~~TOP SECRET-HEXAGON~~

SYSTEM

PERFORMANCE EVALUATION TEAM

MISSION 1208

NOVEMBER 1974

This report consists of 60 pages.

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PERFORMANCE EVALUATION TEAM
REPORT NO. 1208/74

PUBLICATION REVIEW

This report has been reviewed and is approved.

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FOREWORD

This report was prepared for and by direction of the Director of Special Projects, Office of the Secretary of the Air Force. The report is Volume I of the final mission report for HEXAGON Mission 1208. Volume II is entitled, "Sensor Subsystem Post Flight Analysis Report", TCS 363507-74.

The report was prepared by the SAFSP HEXAGON Performance Evaluation Team (PET) using reports and data provided by SAFSP, the Technical Advisor (TA) Staff, Post Flight Analysis (PFA) Team, and HEXAGON Satellite Vehicle Integrating Contractor (SVIC).

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SECTION I

SUMMARY

1.1 INTRODUCTION

The eighth HEXAGON Satellite Vehicle (SV) was placed into the nominal 85 x 162.4 NM orbit by the Titan III D Booster on 10 April 1974. Ascent events were all nominal and proper stabilization of the SV allowed initiation of deployment of the solar arrays at the first station contact. [redacted] (+Y) was properly ejected on Rev 3. The SSU (-Y) Subsatellite was properly ejected on Rev 13. The preflight mission planning was for a 60 day Mapping Camera mission, a 93 day Panoramic Camera mission, and a 3 day Solo operation.

The Panoramic Camera Subsystem operated throughout Mission Segment 1208-1. RV-1 was successfully re-entered; however, the aerial recovery attempt resulted in parachute damage which prevented further air recovery attempts. The capsule was successfully recovered from the water, with no payload damage, on Day 15. The Panoramic Camera operated throughout Mission Segment 1208-2 and RV-2 was aerially recovered on Day 43. The Panoramic Camera operated until Rev 980 where an ESD was experienced. Diagnostic tests determined that the problem was a Forward Camera Verification Interlock Signal failure. Operations resumed and continued without further incident throughout the remainder of this segment. RV-3 was aerially recovered on Day 70. The Panoramic Camera operated until Rev 1268 where an ESD was experienced. The problem was a failure of the integrator to reset in the Take-up. Procedures were implemented to work around this problem, and operations resumed and continued without further incident throughout the remainder of Mission Segment 1208-4. RV-4 was aerially recovered on Day 106. [redacted] [redacted]. All of the film was transported into the RVs including 2,600' of SO-255 Color Film and 3,000' of FE-3916 Infrared Color in RV-4. All the Mapping Camera operations were normal and the entire film load, including the 3414 Special Terrain Film, was transported to RV-5 and aerially recovered on Day 61. Solo tests were completed and the SV was deorbited on Rev 1768 (Day 110).

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SECTION II

MISSION OVERVIEW

2.1 PREFLIGHT PLANNING

Mission 1208 was the second of the HEXAGON Block II Vehicles and Panoramic Camera Systems. All 4 RCS Tanks were installed and filled with 394 pounds of propellent with the OA Tank containing 3,200 pounds of propellent. SGLS Transponders were General Dynamics and Cubic units and a Backup UHF Command receiver was added. The Panoramic Camera System was modified with a Servo Inhibit Assembly to inhibit drive servo dither. The Mapping Camera System contained improved platen press parts. The vehicle also carried the Quantic Horizon Sensor and Star Tracker equipment.

2.2 PREFLIGHT CONSTRAINTS

The Mission 1208 orbit was designed to:

A. Maintain solar angle (Beta) within -8° to +30° for the planned 93 days.

B. Have orbit adjusts occur on a three-day cycle with every third OA having a positive and negative burn for close control of argument of perigee.

2.2.1 Panoramic Camera System Constraints

A rewind velocity constraint limited to 5 inches/second was imposed on the Panoramic Cameras.

2.2.2 General System Constraints

The following constraints were imposed:

A. RV-5 was not to be released until after RV-1 recovery.

B. PACS and RACS gyros were both "ON" at lift-off and remained "ON" throughout the mission.

2.3 LAUNCH BASE

The SV was delivered to the launch pad and mated to the BV on 13 March 1974. The vehicle was launched on 10 April 1974 at 1320:00 PDT at the opening of the launch window, on the third countdown attempt.

2.4 ASCENT

The BV successfully injected the SV into an 84.94 x 162.4 NM orbit. The achieved orbit was close to nominal with the following deviations:

Apogee Altitude (NM)	+2.51
Perigee Altitude (NM)	+0.61
Period (second)	+0.6
Eccentricity	-0.00029
Argument of Perigee (degrees)	-8.35
Inclination (degrees)	+0.01

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2.5 ORBIT AND RECOVERY

2.5.1 1208-1 (Fifteen Days Duration)

Solar arrays were deployed at Rev 1 INDI and positioned at Rev 1 KODI. Panoramic Camera tests were completed by Rev 4 and the system started operational photography with the Rev 5 command message. The Mapping Camera Health Test was completed on Rev 2 with the system ready to start photography on Rev 5. The test commanding on Rev 2 was not successful because of an incompatibility between the test message and the pad load. Loading of the Rev 5 command message was only partially completed as a result of a backup timer time-out. This resulted in missing the Rev 5 Mapping Camera operation. The subsatellites were successfully released on Revs 3 and 13 as planned. The Quantic Experiment was health tested on Revs 29 and 81 and turned completely "ON" at Rev 114 when vehicle power margins permitted. Panoramic and Mapping Camera photography continued without incident until RV-1 recovery on Rev 228, (Day 15).

Overall quality of the acquired photography ranged from Very Good to Poor with the majority rated as Fair. The Poor image quality resulted from cloud cover, haze, high scan angles, and the defocused condition of the Forward Camera.

RV-1 was re-entered on Rev 228; however, the aerial recovery attempt was unsuccessful and resulted in tear and collapse of the cone. This prevented further air recovery attempts. The RV was recovered from the water with no capsule or payload damage. The RV had been loaded to 95.9% of design weight and with a balanced Forward and Aft Camera Take-up load.

2.5.2 1208-2 (Twenty-eight Days Duration)

Mission photography on both the Panoramic and Mapping Cameras continued throughout the segment without incident. Although a slight decrease in the thrust level of REA No. 7 was detected, the SBA performance remained nominal. Quantic Star Tracker No. 1 failed on Rev 453 as a result of a malfunction in the -15 volt regulated power supply. Quantic equipment was turned "OFF" at Rev 455 KODI. Analysis showed acceptable performance of the other sensors; therefore the Horizon Sensors and Star Tracker No. 2 were turned "ON" again on Rev 465. Performance remained nominal during the remainder of the segment.

A Panoramic Camera focus adjustment on the Forward Camera and an OOAA adjustment on the Aft Camera were made after PFA evaluation of RV-1 photographic quality. Overall quality of the acquired photography ranged from Very Good to Poor with the majority rated Fair to Good. Image quality was improved from RV-1 as a result of camera adjustment and improved atmospherics.

RV-2 was successfully re-entered and aerially recovered on Rev 681, (Day 43). The capsule was loaded to 97.9% of capacity with a 3.3% unbalance. Tears were reported in the canopy and in the cone, however, parachute performance was normal. There was no capsule damage reported.

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2.5.3 1208-3 (Thirty-seven Days Duration)

Mission photography continued until Rev 980 where an ESD was experienced. Diagnostic tests determined the problem to be a Forward Camera Verification Interlock Signal failure. Panoramic Camera operations were resumed on Rev 996 and continued through the rest of the segment without incident. Isolation Valve No. 2 was opened to supply RCS-1 with propellant from the OAS Tank on Rev 938. PCM Remote Unit 4A failed on Rev 1023 and operations were switched to Remote 4B with satisfactory performance. A switch to RCS-2 was successfully accomplished on Rev 1083 after the thrust level on REA #8 of RCS-1 had degraded to .71 pounds.

Overall quality of the acquired photography ranged from Poor to Very Good, with the Poor photography attributed to atmospheric conditions, very high solar angles, and shadowless imagery.

RV-3 was re-entered and aerially recovered on Rev 1118, Day 70. The capsule was loaded to 84.6% of capacity with a 3.1% unbalance. No parachute or capsule damage was reported.

2.5.4 1208-4 (Thirty-six Days Duration)

Panoramic Camera photography continued until Rev 1268 where an ESD was experienced on the Aft Camera. Diagnostic tests showed the problem to be a failure of the integrator to reset in the Take-up. Stereo photography was resumed on Rev 1300 with nested operations prohibited. All film in both cameras was expended.

A SGLS-2 Health Test on Rev 1426 HULA showed the power output to have decreased by 20 decibels and subsequent testing verified the degraded performance.

Roll Gyro noise on ACS-1 was detected and control of the SV was successfully transferred to ACS-2 on Rev 1501.

Overall image quality of the black and white photography ranged from Good to Poor with the majority rated Good. Image quality of the SO-255 and FE-3916 IR Color Films was rated Good. All film was expended.

RV-4 was successfully re-entered and aerially recovered on Rev 1701, (Day 106). The capsule was loaded to 95.3% of capacity with a 5.2% unbalance. The heatshield was recovered. No parachute or capsule damage was reported.

2.5.5 1208-5 (Sixty-one Days Duration)

The performance of the Stellar and Terrain Cameras was judged excellent. Seventy-seven Stellar-Terrain Camera mission operations were successfully completed with the MCD shutdown at the film change to 3414 on Rev 949. Three operate cycles were successfully conducted using the special 3414 Film. In-flight calibration (four cycles) was successfully conducted on Rev 965.

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Quality of the acquired photography ranged from Good to Excellent. Sufficient Stellar images were acquired on the Terrain film during the in-flight calibration.

RV-5 was successfully re-entered and aerially recovered on Rev 973, (Day 61). No parachute or capsule damage was reported.

2.5.6 Software and Command Load Summary

The software configuration used to support this mission was "TUNITY MOD 3. MOD 3 contained improved operations software for short term coverage, intelligence MOPs, individual desert polygons, and a routine to prohibit ST operations. The system software used was MOD 15.0. A nominal one rev load cycle for payload revs was used throughout the mission. A total of 1,123 command messages were generated during the flight of which 938 were loaded into the vehicle.

2.6 SECONDARY FLIGHT OBJECTIVE (SFO) ACCOMPLISHMENT

The requirement and definition of the Secondary Flight Objectives (SFO) identified prior to the launch of 1208 are contained in Annex H to the System Test Objectives (STO).

2.6.1 New SFOs

During the mission, three new Secondary Flight Objectives were defined:

A. Early Rev Search and Acquisition

The SV SGLS Transponder was commanded "ON" over specific RTS contacts to provide a test vehicle for another program's acquisition procedure testing.

B. S-Pulse Suppression Tests

The use of the ECS/UHF Command Receiver required disabling SGLS-2 S-pulses. Octal correctors were developed and tested to verify proper operation.

C. Panoramic Camera Leak Decay Testing

A possible pneumatics leak was detected just prior to launch and HPIV-A was closed. The leak decay test was conducted to determine if the normal camera pneumatics configuration could be safely used.

2.6.2 Early Rev Activity

All Primary and Redundant system testing and the initial Quantic Health Test were completed by Rev 29 as planned.

2.6.3 SFO Accomplishment

A. SV Shroud Separation Dynamics

Conducted during ascent.

B. Reaction Control Subsystem Evaluation

SV was switched from RCS-1 to RCS-2 on Day 67. RCS-1 testing after on-orbit storage was conducted during Solo.

C. Orbit Adjust System Evaluation

System performance was monitored and reported during the mission. A burn to depletion was executed on the deboost rev to determine the accuracy of propellant measurement procedures.

