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FINAL FLIGHT EVALUATION REPORT APOLLO 10 MISSION

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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FLIGHT EVALUATION REPORT - APOLLO 10 MISSION

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ABSTRACT

THIS DOCUMENT IS THE FINAL FLIGHT EVALUATION REPORT FOR THE APOLLO 10 MISSION. IT INCLUDES DATA FROM THE NASA CENTER 5-DAY, 30-DAY AND 60-DAY REPORTS, AND THE APOLLO 11 FLIGHT READINESS REVIEW. THE REPORT INCLUDES A SUMMARY OF THE MISSION, A SUMMARY OF MISSION ACCOMPLISHMENTS, AND THE ANOMALIES ENCOUNTERED DURING THE MISSION. THE ANOMALIES ARE LISTED IN A SEPARATE SECTION ACCORDING TO LAUNCH VEHICLE SPACECRAFT, AND GROUND SYSTEMS.

THIS DOCUMENT HAS BEEN PREPARED BY THE BOEING COMPANY WDC/TIE UNDER NASA/APO MAT-1 TECHNICAL DIRECTION; CONTRACT NASW-1650, TASK NO. 10.0.

KEY WORDS

ANOMALY

APOLLO 10

FLIGHT EVALUATION

MISSION REPORT

1.0 INTRODUCTION

APOLLO 10 WAS THE THIRD MANNED SATURN V FLIGHT, THE SECOND FLIGHT OF A MANNED LUNAR MODULE, AND THE FIRST MISSION TO OPERATE THE COMPLETE APOLLO SPACECRAFT AROUND THE MOON. THIS MISSION PROVIDED ADDITIONAL OPERATIONAL EXPERIENCE FOR THE CREW, SPACE VEHICLE, AND MISSION-ORIENTED FACILITIES DURING A SIMULATED LUNAR LANDING MISSION.

APOLLO 10 (SA-505/CS-106/LM-4) WAS AN "F" TYPE MISSION DESIGNED TO DUPLICATE CONDITIONS OF THE LUNAR LANDING MISSION (APOLLO 11) AS CLOSELY AS POSSIBLE WITHOUT ACTUALLY LANDING.

1.1 CARRY-OVER ANOMALIES FOR SUBSEQUENT FLIGHT READINESS REVIEWS

FAILURE OF IU AIR/GN₂ PURGE DUCT (PG 17)

TWO RETAINING SPRINGS ON TUNNEL CHARGE (PG 68)
HOLDER RING DID NOT CAPTURE

DROP IN SIGNAL STRENGTH ON S-BAND STEERABLE ANTENNA (PG 91)

LARGE LM ATTITUDE EXCURSIONS DURING STAGING (PG 97)

1.2 MISSION SUMMARY

FIRST PERIOD

THE APOLLO 10 WAS SUCCESSFULLY LAUNCHED FROM LAUNCH COMPLEX 39A AT KENNEDY SPACE CENTER, FLORIDA ON MAY 18, 1969 AT 12:49 P.M. EDT, WITH NO UNSCHEDULED HOLDS. THE CREW WAS COMPOSED OF LT. COL. THOMAS STAFFORD, CDMR. JOHN YOUNG AND CDMR. EUGENE CERNAN. THE LAUNCH VEHICLE PERFORMED SATISFACTORILY, ACHIEVING AN EARTH PARKING ORBIT OF 102.6 x 99.6 NAUTICAL MILES (NM) AT 00:11:52.8 (HRS:MIN:SEC) GET (GROUND ELAPSED TIME). TRANSLUNAR INJECTION (PRE-TLI) CHECKOUT WAS CONDUCTED AS PLANNED. THE TLI BURN LASTED 5 MINUTES 43 SECONDS WITH ALL SYSTEMS OPERATING SATISFACTORILY AND ALL END CONDITIONS BEING NOMINAL FOR THE TRANSLUNAR COAST, FREE RETURN CIRCUMLUNAR TRAJECTORY.

