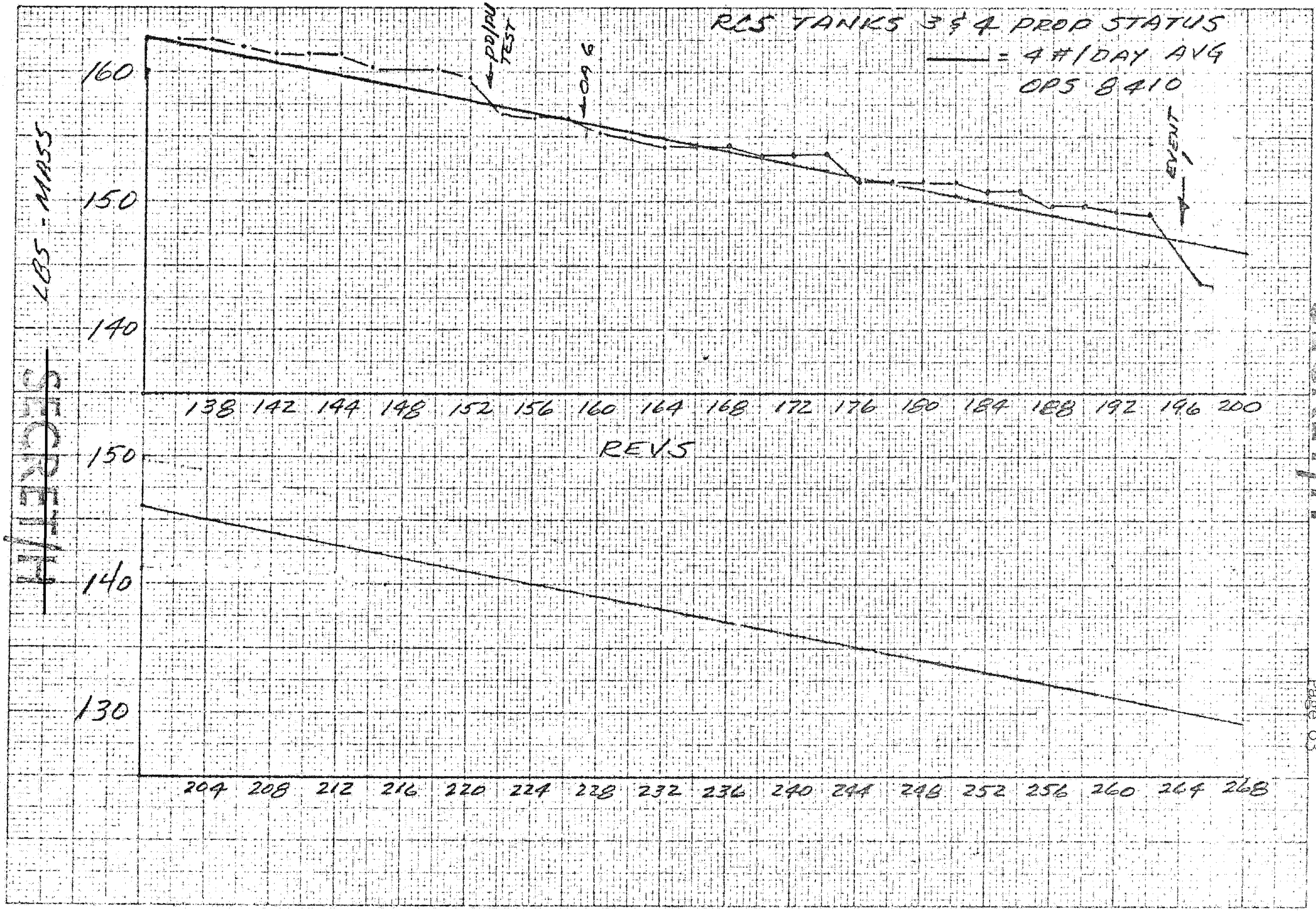

RCS TANKS 3&4-PROP STATUS
——— = 4# PER DAY AVG
OPS 8410
LBS - MASS
200
190
180
OA 1
OA 2
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60
64
68
REVS
LBS-MASS
180
170
160
NEG OA
OA 3&4
OAS
70
74
78
82
86
90
94
98
102
106
110
114
118
122
126
130
134
REVS

Figure 2.7-10



SECRET/H

SECRET/H

BIF-107W-71014-73
Page 83

2.7.4 Orbit Adjust System (OAS) Performance.

The OAS functioned normally throughout Segment 1. The system was used six times consuming 28.5 lbs more propellant than was predicted by the preflight mission length study. At the end of Segment 1, the propellant margin was 177 lbs, allocating 300 lbs for deboost (approx. 150 fps.).

ORBIT ADJUST SUMMARY

OA No. (Pos/Neg.)	1 (Pos)	2 (Pos)	3 (Pos)	4 (Neg)	5 (Pos)	6 (Pos)
Day	2	4	6	6	8	10
Rev.	30	62	94	96	127	159
Delta V-Predict (fps)	7.89	22.43	29.97	-18.85	15.65	14.85
Delta V- CAS (fps)	8.04	22.90	30.63	-19.04	15.97	15.18
Burn Duration (sec)	22.0	62.0	83.2	52.8	45.0	43.0
Propellant Used (lbs)	23.0	62.1	83.3	52.7	43.7	41.4
Avg. Tank Temp. (^oF)	76.0	76.5	76.6	76.6	77.25	77.50
Avg. Tank Pressure (psia)	289.0	280.0	275.0	262.5	251.5	246.5

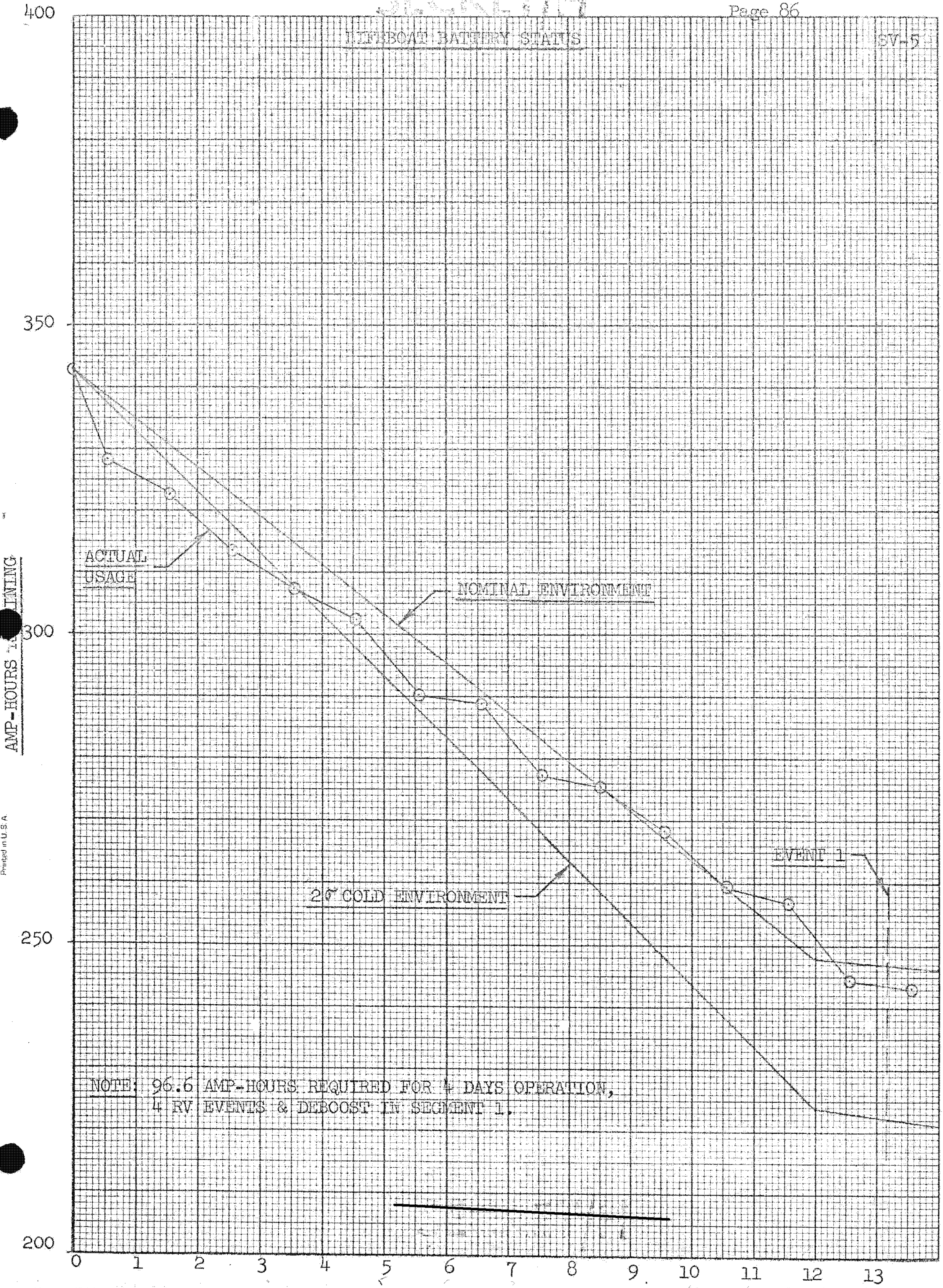
2.7.5 Lifeboat II Performance

The Lifeboat II system was activated on Rev 18 for the normal early Rev health check. Analysis of the LB magnetometer data and the predicted outputs indicated that the system performance was nominal and therefore operational.

Since two of the main batteries (Type 29) were relocated to Bay 10, in close proximity to the LB magnetometers, the LB system was activated on Revs 45 and 46 at five selected positions in the orbit to evaluate and calibrate the magnetometer outputs as influenced by battery current flow. In addition on Rev 47 and 61 the system was activated during a period of maximum current load and again at a position of vehicle inactivity, but maximum charge rate. On Rev 158 the system was enabled during a quiescent period to provide additional data to maintain a history of LB systems performance.

In addition to the above, the Lifeboat system was enabled on Rev 196 during the recovery maneuver. The system functioned normally throughout all the above periods.

The Lifeboat tank heaters were turned on after orbit injection and remained on (under thermostatic control) until after recovery of RV1. The tank temperatures were maintained between a maximum of 181° and a minimum of 161° providing the required impulse capability throughout Segment 1. Approximately 98.4 amp-hours of L/B II battery capacity was used during Segment 1. Operation of the L/B II electrical system was nominal as indicated in Figure 2.7-11.



NOTE: 96.6 AMP-HOURS REQUIRED FOR 4 DAYS OPERATION, 4 RV EVENTS & DEBOOST IN SEGMENT 1.

Figure 2.7-11

2.7.6 Doppler Beacon System

On Rev 12, the Doppler Beacon System antenna deploy commands were executed and the system turned on. Reports from receiving stations indicated that system performance was nominal.

Playback data subsequent to antenna deployment indicated that the antenna did not deploy. The Antenna Position Monitor S750 has indicated 2.38vdc (stowed position) for the duration of the mission. The data being received by the 38 TRANET tracking stations is of good quality; however, some loss of data occurs on overhead or near overhead passes due to a sharp cutoff of the Beacon signals shortly after the vehicle passes overhead. This substantiates the fact that the antenna is not deployed and is being shielded by the vehicle.

The system was on continuously until Day 11, when use of program 'TDERBY was initiated to turn the system off when the vehicle was outside receiving station circles.

2.7.7 Thermal

2.7.7.1 Overall SBA

Forward Section temperatures were in good agreement with predicted nominal values for a BETA -8° orbit. The average temperature of the APSA enclosure was within 3°F of the predicted nominal value. The Thermal environment, provided to the primary payload by midsection structure, was nominal as indicated by an active thermal reference temperature that ranged from 69 to 71°F. Aft section thermal performance was nominal with batteries on their heater/thermostat control systems. Both IRA systems were continuously powered throughout Segment 1 without exceeding maximum allowable gyro temperatures. Figure 2.7-12 shows the Thermal Performance summary of Critical SV 5 areas.

2.7.7.2 Midsection Control (TCEA)

The performance of the TCEA thru Rev 196 was nominal. Temperature of all zones were controlled within 1.0°F of the reference temperature.

2.7.8 Tertiary Payload - [redacted]

A DBS [redacted] interference problem was experienced from Revs 12 (DBS on) through 192. This problem was resolved by alternately commanding the two systems.

(b)(1)
(b)(3)

B-3 and [redacted] have performed nominally throughout the flight.

(b)(1)
(b)(3)

Fig

THERMAL PERFORMANCE SUMMARY OF CRITICAL SV5 AREAS

AREA	MONITOR ID	REQUIREMENT (°F)	FLIGHT DATA FROM 1st DAY (°F)	STABLIZED FLIGHT DATA (°F)
PCM RU (BAY 2)	H022	-30/170	77/82	74/83
IRA GYROS	D080→D085		138/166	157/165
HS HEADS	D090→D093	0/130	75/81	77/79
TAPE RECORDER	H080	20/120	72/88	68/78
ECS	H246	-40/145	85/88	81/84
MCS	H349	-40/149	50/61	45/47
PCM RU (BAY10)	H026	-30/170	66/75	60/75
OAS TANK	B521, B542	70/100	75/78	77/82
RCS TANKS	B101→B104	35/140	66/78	74/86
HYDRAZINE PLUMBING	B151, B153	35/140	74/89	80/92
$\overline{T}_{TCA}$ (MID SECTION)	N/A	49/91	69.6/72.3	69/71
$\overline{T}_{FWD}$ (FWD SECTION)	N/A	47/93	62/68	64/68

Figure 2.7-12

~~SECRET/H~~

~~SECRET/H~~

2.8 MAPPING CAMERA OPERATIONS THROUGH REV 196
(Prepared by Mapping Camera Contractor - NEC)

2.8.1 Mission Performance

The mapping camera subsystem was successfully removed from the Ascent Mode shortly after BV/SV separation. (Power is applied to some of the mapping camera subsystems during the ascent phase of the flight.) A health check of the mapping camera was made on Rev 8 COOK. The telemetry data indicated the terrain thermal shutter was not opening. An engineering test on Rev 13 GUAM was run confirming non-operation of the thermal shutter. A subsequent engineering test at 16 COOK indicated normal operation. The mapping camera was released for mapping requirements on Rev 20.

Recurrence of the thermal shutter problem occurred on Revs 39, 90 and 91. During the failure on Rev 90, the thermal shutter also failed to close. Telemetry data indicated the thermal shutter operation was critical to cold temperatures. Mapping camera operations were restricted to below 50° N Lat. No subsequent thermal shutter problems occurred.

On Revs 59 and 72, the terrain platen press monitor indicated the platen press did not press during the terrain exposure for three (3) frames. However, the mapping camera current monitor indicated normal operation of the platen press. The failure indications were attributed to an intermittent platen press telemetry switch.

56 mapping camera operations were executed through Rev 196, including five (5) engineering diagnostic runs on Revs 8, 13, 16 and 97. Total inflight mapping camera frames taken was 952. Total footage transported into RV-5 included 1626 feet of terrain and 913 feet of stellar.

Operations over the BAR XC calibration range in Arizona were taken on Revs 178 and 243.

Mapping camera operations were inhibited during rev spans 42-44 and 97-99 during the thermal shutter problem evaluation.

The mapping camera configuration at liftoff was as follows:

	Terrain	+Y Stellar	-Y Stellar
Lens Number	003	006	007
Reseau Number	14	17	23
Focal Length	12.043 in.	10.044 in.	10.361 in.
Filter	W21	None	None

	Terrain	Stellar
Film Type	3400/3401/2403	3401
Film Footage	3263/ 22 / 10	2036
Spool Number	091	054

2.9 RV-5 (Prepared by RV-5 Contractor - OPC)

The telemetry measurements indicated that the RV-5 system status (Temperatures and discrete monitors) remained within specification limits during the first phase of the mission.

SECTION 3

3.0 ORBIT PHASE REV 197 THROUGH RV-2 RECOVERY

3.1 Summary

Normal mission photography with the panoramic camera was resumed after RV-1 recovery and continued throughout this segment. ST camera continued with operations restricted to below 50° N. Lat. at the start of the segment and the restriction raised to 57° N. Lat. by Rev 424 to prevent thermal door malfunctions. ACS-1 Pitch Bias errors were observed on Revs 230, 253, 269 and 272 and disappeared after that time. RCS-2 performance remained nominal during the segment. The RTS reported problems with obtaining range lock after Rev 270, however, sufficient range data were acquired. The TCEA stopped cycling RV-4 heaters from Revs 203 to Rev 205, but resumed normal operations after Rev 205.

RV-2 was reentered and aerially recovered on Rev 424.

A summary of significant events and a discussion of problems encountered are presented in the following paragraphs.

3.1.1 Summary of Events

Successful [redacted] Cals were conducted on Revs 201 and 209. (b)(1) (b)(3)

Stellar Terrain operations were restricted to below 50° N. Lat. at the start of this segment to prevent malfunction of the Terrain Camera thermal door because of low temperature. This restriction would be raised in latitude during the mission as the sun elevation increased.

TCEA (Temperature Control Electronics Assembly) stopped controlling RV-4 heaters on Revs 197-205, resulting in a 2 degree temperature drop inside the canister. Normal cycling resumed on Rev 206 and has continued.

An ACS-1 Pitch attitude error of -0.6° was detected on Rev 230 with the error disappearing after 30 seconds. Contingency planning was established to VBE if the pitch error exceeded 1.0° and to inhibit further payload activity. Normal ACS performance continued until Rev 253 HULA where a pitch error was detected but which had disappeared by the 253 KODI contact. On Rev 269 pitch gyro fluctuations were detected. On Rev 272 GUAM a pitch bias of -1.2° was detected and the following rev payload was erased.

On Rev 273 the bias was within limits and payload was again loaded. The pitch bias had disappeared by Rev 295.

The RTS's started experiencing difficulty in obtaining range lock after Rev 270. Sufficient ranging contacts were obtained for orbit determination purposes and the range lock problem eventually improved.

Panoramic camera operations continued without problems during the segment. A 12 micron focus advance on the aft camera was made based on evaluation of RV-1 photography. The quality of the RV-2 segment photography ranged from fair to very good with poor weather and atmospheric haze degrading the quality.

3.1.2 Problem Summary

a. TCEA not controlling RV-4 heaters

Statement of Problem - RV-4 heaters were OFF from Rev 203 to Rev 205, resulting in an internal temperature 2.0 degrees F. below the reference temperature. RV-4 heater cycling started on Rev 206 and have continued normal operation.

Solution - N/A

b. Intermittent Pitch Gyro Bias

Statement of Problem - Intermittent pitch gyro bias resulted in pitch attitude errors from Revs 230 to Rev 272.

Solution - A contingency plan was established to VBE payload if the pitch attitude error exceeded 1.0 degree. A VBE was executed on Rev 272, however, the pitch error started decreasing as of Rev 273 and had disappeared by Rev 295.

3.2 COMMAND SUBSYSTEMS PERFORMANCE

(Prepared by CSC)

3.2.1 Health

The health of the Command Systems remained excellent throughout Segment 2 (Revs 197 - 424). There were no equipment malfunctions. None of the Command Systems were subjected to out of specification temperatures or voltages. There were no power dropouts, relay driver overloads, or clock status errors experienced.

3.2.1.1 EXTENDED COMMAND SUBSYSTEM

3.2.1.1.1 Command Modes

The ECS responded properly in all modes into which it was commanded. There were a total of 154 messages loaded in the ECS for this segment. This resulted in 37,983 SPC's being stored for readout from the PMU's.

Of the 37,983 SPC's loaded, 17,226 were output from the PMU's for processing by the decoders. The remainder were erased out prior to time label matches. In loading the 37,983 SPC's a total of 23 rejects occurred. Cook had one of the rejects, Kodi one, Boss three and the remaining seventeen rejects occurred on six different station passes at Hula.

3.2.1.1.2 ECS Clock Operation

The accuracy of the ECS clock was .0668 parts in 10^6. This corresponds to an average frequency offset of .0684 HZ above the nominal frequency of 1.024×10^6 HZ. The frequency of the clock oscillators changed .0159 HZ in 196 revs. This results in a stability of .155 parts in 10^7 over a 14 day period, or 2.7 parts in 10^{10} for an average 6 hour period. All of these values are well within system specifications. The clock plot is presented in Figure 3.2-1.

3.2.1.1.3 ECS Anomalies

There were no ECS anomalies experienced during this segment.

3.2.1.2 MINIMAL COMMAND SUBSYSTEM

3.2.1.2.1 Command Modes

The MCS was not used during this segment.

3.2.1.2.2 MCS Anomalies

There were no MCS anomalies.

3.2.1.3 REMOTE DECODER/BUD

3.2.1.3.1 Command Modes

The remote decoder was used for the recovery of RV-2 which ended this segment of the flight. The performance of both channels was verified from telemetry to be proper for all commands.

No commands were issued from the BUD during this segment.

3.2.1.3.2 Remote Decoder/BUD Anomalies

There were no remote decoder or back-up decoder anomalies.

3.2.1.4 SUMMARY

3.2.1.4.1 Expendables and Environmental Data

Total Command Readouts	PMU-A 8270 PMU-B 8956
ECS Clock Drift Rate	.0809 parts in 10^6
ECS Clock Stability	.155 parts in 10^7 for a 228 rev period
Total Hours On	ECS 636 MCS 4.5 RD 3 BUD .05

Secure Words Expended at end of Segment 2 PMU-A 52 PMU-B 48

Environmental Data: See Figure 3.2-1 through 3.2-7

Clock Accuracy (Avg) $= \frac{\text{Bias}}{\text{Time}}$

$= \frac{.0809}{12.1\text{x}10^{5}} = .0668 \text{ x}10^{-6}$

Average Clock Frequency $= (.0668\text{x}10^{-6} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$

$= 1{,}024{,}000.0684$

Frequency 1 (f_1) $= \frac{\text{Bias}}{\text{ECS Time}}$

$= \frac{2\text{x}10^{-2} \text{ Sec}}{3.30\text{x}10^{5} \text{ Sec}} \text{ x } 1.024\text{x}10^{6} + 1.024\text{x}10^{6}$

$= (.0606\text{x}10^{-6} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$

$= 1{,}024{,}000.0621$

Frequency 2 (f_2) $= \frac{\text{Bias}}{\text{ECS Time}}$

$= \frac{2.9\text{x}10^{-2}}{3.8\text{x}10^{5} \text{ Sec}} \text{ x } 1.024\text{x}10^{6} + 1.024\text{x}10^{6}$

$= (.0763\text{x}10^{-6} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$

$= 1{,}024{,}000.078$ HZ

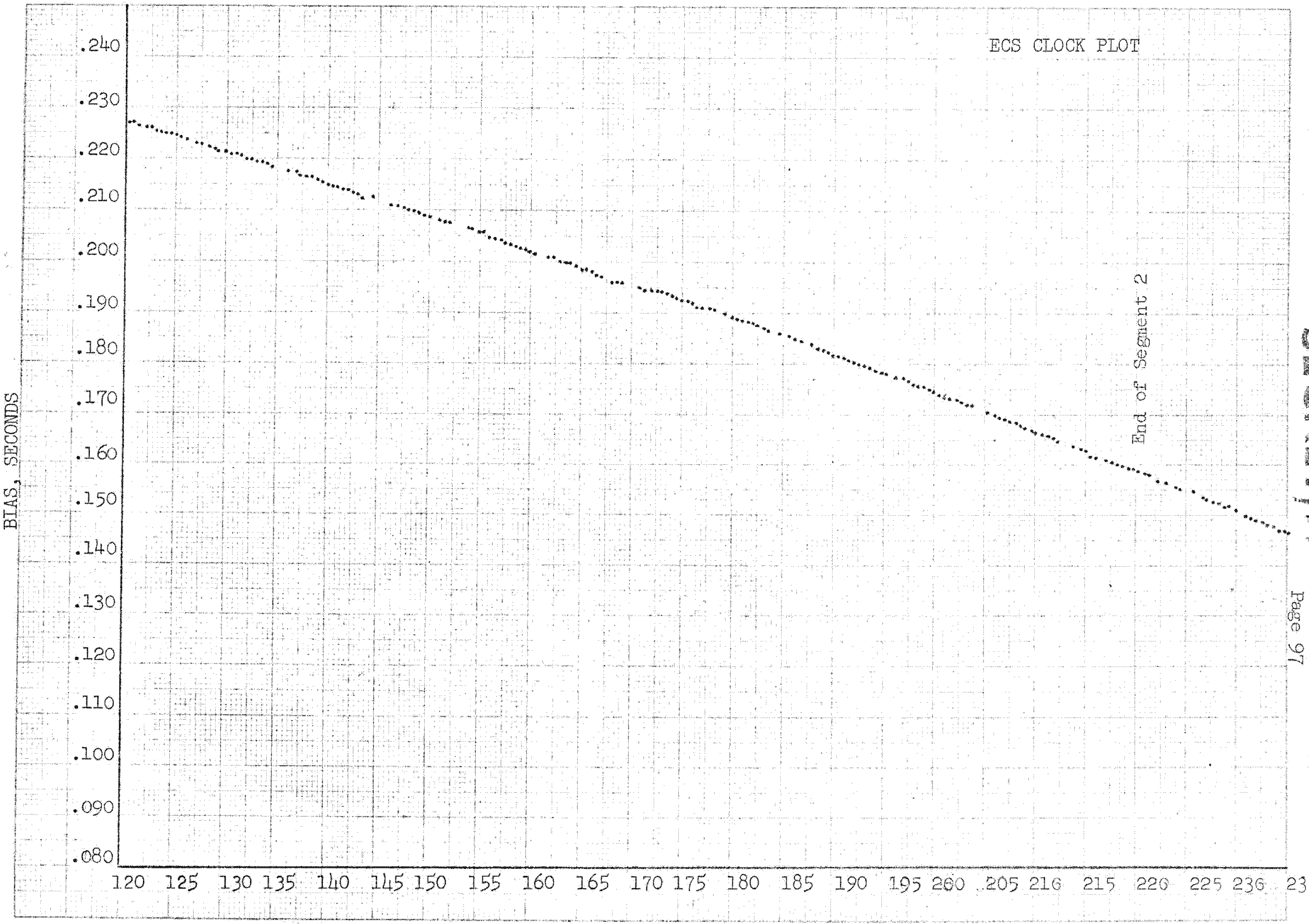
Clock Stability $= \frac{f_1 - f_2}{\text{Frequency (Avg)}}$

$= \frac{.0159 \text{ HZ}}{1.024\text{x}10^{6}} = .155\text{x}10^{-7}$

$= .155$ parts in 10^{7} for this 228 rev period

$= 2.7$ parts in 10^{10} for average 6 hour period

~~SECRET//~~



~~SECRET//~~

Figure 3.2-1

3.3 SENSOR SYSTEM OPERATIONS THROUGH RV-2 (SSC)

3.3.1 MISSION OPERATIONS PERFORMANCE

Sensor Subsystem operations throughout RV-2 demonstrated nominal performance characteristics with no anomalies or malfunctions experienced.

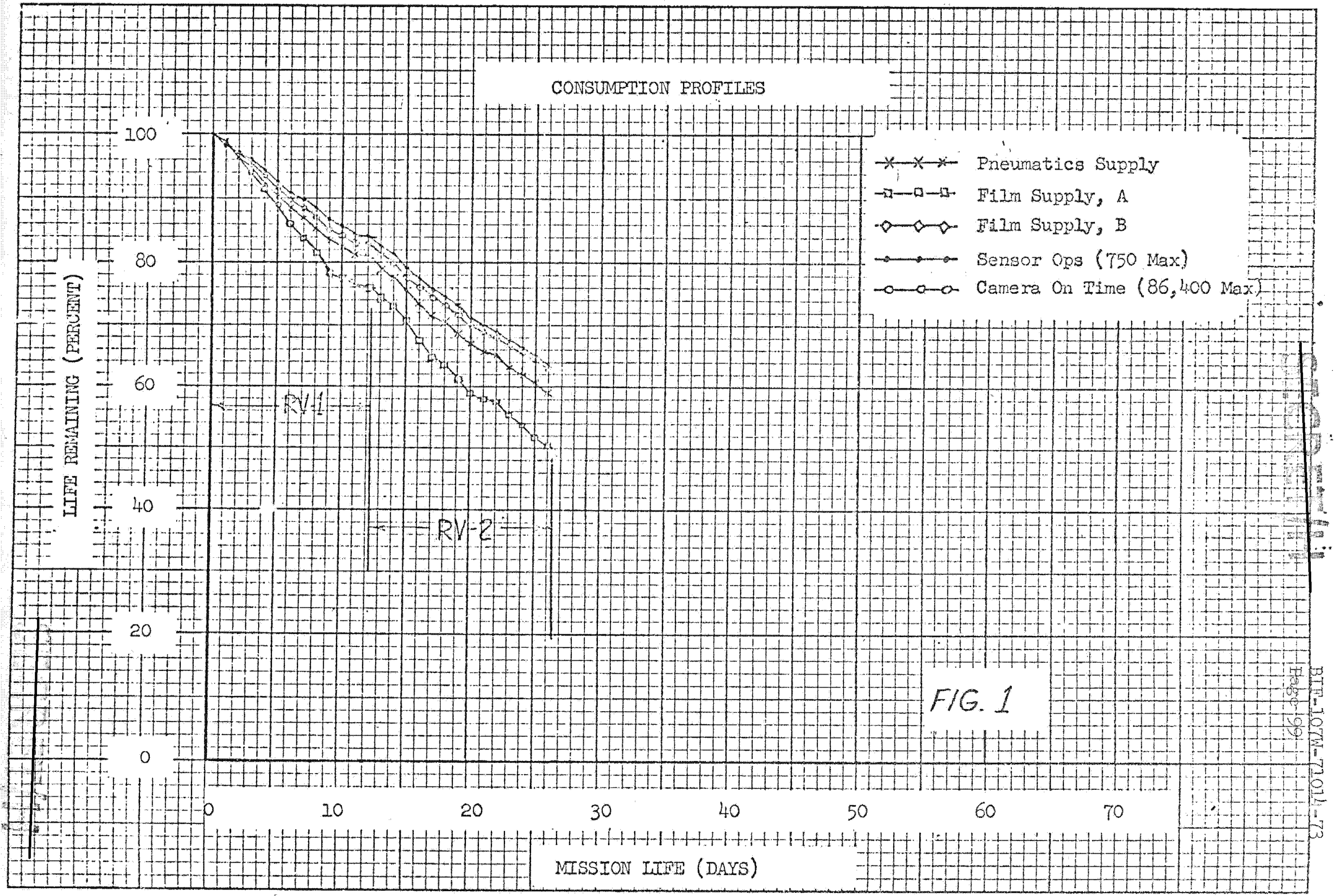
Photographic operations continued without SS temperatures and pneumatics status monitors with thermal stability being inferred from SBAC TREF (C700) and the pneumatics usage rate being estimated at 0.024 lb/min during the interval of pneumatics 'ON' time.

The operational constraints of -5 ips RWV maximum, and no 120 degree at zero or 30 degree at ± 45 scans continued throughout RV-2.

Analysis of the photographic results in RV-1 indicated no change in focal plane setting was required for the forward (A) camera, but that a 12 micron advance was required for the aft (B) camera. This change was accomplished effective with mission operation 158 on Rev 243.

The RV-2 mission segment consisted of 154 sensor system operations, consuming 16,789 seconds of camera power on time, 7.0 pounds (estimated) of nitrogen gas, and approximately 27,400 feet of film per camera. Consumption profiles through RV-2 are graphically depicted in Figure 1.

Overall quality of the acquired photography ranged from very good to fair with the majority rated as fair due primarily to continuing atmospheric haze and poor weather. The best of RV-2 was comparable to the best of RV-1 with the Aft camera imagery significantly improved by the 12 micron change in focal plane setting. Results of engineering MOP analysis indicate that both cameras are now at optimum settings.



CONSUMPTION PROFILES

FIG. 1

3.3.2 ENGINEERING TESTS

The following engineering tests were performed during RV-2 to assist the PFA in evaluating SS operation:

REV	OP	SAL/SC	FR	TEST TYPE
210	132	60/-15	15	(2) 0^2A^2 Lines
211	133	60/-15	18	(2) 0^2A^2 Lines
227	142	30/15	15	(2/3) 0^2A^2 Lines/Culture
243	158	30/0	13	(2/3) 0^2A^2 Lines/Culture
259	172	30/0	7	(5) L. P. On Snow
274	182	30/0	6	(1) Thru Focus +4, +8, 0
356	233	30/15	5	(1) Thru Focus -4, 0
357	234	30/-15	11	(1) Thru Focus -4, 0
372	245	30/-15	14	(1/2) Thru Focus -8, -4, 0/0^2A^2 Lines/Culture
373	246	30/0	22	(1/2) Thru Focus +8, 0/0^2A^2 Lines/Culture
405	266	30/15	31	(1/2) Thru Focus +4, 0/0^2A^2 Lines/Culture
420	276	60/-15	24	(1) Thru Focus -4, -8, +4, +8, 0

3.4 RV 2 (S/N 23) Performance (MWC)

This report presents an analysis of the RV 2 performance based on evaluation of recovery studies, command message, RV and SV telemetry, voice reports and the recovery test report TWX. Tables 3.4-1 and 3.4-2 list all the relevant data. Also included are graphs showing the performance of the RV heaters.

3.4.1 Summary

The RV payload was 94.57% of the maximum I.C.D. weight and was unbalanced 1.57%. The PREP 2 event took place on Rev 423 over POGO and separation occurred on Rev 424. Preparation, deorbit, entry events, drogue and main parachute deployment conditions were normal and executed as planned. Aerial recovery was accomplished on the third pass at 7700 feet altitude. The third pass was necessitated by parachute oscillations up to ±30°.

The recovery location had to be estimated by the recovery aircraft due to a LORAN malfunction just prior to recovery. The estimated position was within 7.58 nautical miles of the predicted impact point. This value is the resultant of in-track and cross-track miss distances, uncorrected for winds. No capsule or parachute damage was reported, neither core pin sheared and the capsule was returned in good condition.

3.4.2 Anomaly

Following the separation of RV 1, on Revs 197, 198, 204 and 205 the real time telemetry data indicated the RV 4 primary Active Thermal Control System heater was not operating (cycling on and off). The failure has been traced to the TCEA, see Section 3.7.7 . This failure has not repeated itself since Rev 205. The critical film path temperatures (RV payload container, Rn06 and the reference temperature, C700) did not vary during the period the RV 4 heater was not cycling.

RV-2

RECOVERY DATA

RV REENTRY PARAMETERS FROM TEAPOT EVALUATION RUN

ORBIT		
REV	424	
APOGEE	146.332	NM
PERIGEE	85.687	NM
ARG OF PERIGEE	131.186	°
INCLINATION	95.676	°
RETRO CONDITION		
TRUE ANOMALY	356.11	°
ALTITUDE	525,226.2	FT
LATITUDE	52.217	°N
LONGITUDE	164.36	°W
ENTRY (400K)		
INERTIAL VEL.	25,524.43	FT/SEC
γ	-2.1	°
α_H	104.51	°
LATITUDE	42.255	°N
LONGITUDE	167.22	°W
DROGUE DEPLOY		
VELOCITY	1430.4	FT/SEC
MACH NO.	1.48	
ALTITUDE	64,013	FT
γ	-31.2071°	
q	190.465	PSF
HEAT SHIELD JETTISON		
ALTITUDE	49,661.59	FT
ETPD		
ALTITUDE	46,000	FT
DESCENT VEL @ 15K	28.6	FT/SEC

RV EVENT TIMES (FROM CMDMSG & TLM) IN SYSTEMS TIME

RV n+1 OUTLET T/S	80509.3
RV n INLET T/S	80513.3
DT START	84637.0
PITCH DOWN START	85688.8
PITCH DOWN STOP	85742.0
RV PYRO ARM (BAT ACT)	85881.8
KODI ACQUISITION	86106.7 (20.3)
ORB PWR OFF	86243.3
RV SEPARATION	86253.3
RV RETRO FIRE	86378.7 (1.3)
KODI FADE (RV)	00020.8 (3.2)
*ENTER IONIZATION	00228.5 (-18.5)
*EXIT IONIZATION	00419.3 (-4.5)
DROGUE DEPLOY	00464.6 (8.4)
ETPD (DISREEF + 3 SEC)	00533.2 (N/A)
HEAT SHIELD JETTISON	00491.5

NOTE: TIME IN PARENTHESIS IS THE DELTA FROM THE PREDICTED TIME. TIMES THAT FALL WITHIN THE ONE SECOND PRINTOUT INTERVAL OF SV TLM IS CONSIDERED TO HAVE A ZERO DELTA TIME.

*BASED ON LOS AND AOS AS REPORTED BY UP-RANGE RECOVERY AIRCRAFT.

RV MASS PROPERTIES (FROM UPDATED TEAPOT RUN)

PAYLOAD WEIGHT		
SIDE A	215.7	LBS
SIDE B	219.3	LBS
% UNBAL $\frac{\lvert W_a - W_b \rvert}{230}$	1.56	%
% FULL (460 lb = 100%)	94.56	%
RV WEIGHTS		
SEPARATION	1518.54	LBS
PRE RETRO	1516.85	LBS
ENTRY	1326.04	LBS
RECOVERY	1105.82	LBS

RV PITCH ANGLE (FROM BASIC STUDY)

θRVS	- 125.35 °
$-\Delta\theta 1$	2.20 °
$+\Delta\theta 2$	.02 °
θSV	- 37.53 °

PITCH ANGLE USED FOR UPDATED TEAPOT

θRVS - 125.33 °

TABLE 3.4-2
RV-2

RECOVERY DATA

EVENT	LATITUDE	LONGITUDE
LOCATION		
NOMINAL PIP	23.497 °N	171.03 °W
UPDATED TEAPOT	23.486 °N	171.04 °W
TEAPOT EVALUATION	23.461 °N	171.05 °W
ACTUAL RECOVERY LOCATION *	23.583 °N	171.083 °W
ERROR (ACTUAL-TEAPOT EVAL.)	- .122 °	.033 °
ERROR (1^{o} = 60 NM)	-7.32 NM	1.98 NM
TOTAL ERROR	7.58 NM	

AERIAL RECOVERY

ALTITUDE 7700 FT

PASS NUMBER

AIRSPEED 139 (KTAS) 120 (KIAS)

CHUTE CONDITION Normal

CHUTE BEHAVIOR Oscillations 30° from vertical, cone swayed from side to side with chute oscillations.

TIME 0029Z

RETRIEVAL

CAPSULE CONDITION

WINCH SETTINGS

PRESET TENSION LEVEL 3500 lb

PAY OUT Normal

CONTACT Inside right pole at cone well, right pole hook engaged load lines.

VERIFIED RECOVERY AREA WIND DATA

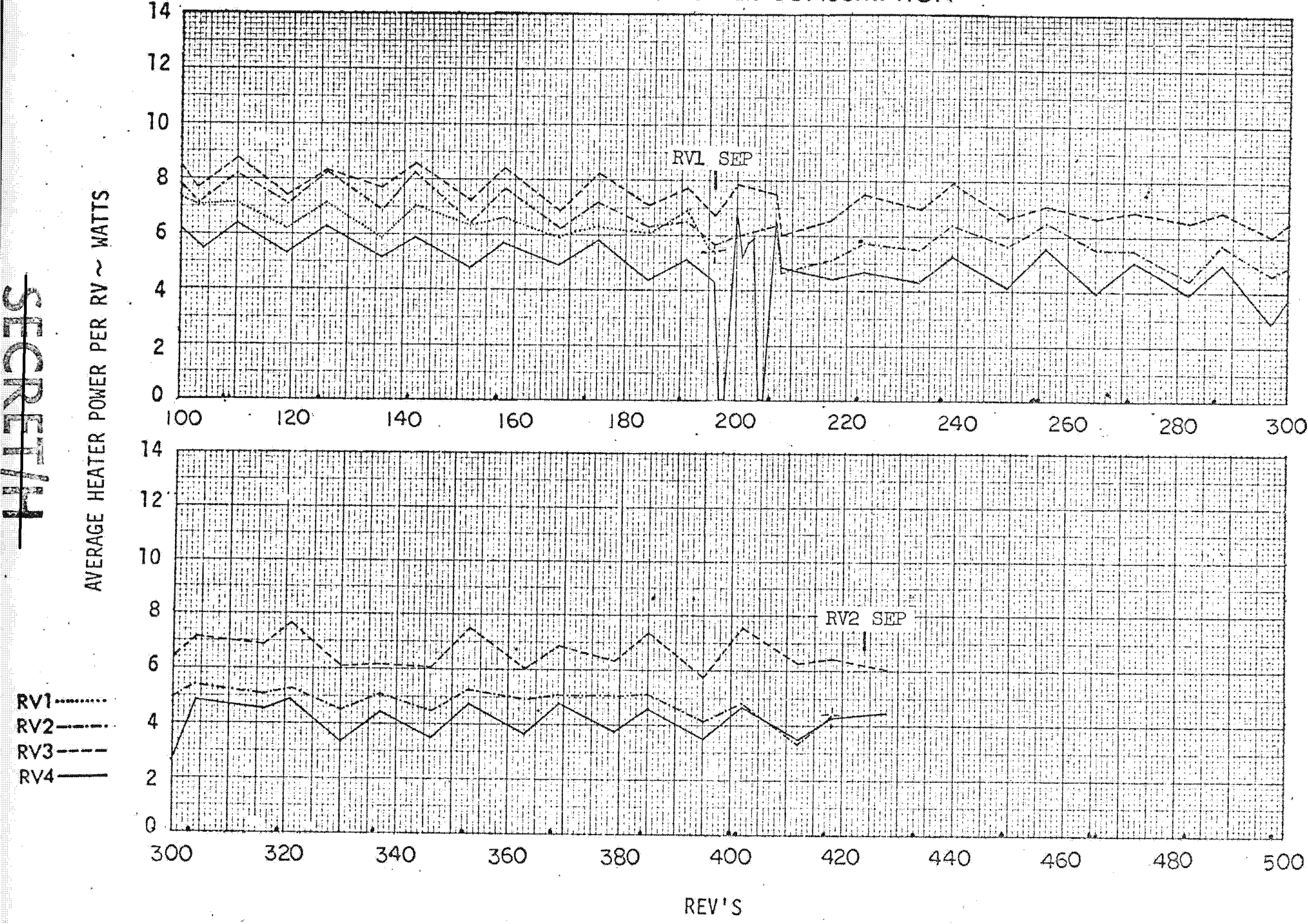
DATA SOURCE: MEMOGRAM 8410-948

ALTITUDE 1000's FT	DIRECTION (DEGREES)	VELOCITY (KNOTS)	ALTITUDE 1000's FT	DIRECTION (DEGREES)	VELOCITY (KNOTS)
60	--	--	20	020	15
55	--	--	15	020	15
50	300	20	10	360	15
45	310	30	8	010	20
40	320	40	6	030	20
35	320	45	4	040	20
30	330	35	2	050	25
25	340	25	SFC	060	25

*Actual recovery location was estimated by recovery aircraft due to a Loran malfunctic just prior to recovery.

ACTIVE THERMAL CONTROL SYSTEM

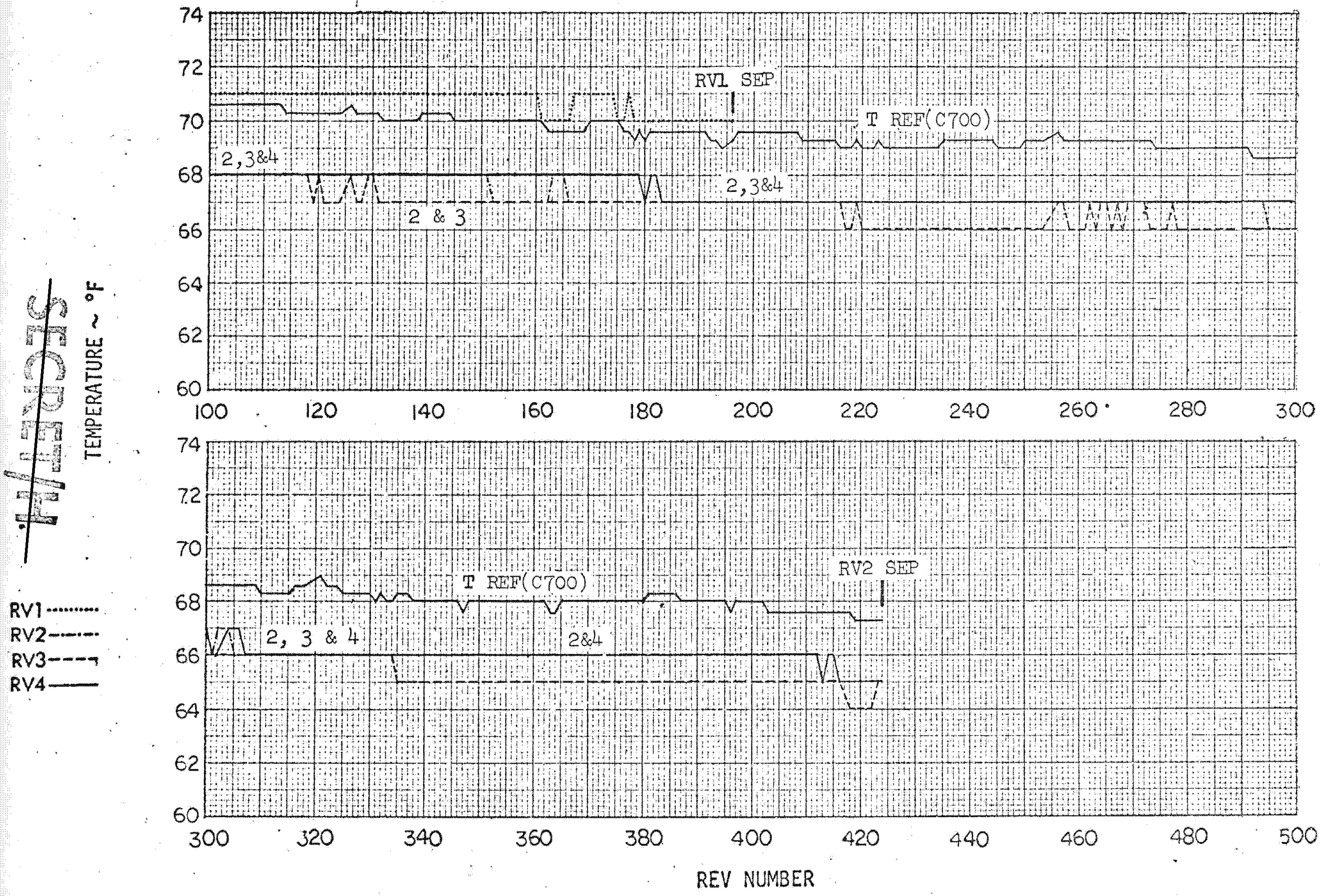
RV HEATER POWER CONSUMPTION



~~SECRET/H~~

~~SECRET/H~~

ACTIVE THERMAL CONTROL SYSTEM
RV PAYLOAD CONTAINER & REFERENCE TEMPERATURES



~~SECRET/H~~

~~SECRET/H~~

3.5 SATELLITE CONTROL FACILITY PERFORMANCE

3.5.1 Orbit Determination and Prediction

3.5.1.1 Orbit Determination

Table 3.5-1 shows a summary of the orbital conditions computed from each tracking reduction from RV-1 recovery to RV-2 recovery on Rev 424. Significant events affecting the orbit included an orbit adjust every two days with the fourth orbit adjust a dual positive/negative to provide tighter control on orbit characteristics, including the location of Argument of Perigee. The events during the RV-2 segment were:

1. Positive orbit adjust on Rev 198
2. Positive orbit adjust on Rev. 257
3. Positive orbit adjust on Rev. 289
4. Positive orbit adjust on Rev. 322
5. Positive orbit adjust on Rev. 354 and a negative adjust on Rev. 356.
6. Positive orbit adjust on Rev. 387.

3.5.1.2 Prediction Accuracy

Table 3.5-2 contains a summary of prediction accuracies over a ten rev span from each tracking reduction epoch rev. Accuracies are determined by comparing the nodal crossing differences between the Best Fit Ephemeris and the tracking reduction ephemeris predictions. Prediction accuracies were within acceptable limits throughout the RV-2 segment although the ten rev prediction exceeded the 3 second limit over the span from Rev. 369 to Rev. 390 as a result of a large drag increase resulting from solar activity.

TABLE 3.5-1

TRACKING REDUCTION SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
199	.0102	.3269	88:54.7	160.62	85.35	139.1	.5748	147/25	OA #7	
200	.0102	.3215	88:55.1	160.74	85.47	139.2	.5717	149/25		
203	.0101	.3053	88:54.3	160.19	85.55	138.4	.5424	157/26		
207	.0101	.2975	88:53.1	159.60	85.37	137.6	.5178	161/27		
210	.0100	.3143	88:52.3	158.95	85.43	136.7	.5449	153/26		
214	.0099	.3226	88:50.9	158.33	85.18	135.6	.5452	147/25		
217	.0098	.3121	88:50.1	157.76	85.20	134.9	.5249	152/25		
219	.0098	.3137	88:49.4	157.38	85.21	134.2	.5244	151/25		
224	.0097	.3201	88:47.8	156.54	84.95	133.2	.5160	147/25		
226	.0096	.3306	88:47.2	155.97	85.10	132.6	.5384	143/24		
229	.0096	.3416	88:46.4	155.55	85.02	132.1	.5511	137/23		
232	.0095	.3489	88:44.9	154.77	84.79	131.2	.5479	133/22		
235	.0094	.3431	88:44.1	154.13	84.86	130.2	.5361	135/23		
240	.0093	.3325	88:42.4	153.24	84.62	129.2	.5041	139/24		
243	.0092	.3602	88:41.3	152.37	84.73	128.3	.5460	127/21		
246	.0091	.3750	88:40.2	151.78	84.51	127.5	.5551	122/21		
249	.0090	.3688	88:39.1	151.07	84.50	126.8	.5389	123/21		
252	.0089	.3670	88:38.0	150.36	84.55	125.7	.5328	123/21		

~~SECRET/H~~

~~SECRET/H~~

TRACKING REDUCTION
SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
256	.0088	.3736	88:36.5	149.52	84.27	125.0	.5265	120/20	OA #8	
259	.0097	.3292	88:46.9	156.50	84.98	130.4	.5283	145/25		
263	.0096	.3529	88:45.4	155.78	84.72	129.3	.5504	134/23		
267	.0095	.3400	88:44.2	154.91	84.80	128.2	.5272	138/23		
272	.0094	.3253	88:42.5	153.95	84.65	127.1	.4920	144/24		
275	.0093	.3303	88:41.6	153.25	84.72	126.3	.4979	141/24		
278	.0092	.3482	88:40.4	152.65	84.55	125.5	.5729	133/23		
282	.0091	.3481	88:39.2	151.81	84.51	124.5	.5060	132/22		
286	.0090	.3529	88:37.7	150.89	84.44	123.3	.5030	129/22		
289	.0099	.3094	88:48.4	158.34	84.94	129.0	.4977	157/27	OA #9	
291	.0099	.3114	88:48.3	158.10	85.08	128.9	.5046	157/27		
296	.0098	.3319	88:46.5	157.17	84.77	127.8	.5195	145/25		
300	.0097	.3246	88:45.3	156.30	84.89	126.6	.5069	147/25		
305	.0096	.3223	88:43.7	155.39	84.69	125.7	.4898	147/25		
309	.0095	.3423	88:42.4	154.44	84.76	124.5	.5764	139/23		
312	.0094	.3619	88:41.1	153.86	84.53	123.7	.5014	129/22		
316	.0092	.3507	88:39.9	152.93	84.62	122.6	.4956	132/22		
321	.0091	.3488	88:38.1	151.87	84.43	121.5	.4949	132/22		

TABLE 3.5-1

~~SECRET/H~~

~~SECRET/H~~

TRACKING REDUCTION SUMMARY

TABLE 3.5-1

~~SECRET/H~~

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
325	.0101	.3082	88:48.7	159.35	85.03	126.5	.4955	159/27	OA #10	
328	.0100	.3302	88:47.0	158.38	84.80	125.4	.5158	148/25		
332	.0099	.3227	88:45.9	157.58	84.88	124.3	.4994	151/26		
337	.0098	.3231	88:44.2	156.57	84.77	123.2	.4888	150/25		
340	.0097	.3452	88:43.2	155.82	84.83	122.3	.5205	139/24		
344	.0096	.3591	88:41.7	155.07	84.56	121.3	.5255	132/23		
348	.0095	.3597	88:40.4	154.14	84.60	120.2	.5205	131/22		
351	.0094	.3689	88:39.1	153.32	84.58	119.3	.5269	127/22		
355	.0092	.2075	88:57.4	159.03	91.01	133.11	.5168	243/41	OA #11 & 12	
357	.0093	.3129	88:47.7	154.13	85.20	140.27	.5274	142/24		
359	.0093	.3273	88:46.9	153.77	85.03	139.69	.5429	135/23		
361	.0093	.3450	88:46.2	153.39	84.90	139.2	.5641	129/22		
363	.0092	.3348	88:45.7	152.95	84.95	138.8	.5474	132/22		
365	.0091	.3413	88:45.0	152.49	84.97	138.0	.5552	129/22		
369	.0090	.3651	88:43.4	151.55	84.80	137.2	.5804	120/20		
373	.0088	.4285	88:41.7	150.31	84.67	136.5	.6675	101/17		
376	.0088	.4927	88:40.1	149.39	84.41	135.6	.7445	87/15		
379	.0086	.5300	88:38.5	148.30	84.27	134.8	.7847	80/14		

~~SECRET/H~~

TRACKING REDUCTION SUMMARY

TABLE 3.5-1

~~SECRET/H~~

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
381	.0085	.5253	88:37.5	147.63	84.27	133.8	.7691	81/14		
386	.0084	.4922	88:35.2	146.41	83.79	132.8	.6868	85/14	OA #13	
390	.0096	.4148	88:49.1	155.79	84.64	140.4	.6802	108/18		
392	.0096	.3830	88:48.3	155.42	84.46	140.0	.6171	117/70		
395	.0095	.3597	88:47.3	154.77	84.47	139.1	.5755	125/21		
397	.0095	.3588	88:46.6	154.35	84.48	138.3	.5711	125/21		
402	.0094	.3519	88:44.9	153.51	84.14	137.3	.5404	126/22		
406	.0093	.3500	88:43.6	152.60	84.18	136.1	.5335	126/22		
408	.0092	.3610	88:42.7	152.18	84.05	135.5	.5412	122/21		
411	.0091	.3666	88:41.7	157.50	83.97	134.8	.5427	120/20		
413	.0091	.3605	88:41.1	151.09	84.01	134.0	.5311	122/21		
418	.0089	.3575	88:39.2	150.05	83.82	132.9	.5128	122/21		
421	.0088	.3698	88:38.2	149.28	83.86	131.9	.5732	117/20		

~~SECRET/H~~

PREDICTION [illegible]ACY SUMMARY

(BFE - Tracking Reduction Predictions)

TABLE 3.5-2

Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch
198	13	--	7.353
200	13	.761	1.261
203	13/14	.276	.489
207	14	-.338	-.869
210	14	-.021	.331
214	14	.265	.913
217	14/15	.021	-.176
219	15	--	-.372
224	15	-.538	-1.326
226	15	-.342	-.535
229	15	.014	.592
232	15	.260	.157
235	15/16	.293	.551
240	16	-.545	-1.654
243	16	-.077	.117
246	16	.241	1.009
249	16/17	.086	.599
252	17	-.029	.905
256	17	.546	1.338
259	17	-.133	-.134
263	17	.341	.671
267	17/18	.367	1.112
272	18	-.174	-.580
275	18	-.251	-.573
278	18	.020	.385
282	18	.045	--
286	18/19	.336	1.318
289	19	.744	1.531
291	19	-.247	-.465
296	19	--	.897
300	19/20	.171	.228
305	20	-.310	-1.025
309	20	-.067	-.051
312	20	.340	1.279
316	20/21	.118	.919
321	21	.387	.991
325	21	-.171	-.243
328	21	.292	.947
332	21/22	.120	-.026
337	22	-.419	-1.459
340	22	-.029	-.157
344	22	.041	.411
348	22/23	.070	.548
351	23	.562	1.272
355	23	.748	.776
357	23	-.439	-1.370
359	23	-.203	-.845
361	23	.121	-.278
363	23/24	-.273	-1.946
365	24	-.427	-3.000

PREDICTION [illegible]ACY SUMMARY

(BFE - Tracking Reduction Predictions)

TABLE 3.5-2

Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch	Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch
369	24	-1.304	-5.511				
373	24	-1.342	-4.141				
376	24	-0.700	-.567				
379	24/25	.779	3.391				
381	25	.247	5.961				
386	25	2.109	6.725				
390	25	.971	3:949				
392	25	.581	2.356				
395	25/26	.382	1.146				
397	26	--	1.355				
402	26	-.026	.019				
406	26	-.126	-.081				
408	26	.020	.493				
411	26	.398	1.268				
413	26/27	.369	.610				
418	27	-.192	-1.854				

~~SECRET~~

~~SECRET~~

BIF-107W-71014-73
Page 112

3.5.1.3 B Factor

Figure 3.5-1 shows a plot of B-factor for this segment of the mission. The B-factors shown are from the individual tracking reductions and from the BFE for comparison. Maneuvers are indicated as to the rev of occurrence.