D. Electrical System Degradation Determination

Conducted after each RV recovery.

E. T&T Redundant Equipment Evaluation

SGLS-2, PCM-2, TPS-2, and the UHF/ECS Receiver were tested weekly. SGLS-2 power output degradation was detected on Rev 1426 and additional testing was executed. The failure of PCM Remote Unit 4A on Rev 1023 required limiting PCM "ON" time and number of on/off cycles for the remainder of the mission.

F. Lifeboat Health Check

Conducted during early rev activity on Rev 18.

G. Weekly RE&T Performance Check

Testing was performed weekly until the RU-4A failure on Rev 1023, when the frequency was changed to a 16-day cycle.

H. Electrical System Rev Status (ES Record)

Performed twice each rev until the RU-4A failure, when the frequency was reduced to 4 times daily.

I. SGLS Signal Strength

Conducted weekly as planned.

J. Panoramic Camera Photographic Operations

All Panoramic Camera engineering operations were completed for each RV and for the black and white, color, and IR film as planned.

K. Panoramic Camera Thermal Evaluation

A thermal survey record was conducted daily until the RU-4A failure, when the frequency was changed to every other day.

L. Panoramic Camera NCVU Operation

Not conducted by direction of the SPO.

M. RV-1 thru RV-4 Thermal Record

Test was accomplished on Rev 135. The results are reported in paragraph 7.5

N. Stellar-Terrain Bar XC MOPs

MOPs were executed on Revs 48, 129, 388, and 566.

O. Stellar-Terrain Calibrations

The ST star field calibration was successfully executed on Revs 965/966.

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P. Stellar-Terrain Type 3414 Test

Three ground target accesses were successfully accomplished with the special 3414 Film.

Q. K-Value Monitoring

K-value monitoring and daily reporting continued until the completion of the Stellar-Terrain mission on Rev 968.

R. INDI Commanding

INDI RTS was used weekly for test commanding to maintain station proficiency.

S.

T.

U. RV-5 Thermal Protection

Data were collected to evaluate RV-5 thermal response over the range of beta angles experienced by SV-8.

V. Quantic Evaluation

Twenty-three Quantic SFOs were defined at SV-8 launch. SPO decision, after mission operations were underway, was to defer all SFOs that required vehicle maneuvers until the Solo phase.

W. Quantic Health Check

Performed on Rev 29 and repeated on Revs 81/82.

X. Pitch Bias Check

Conducted on Revs 1470 and 1555.

Y. Star Catalog Check

Conducted daily early in the mission and keyed to the and then conducted twice daily for the remainder of the flight.

Z. Prime Pylon and SV Attitude Estimation

Continuous record revs were executed on 308 and Rev 1020. Added tests were completed during Solo.

AA. Secondary Pylon and SV Attitude Estimation

Data was collected on a weekly basis starting on Rev 261.

BB. Yaw Maneuvers

The data collected during the mission showed that yaw maneuvers for negative OAs were required.

CC. OA Environment

Data was collected during each OA.

DD. Pitch/Roll Gyro Drift Calibration

Fly inertial for one rev (Rev 1200) and additional tests during Solo.

2.7 SOLO AND DEBOOST

Limited Solo testing started after RV-5 recovery with the DBS redundant equipment testing. The final turn off was on Rev 1053.

Stellar-Terrain testing started during the 1208-4. The failure of the Terrain Thermal Shutter Emergency Open prevented the thermal evaluation test.

Quantic accomplished two maneuver experiments (1 rev inertial hold and pitch maneuver) during this phase with SPO approval. This resulted in an increase in the amount and frequency of data collection.

Redundant system performance tests and diagnostic tests on SGLS-2 were also accomplished.

Active Solo started after RV-4 recovery on Rev 1701 and continued until a successful SV deboost on Rev 1768, (Day 110). All planned experiments were completed during the 4 days of Solo with the emphasis placed on completing the Quantic Testing that required extensive SV maneuvers. Solo test activity is presented in Table 2-1. Further definition of Solo events are described in the Solo Plan Annex E of the STO.

TABLE 2-1

SOLO CHRONOLOGY

Rev or Span	I.D.	Event
— RV-5 Recovery, Rev 973 —		
1004 - 1052	OPS-1 (a, b)	DBS Redundant
1053	-	DBS "OFF"
— RV-3 Recovery, Rev 1118 —		
1200	Q-10A	1 Rev Inertial Hold
1200	EDAP-1	S/A Albedo-Inertial
1200	THERM-1	Sun Exposure
1327	OPS-1 (c-g)	Operation with Redundant Servo Electronics
1344 - 1345	FA-5	Operation with 1 Converter "OFF"
1361	FA-4	± Stellar Capping Shutter
1361	FA-3	FA Opn at 10% and 78% Overlap
1376 - 1378	Q-11	Pylon and SV Attitude Estimation
1458	FA-1	Thermal Shutter Emergency Open
1466	OPS-2 (a)	Backup Timer
1470	Q-2	H/S Pitch Bias Check

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TABLE 2-1 (CONT'D)

Rev or Span	I.D.	Event
1473 - 1474	Q-11	Pylon and SV Attitude Estimation
1477	FA-1	Thermal Shutter Emergency Open
1539	TTC-3	SGLS-2
1540	TTC-3	SGLS-2
1555	Q-2	H/S Pitch Bias Check
1571	TTC-3	SGLS-2
1588	TTC-3	SGLS-2
1633	Q-16	Pitch Maneuver Calibration
1635 - 1637	Q-11	Pylon and SV Attitude Estimation
1669 - 1685	OPS-1 (h)	Redundant TCEA
1697	RX-1	Panoramic Camera Pneumatics, RV-4 ATC
— RV-4 Recovery, Rev 1701 (Start Full Solo) —		
1704	Q-9	OA Environment
1704	Q-22	Sequential Maneuver Calibration
1705 - 1706	Q-16	Roll Maneuver Calibration
1707 - 1718	Q-13	Low Freq Horiz Radiance
1710	TTC-2	PCM RU-4A with MUX-2
1714 - 1715	Q-17B	Pitch H/S Inhibit
1715 - 1717	Q-11	Pylon and SV Attitude Estimation
1718	Q-20B	Sun Impingement
1720 - 1723	Q-10B	P/R Gyro Drift Calibration
1724 - 1726	EDAP-2	S/A Output-Albedo-Geocentric
1729 - 1731	EDAP-4	S/A Output-End to Earth
1733 - 1735	Q-24	Geocentric Rate Determination
1734 - 1735	OPS-2 (e,f,g,h)	Redundant OAS/RCS Tank Heaters
1735	OPS-2 (i)	LB Tank Heaters
1738 - 1739	OPS-2 (g,h)	Primary OAS & RCS Tank Heaters
1738 - 1739	Q-17A	Roll H/S Inhibit
1739 - 1741	RCS-1	RCS-1 Storage Effects
1742 - 1745	EDAP-5	S/A Output-End to Sun
1747	Q-23	Gyro Reference Plane Calibration

TABLE 2-1 (CONT'D)

Rev or Span	I.D.	Event
1749 - 1750	Q-25	Star Tracker #1 Health Check
1751 - 1752	Q-21	LB Attitude Estimation
1751 - 1752	OPS-2 (c)	LB Execute
1753 - 1768	THERM-2	Fly Reverse (-30° Beta)
1753	ACS-2	Turn PACS Thermal Cycle "OFF"
1754 - 1755	TTC-3 (a)	SGLS-2
1756 - 1758	Q-11	Pylon and SV Attitude Estimation
1757	TTC-1	SGLS-1 Frequency Measure
1757	ACS-1	Solar Array Dynamics
1760	ACS-2	Turn PACS Thermal Cycle "ON"
1762 - 1765	Q-18	Best Bet Attitude
1768	OAS-1	Burn to Depletion
1768	-	Deboost

2.8 ANOMALY SUMMARY

Significant anomalies are listed chronologically in Table 2-2. The list includes a brief description of the anomaly and its effects on the mission. A more detailed discussion of these anomalies can be obtained in Sections III, IV, and V.

TABLE 2-2

SUMMARY OF ANOMALIES

Rev	Description	Impact
228	Aerial recovery attempt caused tear in chute cone.	Water recovery was accomplished.
453	Quantic Star Tracker #1 -15V Power Supply failure.	Loss of sensor, continued experiment with remaining sensors.
980	Panoramic Camera ESD from missing builder roller verification signal.	SSC-2 selected and VIA disabled. Mission impact minimal, operation resumed on Rev 996.
1023	Telemetry PCM Remote Unit 4A failure (Pan Camera data).	No mission impact, redundant unit selected.
1083	Thrust level of RCS-1 REA #8 degradation resulting in questionable maneuver capability.	No mission impact, switched to RCS-2 thrusters.

TABLE 2-2 (CONT'D)

Rev	Description	Impact
1268	Aft Pan Camera ESD from failure of Take-up integrator to reset on brake release.	Minor mission impact. Resumed operations on Rev 1300, prohibiting nested operations.
1426	SGLS-2 Transmitter power down by 20 dBm.	No mission impact. Unit still usable with higher gain RTS antennas.
1479	ACS-1 Roll Gyro noisy.	No mission impact, switched to ACS-2 on Rev 1501.
1586	ACS-1 Horizon Scanner pitch and roll output deviations observed.	No mission impact, switched to ACS-2 control earlier.

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SECTION III

SATELLITE BASIC ASSEMBLY SUBSYSTEMS

3.1 INTRODUCTION

The following paragraphs summarize the performance of the Satellite Basic Assembly (SBA) subsystems as verified from flight data.

3.2 ATTITUDE CONTROL SYSTEM (ACS)

The ACS performed within specification; however, the PACS IRA Roll Channel and Horizon Sensor outputs were sporadically abnormal near the end of the flight. These abnormalities are discussed in paragraphs 3.2.6 and 3.2.7.

3.2.1 Booster Vehicle/Satellite Vehicle (BV/SV) Separation

The BV/SV separation was completed at approximately 549.5 seconds vehicle time; the vehicle time started 67.68 seconds prior to lift-off. Master Clear Off, which enables the pitch, roll, and yaw integrators to accumulate angle, was at 512.8 seconds vehicle time. The SV attitude changes from SECO to BV/SV separation and the attitude and rates as measured at BV/SV separation were within the specified values for these parameters.

3.2.2 Subsatellite/SV Separation

The Subsatellite/SV separation events of Rev 13 were as follows:

Event	Vehicle Time (seconds)
Start Negative Yaw Maneuver	70036.2
Stop Yaw	70063.0
Separation	70122.8
Start Positive Yaw Maneuver	70140.0
Stop Yaw	70166.8

The ACS parameters just prior to the instant of separation (70122.8 seconds vehicle time) are presented in Table 3-1.