AFTER CSM SEPARATION FROM THE LM/SLA/IU/S-IVB AT 3:02:51 (HRS:MIN:SEC) GET, CSM TRANSPOSITION AND DOCKING WERE COMPLETED BY 3:17 GET. EXCELLENT QUALITY COLOR TELEVISION COVERAGE OF THE DOCKING SEQUENCES WAS TRANSMITTED TO THE GOLDSTONE TRACKING STATION AND WAS SEEN ON WORLD-WIDE COMMERCIAL TELEVISION. EJECTION OF THE CSM/LM FROM THE S-IVB WAS SUCCESSFULLY ACCOMPLISHED AT 3:56:24 GET, AND A 2.5-SECOND SERVICE PROPULSION SYSTEM (SPS) EVASIVE MANEUVER WAS PERFORMED AS PLANNED AT 4:39:09.8 GET.

ALL LAUNCH VEHICLE SAFING ACTIVITIES AND THE S-IVB LIQUID OXYGEN AND LIQUID HYDROGEN LEAD TEMPERATURE MEASUREMENT EXPERIMENTS WERE PERFORMED SUCCESSFULLY AS SCHEDULED. THE SUBSEQUENT PROPELLANT DUMP WAS SUCCESSFUL AND SUFFICIENT IMPULSE WAS PROVIDED TO THE S-IVB FOR A "SLINGSHOT" MANEUVER TO EARTH ESCAPE VELOCITY. AUGMENTATION OF THIS IMPULSE BY THE S-IVB AUXILIARY PROPULSION SYSTEM ULLAGE ENGINE BURN WAS TERMINATED BY GROUND COMMAND IMMEDIATELY AFTER IGNITION. THE CLOSEST APPROACH OF THE S-IVB TO THE MOON WAS 1752 NM AT 78:54 GET.

SECOND PERIOD

MIDCOURSE CORRECTION BURN NUMBER 1 (MCC-1), ORIGINALLY PLANNED AT 11:30 GET AS A 47 FOOT-PER-SECOND (FPS) SPS MANEUVER, WAS NOT CONDUCTED. MIDCOURSE CORRECTION MANEUVER NUMBER 2 (MCC-2) WAS PERFORMED AT 26:32:56.8 GET BY A 6.7-SECOND FIRING OF THE SPS RESULTING IN A VELOCITY CHANGE OF 48.9 FPS (48.7 FPS PLANNED). ALL PARAMETERS APPEARED NOMINAL AND THE RESULTING PERICYNTHION WAS 60.9 NM. CONSEQUENTLY, MIDCOURSE CORRECTION MANEUVERS NUMBERS 3 AND 4 WERE NOT REQUIRED. BECAUSE OF THE CHANGE IN PLANNED MIDCOURSE EVENTS, ALL LUNAR EVENTS WERE ACCOMPLISHED APPROXIMATELY TWELVE MINUTES AHEAD OF SCHEDULE. FIVE COLOR TV TRANSMISSIONS TOTALING 72 MINUTES WERE MADE DURING TRANSLUNAR COAST.

THE LUNAR ORBIT INSERTION MANEUVER (LOI-1) WAS PLANNED IN REAL TIME FOR 75:55:54 GET AND WAS ACCOMPLISHED ON SCHEDULE. THE SPS ENGINE BURNED FOR 356 SECONDS RESULTING IN AN INITIAL ORBIT OF 170.6 BY 60.2 NM. THIS COMPARES VERY WELL WITH THE PRELAUNCH-PLANNED ORBIT OF 170 BY 60 NM, AND THE REAL-TIME-PLANNED ORBIT OF 170.7 BY 59.7 NM. THE SPS BURN DATA APPEARED TO BE NOMINAL, WITH FUEL TANK PRESSURE AND OXIDIZER INTERFACE PRESSURE SLIGHTLY ON THE HIGH SIDE OF NOMINAL, BUT WELL WITHIN EXPECTED TOLERANCE.

THE LUNAR ORBIT CIRCULARIZATION MANEUVER, LOI-2, WAS PLANNED IN REAL TIME FOR 80:25:07 GET AND WAS ALSO ACCOMPLISHED ON SCHEDULE. THE SPS ENGINE BURNED FOR 14 SECONDS RESULTING IN AN INITIAL ORBIT OF 61.9 BY 59.2 NM. THIS COMPARES WELL WITH THE PRELAUNCH-PLANNED ORBIT OF 60 BY 60 NM AND THE REAL-TIME-PLANNED ORBIT OF 60.1 BY 60.1 NM. ALL SPS PARAMETERS WERE NOMINAL.