3.5.1.4 Orbit Adjust Summary

Table 3.5-3 reflects a summary of each orbit adjust during this segment. For each orbit adjust or set of orbit adjusts occurring on the same or adjacent revs, orbital conditions are provided which describe the orbit prior to the first orbit adjust. In addition, the predicted velocity change and orbit resulting from each orbit adjust or set of orbit adjusts is provided and compared with the actual orbit and velocity change obtained. The actual orbit and velocity change was determined from the Best Fit Ephemeris. All orbit adjusts were close to nominal.

Figure 3.5-2 reflects perigee altitude and perigee locations prior to and after each positive Orbit Adjust and prior to and after the positive/negative pair of Orbit Adjusts Nos. 11 and 12.

3.5.1.5 Best Fit Ephemeris

Table 3.5-4 shows the orbital conditions for each day of this segment of the mission.

3.5.2 Telemetry and Mode Processing

Development of the RCS diagnostic 1 X 7 modes for SV-5 continued.

3.5.3 Command Message Planning

The SV-5 FPA use continued with only minor clarification changes.

The SV-5 policy of coordinating required sequence changes through an on-line mini CSSG (Command Sequence Subgroup) prior to implementation continued.

3.5.4 SCF Support

The SCF mission support continued with only minor problems which did not impact command message loading or data readout.

The use of the DTV (Digital T.V. Display) for real time data monitoring continued with generally satisfactory results.

SECRET/H

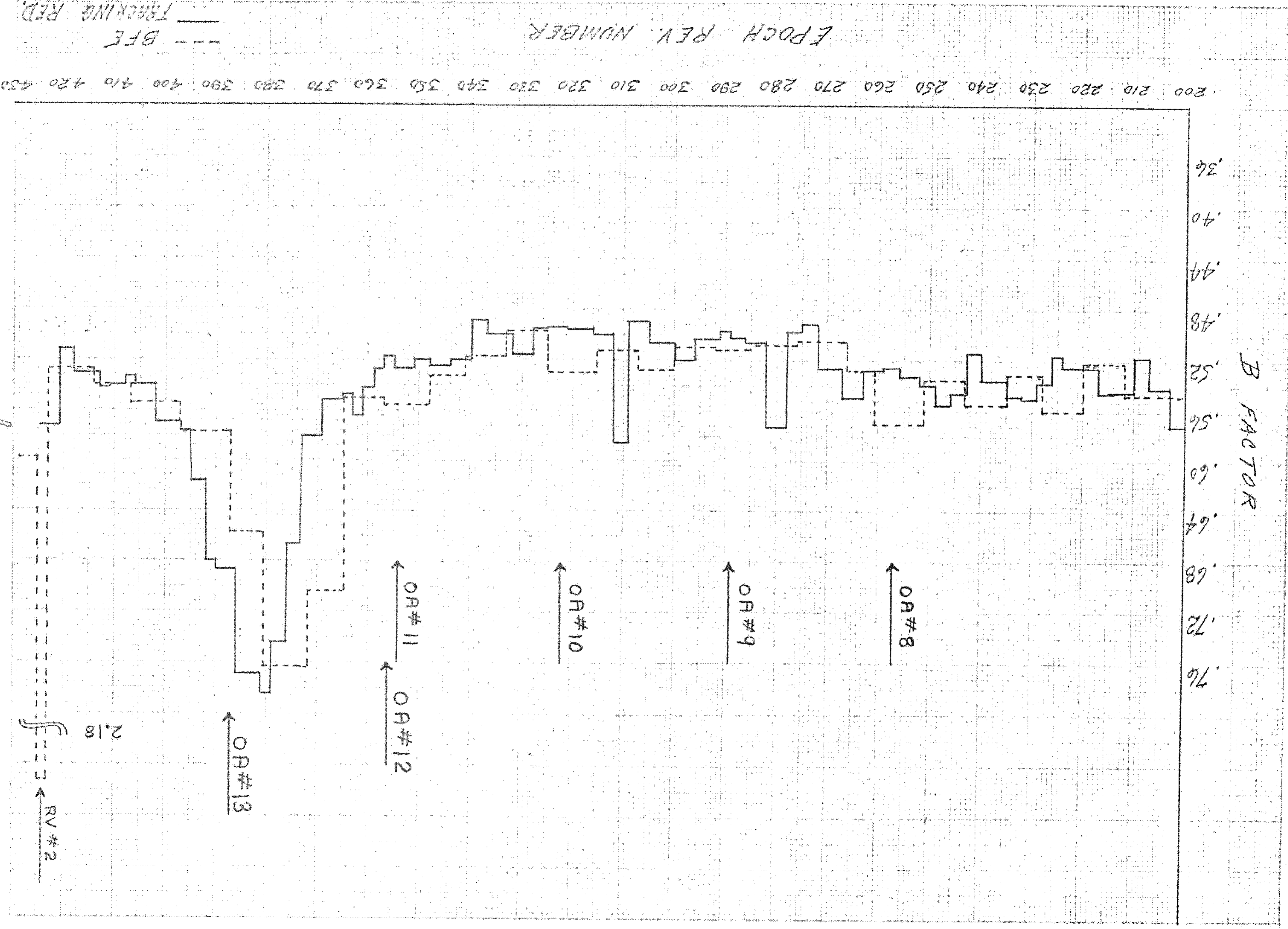


FIGURE 3.5-1

SECRET/H

TABLE 3.5-3

OA No. 7	Rev. No. 198	Period Min:Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur. Sec. XX.X	Delta Velocity XX.XX
Orbit at Rev	197	88:33.3	85.97	144.78	126.451	--	--
Predicted	199	88:54.8	86.89	158.93	139.124	95.2	35.35
Actual	199	88:55.3	86.96	159.31	139.396	95.2	36.20
Delta (A-P)		+.593	+.066	+.380	+.272	0	+.85
OA No. 8	Rev. No. 257						
Orbit at Rev	256	88:36.5	86.29	147.84	124.991	--	--
Predicted	258	88:47.1	86.77	154.95	130.585	48.6	17.68
Actual	258	88:47.3	86.79	155.06	130.680	48.6	18.02
Delta (A-P)		+.182	+.02	-.888	.095	0	+.34
OA No. 9	Rev. No. 289						
Orbit at Rev	288	88:36.9	86.26	148.93	123.062	--	--
Predicted	290	88:48.4	86.74	156.69	129.018	52.4	18.93
Actual	290	88:48.6	86.82	156.74	129.157	52.4	19.35
Delta (A-P)		+.208	+.088	+.050	+.139	0	+.42
OA No. 10	Rev. No. 322						
Orbit at Rev	321	88:37.8	86.32	150.41	121.594	--	--
Predicted	323	88:48.7	86.76	157.77	126.485	48.6	17.51
Actual	323	88:48.8	86.81	157.82	126.541	48.6	17.76
Delta (A-P)		+.138	+.047	.057	+.056	0	+.25

SECRET/H

SECRET/H

TABLE 3.5-3

OA No. 11	Rev. No. 354	Period Min:Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur. Sec. XX.X	Delta Velocity XX.XX
Orbit at Rev	353	88:38.4	86.24	151.58	119.037	--	--
Predicted						87.0	31.15
Actual						87.0	31.83
Delta (A-P)						0	+.68
OA No. 12	Rev. No. 356					-	
Orbit at Rev						--	--
Predicted	357	88:47.5	86.80	152.31	139.691	42.4	-14.83
Actual	357	88:47.8	86.80	152.30	140.271	42.4	-15.16
Delta (A-P)		+.2	+.005	-.011	+.58	0	- .33
OA No. 13	Rev. No. 387						
Orbit at Rev	386	88:35.7	85.80	144.41	132.835	--	--
Predicted	388	88:49.4	86.19	154.18	140.714	68.2	23.84
Actual	388	88:49.9	86.23	154.56	140.994	68.2	24.66
Delta (A-P)		+.560	.038	+.379	+.280	0	+.82
OA No.	Rev. No.						
Orbit at Rev							
Predicted							
Actual							
Delta (A-P)							

SECRET

SECRET

~~SECRET~~

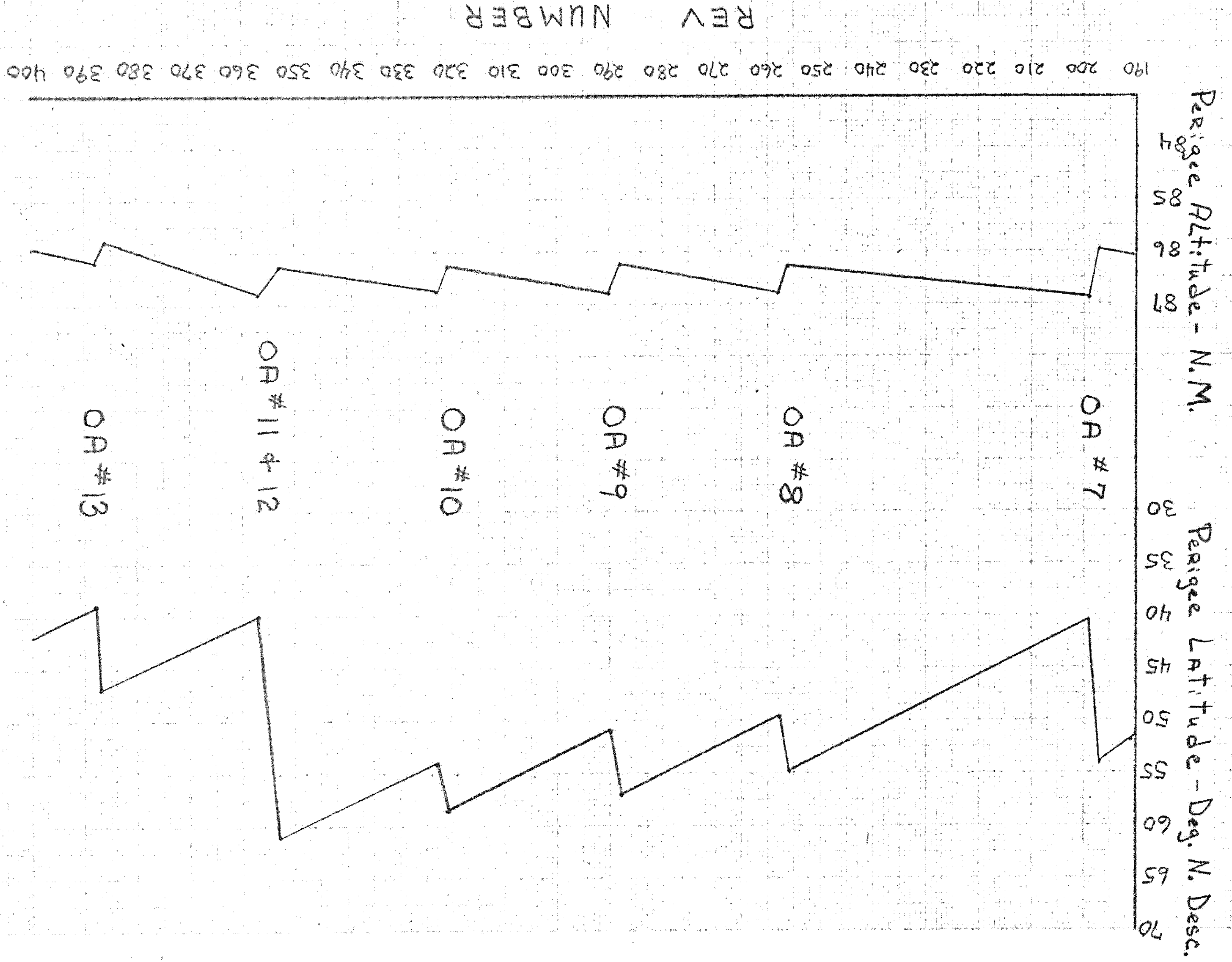


FIGURE 3.5-2

~~SECRET~~

BEST FIT EPHEMERIS SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
14	204	.0101	95.67	88:54.0	159.93	85.62	138.2	.5477	204 - 212
								.5223	212 - 218
								.5246	218 -
15	220	.0097	95.68	88:49.1	157.06	85.27	134.1	.5603	220 - 228
								.5319	228 - 235
								.5061	235 -
16	236	.0093	95.68	88:43.8	153.81	84.99	130.0	.5533	236 - 243
								.5374	243 - 250
								.5282	250 -
17	252	.0089	95.68	88:38.1	150.27	84.67	125.7	.5699	252 - 261
								.5272	261 - 266
								.4940	266 -

TABLE 3.5-4

~~SECRET/H~~

~~SECRET/H~~

BEST FIT EPHEMERIS
SUMMARY

TABLE 3.5-4

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
18	268	.0095	95.68	88:43.9	154.57	84.90	128.0	.5071	268 - 276
								.5086	276 - 284
								.4820	284 -
19	284	.0090	95.68	88:38.5	151.19	84.59	124.1	.5127	284 - 292
								.5116	292 - 300
								.4837	300 -
20	301	.0096	95.68	88:45.0	155.96	85.04	126.4	.5276	301 - 307
								.5133	307 - 315
								.4992	315 -
21	317	.0092	95.68	88:39.6	152.52	84.83	122.3	.5301	317 - 325
								.4979	325 - 332
								.4942	332 -

~~SECRET/H~~

~~SECRET/H~~

~~SECRET/H~~

TABLE 3.5-4

BEST FIT EPHEMERIS
SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
22	333	.0098	95.68	88:45.6	157.22	85.07	123.8	.5182	333 - 341
								.5336	341 - 348
								.4991	348 -
23	349	.0094	95.68	88:40.0	153.71	84.76	119.9	.5555	349 - 357
								.5493	357 - 364
								.5995	364 -
24	336	.0091	95.68	88:44.7	152.12	85.03	138.2	.7037	366 - 372
								.7653	372 - 381
								.6455	381 -
25	380	.0086	95.68	88:38.1	147.98	84.30	134.4	.6576	380 - 387
								.5780	387 - 396
								.5324	396 -

~~SECRET/H~~

~~SECRET/H~~

BEST FIT EPHEMERIS
SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
26	398	.0094	95.68	88:46.3	154.03	84.64	137.9	.5503	398 - 406
								.5399	406 - 412
								.5166	412 -
27	415	.0090	95.67	88:40.3	150.53	84.12	133.3	.5271	415 - 423
								.5001	423 - 424
								2.1804	424 - 424
								.5974	424 - 429
								.5430	429 -

TABLE 3.5-4

~~SECRET/H~~

BIF-107W-71014-73
Page 121

3.6 PROGRAM COMMAND SOFTWARE PERFORMANCE (HTC)

3.6.1 Command Message Summary

This section summarizes pertinent command message data from Mission 1205, IRON 8410. The command messages discussed cover the period from the first RV 2 message (Rev. 197 load) to the RV 2 recovery message (Rev. 421 load).

One hundred seventy-six command messages were received by the Technical Advisor (TA) Staff. One hundred seventy-one were accepted and five were rejected. The rejected messages were subsequently altered or regenerated and loaded into the vehicle. The reasons for rejection of the five messages are summarized below.

Rev. No. & Load Station	Reason for Rejection
209 POGO	Four commands which were to be input to the message via SPC cards were omitted.
282 BOSS	A MOP card was inadvertently left out of the message.
337 GUAM	SGLS 1 and SGLS 2 switching was commanded on the wrong revs.
356 POGO	Two manual SPC commands were input to the message in reverse order.

One hundred sixty-seven messages were loaded and nine were not for the reasons stated below.

1. The five rejected messages were not loaded.
2. One contingency message concerning TCEA temperature was not required.

3. A message containing commands to change ACSDB 1 to the coarse mode was not required.

4. A message containing ACSDB 1 coarse and ACSDB 2 fine commands was not required.

5. One contingency VBE message was not loaded.

A one rev load cycle was employed while the vehicle was over the area of interest. The add-on message generation and loading philosophy was in effect. This resulted in the generation of one hundred twenty-one add-on messages.

3.6.2 'TUNITY Software Problems

The Flight 5 'TUNITY software problems itemized below pertain only to the period for RV 1 recovery through RV 2 recovery. They have been grouped into the following categories to demonstrate their impact on the flight. The disposition of these software problems will be specified by the Configuration Control Board. SPR's 5113 through 5118 are missing from this list. They are written on six separate programs with a common, non-serious coding error.

Category	No. of SPR's	Comments
Flight Critical	1 (MBR 5121)	Software corrections were made and incorporated during this flight period.
Non-Flight Critical (Requiring Work-Around)	0	Work-around procedures were developed and implemented.
Non-Flight Critical (Minor)	2	Work-around procedures were not required.
Product Improvement or New Requirements	1	To be considered during future development.
Documentation Error	2	Milestone 7 affected.

Itemized Software Problems

SPR MBR-5110 ('TFRTFIX)

- Problem Description: The 'TFRTFIX header data contains extraneous characters. (1H)

- Solution or Work-Around: None.

- Operational Impact: None.

- Comment: It is a software problem and has no meaning in the ST mode. The header should be modified and an additional value should be displayed showing the interval between successive ST frame times. No change planned until MOD 2.

SPR MBR-5111 ('TAPOUT)

- Problem Description: 'TAPOUT reported a series of [redacted] records which were nonexistent. These records were biased by -13. seconds from the sequence 96 "on" and +9. seconds from the sequence 96 "off". Actually tape recorder 1 was on for the whole time the series of spurious records were reported. 'TAPOUT appears to be checking the state of the wrong function; this loophole results from the current simultaneous operation of tape recorder 1 and tape recorder 2. (b)(1) (b)(3)

- Solution or Work-Around: The false reports in the 'TAPOUT output can be ignored.

- Operational Impact: There is not operational impact other than confusion to the user.

- Comment: This SPR should be considered as a product improvement item for a future software delivery.

SPR MBR-5112 ('TREPLAY)

- Problem Description: Procedure WTHDEL in 'TREPLAY requested more VER weather than required on Rev 300. Rev 300 had 3 operations in the following time order that overlapped:

  OP 1 ST SCAN 60° CENTER 0° start time 31202. stop time 31309.
  OP 2 PAN SCAN 60° CENTER -15° start time 31206. stop time 31226.
  OP 3 PAN SCAN 60° CENTER 15° start time 31264. stop time 31347.

Operations 1 and 2 combined into a 75° scan and a -7.5° center. But -7.5° is an illegal center so -15° is added to the operation to form a 90° scan and a -15° center. This new operation request is combined with operation 3 for a 105° scan and a -7.5° center which is again illegal. But 15° can't be added to the left so it was added to the right, resulting in a 120° scan, 0° center request. The program operated as designed.

- Solution or Work-Around: None.

- Operational Impact: None.

- Comment: This limitation of possibly getting larger VER requests than necessary should be stated in both the Milestone 4 and the Milestone 7.

SPR MBR-5119 ('TSTAGEN)

- Problem Description: Information message number 2 in 'TSTAGEN is encoded improperly, resulting in the message "OUTPUT IMAGE EXCEEDED". The encode statement established 137 characters for the line of printer output; this exceeds the maximum allowed.

- Solution or Work-Around: None.

- Operational Impact: There was no operational impact other than confusion for the user.

- Comment: It is a software problem; the solution is known and should be fixed at the first opportunity not involving a flight.

SPR MBR-5120 ('TELPRO)

- Problem Description: 'TELPRO forces an abort when a parity error is detected on a BBRT. Most parities are not serious and will cause at the most the loss of an FRT. A great deal of manual effort is required to delete the parity record. If 'TELPRO would simply ignore the parity records, processing would be greatly simplified.

- Solution or Work-Around: The BBRT must be copied leaving out the parity record or the playback retransmitted from the tracking station.

- Operational Impact: Having to use the work-around procedure causes some delay in the stripping of the FRT data to be used in MPR.

- Comment: This SPR should be considered as a product improvement item for a future software delivery, when all aspects of what to do when a parity exists have been reviewed.

SPR MBR-5121 ('THISUM) - FLIGHT CRITICAL -

- Problem Description: CHG passed Rev 367 to MPR as the last active rev; however, there was an ST operation on Rev 368. A dump of the 'TGV shows that the operation data exists for that rev, but the pointer ('TGX) has no entry for Rev 368.

- Solution or Work-Around: The problem was determined to be flight critical. A change was made to 'THISUM correcting the problem and was incorporated on the flight Aux Master.

- Operational Impact: There was no operational impact because the missing rev was picked up after an 'SDBG to the 'TGX, in the next days MPR. With the implementation of the new mod of 'THISUM, the problem has been solved.

SPR MBR-5122 ('TPURR)

- Problem Description: Procedure CHGPUR is not purging the CHG data blocks properly. An 'SDBG log was run and old records of the 'TGX, 'TGY and 'TGV data blocks were found. This causes the data base retrievals to be slightly longer than necessary, but has no effect on 'TUNITY processing.

- Solution or Work-Around: None.

- Operational Impact: None.

- Comment: The data base is not currently available to determine the cause of the problem. CG will run a daily SDBG log to supply SOST with the data required to analyze the problem.

3.6.3 Hardware/Software Interface Changes

For IRON 8410, one change request was processed from the RV 1 recovery message through the recovery of RV 2 (as shown in Table 3.6.3-1). This change was implemented via request SV-5-288.

Table 3.6.3-1. Summary of Hardware/Software Interface Changes

Request No.	Identification	Effectivity
SV-5-288	Deletes the second ST+ command from sequence 153 so that MPR will not treat the ST+/ST- commands separated by 0.6 sec. as an operation.	SV-5 and nominal data base.

3.7 SATELLITE VEHICLE AND AUXILIARY PAYLOAD PERFORMANCE
(Prepared by SBAC)

3.7.1 EDAP Performance

EDAP operations through Segment 2 continued normal in all areas.

The Lifeboat Battery has reached the monoxide level and is stable. The pyro battery voltages are still decaying toward the monoxide state.

The main power system remains in all respects healthy, supporting an average bus load of approximately 21 ampere-hours per rev.

3.7.2 TT&C Performance

The SGLS-1, PCM-1A and Tape Recorder No. 1 performed satisfactorily throughout Segment 2. The redundant systems were not used.

Tape Recorder fast-forward real time commanding was utilized on Revs 307 and 406.

3.7.3 ACS/RCS Performance

The Attitude Control System and the Reaction Control System performed within specification throughout segment two. The Primary ACS exhibited a pitch gyro bias intermittently through Revs 230 to 274. This pitch bias resulted in a pitch attitude offset within dead band limits for all operations except Rev 272 where pitch error was -1.04 deg. Gyro temperatures leveled off between 158°F and 166°F.

The RCS performance was nominal throughout segment two. Propellant consumption was 54.8 lbs. Figure 3.7-1 shows the consumption rate followed closely the predicted 4 lbs per day. A mini-pitch was performed on Rev 412 and thrust compared to the Rev 154 pitch test conducted during segment one. Analysis of RCS thrusters 2, 3, 6 and 7 indicated that these thrusters exhibited nominal degradation. Thruster #7 indicated a lower thrust (3.18) compared to the other pitch thrusters but was still well above the minimum required for maintaining pitch control.

SECRET

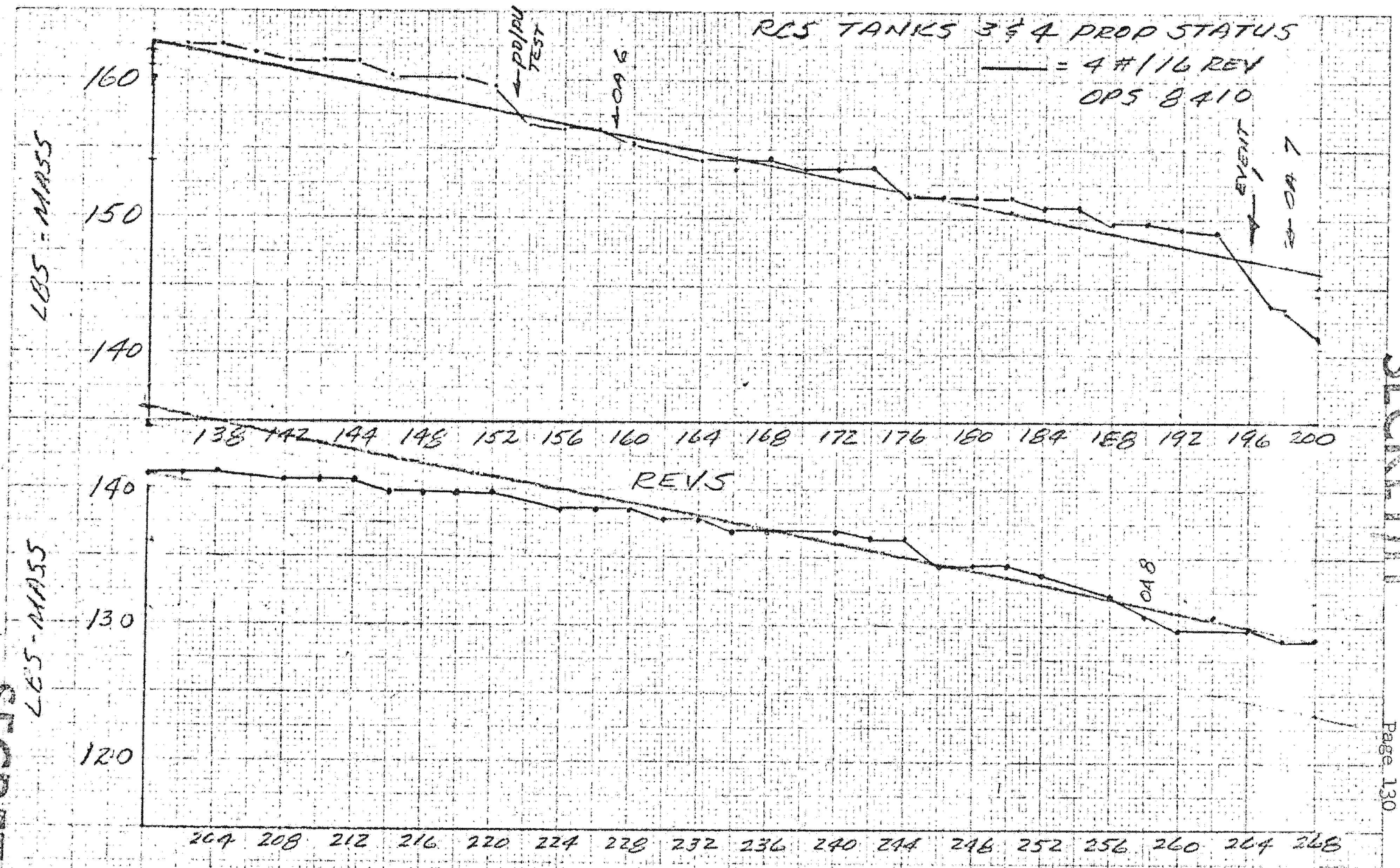


FIGURE 3.7-1

SECRET

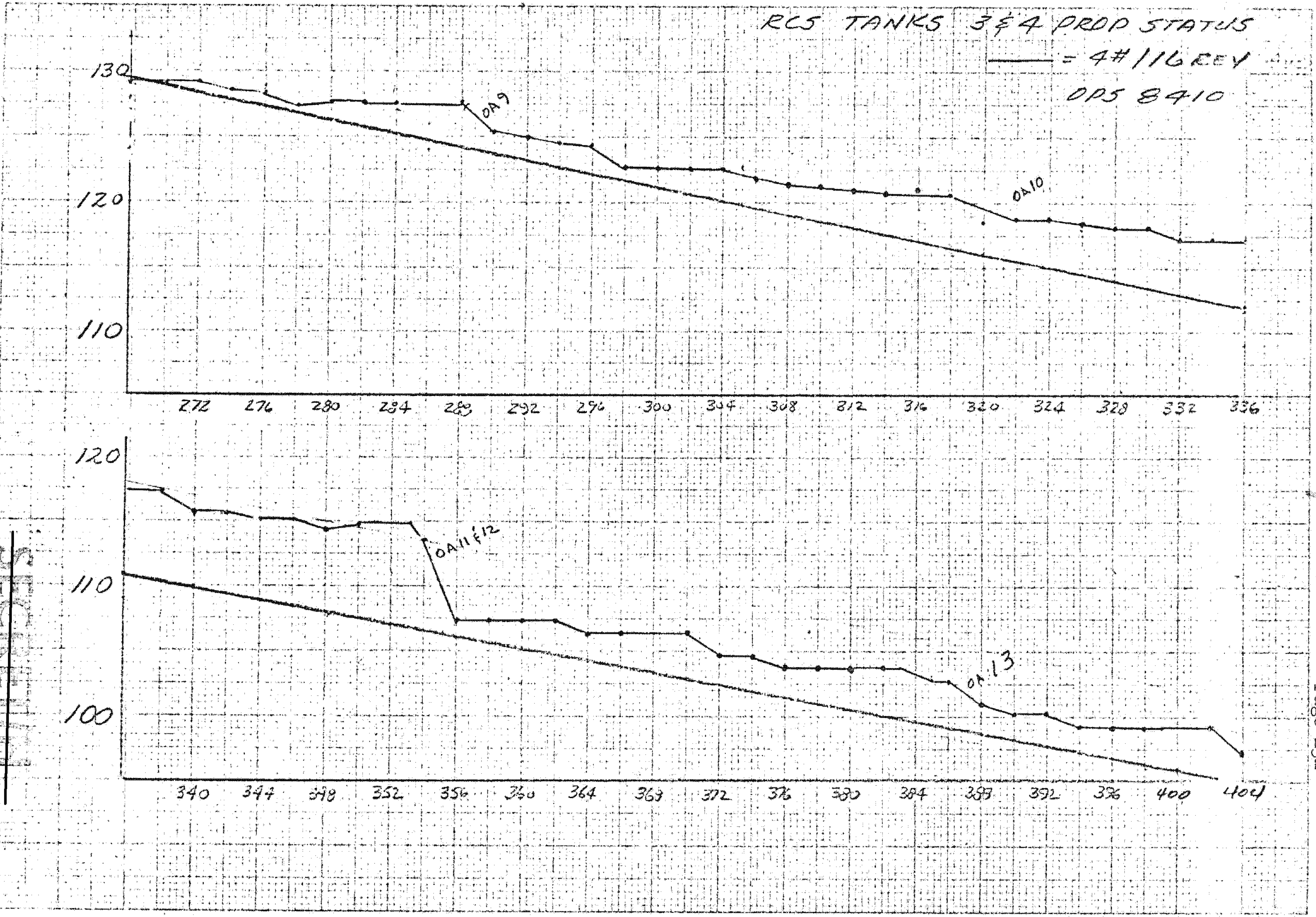

RCS TANKS 3 & 4 PROP STATUS
—— = 4#/16 REV
OPS 8410
130
120
110
OA9
OA10
272
276
280
284
288
292
296
300
304
308
312
316
320
324
328
332
336
120
110
100
OA11 & 12
OA 13
340
344
348
352
356
360
364
368
372
376
380
384
388
392
396
400
404

FIGURE 3.7-1

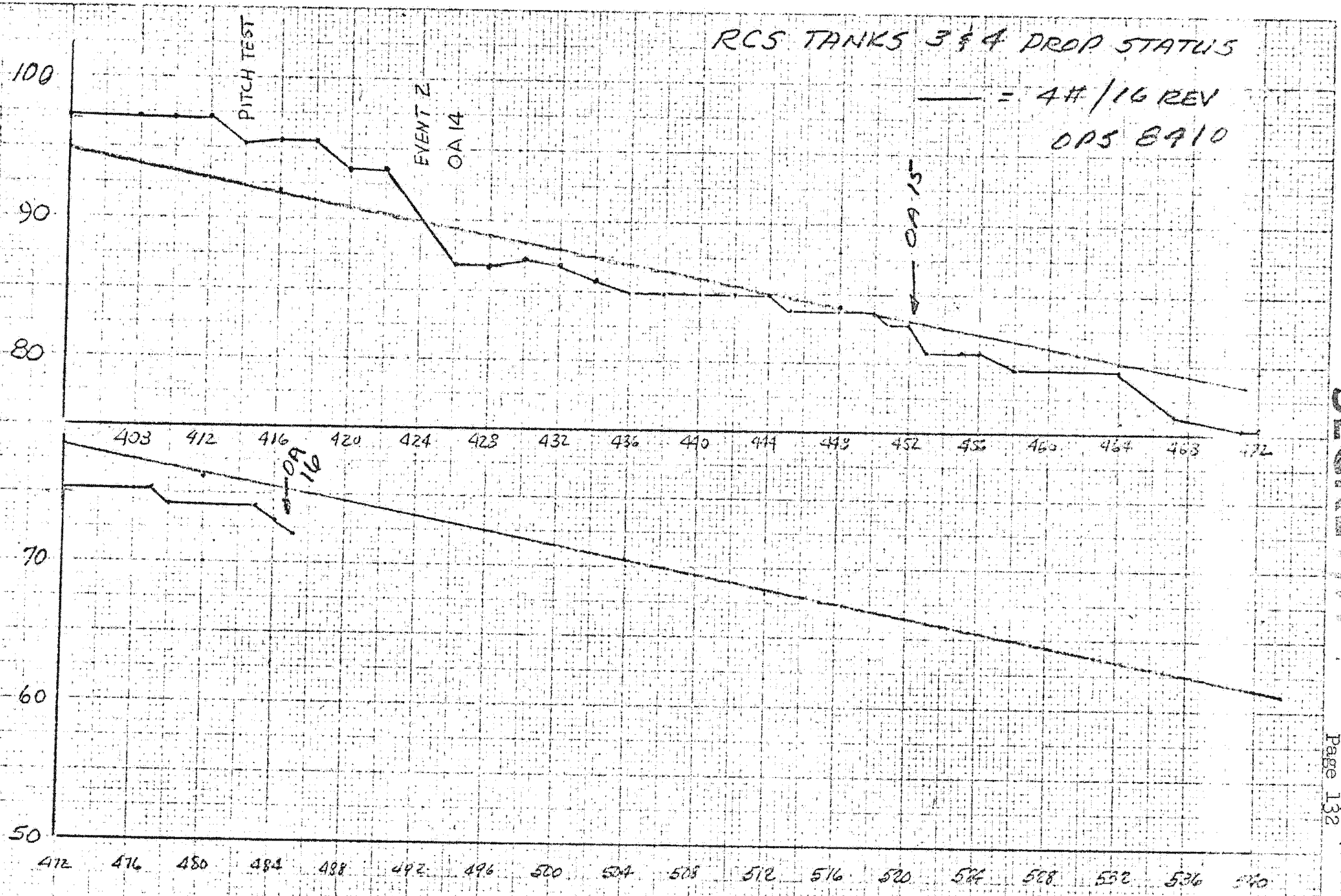


FIGURE 2.7.1

~~SECRET~~

~~SECRET~~

3.7.4 Orbit Adjust System (OAS) Performance

The OAS functioned normally throughout Segment 2. The system was used seven times (OA's number 7 through 13) consuming 405.3 lbs of propellant. At the end of Segment 2, the cumulative propellant usage was 82.5 lbs less than the pre-flight projection.

A revised mission-length orbit adjust study was run on Day 24 in order to assess the possibility of extending mission life. Based on this new projection, there was a margin of approximately 400 lbs over requirements for a 75-day mission.

ORBIT ADJUST SUMMARY

OA Number	7+	8+	9+	10+	11+	12-	13+
Operations Day	13	16	18	20	22	22	24
Rev	198	257	289	322	354	356	387
Delta (Predict (fps)	35.25	17.71	18.94	17.53	31.09	-14.77	23.82
(CAS) (fps)	36.20	18.02	19.35	17.76	31.83	-15.16	24.66
Burn Duration (sec)	95.0	48.6	52.6	48.6	87.0	42.2	68.2
Propellant Used (lbs)	90.1	45.4	49.0	44.6	78.5	37.6	60.0
Avg Tank Temp ($^{\circ}$F)	77.3	78.3	78.5	78.3	78.3	79.0	78.3
Avg Tank Press (psia)	245	232	228	223	218	211	207

3.7.5 Lifeboat II Performance

The Lifeboat II system functioned normally throughout Segment 2. Further data was obtained to evaluate the capability of using the Lifeboat magnetometers as an attitude reference for the Attitude Control System. On Rev 304, data was recorded south of the equator and on Rev 385, data near the North Pole, as well as south of the equator, was obtained. These data compared favorably with the baseline data derived from Revs 45 and 46.

The Lifeboat electronics were again enabled during Rev 424 recovery maneuvers.

The Lifeboat tank heaters were turned off (thermostatic control disabled) on Rev 200, shortly after RV-1 recovery. At that time, the BRAC Battery had a capacity of 244 amp-hours. The heaters remained off throughout Segment 2. The average tank temperature decreased from 175°F to 105°F during that period. At the end of Segment 2, BRAC Battery capacity was 228 A-H, compared with a requirement of 74.9 A-H for 4 days, 3 recoveries and deboost.

3.7-6 Doppler Beacon System

The Doppler Beacon System continued to function normally throughout Segment 2.On Rev 208, the antenna deploy commands were repeated, however, telemetry indicated that no change occurred in the antenna position.

3.7.7 Thermal Performance

An anomaly in the Thermal Control Electronics Assembly (TCEA) performance occurred immediately following RV-1 recovery maneuvers. The TCEA compares the mid-section temperature (C700) with the RV temperatures (C702, C703, C704 and C705). When the RV temperature is 0.3°F less than C700, the RV Heaters come on until the RV temperature is only 0.2°F less than C700. TM error and processing of these absolute temperatures is approximately 0.35°F.

From launch through Rev 195, C700 was always 0.0 to 0.7°F greater than C702, C703, C704 and C705, which is normal. However, after the first RV drop (196K) the C705 (RV-4) temperature decreased to 67.3°F at 199P with C700 at 69.6°F for a delta of 2.3°F. All other RV temperatures, C703 and C704, and RV payload container temperatures, remained constant. From data available, RV-4 heater status monitor indicated off from Rev 197P until 199G at which time it indicated on.

Normal operation was experienced on RV-4 from Rev 199G until Rev 204K at which time only off status was observed. By Rev 205H, C705 was at 67.6°F which was 2.0°F below C700. At Rev 207G (Rev 206 had no station contacts) RV-4 Heater was cycling with C705 at 69.3°F which was within 0.3°F of C700. The RV-4 Heaters started to cycle approximately 3900 seconds prior to the 207G station pass. Table 3.7-1 contains the above temperature history of the Primary TCEA.

Records of these Thermal Control System temperatures are maintained from every rev. No repetition of this anomaly was seen after Rev 205.

3.7.8 Tertiary Payload Performance

[redacted] and B-3 have performed nominally from revs 197 through 424. (b)(1) (b)(3)

TABLE

TCEA TEMPERATURES

Rev/Sta	System Time	C700 Ref Temp	C705 Zone 4 Temp	ΔT
196H	82438	69.3	69.0	-0.3
197P	575	69.6	68.3	-1.3
197K	995	69.6	68.3	-1.3
198P	5820	69.6	67.6	-2.0
199P	10968	69.6	67.3	-2.3
199G	12272	69.6	68.6	-1.0
200B	15800	69.6	69.3	-0.3
201P	21648	69.6	69.3	-0.3
202C	26416	69.6	69.3	-0.3
203C	31653	69.6	69.3	-0.3
204K	37411	69.6	68.6	-1.0
205H	42156	69.6	67.6	-2.0
207G	52578	69.6	69.3	-0.3
208P	59294	69.6	69.0	-0.6
209P	64696	69.3	69.0	-0.3
210P	69918	69.3	69.0	-0.3
211P	75273	69.3	69.0	-0.3

TABLE 3.7-1

3.8 MAPPING CAMERA OPERATIONS (REVS 197 - 424)

3.8.1 Mission Performance (Prepared by NEC)

50 mapping camera operations were executed through the indicated rev span with a total of 650 frames of photography taken. Cumulative totals to Rev 424 included 106 operates with a total of 1665 frames of photography.

There were no telemetry indications of anomalies that might cause a loss of or degradation to any of the photography taken.

The terrain transport phase lock monitor (S241) indicated single frame, momentary drop outs during operates on Revs 269, 317 and 389. These drop outs were not during the terrain exposure and are not considered problems.

The northernmost latitude restriction imposed on the ST operations due to the terrain thermal shutter anomaly noted in Section 2.8 of this report was periodically raised. Listed here is a summary of the changes.

Rev	Limiting North Latitude
214	52°N
255	53°N
295	54°N
335	55°N
375	56°N
415	57°N

Operations over the BAR XC calibration range in Arizona were taken on Revs 243 and 389.

3.9 RV-5 Performance (Prepared by OPC)

The telemetry measurements indicated that the RV-5 system status (temperatures and discrete monitors) remained within specification limits during the second phase of the mission. The RV-5 +45° skirt temperature sensor (S944) indicated 210°F (out-of-band high) on rev. 353, Revs 364-372 and on Revs 398-424, as shown in Figure 3.9-1. The S944 data point started indicating temperature values other than 210°F on Rev. 425. It should be noted that the data did not return to in-band values until sometime after the RV-2 recovery events had occurred.

The Rev. 408 TS Rec data indicated that S944 held at 210°F around the rev. The cause of the apparent malfunction is unknown. The "cause" could be an open in the A328 thermistor leg or a bad input gate in the 3A4 PCM remote unit No. 5.

All other RV-5 temperature sensors have been operating normally.

REV BY REV REAL TIME DATA

RV-5 +45° SKIRT TEMP SENSOR (S944)

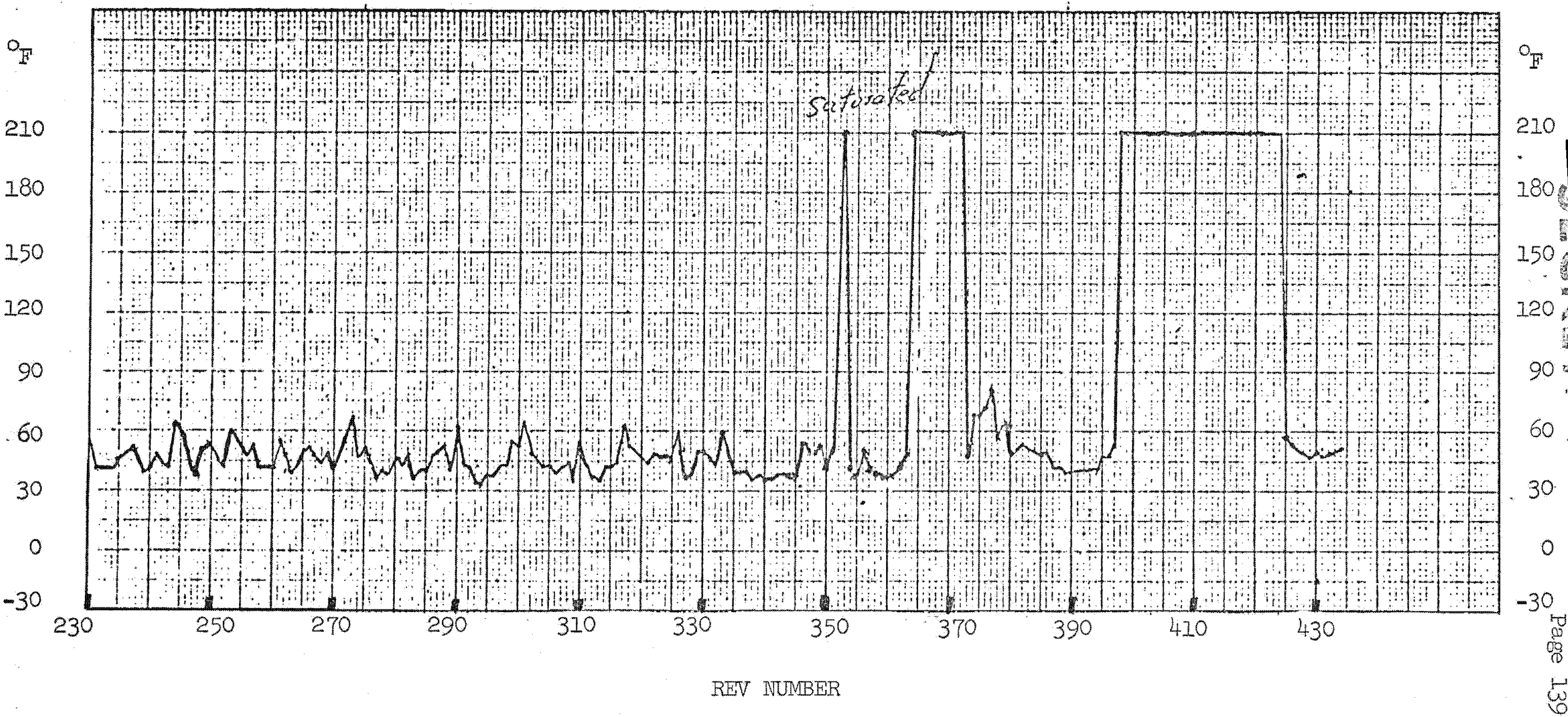


FIGURE 3.9-1

SECRET/H

SECRET/H

SECTION 4

4.0 ORBIT PHASE REV 425 THROUGH RV-3 AND RV-5 RECOVERIES

4.1 Summary

Normal panoramic photography was resumed after RV-2 recovery and continued throughout this segment. ST camera operations continued with latitude restricted to 58°N Lat at the start of the segment and raised to 63°N Lat. on Rev 655 to prevent thermal door malfunction. On Rev 430 the ST system did not shut down as commanded (ran 5 extra frames) and PMU's were VBE'd to contacts. ST MOPs verified normal system operation. Extra ST frames were observed on Rev 446 and loss of first and last frames was noted on Rev 479 and 494. ST operations were halted and resumed on Rev 510 in the backup mode. Leakage rate on RCS-2 had increased to greater than 8 lbs. per day and the transfer to ACS-2 RCS-1 was executed on Rev. 512. On Rev. 519 a yaw rate bias was noted which resulted in yaw attitude errors as high as 1.7 degrees. This bias existed throughout the remainder of the segment. Panoramic camera V_y compensation was used to partially correct the yaw error. On Rev 566 ACS-1 pitch error, noticed earlier in the flight, returned and remained during the rest of the segment. RV-3 was recovered on Rev 651. ST calibration attempts on Revs 665 and 668 were unsuccessful as the thermal door did not open when commanded by the normal or emergency actuators. ST film runout was completed on Rev 675 and RV-5 was air recovered on Rev. 683.

4.1.1 Summary of Events

Successful [redacted] Cals were conducted on Revs 493 and 566. The Rev 639 Cal was aborted just prior to acquisition by a site alpha malfunction. (b)(1) (b)(3)

An improper vector was used in the generation of the Rev 425 messages resulting in large ephemeris errors. The message was regenerated and reloaded into the vehicle on Rev. 428.

The ST camera experienced a late shutdown on Rev 430 which resulted in 5 extra frames of film used. The PMU's were VBE'd to protect against a subsequent failure and the panoramic camera operations were reloaded on the next rev to resume operation. ST MOP's were conducted on Revs 436B and 438C which verified normal ST performance and operations were resumed. Four extra ST frames were lost on Rev

446 and all ST sequences were modified to provide an emergency backup stop. On Revs 479 and 494 the first and last frames were lost (end of tape switch failure) and ST operations were stopped after Rev 494 and resumed on Rev 510 in the backup mode.

RCS-2 use rate had increased to greater than 8 lbs per day and the transfer to ACS-2/RCS-1 was executed on Rev. 512. ACS-1 gyros remained running. On Rev 519 an ACS-2 yaw rate error was detected. This rate error resulted in a yaw attitude error of as high as 1.7 degrees. This error remained throughout the remainder of the segment with the magnitude ranging from 0 to 1.7 degrees. A partial pan camera compensation for the yaw bias by varying V_y was used and proved effective.

On Rev 566 the pitch error in ACS-1, which had been noted earlier in the flight returned and remained during the rest of the segment. The magnitude of this error was sufficiently large enough to preclude consideration of ACS-1 as a useable system.

RV-3 was re-entered and aerially recovered on Rev. 651.

Overall quality of the photography remained comparable to RV-2. Analysis of the photography indicated that the vehicle yaw error caused significant loss in resolution. The V_y compensation was effective in correcting for the yaw error near NADIR.

ST operations continued in the backup mode until the system was properly shut down by the Material Change Detector at the beginning of the calibrate film on Rev 657.

ST calibrations were tried on Rev 665 using the normal thermal door mechanism and again on Rev 668 using the emergency thermal door mechanism. The door failed to open for either attempt and the calibrations were not successful.

ST film runout was programmed for Rev 675 and completion was verified.

RV-5 was re-entered and aerially recovered on Rev 683.

The quality of the mapping camera photography was very good, exceeding expected results.

4.1.2 Problem Summary

a. Late shutdown and loss of frames on ST system

Statement of Problem - Late shutdown of ST system on Revs 430 and 446. After command sequence modification loss of first and last frames was experienced on Revs 479 and 494.

Solution - All ST sequences were modified to include an emergency shutdown at the end of the sequence to protect against failure of the tape stop switch.

After the failures on Revs 479 and 494 the ST system was switched to the backup mode of operation for the remainder of the segment.

b. ACS-2 Yaw rate bias.

Statement of Problem - On Rev 519 a yaw rate bias was detected. This bias resulted in a yaw attitude error of as high as 1.7 degrees. The error continued intermittently throughout the rest of the segment.

Solution - Panoramic camera V_y compensation equivalent to 1.0 degree initially and 0.5 degree later were used from Rev 541 on and proved effective in correcting for the yaw error within plus to minus ten degrees of NADIR. Contingency plans were established on the VBE criteria if the yaw bias became excessive.

c. ACS-1 pitch error.

Statement of Problem - The ACS-1 pitch error, detected earlier in the mission, returned on Rev 566 and remained during the rest of the segment. ACS-1 is running but not controlling the SV. Pitch error magnitude is large enough to prevent use of ACS-1 as a redundant system if ACS-2 were to fail.

Solution - None.

d. Thermal door failure during ST Calibrations.

<u>Statement of Problem</u> - Thermal door failed to open early in the mission under cold temperatures but operated normally in a warm environment. The thermal door did not open during the first ST calibration attempt using normal door mechanism. The thermal door did not open during the second ST calibration attempt using the emergency thermal door operating mechanism. Both calibrate attempts exposed the door to extremely cold temperatures. All subsequent attempts to open the door under various temperature ranges were not successful.

<u>Solution</u> - Redesign and test door over typical orbit temperature ranges.