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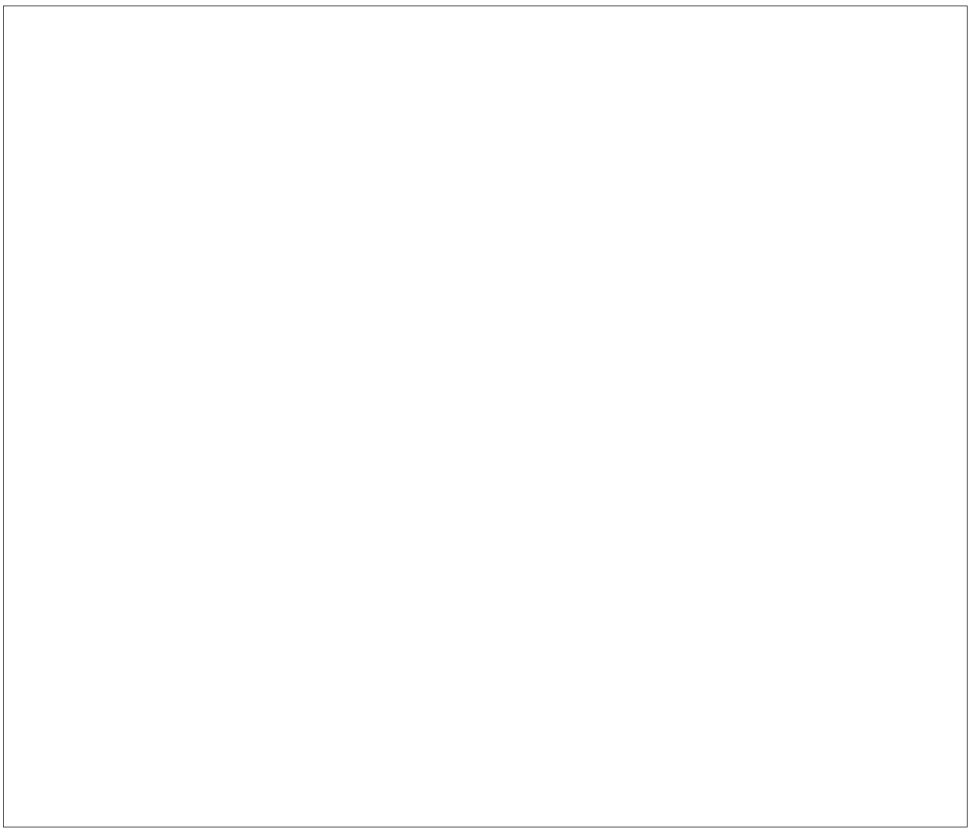
TABLE 3-1

RATE AND ATTITUDE PARAMETERS AT SUBSATELLITE SEPARATION

Parameter	Specified	Actual
Pitch H/S	±1.0 deg	+.22 deg
Roll H/S	±1.0 deg	-.68 deg
Roll Integrator	-	-.24 deg
Yaw Integrator	-	-.16 deg
Pitch Integrator	-	+.24 deg
Yaw Attitude	(-23.5 deg desired)	
Pitch Gyro Rate*	±0.1 deg/sec	-.07 deg/sec
Roll Gyro Rate	±0.1 deg/sec	+.03 deg/sec
Yaw Gyro Rate	±0.1 deg/sec	0
Maximum rates following separation:		
Pitch Gyro Rate*		-.07 deg/sec
Roll Gyro Rate		+.21 deg/sec
Yaw Gyro Rate		+.08 deg/sec

NOTE: The asterisk (*) denotes that the Geocentric Program rate is connected.

3.2.3 Payload Operations



3.2.4 Mapping Camera Module (MCM) Operations

3.2.4.1 MCM Calibration Maneuvers

The calibration maneuvers on Rev 965 consisted of a negative pitch maneuver of 160.1°, followed by four inertial periods, one for each calibration. The durations of the inertial periods were 160, 100, 120, and 110 seconds for Calibrations 1, 2, 3, and 4, respectively. The desired pitch attitudes at the beginning of each calibration were -60°, -149°, -142°, and -134° for Calibrations 1, 2, 3, and 4, respectively.

A positive pitch maneuver was performed after the calibrations to return to nose forward horizontal flight. Upon return to fine mode, the horizon sensor was reading .18°, indicating successful execution of the calibration sequence. The settling time for Calibration 1, the time from initiation of the pitch-down maneuver to the start of Frame 001, was 395.2 seconds. The settling time for Calibrations 2, 3, and 4, and time from the removal of geocentric rate to the start of Frame 001 was 16.65 seconds for each calibration. Settling times were well within the 600 seconds allowable.

3.2.4.2 MCM Recovery

The ST-RV (RV-5) recovery is performed with the SV yawed 180° and pitched down, with the release taking place along the SV X-axis. Vehicle rate and attitude parameters at RV-5 separation were nominal. RV-5 was separated during Rev 973 at a satellite vehicle time of 157167.2.

3.2.5 Recovery

The pitch-down maneuvers preceding RV-1 thru RV-4 separations were all within specification. The RV separation performance summary is shown in Table 3-3. It appears that the RV-4 separation impulse may have been in excess of the 166 lbs/second specification limit. Excessive separation impulse from RV-4 has also been observed on previous missions. Analyses have shown that observed RV-4 separation impulses will not adversely alter SV performance.

3.2.6 IRA 1021 Anomaly

The ACS performed normally until substantial noise on the roll gyro output of the PACS IRA 1021 was observed on Rev 1487. The noise increased on subsequent revs; therefore, the decision was made to transfer control to RACS. This transfer was accomplished on Rev 1501. Some of the larger noise spikes resulted in error signals which in turn caused spurious thruster firing.

A failure mode analysis of IRA 1021 concluded the most probable cause of the noise to be a random failure in the demodulator amplifier or a gain change amplifier, i.e., functional electronic blocks (FEBs). Problems have been encountered in the past with leaky field effect transistors (FETs), intermittent FEB pin connections, and cracked signal traces on FEBs.

FEBs in the demodulator and gain change amplifiers have been replaced on IRA 1026 and subsequent units. FETs were eliminated from the redesigned demodulator and gain change amplifiers.

3.2.7 HSA 1007 Anomaly

On Rev 1586, transients were noted on PACS HSA 1007. Intermittent transients were observed on subsequent revs. The vehicle attitude was not affected since control had been transferred to RACS.

Magnitude of the transients varied but in all cases exhibited a 5 second exponential decay after the transient peak. Other data indicated transients as large as -1.8° (coarse mode TM) in pitch and -.85° in roll. Since the pitch HSA signal is fed directly into the pitch rate channel, the transients were also seen on the pitch analogue rate output. Transients were large enough to have fired the thrusters if PACS had been the controlling system.

A failure mode analysis indicated the most probable cause of the transients is either a random failure in the comparator module of the right radiance channel of the HSA Electronics Box or a random failure in the right head electronics which results in a negative spike into the Mixer Box.

TABLE 3-3

SUMMARY OF RE-ENTRY VEHICLE/SATELLITE VEHICLE SEPARATION PERFORMANCE

RV/Rev	Peak Pitch Rate (deg/sec)	Max. Pitch Integrator Angle (degrees)	Induced Impulse By RV (lbs/sec)	Pitch-Down Prior to Sep (degrees)	Pitch-Up Following RV Sep to Removal of Maneuver Command (degrees)	Pitch Inertia (After Sep) (slug-ft^2)	Pitch Thruster Moment Arm (feet)	Roll Angle Spec (degrees)	Roll Angle Meas H/S (degrees)
1/228	1.14	4.1	107	-32.7	98.0	146446	27.13	±1.0	-.10
2/681	1.36	7.1	133	-35.8	98.2	123483	22.01	±1.0	-.06
3/1118	1.44	4.7	134	-35.7	99.1	94613	17.68	±1.0	-.06
4/1701	1.40	5.1	172	-36.5	100.0	83840	11.92	±1.0	-.08

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3.3 REACTION CONTROL SYSTEM (RCS)

3.3.1 Flight Summary

SV-8 was the second vehicle with a complete set of soft seat valves for the thrusters. Propellant was drawn from RCS Tanks 1 and 2 until Rev 938 when the Supply was switched to the OAS Tank. Control was maintained by the Primary RCS thru Rev 1082. At that time, the control function was switched to the Standby System (RCS-2) because the thrust on REAs-1 and 8 had seriously deteriorated. The flight was continued with the Standby Thrusters drawing propellant from RCS Tanks 3 and 4 until Rev 1742 when the Supply was switched to the OAS Tank.

REA and REM temperatures gave no indication of leakage throughout the flight.

3.3.2 Propellant Consumption.

The RCS propellant consumption averaged 3 pounds/day on the Primary RCS. Over the first 938 revs, the RCS-2 averaged 4.0 pounds/day over 685 revs that included the SSP maneuvers and Solo activities.

3.3.3 Thruster Performance

RCS-1 thrust levels were determined using individual REA chamber pressures. Figure 3-1 is a history of the normalized thrust. The dashed lines are the $\pm 8\%$ run-to-run tolerance allowed. As can be seen, REAs -1 and 8 were seriously degraded while REA-7 was just starting to degrade when the control function was switched on Rev 1083. RCS-1 was re-activated on Rev 1761 for a two rev thruster performance evaluation during Solo operations. REAs -1 and 8 of RCS-1 produced less thrust during this test than they did just prior to the switch to RCS-2. Similarly, REAs -3 and 7 of RCS-1 exhibited a marked decrease in thrust output during the Solo re-activation. No explanation currently exists for thruster degradation after dormant periods.

The estimated total pulse count for RCS-1 thru Rev 1083 is shown in Table 3-4.

TABLE 3-4

RCS-1 PULSE COUNT SUMMARY

REA	TOTAL COUNT	AVERAGE COUNT/DAY
1	22,500	338
2	8,000	120
3	83,000	1,240
4	5,000	34
5	6,000	40
6	6,600	79
7	117,000	1,750
8	5,000	34

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NORMALIZED THRUST HISTORY

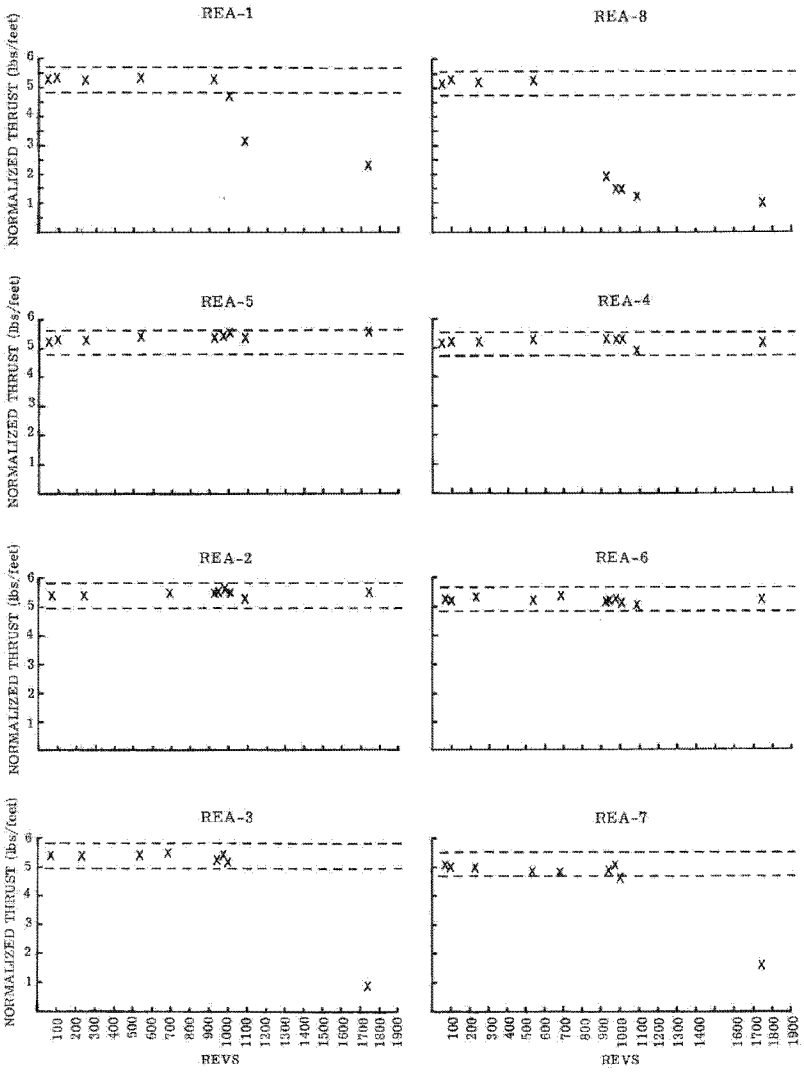

FIGURE 3-1

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The technique used to estimate the total pulse count is restricted by the sample rate attainable. Past flight tests have shown that on the high duty cycle engines the total count may be accurate within ±30 percent. The total pulse count on the low duty cycle engines is only accurate enough to establish them as low duty cycle.