A 29-MINUTE SCHEDULED COLOR TELEVISION TRANSMISSION OF THE LUNAR SURFACE WAS CONDUCTED AT 80:45 GET (21:34 EDT, 21 MAY). LUNAR LANDMARK TRACKING ON TWO TARGETS WAS ACCOMPLISHED AND INDICATIONS ARE THAT THESE LANDMARKS WERE WELL SPACED AND OF GOOD QUALITY.

THE LUNAR MODULE PILOT TRANSFERRED TO THE LM AT 81:55 GET FOR ABOUT TWO HOURS OF SCHEDULED "HOUSEKEEPING" ACTIVITIES AND SOME LM COMMUNICATIONS TESTS. THE TESTS WERE TERMINATED AFTER THE LM RELAY COMMUNICATIONS TESTS BECAUSE OF TIME LIMITATIONS. RESULTS OF THE COMPLETED TESTS WERE EXCELLENT AND THOSE TESTS REMAINING WERE CONDUCTED AT A LATER TIME IN THE MISSION.

THIRD PERIOD

THE COMMANDER AND LUNAR MODULE PILOT ENTERED THE LM AT 95:02 GET AND PERFORMED THE PRE-PLANNED CHECKS OF ALL SYSTEMS. THE RENDEZVOUS EXERCISE WAS BEGUN ON TIME WITH UNDOCKING AT 98:22 GET. THE SERVICE MODULE REACTION CONTROL SYSTEM (SM RCS) WAS USED TO SEPARATE THE CSM ABOUT 30 FEET FROM THE LM. SUBSEQUENTLY THE LM LANDING GEAR WAS DEPLOYED. STATIONKEEPING WAS INITIATED AT THIS POINT WHILE THE COMMAND MODULE PILOT IN THE CSM VISUALLY INSPECTED THE LM. THE SM RCS WAS THEN USED TO PERFORM THE SEPARATION MANEUVER DIRECTED RADially DOWNWARD TOWARD THE MOON'S CENTER. THIS MANEUVER PROVIDED AN LM/CSM SEPARATION AT DESCENT ORBIT INSERTION (DOI) OF ABOUT 2 NAUTICAL MILES. THE DOI WAS PERFORMED BY AN LM DESCENT PROPULSION SYSTEM (DPS) BURN (HORIZONTAL, RETROGRADE), SUCH THAT THE RESULTING PERICYNTHION (LOWEST POINT IN ORBIT) OCCURRED ABOUT 15° PRIOR TO LUNAR LANDING SITE NUMBER 2. THE LOWEST ALTITUDE ABOVE THE MOON'S SURFACE ACHIEVED BY THE LM WAS 8.4 NM. NUMEROUS PHOTOGRAPHS OF THE LUNAR SURFACE WERE TAKEN; HOWEVER, SOME CAMERA MALFUNCTIONS WERE REPORTED. ALTHOUGH SOME COMMUNICATIONS DIFFICULTIES WERE

EXPERIENCED, THE CREW PROVIDED A CONTINUOUS COMMENTARY ON THEIR OBSERVATIONS. THE LM LANDING RADAR TEST WAS EXECUTED DURING THE LOW ALTITUDE PASS OVER THE SURFACE. EARLY DATA INDICATES INITIAL ACQUISITION OCCURRED AT A HEIGHT OF 65,000 FEET. INDICATED PERICYNTHION ALTITUDE AS MEASURED BY THE LANDING RADAR DURING THE FLY-BY WAS 47,000 FEET.

THE SECOND LM MANEUVER, THE DPS PHASING BURN, ESTABLISHED AT THE RESULTING LM PERICYNTHION, A CSM LEAD ANGLE EQUIVALENT TO THAT WHICH WOULD OCCUR DURING THE LUNAR LANDING MISSION. THE APOCYNTHION ALTITUDE OF THE PHASING ORBIT WAS 190.1 NM.

ABOUT TEN MINUTES PRIOR TO PERICYNTHION, THE LM DESCENT STAGE WAS JETTISONED. THE LM REACTION CONTROL SYSTEM (LM RCS) SEPARATION MANEUVER AT STAGING WAS ACCOMPLISHED USING THE ABORT GUIDANCE SYSTEM (AGS) AS PRESCRIBED IN PREMISSION PLANS. INADVERTENTLY, THE MODE CONTROL SWITCH WAS LEFT IN "AUTO" RATHER THAN THE REQUIRED "ATTITUDE HOLD" MODE. IN AUTO, THE AGS ATTEMPTED TO POINT THE LM Z AXIS TOWARD THE CM. THE COMMANDER TOOK OVER MANUAL CONTROL TO REESTABLISH THE PROPER LM ATTITUDE. THEN, AT PERICYNTHION, THE INSERTION MANEUVER WAS PERFORMED ON TIME USING THE LM ASCENT PROPULSION SYSTEM (APS). THIS BURN ESTABLISHED THE EQUIVALENT OF THE STANDARD LM INSERTION ORBIT (45 BY 11.2 NM) OF A LUNAR LANDING MISSION.