4.2 COMMAND SUBSYSTEMS PERFORMANCE

(Prepared by CSC)

4.2.1 Health

The health of the Command Systems remained excellent throughout Segment 3 (Revs 425 - 683). There were no equipment malfunctions. None of the Command Systems were subjected to out of specification temperatures or voltages. There were no power dropouts, relay driver overloads, or clock status errors experienced.

4.2.1.1 EXTENDED COMMAND SUBSYSTEM

4.2.1.1.1 Command Modes

The ECS responded properly in all modes into which it was commanded. There were a total of 189 messages loaded in the ECS for this segment. This resulted in 42,208 SPC's being stored for readout from the PMU's.

Of the 42,208 SPC's loaded, 19,311 were output from the PMU's for processing by the decoders. The remaining were erased out prior to time label matches. In loading the 42,208 SPC's a total of 112 rejects occurred. Hula had 70 of those rejects over 12 different passes, Guam had 15 rejects over 3 passes, Boss had 23 rejects over 2 passes, Kodi had 3 rejects in as many passes, Cook had 1 reject. Only Pogo had no rejects.

4.2.1.1.2 ECS Clock Operation

The accuracy of the ECS clock was .0923 parts in 10^6. This corresponds to an average frequency offset of .0945 HZ above the nominal frequency of 1.024×10^6 HZ. The frequency of the clock oscillators changed .0199 HZ in 259 revs. This results in a stability of 1.94 parts in 10^8 over a 16 day period, or 3.03 parts in 10^{10} for an average 6 hour period. All of these values are well within system specifications. The clock plot is presented in Figure 4.2-1.

4.2.1.1.3 ECS Anomalies

There were no ECS anomalies experienced during this segment.

4.2.1.2 MINIMAL COMMAND SUBSYSTEM

4.2.1.2.1 Command Modes

The MCS was not used during this segment.

4.2.1.2.2 MCS Anomalies

There were no MCS anomalies.

4.2.1.3 REMOTE DECODER/BUD

4.2.1.3.1 Command Modes

The remote decoder was used for the recovery of RV-3 and RV-5 which ended this segment of the flight. The performance of both channels was verified from telemetry to be proper for all commands.

No commands were issued from the BUD during this segment.

4.2.1.3.2 Remote Decoder/BUD Anomalies

There were no remote decoder or back-up decoder anomalies.

4.2.1.4 SUMMARY

4.2.1.4.1 Expendables and Environmental Data

Total Command Readouts	PMU-A 9906 PMU-B 9405
ECS Clock Drift Rate	.0923 parts in 10^6
ECS Clock Stability	1.94 parts in 10^8 for a 259 rev period
Total Hours On	ECS 1020 MCS 4.5 RD 4.5 BUD .05

Secure Words Expended at end of Segment 3 PMU-A 92 PMU-B 76

Environmental Data: See Figure 4.2-1 through 4.2-7

Clock Accuracy (Avg) $= \frac{\text{Bias}}{\text{Time}}$

$= \frac{.1267}{1.373\text{x}10^{6}} = .0923\ \text{x}10^{-6}$

Average Clock Frequency $= (.0923\text{x}10^{-6} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$

$= 1,024,000.0945$

Frequency 1 (f_1) $= \left(\frac{\text{Bias}}{\text{ECS Time}} \text{ x } 1.024\text{x}10^{6} \right) + 1.024\text{x}10^{6}$

$= \frac{1.01\text{x}10^{-2}\ \text{Sec}}{.95\text{x}10^{5}\ \text{Sec}} \text{ x } 1.024\text{x}10^{6} + 1.024\text{x}10^{6}$

$= 1,024,000.1089$

Frequency 2 (f_2) $= \frac{\text{Bias}}{\text{ECS Time}}$

$= \frac{(1.0\text{x}10^{-2}}{(1.15\text{x}10^{5}\ \text{Sec}} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$

$= 1,024,000.089$ HZ

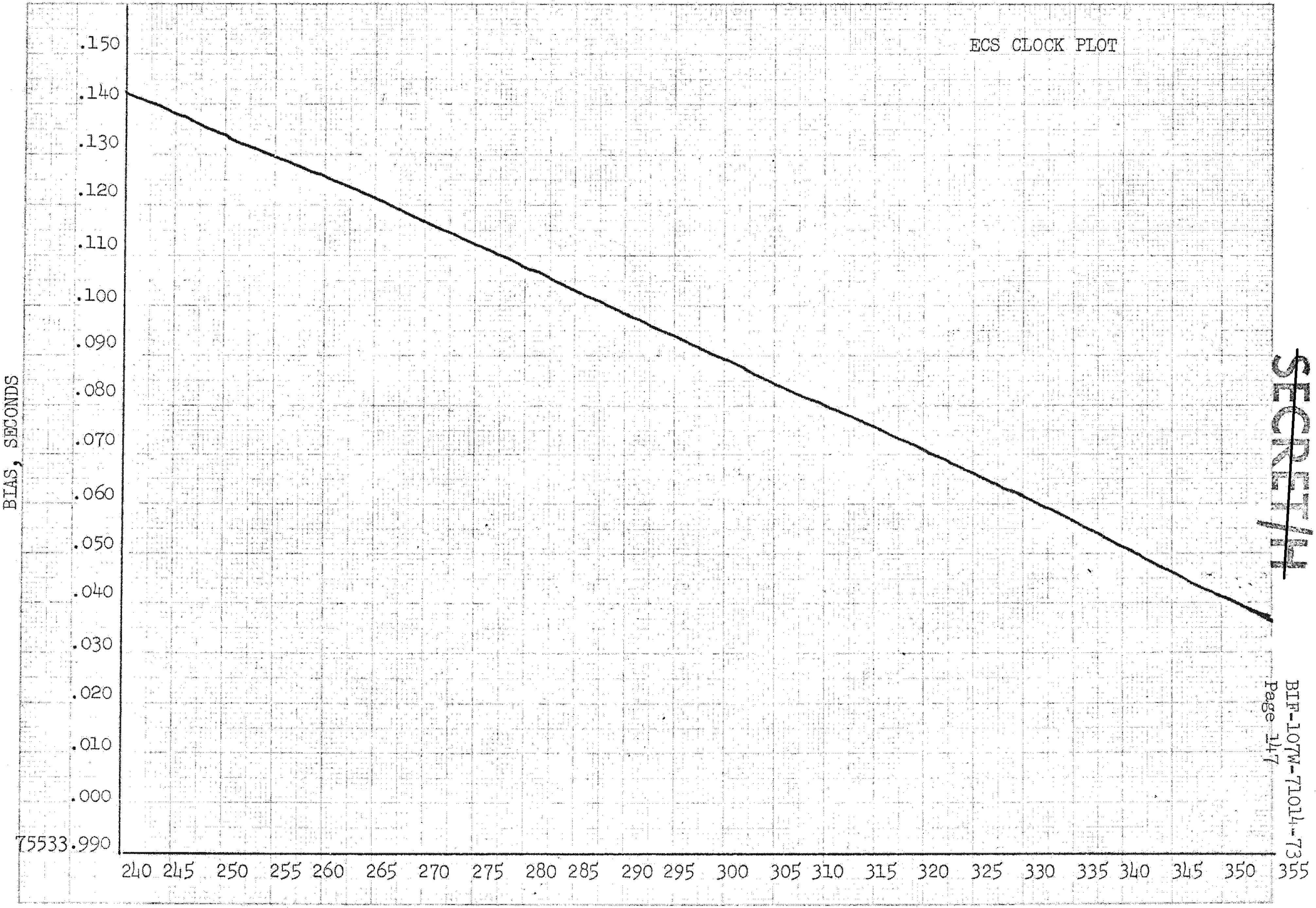
Clock Stability $= \frac{f_1 - f_2}{\text{Frequency (Avg)}}$

$= \frac{.0199\ \text{HZ}}{1.024\text{x}10^{6}} = 1.94\text{x}10^{-8}$

$= 1.94$ parts in 10^{8} for this 259 rev period

$= 3.03$ parts in 10^{10} for average 6 hour period

~~SECRET/H~~



~~SECRET/H~~

Figure 4.2-1

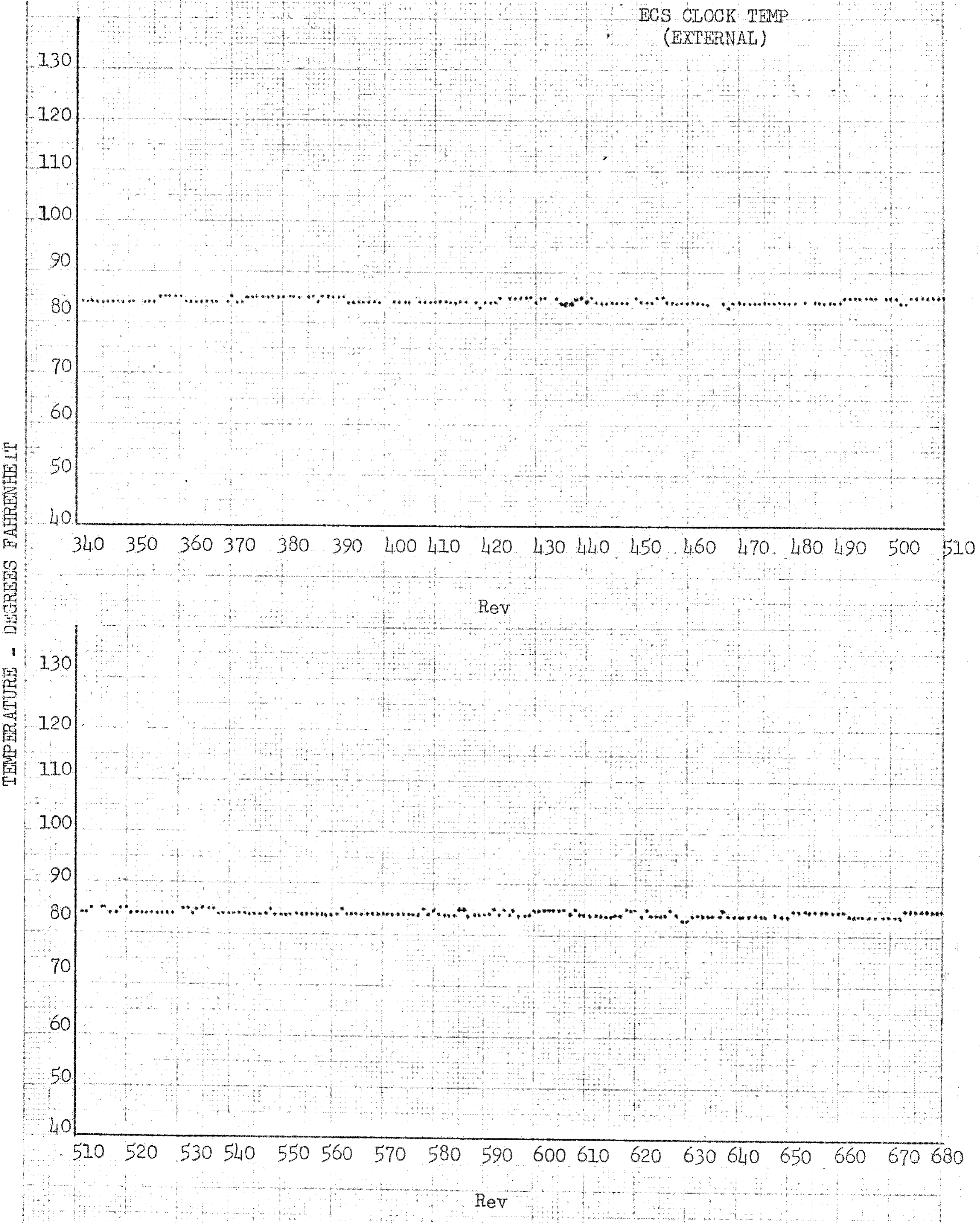

ECS CLOCK TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
340
350
360
370
380
390
400
410
420
430
440
450
460
470
480
490
500
510
Rev
130
120
110
100
90
80
70
60
50
40
510
520
530
540
550
560
570
580
590
600
610
620
630
640
650
660
670
680
Rev

Figure 4.2-2

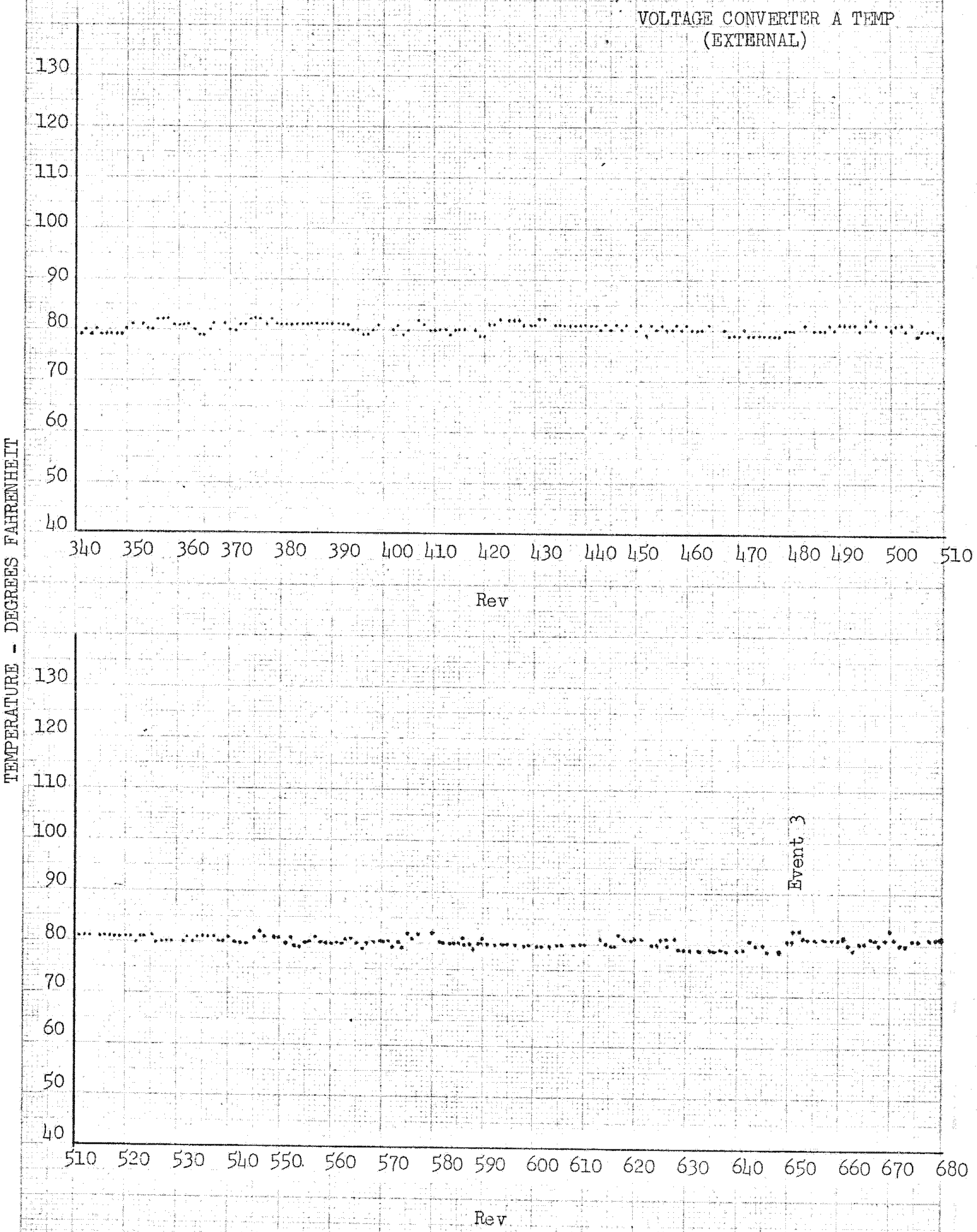
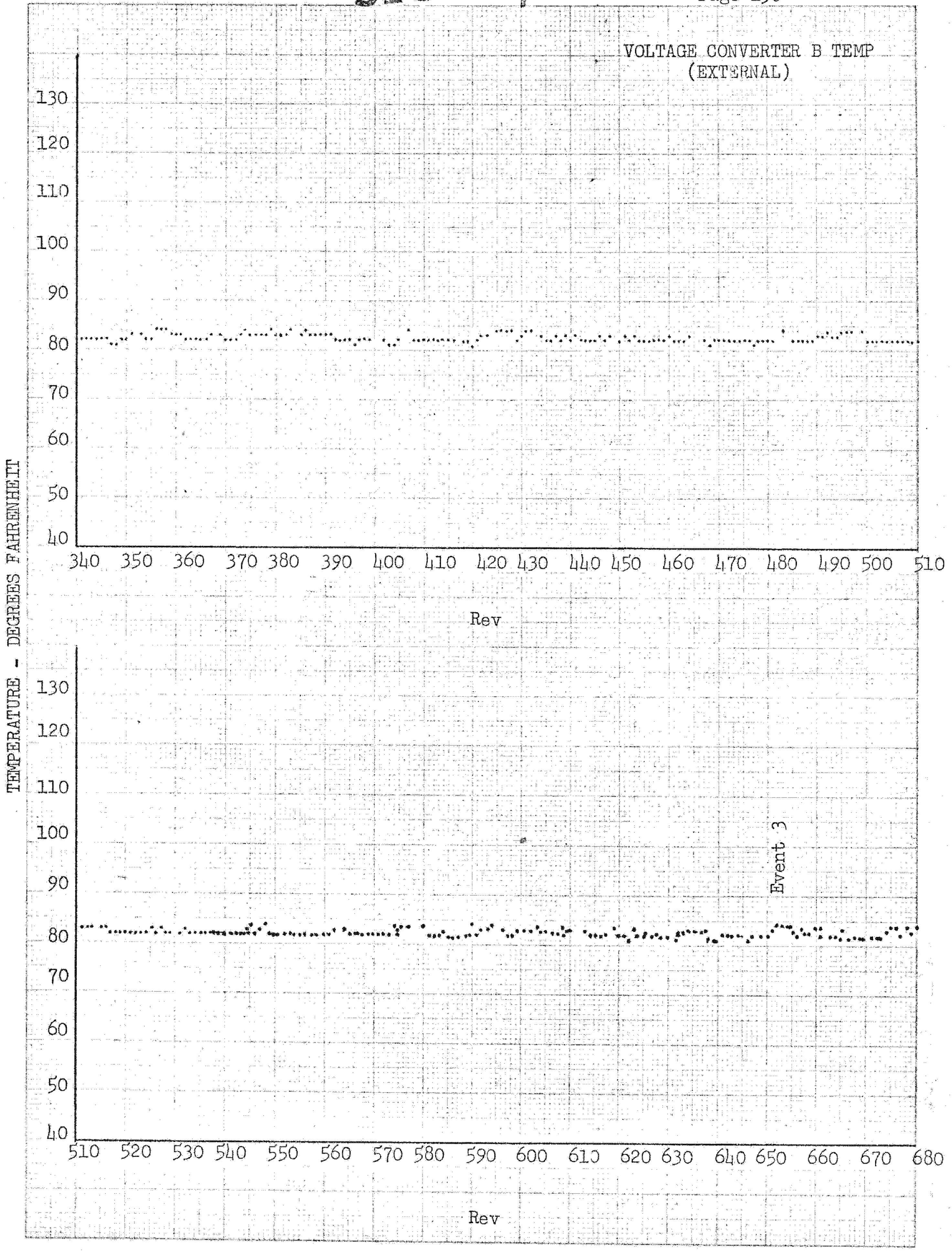
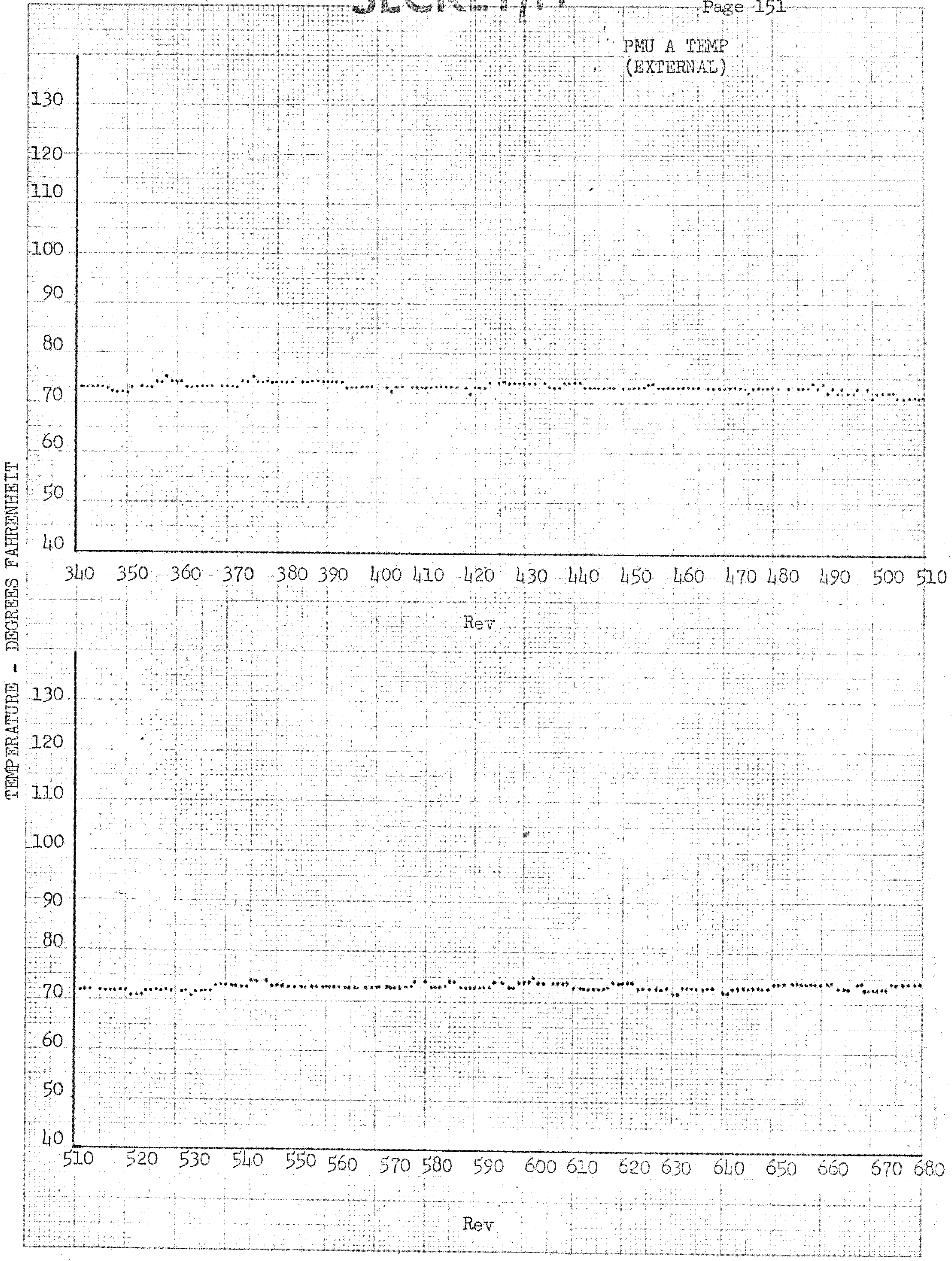

VOLTAGE CONVERTER A TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
340
350
360
370
380
390
400
410
420
430
440
450
460
470
480
490
500
510
Rev
130
120
110
100
90
80
70
60
50
40
510
520
530
540
550
560
570
580
590
600
610
620
630
640
650
660
670
680
Rev
Event 3

Figure 4.2-3



VOLTAGE CONVERTER B TEMP
(EXTERNAL)

Figure 4.2-4



PMU A TEMP
(EXTERNAL)

Figure 4.2-5

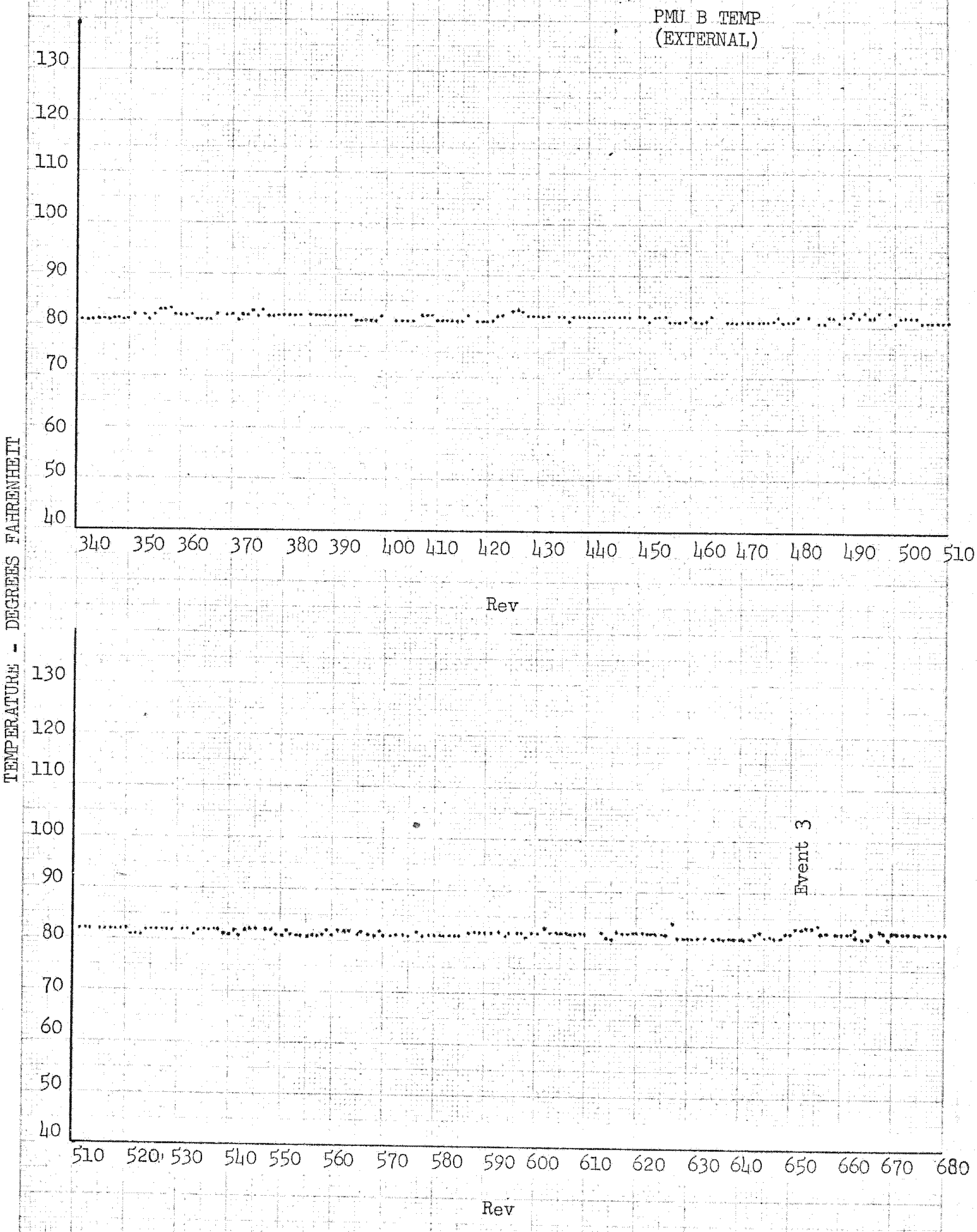

PMU B TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510
Rev
130
120
110
100
90
80
70
60
50
40
Event 3
510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680
Rev

Figure 4.2-6

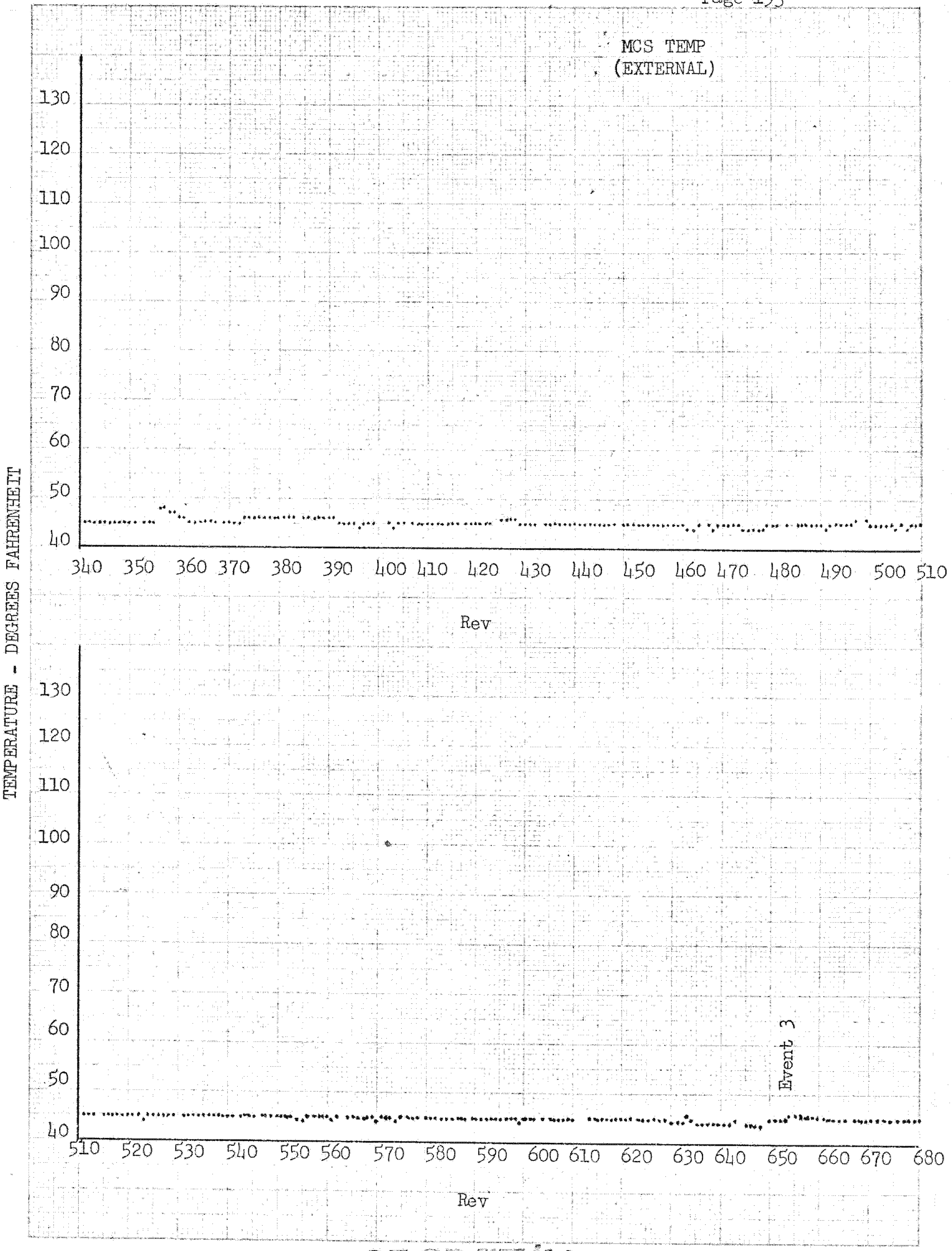

MCS TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
340
350
360
370
380
390
400
410
420
430
440
450
460
470
480
490
500
510
Rev
130
120
110
100
90
80
70
60
50
40
510
520
530
540
550
560
570
580
590
600
610
620
630
640
650
660
670
680
Rev
Event 3

Figure 4.2-7

4.3 SENSOR SYSTEM OPERATIONS THROUGH RV-3 (SSC)

4.3.1 Mission Operations Performance

Sensor Subsystem operations throughout RV-3 demonstrated nominal performance characteristics with no major anomalies or malfunctions. The operational constraints of a fixed -5 IPS rewind, and no 120-degree scans or 30-degree scans at ±45-degree centers continued throughout RV-3.

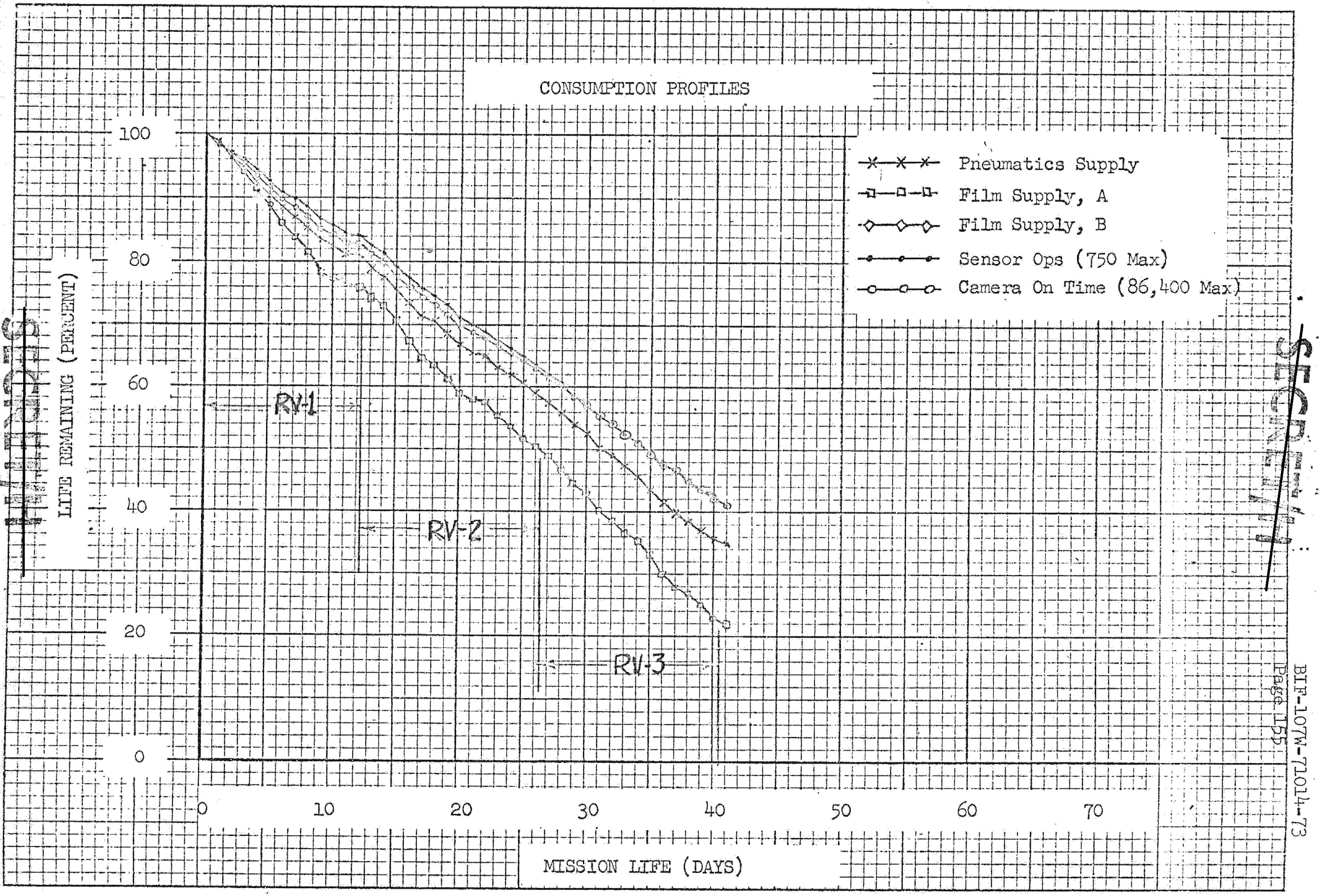
The TIM TU3 select discrete changed to the zero state on Rev 491 during Op 324. The loss of this discrete had no effect on the operation of the sensor system so operations continued without interruption. Later in the RV-3 segment, the discrete returned to the proper state for a few revs. The TU4 select discrete indicated properly when the TU4 transfer was commanded at the end of the RV-3 segment.

Analysis of the photographic results in RV-2 indicated that no further adjustments in the focal plane positions were required. The photographic evaluation did reveal that the aft camera film speed (V_f) was not optimum so on Rev 476, the aft camera V_f 00AA nominal was changed to 0.010 IPS.

The RV-3 mission segment consisted of 155 sensor system operations, consuming 17,738 seconds of camera power on time, 7.5 pounds (estimated) of nitrogen gas, and approximately 28,460 feet of film for the forward looking camera and 28,620 feet for the aft. Consumption profiles through RV-3 are graphically depicted in Figure 1. The difference in forward and aft footages represents an initial aft mono operation among many that will be required prior to the completion of the mission to utilize the approximately 1700 feet of extra film on that side.

The overall quality of the acquired photography for the RV-3 mission segment was fair, with atmospheric haze and weather continuing to degrade the imagry throughout. The image quality of both cameras for this mission segment appeared comparable. The best photography from RV-3 was comparable to the best from RV-2. The photographic analysis also indicated that the vehicle yaw errors (up to 1.7 deg.) that begin on Rev 523 caused as much as 20 to 30 line/mm loss in resolution, and that the V_y compensation utilized was effective in correcting for this error, especially for scan angles from plus to minus 10 degrees.

~~SECRET~~



~~SECRET~~

4.3.2 Engineering Tests

Several engineering tests were performed during this segment of the mission, primarily in support of a special PFA photographic distortion test referred to as "McDonald's Arches".

Rev 470 - Tucson, Arizona MOP
Rev 518 - McDonald's Arches MOP
Rev 519 - McDonald's Arches MOP
Rev 535 - Snow Cover Evaluation MOP
Rev 550 - McDonald's Arches MOP
Rev 551 - Resolution Target MOP
Rev 568 - McDonald's Arches MOP
Rev 582 - McDonald's Arches MOP
Rev 616 - Snow Cover Evaluation MOP
Rev 631 - McDonald's Arches MOP.

4.4 RV3 (S/N 22) Performance (MWC)

This report presents an analysis of the RV3 performance based on evaluation of recovery studies, command message, RV and SV telemetry, voice reports, and the recovery test report TWX. Tables 4.4-1 and 4.4-2 list all relevant data. Also included are graphs showing the performance of the RV heaters.

4.4.1 Summary

The RV payload was 98.50% of the maximum I.C.D. weight and was unbalanced 2.04%. The PREP 2 event took place on Rev 650 over POGO and separation occurred on Rev 651. Preparation, deorbit, and entry events, and drogue and main parachute deployment conditions were normal and executed as planned. Aerial recovery was accomplished on the first pass at 14,200 feet altitude. The parachute system oscillated 30 degrees from vertical during descent to 15,000 feet but was stable during the recovery pass. The cone had two tears and the min canopy was frayed at the skirt. No capsule damage was reported.

The recovery location was within 13.76 nautical miles of the predicted impact point. This value is the resultant of in-track and cross-track miss distances, uncorrected for winds. The capsule was returned in good condition. Both Core Pins were sheared.

4.4.2 Anomaly

The recovery forces reported that the xenon strobe light that is used as a recovery aid in the event of water impact, was flashing during reel-in of the RV after aerial recovery. This light is normally actuated when sea water comes in contact with a water sensor. This problem is under investigation.

RECOVERY DATA

RV REENTRY PARAMETERS FROM TEAPOT EVALUATION RUN

ORBIT		
REV	651	
APOGEE	143.909	NM
PERIGEE	85.947	NM
ARG OF PERIGEE	122.655	°
INCLINATION	95.655	°
RETRO CONDITION		
TRUE ANOMALY	5.18	°
ALTITUDE	516680.81	FT
LATITUDE	51.694	°N
LONGITUDE	160.96	°W
ENTRY (400K)		
INERTIAL VEL.	25515.48	FT/SEC
γ	-1.9914	°
α_H	105.05	°
LATITUDE	41.835	°N
LONGITUDE	163.73	°W
DROGUE DEPLOY		
VELOCITY	1429.88	FT/SEC
MACH NO.	1.48	
ALTITUDE	63643.19	FT
γ	-31.2464	°
q	193.790	PSF
HEAT SHIELD JETTISON		
ALTITUDE	49632.61	FT
ETPD		
ALTITUDE	46000	FT
DESCENT VEL @ 15K	29.2	FT/SEC

RV EVENT TIMES (FROM CMDMSG & TLM) IN SYSTEMS TIME

RV n+1 OUTLET T/S	79309.5	
RV n INLET T/S	79313.5	
DT START	83433.5	
PITCH DOWN START	84486.5	
PITCH DOWN STOP	84539.8	
RV PYRO ARM (BAT ACT)	84656.3	
KODI ACQUISITION	84885.2	(79.8)
ORB PWR OFF	85026.8	
RV SEPARATION	85036.8	
RV RETRO FIRE	85162.2	
KODI FADE (RV)	85212.5	(18.3)
*ENTER IONIZATION	85415.5	
*EXIT IONIZATION	85612.5	(-7.5)
DROGUE DEPLOY	85657.9	(9.1)
ETPD (DISREEF + 3 SEC)	85724.4	(N/A)
HEAT SHIELD JETTISON	85683.1	

NOTE: TIME IN PARENTHESIS IS THE DELTA FROM THE PREDICTED TIME. TIMES THAT FALL WITHIN THE ONE SECOND PRINTOUT INTERVAL OF SV TLM IS CONSIDERED TO HAVE A ZERO DELTA TIME.

*BASED ON LOS AND AOS AS REPORTED BY UP-RANGE RECOVERY AIRCRAFT.

RV MASS PROPERTIES (FROM UPDATED TEAPOT RUN)

PAYLOAD WEIGHT		
SIDE A	224.2	LBS
SIDE B	228.9	LBS
% UNBAL $\frac{\lvert W_a-W_b \rvert}{230}$	2.04	%
% FULL (460 lb = 100%)	98.50	%
RV WEIGHTS		
SEPARATION	1541.36	LBS
PRE RETRO	1539.67	LBS
ENTRY	1348.86	LBS
RECOVERY	1134.22	LBS

RV PITCH ANGLE (FROM BASIC STUDY)

θRVS	-125.83	°
$-\Delta\theta 1$	1.94	°
$+\Delta\theta 2$	-.051	°
θSV	37.821	°

PITCH ANGLE USED FOR UPDATED TEAPOT

θRVS	-125.656	°

TABLE 4.4-2
RV-3

RECOVERY DATA

EVENT	LATITUDE		LONGITUDE	
LOCATION				
NOMINAL PIP	22.000	°N	167.70	°W
UPDATED TEAPOT	22.269	°N	167.66	°W
TEAPOT EVALUATION	22.291	°N	167.66	°W
ACTUAL RECOVERY LOCATION	22.383	°N	167.45	°W
ERROR (ACTUAL-TEAPOT EVAL.)	-.092	°	.21	° E
ERROR (1° = 60 NM)	-5.52	NM	12.6	NM E
TOTAL ERROR	13.76	NM		

AERIAL RECOVERY

ALTITUDE	14200 FT
PASS NUMBER	1
AIRSPEED	158 (KTAS) 124 (KIAS)
CHUTE CONDITION	Cone had 2 tears just below geodetic lines, chute frayed at skirt.
CHUTE BEHAVIOR	± 30° oscilliations to 15,000 ft. altitude, moved some during recovery approach.
TIME	0004Z (to nearest minute)

RETRIEVAL
CAPSULE CONDITION No Visible Damage

WINCH SETTINGS
PRESET TENSION LEVEL 3700 lb.

PAY OUT Normal
CONTACT Right Pole hook engaged load lines

VERIFIED RECOVERY AREA WIND DATA

DATA SOURCE: MEMOGRAM 8410-1199

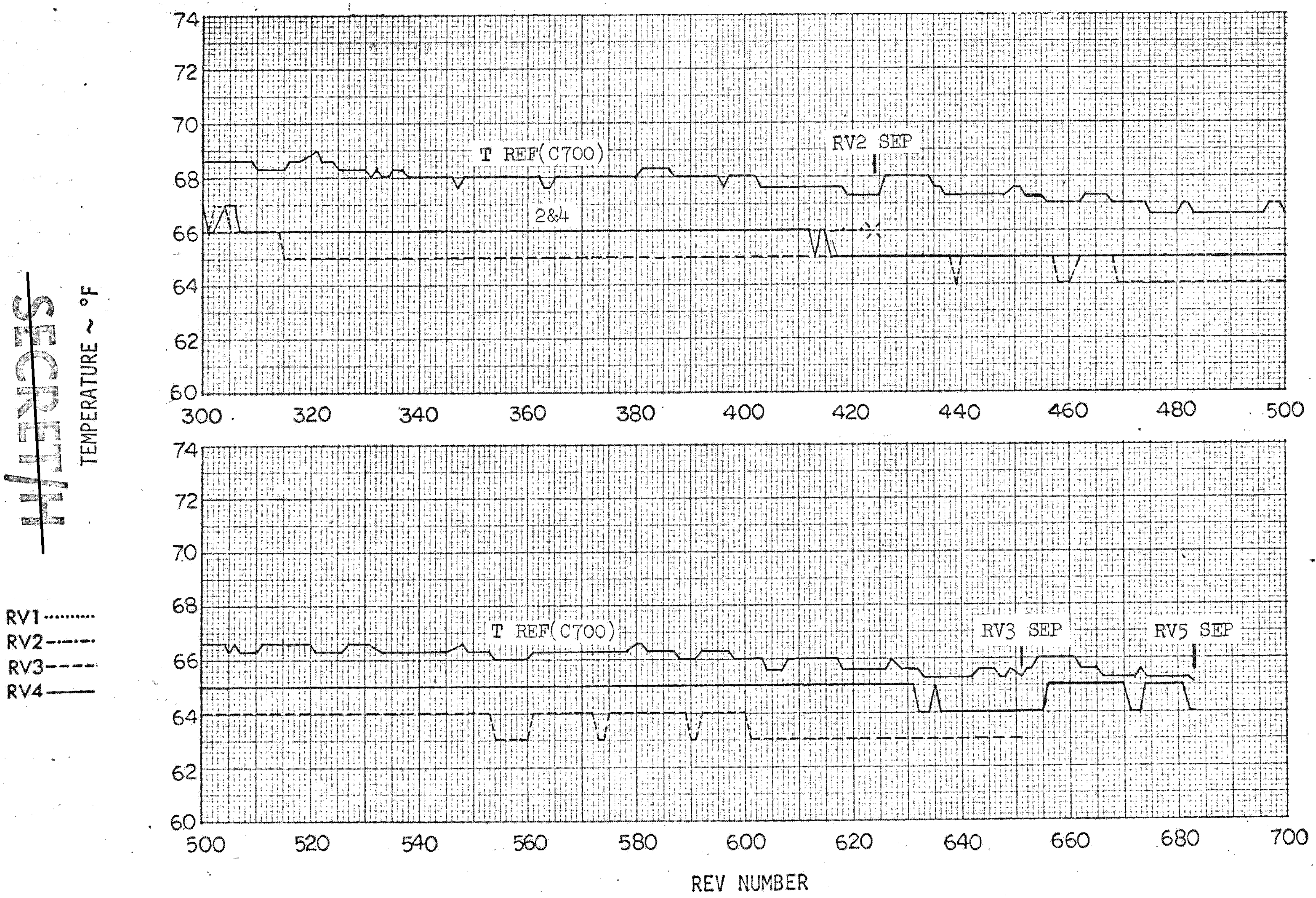
ALTITUDE 1000's FT	DIRECTION (DEGREES)	VELOCITY (KNOTS)	ALTITUDE 1000's FT	DIRECTION (DEGREES)	VELOCITY (KNOTS)
60	-	-	20	240	15
55	-	-	15	230	10
50	270	70	10	120	10
45	270	80	8	120	10
40	260	85	6	120	10
35	260	75	4	130	10
30	250	55	2	130	05
25	240	45	SFC	130	05

~~SECRET/H~~

ACTIVE THERMAL CONTROL SYSTEM

RV PAYLOAD CONTAINER & REFERENCE TEMPERATURES

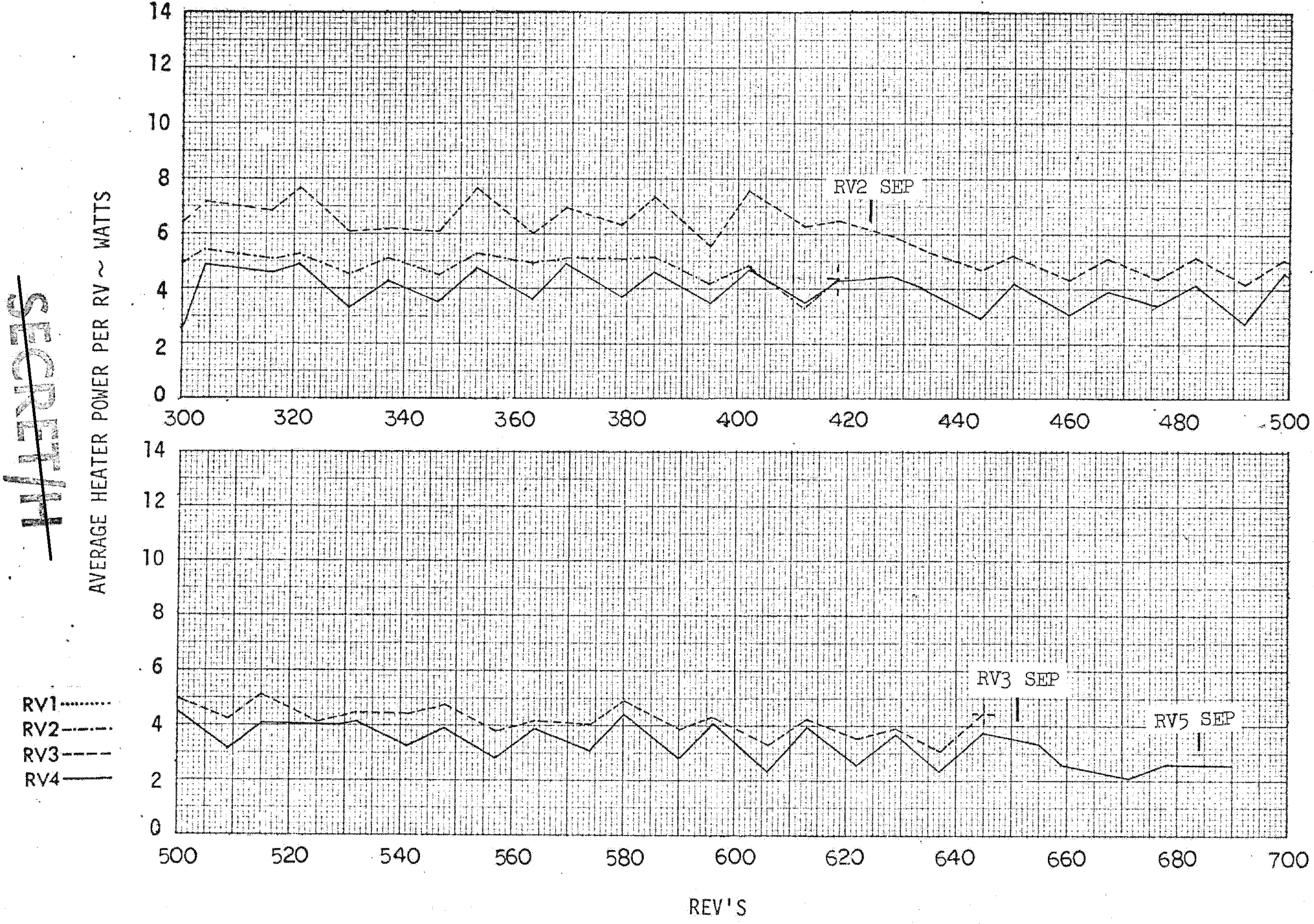
~~SECRET/H~~



~~SECRET/H~~

ACTIVE THERMAL CONTROL SYSTEM

RV HEATER POWER CONSUMPTION



~~SECRET/H~~

~~SECRET/H~~

BIF-107W-71014-73
Page 161

4.5 SATELLITE CONTROL FACILITY PERFORMANCE

4.5.1 Orbit Determination and Prediction

4.5.1.1 Orbit Determination

Table 4.5-1 shows a summary of the orbital conditions computed from each tracking reduction from RV-2 recovery to RV-3 recovery on Rev 651 and RV-5 recovery on Rev 683. Significant events affecting the orbit included an orbit adjust every two days. The events during the RV-3 segment were:

1. Positive orbit adjust on Rev 426
2. Positive orbit adjust on Rev 452
3. Positive orbit adjust on Rev 484
4. Positive orbit adjust on Rev 516
5. Positive orbit adjust on Rev 549
6. Positive orbit adjust on Rev 581
7. Positive orbit adjust on Rev 614
8. Positive orbit adjust on Rev 653.

A more exact method of calculating tumbling lifetime, based upon the stable lifetime and the measured B factor increase for a tumbling vehicle, was implemented during this segment of the mission. The corrected tumbling lifetime data have been used for Table 4.5-1.

4.5.1.2 Prediction Accuracy

Table 4.5-2 contains a summary of prediction accuracies over a ten rev span from each tracking reduction epoch rev. Accuracies are determined by comparing the nodal crossing differences between the Best Fit Ephemeris and the tracking reduction ephemeris predictions. Prediction accuracies were within accpetable limits throughout the RV-3 segment although the ten rev prediction exceeded the 3 second limit on Rev 527 and Rev 543 as a result of sudden drag increases. Prediction accuracy on Rev 668 resulted from the ST calibrate maneuvers on Revs 665 and 668.