3.4 ORBIT ADJUST SYSTEM (OAS)

3.4.1 Orbit Control

The Orbit Adjust System was used a total of 46 times during the mission. The orbit adjust firings were all normal and engine performance was within specifications. The catalyst bed resistance factor history was similar to that of other flight engines, exhibiting an initial increase followed by a period of decline. Orbit adjust burns occurred every three days with an adjustment of perigee location every nine days.

3.4.2 Deboost

The deboost was successfully accomplished with one 231 second firing, followed by a firing to obtain propellant depletion. The depletion was observed to occur at approximately 185 seconds into the burn, close to the predicted time. Engine performance was normal during the deboost and depletion operations.

3.5 LIFEBOAT II SYSTEM

On SV-8, the Type 29 Batteries were carried in Bays 3 and 4, and, therefore, had less influence on the Lifeboat Magnetometers in Bay 9. The equivalent attitude errors of the Q, P, and R magnetometers were less than .5 degree. The three rate gyros were within .05 degrees/second of the rates monitored on the ACS gyros. On Rev 1474, a calibration test was conducted prior to a Solo test wherein Lifeboat II would control the vehicle. The calibration showed that the small induced magnetic distortion effects fell within the error allocation for such errors. No anomalies were noted.

3.6 ELECTRICAL DISTRIBUTION AND POWER (EDAP)

3.6.1 Solar Arrays

Solar arrays were extended on Rev 1. Power output from each leg exceeded the specification value. Degradation from normal orbit environments was 2.8% (average of four legs) after 107 days (1,701 revs) in orbit.

3.6.2 Main Bus Voltage

The main bus voltage varied from 26.6 to 31.3 volts. The allowable range is 25.5 to 33.0 volts. Low range voltage was obtained during payload operations with a bus load of 62 amps. High voltage data was gathered during charge cycles.

3.6.3 Power Capability and Usage

Power usage ranged from 325 to 387 amp-hours/day. The 390 amp-hour/day capability was not

exceeded during this mission. Excess capability was demonstrated with K2s occurring a minimum of once per day.

3.6.4 Type 29 Main Battery Performance

All Type 29 Batteries operated normally and in a desirable environment (44°F to 50°F) throughout the mission. The No. 1 main battery heater experienced abnormal cycling patterns during Revs 1002 thru 1008 and 1135 thru 1141 which were similar to the anomalies observed on SV-6 and SV-7. A solid state thermal control device, replacing the present thermostats, will be incorporated starting with SV-11; however, in the interim, additional testing is being performed to screen out malfunctioning thermostats.

3.6.5 Pyro Battery Performance

Pyro Battery 1 stabilized at 49°F to 50°F which minimized self discharge during the mission. Lift-off capacity was 11.27 amp-hours. After 107 days and additional usage for instrumentation and self discharge, a residual capacity of 5.84 amp-hours remained. There was still 11 days of life available at the end of the primary mission.

Pyro Battery 2 followed the same pattern except that there was 7 days of cell degradation life remaining.

3.6.6 Lifeboat Battery Performance

The Lifeboat battery operated normally in a 47°F environment throughout the entire mission. A total of 229 amp-hours remained at the end of 107 mission days from an initial 360 amp-hours at launch. Remaining cell degradation life was 10 days.

3.7 TRACKING, TELEMETRY, AND COMMAND (TT&C)

3.7.1 Tracking

Tracking performance was satisfactory throughout the flight. Although there was no affect on the mission, reduced power output from the SGLS-2 Transmitter was reported after a health check on Rev 1426. Subsequent analysis revealed that the transmitter power level had been reduced as early as Rev 746. This anomaly is similar to a 25 to 30 dBm reduction in transmitter power output experienced on the SV-5 transmitter during Solo. The SV-5 anomaly was attributed to a loss of pressure in a sealed RF cavity of the transmitter output. As a result, a second epoxy seal was added to the rear of the cavity and additional leak rate testing was conducted on the remaining transmitters. A leak and resulting corona in the sealed cavity is also the most probable cause of the SV-8 anomaly, but this time the front seal of the cavity is suspect.

Corrective action on remaining Block II Cubic Transmitters will consist of: (1) individually evaluating each as to the need for additional leak rate tests, (2) widening of a marginal gap on an RF Amplifier Board, and (3) resealing and repressurization of the RF cavity.

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3.7.2 Telemetry

3.7.2.1 General Performance

Telemetry System performance was satisfactory until Rev 1203 when the PCM Remote Unit 4A (RU-4A) in the Mid-section failed to come "on" as programmed at the start of a Tape Recorder (T/R) record sequence. RU-4B was subsequently programmed on for a T/R record sequence between POGO and GUAM on Rev 1024. Playback revealed satisfactory receipt of normal data, and isolated the problem to RU-4A. Two revs of real time Mid-section data were lost before the Telemetry System was configured to use RU-4B; however, this did not curtail or postpone any payload operations. A diagnostic test during the Rev 1037 KODI pass in which RU-4A and RU-4B were both commanded allowed an evaluation of the RU-4A power input circuitry via monitor H462 (PCM Remote Unit 4A On/Off Monitor). This evaluation revealed that the power input circuitry (fuse and on/off switch) was operational, but that the RU-4A did not reply to the PCM Master Unit request for data.

All later operations utilized RU-4B with exception of the Quantic Experiments for which RU-4A was programmed "on", since the Mid-section data was not relevant to the Quantic operations. The use of RU-4B was restricted to support of the primary mission to reduce the number of on/off cycles and operational time. RU-4A failed to respond on any of the Quantic operations when it was programmed "on".

All other operations of the Telemetry System were satisfactory throughout the mission.

All RU failures, both Block I and II, that resulted in no reply were power supply failures. These RU failures which have occurred at the vendors facility are being reviewed in an effort to isolate the most probable cause. As of this date, failure data has not revealed evidence of a generic problem.

3.7.2.2 Ascent FM/FM Telemetry

The performance of the ascent FM/FM Telemetry System via the SGLS-1 1.7 MHz FM Subcarrier Link was good except for the failure of one vibration transducer located on the Y-axis at Station 1642. Data from all other transducers was reported as being good.

3.7.2.3 Instrumentation

Table 3-5 presents the instrumentation anomalies at lift-off.

TABLE 3-5

INSTRUMENTATION ANOMALIES AT LIFT-OFF

Monitor Number	Item	Condition
S152	D Low SH + LS Temp 1	Open, 5.06 TMV
H370	Time Word Converter No. 1 Voltage	Will read low by about 80 MV
H371	Time Word Converter No. 2 Voltage	
B511	OAS Tank Temp 1	Single samples may read in error
P902	TP Drive 1B Sun Error	Randomly reads "O" TMV
P367	CPA+	May fail limits at C-
P368	CPB+	

3.7.2.4 T&T Equipment On/Off Cycles and Operating Time

The utilization through Rev 1701 of selected T&T equipment is summarized in Table 3-6.

TABLE 3-6

TRACKING AND TELEMETRY EQUIPMENT

ON/OFF CYCLES AND OPERATING TIMES

Primary Equipment	On/Off Cycle	Operating Time (hours)
SGLS-1	1952	195.44
T/R-1	7572	427.80
PCM-1 (*)	8180	571.60

NOTE: The asterisk (*) means that the PCM-1 values includes both RU-4A and RU-4B time.

RU-4A had approximately 5,623 on/off cycles and 327.67 operating hours at the time of failure on Rev 1023.

3.7.3 Command

3.7.3.1 General

The vehicle SGLS command equipment was utilized to receive more than 19 million bits with no vehicle problem indications.

3.7.3.2 GFE Command System

A. Extended Command System (ECS)

The ECS responded satisfactorily in all command modes resulting in the loading of

245,657 Stored Program Commands (SPCs) in memory. Of these 104,216 SPCs were output by both PMUs for decoder processing. The remainder were erased prior to their time label matches. There were no command rejects attributable to the ECS.

B. Minimal Command System (MCS)

The MCS responded correctly to all commanding. The MCS was commanded into the Operate Mode on Rev 18.

C. Remote Decoder/Backup Decoder

The Remote Decoder was used for each of the five recoveries. The performance of both channels was verified from telemetry to be proper in each case. One command was issued from the Backup Decoder on Rev 18.

D. Command System Usage Summary

Table 3-7 presents a summary of the Command System usage through Rev 1701.

TABLE 3-7

COMMAND SYSTEM USAGE SUMMARY

(hours)

System	Total Operating Time
ECS	2502.8
MCS	6.0
Remote Decoder	8.3
Backup Decoder	0.05

3.8 MASS PROPERTIES

A history of SV mass properties throughout the flight are tabulated in Table 3-8.

3.9 PREFLIGHT WINDS ALOFT LOADS ANALYSIS

A series of nine preflight winds aloft observations were made using Rawinsonde balloon soundings over a three-day span (8 April to 10 April 1974). The results are plotted in Figure 3-2.

The 8 April 1974 results were within the established critical 100% criteria for all monitored parameters. As a result of this data, it was decided to "go" with the launch recommendation; however, a ground equipment problem developed which caused a 24 hour launch delay.

The 9 April 1974 results indicated excessive booster TVC fluid usage for control and also one instance of exceeding the maximum Alpha Q Bar constraint. The data indicated an increasing winds aloft trend, consequently the launch was delayed 24 hours.

The 10 April 1974 data initially (T-12.3 and T-6 hours) violated the booster specified TVC fluid usage; however, the succeeding data analysis indicated a decreasing winds aloft trend which became acceptable,

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TABLE 3-8

MASS PROPERTIES

Description	Weight (lb)	Center of Gravity (inches) X	Y	Z
At Launch	25682	1972.4	0.93	3.43
At Injection	22905	1985.5	1.03	3.88
Sep from Stage 2	22676	1983.3	1.04	3.88
After Subsats Ejected	21892	1989.8	1.02	4.50
After RV-1 Sep	19914	2001.2	1.14	4.21
After RV-2 Sep	17431	2005.7	1.30	4.08
After RV-5 Sep	16417	2005.2	1.38	5.35
After RV-3 Sep	14721	2018.8	1.54	4.57
After RV-4 Sep	12243	2017.1	1.85	3.79
Prior to Deboost	12082	2014.9	1.87	3.64
End Deboost	11836	2011.6	1.91	3.71