~~SECRET/H~~

TRACKING REDUCTION SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
425	.0087	.4147	88:36.2	148.20	83.54	130.9	.5686	103/30		
426	.0095	.3319	88:49.2	155.46	85.29	140.1	.5684	136/40	OA #14	
427	.0095	.3319	88:49.5	155.59	85.31	140.2	.5703	136/40		
430	.0095	.3072	88:48.7	155.05	85.39	139.2	.5264	147/43		
435	.0094	.3242	88:47.1	154.22	85.09	138.3	.5382	139/40		
438	.0092	.3388	88:46.1	153.36	85.28	137.4	.5655	132/38		
441	.0092	.3551	88:44.9	152.81	85.06	136.6	.5793	126/37		
444	.0090	.3489	88:43.9	152.18	85.01	135.9	.5626	127/37		
445	.0090	.3480	88:43.6	152.01	85.00	135.5	.5600	127/37		
451	.0089	.3337	88:41.5	150.79	84.72	134.1	.5491	124/36		
453	.0096	.3264	88:48.3	155.57	85.14	137.2	.5469	140/41	OA #15	
457	.0094	.3388	88:46.8	154.82	84.93	136.1	.5540	134/39		
459	.0094	.3454	88:46.1	154.40	84.85	135.6	.5578	131/38		
462	.0093	.3472	88:45.2	153.73	84.92	134.6	.5592	130/38		
467	.0092	.3509	88:43.4	152.75	84.66	133.6	.5480	128/37		
470	.0090	.3539	88:42.4	151.95	84.77	132.7	.5509	127/37		
473	.0090	.3698	88:41.2	151.36	84.57	131.9	.5632	121/35		

Table 4.5-1

~~SECRET/H~~

~~SECRET~~

TRACKING REDUCTION SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
475	.0090	.3779	88:40.4	150.92	84.46	131.3	.5677	117/34		
478	.0089	.3725	88:39.4	150.21	84.53	130.40	.5597	118/34		
483	.0087	.3863	88:37.5	149.04	84.31	129.3	.5599	114/33		
486	.0097	.3385	88:48.6	156.48	85.07	135.3	.5621	138/40	OA #16	
488	.0097	.3610	88:47.8	156.02	84.91	135.1	.5911	128/37		
491	.0091	.3739	88:46.6	155.46	84.70	134.1	.5971	123/36		
494	.0094	.3668	88:46.1	154.92	84.87	133.5	.5904	125/36		
499	.0093	.3765	88:43.7	153.56	84.65	131.9	.5858	121/35		
502	.0092	.3781	88:42.7	152.80	84.69	131.1	.5849	120/35		
506	.0091	.3973	88:41.1	151.93	84.42	130.0	.5941	113/33		
508	.0091	.3976	88:40.2	151.40	84.37	129.5	.5895	113/33		
511	.0090	.3950	88:39.2	150.65	84.41	128.5	.5818	113/33		
516	.0099	.3399	88:49.9	157.76	85.08	134.9	.5691	139/40	POS OA #17	
518	.0098	.3370	88:49.9	157.67	85.22	134.8	.5683	140/41		
522	.0098	.3522	88:48.4	156.83	84.95	134.1	.5783	133/39		
524	.0097	.3563	88:47.7	156.41	84.87	133.5	.5781	131/38		
527	.0096	.3579	88:46.7	155.68	84.98	132.4	.5801	130/38		
532	.0094	.4123	88:44.5	154.22	84.84	131.4	.6515	112/33		

Table 4.5-1

~~SECRET~~

~~SECRET/H~~

TRACKING REDUCTION
SUMMARY

EPOCH REV XXX	ECCENT. .XXXX	PERIOD DECAY .XXXX	INTEG. PERIOD XX:XX.X	MAX. ALTIT. XXX.XX	MIN. ALTIT. XX.XX	ARG. PERIGEE XXX.X	DRAG .XXXX	STABLE/ TUMBLE XXX/XX	COMMENTS	DMEEK
535	.0093	.4691	88:43.1	152.22	84.80	130.5	.7314	97/28		
538	.0092	.4783	88:41.6	152.43	84.53	129.7	.7248	95/28		
540	.0091	.4722	88:40.7	151.90	84.39	129.2	.7025	96/28		
543	.0090	.4561	88:39.5	151.05	84.44	128.2	.6742	98/28		
548	.0089	.4222	88:37.4	149.83	84.15	127.1	.6018	105/31		
551	.0099	.3599	88:50.0	157.97	85.18	134.2	.6053	132/38	OA #18	
554	.0098	.3911	88:48.8	157.25	85.05	133.4	.6472	120/35		
556	.0098	.3859	88:48.0	156.87	84.89	132.9	.6271	122/35		
559	.0096	.3727	88:47.1	156.14	85.02	131.9	.6070	126/37		
565	.0095	.4043	88:45.8	155.20	85.12	131.1	.6520	115/33		
567	.0093	.4497	88:43.6	153.77	84.97	129.8	.7103	102/30		
571	.0092	.4743	88:41.7	152.78	84.57	128.6	.7168	96/28		
574	.0091	.4524	88:40.5	151.86	84.59	127.9	.6789	100/29		
576	.0090	.4577	88:39.6	151.26	84.55	127.2	.6794	98/28		
581	.0099	.4301	88:50.0	158.09	85.17	133.6	.7231	110/32	OA #19	
583	.0098	.4301	88:49.7	157.83	85.25	133.4	.7240	110/32		
587	.0098	.4267	88:48.0	156.91	84.84	132.7	.6920	110/32		
589	.0097	.4086	88:47.2	156.44	84.76	132.3	.6555	115/33		

Table 4.5-1

~~SECRET/H~~

BIF-107W-71014-73
Page 165

TRACKING REDUCTION SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
592	.0096	.4001	88:46.1	155.67	84.84	131.1	.6386	117/34		
597	.0095	.3955	88:44.2	154.60	84.53	130.1	.6088	116/34		
600	.0094	.3693	88:43.1	153.79	84.72	129.1	.5	124/36		
603	.0093	.3801	88:42.0	153.21	84.49	128.3	.5717	121/35		
605	.0093	.3834	88:41.1	152.72	84.41	127.8	.5706	119/34		
608	.0091	.3904	88:40.1	151.94	84.47	126.9	.5779	116/34		
612	.0090	.4403	88:37.8	150.45	84.23	125.8	.6294	101/29	OA #20	
616	.0096	.3836	88:47.0	159.01	85.26	131.4	.6339	122/35		
619	.0095	.4407	88:45.6	155.21	84.97	130.8	.7071	105/31		
621	.0095	.4351	88:44.7	154.74	84.83	130.4	.6872	106/31		
624	.0094	.4267	88:43.6	153.90	84.92	129.4	.6707	108/31		
629	.0092	.4247	88:41.5	152.60	84.70	128.2	.6462	107/31		
632	.0091	.4272	88:40.3	151.72	84.73	127.3	.6452	106/30		
635	.0090	.4430	88:38.9	150.95	84.50	126.5	.6511	101/29		
637	.0089	.4559	88:37.9	150.43	84.34	125.9	.6574	98/28		
639	.0088	.4512	88:37.2	149.81	84.41	125.5	.6481	99/29		
645	.0087	.4509	88:34.5	148.13	84.12	123.9	.6211	97/28		
648	.0085	.4542	88:33.2	147.15	84.17	123.1	.6210	96/28		

SECRET/H

Table 4.5-1

SECRET/H

SECRET/H

TRACKING REDUCTION SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
652	.0084	.5335	88:30.6	145.51	83.80	122.1	.6962	80/23	RV3 Recovery	
654	.0105	.3917	88:55.3	162.05	85.27	136.1	.6878	125/36	OA #21	
657	.0102	.3803	88:54.3	161.12	85.55	135.4	.6760	128/37		
662	.0107	.3866	88:52.4	160.00	85.23	134.4	.6638	125/36		
664	.0101	.3821	88:51.7	159.43	85.34	133.8	.6572	126/37	FA CAL 1	
668	.0099	.4027	88:49.9	158.49	85.05	132.6	.6564	121/35	FA CAL 2	
670	.0099	.4008	88:48.8	157.77	84.91	132.3	.6561	118/34		
673	.0098	.4473	88:47.6	156.81	84.97	131.3	.7265	105/31		
678	.0096	.4456	88:45.4	155.50	84.63	130.4	.6963	105/31		
681	.0095	.4488	88:44.1	154.53	84.68	129.5	.7161	103/30		

Table 4.5-1

SECRET/H

PREDICTION [illegible]ACY SUMMARY

(BFE - Tracking Reduction Predictions)

Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch	Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch
425	27	--	--	502	32	-.162	-.233
426	27	1.481	3.548	506	32	.096	.795
427	27	.677	1.761	508	32	.163	.970
430	27/28	-.148	-.989	511	32/33	.271	--
435	28	-.444	-1.217	516	33	1.515	3.126
438	28	-.216	-.288	518	33	-.193	-.627
441	28	.184	.733	522	33	.006	-.975
444	28/29	-.044	.397	524	33	-.178	-1.753
445	29	--	.534	527	33/34	-.829	-3.762
451	29	.694	.945	532	34	-1.018	-2.634
453	29	-.136	-.426	535	34	.239	1.747
457	29	-.140	-.237	538	34	.696	3.094
459	29	-.012	.042	540	34	.761	3.086
462	29/30	.073	.206	543	34/35	.897	3.764
467	30	.097	-.397	548	35	.875	2.259
470	30	-.182	-.688	551	35	-.118	-.163
473	30	-.010	.130	554	35	.519	1.459
475	30	.187	.555	556	35	.467	.770
478	30/31	-.021	.843	559	35/36	-.093	-1.748
483	31	.972	2.104	564	36	-.989	-2.608
486	31	-.244	-.878	567	36	-.131	.165
489	31	.054	.119	571	36	.380	.981
491	31	.211	.570	574	36/37	-.321	-1.289
494	32	--	.022	576	37	--	-1.470
499	32	-.058	-.213	581	37	.633	2.471

~~SECRET~~

~~SECRET~~

Table 4.5-2

PREDICTION [illegible]ACY SUMMARY

(BFE - Tracking Reduction Predictions)

Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch	Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch
583	37	.162	1.687	664	42	-.710	-2.964
587	37	.654	2.589	668	42	-1.433	-3.520
589	37	.339	1.602	670	42	-1.321	-1.736
592	37/38	.385	1.743	673	42/43	.322	1.068
597	38	.648	1.899	678	43	-.094	-2.012
600	38	-.010	-.253	681	43	.365	1.453
603	38	-.117	-.991				
605	38	-.290	-1.771				
608	38/39	-.746	-2.846				
613	39	-.473	-1.432				
616	39	-.608	-1.616				
619	39	.464	1.852				
621	39	.425	1.532				
624	39/40	.341	.958				
629	40	-.099	-.184				
632	40	-.151	-.206				
635	40	-.022	.418				
637	40	.246	.344				
639	40/41	.253	1.043				
645	41	-.070	-2.376				
648	41	-1.014	-1.825				
652	41	.018	.894				
654	41	.438	1.542				
657	41/42	.070	.051				
662	42	-.158	-1.684				

~~SECRET/H~~

~~SECRET/H~~

Table 4.5-2

BIF-107W-71014-73

4.5.1.3 B Factor

Figure 4.5-1 shows a plot of B-factor for this segment of the mission. The B-factors shown are from the individual tracking reductions and from the BFE for comparison. Maneuvers are indicated as to the rev of occurrence.

4.5.1.4 Orbit Adjust Summary

Table 4.5-3 reflects a summary of each orbit adjust during this segment. For each orbit adjust or set of orbit adjusts occurring on the same or adjacent revs, orbital conditions are provided which describe the orbit prior to the first orbit adjust. In addition, the predicted velocity change and orbit resulting from each orbit adjust or set of orbit adjusts is provided and compared with the actual orbit and velocity change obtained. The actual orbit and velocity change was determined from the Best Fit Ephemeris. All orbit adjusts were close to nominal.

Figure 4.5-2 reflects perigee altitude and perigee locations prior to and after each positive Orbit Adjust.

4.5.1.5 Best Fit Ephemeris

Table 4.5-4 shows the orbital conditions for each day of this segment of the mission.

4.5.2 Telemetry and Mode Processing.

Generation and validation of the SV-5 diagnostic modes 117, 127 and 147 was completed and development of SV-6 modes was started.

4.5.3 Command Message Planning

Definition and generation of message 062 (Test Pad Load) for SV-6 factory and launch range use was completed.

4.5.4 SCF Support

SCF support was generally acceptable for support of mission operations except for:

a. The Rev 425 Station Pass message was generated using an improper OA vector resulting in large ephemeris errors. The SP message was regenerated and reloaded on Rev. 428.

b. <u>RTS Problems</u>

   (1) BOSS Rev 573/590 unable to load message using 60 foot dish.

   (2) KODI Rev 496 bad prepass disk.

(3) KODI Rev 650 - no command capability so could not send Format A Select command for recovery on Rev 651.

(4) KODI Rev 651 - no command capability - no effect.

c. Improper ID On's and ID Off's after the ACS/RCS transfer caused data overprinting for approximately 24 hours until the correct data could be determined and coordinated among the TAS/Test Control/FTFD and entered properly.

~~SECRET/H~~

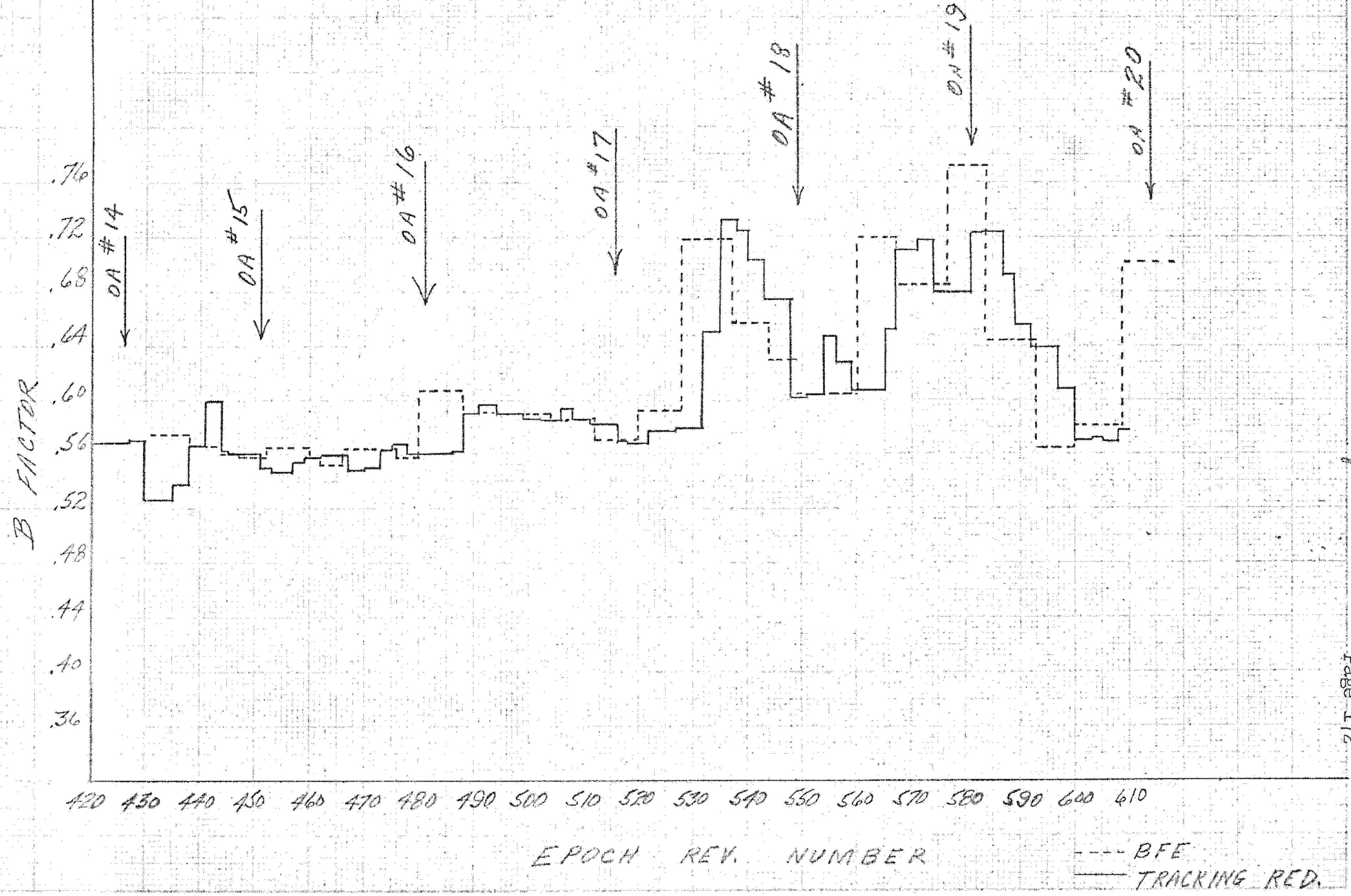


Table 4.5-1

~~SECRET/H~~

SECRET//H

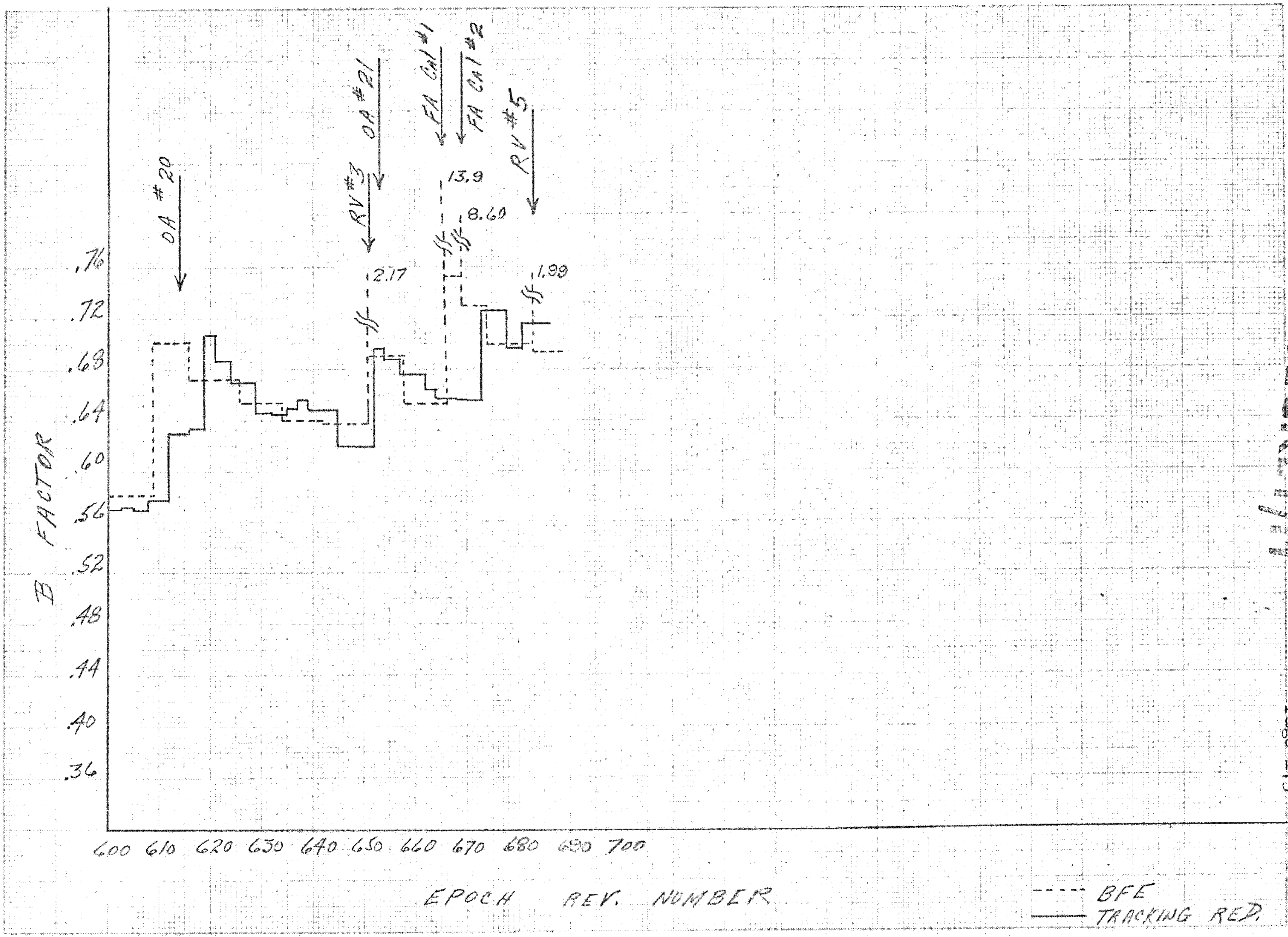


Figure 4.5-1

SECRET//H

Table 4.5-3

OA No. 14	Rev. No. 426	Period Min:Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur Sec. XX.X	Delta Velocity XX.XX
Orbit at Rev	425	88:36.2	85.53	146.30	130.931	---	---
Predicted	427	88:49.3	86.80	153.67	140.122	58.4	21.98
Actual		88:59.5	86.89	153.79	140.240	58.4	22.36
Delta (A-P)		+.180	+.005	+.119	+.118	0	+.38
OA No. 15	Rev. No. 452						
Orbit at Rev	451	88:41.5	86.61	148.86	134.141	---	---
Predicted	453	88:48.1	86.76	153.69	137.114	31.2	11.48
Actual		88:48.3	86.83	153.76	137.235	31.2	11.79
Delta (A-P)		+.204	.08	+.07	+.121	0	+.31
OA No. 16	Rev. No. 484						
Orbit at Rev	483	88:37.5	86.33	147.18	129.270	---	---
Predicted	485	88:48.7	86.75	154.78	135.380	50.60	18.79
Actual		88:49.0	86.77	154.98	135.522	50.60	19.29
Delta (A-P)		+.03	+.02	+.20	+0.142	0	+.50
OA No. 17	Rev. No. 516						
Orbit at Rev	515	88:37.5	86.22	147.86	127.711	---	---
Predicted	517	88:50.0	86.80	156.01	134.854	55.8	20.67
Actual		88:50.3	86.87	156.19	135.068	55.8	21.25
Delta (A-P)		+.3	+.07	+.18	+.214	0	+.58

SECRET/H

SECRET/H

OA No.	Rev. No.	Period Min:Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur. Sec. XX.X	Delta Velocity XX.XX
OA No. 18	Rev. No. 549						
Orbit at Rev	548	88:37.4	86.17	148.07	127.110	---	---
Predicted	550	88:50.2	86.89	156.32	134.307	57.6	21.28
Actual		88:50.5	86.89	156.53	134.450	57.6	21.75
Delta (A-P)		+.3	0	+.21	+.143	0	+.47
OA No. 19	Rev. No. 581						
Orbit at Rev	580	88:37.4	86.30	148.13	126.431	---	---
Predicted	582	88:50.1	86.91	156.36	133.669	57.2	20.94
Actual		88:50.2	86.94	156.46	133.761	57.2	21.53
Delta (A-P)		+0.1	+.03	.10	+.092	0	+.59
OA No. 20	Rev. No. 614						
Orbit at Rev	613	88:37.8	86.22	148.76	125.858	---	---
Predicted	615	88:47.5	87.03	154.66	131.688	44.8	16.19
Actual		88:47.5	87.09	154.57	131.669	44.8	16.53
Delta (A-P)		0	+.06	-.09	-.019	0	+.34
OA No. 21	Rev. No. 653						
Orbit at Rev	652	88:30.7	85.88	143.89	122.072	---	---
Predicted	654	88:55.3	86.94	160.34	136.108	99.6	40.02
Actual		88:55.3	86.89	160.38	136.142	99.6	40.83
Delta (A-P)		0	-.05	+.04	+.034	0	+.81

~~SECRET/H~~

~~SECRET/H~~

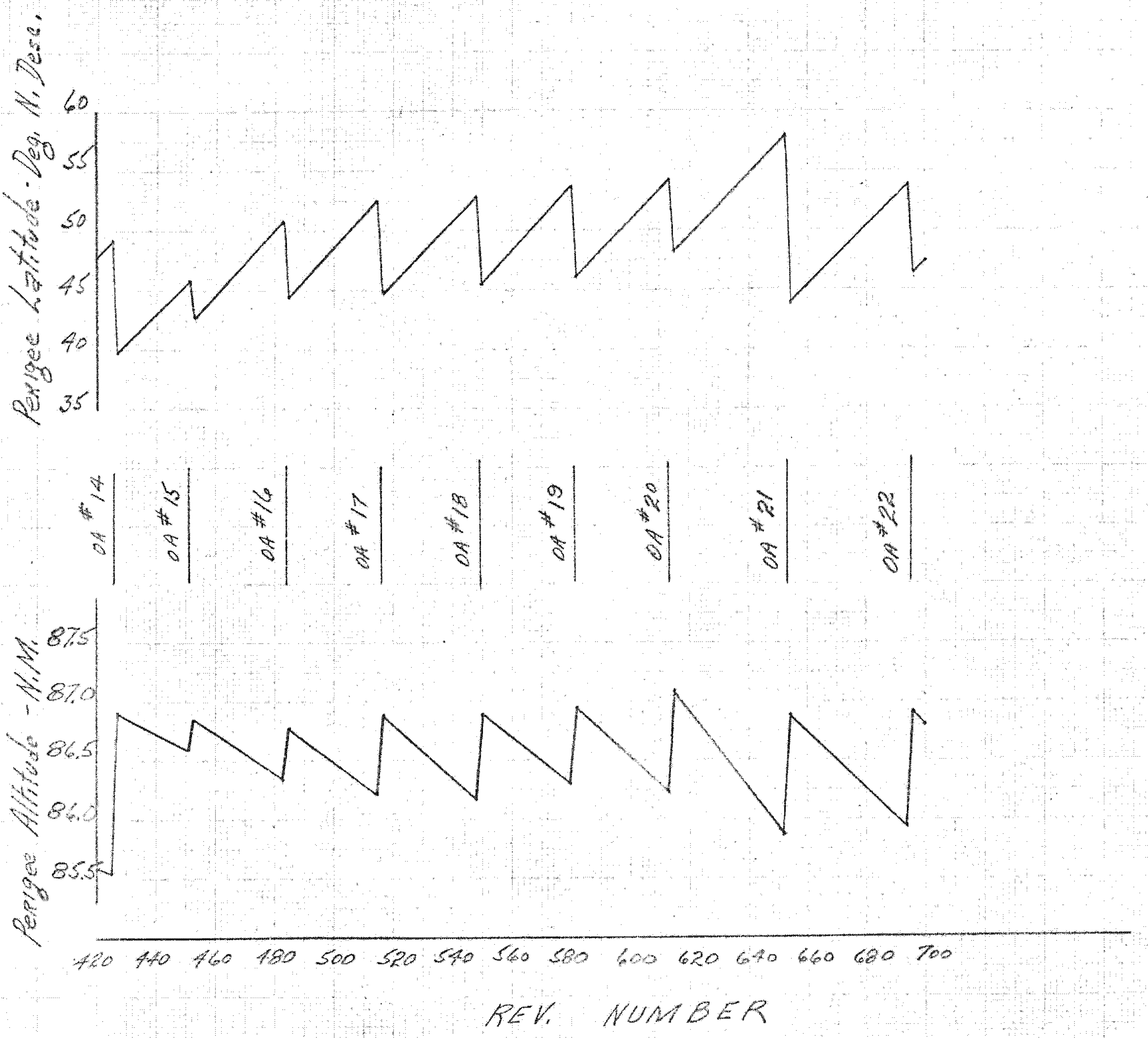

Perigee Latitude - Deg. N, Desc.
60
55
50
45
40
35
OA #14
OA #15
OA #16
OA #17
OA #18
OA #19
OA #20
OA #21
OA #22
Perigee Altitude - N.M.
87.5
87.0
86.5
86.0
85.5
420
440
460
480
500
520
540
560
580
600
620
640
660
680
700
REV. NUMBER

Figure 4.5-2

BEST FIT EPHEMERIS
SUMMARY

~~SECRET/H~~

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
28	431	.0094	95.67	88:48.4	154.60	85.55	139.2	.5749	431 - 438
								.5666	438 - 444
								.5600	444 -
29	447	.0089	95.67	88:42.8	151.28	85.19	135.0	.5586	447 - 452
								.5657	452 - 460
								.5557	460 -
30	462	.0093	95.67	88:45.2	153.60	85.03	134.7	.5520	462 - 466
								.5644	466 - 476
								.5581	476 -
31	480	.0088	95.67	88:38.6	149.58	84.63	129.8	.6078	480 - 488
								.5905	488 - 495
								.5837	495 -

Table 4.5-4

~~SECRET/H~~

~~SECRET/H~~

BEST FIT EPHEMERIS
SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
32	496	.0094	95.67	88:44.9	154.12	84.86	132.7	.5900	496 - 504
								.5867	504 - 510
								.5510	510 -
33	512	.0089	95.67	88:38.7	150.18	84.51	128.4	.5712	512 - 520
								.5903	520 - 527
								.6777	527 -
34	528	.0095	95.66	88:46.3	155.27	85.04	132.2	.7177	528 - 537
								.6573	537 - 543
								.6044	543 -
35	544	.0089	95.66	88:39.2	150.63	84.65	127.7	.6310	544 - 549
								.6054	549 - 559
								.6448	559 -

Table 4.5-4

~~SECRET/H~~

~~SECRET/H~~

BEST FIT EPHEMERIS
SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
36	560	.0096	95.66	88:46.8	155.84	85.09	131.7	.7197	560 - 567
								.6843	567 - 576
								.7208	576 -
37	577	.0089	95.66	88:39.0	150.70	84.58	127.3	.7716	577 - 584
								.6445	584 - 592
								.5945	592 -
38	593	.0095	95.66	88:45.7	155.28	84.95	130.8	.5649	593 - 600
								.5822	600 - 608
								.6504	608 -
39	609	.0090	95.66	88:39.6	151.36	84.65	126.8	.7022	609 - 616
								.6729	616 - 624
								.6428	624 -

Table 4.5-4

~~SECRET/H~~

~~SECRET/H~~

BEST FIT EPHEMERIS
SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
40	626	.0093	95.66	88:42.7	153.31	84.93	128.8	.6536	626 - 634
								.6406	634 - 642
								.5885	642 -
41	642	.0087	95.65	88:35.9	148.82	84.39	124.8	.6381	642 - 651
								2.716	651 -
								.6894	651 - 656
								.6366	656 -
42	658	.0103	95.65	88:53.9	160.82	85.40	135.5	.6533	658 - 666
								13.9140	666 -
								.7532	666 - 669
								8.5980	669
								.7308	669 - 673
								.6675	673 -

~~SECRET/H~~

Table 4.5-1

~~SECRET/H~~

BEST FIT EPHEMERIS SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
43	674	.0097	95.65	88:47.2	156.53	84.87	131.4	.6997	674 - 683
								1.9897	683
								.6937	683 - 689
								.7160	689 -

Table 4.5-4

~~SECRET/H~~

4.6 PROGRAM COMMAND SOFTWARE PERFORMANCE
(Prepared by HTC)

4.6.1 Command Message Summary

This section summarizes pertinent command message data from Mission 1205, IRON 8410. The command messages discussed cover the period from the first RV 3 message (Rev. 425 load) to the RV 5 recovery message (Rev. 680 load).

Two hundred one command messages were received by the Technical Advisor (TA) Staff. One hundred ninety-three were accepted and seven were rejected. The rejected messages were subsequently altered or regenerated and loaded into the vehicle. The reasons for rejection of the seven messages are summarized below.

Rev. No. & Load Station	Reason for Rejection
436 POGO	Manually input ST+ and ST- commands had time tags which conflicted with sequence 159.
479 COOK	Slit Width cards which were input for the command message were incorrect.
480 HULA	A MOP scan size requirement was changed.
491 POGO	Message was altered to add a TT/C blink on Rev. 492.
534 POGO	MOP requirements changed.
545 HULA	The V_y bias caused incorrect values to be computed for ascending photography. Three V_y commands required modification.
664 POGO	Sequence 148 was inadvertently omitted from the command message.

One hundred eighty-seven messages were loaded and fourteen were not loaded for the reasons stated below:

1. The seven rejected messages were not loaded.
2. The 573 BOSS message was not loaded due to a station antenna problem.
3. The 665 POGO message was not loaded because it did not contain any payload operation.
4. The 667 POGO message was not loaded because the ST system failed on Rev. 665.
5. A message containing an ST calibration test for Rev. 670 was not loaded because of the ST failure.
6. A message containing an ST calibration was not loaded on Rev. 674 because it was determined that the thermal doors would not open.
7. Two contingency VBE messages were not loaded.

A one rev load cycle was employed while the vehicle was over the area of interest. The add-on message generation and loading philosophy was in effect. This resulted in the generation of one hundred sixty-six add-on messages.

4.6.2 'TUNITY Software Problems

The Flight 5 'TUNITY software problems itemized below pertain only to the period for RV 2 recovery through RV 5 recovery. They have been grouped into the following categories to demonstrate their impact on the flight. The disposition of these software problems will be specified by the Configuration Control Board.

Category	No. of SPR's	Comments
Flight Critical	1 (5124)	Software corrections were made and incorporated during this flight period.
Non-Flight Critical (Requiring Work-Around)	1	Work-around procedures were developed and implemented.

Category	No. of SPR's	Comments
Non-Flight Critical (Minor)	5	Work-around procedures were not required.
Product Improvement or New Requirements	2	To be considered during future development.
Documentation Error	2	Milestone 7 or 4 affected.

Itemized Software Problems

SPR MBR-5123 ('TFRTIN)

- Problem Description: Currently if a frame reference time is input to MPR via an FRT data card, the time field must be specified a non-cyclic vehicle time. Cyclic vehicle time is more readily available and should be a valid input.
- Solution or Work-Around: None.
- Operational Impact: None.
- Comment: This SPR should be considered as a product improvement item for a future software delivery.

SPR MBR-5124 ('TCATCHM) - FLIGHT CRITICAL -

- Problem Description: Identical data cards specifying a manual operation (MOP) for the Stellar Terrain system produced a different coverage area depending on the rev of the SE span that the MOP was assigned to. If the MOP was inserted in the first rev of a span, it covered two less DEA's than it would when the span was changed so that the MOP occurred on an intermediate rev. The problem became apparent because of the one rev load cycle where each MOP gets assembled and loaded in at least two messages before it executes.
- Solution or Work-Around: The problem was determined to be flight critical. A change was made to 'TCATCHM correcting the problem and was incorporated on the Flight Aux Master.
- Operational Impact: There was no operational impact because the first generation message could be left in the vehicle.

SPR MBR-5125 ('TPOLY)

- Problem Description: Polygon 100 was input to activate WAC cells at 86° N. PCAT 100 was added with parameters of sun angle, weight, DOL, min. and max. obliquity. Cells were not activated. 'TPOLY does not activate cells which did not previously exist in the MOB files.
- Solution or Work-Around: The WAC cells must first be input to the MOB file before a polygon can activate them.
- Operational Impact: None.

SPR MBR-5126 ('TEMPER/'TFRTIN)

- Problem Description: The commanded V/h value is being used in MPR for ST Mode B operations instead of the V/h constant specified in the 'CTEVHB.
- Solution or Work-Around: None.
- Operational Impact: There is no operational impact, just confusion to the user of the output.
- Comment: It is a software problem; the solution is known and should be fixed at the first opportunity not involving a flight.

SPR MBR-5127 ('TUNITY)

- Problem Description: 'TUNITY error messages output on the typewriter should be unclassified.
- Solution or Work-Around: None.
- Operational Impact: None.
- Comment: It has not been a design requirement to make all typewriter messages unclassified.

SPR MBR-5128 ('TELCAL)

- Problem Description: The 'TELOP output, after the Rev. 558 BOSS 'TLMP run, did not show count 365 for OB A. This count was in record 0, entry 499 of the 'TMB. The above problem will repeat whenever an FRT entry begins in entry 499 of a 'TMB record. That is, entries 0 - 498 contain attitude data, and entry 499 the first FRT entry.
- Solution or Work-Around: For the infrequent case described above, a 'TFRTFIX MODF RUN is required to reflect the missing FRT. This FRT will always be the first FRT of the operation which is required by MPR.
- Operational Impact: None.
- Comment: It is a software problem; the solution is known and has been fixed in MOD 2 software.

SPR MBR-5129 ('TBALL)

- Problem Description: The following error message was output while executing 'TBALL: 'TEPH "REQUESTED REV 534 NOT WITHIN THE SPAN OF THE CURRENT EPHEMERIS". The message is coming from an attempt by the program to check for the chance of a partial accept of all revs from the last counted down rev to the first of the current span. This logic should only be entered for the start rev of the SE span for which there will always be ephemeris available.

- Solution or Work-Around: The error message can be ignored.

- Operational Impact: None.

- Comment: It is a software problem; the solution is known and should be fixed at the first opportunity not involving a flight.

SPR MBR-5130 (COMPOOL/DATA BASE HANDBOOK)

- Problem Description: An item in the 'CNO data block has the wrong source/responsible agency. 'CNOBNR should be [redacted] Also, the MOD 2 data base handbook has the wrong source/responsible agency for all items in the 'CFR block. Change these to read TRW [redacted] as in Compool COMOCPWJ. (b)(1) (b)(3)

- Solution or Work-Around: None.

- Operational Impact: None.

- Comment: The COMPOOL and Data Base handbook should be changed according to the above recommendations.

SPR MBR-5131 (COMPOOL)

- Problem Description: The following discrepancies exist in the Compool: Item 'COPOBS has a typical value of 125. Typical value should be 121; item 'COPERM typical value should be 152, and item 'COPFSR typical value should be 128.

- Solution or Work-Around: None.

- Operational Impact: None.

- Comment: The Compool should be changed to reflect the above recommendations.

SPR MBR-5132 ('TCATCHM)

- Problem Description: ST MOP's were input for revs 557 and 558 in the 557 load. The MOP's were supposed to cover a span of 6 and 8 DEA's respectively. This should have resulted in the exposure of 8 and 10 frames respectively for these two ops. Instead, the number of frames exposed were 10 and 12. The 2 extra frames on each op occurred at the end of each op. The result was that two additional DEA's were photographed in triple overlap.

- Solution or Work-Around: A change in the rules used for setting up MOP Cards was used to account for the extra frames.

- Operational Impact: Additional film expended for the operations as noted above.

SPR MBR-5133 ('TSTAGEN)

- Problem Description: When two pairs of "rise-sets" are present for a station split by obscura, the second of the two cones is deleted as redundant. This occurs when the mid-angle rev is identical for both cones.

- Solution or Work-Around: If the entire station (both cones) is required, it can be done manually.

- Operational Impact: None.

4.6.3 Hardware/Software Interface Changes

For IRON 8410, nineteen change requests were processed from the RV 2 recovery message through the recoveries of RV 3 and RV 5 (as shown in Table 4.6.3-1).

These changes were inplemented via requests SV 5-289 through SV5-307 and have been incorporated in the nominal data base and hardware/software interface documentation.

Table 4.6.3-1. Summary of Hardware/Software Interface Changes

Request No.	Identification	Effectivity
SV5-289	New sequence 450 identified as FA CAL 1. It is manually implemented and is used to set up, operate and shut down the ST for in-flight calibration operation.	SV-5 only
SV5-290	New sequence 451 identified as FA CAL 2. It is manually implemented and used to set up, operate and shut down the ST for in-flight calibration operation after thermal door open verification.	SV-5 only
SV5-291	New sequence 452 identified as FA CAL 2 THERMAL OPEN. It is manually implemented and used to set up, operate and shut down the ST for in-flight calibration operation if the thermal door open did not occur during the FA CAL 1 event.	SV-5 only
SV5-292	Sequence 269 was modified by changing one TT/C + command so that it executes through decoder B only. FORMAT A recording made this change necessary.	SV-5 and nominal data base
SV5-293	Sequence 276 was modified by changing one TT/C + command so that it executes through decoder B only. FORMAT A recording made this change necessary.	SV-5 and nominal data base
SV-294	Sequence 299 was modified by changing one TT/C + command so that it executed through decoder B only. FORMAT A recording made this change necessary.	SV-5 and nominal data base
SV-295	Sequence 150 was modified by adding ST+ and ST- commands to provide emergency turn-off capability.	SV-5 only
SV5-296	SEQ 150 was again modified to extend the added emergency off command beyond a possible critical area.	SV-5 only

Request No.	Identification	Effectivity	
SV-297	Sequence 159 was modified by adding ST+ and ST- commands as was done in sequence 150.	SV-5 only	
SV-298	Modification to sequence 144 was required to reflect new aft camera cross track nominal value.	SV-5 and nominal data base	
SV5-299	Sequence 153 was modified as per sequence 150.	SV-5 only	
SV5-300	New sequence 148 identified as END OF REV INITIALIZE - B MODE, provides redundant sensor off commands for BACK-UP MODE event generated ST operations.	SV-5 and nominal data base	
SV5-301	New sequence 149 identified as FA ENGINEERING OVER STATION - B MODE, provides BACK-UP MODE evaluation and operation over a tracking station.	SV-5 and nominal data base	
SV5-302	New sequence 453 identified as DBS [redacted] LIMITED DUTY CYCLE TEST provides data for the evaluation of the interface problem between the Doppler Beacon and [redacted]	SV-5 only	(b)(1) (b)(3)
SV5-303	New sequence 454 identified as DBS [redacted] HEAVY DUTY CYCLE TEST provides data for the evaluation of the interface problem between the Doppler Beacon and [redacted]	SV-5 only	(b)(1) (b)(3)
SV5-304	Sequence 158 was modified by adding ST+ and ST- commands to provide emergency turn off capability.	SV-5 only	
SV5-305	New sequence 455 identified as PRE-DEBOOST TEST is provided to test procedures which will be used during actual deboost.	SV-5 only	
SV5-306	New sequence 437 identified as MONO B WITH CA+ ON/OFF OVER STATION provides an additional SSC engineering test.	SV-5 only	
SV5-307	New sequence 438 identified as MONO B WITH CA+ ON/OFF NOT OVER STATION provides an additional SSC engineering test.	SV-5 only	

4.7 SATELLITE VEHICLE AND AUXILIARY PAYLOAD PERFORMANCE (SBAC)

4.7.1 EDAP Performance

EDAP operations through RV-5 continued normal in all aspects. The main power system continued to operate normally, supporting an average load of approximately 21 ampere-hours per rev. Operation of K-2 relays on most revs indicates that the batteries are being maintained near 90% capacity. The solar array output at the end of this report period was approximately 94% of the output on Day 1.

The pyro batteries continued to drop toward the monoxide level reaching terminal voltages approximately 28.1 volts.

The L/B II battery terminal voltage was approximately 28.6 volts throughout segment 3.

4.7.2 TT&C Performance

The SGLS-1 and PCM-1A performed satisfactorily throughout segment 3. Tape Recorder No. 1 was used for all recording except the PREP 5.2 (runout) on Rev 675. This was 1660 seconds of read-in. In producing this data, MCS commanding for readout as well as ECS command for Fast-Forward and readout was employed. Fast-Forward was also used on Tape Recorder No. 1 on Revs 432 and 683.

4.7.3 ACS/RCS Performance

Both Primary and Redundant Attitude Control Systems remained on throughout segment three. The Primary System (PACS) was used for vehicle control until Rev 512, at which time control was transferred to the Redundant System (RACS) for the remainder of the period.

The pitch bias in the PACS reported in segment two recurred on Rev 566 and persisted throughout the remainder of the period. The RACS exhibited a yaw bias on Rev 519. This condition was intermittent and variable throughout this segment, as shown in Table 4.7-1.

Following Orbit Adjust 15 on Day 28, propellant usage by RCS-2 increased until on Day 32 the usage rate exceeded 8 lbs per day. On Rev 512 an orderly transfer M1V1(M2) to M2V2(M1) was executed, transferring control from RCS-2 to RCS-1. Sixty of the 196 lbs of RCS propellant remains in RCS Tanks 3 and 4.

Since transfer on Rev 512, RCS-1 has performed normally with an apparent propellant usage of approximately 5 lbs per day. Figure 4.7-1 shows average daily REM baseplate temperatures through segment 3.

YAW ATTITUDE BIAS

	REV	SSC OPS NO.	AVG. YAW ATT.
NO P/L Yaw comp.	519 *	346	-.6
	523	347	-.2
	524	348	-.2
	525	349	-.5
		350	-.5
		351	-.5
		352	-.5
	526	353	-1.3
		354	-1.4
	527	ST	
		ST	
	528	355	-1.3
		356	-1.4
	529	357	-1.0
	534	358	-.7
	535	359 & ST	-.7
1.0 deg P/L Yaw compensation	541	360	-.9
		361 & ST	-.8
		362 & ST	-.7
	544	363 & ST	-.5
		364	-.5
		365	-.7
	546	366	-.7
	550	367	-.5
	551	368	-.7
	556	369	-.5
	557	370	-.5
	558	371	-.5
	559	372	-.7
	559	373	-.7
	560	374 & ST	-.5
	560	375	-.7
	560	376	-.6
	561	377	-.5
	562	378	-.5
	565	378	-.6
	566	380	-.2
	568	381	-.2
	572	382	-.2
	574	383	0
	575	384	0
	575	385	-.2
	576	386	0
	576	387	0
	576	388	-.2
0.5 deg Yaw compensation	578	389	-.2
	578	390	-.2
	578	391	-.2
	578	392	-.5
	582	393	-.2
	589	394	0
	590	395	-.2
	591	396	-.2
	591	397	-.2
	592	398	-.8
	592	399	-.7
	592	400	-.7
	593	401	-.2
	594	402	-.3
	594	403	-.2
	606	404	-.5
	606	405	-.5
	606	406	-.2
	606	407	-.2
	606	408	-.2
	607	409	-.2
	609	410	-.2
	608	411	-.2
	609	412	-.2
	610	413	-.2
	610	414	-.5
	616	415	-.2
	620	416	-.5
	622	417	-.2
	622	418	-.2
	624	419	-.2
	624	420	-.2
	626	421	-.2
	626	422	-.2
	626	423	-.2
	631	424	0
	636	425	-.2
	637	426	-.5
	639	427	-.2
	640	428	-.2
	640	429	-.2
	642	430	-.5
	642	431	-.5
0.5 deg Yaw comp.	642	432	-.2
	654	433	-.5
	655	434	-.5
	655	435	-.3
	655	436	-.7
	657	437	-.2
	658	438	-.5
	659	439	-.2
	662	440	-.2
	667	441	-.5
	669	442	-.5
	670	443	0
	671	444	-.3
	671	445	-.2
	671	446	-.2
	672	447	-.2
	672	448	-.2
	674	449	-.5
	674	450	-.3
	675	451	-.2
	677	452	-.2

* First observation of yaw bias.

Table 4.7-1

~~SECRET/H~~

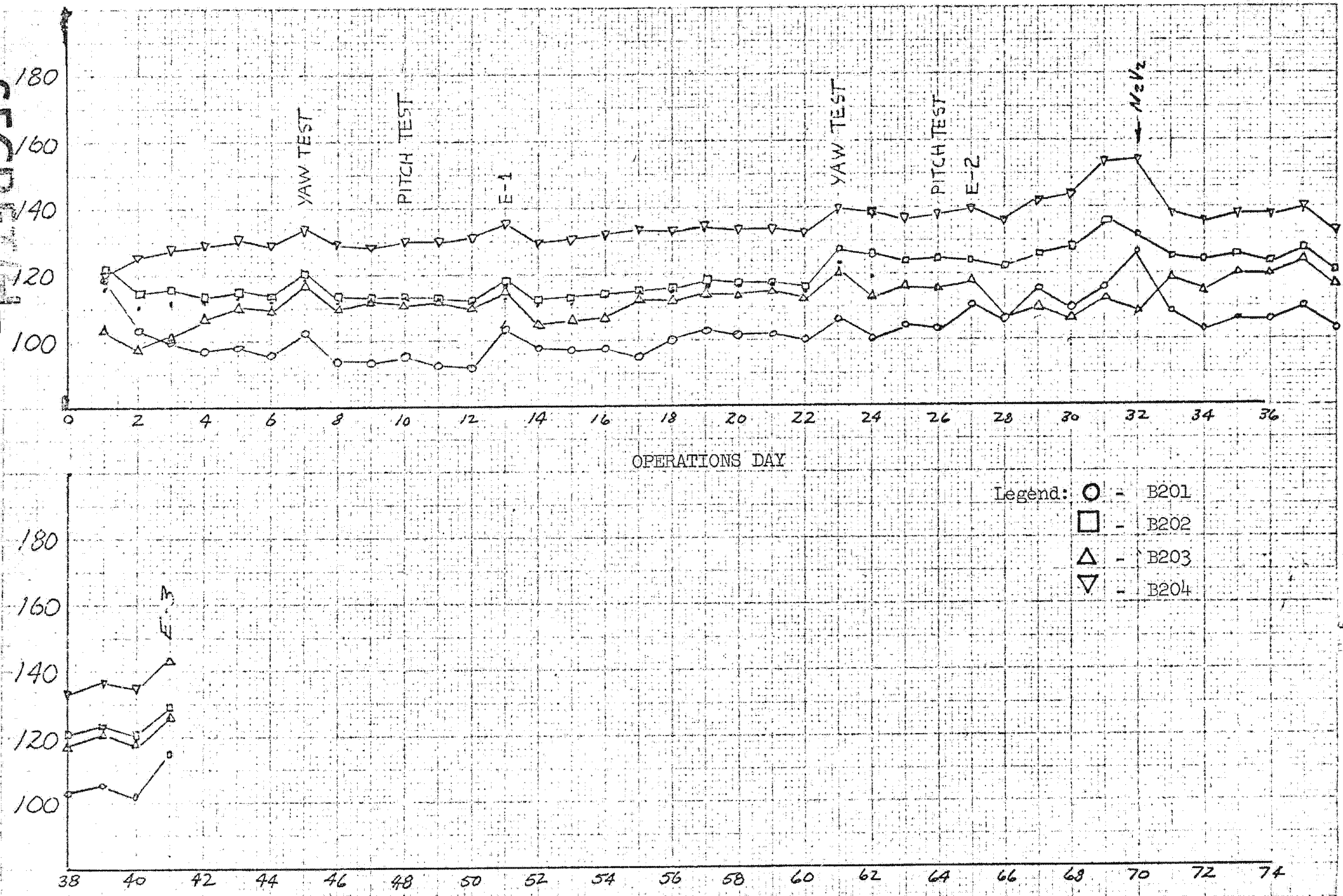


Figure 4.7-1

~~SECRET/H~~

4.7.4 Orbit Adjust System (OAS) Performance

The OAS functioned normally throughout Segment 3. The system was used eight times for positive burns (OA's number 14 thru 21) consuming 380.4 lbs of propellant. At the end of this report period, the cumulative total propellant usage for OA's was 1092.4 lbs which is 164.9 lbs less than the pre-flight prediction. It was 76.8 lbs less than the prediction from the updated study run on Day 24. The absence of negative burns was due to a higher than predicted drag throughout this segment.

On Rev 512, Day 32 ACS/RCS control was switched to M2V2 which resulted in RCS-1 propellant being supplied from the OAS tank (isolation valves 1, 2 and 5 open). This configuration was used for the remainder of this report period.

ORBIT ADJUST SUMMARY

OA Number	14+	15+	16+	17+	18+	19+	20+	21+
Operations Day	27	28	30	32	34	36	39	41
Rev	426	452	484	516	549	581	614	653
Delta V								
(Predict) fps	22.01	11.48	18.78	20.69	21.24	21.27	16.55	40.72
(CAS) fps	22.36	11.79	19.29	21.25	21.75	21.53	16.53	40.83
Burn Duration - Sec	58.4	31.2	50.6	55.8	57.6	57.2	45.0	99.6
Propellant Used - Lbs	49.3	26.7	43.2	47.4	48.4	47.7	36.4	81.3
Avg. Tank Temp. - ^{o}F	80	79.5	79.3	79.3	79.3	80.3	80.3	80.0
Avg. Tank Press. - psia	202	200	196	192	189	187	180	177

Figure 4.7-2 shows OAS bed resistance factor through OA #21.

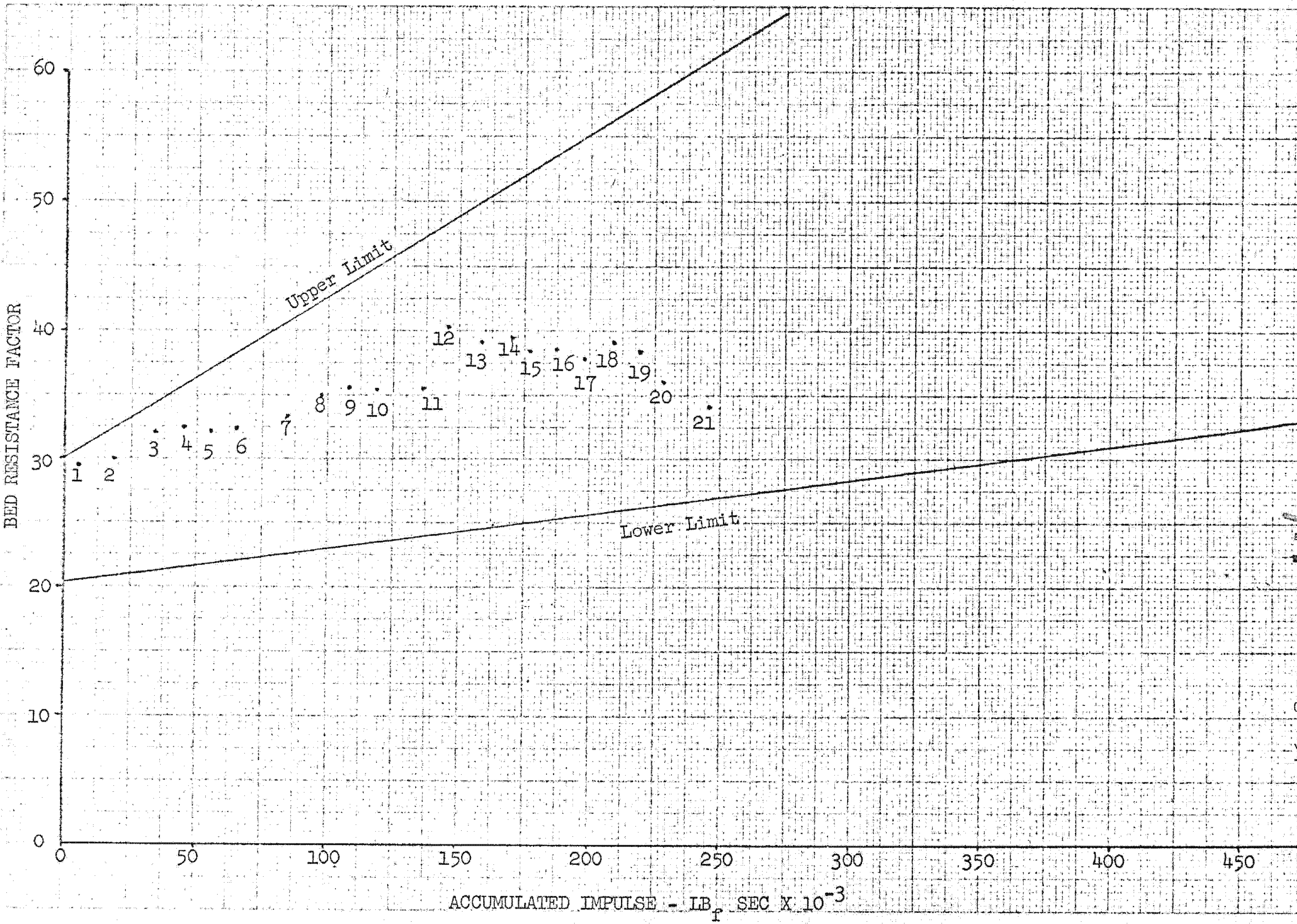

BED RESISTANCE FACTOR
60
50
40
30
20
10
0
Upper Limit
Lower Limit
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
0
50
100
150
200
250
300
350
400
450
ACCUMULATED IMPULSE - LB_f SEC X 10^{-3}

Figure 4.7-2

4.7.5 Lifeboat II Performance

The Lifeboat system functioned normally throughout segment 3. Weekly attitude correlation checks at 72°N and 10°S latitudes descending were made on Revs 499, 531 and 612. In addition, a check was made at 72°N on Rev 542 to get a Lifeboat/ACS correlation on a payload rev.