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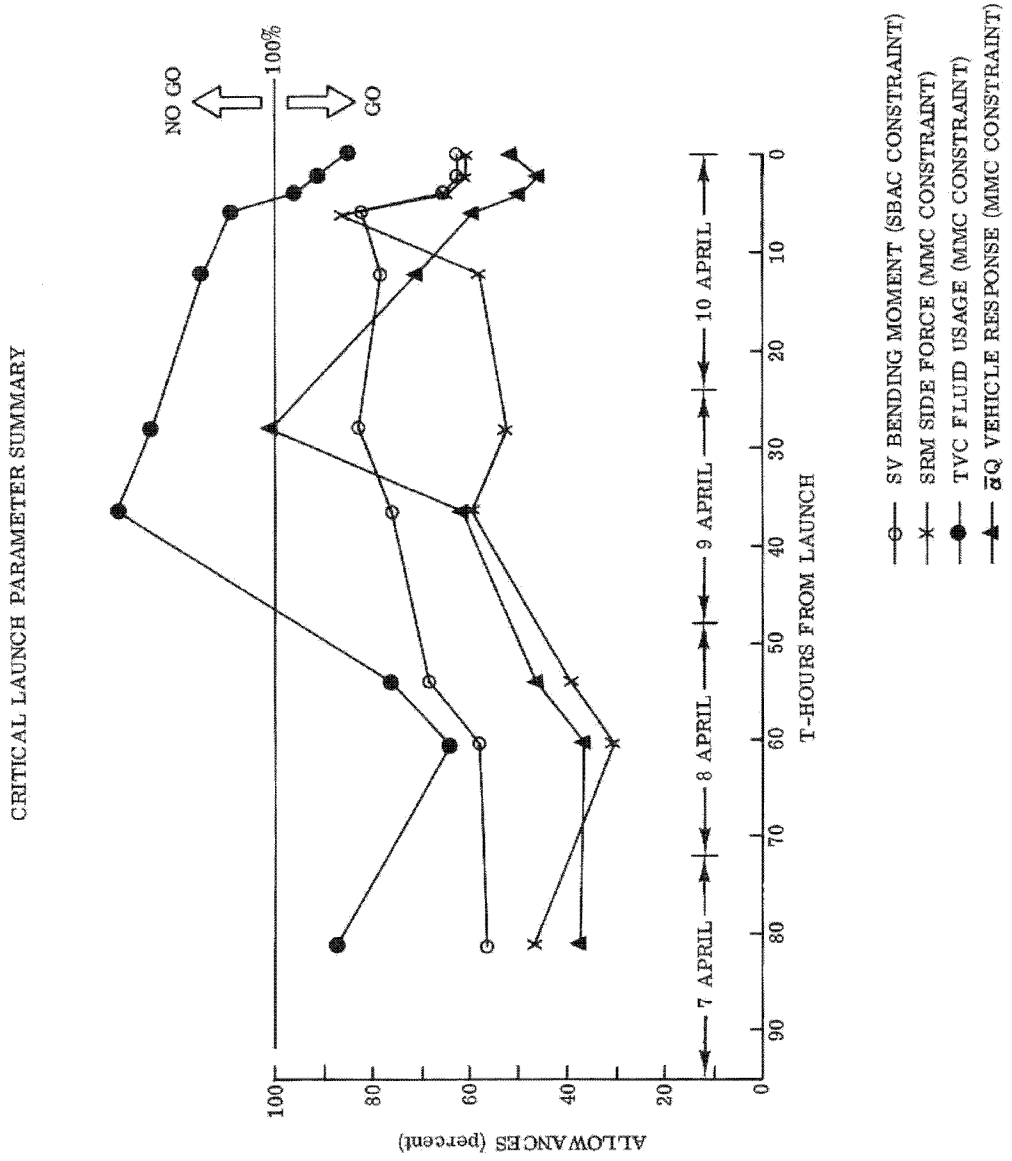

FIGURE 3-2

i.e., less than the 100% allowable, at T-4 and again at T-2.6. Consequently, a "go" for launch recommendation was issued.

3.10 SOLAR ARRAY (SA)

Deployment and erection time histories for the Solar Arrays were nominal. The arrays were deployed at the first station pass (INDI) and were repositioned from 18° to 0° at KODI on Rev 1 for maximum output at the initial flight beta angle of -2.6 degrees. The arrays were repositioned on Rev 713 to 10.7° on the right and 12.5° on the left when the beta angle reached 7.6 degrees. On Rev 1134, the arrays were repositioned to 18° when the beta angle reached 15.2 degrees.

3.11 THERMAL CONTROL

3.11.1 Mid and Forward-sections Including MCM

Flight data indicates that average section temperatures were well within the required design limits. No design changes are forthcoming as a result of SV-8 flight experience.

3.11.2 Active Thermal Control (ATC)

The Active Thermal Control reference temperature in the Mid-section remained relatively constant throughout the flight.

The change in orbital beta angle that occurred during the flight would, by itself, have produced an obvious change in temperature. The seasonal change in solar constant, due to change in distance from the sun, appeared to counteract the effect of beta angle. Another factor which could have possibly counteracted the effect of beta angle is the cooling trend experienced on some of the previous flights. This cooling trend was noted up to 1°F per week. The RV heater control zones, which are actively controlled to the reference temperature, were generally at the desired temperature.

3.11.3 Aft-section

Acceptable Aft-section temperature control was maintained throughout the flight. All equipment temperatures remained within the design limits.

The SV-8 Aft-section was configured to accommodate a beta angle range of -15° to +60° as follows:

A. Batteries were relocated to Bays 3 and 4.

B. More Flexible Optical Solar Reflector (FOSR) was used in the new paint pattern, see Figure 3-3.

C. RCS Tanks 1, 2, 3, and 4 were all installed.

Equipment and structural temperatures indicated contamination degradation to external thermal control surfaces similar to that observed on previous flights. The amount of degradation was within the bounds of preflight analysis.

The wide beta range flown on SV-8 provided an opportunity to observe the performance of the new Aft-section thermal design over a variety of environmental conditions. The close correlation of

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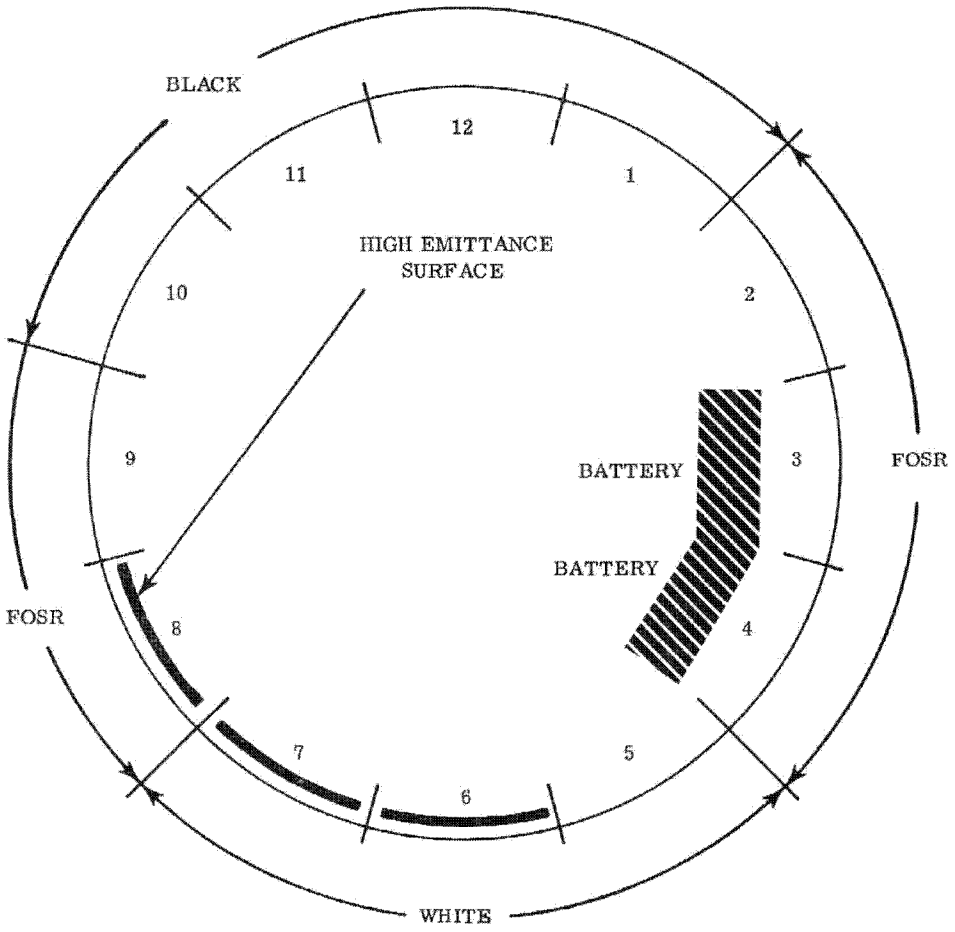
AFT-SECTION PAINT PATTERN

(AFT VIEW OF VEHICLE LOOKING FORWARD)



NOTE: OAM-RCM: RCS skins Bays 3 and 4 all white, while the remainder are all black/aluminum.

FIGURE 3-3

equipment temperature levels with preflight predictions over the beta range -2.6° to +28° substantiates the predicted capabilities of this design.

3.12 ASCENT DYNAMIC CHARACTERISTICS EXPERIMENT

3.12.1 Description

Analytical predictions of structural responses to the Stage I shutdown event have been significantly larger than those obtained from flight data in the lateral direction. The magnitude has been that the predicted peak responses have been two to three times that of the actual flight values. In order to improve the analytical model with respect to frequency response and structural damping, the Ascent Dynamic Characteristics Experiment was flown on SV-8. Eighteen accelerometers were installed. All accelerometers appear to have given credible results except for the Y accelerometer at Station 1644, which failed. The reason for this failure is unknown.

3.12.2 Results

The analytical model improvement process is currently underway. Flight data is being filtered in various frequency bands and utilized to give indications of the real system frequency and mode shape characteristics. The flight data has revealed more damping exists than previously assumed. For example, utilizing the system model damping indicated in the flight data rather than the 1% damping in all modes previously assumed, the margin of safety for the Mapping Camera support structure changed from a negative margin to positive. Complete results of the dynamic model refinements will be published in a final report of this experiment.

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SECTION IV

PAYLOADS

4.1 SENSOR SUBSYSTEM

4.1.1 Camera Operations and Performance

Mission 1208, the second of the Block II systems, was a successful operation. The entire supply of film was utilized with over 215,000' of film being recovered. Of this amount, 2,588' were SO-255 Color Film, 3,036' were FE-3916 IR (false color) Film, and the remainder was 1414 Black and White Film. During the course of the mission, there were two anomalies that resulted in system malfunctions. Operational contingency modes that did not impact system performance were employed to bypass these anomalies.

This mission was the first to incorporate the Servo Inhibit Assembly (SIA), which inhibits the drive servos from dithering when the recycle profile is at pause. It also was the first vehicle to incorporate the metering capstan settling time fix. This improves film to optical bar synchronization in the first few degrees of photography. These design improvements performed well during the mission.

4.1.2 Camera Data

The Panoramic Camera data for Mission 1208 is summarized in Table 4-1.

TABLE 4-1

CAMERA STATISTICS

Parameter	Forward Camera	Aft Camera
Camera Designation	A	B
Film	1414	1414/SO-255/FE-3916
Focal Length (inches)	59.9760	59.9890
Equivalent Filter Type	W-12*/2E3	W-12/2E3
Initial Focus Setting (microns)	68	25/55
Supply Footage (feet)	108,981	101,088/2,588/3,036
Supply Spool No.	5077	5076
Supply Film Weight (lbs)	862	861
Optical Set Numbers	035	037
Initial Pneumatics (lbs)	35.4	
Estimated Remaining Pneumatics (lbs)	2.3	

NOTE: The asterisk (*) means that the W-12 Filter on the Forward Camera was used throughout the mission.

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4.1.3 Camera Operations

Mission 1208 was the longest active photographic mission to date with RV-4 recovery on Day 106. The other recoveries were on Day 15, 43, and 70. The Solo phase extended the vehicle life to Day 109.

Film footage for each camera and mission segment is broken down by each 15° segment, see Table 4-2.

TABLE 4-2

DISTRIBUTION OF FILM FOOTAGE PER SCAN SECTOR

(feet)

Mission Segment	Camera	Scan Sector (degrees) -60 to -45	-45 to -30	-30 to -15	-15 to 0	0 to 15	15 to 30	30 to 45	45 to 60
1208-1	Fwd	879	2649	3279	3422	3369	3115	2713	979
	Aft	879	2639	3204	3423	3369	3114	2713	979
1208-2	Fwd	661	2792	3714	3784	3416	3259	2773	730
	Aft	623	2695	3615	3684	3317	3160	2641	657
1208-3	Fwd	490	2247	2686	3222	3178	3445	2978	420
	Aft	479	2162	2577	3084	3051	3318	2852	396
1208-4	Fwd	91	2585	3168	3626	3933	3182	2668	150
	Aft	91	2581	3040	3792	3904	3198	2684	150

The number of frames for each camera and mission segment acquired in each of the four scan modes is given in Table 4-3.