The Lifeboat electronics were also enabled during recovery maneuvers for RV-3 and RV-5.

The Lifeboat tank heater thermostatic control was cycled ON/Off five times (5 or 6 revs on, 53 to 63 revs off) to maintain the average tank temperature between 100°F and 112°F. At the end of the report period (Day 43), the L/B II battery capacity was 170 A-H, compared with a requirement of 31.8 A-H for 4 days, one recovery and deboost.

4.7.6 Doppler Beacon System

The Doppler Beacon System continued to function normally throughout segment 3.

4.7.7 Tertiary Payload

[redacted] and B-3 have performed nominally from Revs 425 through 683. (b)(1)
(b)(3)

4.8 Mapping Camera Operations (Revs. 425-683)

Mission Performance (Prepared by NEC)

35 mapping camera operations were executed through the indicated rev span with a total of 369 frames of photography taken, including three four frame operates to verify the Backup Mode of operation.

The following is a summary of the northern most latitude restriction revision (reference para. 2.8 and 3.8 of this report).

Rev	Limiting North Latitude
455	58°N
495	59°N
535	60°N
575	61°N
615	62°N
655	63°N

On Revs 430, 446, 479 and 494 there existed an intermittent "tape stop" switch failure that resulted in loss of photography for a total of sixteen frames. The mapping camera was transferred to the Backup Mode of Operation on rev span 503-641.

Automatic shutdown occurred on Rev 657 when the Material Change Detector Strip passed through the system. This concluded the mapping operation for 8410.

Two unsuccessful attempts to provide in-flight mapping camera calibration were made on revs 665 and 668. The in-flight calibration event required subjecting the terrain thermal shutter to temperatures below that which caused an apparent mechanical bind, preventing photography. An emergency open sequence was attempted prior to the second calibrate event with negative results. Film runout was completed on rev. 675 with an RV-5 air recovery completed on rev. 683.

Payload Evaluation

A preliminary report from the payload evaluation team indicated the terrain film quality was very good, exceeding the expected results. The stellar exhibited a high amount of dendritic static. The reseau images were very weak but may be improved by special processing. It is felt by NEC breakdown team that the stellar material will be useable. The expected loss of photography, based on telemetry, was confirmed with no additional discrepancies noted.

4.9 RV-5 Performance (Prepared by OPC)

The telemetry measurements indicated that the RV-5 system status (temperatures and discrete monitors) remained within specification limits during the third phase of the mission (through successful recovery on Rev 683). The following information is reported after evaluating drop recovery studies, command messages, RV5 telemetry, SV PCM telemetry, voice reports, and the recovery test report TWX.

4.9.1 Weights

SRV5 weight separated from SV	394.97 lbs
SRV5 weight at retro	393.97 lbs
100% payload predicted weight (55.39 + 10.54)	65.93 lbs
RV5 weight at top of atmosphere	296.97 lbs
RV5 capsule suspended weight	179.47 lbs
RV5 air snatch weight	203.17 lbs

4.9.2 PREPS

PREP 5.1 (Recovery Battery Power On) occurred on Rev 679P. The temperature monitor indicated 50°F before turn-on, 73°F on Rev 680 and 60°F at the time of battery activation (arm command) on Rev 683.

PREP 5.2 (Run Out Verification) was not required as run-in was accomplished on Rev 675.

PREP 5.3 (RV5 Closure) was accomplished on Rev 682P.

4.9.3 Recovery Conditions

Orbit

Rev No.	683
Apogee	151.95 N.M.
Perigee	86.337 N.M.
Argument	129.094 Degrees
Inclination	95.651 Degrees
Eccentricity	0.00938754
Period (Keplerian)	88:42.748 Minutes: Seconds

Retro

True Anomaly	7.3 Degrees
Altitude	517543.88 Ft
Latitude	43.502 Degrees North
Longitude	153.96 Degrees West
Velocity	25751.58 Ft/Sec
Pitchdown Angle (Sep)	-64.437 Degrees (after Yaw Reverse)

Entry (410K Ft)

Velocity (Inertial)	25520.27 Ft/Sec
Gamma (Geod. Inertial)	-2.0556 Degrees
Alpha	104.42 Degrees
Latitude	35.211 Degrees North
Longitude	155.90 Degrees West

Drogue

Velocity (Local)	955.19 Ft/Sec
Mach No.	0.99
Altitude	57975.13 Ft
Dynamic Pressure	103.044 PSF

Impact

Altitude	55000.03 Ft
Latitude	16.175 Degrees North
Longitude	159.39 Degrees West

4.9.4 Miss Distance

Figure 4.9.1 shows the predicted impact point (PIP), the actual impact point (EPPD) and the air snatch point. The miss distance between the distance between PIP and EPPD was calculated to be 11.77 N.M. (11.68 N.M. short and 1.46 N.M. west of the ground track).

Analysis of the wind data of memogram 8410-1246 resulted in the capsule being blown 16 N.M. by a wind out of 250 degrees. The maximum wind on the memogram was 105 KTS. Additional information yielded that the capsule was affected by the 125 KTS jet stream, thus explaining the location of the snatch point.

4.9.5 Aerial Recovery

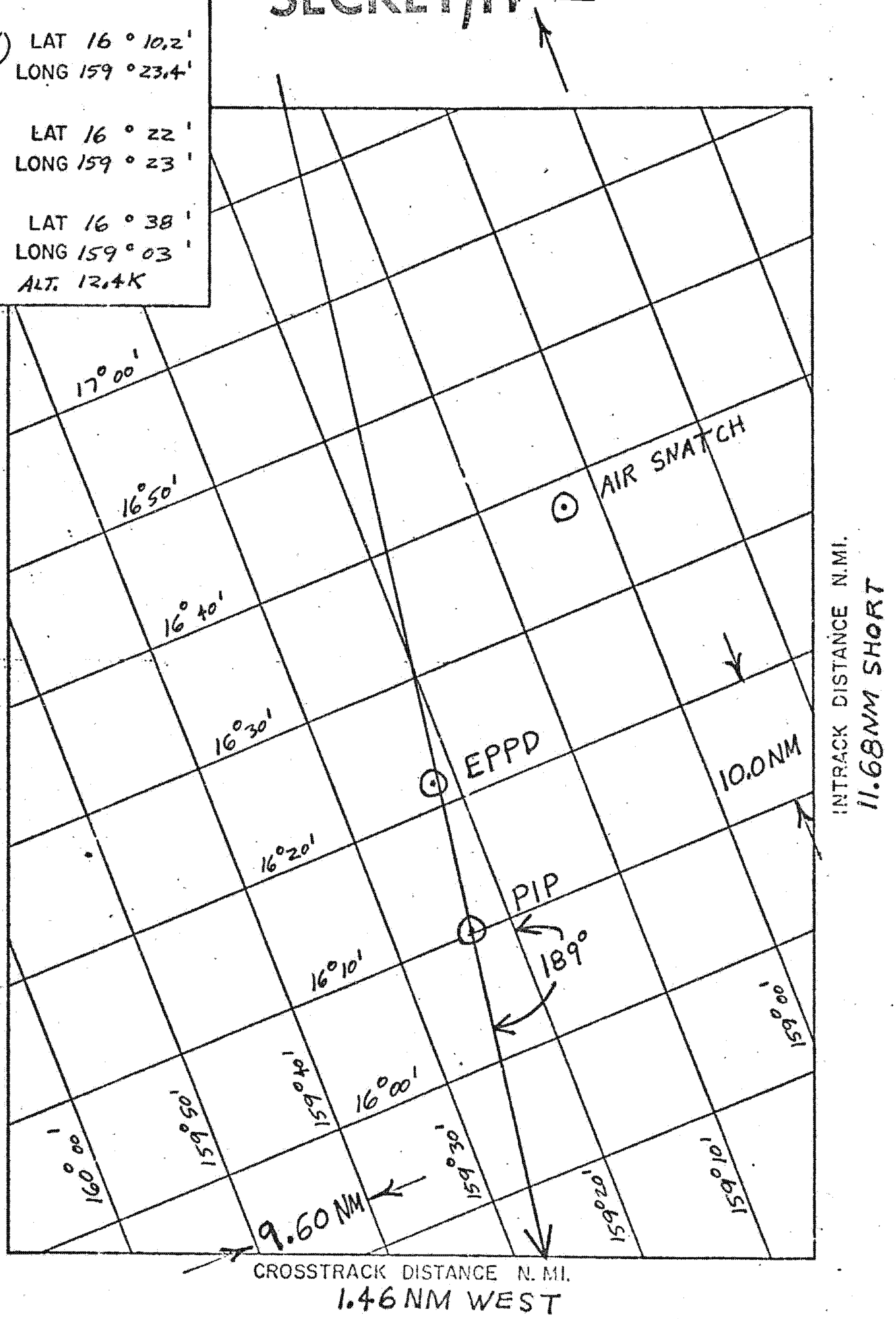
Altitude	12400 Ft
Pass Number	1
Airspeed	155 KTAS 125 KIAS
Chute condition	No Visible Damage
RV5	No Damage
Winch Setting	800 lbs
Payout	Normal
Contact Location	No. 8 Hook Engaged No. 2 Lateral
Deployment 14 Recovery Aircraft	No. 1

4.9.6 Recovery Events

Table 4.9-1 presents the predicted and actual times of RV5 ejectment/recovery events.

~~SECRET/H~~N

PIP (POST REC'Y DROP)	LAT	16 ° 10.2 '
	LONG	159 ° 23.4 '
EPPD	LAT	16 ° 22 '
	LONG	159 ° 23 '
AIR SNATCH	LAT	16 ° 38 '
	LONG	159 ° 03 '
	ALT.	12.4K



Predicted / Actual Impact Locations

FORM DB-28-C4

Figure 4.9-1.

RECOVERY DATE 4/20/73 SRV RV5 SERIAL NO. 1801 SHIELD SERIAL NO. 439

OVERY REV 683 MANUFACTURING DATE 9 July 71

STRESS LEVEL 2480 PSI

	PLANNED	ACTUAL
IMPACT LOCATION	Lat 16°10.2'N Long 159°23.4'W	Lat 16°22'N Long 159°23'W

Events	Predicted Time System Time (sec)	Execution Time System Time (sec)	Beacon Rep. Rate CPS	Source of Data
Arm	82866.0	82867	NA	A
Beacon 1 On	82891	82891	4.0 3.97	KTS
Beacon 2 On	82891	82893	4.0 4.0(RS-6)	KTS
Recovery Battery 1 On (14.8V)	82890.2	82894	4.0 3.97	A
Recovery Battery 2 On (14.8V)	82890.2	82894	4.0 4.0(RS-6)	A
Transfer	82982.0	82983	N A	A
IFD Disconnect	82982.9	82984	N A	A
Separation	82983.6	82985	N A	A
Spin Time/RPM	82986.3/50-70	82986.5/55.5	N A	RS-6
Retro	82994.0	82993.85	1.96 2.05	RS-6
Despin Time/RPM	83004.8/10-16	83004.72/12.3	N A	RS-6
T/C Separation	83006.3	83007	0.964 1.0	RS-6
G Switch Close	83342.18	N/A-Blackout	7.9 8.56	RS
G. Switch Open	83450.94	83443.2	0.975 1.01	RS-1
Piston Fire	83476.94	83469.3	0.505 0.51	RS-1
Drogue Shock Time/Duration (sec)	83477.74	83471.3/2.6	7.6 8.1	RS-1
Main Shock Time/Duration (sec)	83487.74	N/A - None	NONE	RS
Air Snatch Time/Duration	84537.10	84600	NONE	TWX
B/U G Switch Close	84922	84925.3	6.9 OFF	RS-2
B/U G Switch Open	84982	84985.6	0.505 OFF	RS-2

DF-Data Fax V-Voice Report SP-Slow Poke Mag-Mag Tape Reduction RS-Recovery A/C Strip
A-Augie RTA-Real Time Audio

~~SECRET/H~~

DB-30-C3

Table 4.9-1

SECTION 5

5.0 ORBIT PHASE REV 651 THROUGH RV-4 RECOVERY

5.1 Summary

Normal panoramic camera photography was resumed after RV-3 recovery and continued throughout the segment. Along with mission operations, planning and site testing in preparation for the VAST exercise during deboost, SV-6 padload design, MOD 2 software exercises were held, SV-6 mode generation and validation started and those SOLO tests that were non-interference with the mission were conducted.

The SV yaw bias decreased to zero on Rev 785 and the payload Vy compensation was removed on Rev 801. The yaw bias returned on Rev 817 and a Vy compensation introduced on Rev 831 for the remainder of the segment.

The orbit Adjust Bed Resistance Factor reached the allowable lower limit for a long deboost burn on Rev 760 and the OA plan was modified to a 3-day cycle to provide longer more infrequent burns to alleviate the degradation.

The panoramic camera transferred to color film in the forward camera on Rev 971. All film in both cameras was expended by Rev 1016. RV-4 was reentered and aerially recovered on Rev 1024.

5.1.1 Summary of Events

COOK RTS was unable to support commanding on Revs 754 and 755 from a power failure. This prevented loading an updated command message and resulted in the undesired use of 300 feet of film.

The Orbit Adjust Bed Resistance Factor continued to drop, reaching the preflight lower limit on Rev 760. This limit was established as the factor required for a normal 1200 second deboost burn.

Orbit Adjust system performance for the drag makeup burns remained nominal. The OA cycle was changed from the normal 2-day burn to a 3-day cycle to provide longer OA burns to minimize bed degradation.

A computer hardware failure during generation of the Rev 777 GUAM SP message resulted in station pass commands which violated the TTC constraints. The message was approved and loaded into the SV and one RTS sequence executed before the error was found. An emergency message was generated to prevent loss of a COOK contact.

The SV yaw bias had decreased to zero and the pan camera Vy compensation was removed on Rev 801. The Vy compensation was reintroduced on Rev 831 for the remainder of the mission phase.

[redacted] Solo tests were conducted on Revs 868, 917, 937, 945, 953 and 961.

A successful [redacted] Cal was conducted on Rev 1004.

(b)(1)
(b)(3)

[redacted]/tape recorder management tests were conducted using large [redacted] circles to determine feasibility for employment on future vehicles. (b)(1) (b)(3)

Calibration runs for the Turkey Radar were conducted during this period. The forward camera transferred to color film on Rev 971. VAST planning and training runs for the Shemya site and ARIS ship were conducted.

Rv-4 was reentered and aerially recovered on Rev 1024.

The quality of the photography was rated good with less atmospheric haze and weather degradation than in the previous segments. The aft camera experienced an out-of-focus band near the center of the film from Rev 875 to 965. The color photography was comparable to the corresponding black and white.

5.1.2 Problem Summary

a. Yaw bias in ACS2

Statement - The yaw bias and consequent SV yaw error continued in varying amounts throughout the segment.

Solution - Panoramic camera V_y compensation was used as required during the segment. The compensation was effective within +/- 10 degrees of Nadir.

b. Pitch error in ACS1

Statement - The pitch error in ACS1 (non-controlling) remained during the segment at levels preventing consideration of ACS1 as backup.

Solution - None - No ACS redundancy.

c. Drop in OAS Bed Resistance Factor

Statement - The bed resistance factor reached the lower limit on Rev 760 although OA engine performance remained nominal. Of concern was the retention of sufficient OA capability to deboost and satisfy VAST requirements.

Solution - Switched to fewer but longer burns to slow bed degradation.

5.2 COMMAND SUBSYSTEMS PERFORMANCE

(Prepared by CSC)

5.2.1 Health

The health of the Command Systems remained excellent throughout Segment 4 (Revs 683 - 1024). There were no equipment malfunctions. None of the Command Systems were subjected to out of specification temperatures or voltages. There were no power dropouts, relay driver overloads, or clock status errors experienced.

5.2.1.1 EXTENDED COMMAND SUBSYSTEM

5.2.1.1.1 Command Modes

The ECS responded properly in all modes into which it was commanded. There were a total of 51 messages loaded in the ECS for this segment. This resulted in 52,703 SPC's being stored for readout from the PMU's.

Of the 52,703 SPC's loaded, 23,156 were output from the PMU's for processing by the decoders. The remaining were erased out prior to time label matches. In loading the 52,703 SPC's a total of 29 rejects occurred. Hula had 5 of those rejects over 5 different passes, Guam had 2 rejects over 1 pass, Boss had 5 rejects over 3 passes, Kodi had 13 rejects in 7 passes, Cook had 6 rejects in 2 passes. Only Pogo had no rejects.

5.2.1.1.2 ECS Clock Operation

The accuracy of the ECS clock was .1128 parts in 10^6. This corresponds to an average frequency offset of .1155 HZ above the nominal frequency of 1.024×10^6 HZ. The frequency of the clock oscillators changes .0266 HZ in 341 revs. This results in a stability of 2.598 parts in 10^8 over a 21 day period, or 1,173 parts in 10^{10} for an average 6 hour period. All of these values are well within system specifications. The clock plot is presented in Figure 5.2-1.

5.2.1.1.3 ECS Anomalies

There were no ECS anomalies experienced during this segment.

5.2.1.2 MINIMAL COMMAND SUBSYSTEM

5.2.1.2.1 Command Modes

The MCS was not used during this segment.

5.2.1.2.2 MCS Anomalies

There were no MCS anomalies.

5.2.1.3 REMOTE DECODER/BUD

5.2.1.3.1 Command Modes

The remote decoder was used for the recovery of RV-4 which ended this segment of the flight. The performance of both channels was verified from telemetry to be proper for all commands.

No commands were issued from the BUD during this segment.

5.2.1.3.2 Remote Decoder/BUD Anomalies

There were no remote decoder or back-up decoder anomalies.

5.2.1.4 SUMMARY

5.2.1.4.1 Expendables and Environmental Data

Total Command Readouts	PMU-A 11,478 PMU-B 11,678
ECS Clock Drift Rate	.1128 parts in 10^6
ECS Clock Stability	2.598 parts in 10^8 for a 341 rev period
Total Hours On	ECS 1531 MCS 4.5 RD 6.0 BUD .05

Secure Words Expended at end of Segment 4 PMU-A 116 PMU-B 104

Environmental Data: See Figures 5.2-1 through 5.2-7

Clock Accuracy (Avg) $= \frac{\Delta \text{Bias}}{\Delta \text{Time}}$

$$= \frac{.2056}{1.822\text{x}10^{6}} = .1128 \text{ x } 10^{-6}$$

Average Clock Frequency $= (.112\text{x}10^{6} \text{ x } 1.024\text{x}10^{6}) +1.024\text{x}10^{6}$

$$= 1,024,000.1155$$

Frequency 1 (f_1) $= \frac{(\Delta \text{Bias}}{(\Delta \text{ECS Time}} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$

$$= \frac{9\text{x}10^{-2} \text{ Sec}}{7\text{x}10^{5}} \text{ x } 1.024\text{x}10^{6} + 1.024.10^{6}$$

$$= 1024000.1317$$

Frequency 2 (f_2) $= \frac{\Delta \text{Bias}}{\Delta \text{ECS Time}}$

$$=(\frac{.118}{(1.15\text{x}10^{6} \text{ Sec}} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$$

$$= 1,024,000.1051$$

Clock Stability $= \frac{f_1 - f_2}{\text{Frequency (Avg)}}$

$$= \frac{.0266 \text{ HZ}}{1.024\text{x}10^{6}} = 2.598\text{x}10^{-8}$$

= 2.598 parts in 10^{8} for this 259 rev period

= 1.173 parts in 10^{10} for average 6 hour period

~~SECRET/H~~

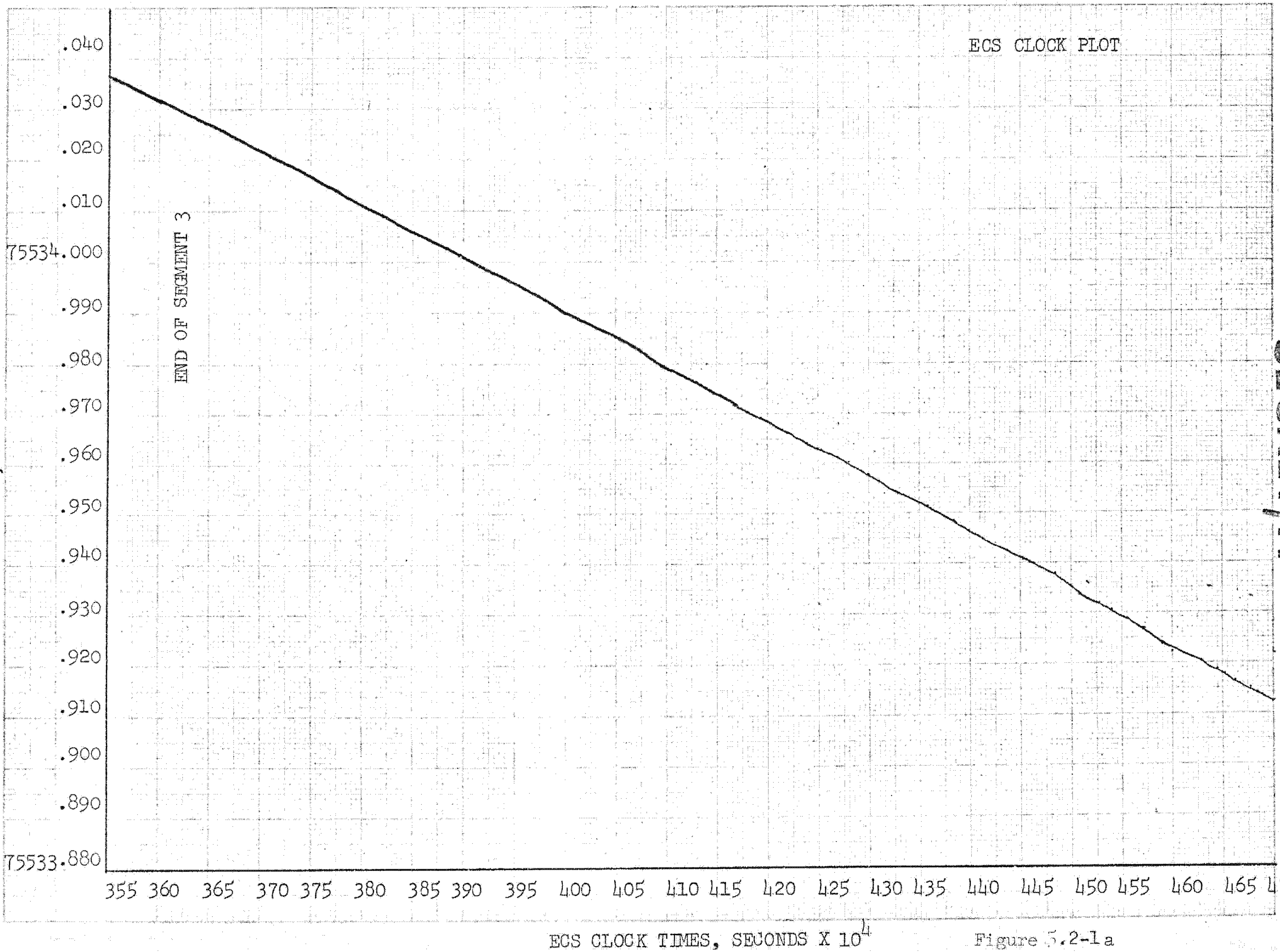


Figure 5.2-1a

~~SECRET/H~~

SECRET/H

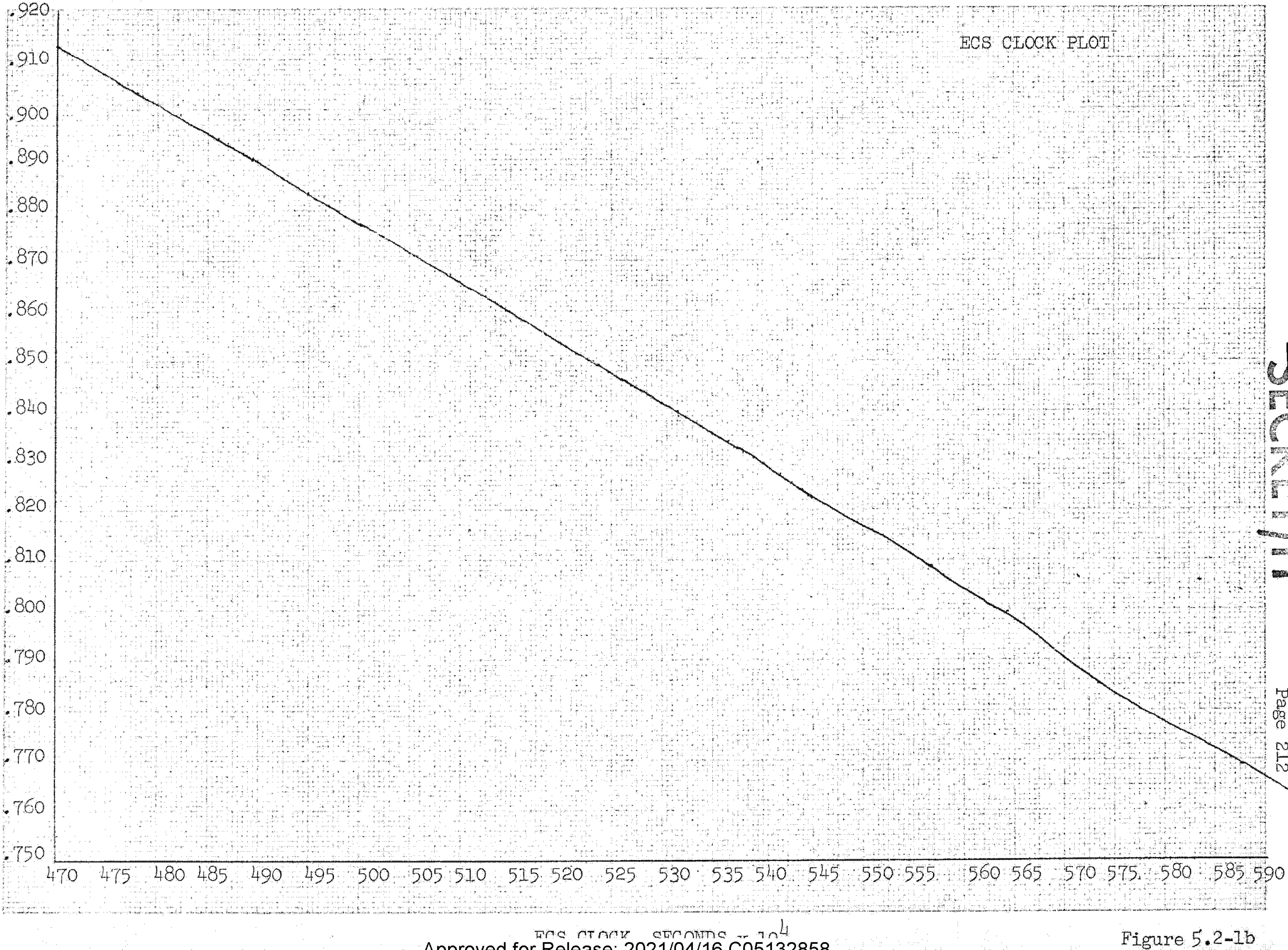
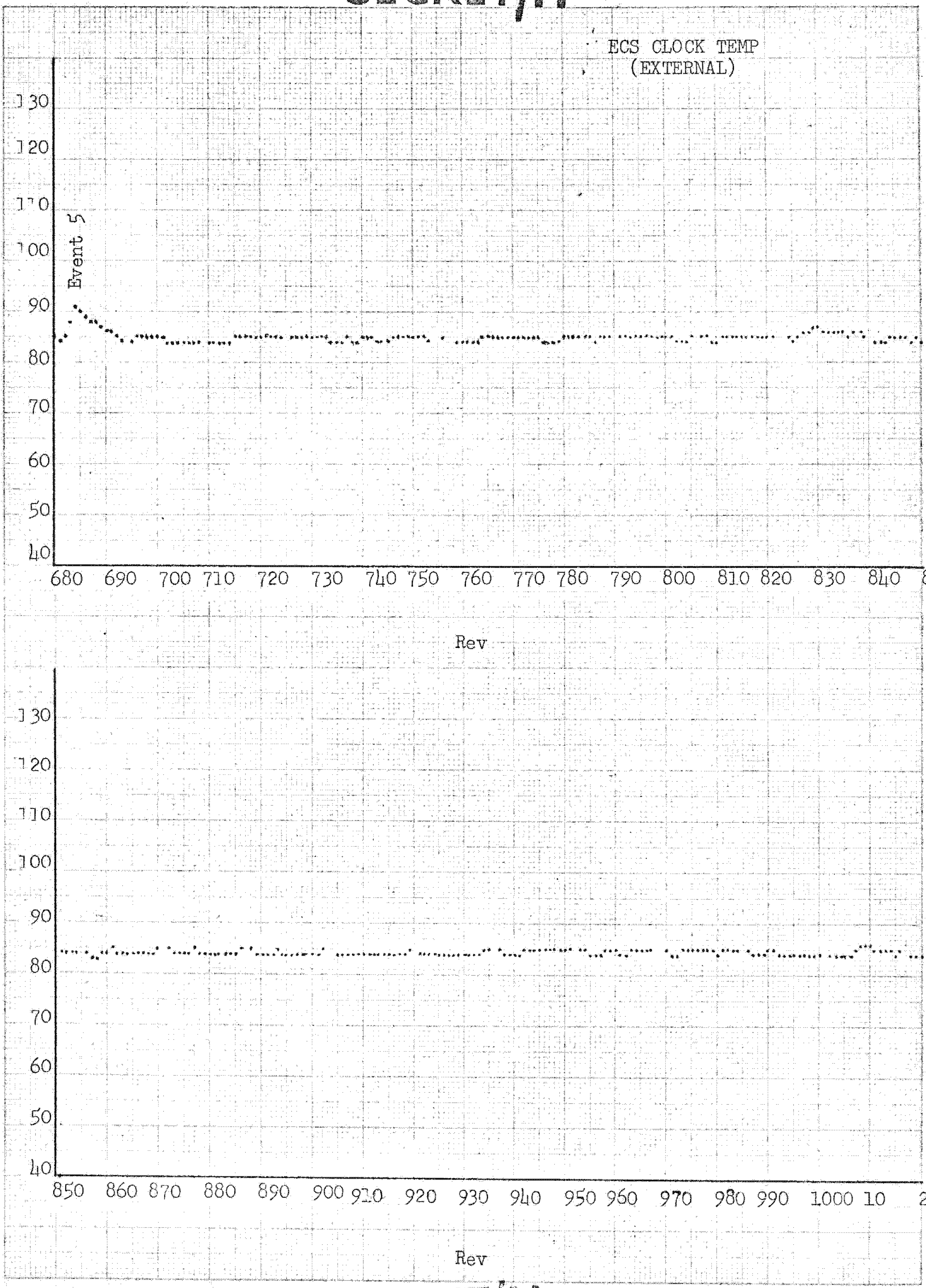


Figure 5.2-1b

SECRET/H

~~SECRET/H~~



~~SECRET/H~~

Figure 5.2-2a

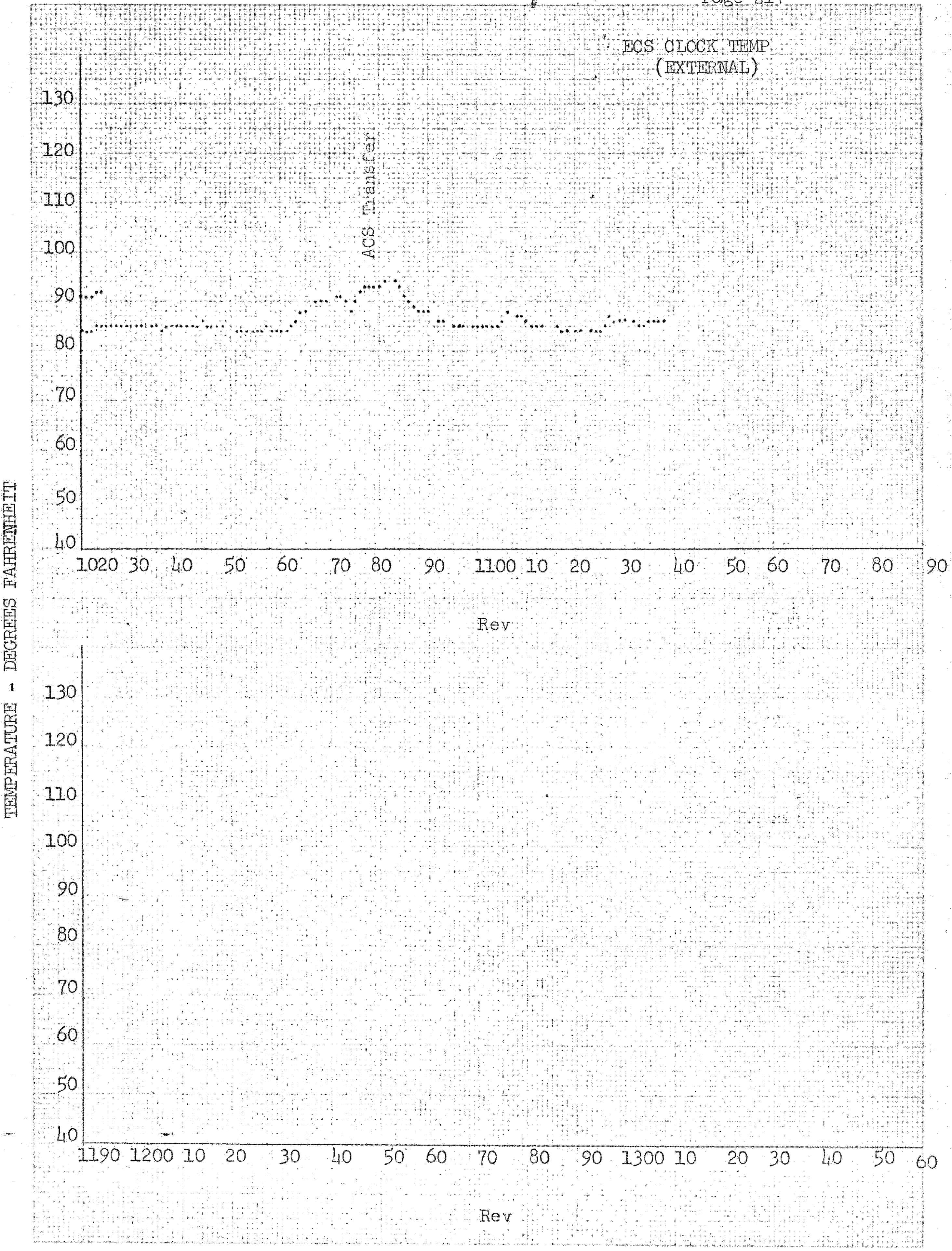

ECS CLOCK TEMP
(EXTERNAL)
ACS Transfer
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
1020
30
40
50
60
70
80
90
1100
10
20
30
40
50
60
70
80
90
Rev
130
120
110
100
90
80
70
60
50
40
1190
1200
10
20
30
40
50
60
70
80
90
1300
10
20
30
40
50
60
Rev

Figure 5.2-2b

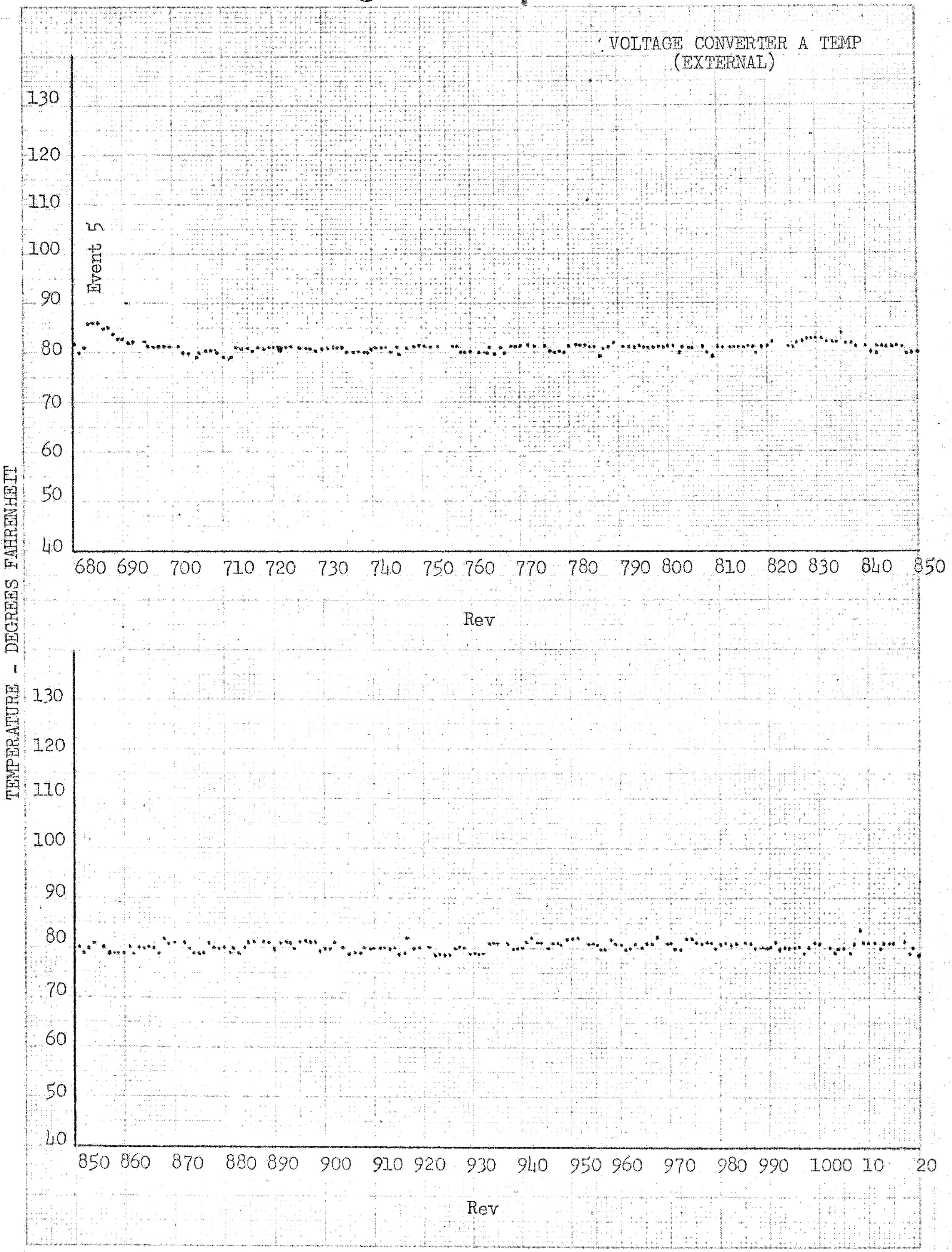
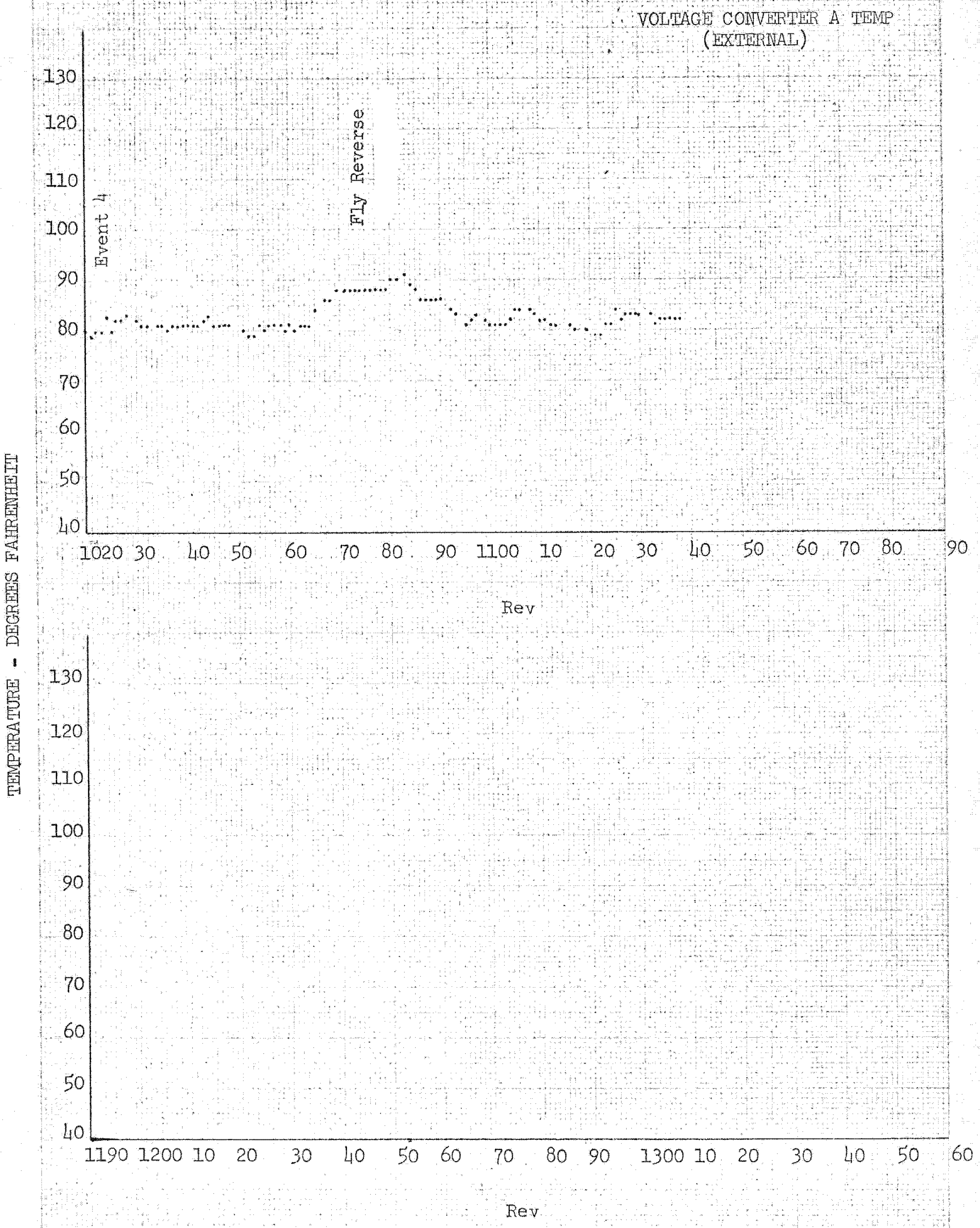

VOLTAGE CONVERTER A TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
Event 5
130
120
110
100
90
80
70
60
50
40
680
690
700
710
720
730
740
750
760
770
780
790
800
810
820
830
840
850
Rev
130
120
110
100
90
80
70
60
50
40
850
860
870
880
890
900
910
920
930
940
950
960
970
980
990
1000
10
20
Rev

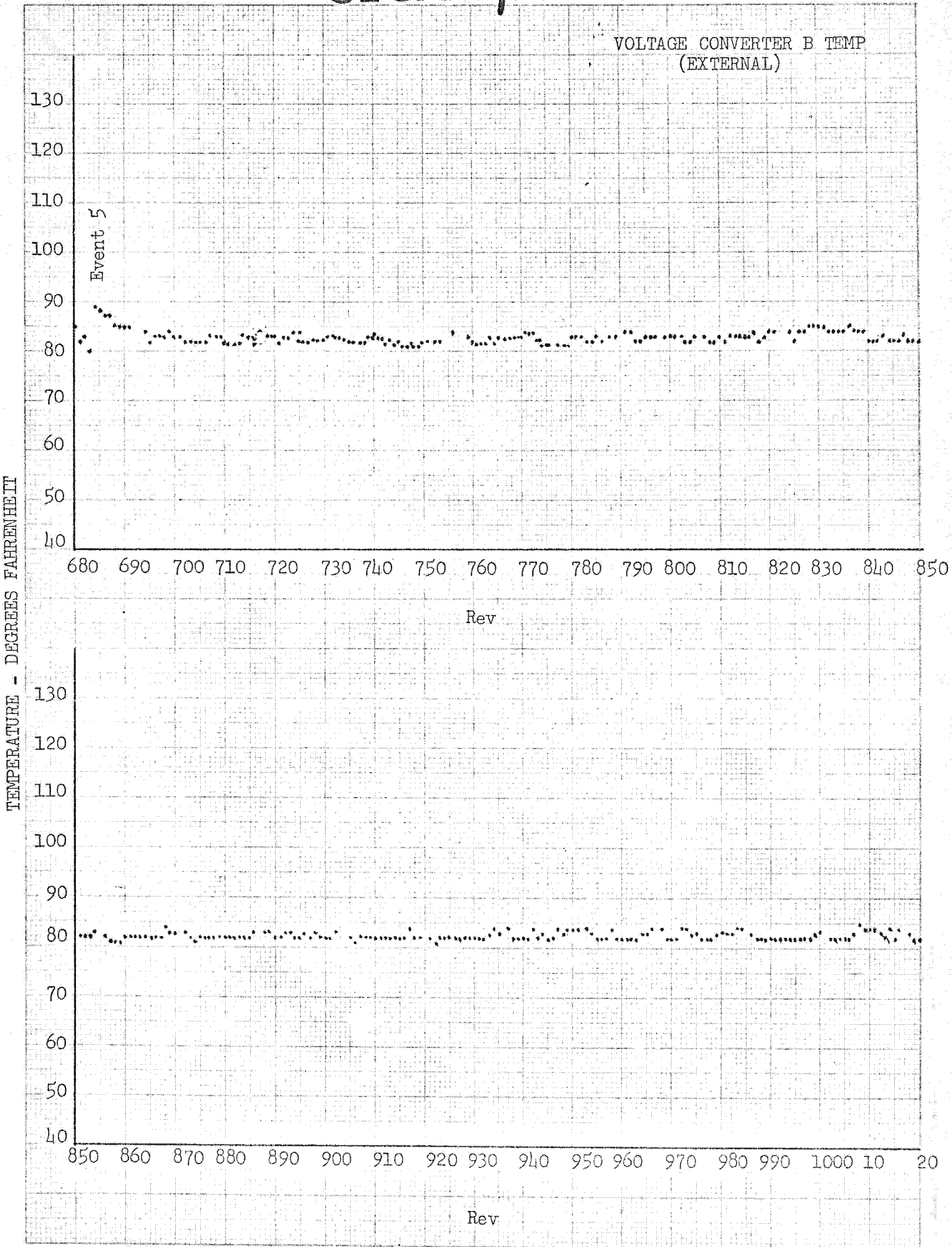
Figure 5.2-3a



VOLTAGE CONVERTER A TEMP
(EXTERNAL)

Figure 5.2-3b

~~SECRET/H~~



~~SECRET/H~~

Figure 5.2-4 a

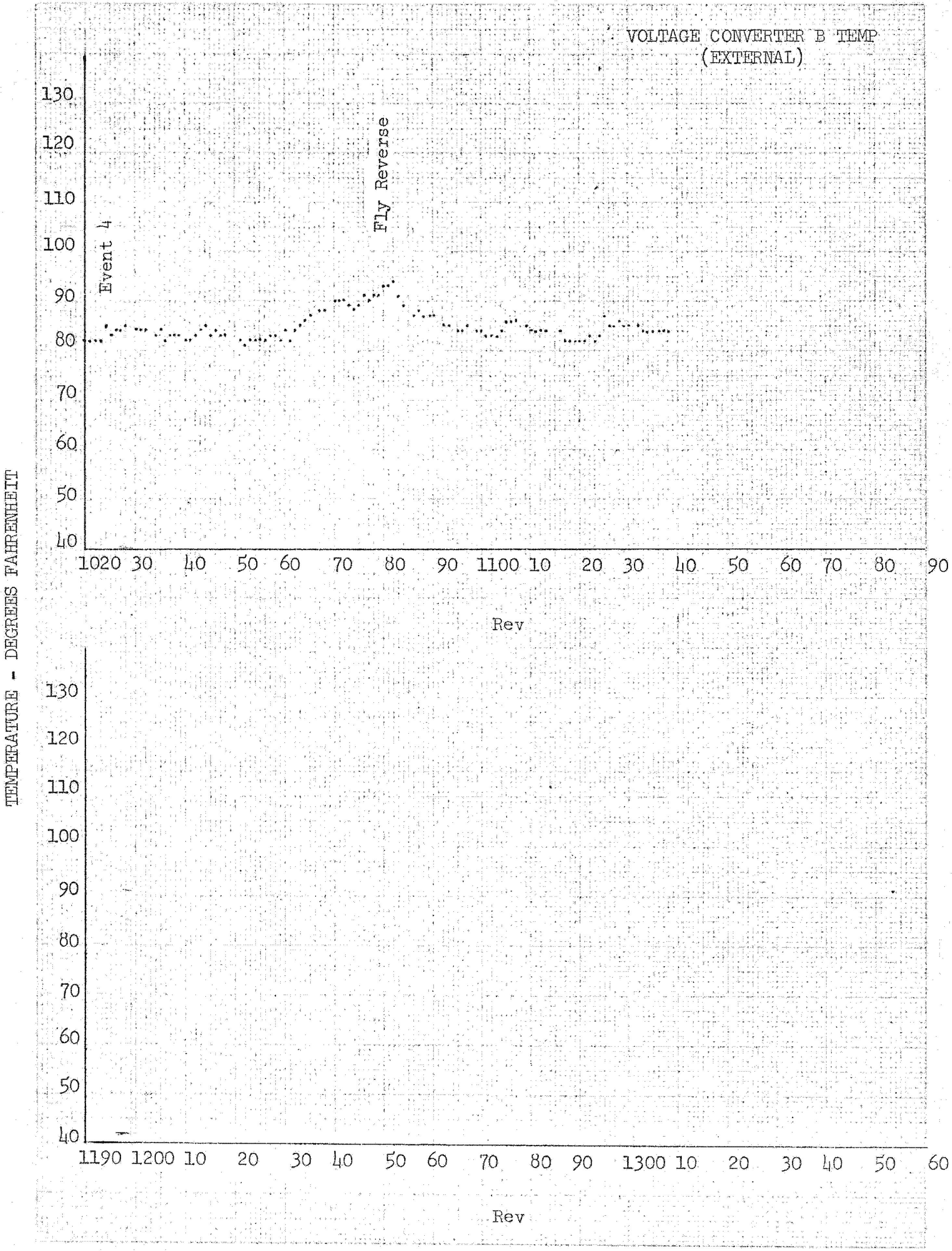

VOLTAGE CONVERTER B TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
Event 4
Fly Reverse
1020 30 40 50 60 70 80 90 1100 10 20 30 40 50 60 70 80 90
Rev
130
120
110
100
90
80
70
60
50
40
1190 1200 10 20 30 40 50 60 70 80 90 1300 10 20 30 40 50 60
Rev

Figure 5.2-4b

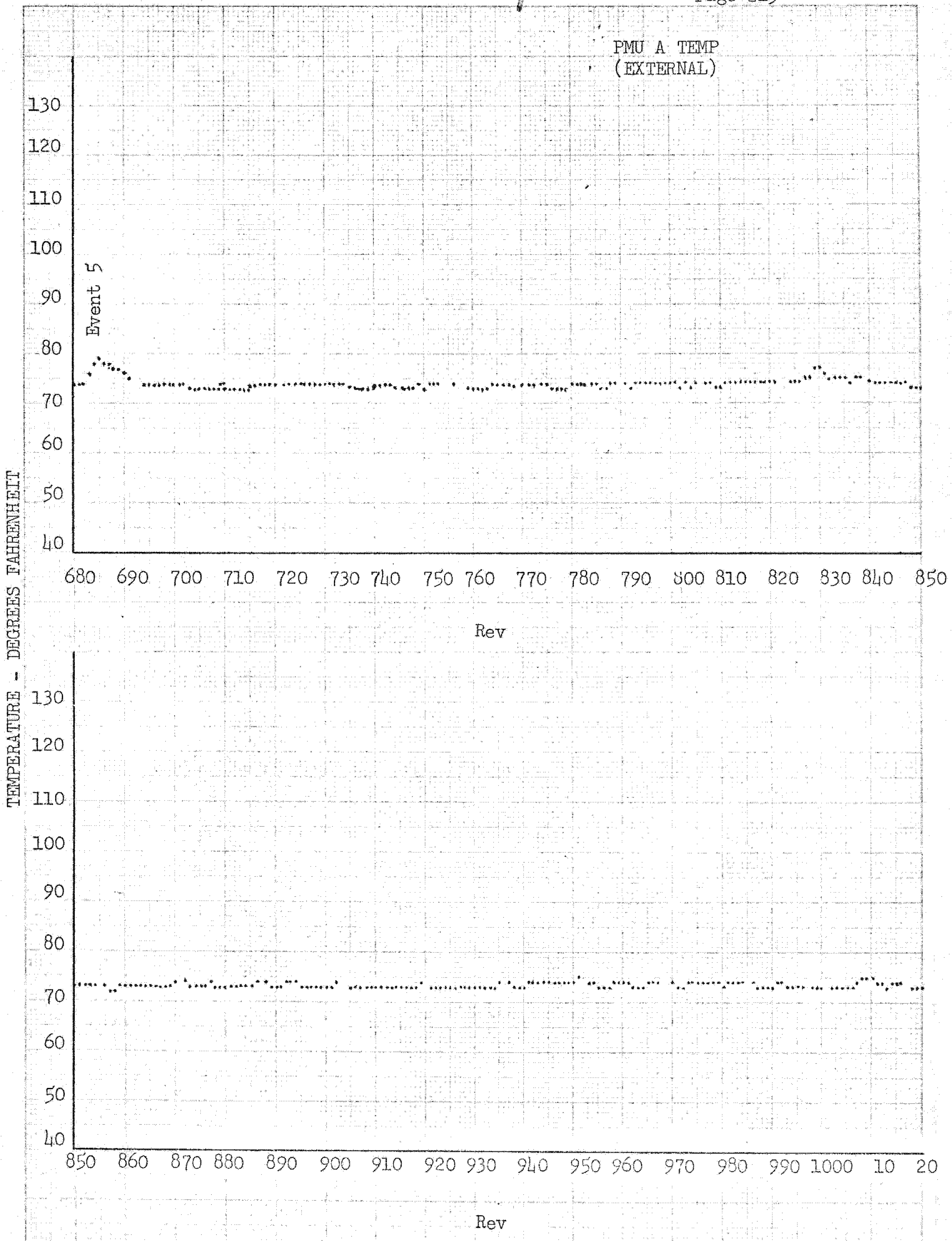

PMU A TEMP
(EXTERNAL)
Event 5
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
680
690
700
710
720
730
740
750
760
770
780
790
800
810
820
830
840
850
Rev
130
120
110
100
90
80
70
60
50
40
850
860
870
880
890
900
910
920
930
940
950
960
970
980
990
1000
10
20
Rev

Figure 5.2.5a

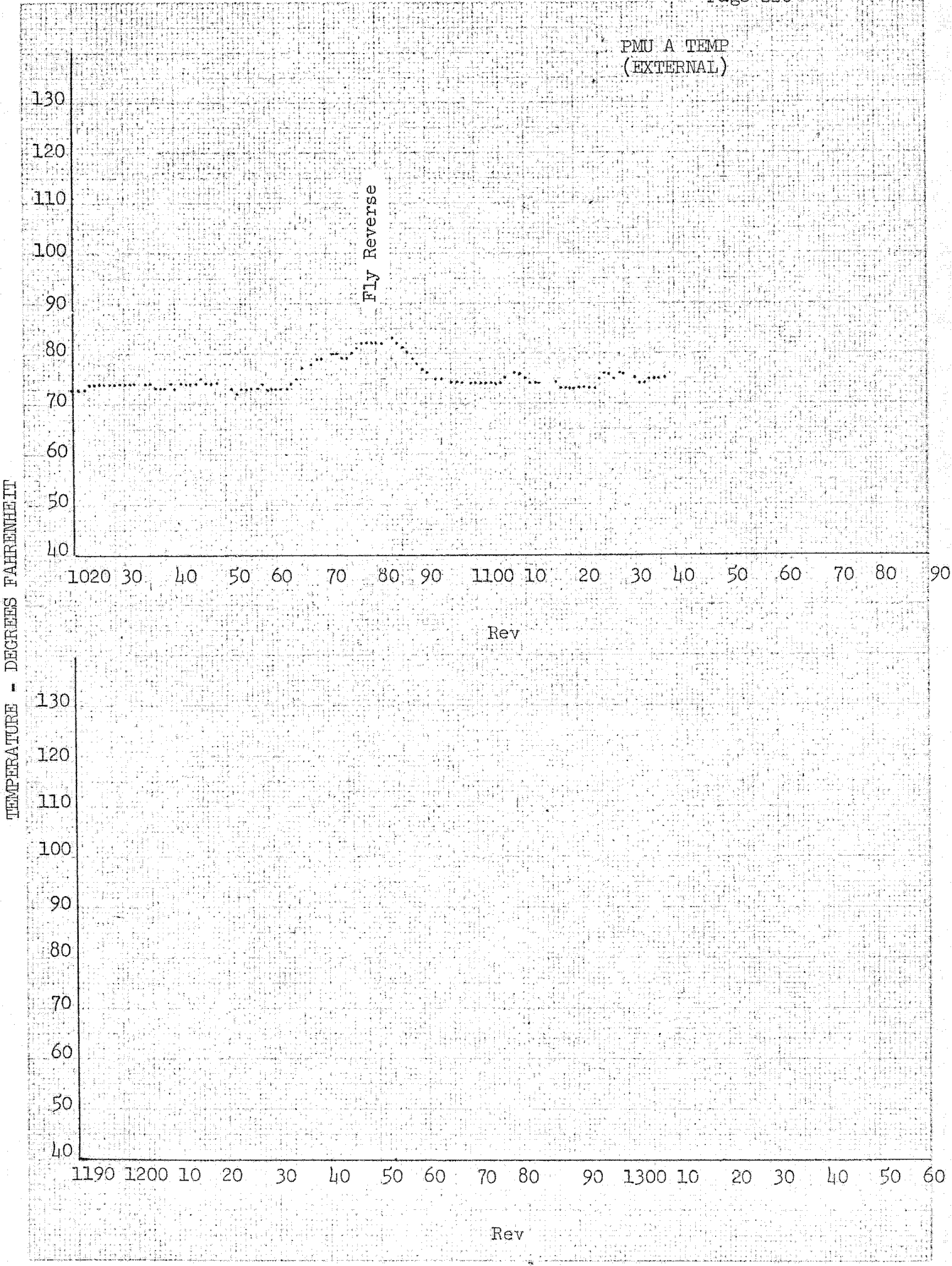

PMU A TEMP
(EXTERNAL)
Fly Reverse
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
1020 30 40 50 60 70 80 90 1100 10 20 30 40 50 60 70 80 90
Rev
130
120
110
100
90
80
70
60
50
40
1190 1200 10 20 30 40 50 60 70 80 90 1300 10 20 30 40 50 60
Rev

Figure 5.2-5b

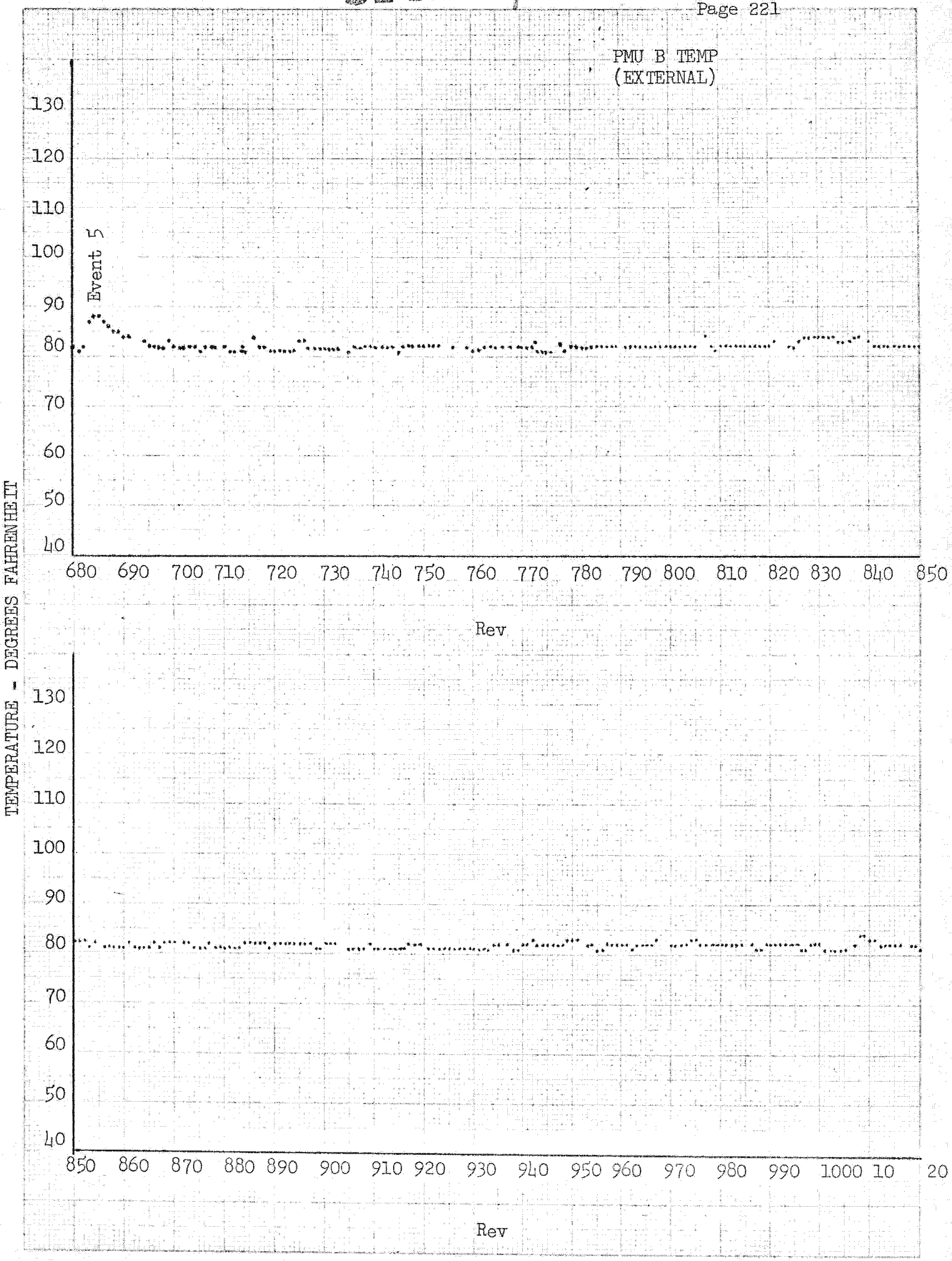

PMU B TEMP
(EXTERNAL)
Event 5
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
680
690
700
710
720
730
740
750
760
770
780
790
800
810
820
830
840
850
Rev
130
120
110
100
90
80
70
60
50
40
850
860
870
880
890
900
910
920
930
940
950
960
970
980
990
1000
10
20
Rev

Figure 5.2-6a

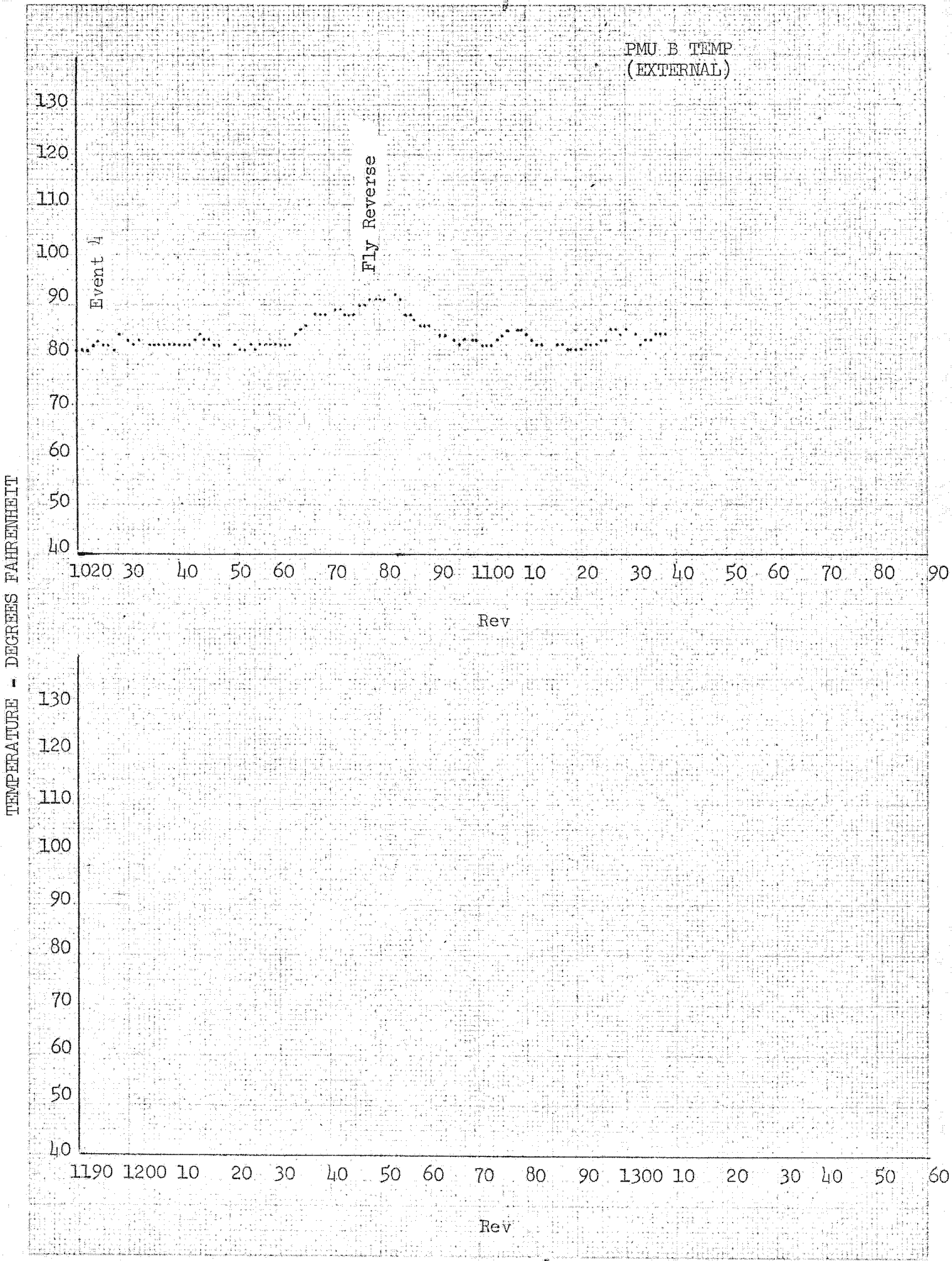

PMU B TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
Event 4
Fly Reverse
1020
30
40
50
60
70
80
90
1100
10
20
30
40
50
60
70
80
90
Rev
130
120
110
100
90
80
70
60
50
40
1190
1200
10
20
30
40
50
60
70
80
90
1300
10
20
30
40
50
60
Rev

Figure 5.2-6b

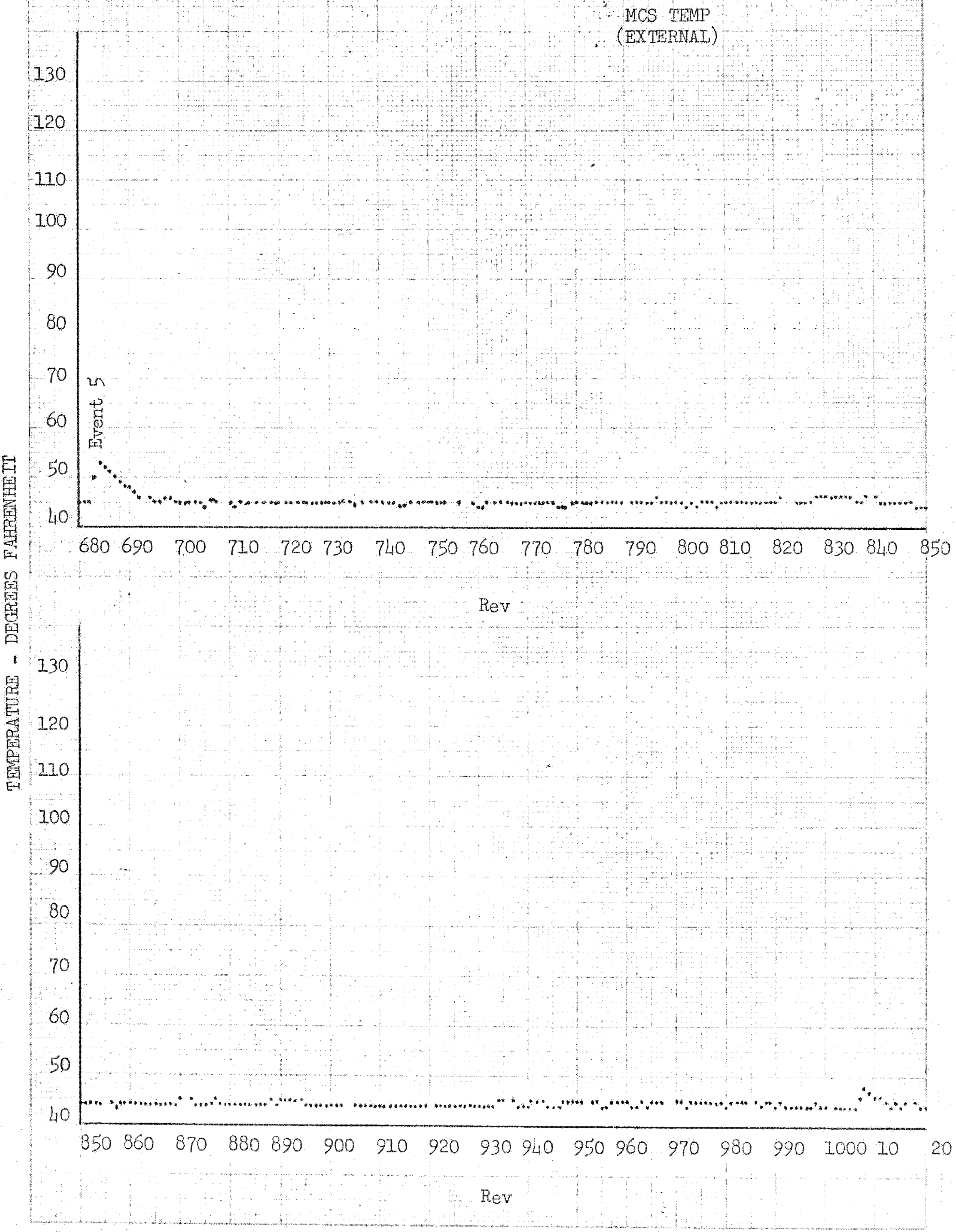

MCS TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
Event 5
680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850
Rev
130
120
110
100
90
80
70
60
50
40
850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000 10 20
Rev

Figure 5.2-7a

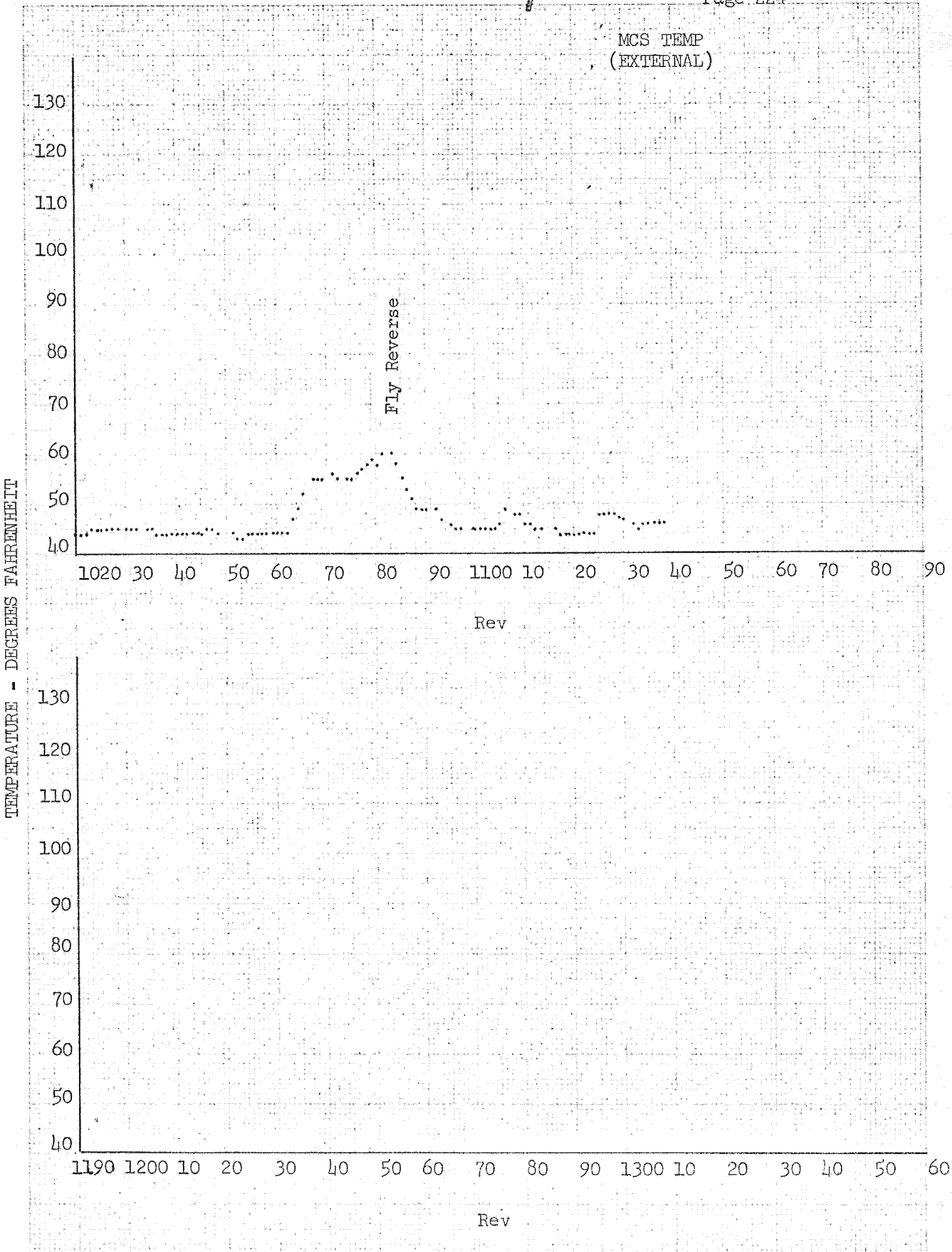

MCS TEMP
(EXTERNAL)
TEMPERATURE - DEGREES FAHRENHEIT
130
120
110
100
90
80
70
60
50
40
Fly Reverse
1020 30 40 50 60 70 80 90 1100 10 20 30 40 50 60 70 80 90
Rev
130
120
110
100
90
80
70
60
50
40
1190 1200 10 20 30 40 50 60 70 80 90 1300 10 20 30 40 50 60
Rev

Figure 5.2-7b

5.3 SENSOR SYSTEM OPERATIONS THROUGH RV-4 (SSC)

5.3.1 Mission Operations Performance

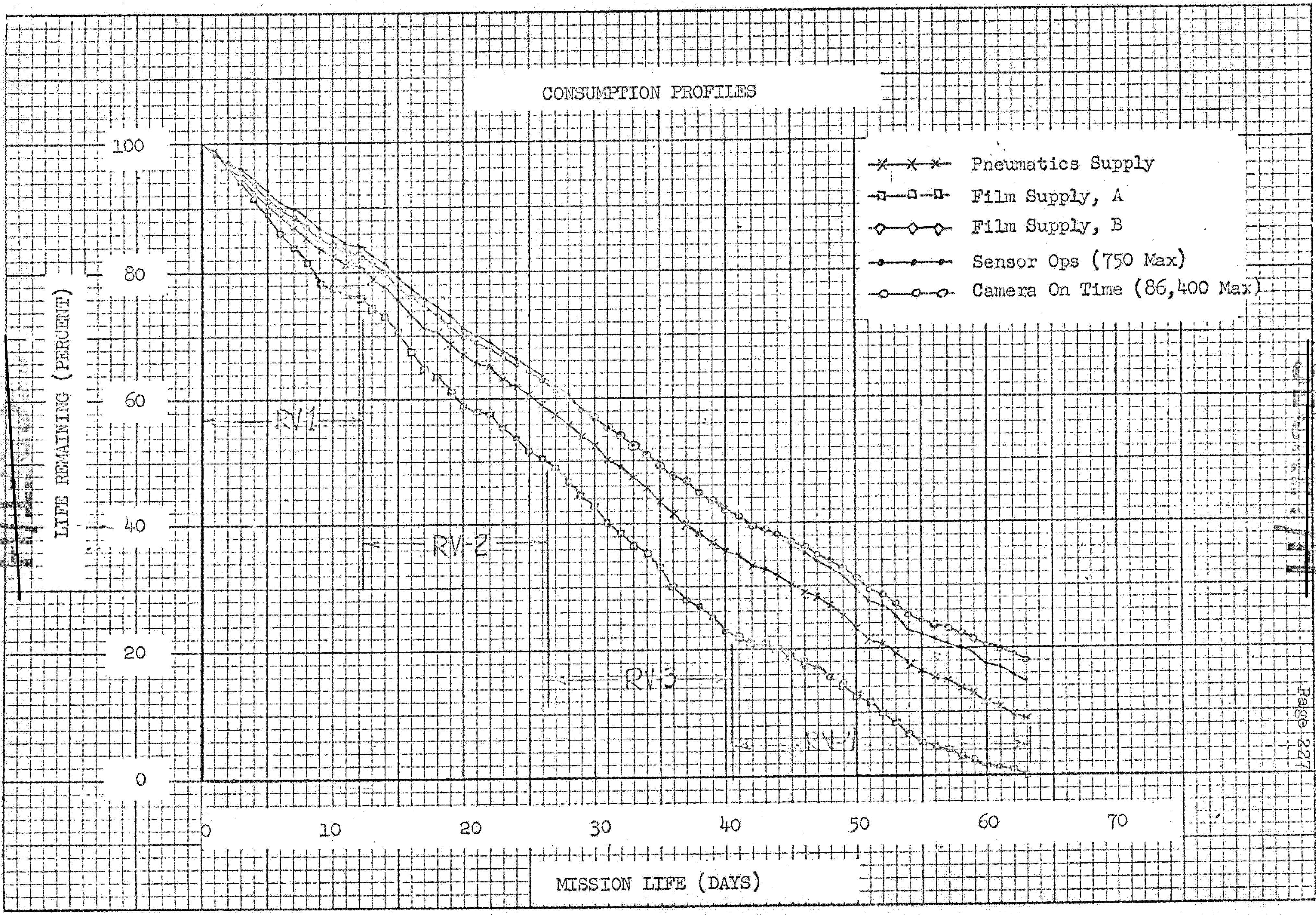
Sensor Subsystem operations throughout RV-4 demonstrated nominal performance characteristics with no major anomalies or malfunctions. The operational constraints of a fixed -5 ips rewind, and no 120-degree scans or 30-degree scans at ± 45-degree centers continued throughout RV-4.

The last 2000 feet of film on the forward camera was SO-255, a special aerial color film. The transition from black and white to color materials was achieved with a pair of constant velocity runs on Rev 971.

The bias to V_y to compensate for yaw attitude errors continued throughout RV-4. The errors fluctuated from zero to three degrees, requiring corresponding V_y bias of zero to seven command steps, plus an OOAA bias for yaw errors above two degrees.

The RV-4 mission segment consisted of 207 sensor system operations, consuming 20,456 seconds of camera power on time, 8.7 pounds (estimated) of nitrogen gas, and approximately 24,760 feet of film for the forward-working camera, and 26,420 for the aft. The total film supply available was utilized, the forward camera experiencing depletion on Rev 1015, and the aft on Rev 1016. Consumption profiles for the complete mission are graphically summarized in Figure 1.

The overall quality of the acquired photography was rated good, with less atmospheric haze and weather degradations than on previous mission sequences. The best photography of both cameras was very good and equal to or better than the best produced throughout the mission. The aft photography exhibited an out-of-focus band near the center of the film for all ops during the rev span approximately Rev 875 to 965. No cause has yet been identified. The color photography was comparable to that from SV-4. The best color original was nearly comparable to the corresponding aft camera black and white, and would withstand 100X magnification.


CONSUMPTION PROFILES
Pneumatics Supply
Film Supply, A
Film Supply, B
Sensor Ops (750 Max)
Camera On Time (86,400 Max)
LIFE REMAINING (PERCENT)
100
80
60
40
20
0
MISSION LIFE (DAYS)
0
10
20
30
40
50
60
70
RV-1
RV-2
RV-3
RV-4

5.3.2 Engineering Tests

The engineering tests performed during this segment of the mission were for the purpose of special purpose photographic quality performance evaluations.

Rev 697	Tri-Bar Resolution MOP
Rev 714	"McDonald's Arches" MOP
Rev 746	MTF Lines MOP
Rev 794	Tri-Bar Resolution MOP
Rev 810	Mono B Dither MOP
Rev 860	"McDonald's Arches" MOP
Rev 876	MTF Lines MOP
Rev 891	Mono B Dither Baseline MOP
Rev 907	Tri-Bar Resolution MOP
Rev 908	Log Periodic Target on Snow MOP
Rev 923	Tri-Bar Resolution MOP
Rev 941	Mono B Dither MOP
Rev 957	Mono B Dither Baseline MOP
Rev 971	Constant Velocity, A only, Transition to SO-255
Rev 973	Tri-Bar Resolution and Color Target MOP
Rev 989	Tri-Bar Resolution and Color Target MOP
Rev 1006	Color Target MOP

5.4 RV 4 (S/N 21) Performance (MWC)

This report presents analysis of the RV-1 performance based on evaluation of recovery studies, command message, RV and SV Telemetry, voice reports and the recovery test report TWX. Tables 5.4-1 and 5.4-2 list all relevant data. Also included are graphs showing the performance of the RV heaters. A solo test was conducted on RV 4 which switched to the redundant TCEA on Rev 999 to verify operation on the redundant heater.

5.4.1 Summary

The RV payload was 89.68% of the maximum I.C.D. weight and was unbalanced 4.47%. The PREP 2 event took place on Rev 1023 over POGO and separation occurred on Rev 1024. Preparation, deorbit, entry events and drogue and main parachute deployment conditions were normal with the exception of a 3' x 3' hole in the cone skirt. This hole was just above the main chute/cone interface. Aerial Recovery was accomplished on the 2nd pass at 10,300 feet altitude. The chute cone was breathing and occasionally collapsed up to 30 degrees off the vertical. The main parachute had oscillation with lateral movements up to ± 30 degrees off the vertical.

The recovery location was within 18.0 nautical miles of the predicted impact point. This value is the resultant of in-track and cross-track miss distances. No capsule damage was reported. The capsule was returned in good condition.

RECOVERY DATA

RV REENTRY PARAMETERS FROM TEAPOT EVALUATION RUN

ORBIT		
REV	1024	
APOGEE	149.01	NM
PERIGEE	86.498	NM
ARG OF PERIGEE	129.118	°
INCLINATION	95.606	°
RETRO CONDITION		
TRUE ANOMALY	355.63	°
ALTITUDE	530812.8	FT
LATITUDE	54.78	°N
LONGITUDE	156.76	°W
ENTRY (400K)		
INERTIAL VEL.	25527.06	FT/SEC
γ	-2.1313	°
α_H	104.18	°
LATITUDE	44.537	°N
LONGITUDE	159.90	°W
DROGUE DEPLOY		
VELOCITY	1426.16	FT/SEC
MACH NO.	1.47	
ALTITUDE	64281.01	FT
γ	-31.1932	°
q	186.998	PSF
HEAT SHIELD JETTISON		
ALTITUDE	49791.86	FT
ETPD		
ALTITUDE	46000	FT
DESCENT VEL @ 15K	28.5	FT/SEC

RV EVENT TIMES (FROM CMDMSG & TLM) IN SYSTEMS TIME

RV n+1 OUTLET T/S	N/A	
RV n INLET T/S	77957.8	
DT START	81983.0	
PITCH DOWN START	83097.8	
PITCH DOWN STOP	83150.6	
RV PYRO ARM (BAT ACT)	83267.6	
KODI ACQUISITION	83490.0	(+122)
ORB PWR OFF	83587.2	
RV SEPARATION	83597.0	
RV RETRO FIRE	83722.4	
KODI FADE (RV)	83857.2	(+4.5)
*ENTER IONIZATION	83980	(+6)
*EXIT IONIZATION	84100	(-63)
DROGUE DEPLOY	84216	(+7)
ETPD (DISREEF + 3 SEC)	84231.2	(N/A)
HEAT SHIELD JETTISON	84237	(-2)

NOTE: TIME IN PARENTHESIS IS THE DELTA FROM THE PREDICTED TIME. TIMES THAT FALL WITHIN THE ONE SECOND PRINTOUT INTERVAL OF SV TLM IS CONSIDERED TO HAVE A ZERO DELTA TIME.

*BASED ON LOS AND AOS AS REPORTED BY UP-RANGE RECOVERY AIRCRAFT.

RV MASS PROPERTIES (FROM UPDATED TEAPOT RUN)

PAYLOAD WEIGHT		
SIDE A	201.12	LBS
SIDE B	211.41	LBS
% UNBAL $\frac{\lvert W_a - W_b \rvert}{230}$	4.47	%
% FULL (460 lb = 100%)	89.68	%
RV WEIGHTS		
SEPARATION	1501.38	LBS
PRE RETRO	1499.69	LBS
ENTRY	1308.88	LBS
RECOVERY	1095.83	LBS

RV PITCH ANGLE (FROM BASIC STUDY)

θRVS	-125.27	°
$-\Delta\theta 1$	1.91	°
$+\Delta\theta 2$	0.01	°
θSV	- 37.17	°

PITCH ANGLE USED FOR UPDATED TEAPOT

θRVS	-125.324	°

TABLE 5.4-2

RECOVERY DATA

EVENT	LATITUDE		LONGITUDE	
LOCATION				
NOMINAL PIP	26.000	°N	163.80	°W
UPDATED TEAPOT	26.043	°N		°W
TEAPOT EVALUATION	25.996	°N	163.80	°W
ACTUAL RECOVERY LOCATION	26.133	°N	163.533	°W
ERROR (ACTUAL-TEAPOT EVAL.)	.137	°	.267	°
ERROR (1° = 60 NM)	8.22	NM	16.02	NM
TOTAL ERROR	18.0		NM	

AERIAL RECOVERY

ALTITUDE	10,300		FT	
PASS NUMBER	2			
AIRSPEED	145	(KTAS)	120	(KIAS)

CHUTE CONDITION: 3 FT x 3FT Hole in Cone Skirt just above Main Chute/Cone Interface

CHUTE BEHAVIOR: Chute Cone breathed and occasionally collapsed up to up to 30° off the Vertical. Main Chute oscillated 30° off Vertical.

TIME: 2341Z

RETRIEVAL

CAPSULE CONDITION: No Visible Damage

WINCH SETTINGS

PRESET TENSION LEVEL: 3500

PAY OUT: Normal

CONTACT: Number 2 hook contacted 2 Cone lines

VERIFIED RECOVERY AREA WIND DATA

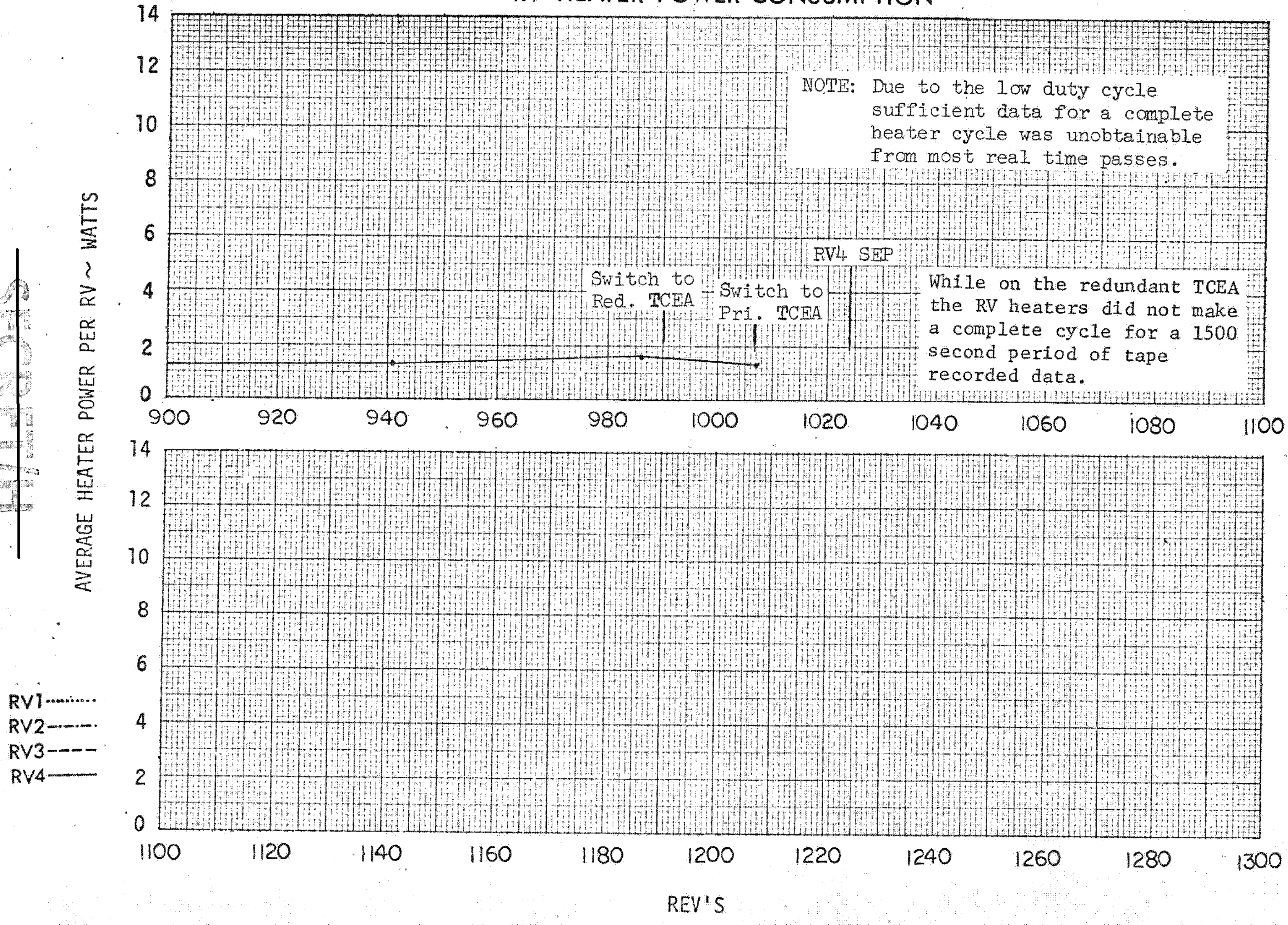
DATA SOURCE: MEMOGRAM

ALTITUDE 1000's FT	DIRECTION (DEGREES)	VELOCITY (KNOTS)	ALTITUDE 1000's FT	DIRECTION (DEGREES)	VELOCITY (KNOTS)
60	-	-	20	270	25
55	-	-	15	280	15
50	260	60	10	20	10
45	260	50	8	-	-
40	260	55	6	20	10
35	260	50	4	-	-
30	250	45	2	-	-
25	240	35	SFC	70	10

ACTIVE THERMAL CONTROL SYSTEM

RV HEATER POWER CONSUMPTION

~~SECRET/H~~

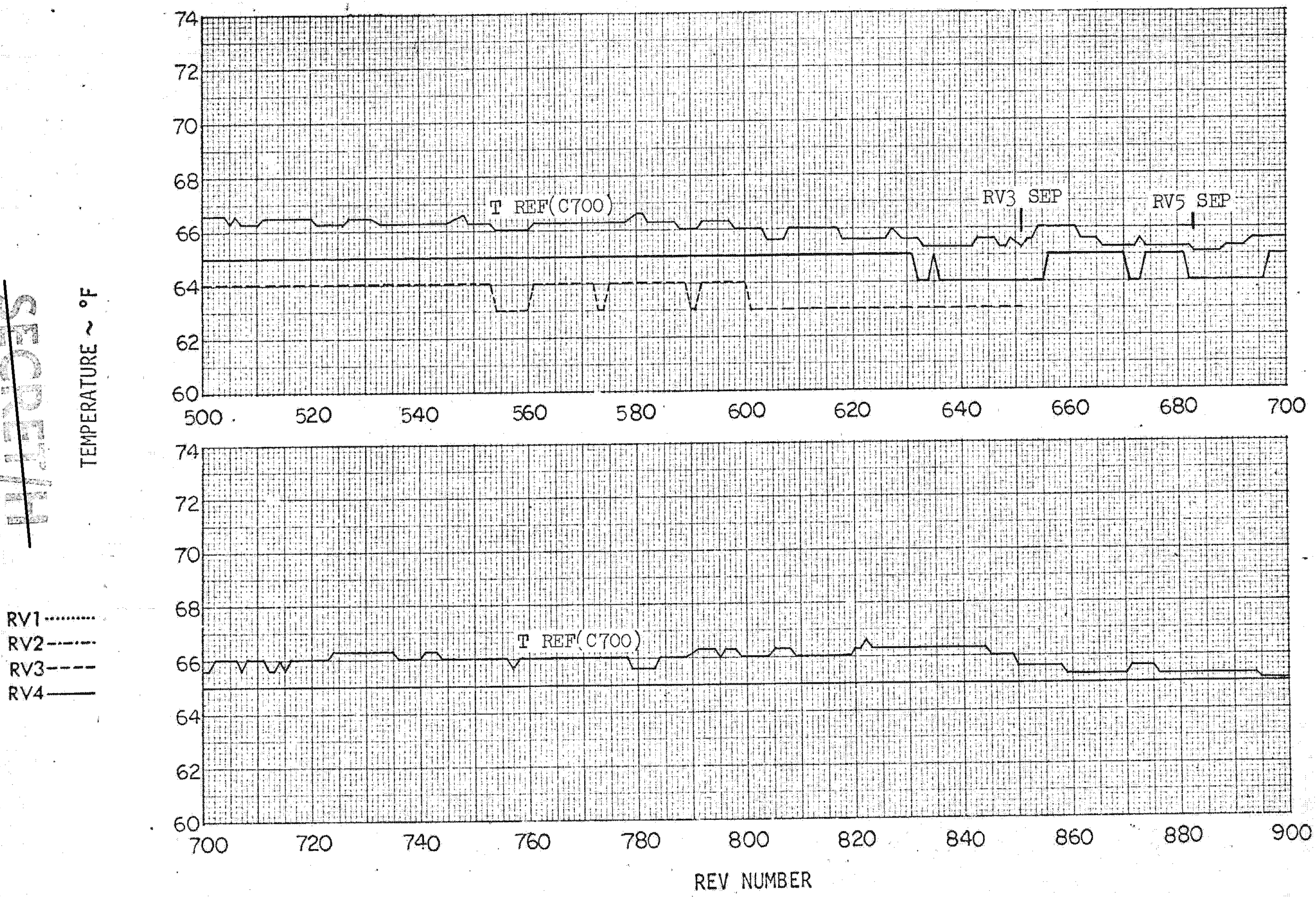


NOTE: Due to the low duty cycle sufficient data for a complete heater cycle was unobtainable from most real time passes.

While on the redundant TCEA the RV heaters did not make a complete cycle for a 1500 second period of tape recorded data.

~~SECRET/H~~

ACTIVE THERMAL CONTROL SYSTEM
RV PAYLOAD CONTAINER & REFERENCE TEMPERATURES



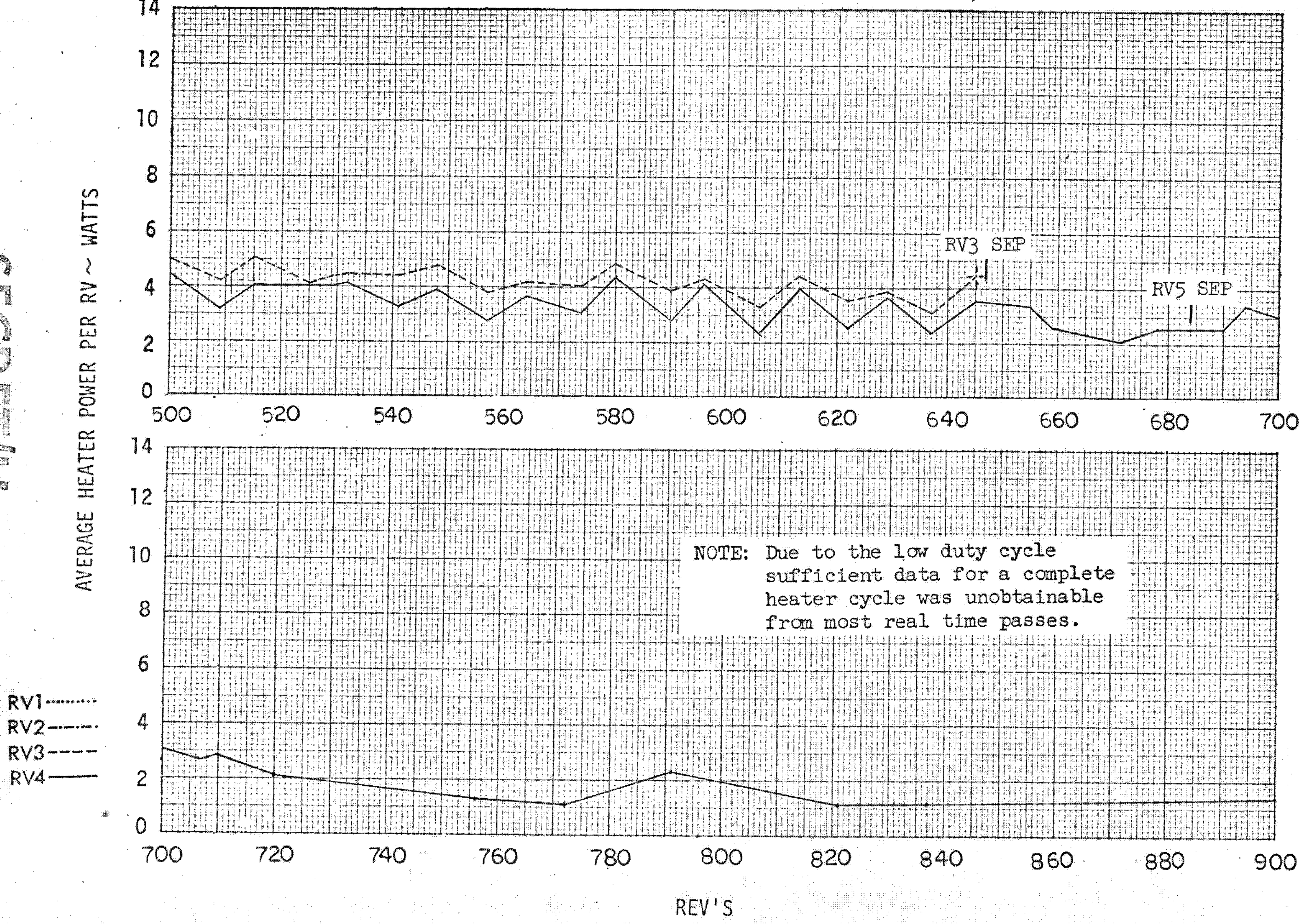
~~SECRET/H~~

~~SECRET/H~~

ACTIVE THERMAL CONTROL SYSTEM

RV HEATER POWER CONSUMPTION

~~SECRET/H~~

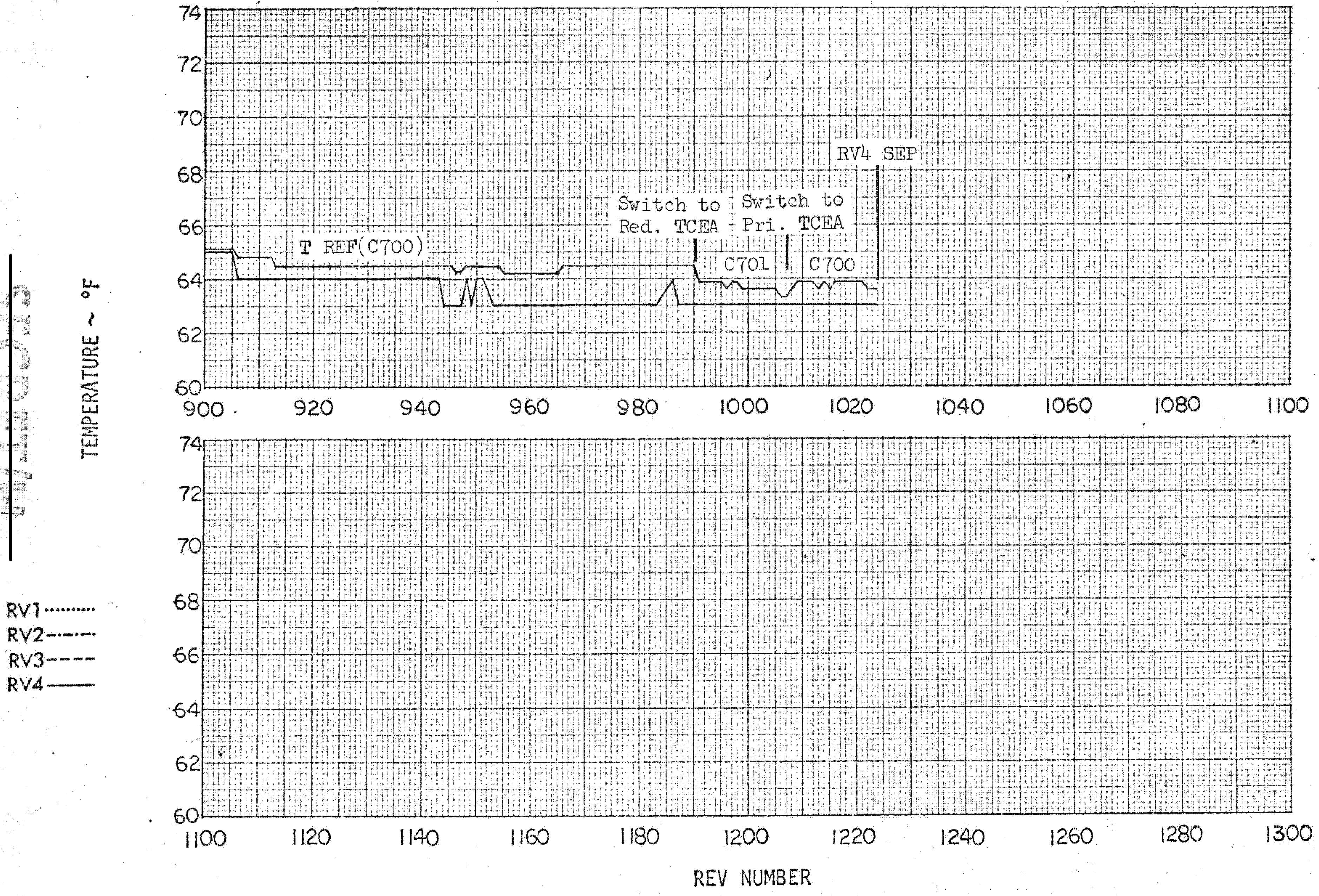


NOTE: Due to the low duty cycle sufficient data for a complete heater cycle was unobtainable from most real time passes.

~~SECRET/H~~

~~SECRET//H~~

ACTIVE THERMAL CONTROL SYSTEM
RV PAYLOAD CONTAINER & REFERENCE TEMPERATURES



~~SECRET//H~~

5.5 SATELLITE CONTROL FACILITY PERFORMANCE

5.5.1 Orbit Determination and Prediction

5.5.1.1 Orbit Determination

Table 5.5-1 shows a summary of the orbital conditions computed from each tracking reduction from RV-3 recovery to RV-4 recovery on Rev 1024. Significant events affecting the orbit during the RV-4 segment were:

1. Positive orbit adjust on Rev 695
2. Positive orbit adjust on Rev 727
3. Positive orbit adjust on Rev 760
4. Positive orbit adjust on Rev 792
5. Positive orbit adjust on Rev 841
6. Positive orbit adjust on Rev 890
7. Positive orbit adjust on Rev 938
8. Positive orbit adjust on Rev 987.

The tumbling lifetime data of Table 5.5-1 continued using the correct tumbling drag to calculate lifetime.

5.5.1.2 Prediction Accuracy

Table 5.5-2 contains a summary of prediction accuracies over a ten rev span from each tracking reduction epoch. Accuracies are determined by comparing the nodal crossing differences between the Best Fit Ephemeris and the tracking reduction ephemeris predictions. Prediction accuracy was acceptable although excursions were noted on the Rev 791 and Rev 840 reductions for no explainable reason.