TABLE 4-3

DISTRIBUTION OF FRAMES PER SCAN MODE

(frames)

Mission Segment	Camera	Scan Mode (degrees) 30	60	90	120
1208-1	Forward	763	1238	1149	270
	Aft	763	1238	1149	270
1208-2	Forward	2115	1344	934	117
	Aft	2063	1340	858	117
1208-3	Forward	2003	1316	778	41
	Aft	1986	1264	723	41
1208-4	Forward	1059	1911	853	0
	Aft	1088	1889	853	0

Operational photography began on Rev 5, Op 4 and continued with no camera system malfunctions until Rev 980 when the system failed to execute two operations. This failure was the result of a missing Forward Camera Take-up Builder Roller down verification interlock signal. Operations were resumed on Rev 996 with the system configured in SCC II with the Builder Roller down verification interlock disabled (VIA-DIS). When transfer to RV-4 was made, VIA was re-enabled and operated satisfactorily for the remaining portion of the mission.

On Rev 1268, the system shut down due to a failure of the Aft Camera Take-up Integrator Servo to reset at TU brakes-off. This failure necessitated eliminating nested operations when operations were resumed on Rev 1300. The system continued to operate normally for the rest of the mission.

For the first time in eight missions, it became necessary to actuate the Pneumatic System to maintain the film path pressure above the ballooning criterion. The combination of short operations with corresponding small increases in path pressure, separated by long quiescent periods, caused the repeated occurrence of the low pressure condition.

4.1.4 Focus

Thru Focus Engineering Tests showed the need to change focus on the Forward Camera by +8 microns for 1414 Film. The Aft Camera prelaunch setting was correct for orbital operation. The change was accomplished on Op 156 of RV-2. Focus for the SO-255 was examined subjectively and was found to be near optimum.

4.1.5 Film Synchronization

The ground image motion compensation settings for Film Type 1414 were correct for the Forward Camera in-track and Aft Camera cross-track directions. Minor changes were made on-orbit to the Forward Camera (Op 399) cross-track and Aft Camera (Op 160) in-track directions of +.013 inch/second and -.024 inch/second respectively. The film synchronization for the SO-255 Color Film was subjectively judged to be adequate. The inherent low image quality of the false color FE-3916 Film, rendered smear slit evaluation of this film's synchronization impossible.

Image motion variability for Mission 1208 was similar to that of 1207 and showed that it was within the SV design criteria.

4.1.6 Photographic Image Quality

Photographic image quality of Mission 1208 was good. The Aft Camera imagery was considered slightly better than that from the Forward Camera. The mean 2:1 contrast VEM resolution performance was 151 cycles/mm with peak resolution being at 199 cycles/mm. The ground resolved distance from the 12 CORN tribar acquisitions read from 1.8' to 2.6', format location and incident contrast being variable. CORN target data adjusted to 2:1 contrast is shown in Table 4-4. Two acquisitions from the color and two from the infrared films read 3.2' and 5.6' respectively. The image quality of Mission 1208 was comparable with previous missions.

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TABLE 4-4

CORN TRIBAR ACQUISITIONS NORMALIZED TO 2:1 CONTRAST

— Forward Camera —

Op	Frame	Scan Angle (degrees)	Field Angle (degrees)	GRD (feet) IT	GRD (feet) CT	GRD (feet) GM	RP (cycles/mm) IT	RP (cycles/mm) CT	RP (cycles/mm) GM
84	004	1.1	-0.8	2.1	2.4	2.2	169	140	154
311	012	16.0	-1.7	2.0	2.6	2.3	179	141	159
397	003	11.0	-1.5	1.9	2.8	2.3	186	127	154
620	003	21.0	1.9	2.7	4.0	3.3	139	100	118
641	004	-16.0	-0.3	2.6	2.9	2.7	140	128	134
745	003	-8.0	-2.3	2.2	2.8	2.5	156	124	139
758	003	-27.5	0.5	3.2	4.4	3.8	121	100	110
764	003	14.0	0.0	2.4	3.6	3.0	146	101	121
			— Aft Camera —						
184	004	-0.4	-2.0	1.9	2.7	2.2	187	125	153
314	012	16.7	-1.5	2.0	2.5	2.3	178	150	163
397	003	11.0	-1.3	1.4	2.3	1.8	250	158	199
620	004	22.0	0.1	2.1	2.7	2.4	181	151	165

VEM analysis showed that the optical field curvature was essentially flat with little or no platen tilt required. The on-orbit resolution, as measured by VEM, is comparable to the best performance in ground testing except for the Forward Camera in-track direction which is at most 15% low.

4.1.7 Exposure

The new exposure algorithm used for Mission 1208 black and white film was successful; this algorithm includes a .06 log E reduction on the Aft Camera. The SO-255 and FE-3916 were overexposed by about .10 log E. These films were flown on the Aft Camera and were not given the .06 log E reduction in exposure. Thus, it is recommended for future missions that SO-255 Color and FE-3916 IR false color

films on the Aft Camera include this bias.

Frequent instances of dirty and/or melted snow in prime areas of interest indicate that snow bias techniques should be suspended on late spring and summer missions.

4.1.8 Engineering Tests

Twelve engineering tests were defined in the SV-8 Engineering Photography Plan. This series of tests was designed to acquire data for assessment of on-orbit camera, lens, and film performance. Table 4-5 is a summary of the objective and status of each test.

TABLE 4-5

1208 ENGINEERING TESTS

Test	Objective	Status
1. Thru Focus (1414)	Optimize focus.	Accomplished; confirmed focus (1414) was optimum in RV-2.
2. Smear Slits (1414)	Validate IMC settings.	Completed in RV-2.
3. Smear Slits (SO-255)	Evaluate smear slit for validating SO-255 IMC settings.	Not accomplished; no operations due to limited SO-255 film.
4. Smear Slits (FE-3916)	Evaluate smear slit for validating FE-3916 IMC settings.	Completed in RV-4.
5. CORN Acquisitions (SO-255)	Evaluate and radiometrically calibrate SO-255.	Completed in RV-4.
6. CORN Acquisitions (FE-3916)	Evaluate image quality of FE-3916.	Accomplished in RV-4.
7. Lens MTF (1414)	Measure on-orbit lens MTF.	Completed in RV-3.
8. Tucson Acquisition	Standard scene for quality assessment.	Completed in RV-1, 2, 3, and 4.
9. Color Thru Focus (SO-255)	Optimize focus.	Completed in RV-4.
10. Tribars for Resolution	Photo quality assessment.	Satisfied in RV-1, 2, 3, and 4. Acquisitions common with Test 7.
11. Smear Versus Scan Angle (1414)	Assess smear as a function of scan angle location.	Completed in RV-3.
12. Dense Culture Acquisition (1414)	Photo/EM correlation.	Satisfied in RV-1, 2, 3, and 4.

4.1.9 Processing and Reproduction

Defilming of all RVs was accomplished without major difficulty except on RV-3. The RV-3 Aft core locking pin had been bent and required that the pin assembly be drilled out which caused minor damage

to the TUA. The processing of the SO-255 and FE-3916 was accomplished without incidence.

During processing of the 1414 Film on 1208-1, an abnormally high base fog level was noted on some portions of both the Forward and Aft material. The high base fog was associated with specific manufactured film rolls. The probable cause was a film backing contamination which, when in contact with the emulsion, caused a fog buildup with time. Subsequent mission segments which had this suspect material were given 26 DN processing, which reduced the fog and retained the desirable sensitometric curve shape.

4.1.10 Exploitation Suitability

The overall interpretation suitability for 1208 was better than that of Mission 1207. These are the only missions that have been rated with the new National Imagery Interpretation Rating Scale (NIIRS). The average NIIRS rating for Mission 1208 was 3.9 while for 1207 it was 3.7.

Mission 1208 was affected by front-lighting conditions and specular reflections. Subsequent studies showed that the camera-target-sun (CATS) angle below which front-lighting becomes detrimental to PI readout is about 7 degrees.

Color balance of the color DP was found to be significantly improved over Mission 1207; however, in some cases the contrast was found to be unsatisfactory.

4.2 MAPPING CAMERA SUBSYSTEM

4.2.1 Mapping Camera Operations and Performance

The Mission 1208 Mapping Camera Subsystem (RV-5) operated on 171 revs between Rev 2 and Rev 966 with Recovery on Rev 973. A total of 2,045 frames were exposed in the Terrain Camera and a corresponding number of frame pairs were exposed in the Stellar unit. Those frames included were 18 of Film Type 3414 in the Terrain Camera for engineering purposes and 20 frames in each camera for in-flight Stellar calibration.

Post flight analyses conducted at the processing site, the contractor's facility, and Defense Mapping Agency Topographic Center (DMATC) have shown that mission objectives were met with a high level of success. The Terrain imagery was comparable to the best of past missions and an adequate distribution of sixth magnitude stars was acquired on the Stellar frames. The ancillary data generated by both units was acceptable.

Weather conditions for the first half of the mission were generally good. However, as the mission progressed, weather conditions deteriorated resulting in 30% or more cloud cover on approximately 25% of all Terrain frames.

Table 4-6 summarizes the significant Mapping Camera Subsystem activities.

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TABLE 4-6

SUMMARY OF SIGNIFICANT MAPPING CAMERA SUBSYSTEM ACTIVITIES

Rev	Activity	Event
-	Ascent	No anomalies.
2	Photography	Health check with programmed ocean photography.
48	Photography	Bar XC acquisition.
129	Photography	Bar XC acquisition.
388	Photography	Bar XC acquisition.
566	Photography	Bar XC acquisition.
954	Photography	3414 engineering.
955	Photography	3414 engineering.
958	Photography	3414 engineering.
965	Photography	ST in-flight calibration (4 operates).
969	Film runout	Successful Stellar film runout event.
973	RV-5 recovery	Successful air recovery.

4.2.2 Mapping Camera Subsystem Data

The Mapping Camera Subsystem data for Mission 1208 is presented in Table 4-7.

TABLE 4-7

MAPPING CAMERA SUBSYSTEM STATISTICS

		Stellar	
Camera Designations	Terrain	+Y	-Y
Focal Length (inches)	12.0772	9.9784	9.9780
Filter Type	WR-21	None	None
Reseau S/N	012	029	024
Lens S/N	006	012	005
Supply Spool S/N	094	107	
Supply Film Weight (lbs)	58.03	10.99	

— Film Data —

Terrain					
Type	3400	MCD	3414	MCD	3401
Length (feet)	3,301	2.0	30	2.0	30
Stellar					
Type	3401		3400		
Length (feet)	1,966		100		

4.2.3 Image Quality

The majority of the Terrain photography was good and appeared consistent throughout the flight. The average resolution derived by VEM analysis was 60 cycles/mm. Stellar imagery was good for both the Plus (+) and Minus (-) Y units. On evaluated frames, each camera recorded between 75 and 100 star images.

As on Mission 1207, a 30' length of 3414 was added to the Terrain film Supply for special engineering tests. A subjective evaluation of the 3414 Engineering Test was conducted at the processing site by the PFA Team and at the contractor's facility. The imagery on 3414 was judged to be significantly better than imagery on 3400. The level of performance was measured at approximately 90 to 100 cycles/mm; however, it is important to note that the sampling consisted of only 18 frames and, therefore, there were only limited cultural areas available. A direct comparison of targets covered by 3400 and 3414 was not possible, nor was it possible to objectively analyze the 3414 performance.

Data acquired from 3414 Engineering Tests during Missions 1207 and 1208 provide empirical support for using 3414 as the primary Terrain film load on 1209 and subsequent missions.