TRACKING REDUCTION SUMMARY

SECRET/H

Table 5.5-1

EPOCH REV XXX	ECCENT. .XXXX	PERIOD DECAY .XXXX	INTEG. PERIOD XX:XX.X	MAX. ALTIT. XXX.XX	MIN. ALTIT. XX.XX	ARG. PERIGEE XXX.X	DRAG .XXXX	STABLE/TUMBLE XXX/XX	COMMENTS	DMEEK
684	.0093	.4761	88:42.1	153.31	84.40	128.7	.7166	96/28		
686	.0093	.4749	88:41.2	152.76	84.29	128.3	.7029	96/28		
689	.0091	.4709	88:39.9	151.80	84.36	127.3	.6935	96/28		
696	.0099	.4201	88:49.7	157.77	85.24	133.5	.7088	113/33	OA #22 on Rev 695	
697	.0098	.4233	88:49.2	157.47	85.21	133.2	.7109	111/32		
700	.0097	.4534	88:47.7	156.66	84.99	132.3	.7419	103/30		
702	.0097	.4567	88:46.8	156.14	84.86	131.8	.7359	102/29		
705	.0095	.4457	88:45.6	155.27	84.92	130.8	.7138	104/30		
710	.0094	.4576	88:43.3	153.81	84.69	129.7	.7084	100/29		
713	.0092	.4665	88:41.9	152.82	84.71	128.8	.7161	98/28		
716	.0091	.4807	88:40.5	151.98	84.45	128.0	.7145	94/27		
719	.0090	.4867	88:39.0	151.06	84.30	127.2	.7092	92/26		
722	.0089	.4845	88:37.7	150.12	84.29	126.2	.6979	91/26		
728	.0099	.4048	88:50.7	158.28	85.31	134.6	.6927	117/34	OA #23 on Rev 727	
729	.0098	.4057	88:50.2	157.86	85.42	134.3	.6977	116/34		
733	.0097	.4258	88:48.5	156.75	85.19	133.5	.7117	109/31		
735	.0096	.4098	88:47.6	156.27	85.10	133.1	.6776	113/32		
738	.0095	.4081	88:46.5	155.47	85.18	131.9	.6701	113/32		

SECRET/H

TRACKING REDUCTION SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
743	.0094	.4192	88:44.4	154.23	84.89	130.9	.6652	110/32		
746	.0092	.4276	88:43.2	153.25	84.97	130.0	.6361	107/31		
749	.0092	.4425	88:41.8	152.40	84.74	129.2	.6815	102/29		
751	.0091	.4454	88:40.8	151.95	84.63	128.7	.6751	101/29		
754	.0090	.4403	88:40.2	151.38	84.10	128.1	.6655	102/29		
759	.0088	.4519	88:37.4	149.69	84.40	126.5	.6555	98/28		
762	.0097	.3911	88:48.5	156.83	85.36	132.9	.6599	120/35	OA #24 on Rev 760	
765	.0096	.4559	88:47.1	155.86	85.27	132.1	.7579	102/30		
767	.0095	.4549	88:46.1	155.36	85.08	131.7	.7404	102/30		
770	.0094	.4527	88:44.9	154.44	85.16	130.7	.7347	102/30		
775	.0092	.4547	88:42.7	153.11	84.87	129.5	.7106	100/29		
778	.0091	.4470	88:41.3	152.02	84.90	128.8	.6930	101/29		
781	.0090	.4960	88:39.7	151.14	84.66	127.8	.7452	90/26		
783	.0089	.5114	88:38.7	150.54	84.49	127.2	.7543	87/25		
785	.0088	.5160	88:37.8	149.83	84.50	126.7	.7573	86/25		
791	.0086	.5297	88:34.5	147.76	84.20	125.1	.7401	82/24		
794	.0099	.4286	88:50.7	158.22	85.44	134.4	.7403	111/32	OA #25 Rev 792	
798	.0098	.4328	88:48.9	157.19	85.14	133.7	.7247	108/31		

~~SECRET/H~~

Table 5.5-1

~~SECRET/H~~

TRACKING REDUCTION
SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
800	.0097	.4339	88:48.0	156.63	85.07	133.2	.7186	108/31		
803	.0096	.4235	88:46.9	155.81	85.13	132.1	.6971	110/32		
808	.0095	.4219	88:44.2	154.61	84.79	131.1	.6686	109/32		
811	.0093	.4343	88:43.5	153.60	84.88	130.3	.6854	105/31		
814	.0092	.4735	88:42.0	152.79	84.62	129.4	.7242	96/28		
816	.0092	.4844	88:41.0	152.15	84.49	128.9	.7302	93/27		
819	.0090	.4972	88:39.6	151.13	84.51	127.9	.7419	90/26		
824	.0088	.5392	88:36.9	149.35	84.20	126.8	.7707	81/24		
827	.0086	.5663	88:35.2	148.09	84.20	125.9	.7959	76/22		
830	.0085	.5797	88:33.4	147.07	83.88	125.1	.7875	74/21		
832	.0084	.5933	88:32.2	146.30	83.72	124.5	.7892	72/21		
835	.0083	.5949	88:30.6	145.11	83.71	123.4	.7774	71/20		
840	.0080	.6217	88:27.5	143.06	83.34	122.2	.7721	66/11		
843	.0103	.4203	88:56.7	161.80	85.61	139.9	.7717	113/32	OA #26 Rev 841	
846	.0103	.4244	88:55.4	161.06	85.37	139.4	.7601	112/32		
848	.0103	.4286	88:54.5	160.61	85.22	138.8	.7544	111/32		
851	.0101	.4228	88:53.4	159.73	85.34	137.8	.7451	112/32		
856	.0100	.4206	88:51.3	158.53	85.08	136.60	.7177	111/32		

SECRET/H

SECRET/H

Table 5.5-1

BIF-107W-71014-73
Page 239

TRACKING REDUCTION
SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
859	.0098	.4354	88:50.1	157.59	85.13	135.72	.7373	107/31		
863	.0097	.4500	88:48.2	156.56	84.86	134.57	.7394	103/30		
865	.0097	.4472	88:47.3	155.95	84.81	134.10	.7282	103/30		
868	.0095	.4405	88:46.1	155.10	84.85	133.02	.7111	104/30		
873	.0094	.4462	88:44.3	154.01	84.61	132.18	.6995	101/29		
875	.0092	.4484	88:43.1	153.11	84.62	131.35	.6972	100/29		
879	.0092	.4732	88:41.1	151.97	84.35	130.22	.7117	94/27		
881	.0091	.4716	88:40.1	151.35	84.26	129.7	.6991	94/27		
884	.0089	.4736	88:38.8	150.43	84.27	128.7	.6947	93/27		
889	.0087	.4761	88:46.5	148.99	83.93	127.7	.6698	91/26		
892	.0101	.3814	88:53.2	159.78	85.35	137.2	.6704	124/36	OA #27 Rev 890	
895	.0101	.4065	88:51.9	159.06	85.09	136.7	.6977	116/34		
897	.0100	.4128	88:51.1	158.59	84.96	136.1	.6967	114/33		
900	.0099	.4058	88:50.0	157.78	85.08	135.1	.6836	115/33		
905	.0098	.4089	88:48.0	156.52	84.80	133.9	.6675	113/33		
908	.0096	.4183	88:46.8	155.68	84.88	133.0	.6803	110/32		
913	.0095	.4513	88:44.4	154.35	84.56	131.6	.7051	101/29		
916	.0093	.4492	88:43.2	153.46	84.61	130.6	.6967	100/29		

Table 5.5-1

TRACKING REDUCTION
SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
921	.0092	.4471	88:40.9	152.10	84.37	129.4	.6699	100/29		
924	.0090	.4636	88:39.7	151.11	84.40	128.5	.6889	96/28		
927	.0089	.4787	88:38.1	150.25	84.16	127.7	.6919	92/27		
929	.0089	.4856	88:37.1	149.70	84.01	127.1	.6879	90/26		
932	.0088	.4790	88:36.4	149.03	84.07	126.7	.6782	91/26		
937	.0086	.4851	88:33.4	147.19	83.78	125.0	.6558	88/25		
940	.0099	.3740	88:51.7	158.62	85.45	136.2	.6565	126/37	OA #28 Rev 938	
943	.0098	.4147	88:50.4	157.76	85.30	135.6	.7133	113/32		
946	.0098	.4261	88:49.1	156.98	85.16	134.8	.7199	109/32		
949	.0096	.4280	88:47.9	156.15	85.20	133.7	.7173	100/32		
954	.0095	.4491	88:45.7	154.80	84.89	132.7	.7255	102/30		
957	.0093	.4600	88:44.3	153.74	84.97	131.8	.7398	99/29		
960	.0092	.4810	88:42.8	152.93	84.70	130.9	.7345	93/27		
962	.0091	.4699	88:41.8	152.35	84.61	130.4	.7233	95/27		
965	.0090	.4662	88:40.6	151.43	84.65	129.4	.7120	95/27		
970	.0089	.4781	88:38.2	149.97	84.33	128.4	.7016	92/27		
973	.0087	.5068	88:36.7	148.81	84.38	127.5	.7346	86/25		
976	.0086	.5247	88:35.1	147.90	84.08	126.6	.7367	82/23		

~~SECRET/H~~

~~SECRET/H~~

Table 5.5-1

SECRET/H

TRACKING REDUCTION
SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
978	.0085	.5315	88:34.0	147.2	83.93	126.1	.7326	80/23		
981	.0084	.5315	88:32.6	146.19	83.95	125.1	.7221	79/22		
986	.0082	.5462	88:29.9	144.44	83.63	123.9	.7107	76/22		
989	.0102	.4002	88:54.0	160.03	85.45	138.2	.7146	118/34	OA #29 on Rev 987	
992	.0101	.4137	88:52.7	159.23	85.24	137.8	.7234	113/32		
994	.0100	.4049	88:51.8	158.85	85.09	137.2	.6960	115/33		
997	.0099	.3953	88:50.9	158.04	85.22	136.3	.6811	117/33		
1003	.0097	.3949	88:48.6	156.70	84.95	134.8	.6566	117/44		
1005	.0096	.4059	88:47.7	155.98	85.08	134.2	.6765	113/32		
1008	.0095	.4129	88:46.4	155.27	84.87	133.4	.6713	110/31		
1011	.0095	.4121	88:45.2	154.53	84.74	132.6	.6587	110/31		
1014	.0093	.4030	88:44.1	153.76	84.81	131.6	.6397	112/32		
1018	.0092	.4124	88:42.4	152.73	84.61	130.7	.6377	109/32		
1021	.0091	.4242	88:41.3	151.88	84.63	129.9	.7286	105/31		

Table 5.5-1

SECRET/H

BIF-107W-71014-73
Page 242

PREDICTION [illegible]ACY SUMMARY

(BFE - Tracking Reduction Predictions)

Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch	Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch
684	43	.637	.475	765	48	.267	1.293
686	43	.209	.195	767	48	.269	1.059
689	43/44	-.183	-.949	770	48/49	.384	.698
694	44	-.277	-.674	775	49	-.434	-1.584
697	44	-.272	-.555	778	49	-.498	-2.187
700	44	.215	1.046	781	49	-.192	-.356
702	44	.333	1.165	783	49	-.029	.303
705	44/45	.067	.054	786	49/50	.207	2.558
710	45	-.147	-.227	791	50	1.947	5.279
713	45	-.029	.297	794	50	.057	.849
716	45	.108	.652	798	50	.320	1.252
719	45/46	.224	.569	800	50	.429	1.481
722	46	--	-.107	803	50/51	.204	.406
727	46	-.326	-.301	808	51	-.359	-1.691
729	46	-.209	.130	811	51	-.472	-1.921
733	46	.507	1.692	814	51	-.202	-1.107
735	46	.115	.462	816	51	-.268	-1.414
738	46/47	-.009	-.188	819	51/52	-.388	-1.757
743	47	-.215	-.514	824	52	-.435	-.949
746	47	-.038	.087	827	52	.115	.683
749	47	.159	.644	830	52	.077	.526
751	47	.154	.529	832	52	.323	.988
754	47/48	.010	.625	835	52/53	.115	2.146
759	48	.415	.366	840	53	1.894	5.107
762	48	-.734	-2.308	843	53	.208	.997

~~SECRET/H~~

~~SECRET/H~~

PREDICTION [illegible]ACY SUMMARY

(BFE - Tracking Reduction Predictions)

Table 5.5-2

Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch
846	53	.233	.990
848	53	.355	1.270
851	53/54	.707	.921
856	54	-.215	-.428
859	54	-.017	.381
863	54	.319	1.281
865	54	.296	1.076
868	54/55	.148	.358
873	55	-.012	.006
875	55	-.209	-.303
879	55	.160	.932
881	55	.034	.535
884	55/56	.186	.931
889	56	.131	.352
892	56	-.261	-.558
895	56	.151	.671
897	56	.337	1.054
900	56/57	.208	.365
905	57	-.242	-.881
908	57	-.209	-.590
913	57	.257	1.193
916	57/58	.423	.996
921	58	-.269	-.729
924	58	-.018	.304
927	58	.169	1.005
929	58/59	.300	1.213
932	59	.329	1.473
937	59	.336	.319
940	59	-.532	-1.826
943	59	-.083	-.272
946	59	-.003	-.070
949	59/60	-.083	-.644
954	60	-.288	-.494
957	60	-.057	.450
960	60	.367	1.795
962	60	.225	.774
965	60/61	.104	-.106
970	61	.472	-1.311
973	61	-.069	.296
976	61	.202	1.020
978	61	.356	.658
981	61/62	.286	1.328
986	62	.585	2.112
989	62	.050	.868
992	62	.585	2.009
994	62	.437	1.351
997	62/63	.324	.680
1003	63	-.403	-.706
1005	63	.042	.639
1008	63	.286	1.142

~~SECRET/H~~

~~SECRET/H~~

PREDICTION [illegible]ACY SUMMARY

(BFE - Tracking Reduction Predictions)

Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch	Tracking Reduction Epoch Rev	BFE ID NO.	5 Revs After Epoch	10 Revs After Epoch
1011	63	.383	1.073				
1014	63/64	.029	-.173				
1019	64	-.175	-.371				
1021	64	.091	2.851				

SECRET/H

SECRET/H

Table 5.5-2

5.5.1.3 B Factor

Figure 5.5-1 shows a plot of B-factor for this segment of the mission. The B-factors shown are from the individual tracking reductions and from the BFE for comparison. Maneuvers are indicated as to the rev of occurrence.

5.5.1.4 Orbit Adjust Summary

Table 5.5-3 reflects a summary of each orbit adjust during this segment. For each orbit adjust or set of orbit adjusts occurring on the same or adjacent revs, orbital conditions are provided which describe the orbit prior to the first orbit adjust. In addition, the predicted velocity change and orbit resulting from each orbit adjust or set of orbit adjusts is provided and compared with the actual orbit and velocity change obtained. The actual orbit and velocity change was determined from the Best Fit Ephemeris. All orbit adjusts were close to nominal.

Figure 5.5-2 reflects perigee altitude and perigee locations prior to and after each positive Orbit Adjust.

5.5.1.5 Best Fit Ephemeris

Table 5.5-4 shows the orbital conditions for each day of this segment of the mission.

5.5.2 SCF Support

SCF support was generally excellent during this segment of the mission except for three occasions:

1. Power failure at COOK Rev 754/755 prevented load of a command message which resulted in the use of 300 feet of film which was to have been eliminated.
2. A computer failure resulted in the generation and loading of a bad SP message for GUAM Rev 777. The message resulted in SV TTC commanding in violation of hardware constraints and required generation of an emergency add-on message to prevent loss of a COOK contact. The system command checking procedures failed to catch the erroneous commanding.
3. Late determination by SSC that the second CV test at 971B was not required along with confusion between TA/TC/FTFD resulted in the desired VBE of the second CV not being executed and the unnecessary use of 100 feet of color film.

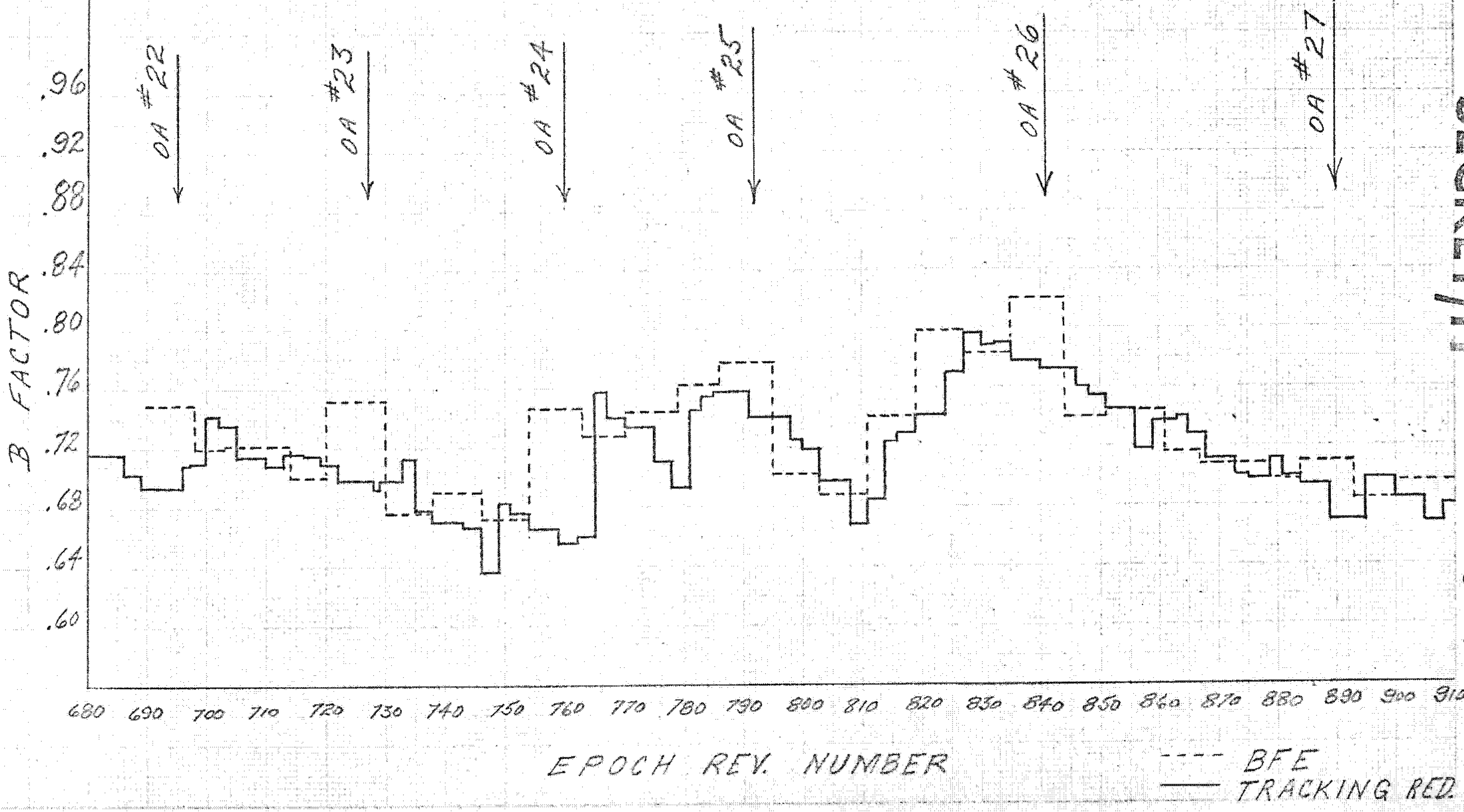

OA #22
OA #23
OA #24
OA #25
OA #26
OA #27
B FACTOR
.96
.92
.88
.84
.80
.76
.72
.68
.64
.60
680
690
700
710
720
730
740
750
760
770
780
790
800
810
820
830
840
850
860
870
880
890
900
910
EPOCH REV. NUMBER
BFE
TRACKING RED.

Figure 5.5-1

~~SECRET/H~~

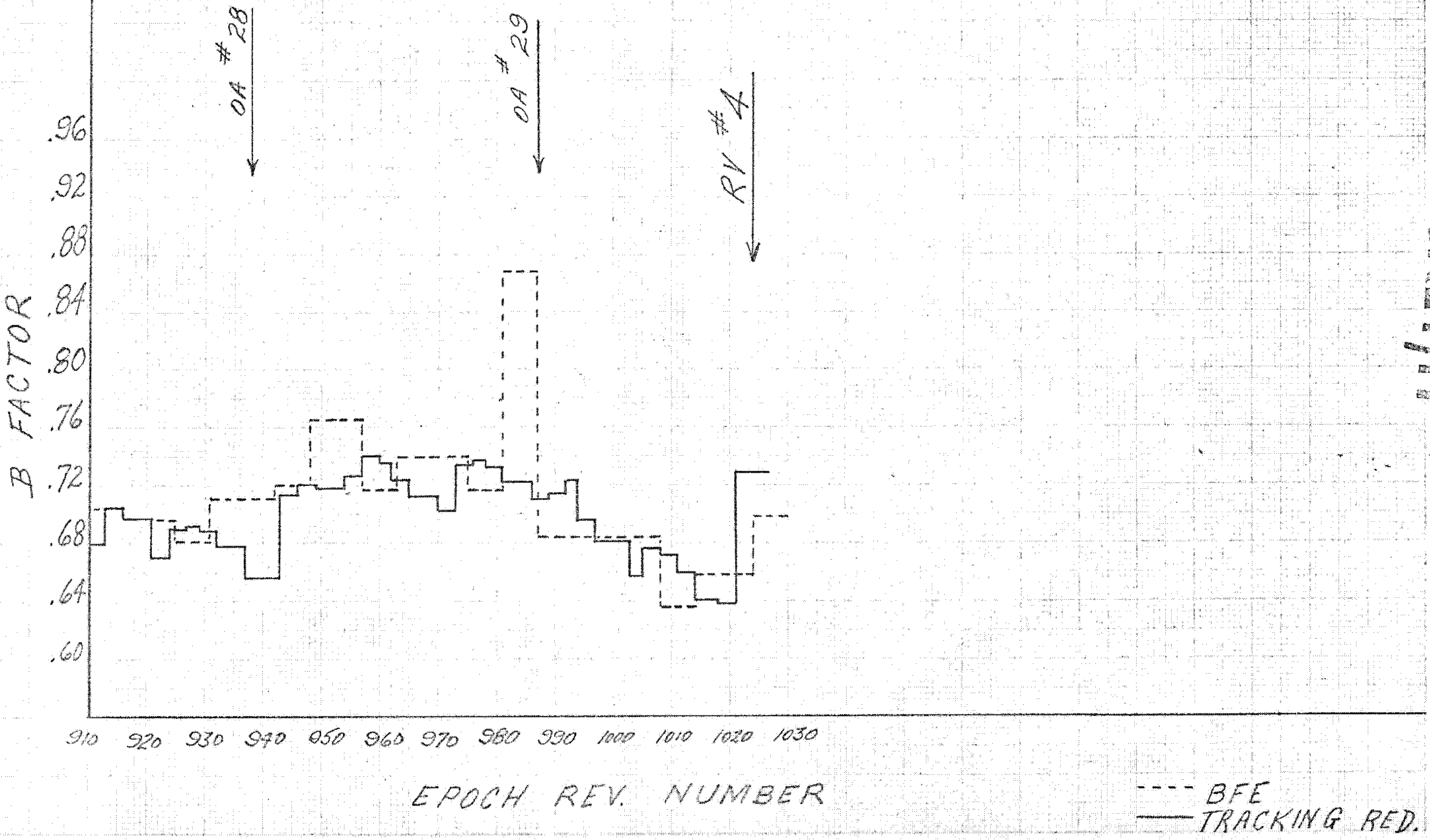


Figure 5.5-1

~~SECRET/H~~

OA No. 22	Rev. No. 695	Period Min:Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur. Sec. XX.X	Delta Velocity XX.XX
Orbit at Rev	694	88:37.4	86.08	148.47	126.134	--	--
Predicted	696	88:49.7	87.00	156.03	133.494	50.3	20.37
Actual	696	88:49.7	86.96	156.07	133.468	50.3	20.76
Delta (A-P)		0	-.04	+.037	-.028	0	+.39
OA No. 23	Rev. No. 727						
Orbit at Rev	726	88:35.6	86.07	147.12	125.420	--	--
Predicted	728	88:50.7	87.03	156.53	134.550	60.6	24.51
Actual	728	88:50.7	87.10	156.44	134.571	60.6	25.06
Delta (A-P)		0	+.07	-.09	+.021	0	+.54
OA No. 24	Rev. No. 760						
Orbit at Rev	759	88:37.4	86.43	147.94	126.534	--	--
Predicted	761	88:48.8	87.09	155.29	133.065	48.0	19.24
Actual	761	88:48.8	87.14	155.38	133.185	48.0	19.61
Delta (A-P)		0	+.05	+.09	+.120	0	+.37
OA No. 25	Rev. No. 792						
Orbit at Rev	791	88:34.5	86.27	146.03	125.063	--	--
Predicted	793	88:50.6	87.02	156.53	134.425	66.8	26.88
Actual	793	88:51.2	87.11	156.83	134.746	66.8	27.68
Delta (A-P)		+.6	+.09	+.30	+.321	0	+.80

Table 5.5-3

SECRET/H

Table 5.5-3

		Period Min:Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur. Sec. XX.X	Delta Velocity XX.XX
OA No. 26	Rev. No. 841						
Orbit at Rev	840	88:27.5	85.50	141.36	122.264	--	--
Predicted	842	88:56.7	87.06	160.11	139.903	117.2	46.92
Actual	842	88:57.2	87.08	160.49	140.156	117.2	48.64
Delta (A-P)		+5	+.02	+.38	+.253	0	+1.72
OA No. 27	Rev. No. 890						
Orbit at Rev	889	88:36.5	85.96	147.19	127.679	--	--
Predicted	891	88:53.6	86.86	158.43	137.307	70.0	27.72
Actual	891	88:53.7	86.97	158.35	137.421	70.0	28:51
Delta (A-P)		+1	+.11	-.08	+.114	0	.79
OA No. 28	Rev. No. 938						
Orbit at Rev	937	88:33.4	85.86	145.45	125.038	--	--
Predicted	939	88:52.0	86.99	157.18	136.344	76.0	30.09
Actual	939	88:52.2	87.07	157.19	136.458	76.0	30.09
Delta (A-P)		+.2	+.08	+.01	+.114	0	0
OA No. 29	Rev. No. 987						
Orbit at Rev	986	88:29.9	85.78	142.68	123.918	--	--
Predicted	988	88:54.3	86.97	158.52	138.397	99.4	39.35
Actual	988	88:54.5	87.01	158.66	138.489	99.4	40.38
Delta (A-P)		+.2	+.04	+.14	+.092	0	+1.03

SECRET/H

~~SECRET/H~~

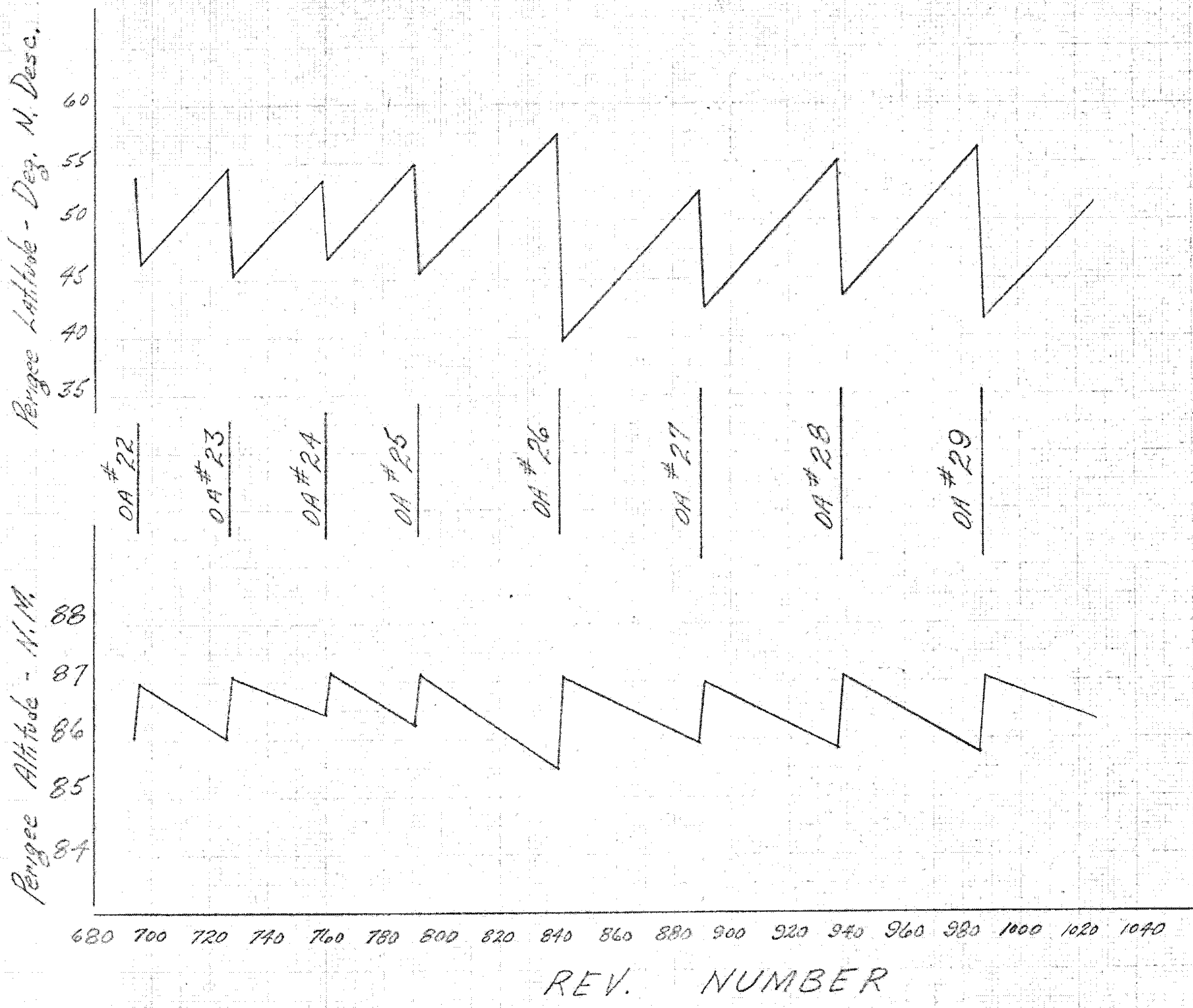


Figure 5.5-2

SECRET/H

~~SECRET/H~~

BEST FIT EPHEMERIS SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
44	690	.0091	95.65	88:39.5	151.4	84.40	126.9	.7496	695 - 698
								.7199	698 - 703
								.7050	703 -
45	706	.0095	95.64	88:45.2	154.86	84.95	130.7	.7220	706 - 714
								.7009	714 - 720
								.6930	720 -
46	723	.0088	95.64	88:37.2	149.51	84.48	126.2	.7527	723 - 730
								.6761	730 - 738
								.6671	738 -
47	739	.0095	95.64	88:46.1	155.04	85.31	131.7	.6902	739 - 746
								.6717	746 - 754
								.6617	754 -

Table 5.5-4

~~SECRET/H~~

BEST FIT EPHEMERIS
SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
48	755	.0089	95.64	88:39.3	150.62	84.92	127.3	.7465	755 - 763
								.7275	762 - 770
								.7041	770 -
49	771	.0093	95.64	88:44.6	154.15	85.21	130.3	.7441	771 - 779
								.7616	779 - 786
								.7289	786 -
50	788	.0086	95.63	88:36.2	148.56	84.59	125.9	.7768	788 - 795
								.7023	795 - 803
								.6727	803 -
51	804	.0095	95.63	88:46.5	155.44	85.18	131.9	.6879	804 - 811
								.7413	811 - 819
								.7874	819 -

~~SECRET/H~~

Table 5.5-4

~~SECRET/H~~

BEST FIT EPHEMERIS
SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
52	820	.0089	95.63	88:39.0	150.50	84.67	127.7	.7979	819 - 827
								.7814	827 - 835
								.7770	835 -
53	836	.0082	95.63	88:30.1	144.56	83.83	123.1	.8205	836 - 844
								.7397	844 - 851
								.7090	851 -
54	853	.0100	95.63	88:52.6	159.11	85.40	137.3	.7440	853 - 861
								.7159	861 - 867
								.6977	867 -
55	869	.0095	95.62	88:45.7	154.66	84.92	132.9	.7087	869 - 878
								.6976	878 - 884
								.6726	884 -

~~SECRET/H~~

Table 5.5-4

~~SECRET/H~~

BEST FIT EPHEMERIS SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
56	885	.0088	95.62	88:38.4	149.86	84.45	128.6	.7102	885 - 893
								.6836	893 - 900
								.6691	900 -
57	901	.0098	95.62	88:49.6	157.33	85.29	134.7	.6967	901 - 910
								.7041	910 - 916
								.6630	916 -
58	918	.0092	95.62	88:42.3	152.76	84.72	129.9	.6966	918 - 925
								.6813	925 - 931
								.6542	931 -
59	934	.0086	95.62	88:34.9	147.86	84.20	125.8	.7115	934 - 942
								.7191	942 - 948
								.7246	948 -

~~SECRET/H~~

Table 5.5-4

~~SECRET/H~~

BIF -107W-71014-73
Page 255

~~SECRET/H~~

BEST FIT EPHEMERIS SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
60	950	.0095	95.61	88:47.5	155.67	85.33	133.6	.7644	950 - 957
								.7174	957 - 963
								.7061	963 -
61	966	.0089	95.61	88:40.2	150.97	84.77	129.2	.7402	966 - 975
								.7159	975 - 981
								.7129	981 -
62	983	.0082	95.61	88:31.6	145.22	84.16	124.6	.8681	983 - 987
								.6846	987 - 996
								.6627	996 -
63	999	.0098	95.61	88:50.1	157.44	85.31	135.7	.6842	999 - 1008
								.6361	1008 - 1014
								.6390	1014 -

Table 5.5-4

~~SECRET/H~~

~~SECRET/H~~

BEST FIT EPHEMERIS SUMMARY

DAY	EPOCH REV	ECCENT.	INCL.	INTEG. PERIOD	MAX. ALTITUDE	MIN. ALTITUDE	ARG. PERIGEE	DRAG	REV. SPAN
XX	XXX	.XXXX	XX.XX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX - XXX
64	1015	.0093	95.61	88:43.7	153.31	84.96	131.4	.6582	1015 - 1024
								1.0705	1024
								.6979	1024 - 1030
								.7107	1030 -

Table 5.5-4

~~SECRET/H~~

5.6 PROGRAM COMMAND SOFTWARE PERFORMANCE (HTC)

5.6.1 Command Message Summary

This section summarizes pertinent command message data from Mission 1205, IRON 8410. The command messages discussed cover the period from the first RV 4 message (Rev. 694 load) to the RV 4 recovery message (Rev. 1022 load).

Two hundred fifty-four command messages were received by the Technical Advisor (TA) Staff. Two hundred forty-eight were accepted and six were rejected. The rejected messages were subsequently altered or regenerated and loaded into the vehicle. The reasons for regeneration of the six messages are summarized below.

Rev. No. & Load Station	Reason for Rejection
697 POGO	The Rev 698 COOK station contact required widening and station capability 7, which was overlooked during the message generation.
713 POGO	This message was rejected due to a tape recorder constraint violation.
752 BOSS	The requirements for a MOP were changed after the message was generated.
842 POGO	The BC card for Doppler Beacon selection was omitted from the message generation deck.
864 POGO	Two manually input O^2A^2 commands had incorrect time tags.
1002 GUAM	The Vy bias caused incorrect values to be computed for ascending photography.

Two hundred forty-five messages were loaded and nine were not loaded for the reasons stated below:

1. The six rejected messages were not loaded.
2. Two messages were not loaded at COOK on Revs. 754 and 755 because the station was down.
3. One contingency VBE message was not loaded.

A one rev load cycle was employed while the vehicle was over the area of interest. The add-on message generation and loading philosophy was in effect. This resulted in the generation of two hundred twelve add-on messages.

5.6.2 'TUNITY Software Problems

The Flight 5 'TUNITY software problems itemized below pertain only to the period for RV 5 recovery through RV 4 recovery. They have been grouped into the following categories to demonstrate their impact on the flight. The disposition of these software problems will be specified by the Configuration Control Board. SPR MBR-5144 is not in this list because it is written against 'SPTTP, a non-'TUNITY program.

Category	No. of SPR's	Comments
Flight Critical	1 (5145)	Software corrections were made and incorporated during this flight period.
Non-Flight Critical (Requiring Work-Around)	1	Work-around procedures were developed and implemented.
Non-Flight Critical (Minor)	4	Work-around procedures were not required.
Product Improvement or New Requirements	3	To be considered during future development.
Documentation Error	2	MS 7 or 4 affected.

Itemized Software Problems

SPR MBR-5134 ('TCATCHM)

- Problem Description: In the 'TBALL listing of DEA's that are a part of an operation, the first DEA is a single exposure (no overlap), the second DEA is a double exposure, and all the rest are triple overlap DEA's. The two DEA's at the end of the op (which are double and single exposure) are not displayed. This lack of consistency has led to confusion. Either these last two DEA's should be listed, or (preferably) only triple overlap DEA's should be displayed.
- Solution or Work-Around: None.
- Operational Impact: None.
- Comment: This SPR should be considered as a product improvement item for a future software delivery.

SPR MBR-5135 ('TREPLAY)

- Problem Description: The header for the list of deleted and modified operations in the 'TBALL summary prints on the SO but not on the printer.
- Solution or Work-Around: The output is available on the SO tape which is listed with each generation.
- Operational Impact: None.

SPR MBR-5136 ('TFIELD)

- Problem Description: An erroneous Lat-on and Lat-off was displayed in the "Summary Output for deleted and/or modified Operations." Message 800 - Rev. 781. This occurs only when an unsuccessful attempt is made to trim an operation, which is subsequently deleted.
- Solution or Work-Around: None.
- Operational Impact: There is no operational impact because it is an output problem only.
- Comment: This SPR should be considered as a product improvement item for a future software delivery.

SPR MBR-5137 ('TFIELD)

- Problem Description: An attempt was made to input two VIP MOPS and one VIG MOP on Rev. 801 of message 190. This resulted in erroneous commands for the first MOP, due to a calculated DT for sequence 120 of 0. seconds.
- Solution or Work-Around: The work-around was to delete one of the VIP MOPS and change the other one to a VIG and regenerate the message.
- Operational Impact: The message had to be regenerated with the work-around procedure to delete the erroneous commands.
- Comment: It is a software problem; the solution is known and should be fixed at the first opportunity not involving a flight.

SPR MBR-5138 ('TFIELD)

- Problem Description: In the MS-4 the duration "value" for 'COPSEQ (Seq. 120) is incorrect. Duration value is given by 'TLICDR, not 'TLIODR.
- Solution or Work-Around: None.
- Operational Impact: None.
- Comment: The MS-4 should be changed according to the above recommendation.

SPR MBR-5139 ('TFUNOPT)

- Problem Description: When a big series of records are needed (such as GDI/GDF which occur every Sunday) 'TFUNOPT's table TFCOMFT overflows due to the large number of FID's. This causes two problems: (1) the size of a message is 'TFUNOPT limited - not PMU limited; (2) when problems occur prior to 'TFUNOPT, i.e., 'TBALL, the timeline is unnecessarily jeoparidzed by having to restructure the message deck and rerun.
- Solution or Work-Around: When the table overflows, the time must be checked carefully. If the time is later than the last command in the current message command list (TCL), the overflow can be ignored. If the time of the overflow is in the 'TCL, then the message must be shortened and regenerated.

- Operational Impact: When this happens, the message has to be regenerated causing a pertibation in the computer usage timeline.

- Comment: This SPR should be considered as a product improvement item for a future software delivery because to increase table size requires a restructuring of core loads.

SPR MBR-5140 ('TWORT)

- Problem Description: MACRO 32 was requested with a DT of 117.4 seconds. Sequence 32, which is defined to have the same DT as the MACRO was assigned a DT of 117.2 seconds by 'TWORT.

- Solution or Work-Around: A sequence card should be used in place of the MACRO.

- Operational Impact: None.

- Comment: It is a software problem; the solution is known and should be fixed at the first opportunity not involving a flight.

SPR MBR-5141 ('TFIELD)

- Problem Description: In message 640 (Rev 853K) 'TFIELD calculated values for Vy/h greater than allowed by 'TSTEP. There were 4 MOPs scheduled for this message and for the first two Vy/h was displayed correctly. MOP #3 was displayed to be at a max. value (0.00336) while it should have been displayed at (0.0025). Data Base flag 'CSCMIP was set at (-0.00116), during this load, to compensate for a yaw angle error. This is the reason 'TBALL is displaying improper values for the third MOP.

- Solution or Work-Around: If the true calculated value is needed then 'CSCMIP must be set to its original value and 'TSEL rerun over the same rev span.

- Operational Impact: There is no operational impact because even though an erroneous value is printed out in 'TREPLAY, the proper commands are being assembled.

SPR MBR-5142 ('TEMPER)

- Problem Description: 'TEMPER was thought to be displaying improper film speeds online as well as on the transfer tape.

- Solution or Work-Around: None.

- Operational Impact: None.

- Comment: The film speed output by MPR is platen film speed and is the correct value. The platen speed was being compared with the commanded Vs which is the film supply and is expected to be different.

SPR MBR-5143 ('TFIELD)

- Problem Description: A study run was made with two VIP MOP's which conflicted. With the 'COPCFL set to trim the first operation, the following erroneous data was printed out:

  (1) "off-lon" and "off-lat" values were in error

  (2) VER requests are incorrect.

- Solution or Work-Around: None.

- Operational Impact: There was no operational impact because this run was a study run and was not to be loaded in the vehicle.

- Comment: This was not a legitimate run because OP 1 end time had to be moved until it was earlier than the start time. Either more care must be used in preparing the MOP cards or the data base should have been set up to delete the first OP rather than trim it.

SPR MBR-5145 ('THISUM) - FLIGHT CRITICAL -

- Problem Description: MPR(72-87) aborted attempting to read record 1 of the 'TGX data block because 'THISUM did not write record 1 of the 'TGX.

- Solution or Work-Around: The problem was determined to be flight critical. A change was made to 'THISUM correcting the problem and a binary delivered to the SWFTFD.

- Operational Impact: The MPR run was delayed until the fix was made. MPR was then run with no problems.

5.6.3 Hardware/Software Interface Changes

For IRON 8410, ten change requests were processed from the RV 5 recovery message through the RV 4 recovery message (as shown in Table 5.6.3-1).

These changes were implemented via requests SV5-308 through SV5-317 and have been incorporated in the nominal data base and hardware/software interface documentation.

Table 5.6.3-1. Summary of Hardware/Software Interface Changes

Request No.	Identification	Effectivity	
SV5-308	Deletes pad load sequence 12 thru 17, 20 thru 25, and 250 thru 255 to provide space in the 'TSCTAB for SOLO sequences.	SV-5 only	
SV5-309	Modification to sequence 160 to set Doppler Beacon FIDS (276 thru 279) from status.	SV-5 and nominal data base	
SV5-310	Adds four new check messages to the 'TCTTAB to flag when the XDR is commanded off during a station contact.	SV-5 and nominal data base	
SV5-311	Modifies sequence 269 by deleting [redacted] off commands. This is a SOLO experiment.	SV-5 only	(b)(1) (b)(3)
SV5-312	Modification to sequence 144 because of change in film type.	SV-5 only	
SV5-313	This is new sequence no. 439 identified as TAKEUP SELECT WITH I+.	SV-5 only	
SV5-314	Modifies sequence 269 by changing the time label of the [redacted] on command. This is a SOLO experiment.	SV-5 only	(b)(1) (b)(3)
SV5-315	Modification of sequence 133 to disable ESD protection. The purpose is to insure utilization of total film supply.	SV-5 only	
SV5-316	Modification of sequence 256 to permit [redacted] reset for extended [redacted] on time. This is required for a SOLO test.	SV-5 only	(b)(1) (b)(3)
SV5-317	This is new sequence 456 identified as FERROTIC GYRO STOP/START SOLO TEST.	SV-5 only	

5.7 SATELLITE VEHICLE AND AUXILIARY PAYLOAD PERFORMANCE (SBAC)

5.7.1 EDAP Performance

EDAP operations through RV 4 continued normal in all aspects. Main Battery voltages at sun entrance were 28.1 to 29.6. Battery load sharing has been approximately 25% for each battery throughout this flight. Battery temperatures remained between 43° and 50°F. Solar Array output degraded to approximately 92% of Day 1 output.

Pyro batteries stabilized at the beginning of this period and the no-load voltage remained between 28.0 and 28.2 volts throughout this segment. The Lifeboat Battery no load voltage was 28.7 volts throughout this segment.

5.7.2 TT & C Performance

SGLS 1 and PCM 1A were used exclusively during Segment 4 and performed nominally throughout the segment. TR 1 was used for all revs except 677, 942 and 1007, where operational conditions necessitated the use of TR 2 to retrieve data in an orderly manner. Both tape recorders operated nominally. A real time fast forward was required on Rev 1008 at POGO and KODI to insure proper data retrieval and operated in a nominal fashion.

5.7.3 ACS/RCS Performance

The Redundant Attitude Control System (RACS) was used for vehicle control throughout the segment four (4) period. The Primary System (PACS) remained on and was monitored, but not employed during this segments activities.

The pitch bias in the PACS continued to reflect a very noisy output of varying magnitude. The RACS yaw bias first exhibited during Segment 3 remained intermittent and variable, staying within compensating tolerance as shown in Table 5.7-1.

The primary thrusters (RCS 1) continued to control the SV through the successful completion of the mission and Events 4 and 5. Pitch and yaw maneuvers were performed with resultant data showing nominal thruster performance.

Propellant usage for SV attitude control averaged five pounds per day. Figure 5.7-1 shows the average daily REM baseplate temperatures through Segment 4.

5.7.4 Orbit Adjust System (OAS) Performance

The OAS functioned normally throughout Segment 4. The system was used ten times for positive burns (OA's 22 through 31) consuming 514.2 pounds of propellant. At the end of this report period, the cumulative total propellant usage for OAs was 1606.6 pounds which is 236.0 pounds less than the pre-flight prediction due to fewer orbit adjusts than predicted. The total usage for OAs was also 63.5 pounds less than the prediction from the updated study run on Day 24. No negative burns were performed during the report period. Table 5.7-2 presents the orbit adjust performance summary during this segment and includes a dual positive burn executed just after RV-4 recovery.

The bed resistance factor for the OA engine approached the lower allowable limit during OA 24 and was below the limit for the remaining OAs of this report period. The lower limit is based on attainment of all engine design parameters for a continuous 1200 second duration deboost burn. The lower limit boundary did not affect engine performance for burn durations required for orbit adjusts during the segment. Fig.5.7-2 shows the OAS bed resistance factor through OA 31.

Rev	SSC Ops No.	Avg Yaw Attitude (deg)	P/L Yaw Comp (deg)	Rev	SSC Ops No.	Avg Yaw Attitude (deg)	P/L Yaw Comp (deg)
654	433	-0.5	-0.5	724	475	-0.8	0
655	434	-0.5	-0.5	729	476	-1.2	-0.6
655	435	-0.3	-0.5	732	477	-1.0	-0.6
655	436	-0.7	-0.5	738	478	-1.1	-0.6
657	437	-0.2	-0.5	738	479	-1.1	-0.6
658	438	-0.5	-0.5	738	480	-1.1	-0.6
659	439	-0.2	-0.5	739	481	-1.1	-0.6
662	440	-0.2	-0.5	739	482	-1.1	-0.6
667	441	-0.5	-0.5	739	483	-1.1	-0.6
669	442	-0.5	-0.5	739	484	-1.1	-0.6
670	443	0	-0.5	740	485	-0.8	-0.6
671	444	-0.3	-0.5	746	486	-0.7	0
671	445	-0.2	-0.5	752	487	-0.5	-0.5
671	446	-0.2	-0.5	752	488	-0.5	-0.5
671	446	-0.2	-0.5	752	489	-0.5	-0.5
672	447	-0.2	-0.5	754	490	-0.5	-0.5
672	448	-0.2	-0.5	755	491	-0.6	-0.5
674	449	-0.5	-0.5	755	492	-0.6	-0.5
674	450	-0.3	-0.5	756	493	-0.3	-0.5
675	451	-0.2	-0.5	765	494	-0.5	-0.5
677	452	-0.2	-0.5	768	495	-0.6	-0.5
686	453	-0.5	-0.5	769	496	-0.6	-0.5
689	454	-0.2	-0.5	769	497	-0.6	-0.5
690	455	-0.2	-0.5	771	498	-0.6	-0.5
691	457	0	-0.5	771	499	-0.6	-0.5
696	458	-1.9	-0.5	772	500	-0.2	-0.5
697	459	-1.7	-0.5	781	501	-0.8	-0.5
699	460	-1.3	-0.5	783	502	-0.5	-0.5
700	461	-1.7	-0.5	784	503	-0.7	-0.5
706	462	-0.5	-1.0	784	504	-0.7	-0.5
707	463	-0.5	-1.0	785	505	0	-0.5
707	464	-0.2	-1.0	785	506	0	-0.5
713	465	0	-0.6	787	507	0	-0.5
714	466	0	-0.6	787	508	0	-0.5
716	467	0	-0.6	787	509	0	-0.5
719	468	-0.2	0	788	510	0	-0.5
720	469	-0.2	0	788	511	0	-0.5
721	470	-0.2	0	788	512	0	-0.5
722	471	-0.5	0	791	513	-0.3	-0.5
723	472	-0.5	0	794	514	0	-0.5
723	473	-0.5	0	794	515	0	-0.5
724	474	-0.7	0	795	516	-0.4	-0.5

Table 5.7-1

~~SECRET/H~~

Rev	SSC Ops No.	Avg Yaw Attitude (deg)	P/L Yaw Comp (deg)	Rev	SSC Ops No.	Avg Yaw Attitude (deg)	P/L Yaw Comp (deg)
800	517	0	-0.5	854	562	-2.9	-1.4
801	518	-0.1	0	860	563		-2.5
801	519	-0.1	0	865	564	-2.0	-1.4
802	520	0	0	865	565	-2.0	-1.4
802	521	0	0	866	566	-1.2	-1.4
802	522	0	0	866	567	-1.2	-1.4
803	523	0	0	866	568	-1.2	-1.4
803	524	0	0	867	569	-1.2	-1.4
803	525	0	0	868	570	-0.8	-1.4
804	526	0	0	868	571	-0.8	-1.4
805	527		0	869	572	-1.9	-1.4
810	528	-0.2	0	869	573	-1.9	-1.4
810	529	-0.2	0	869	574	-1.9	-1.4
815	530		0	869	575	-1.9	-1.4
817	531	-0.8	0	870	576	-2.1	-1.4
817	532	-0.8	0	876	575		-1.4
817	533	-0.8	0	884	578	-1.9	-1.4
817	534	-0.8	0	884	579	-1.9	-1.4
817	535	-0.8	0	884	580	-1.9	-1.4
818	536	-0.8	0	884	581	-1.9	-1.4
818	537	-0.8	0	885	582	-0.9	-1.4
819	538	-0.5	0	886	583	-0.9	-1.4
819	539	-0.5	0	891	584	-0.5	-1.4
820	540	-0.8	0	902	585	-0.5	-1.4
820	541	-0.8	0	902	586	-0.5	-1.4
820	542	-0.8	0	902	587	-0.5	-1.4
821	543	-1.1	0	901	588	-0.6	-1.4
821	544	-1.1	0	902	589	-0.2	-1.4
821	545	-1.1	0	907	590	-0.3	-1.4
821	546	-1.1	0	908	591		-1.4
834	547	-1.2	-0.5	915	592	-1.0	-0.6
835	548	-1.7	-0.6	915	593	-1.0	-0.6
836	549	-1.2	-0.6	918	594		-0.6
836	550	-1.2	-0.6	918	595		-0.6
837	551	-1.3	-0.6	918	596		-0.6
837	552	-1.3	-0.6	923	597	-0.8	-0.6
844	553	-1.6	-0.6	930	598	-1.2	-0.6
850	554	-2.9	-1.0	934	599	-1.1	-0.6
851	555	-2.8	-1.4	934	600	-1.1	-0.6
851	556	-2.8	-1.4	941	601	-1.4	-0.6
852	557	-2.8	-1.4	947	602	-0.6	-0.6
853	558	-2.9	-1.4	947	603	-0.6	-0.6
853	559	-2.9	-1.4	947	604	-0.6	-0.6
853	560	-2.9	-1.4	948	605	-0.5	-0.6
853	561	-2.9	-1.4	949	606	-0.5	-0.6

Table 5.7-1 (Cont'd)

~~SECRET/H~~

Rev	SSC Ops No.	Avg Yaw Attitude (deg)	P/L Yaw Comp (deg)
950	607		-0.6
957	608	-0.5	-0.6
963	609	-0.3	-0.6
963	610	-0.3	-0.6
963	611	-0.3	-0.6
964	612	-0.3	-0.6
964	613	-0.3	-0.6
964	614	-0.3	-0.6
965	615	-0.3	-0.6
965	616	-0.3	-0.6
965	617	-0.3	-0.6
	618		-0.6
	619		-0.6
	620		-0.6
979	621	-1.6	-0.6
979	622	-1.6	-0.6
980	623	-2.0	-0.6
989	624	-1.8	-0.6
995	625	-0.6	-0.6
996	626	-0.6	-0.6
998	627	-0.6	-0.6
999	628	-0.3	-0.6
999	629	-0.3	-0.6
1000	630	-0.8	-0.6
1003	631	-0.5	-0.6
1006	632	-1.1	-0.6
1011	633	-0.6	-0.6
1012	634	-0.8	-0.6
1014	635	-0.8	-0.6
1014	636	-0.8	-0.6
1015	637	-0.8	-0.6
1016	638	-1.1	-0.6

Table 5.7-1 (Cont'd)

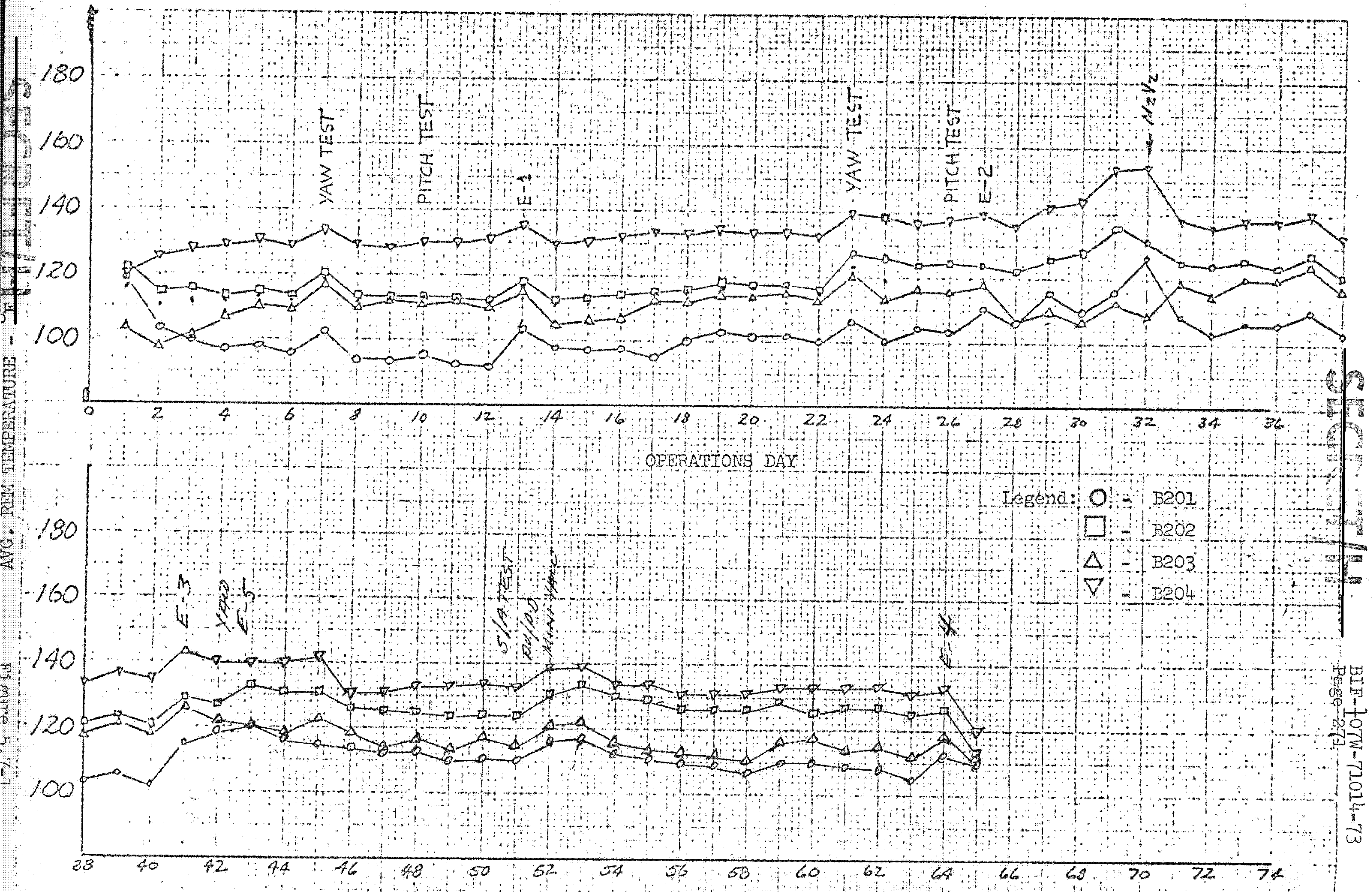

AVG. REM TEMPERATURE - °F
180
160
140
120
100
YAW TEST
PITCH TEST
E-1
YAW TEST
PITCH TEST
E-2
M2V2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
OPERATIONS DAY
Legend: ○ - B201
□ - B202
△ - B203
▽ - B204
180
160
140
120
100
E-3
YAW
E-5
S/A TEST
PV/PD
MINI YAW
E-4
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74

Figure 5.7-1

~~SECRET/H~~

ORBIT ADJUST SUMMARY

OA Number	22+	23+	24+	25+	26+	27+	28+	29+	30+	31+
Operations Day	43	45	47	49	52	55	58	61	64	64
Rev	695	727	760	792	841	890	938	987	1027	1027
Delta V										
Predict (fps)	20.7433	25.0710	19.2592	26.8130	47.7848	28.3920	30.6695	39.9911	18.1479	18.1911
CAS (fps)	20.7567	25.0649	19.6122	27.6795	48.6404	28.5088	30.8831	40.3836	---	18.4915
Burn Duration (sec)	50.2	60.6	48.0	66.8	117.2	70.0	76.0	99.4	41.8	42.0
Propellant Used (lb)	40.2	48.2	37.7	51.0	90.0	53.2	57.1	75.41	30.7	30.7
Avg Tank Temp (°F)	80.6	80.3	80.3	81.0	81.0	80.3	80.7	80.3	80.3	80.3
Avg Tank Press (psia)	171.5	168.0	165.0	164.0	161.0	154.0	150.5	147.5	144.0	142.5

~~SECRET/H~~

Table 5.7-2

~~SECRET/H~~

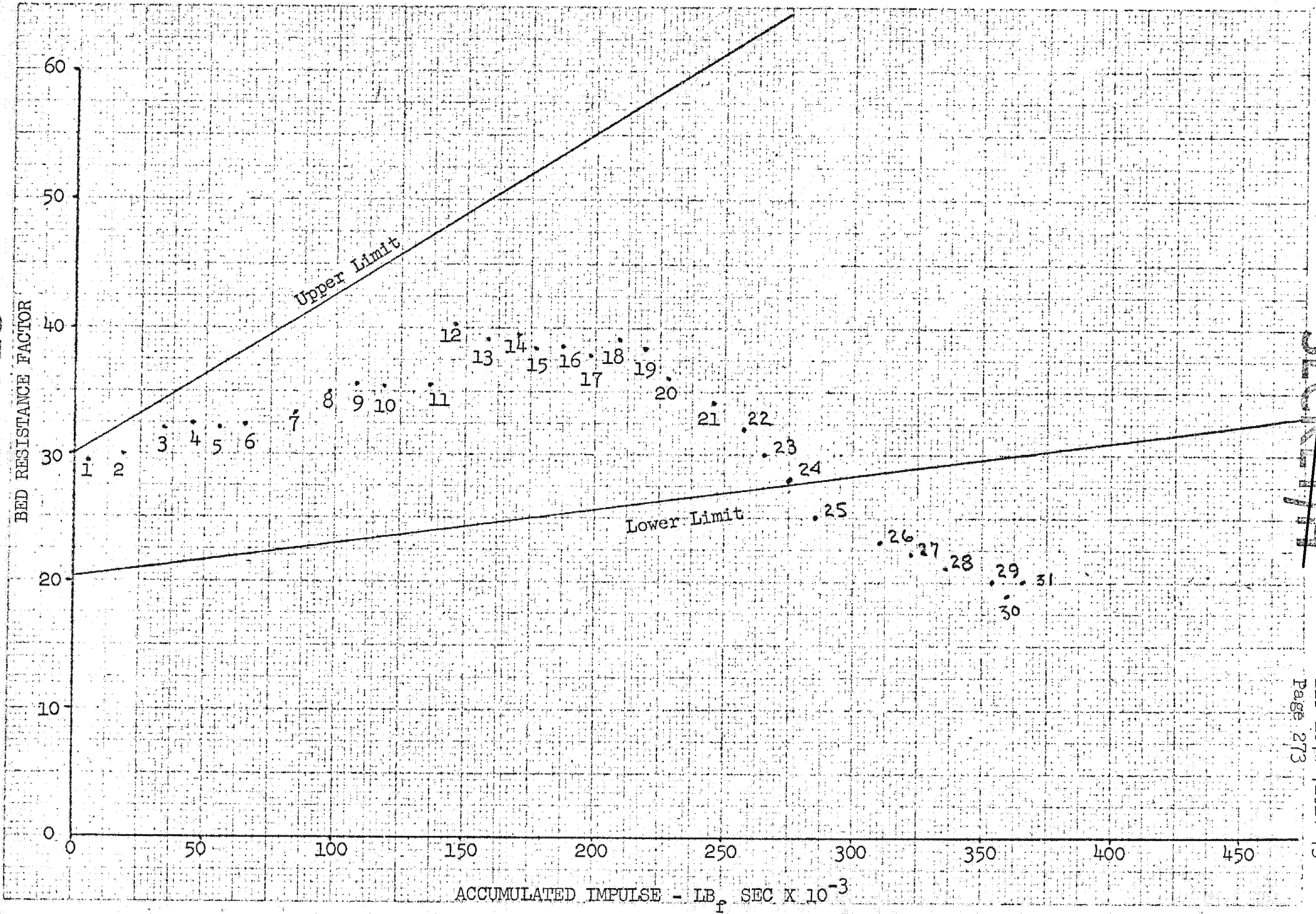


Figure 5.7-2

~~SECRET/H~~

5.7.5 Lifeboat II Performance

The Lifeboat System functioned normally throughout Segment 4. Weekly attitude correlation checks at 72°N and 10° S latitudes descending were made on Revs 726, 839, and 953.

The Lifeboat electronics were also enabled during recovery maneuvers for RV 4.

The Lifeboat Tank Heater thermostatic control was cycled on/off six times (5 to 6 revs on, 53 to 63 revs off) to maintain the average tank temperature between 100°F and 112°F. Pre Event 4 Lifeboat Tank average temperature was 115°F and impulse capability was 3625 lb/second. At the end of the report period (Day 64), the Lifeboat Battery capacity was 106 amp-hours, compared with a requirement of 28.9 amp-hours for 4 days, one recovery and deboost.

5.7.6 Doppler Beacon System

The Doppler Beacon System continued to function normally throughout the segment.

5.7.7 Tertiary Payloads

[redacted] and B-3 have performed nominally from Revs 648 through (b)(1)
1024. (b)(3)

SOLO Experiment [redacted] was successfully performed on Revs 937, (b)(1)
953 and 691. (b)(3)

SOLO Experiment [redacted] was performed on Rev 1004. (b)(1)
(b)(3)

SECTION 6

6.0 SOLO AND DEBOOST THROUGH REV 1139

6.1 Solo Summary

Solo experiments started after RV-3 recovery for those tests that were non-interference with the HEXAGON mission.

After RV-4 recovery on Rev 1024, the more complex Solo tests involving SV maneuvers and panoramic camera redundant systems was started.

The majority of the Solo objectives were completed with the only major failure being the loss of SGLS 2 downlink when commanded "ON" on Rev 1027. Signal strength was approximately 30 db lower than SGLS 1 and from SGLS 2 when tested on Revs 9 and 18 during Day 1 redundant system health tests. The SV became unstable while recovering from the Pitch Down of the LB execute test. The tumbling capture sequence was loaded at the next contact and attitude control was regained.

The Solo phase continued until Rev 1139 where the SV was deboosted into the SHEMYA/Aris ship station acquisition cones as part of the VAST-2 exercise. SV telemetry and radar acquisition on vehicle debris was obtained.

6.1.1 Solo Chronology of Events

Rev/Sta	Event	Reference	
744-843	ST-1 Test all normal ST modes of operation not used during mission	6.8.1	
746-795	ST-2 Thermal effects on terrain lens extended to door open attempts	6.8.2	
748-797	OPS-2(n) & (o) Doppler Beacon redundant systems test	6.7.8.8	
762-778	OPS-2(p) - (t) ST redundant systems test	6.8.7	
824-830	ACS-3 Obtain REM pulse count as a function of S/A position	6.7.3	
868-917	[redacted] Calibrates with site CARDINAL	--	(b)(1) (b)(3)
937-961	[redacted] Calibrate over South America Anomaly	--	(b)(1) (b)(3)

Rev/Sta	Event	Reference	
941-973	OPS-4 INDI Rev 0.9 commanding	6.7.8	
990-1007	OPS-2(1) Redundant TCEA performance	6.4.2	
1004	[redacted] Calibration	--	(b)(1) (b)(3)
1006	ACS-5 Horizon Sensor and Magnetic Field Mapping	6.7.5	
1024	RV-4 RECOVERY		
1028-1092	ACS-4(a) Ferrotic Gyro Start/Stop Test, 8 cycles per Rev	6.7.4	
1030	SS-1 SS Takeup Select signature test	6.3.1	
1030	SS-2 Instrumentation Power Supply "ON"	6.3.2	
1030	SS-3 Negative Constant Velocity Test	6.3.3	
1027-1030	OPS-2(a) - (c) SGLS-2/PCM Test	6.7.8.1	
1027	OAS-1(b) OAS hot restart	6.7.6	
1038-1089	OPS-5 RTS Software Tests	--	
1041-1083	ST-4 Stellar Shutter Inhibit	6.8.4	
1041-1043	ACS-6 Obtain REM pulse count with one S/A displaced	--	
1056	OPS-3 Commanding at KODI with SV pitched down	6.4.1	
1060-1092	ACS-2 Horixon Sensor inhibit under temperature cycling	6.7.2	
1062-1083	THERM-1 Fly Reverse to test SV thermal characteristic under +8^{o} Beta Angle	6.7.7	
1062-1136	ACS-4(b) Ferrotic Gyro Start/Stop Test on 4 Rev cycle	6.7.4	
1063-1068	SS-4 SS Pneumatics depletion	6.3.4	
1077	[redacted] Calibration	--	(b)(1) (b)(3)
1085	OPS-2(d) Backup Timer Test	6.7.8.3	

Rev/Sta	Event	Reference
1089	OPS-2(g) MCS operate test	6.2.1.2
1095-1097	OPS-2(h) - (k) Redundant heater performance test	6.7.8.6
1097	OPS-2(f) Lifeboat Execute	6.7.8.5
1100	ST-3 Stellar Capping Shutter	6.8.3
1101	OPS-2(m) SCC-II Select	6.3.5
1102	ST-6 ST Maximum Run time at 3 msec.	6.8.6
1103	OPS-2(a) SGLS 2 Antenna/Receiver performance at reduced RTS transmit power	--
1105	OAS-1 Engine Washout characteristics-Cross Plane burn	6.7.6
1107-1123	ACS-1(A) - (D) Pitch and Yaw Offset investigation	6.7.1
1128	OPS-2(e) Aft Switched Bus to LB battery	6.7.8.4
1139	VAST-2 SV Deboost over SHEMYA and ARIS ship	6.7.9 6.5

6.2 COMMAND SUBSYSTEMS PERFORMANCE
(Prepared by CSC)

6.2.1 Health

The health of the Command Systems remained excellent throughout Segment 5 (Revs 1024 - 1139). There were no equipment malfunctions. None of the Command Systems were subjected to out of specification temperatures or voltages. There were no power dropouts, relay driver overloads, or clock status errors experienced.

6.2.1.1 EXTENDED COMMAND SUBSYSTEM

6.2.1.1.1 Command Modes

The ECS responded properly in all modes into which it was commanded. There were a total of 63 messages loaded in the ECS for this segment. This resulted in 21,672 SPC's being stored for readout from the PMU's.

Of the 21,672 SPC's loaded, 14,143 were output from the PMU's for processing by the decoders. The remaining were erased out prior to time label matches. In loading the SPC's a total of 122 rejects occurred. HULA had 4 of those rejects over 2 different passes, GUAM had 1 reject, BOSS had 7 rejects in 1 pass, KODI had 19 rejects in 4 passes, POGO had 2 rejects in 2 passes, and COOK had the remaining 89 rejects in 5 passes.

6.2.1.1.2 ECS Clock Operation

The accuracy of the ECS clock was .1285 parts in 10^6. This corresponds to an average frequency offset of .1311 HZ above the nominal frequency of 1.024×10^6 HZ. The frequency of the clock oscillators changes .0174 HZ in 113 revs. This results in a stability of 1.7 parts in 10^8 over a 7 day period. All of these values are well within system specifications. The clock plot is presented in Figure 5.2-1.

6.2.1.1.3 ECS Anomalies

There were no ECS anomalies experienced during this segment.

6.2.1.2 MINIMAL COMMAND SUBSYSTEM

6.2.1.2.1 Command Modes

All MCS functions scheduled for the MCS Solo Test were performed nominally. The MCS Real Time command to select SGLS 2 was not sent because of problems with the SGLS. MCS secure word 5 was used to 1089P to put the MCS into operate. All MCS RTC's and SPC's executed properly. The MCS was commanded out of operate at 1090P.

6.1.2.2.2 MCS Anomalies

There were no MCS anomalies.

6.2.1.3 REMOTE DECODER/BUD

6.2.1.3.1 Command Modes

No commands were issued from the Remote Decoder or BUD during this segment.

6.2.1.3.2 Remote Decoder/BUD Anomalies

There were no remote decoder or backup decoder anomalies.

6.2.1.4 SUMMARY

6.2.1.4.1 Expendables and Environmental Data

Total Command Readouts: PMU-A 7037 PMU-B 7106

ECS Clock Drift Rate: 1.7 parts in 10^8 for a 113 rev period

Total Hours On: ECS 1700 MCS 6.0 RD 6.0 BUD .05

Secure Words Expended at end of SOLO: PMU-A 140 PMU-B 148

Environmental Data: See Figures 5.2-1 through 5.2-7

Clock Accuracy (Avg) $= \frac{\Delta \text{ Bias}}{\Delta \text{ Time}}$

$= \frac{.0756}{0.596\text{x}10^{6}} = .1285 \text{ x } 10^{-6}$

Average Clock Frequency $= (.128\text{x}10^{6} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$

$= 1{,}024{,}000.1311$

Frequency 1(f_1) $= \frac{(\Delta \text{ Bias}}{(\Delta \text{ ECS Time}} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$

$= \frac{11.3\text{x}10^{-3} \text{ sec}}{9.5\text{x}10^{4}} \text{ x } 1.024\text{x}10^{6} + 1.024\text{x}10^{6}$

$= 1024000.122$

Frequency 2 (f_2) $= \frac{\Delta \text{ Bias}}{\Delta \text{ ECS Time}}$

$= \frac{(6\text{x}10^{-3}}{(4.4\text{x}10^{4} \text{ Sec}} \text{ x } 1.024\text{x}10^{6}) + 1.024\text{x}10^{6}$

$= 1{,}024{,}000.1393$

Clock Stability $= \frac{f_1 - f_2}{\text{Frequency (avg)}}$

$= \frac{.0174 \text{ HZ}}{1.024\text{x}10^{6}} = 1.7\text{x}10^{-8}$

$=$ 1.7 parts in 10^{8} for this 113 rev period

6.3 Sensor Subsystem Operations During Solo Phase

The solo phase of Mission 1205 was utilized to perform several tests as follows.

6.3.1 Take-up Select Test

The four take-ups were, in turn, selected during the 1030C contact in an attempt to gain insight into the loss of the TLM TU-3 discrete described in Section 4.3.1 of this report. The solo operation was proper with all four discretes functioning.

6.3.2 Instrumentation Power Test

The instrumentation power was commanded ON during the 1030C contact with no effect on the TLM monitors powered by the ISSCU. The loss of these TLM points is described in Section 2.3.1 of this report.

6.3.3 NCVU Test

A solo test was run during the 1030C contact to verify the "Supply Only" mode of operation with the Negative Constant Velocity Unit.

6.3.3.1 Aft Camera - Supply Only

The run of the Aft Camera Supply in the reverse direction exhibited proper operational characteristics.

6.3.3.2 Fwd Camera - Supply Only

The run of the Fwd Camera Supply in the reverse direction was unsuccessful. Telemetry data showed that the supply drive summed error dithered or oscillated when camera power was applied. The data is indicative of a failure in the supply drive servo loop. Investigation showed that this failure occurred on Rev 1016 after the depletion of the supply on Rev 1015. The fwd camera supply was running unloaded and the failure occurred just prior to depletion of the aft supply in the last mission operation. The failure was evidenced by current spikes on the SV current monitor as the supply summed error diagnostic signal broke up.

6.3.4 Pneumatics Depletion

A solo test was initiated on Rev 1063 and terminated on Rev 1068 to deplete the pneumatics supply to enable calculation of the mission usage rate. The pneumatics ON time during solo, and the ON time during the active mission were used along with the amount of GN_2 loaded to calculate the usage rate.

$$\frac{33.99 \text{ lbs } (GN_2 \text{ loaded})}{1244 \text{ min (active)} + 443 \text{ min (solo)}} = 0.0201 \text{ lbs/min}$$

6.3.5 SCC-2 Health Test

A health test of SCC-2 was run during the 1101 B contact to verify operability of the unit. The check was satisfactory.

6.4 RV-4/SOLO RECOVERY ABORT TEST

6.4.1 VBE AT KODI WHILE PITCHED DOWN OPS-3

PROCEDURE

The SV is to be pitched down approximately 40° while flying forward prior to a subcycle 2 KODI pass. Telltale commands that will execute at 5 second intervals after KODI acquisition are to be loaded. At the normal acquisition time, KODI will transmit a VBE message similar to that used for recovery at maximum transmitter power (approx. 10 KW), every 5 seconds.

RATIONALE

The objective is to determine if a VBE message that is sent at maximum power will be accepted while the SV is pitched down and the downlink cannot be acquired.

TEST RESULTS

The SV started the pitch down maneuver 100 seconds after 1056 P TRAN (81148) and completed pitch down 55 seconds later at 81203. This resulted in an SV pitch angle = -38.8°. The SV was programmed to cycle the primary RCS tank heaters on and off every 5 seconds, beginning 30.4 seconds prior to KODI TRAN. (81454.6). Telemetry data showed RCS tank heater cycling beginning at 81424.4. Cycling ended with an ON command executing at 81454.2. VBE message 560 was first transmitted at 81455. Since no tank heater commands executed after this time, it is apparent that the first transmission of the VBE message was accepted by the SV. It may be concluded from the results of this test, that contingency action may be taken when the SV is pitched down provided that the RTS uses maximum transmitter power.

6.4.2 REDUNDANT TCEA - OPS 2 (L)

PROCEDURE

With at least one of the first four RV's still on the SV, switch to the redundant TCEA (RV Heater Control) for a minimum period of one day. Switch back to the primary TCEA for period of at least one day prior to recovery of RV 4.

RATIONALE

The objective is to determine if the change in RV heater power requirements during the switch to the redundant TCEA is a result of a different set point in the primary and redundant TCEA's, and to determine the cause of the lower power usage experienced on RV 4 (SV 5).

TEST RESULTS

The TCEA was successfully switched to the redundant system on Rev 990. The temperature monitor, C709, indicated that operation was within the proper thermal envelope.

One opportunity was available for evaluation of the redundant heater duty cycle. This was the 1500 sec. playback from the 60 min. record just prior to 1007 POGO. Heater operation was verified. However, a complete heater cycle (on - off - on) was not observed. At 1007 POGO the system was successfully switched back to primary.

In light of these events, no conclusion can be drawn concerning "set points" and "power usage".

6.5 SATELLITE CONTROL FACILITY PERFORMANCE

6.5.1 Orbit Determination

Table 6.5-1 shows a summary of the orbital conditions computed for the SOLO phase from RV-4 recovery on Rev 1124 to Deboost on Rev 1139. The orbit was significantly affected by the SOLO SV maneuvers.

6.5.2 Orbit Adjust Summary

Table 6.5-2 reflects a summary of each orbit adjust during SOLO. For each orbit adjust or set of orbit adjusts, the orbital conditions are provided prior to each OA or OA set. In addition the predicted and actual orbital conditions and velocity after the OA(s), are provided for comparison. The achieved orbit and velocity change was determined from the Best Fit Ephemeris. The OAS bed resistance factor decay was substantially below the nominal value, however, OA performance remained nominal. The cross-plane burn maneuver designed to test engine washout characteristics, was aborted after 190 seconds of the planned 400 second by loss of SV data visibility from mode/data line saturation from KODI.

Figure 6.5-1 shows perigee altitude and argument of perigee range as functions of the orbit adjusts accomplished during SOLO.

6.5.3 Deboost and VAST-2

The SV was deboosted on Rev 1139, 18 May 1973. The deboost burn was accomplished in 5 discreet segments to minimize the probability of OA engine washout.

Nominal, worst case uptrace, and worst case down range conditions were obtained from the T-12 hr deboost study made by Orbit Plans. This study assumed no segmentation of the deboost burn. The actual impact position was computed by Orbit Plans using an updated orbit vector and the segmented burn conditions. Observation of reentry breakup by SHEMYA and the VAST task force indicate that deboost impact was nominal.

TRACKING REDUCTION SUMMARY

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	DMEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
1026	.0089	.4962	88:38.7	150.40	84.31	128.5	.7308	88/26		
1029	.0088	.2137	89:01.4	160.35	94.81	127.4	.6705	246/72		
1031	.0088	.2325	89:00.8	159.95	94.97	126.6	.7298	226/66		
1035	.0088	.2305	88:59.8	159.63	94.68	125.9	.7082	228/66		
1037	.0087	.3224	88:59.5	159.21	94.88	125.4	.7175	226/66		
1041	.0086	.2380	88:58.4	158.74	94.70	124.5	.7215	220/64		
1043	.0086	.2467	88:57.8	158.46	94.63	123.9	.7403	213/62		
1046	.0085	.2481	88:57.2	158.03	94.71	123.0	.7430	211/61		
1051	.0085	.2591	88:55.9	157.31	94.54	122.1	7562	203/59		
1054	.0084	.2604	88:55.1	156.74	94.65	121.3	.7607	200/58		
1057	.0083	.2592	88:54.1	156.23	94.43	120.6	.7414	201/58		
1060	.0082	.3011	88:52.9	155.30	94.51	119.9	.8570	172/50		
1063	.0081	.3077	88:52.0	154.73	94.51	118.9	.8643	168/49		
1067	.0080	.3149	88:50.6	153.91	94.33	118.1	.8655	163/47		
1069	.0080	.3183	88:50.1	153.56	94.35	117.4	.8685	161/46		
1074	.0077	.5160	88:39.2	145.77	87.76	133.3	.9649	82/24	POS OA ON 1071	
1077	.0076	.4831	88:37.9	144.89	87.56	132.9	.8830	87/25		
1079	.0076	.4850	88:36.9	144.26	87.51	132.1	.8763	86/25		

Table 6.5-1

TRACKING REDUCTION SUMMARY

SECRET/H

EPOCH REV	ECCENT.	PERIOD DECAY	INTEG. PERIOD	MAX. ALTIT.	MIN. ALTIT.	ARG. PERIGEE	DRAG	STABLE/ TUMBLE	COMMENTS	WEEK
XXX	.XXXX	.XXXX	XX:XX.X	XXX.XX	XX.XX	XXX.X	.XXXX	XXX/XX		
1084	.0074	.4896	88:34.5	142.91	87.07	131.1	.8440	84/24		
1086	.0073	.5005	88:33.5	142.15	87.11	130.4	.8553	82/24		
1090	.0072	.5023	88:31.5	141.06	86.75	129.2	.8249	81/24		
1093	.0071	.5077	88:30.1	140.06	86.64	128.6	.8181	79/23		
1095	.0070	.5179	88:29.1	139.41	86.55	127.7	.8211	78/22		
1100	.0068	.5567	88:26.2	137.7	86.02	126.7	.8341	71/20	OA #34 Rev 1101	
1103	.0074	.4844	88:35.4	143.0	86.83	134.1	.8370	83/24		
1106	.0075	.4784	88:34.8	143.11	86.63	133.0	.8102	85/25	OA #35 REV 1105	
1110	.0074	.5174	88:32.9	141.76	86.35	132.4	.8484	78/23		
1116	.0072	.5077	88:29.8	140.05	89.86	130.8	.7844	78/23		
1119	.0070	.5162	88:28.4	138.98	85.82	129.9	.7849	76/22		
1122	.0069	.5486	88:26.7	137.98	85.54	129.0	.8072	71/21		
1126	.0060	.6321	88:18.3	131.18	84.99	127.7	.8347	57/16	OA#36 Rev 1124	
1132	.0057	.6210	88:14.7	128.75	84.55	126.1	.7688	57/16		

Table 6.5-1

SECRET/H

OA No. 30	Rev. No. 1027	Period Min:Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur. Sec. XX.X	Delta Velocity XX.XX
Orbit at Rev	1026	88:38.7	86.30	148.60	128.512	--	--
Predicted						41.8	17.81
Actual						41.8	18.49
Delta (A-P)						0	+.68
OA No. 31	Rev. No. 1027						
Orbit at Rev							
Predicted	1028	89:00.8	96.49	158.36	127.678	42.0	18.20
Actual	1028	89:01.5	96.80	158.64	127.777	42.0	18:75
Delta (A-P)		+.7	+.31	+.28	+.099	0	+.55
OA No. 32	Rev. No. 1071						
Orbit at Rev	1070	88:49.7	94.40	151.89	117.128	--	--
Predicted						20.0	8.45
Actual						20.0	8.47
Delta (A-P)						0	+.02
OA No. 33	Rev. No. 1073						
Orbit at Rev							
Predicted	1074	88:39.7	90.08	143.98	133.020	54.0	-23.36
Actual	1074	88:39.2	89.89	143.60	133.303	54.0	-22.50
Delta (A-P)		-.5	-.17	-.38	+.283	0	+.86

SECRET/H

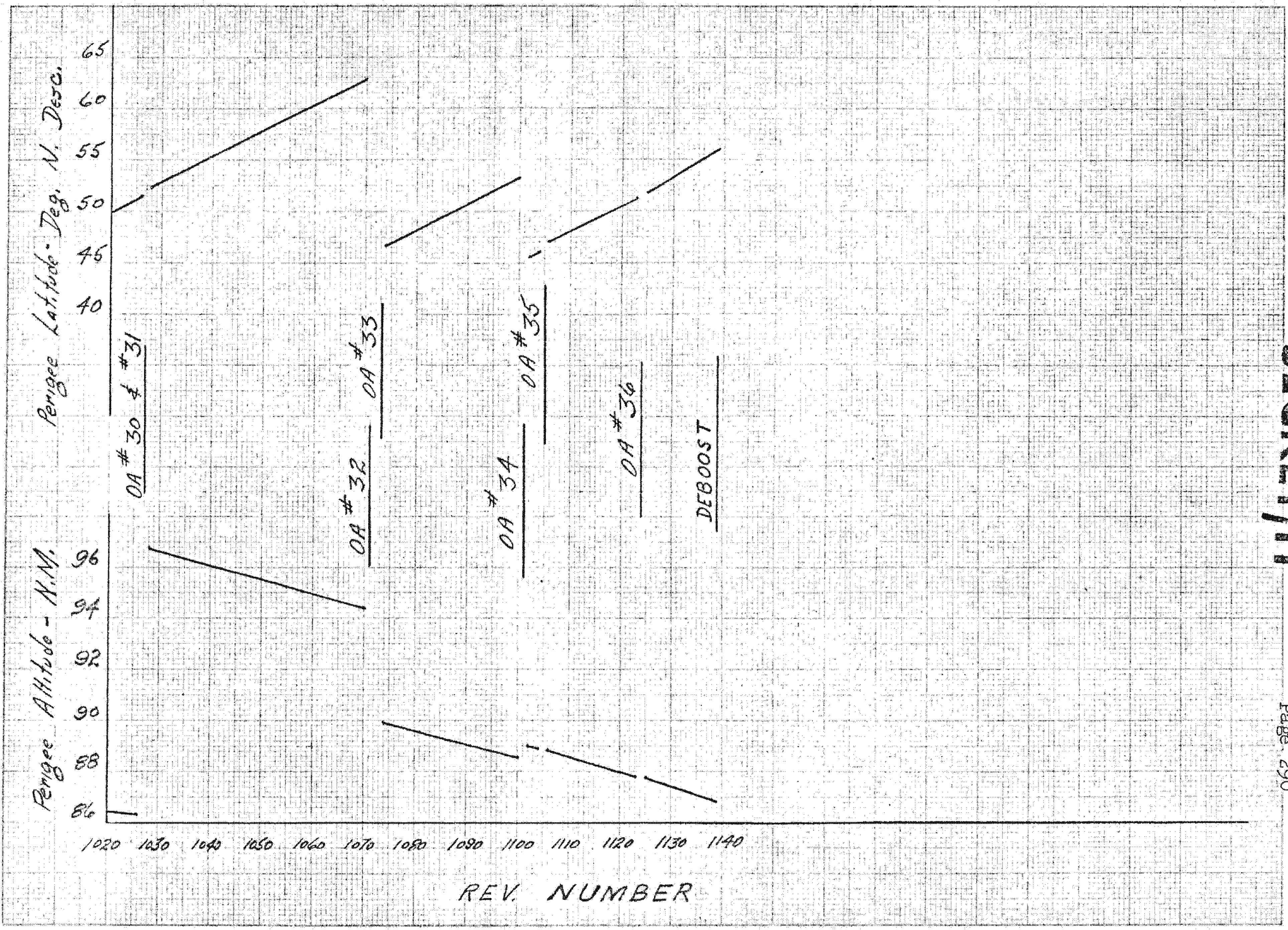
		Period Min:Sec. XX:XX.X	Perigee N.M. XX.XX	Apogee N.M. XXX.XX	Arc of Per. Deg. XXX.XXX	Burn Dur. Sec. XX.X	Delta Velocity XX.XX
OA No. 34	Rev. No. 1101						
Orbit at Rev	1100	88:26.3	88.54	135.51	126.796	--	--
Predicted	1102	88:35.9	88.89	141.26	134.377	38.4	16.51
Actual	1102	88:35.9	89.03	141.16	134.434	38.4	16.92
Delta (A-P)		0	+.14	-.1	+.057	0	+.41
OA No. 35	Rev. No. 1105						
Orbit at Rev	1104	88:34.9	88.93	140.56	133.855	--	--
Predicted	1106	88:33.2	88.67	139.40	133.359	190.0	79.94
Actual	1106	88:34.8	88.82	140.89	133.003	190.0	84.20
Delta (A-P)		+1.6	+.15	+1.49	+.356	0	+4.26
OA No. 36	Rev. No. 1124						
Orbit at Rev	1123	88:26.2	87.80	135.57	128.670	--	--
Predicted	1125	88:19.3	87.76	129.43	128.129	21.6	-9.01
Actual	1125	88:18.8	87.78	128.99	128.112	21.6	-9.55
Delta (A-P)		-.5	+.02	-.44	-.017	0	-.54
OA No.	Rev. No.						
Orbit at Rev							
Predicted							
Actual							
Delta (A-P)							

~~SECRET/H~~

~~SECRET/H~~

Table 6 5-2

~~SECRET/H~~



~~SECRET/H~~

Figure 6.5-1

DEBOOST IMPACT POINT

	NOMINAL	WORST CASE UP TRACE	WORST CASE DOWN TRACE	ACTUAL
LATITUDE	44.0°N	51.12°N	41.37°N	44.13° NORTH
LONGITUDE	170.12°E	172.12°E	169.48°E	170.13° EAST
DELTA VEL.	-317.047	-329.04	-305.06	---
THRUST	158.63	164.63	152.63	---

Table 6.5-3

6.5.4 SCF Support

Exceptionally fine support was provided by the SCF in satisfying SOLO objectives. The high level of RTS support in real time and extensive playbacks was efficiently accomplished. CG response in satisfying the complex and non-standard SOLO command message requirements was excellent.

6.6 PROGRAM COMMAND SOFTWARE PERFORMANCE
(Prepared by HTC)

6.6.1 Command Message Summary

This section summarizes pertinent command message data from Mission 1205, IRON 8410. A total of eight hundred fifty-three command messages were reviewed by the Technical Advisory (TA) Staff throughout the flight. Seven hundred ninety one of these messages were loaded into the vehicle. Additional information regarding these messages may be found in Sections 2 through 6 of this report.

During the solo phase of the flight, seventy-six command messages were received by the TA Staff. Sixty of these messages were accepted and loaded. Sixteen were rejected. All of the rejected messages were altered and subsequently loaded. The reasons for rejection of the sixteen messages are summarized below.

Rev. No. & Load Station	Reason for Rejection
1028 BOSS	This message included a special solo sequence (456) which contained two pair of TR1+, TR1- commands. When sequence 456 conflicted with other sources of tape recorder activity, the second pair of records did not assemble properly due to the manner in which deletion logic and hold flags were employed. An alter was required to complete the recording over the desired time span.
1031 KODI	Same reason as for 1028 BOSS.
1039 POGO	TT/C constraint was violated.
1039 POGO	More tape recorder sequences were required for Rev. 1040 than had been originally planned.

Rev. No. & Load Station	Reason for Rejection
1042 POGO	Same reason as for 1028 BOSS.
1054 POGO	TT/C constraint was violated.
1054 POGO	An additional alter was required for 1054 POGO to add an ES record.
1058 POGO	Same reason as for 1028 BOSS.
1061 BOSS	Tape recorder and TT/C constraints were violated.
1061 BOSS	An additional alter was required for 1061 BOSS because of tape recorder and TT/C constraint violations.
1080 KODI	Tape recorder constraint was violated.
1083 GUAM	An [redacted] sequence interferred with a station contact that had been called by use of sequence cards.
1087 POGO	PCM 1 was commanded when PCM 2 was desired.
1103 POGO	The EE records had been assigned a DT of 16 when it should have been 0.
1122 POGO	The wrong ephemeris data was used in generating the message.
1136 POGO	A TR2- command was required in the command message.

(b)(1)
(b)(3)

Fifty-seven messages were loaded and nineteen were not for the reasons stated below:

1. The sixteen rejected messages were not loaded.
2. Three contingency messages for vehicle attitude stabilization were not required.

6.6.2 'TUNITY Software Problems

The Flight 5 'TUNITY software problems itemized below pertain only to the period for RV4 recovery through DEBOOST. They have been grouped into the following categories to demonstrate their impact on the flight. The disposition of these software problems will be specified by a future meeting of the Configuration Control Board.

Category	No. of SPR's	Comments
Flight Critical	1 (5148)	Software corrections were made and incorporated during this flight period.
Non-Flight Critical (Requiring Work-Around)	0	Work-around procedures were developed and implemented.
Non-Flight Critical (Minor)	0	Work-around procedures were not required.
Product Improvement or New Requirements	1	To be considered during future development.
Documentation Error	2	Milestone 4 of 7 affected.

Itemized Software Problems

SPR MBR-5146 (COMPOOL)

- Problem Description: An incorrect comment appears at the end of the description of the 'COXTAB in the 'COX data block. The comment reads "that is, a polygon must be wholly contained in one hemisphere". This comment should be deleted.
- Solution or Work-Around: None.
- Operational Impact: None.
- Comment: The COMPOOL should be changed according to the above recommendations.

SPR MBR-5147 ('TOTEM - MS-4)

- Problem Description: The following limitations should be added to the 'TOTEM MS-4 to facilitate correct input of polygon vertices:

Vertices should not be input with latitudes which are greater than max. lat. 'TCROSS is unable to work with such a point, which causes STICK (POLY processor) to ignore any intersections which occur between that vertex and the one to either side. Failure to do this causes loss of [redacted] Since the high lat point can't be accessed, a lower point(s) should be input instead.

(b)(1)
(b)(3)

- Solution or Work-Around: None.

- Operational Impact: None.

- Comment: The 'TOTEM MS-4 limitation section should be changed according to the above recommendations.

SPR MBR-5148 ('THISUM) - FLIGHT CRITICAL -

- Problem Description: CHG aborted on an illegal instruction at 126444 in Rev. 142.5 of message 502.

- Solution or Work-Around: The problem was determined to be flight critical. A change was made to 'THISUM correcting the problem and a binary tape was delivered to the SWFTFD.

- Operational Impact: CHG had to be delayed until the fix was accomplished.

SPR MBR-5149 ('THISUM)

- Problem Description: When 30 or more revs exist between the last SS and the last ST operations, 'THISUM run time is greatly increased. This is because PROC TGXFLIP is called for each command, whether it pertains to the SS or ST system. This causes many disc reads which should not be necessary.

- Solution or Work-Around: None.

- Operational Impact: Increased run time for CHG impacts the computer time line.

- Comment: This SPR should be considered as a product improvement item for a future software delivery.

6.6.3 Hardware/Software Interface Changes

For IRON 8410, seven change requests were processed during the solo phase of the flight (as shown in Table 6.6.3-1).

These changes were implemented via requests SV5-318 through SV5-324 and have been incorporated in the nominal data base and hardware/software interface documentation.

Table 6.6.3-1. Summary of
Hardware/Software Interface Operations

Request No.	Identification	Effectivity
SV5-318	New sequence 457 identified as SOLO-4. It is to be used in determining the approximate point of pneumatics depletion.	SV-5 only
SV5-319	Change to sequence 256 to return it to its original configuration.	SV-5 only
SV5-320	New sequence 458 identified as OPS 3 TELLTALE/VBE - PMU A. It is required for a solo test.	SV-5 only
SV5-321	New sequence 459 identified as OPS 3 TELLTALE/VBE - PMU B. It is required for a solo test.	SV-5 only
SV5-322	New sequence 460 identified as SOLO TEST ACS 1 PREP.	SV-5 only
SV5-323	New sequence 461 identified as SOLO TEST ACS1/ACS2 CYCLE.	SV-5 only
SV5-324	New sequence 444 identified as SEGMENTED DEBOOST. The purpose is to segment a long engine burn to preclude catalyst washout.	SV-5 only

6.7 SATELLITE VEHICLE SOLO TESTS
(Prepared by SBAC)

6.7.1 ACS-1 (A, B, C, D)

Pitch Offset Investigation

The purpose of the test was to repeat the primary pitch rate offset that existed on earlier orbits so that the anomaly could be studied.

The experiment was conducted as follows:

ACS-1(A) Rev 1107 GUAM, 1126 BOSS

The vehicle was pitched for one second and then the RACS was turned off for 9 seconds, turned on for 0.4 seconds (repeated 4 times). The total sequence was operated for a total of four maneuvers.

ACS-1(B) Rev 1113 KODI

The sequencing was the same as ACS-1(A) except the RACS was not turned off.

ACS-1(C) Rev 1121 HULA

The sequence was the same as ACS-1(B) except the maneuver was in yaw instead of pitch.

ACS-1(D) Rev 1120 COOK

The sequence was the same as ACS-1(A) except the maneuver was in yaw instead of pitch.

6.7.2 ACS-2

Horizon Sensor Inhibit Investigation

The purpose of this experiment was to determine if temperature cycling would cause a repeat of the horizon sensor inhibit anomaly which occurred early in SV-5 flight.

The ACS-2 experiment was performed on Rev 1060 through Rev 1092 and produced no horizon sensor inhibits. The test was conducted by turning the Primary Attitude Control off and on at four rev intervals and recording horizon sensor data every 110 seconds throughout the four rev off/on periods.

6.7.3 ACS-3

REM Pulse Count Experiment

The REM Pulse Count experiment was conducted to obtain the change in thruster activity for different Solar Array positions. The Solar Arrays were repositioned to +18 degrees on Rev 824 GUAM, repositioned to 0 degrees on Rev 826 POGO and back to -18 degrees on Rev 828 POGO. This activity was successfully accomplished during primary mission quiescent periods. The data is being analyzed.

6.7.4 ACS-4

Ferrotic Gyro Start/Stop Capability Verification

The object of the test was to verify the on orbit start/stop capability of the Ferrotic Gyro used in PACS.

The initial experiment was conducted on Rev 1027 followed by 32 revs where the PACS was turned off/on 8 times per rev. The second phase started on Rev 1062 with the PACS being sequentially turned on for 4 revs and off for 4 revs. The test terminated on Rev 1136. There were no instances when the gyros failed to start.

6.7.5 ACS-5

Horison Sensor and Magnetic Field Mapping

The purpose of the Horizon Sensor (H/S) and Magnetic Field Mapping Test was to obtain latitude dependent H/S noise and to map the magnetic field. Continuous TM data was obtained for 1.3 revs starting on Rev 1006 with the Lifeboat configuration consistent with Magnetometer non-saturation for best data correlation.

The data was sufficient for analysis of magnetic field mapping.

6.7.6 OAS-1

Engine Washout Characteristics

The purpose of this test was threefold:

1. To determine if variable conditions influence catalyst bed delta pressure.
2. To determine engine washout resistance at the current low catalyst bed delta pressure level.
3. To obtain diagnostic engineering data.

OAS-1 consisted of an orbit adjust engine burn 90° to the orbit plane. This test was performed during the Rev 1105 KODI contact. The engine burn was terminated after 190 seconds due to Station to STC data line loss.

Engine performance during the test was within the expected limits.

The test was performed by yawing the vehicle 90° in the positive direction.

The engine burn was performed with the vehicle approximately 90 degrees to the orbit plane to reduce the effect of the burn on the orbit to a minimum. After completion of the burn the vehicle was returned to the normal fly forward flight configuration.

6.7.7 Therm-1

Plus 8° Beta Angle Test

The purpose of this test was to determine the effect of a +8° Beta Angle on Bays #3 and #10 to prove the feasibility of extending the launch window to plus 8°.

The Therm-1 test was started on Rev 1062 with the scheduled yaw reverse and repositioning of the solar arrays to +18°.

The test plan called for flying reverse until the battery temperatures leveled off at $\leq 90°$F. However, after 21 revs, on Rev 1083, the test was terminated because there was no observable temperature change in the batteries from the normal flight temperature range of 43° to 50°.

6.7.8.1 Ops-2(a, b)

SGLS-2, PCM 2, TPS 2, & APS 2

The purpose of this test was to evaluate the performance of the redundant T&T equipment.

SGLS #2, PCM 2, TPS 2, APS 2 and FPS 2 were programmed "on", on Rev 1027. SGLS #2 was used on Revs 1027, 1028 and 1029 only, due to a 30 db degradation in output when comparing it to Rev 9 and 18. SGLS #2 was also used on 9 additional passes prior to deboost to help determine the reason for the low output.

PCM 2, TPS 2, APS 2 and FPS 2 were used for the remainder of the flight, and all equipment except for SGLS #2 performed without anomaly throughout the entire mission.

6.7.8.2 Ops-2(a) Modified

SGLS-2 on Full Rev

The SGLS-2 was turned on for a full rev to determine if increased temperature would affect the degraded performance. SGLS-2 was turned on at Rev 1133 POGO fade and remained on until Rev 1134 BOSS. 1134 BOSS was programmed in SGLS-2 and switched to SGLS-1 mid pass. No change in SGLS-2 performance at 1134 BOSS was apparent. The temperature rose from 74° at turn on to 133° at the end of the experiment.

6.7.8.3 Ops-2(d)

Verification of Redundant Systems Performance

This test was performed to verify that the backup timer would turn off the SGLS link as designed.

The test was performed on Rev 1085 GUAM and the timer turned off the SGLS link in a nominal 540 sec.

6.7.8.4 Ops-2(e)

Switched Bus to LB Battery

The purpose of this test was to verify functional operation of the Switched Bus from the L/B Battery.

On Rev 1128 the switched bus received power from the L/B battery for approximately 90 seconds over COOK.

All systems appeared to function normally. The TM system was operating on Side 2-B during the test. The calculated power usage from the L/B battery was 0.35 A/H.

6.7.8.5 Ops-2(f)

Lifeboat Execute Test

The Lifeboat Execute Test was performed to provide data to verify that the SBA Lifeboat system was operating and functional. This test was performed over the HULA Station on Rev 1097 on a South to North pass. Data from the test indicated the Lifeboat System was fully operational and provided attitude control of the vehicle.

6.7.8.6 Ops-2 (h, i, j, k)

Verification of Redundant Mechanical System Heater Operation

The purpose of this test was to verify the operational status of the redundant heaters on the following systems:

(a) TCS, Injector Manifold & Propellant Valve Heaters (h & i)

(b) OAS, Tanks Heaters (j)

(c) RCS, Tank Heaters (k)

Redundant heaters for the above systems were activated on Rev 1095 COOK and deactivated on Rev 1097 KODI.

The redundant heaters for all systems did turn on and effectively control the system and component temperatures at the levels required for on orbit performance.

6.7.8.7 Ops-2(l)

TCEA Verification

The purpose of this test was to evaluate the temperature point setting of the heaters with respect to the reference point C700 and, in addition, evaluate TCEA low power consumption on RV-4.

The Redundant TCEA was activated and the Primary TCEA was deactivated on Rev 990 COOK. Temperature control and monitoring was returned to the Primary TCEA on Rev 1007.

The TCEA Redundant system did turn on and maintained the temperature of RV-4 within 0.3°F of the Primary system control. The power consumption was not appreciably affected.

6.7.8.8 Ops-2(m, o)

DBS Redundant Heater & Oscillator

Operation of the redundant oscillator and heater subsystems of the DBS system were verified during the Rev span from 748 HULA through 797 POGO. Operation of the redundant subsystems were apparently normal.

Implementation was as follows:

Rev	Sta	Execution Time	Osc	Htr	Transmitter
748	HULA	Tran +100	1	2	OFF
748	HULA	Tran +130	1	2	ON
756	KODI	Tran +20	2	2	OFF
756	KODI	Tran +50	2	2	ON
788	KODI	Tran +20	2	1	OFF
788	KODI	Tran +50	2	1	ON
797	POGO	Tran +30	1	1	OFF
797	POGO	Tran +60	1	1	ON

6.7.8 Ops-4

INDI Rev 0.9 Commanding Exercise

The Rev 0.9 INDI commanding test was performed to verify that the new commanding sequence which turns the tape recorder on over the station to record Solar Array Deploy operates correctly. Also, that the RTS can respond to the required format switch and reacquire decom sync in a timely manner.

The test was performed three times, once each on Revs 941, 957 and 973 INDI.

The command sequence performed as expected in all cases and the RTS was able to reacquire decom sync and transmit valid data in all cases within an acceptable period of time.

The station took 34, 38 and 8 sec to reacquire decom sync during the respective passes.

6.7.9 VAST-2

Vehicle Atmospheric Survivability Test

The object of the test was to determine the vehicle reentry breakup process, identify those items of debris which might identify the satellite mission and establish the band of impact location of debris with respect to the PIP determined by the 'DROP software program.

The experiment was conducted on Rev 1139 with the last part of the segmented deboost burn occurring over POGO and the reentry observed by SHEMYA. The burn had been calculated to place the SV over SHEMYA at breakup altitude, approximately 45 n.m. An instrumented ship and instrumented aircraft were used to record the reentry telemetry and to track the debris during the reentry trajectory.

SECTION 6.8 - NEC SOLO SUMMARY

6.8.1 ST-1 Exercise ST Alternate Modes of Operation.

The ST normal operating capabilities not utilized in flight were exercised. The various operations included maximum frame time of 87 sec/frame, 10% and 78% overlap and 3 millisecond terrain exposure.

The ST operation was normal.

6.8.2 ST-2 Evaluate Emergency Shutter Open Characteristics.

This test was to evaluate the thermal effects on the terrain lens with the terrain thermal shutter opened permanently.

Due to the temperature problem encountered with the thermal shutter (inoperative at cold temperature), this test was not completed. The thermal shutters have not operated since the in flight calibration attempt. At that time, with the shutters exposed to colder temperatures, the shutters were mechanically bound to the point of failure.

6.8.3 ST-3 Verify Operation of the Stellar Capping Shutters.

This test verified operation of the Stellar Capping Shutter Contingency.. (This is a safety device to protect the remaining Stellar photography if one of the Stellar normal shutter fails open).

Stellar capping shutter operation was normal.

6.8.4 ST-4 Verify Stellar Shutter Inhibit Capability.

This test verified the inhibiting circuit of the Stellar shutter. When the sun comes into approximately 20° of either Stellar field of view, a photo cell is activated inhibiting that Stellar shutter from opening.

The ST was operated during a vehicle yaw maneuver, which forced the sun to within 20° of the Stellar field of view. The exposed Stellar camera shutter was inhibited. Operation was normal.

6.8.5 ST-5 Evaluation of the Terrain Thermal Shutter Operation at High Northern Latitudes.

This test was deleted due to the terrain thermal shutter failed closed condition.

6.8.6 ST-6 Evaluate ST Maximum Run Time With 3 Msec Exposure Option.

This test verified the terrain rotary shutter operation at its highest rate of rotation for the maximum single rev operating time.

Operation was normal.

6.8.7 OPS 2 p-t Verification of the Redundant Systems Performance.

Normal operation of the following redundant systems was verified:

Redundant ST Power Converter
Redundant Terrain Thermal Shutter Servo Electronics
Redundant Terrain Capping Shutter Servo Electronics
Redundant Stellar Transport Servo Electronics
Redundant Stellar Platen Press Servo Electronics.

The back up mode of operations was confirmed during the regular mapping mission. Operation was normal with no initial observable differences in photography between normal and back up modes of operation.

Summary

With the exception of the terrain thermal shutter solo experiments, all planned solo tests were completed. All systems responded normally. Table 6.8-1 lists the SOLO testing by rev.

NEC SOLO SUMMARY - CHRONOLOGICAL

REV	MODE	FRAMES	COMMENTS
697	NORMAL	10	THERMAL SHUTTER OPEN ATTEMPT
714	NORMAL	3	DITTO
744	NORMAL	5	10 PERCENT OVLP
745	NORMAL	5	78 PERCENT OVLP
746	NORMAL	1	THERMAL SHUTTER OPEN ATTEMPT
762	BACKUP	6	CONVERTER 1 OFF
		6	CONVERTER 2 OFF
763	NORMAL	3	THERMAL SHUTTER OPEN ATTEMPT
778	NORMAL	5	CONVERTER 1 OFF
		5	CONVERTER 2 OFF
779	NORMAL	3	THERMAL SHUTTER OPEN ATTEMPT
794	NORMAL	3	87 SEC FRAME TIME AND THERMAL SHUTTER OPEN ATTEMPT
795	NORMAL	3	THERMAL SHUTTER OPEN ATTEMPT
843	NORMAL	5	CONVERTER 1 OFF
		5	CONVERTER 2 OFF
			(COLD ORBIT SECTION)
1041	NORMAL	66	INHIBIT TEST (INCORRECT INPUT)
1071	BACKUP	29	INHIBIT TEST
1072	BACKUP	29	INHIBIT TEST (STATION CON PROBLEM LOSS OF DATA) -Y
1083	BACKUP	29	INHIBIT TEST
1100	BACKUP	6	STELLAR CAPPING
1102	NORMAL	125	20 MINUTE 3 MSEC EXP

SECRET//H

Table 6.8-1

SECRET//H