During the runout sequence, a special tag end of 3400 was exposed to judge this film's potential as the primary load in the Stellar Camera System. All the film was recovered successfully and evaluation of the imagery is in progress.

4.2.4 Exposure

Density measurements made at the processing facility indicated that the exposure levels for 1208 were correct. Essentially, exposure levels were the same for Missions 1206, 1207, and 1208.

Exposure times for the special engineering test with 3414 Film were manually programmed and produced properly exposed imagery.

4.2.5 Thermal Profile

There were no thermal control problems. Paint patterns, the same as those on 1207, provided excellent thermal distribution on the MISEA and EDAP Assemblies.

4.2.6 Pressure Profile

Average film path pressure stabilized at 22 micrometers, a decrease of approximately 20 micrometers from the average level of Mission 1207. This decrease was planned in order to supply pressure levels that were compatible with corona-free pressure marks experienced during ground testing. A maximum of 47 micrometers and a minimum of 10 micrometers were recorded during the flight.

4.2.7 On-Orbit Calibration

In addition to the preflight calibration data, two additional calibration steps are conducted in-flight. The two in-flight calibrations, range and stellar, are distinctly different operations.

Range calibration is conducted while operating the camera in the normal mode over a ground range

containing accurately measured control points. A typical range is the Bar XC located in the Arizona/ New Mexico area.

Stellar calibration was accomplished in four separate operations at the end of Mission 1208. This calibration required the vehicle to be pitched to an attitude that pointed all three camera lenses at the stars. The camera system was then operated in the calibrate (C) mode to record star imagery on the Terrain and Stellar formats simultaneously. Evaluation is currently in progress to determine the calibration potential of the star imagery.

4.2.8 Summary of Anomalies

There were no telemetry or system anomalies.

4.2.9 Exploitation Suitability

The technical analysis of the Mission 1208 imagery by the DMA Post Flight Analysis Team included a comparison of the photography with the system specifications. As a result of the instrument measurements and various other metric evaluations, it was determined that the system satisfied all critical performance requirements.

4.2.10 Processing and Reproduction

The RV arrived at the processing site in good condition at 1120 EDT, 10 June 1974. The anti-backup solenoids on both the Terrain and Stellar Take-ups functioned properly.

All camera records were processed on 10 and 11 June 1974. The 3400 Terrain record was cut at the head of the processor on Frame 004, Op 65 because of the inability of the titling equipment to maintain synchronization. After the problem was resolved, processing proceeded without incident.

There was 71.8% of the Terrain 3400 Film optically titled. The majority of the frames not optically titled were contained in the first 1,200' of imagery (Ops 1-64). The titling problem was caused by an electrical malfunction in the connection to the amplifier which interfaces with the frame mark detector in the optical titling hardware.

The Stellar 3401 was not optically titled because of equipment inability to read frame marks at the point of detection (film 1/4 processed). It appears that the delta density between the base plus fog and frame mark density was insufficient for detection by the optical titling equipment. The processing facility has taken the action to investigate the optical titling of 3401 with high base plus fog densities.

All duplicate copies were printed on the Kingston Printer. Duplicate positives of the Terrain 3400 and 3401 Films were prepared using Kodak Aerial Duplicating Film (Estar base) SO-284 and those for the 3414 Film were prepared using Kodak High Resolution Aerial Duplicating Film (Estar base) SO-192. Duplicate positives of the Stellar record were prepared using Kodak Aerographic Duplicating Film (Estar base) 2420. All duplicate negatives were prepared using Kodak Direct Duplicating Aerial Film (Estar base) 2422. Viscous Dalton processors were utilized for all duplicate processing.

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4.4 SUBSATELLITES

Two subsatellites were carried into orbit on SV-8. One subsatellite is Minus (-) Y side of the Forward-section and the other on the Plus (+) Y side. The +Y satellite was properly ejected on Rev 3. The -Y satellite was properly ejected on Rev 13 after an SV yaw maneuver of 19 degrees.

4.5 SV-8 QUANTIC FLIGHT EXPERIMENT

4.5.1 Description

The Quantic Experiment utilized a Quantic Industries Horizon Sensing and Star Tracking System. The Horizon Sensing System (HSS) was comprised of four independent Horizon Trackers (H/T) and a Central Electronics Unit (CEU). The CEU processed the H/T angle outputs to form vehicle pitch and roll attitude estimates. The HSS CEU also provided HSS power and telemetry data processing. Two independent Star Trackers and an additional CEU comprised the Star Tracking System (STS).

4.5.2 Objectives

The main objectives of the Quantic Flight Experiment were:

A. Design an experiment which approaches a true flight configuration for both the Horizon and Star Sensing Attitude Measurement Systems.

B. Determine the accuracy of the Quantic HSS, STS, and Barnes Horizon Sensor by using the combination of the experiment sensors. The Barnes Horizon Sensor is presently being used in the Attitude Control System of the HEXAGON Vehicle.

C. Evaluate the flight performance of the HSS and STS to determine whether or not critical performance specifications are met.

D. Develop the experience required to interface the HSS with the HEXAGON Vehicle.

E. Obtain information regarding the effect of horizon radiance noise on both the Quantic and Barnes Horizon Sensors.

4.5.3 Experiment Configuration

Because of the selected geometry for mounting the experiment trackers on the HEXAGON Vehicle, it was not possible to mount all trackers on the same integral structure. Figure 4-1 portrays the Quantic Experiment Configuration. Three of the four Horizon Trackers were mounted on a large pylon which was bolted to the Aft bulkhead near Bay 8. The fourth Horizon Tracker was mounted on a small pylon which was bolted on the Aft bulkhead near Bay 5. Since pitch and roll attitude could be extracted from any three of the four Horizon Trackers as well as the two single-axis Star Trackers (both are required),

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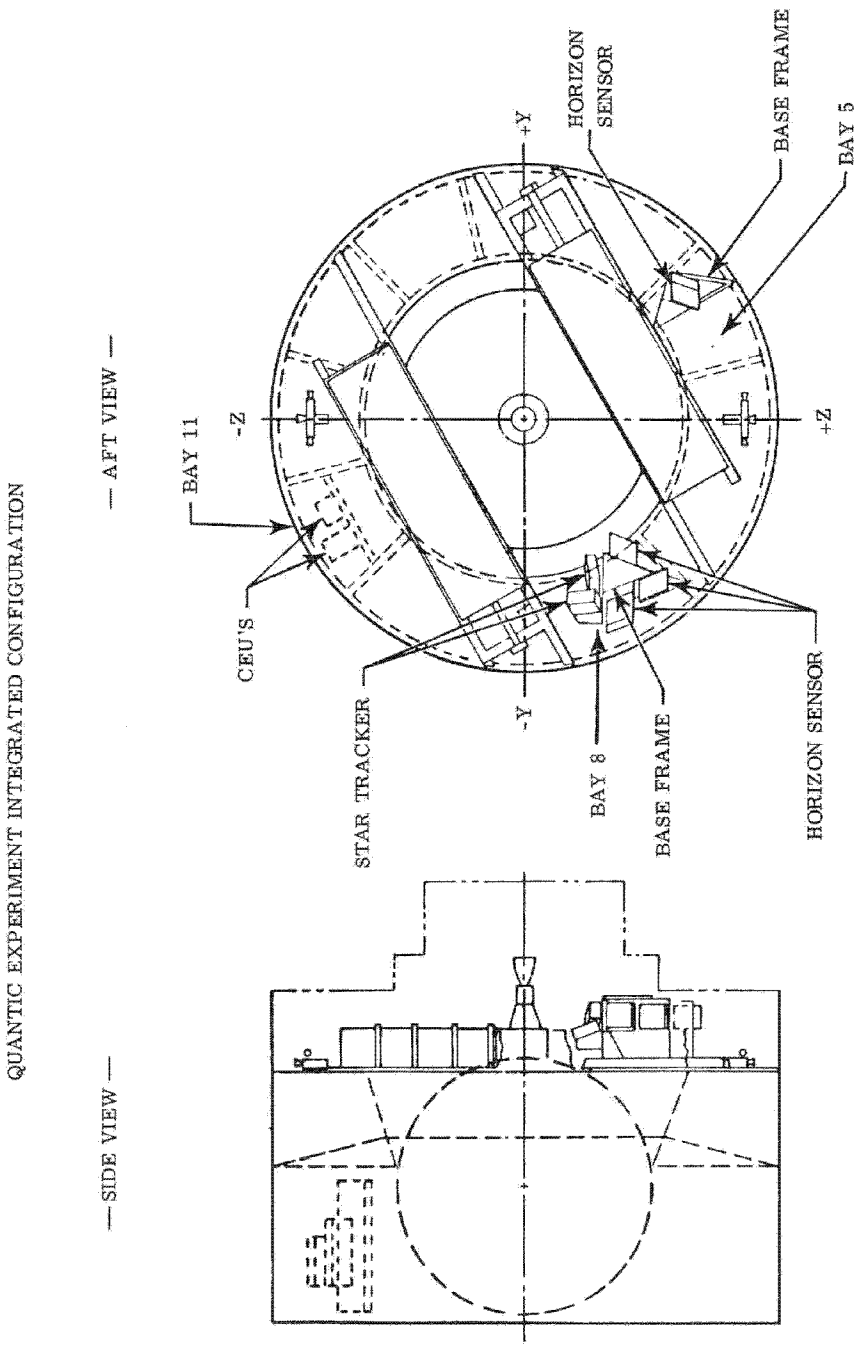

FIGURE 4-1

the large pylon configuration resulted in an accurate comparison of the two Attitude Sensing Systems. The CEUs for the HSS and STS were mounted in Bay 11.

4.5.4 Results

The experiment was successful. A detailed determination of the accuracy of the Quantic hardware is in progress. Extensive Post Flight Data reduction and analysis is being performed to determine the specific flight performance of the HSS and STS. Preliminary data evaluation of the comparison of the Barnes (primary and redundant Attitude Control System Horizon Sensors) and the Quantic Horizon Sensors with pitch and roll attitude as determined by the Star Tracker System indicates that both systems were within specifications for adequate HEXAGON Vehicle performance. Primary and redundant Inertial Reference Assembly Gyro bias drift measurements were made on the gyros flown on SV-8 using the Quantic Sensors. The measured bias drifts were well within specifications.

The only hardware anomaly which occurred during the flight was the failure of a semi-conductor in the Star Tracker Electronics Unit. When this failure occurred one of the two Star Trackers became inoperative. The other Star Tracker continued to operate properly because it received its power from another supply source. Sufficient data was obtained early in the flight, while both Star Trackers were operating, to permit adequate evaluation of Star Tracker performance.

The Quantic hardware (with the exception of the anomaly noted above) operated successfully for 103 days with eight "turn-ons" and seven "turn-offs" during the flight. The HSS and STS were turned "on" when sufficient vehicle power was available but were not "on" throughout the entire mission. Preliminary data evaluation indicates that all hardware specifications were met.

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SECTION V

RE-ENTRY VEHICLE SUMMARY

5.1 SUMMARY

The recovery statistics are shown in Tables 5-1 and 5-2. Performance of the RV subsystems is summarized in Table 5-2. All RV on-orbit and re-entry events occurred as planned and the RV flights followed the predicted trajectories. Three recoveries terminated in aerial retrieval. RV-1, even though exhibiting a stable fully inflated main chute and target cone, was recovered from the water by Surface Recovery Units. It appears that a very shallow engagement of the retrieval loop and the crown area of the target cone permitted a hook tear without engaging a load loop.

The outer wraps of film on one RV-3 stack were torn and loose due to relative motion between the film stack and the RV after pin failure. The second pin in RV-3 was bent and significant RV and Take-up damage occurred during the pin removal operations required to permit despooling. Aerial retrieval loads exceeding the core pin strength are not unusual.

All subsystems performed satisfactorily and met all mission requirements.

5.2 RE-ENTRY VEHICLE PERFORMANCE

All RV on-orbit functions were normal and occurred on time. The SV provided a satisfactory pitch angle for each RV separation. All other SV/RV interface functions were nominal.

The RVs were adequately spin stabilized during the vacuum coast phase and aerodynamically stable during the atmospheric phase of the re-entry trajectory.

5.3 RE-ENTRY VEHICLE SUBSYSTEM PERFORMANCE

Three secondary discrepancies were observed during the post flight examination of the recovered vehicles.

A. Loose Wire

On RV-2, one of the three redundant wires was loose in a Burndy Terminal Block. No anomalous preflight test or flight behavior could be attributed to the loose wire. Additonal emphasis will be placed on manufacturing and inspection personnel to insure that all processes and procedures are followed.

B. Batteries

On RV-4, the Main Battery vented a quantity of electrolyte through the overboard vent. This condition may have been aggravated by reduced cell block pressure, with the long time orbit vacuum exposure. Previously initiated corrective action to make more stringent leak test verification of the cell block was not effected on this battery. Main batteries which incorporate this leak test are installed in RVs in Position 4 of SV-9 and SV-10 and all RVs in SV-11 and up.

TABLE 5-1

RECOVERY VEHICLE RECOVERY SUMMARY

	RV-1	RV-2	RV-3	RV-4
RV Serial No.	36	35	34	33
Recovery Rev No.	228	681	1118	1701
Recovery Date	24 April 1974	22 May 1974	18 June 1974	24 July 1974
Payload Weight (lbs) (Measured weight from recovered RV)				
Forward	221.0	230.0	199.0	212.4
Aft	221.0	221.0	191.3	226.6
Unbalance Percent	0	3.3	3.1	5.2
SV Orbit (hp x ha/ωp)	85.52 x 160.97/127.63	85.47 x 158.07/124.8	85.35 x 154.2/119.48	83.53 x 136.48/113.08
SV Pitch Angle (degrees)	-33.5	-37.7	-37.5	-37.9
Nominal PIP Latitude	18.00	18.50	18.00	21.00
Impact Location Error (EPPD versus Teapot Eval)				
Overshoot (NM)	1.2	9.0		
Undershoot (NM)			0.5	0.4
Cross-Track (NM)	1.2E	0.6W	2.8E	0.5E
Recovery (Aerial)				
Altitude (feet)	Water Recovery	7,500	12,800	5,300
Parachute Condition	4 Cone & 1 Main Tears	2 Cone & 1 Main Tear	No Damage	No Damage
Retrieval Pass	Not Applicable	2	1	2
Recovery Capsule Payload Condition	Good	Good	Good	Good

NOTES: 1. hp = Altitude of Perigee (NM)
2. ha = Altitude of Apogee (NM)
3. ωp = Argument of Perigee (degrees)

C. PCM Commutator

Low level channels on RV-1 and RV-4 read 4 to 5 counts high. No data was lost since the flight data measurements can be compensated by taking into account the amount of offset.

5.4 STELLAR-TERRAIN RECOVERY (RV-5)

RV-5 (SN-1804) was successfully recovered on Rev 973. Recovery statistics are shown in Table 5-2. All RV subsystems performed normally. The SV provided a satisfactory pitch angle after a yaw reverse and all other interface functions were nominal.

The miss distance between the PIP and EPPD was calculated to be 2.53 NM short and 3.65 NM West of the ground track. The capsule was recovered at 13,500' on the first pass.

TABLE 5-2

RV-5 RECOVERY SUMMARY

Recovery Rev		973
Date		9 June 1974
Payload Weight (lbs)		69.82
SV Recovery Orbit		
Perigee (NM)		85.20
Apogee (NM)		152.58
Argument of Perigee (degrees)		136.44
SV Pitch Angle after yaw around (degrees)		-63.3

	PIP	EPPD	Air Recovery
Latitude	15° 00'	15° 03'	15° 14'
Longitude	166° 51.6'	166° 55'	166° 41'
Altitude	-	-	13,500'

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SECTION VI

OPERATIONAL SUPPORT

6.1 SOFTWARE

The software configuration used to support Mission 1208 was 'TUNITY MOD 3. The following areas were significantly changed from the previous mission:

A. Short term coverage

B. Intelligence MOPs

C. Individual desert polygons

D. No ascending STOPs

AOES/System II configuration was 15.0, Corrector Tape CST 15.1-15. A nominal one rev load cycle for the payload revs was used during the mission phase. A total of 1,123 command messages were generated, of which 938 were loaded into the vehicle. Ten software problems (SPRs) were encountered during the mission phase and considered flight critical. These SPRs are:

A. SPR MD3-7166 ('TAPWRP)

The acquisition tables in the 'TBAT span could not be properly built with every ephemeris. The module software was corrected.

B. SPR MD3-7176 ('THAYER)

The 'THAYER output erroneously reported, including a cell from a category that actually was not included in the operation. The module software was corrected.

C. SPR MD3-7180 ('TLMP)

When frame data was stripped from one RTS tape, it made previous stripped data inaccessible for the MPR run. The module software was corrected.

D. SPR MD3-7181 ('TAPWRP)

A desert polygon was applied to an operation where no desert polygon had been defined, hence applying an improper bias. The module software was corrected.

E. SPR MD3-7190 ('TBAT)

'TBAT was not showing weighted ground belonging to some ACATS. With the weight not properly being passed, acquisition tables were incorrect and new selections would be affected. The 'TUPCAT submodule software was corrected.

F. SPR MD3-7194 ('TUPWIC)

The MOB file could not be properly maintained because 'TUPWIC would not let a cell be removed that was activated without a reference date and without SS or ST categories. The module software was corrected.

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G. SPR MD3-7196 ('TFUNCHK)

An error message, flagging insufficient time between commands FT- and C- was appearing frequently in the messages and not correctly per hardware constraints. The problem was defined as a difference in truncation procedures in the base calculation and the check routine. The module software in 'TFUNCHK and 'TUMP was corrected.

H. SPR MD3-7199 ('TBALL)

This SPR was the same as MD3-7196 and corrected with that SPR.

I. SPR MD3-7211 ('THISTLE)

Investigation of missing commands at the load station in an SP message indicated that the update message was missing the first 80 locations of PMU-B. Manual alterations to the message were used until the 'TMEUP submodule software was corrected.

J. SPR MD3-7214 ('TUPCAT)

The targeting category RCG capability that existed in the previous software model was missing on the current version. The module software was properly updated and corrected.

6.2 SATELLITE CONTROL FACILITY (SCF)

The performance of the SCF in support of 1208 was commendable. However, some equipment and operational problems were encountered which caused minimal impact on the mission. Command message generation and transmission, and downlink TM reception and processing were satisfactory to support the operation.

6.2.1 Readiness

A 34 rev Dress Rehearsal using 'TUNITY MOD 3 and MODEL 15.0 was begun on 2 April 1974 and successfully concluded on 4 April 1974.

6.2.2 Orbit Operation

One dedicated CDC 3800 Computer was used throughout the operation; a second computer was used as required. The computer usage rate was 1.3 computers per day. In general, some poor tape recorder data caused a delay in MPR generation and a number of additional command messages were required to bring up alternate remote tracking station support. The more significant RTS problems were:

A. POGO Rev 760

Power fluctuations caused a loss of approximately 65 seconds of TLM and tracking data.

B. POGO Rev 1281

Loss of SGLS transmitter caused loss of 70 seconds of range and 20 seconds of TLM and tracking data.

C. POGO Revs 1357, 1358, 1360, 1361, 1362, and 1363

Outage on two discs resulted in a delay of more than seven hours in receiving playback data.

D. KODI Rev 301

Disc drive faults resulted in a loss of 280 seconds of real time data and a delay in commanding.

E. HULA Rev 163/COOK Rev 591

NOV alarms resulted in incomplete commanding.

F. KODI Rev 697/GUAM Rev 1048

Inability to bring the computer on-line resulted in tracking and recording data only.

G. HULA Rev 1264

Loss of data line prevented transmission of the command message to the site.

H. KODI Rev 1312/POGO Rev 1340

Inability to activate the SGLS transmitter prevented transmission of the command message to the vehicle.

6.2.3 Recovery Operations

A. Recovery 1208-1

RV-1 was successfully re-entered on Rev 228 (Day 15). The aerial recovery attempt was unsuccessful and resulted in parachute cone damage which prevented further air recovery attempts. The capsule was recovered from the water with no capsule or payload damage.

B. Recovery 1208-2

RV-2 was successfully re-entered and aerially recovered on Rev 681 (Day 43). The capsule was loaded to 97.6% of capacity with a 3.4% unbalance. Tears were reported in the canopy and in the cone; however, parachute performance was normal. There was no capsule damage reported.

C. Recovery 1208-3

RV-3 was re-entered and aerially recovered on Rev 1118 (Day 70). No parachute or capsule damage was reported.

D. Recovery 1208-4

RV-4 was successfully re-entered and aerially recovered on Rev 1701 (Day 106). The heatshield was also recovered. No parachute or capsule damage was reported.

E. Recovery 1208-5

RV-5 was successfully re-entered and aerially recovered on Rev 973 (Day 61).

6.2.4 Command Message Generation

A one rev load philosophy was employed, whereby the SE/OT add-on message is generated each rev in order to use the latest weather data. There were 1123 command messages generated during the primary mission, of which 16% were rejected. The major cause of rejection was that no new payload selections were found in the new message after generation. Minor causes were: (1) hardware constraint violations, (2) problems with meshing of sequences, and (3) problems with non-standard payload operations.

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APPENDIX A

GLOSSARY OF TERMS

ACS	Attitude Control System.
ATC	Active Thermal Control.
BV	Booster Vehicle.
BV/SV	Booster Vehicle/Satellite Vehicle.
DBS	Doppler Beacon System.
ECS	Extended Command System.
EDAP	Electrical Distribution and Power.
EPPD	Estimated Point of Parachute Deployment.
GFE	Government Furnished Equipment.
H/S	Horizon Sensor.
ips	inch(es) per second.
MCM	Mapping Camera Module.
MCS	Minimal Command System.
MMC	Martin Marietta Corporation.
NM	nautical mile(s).
NVR	Non-volatile Residue.
OA	Orbit Adjust.
OAS	Orbit Adjust System.
OOAA	On-Orbit Adjust Assembly.
PACS	Primary Attitude Control System.
PCM	Pulse Code Modulator.
PDWN	Pitch-down.
PFA	Post Flight Analysis.
PGR	Pitch Gyro Rate.
PIP	Predicted Impact Point.
PMS	Pressure Makeup System.
PMU	Programmable Memory Unit.
PST	Pacific Standard Time.
PWM	Pulse Width Modulator.
RACS	Redundant Attitude Control System.
RCS	Reaction Control System.

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APPENDIX A (CONT'D)

REA	Reaction Engine Assembly.
REM	Reaction Engine Module.
Rev	Revolution.
RTS	Remote Tracking Station.
RV	Re-entry Vehicle.
SBA	Satellite Basic Assembly.
SBAC	Satellite Basic Assembly Contractor.
SECO	Stage II Engine Cut-Off.
Sep	Separation.
SGLS	Space Ground Link System.
Solo	System Engineering Test after Fourth RV Separation.
SPC	Stored Program Command.
SRM	Solid Rocket Motor.
SSU	Subsatellite Unit.
ST	Stellar Terrain.
ST/RV	Stellar Terrain/Re-entry Vehicle.
SU	Supply Unit.
SV	Satellite Vehicle.
TT & C	Telemetry, Tracking, and Command.
TVC	Thrust Vector Control.
VBE	Variable Block Erase.
Vx/h	Orbit Angular Rate, In-Track.