THE LM COASTED FROM INSERTION IN THE 45.3 NM BY 11.2 NM ORBIT FOR ABOUT AN HOUR. CONCENTRIC SEQUENCE INITIATION (CSI) WAS ACCOMPLISHED AT APOCYNTHION. A SMALL CONSTANT DELTA HEIGHT (CDH) MANEUVER WAS REQUIRED (AS EXPECTED) TO NULL OUT MINOR DISPERSIONS. THE TERMINAL MANEUVER OCCURRED AT ABOUT THE MIDPOINT OF DARKNESS. BRAKING DURING THE TERMINAL PHASE FINALIZATION (TPF) WAS PERFORMED MANUALLY AS PLANNED.

THE RENDEZVOUS WAS HIGHLY SUCCESSFUL AND ALL PARAMETERS WERE VERY CLOSE TO NOMINAL. CSM-ACTIVE DOCKING WAS ACCOMPLISHED SMOOTHLY AND EXPEDITIOUSLY AT 106:22:08 GET.

ONCE DOCKED TO THE CSM, THE TWO LM CREWMEN TRANSFERRED WITH THE EXPOSED FILM PACKETS AND THE LM HASSELBLAD CAMERA TO THE CSM. THE LM MAURER SEQUENCE CAMERA AND PRIMARY LITHIUM HYDROXIDE CANNISTER (BOTH OF WHICH INCURRED INFIGHT PROBLEMS) WERE ALSO TRANSFERRED TO THE CSM SO THESE ITEMS COULD BE INSPECTED POSTFLIGHT. THE CSM WAS SEPARATED FROM THE LM AT 108:43:30 GET USING THE SM RCS.

FOURTH PERIOD

ABOUT ONE REVOLUTION AFTER DOCKING, THE LM APS BURN TO DEPLETION WAS COMMANDED BY THE MANNED SPACE FLIGHT NETWORK (MSFN), UTILIZING THE LM ASCENT ENGINE ARMING ASSEMBLY. THIS BURN PLACED THE LM IN A SOLAR ORBIT. LM/MSFN COMMUNICATIONS WERE MAINTAINED UNTIL LM ASCENT STAGE BATTERY DEPLETION AT ABOUT 12 HOURS AFTER CSM/LM SEPARATION.

DURING THE REMAINING LUNAR ORBITAL PERIOD OF OPERATION, 18 LANDMARK SIGHTINGS AND EXTENSIVE STEREO STRIP AND OBLIQUE PHOTOGRAPHS WERE TAKEN. TWO SCHEDULED TV PERIODS WERE DELETED BECAUSE OF CREW FATIGUE. THE CREW SIGHTED THE LM DESCENT STAGE ON SEVERAL OCCASIONS. AT 137:36:28 GET, THE SPS INJECTED THE CSM INTO A TRANSEARTH TRAJECTORY AFTER A TOTAL TIME IN LUNAR ORBIT OF 61.5 HOURS (31 ORBITS). THE TEI BURN WAS TARGETED FOR A TRANSEARTH RETURN TIME OF 53 HOURS.

FIFTH PERIOD

THIS PERIOD COMMENCED WITH A LIVE TELEVISION TRANSMISSION THROUGH THE HONEYSUCKLE TRACKING STATION AND INTELSAT III COMMUNICATIONS SATELLITE, SHORTLY AFTER TEI AT 137:51 GET. FOCUS AT ALL ZOOM LENS SETTINGS WAS EXCELLENT. ANOTHER COLOR TELEVISION TRANSMISSION WAS RECEIVED AT 139:27 GET.

FOLLOWING A SLEEP PERIOD, STAR LUNAR LANDMARK NAVIGATION SIGHTINGS WERE TAKEN AT 151:00 GET.

THE ACCURACY OF THE TRANSEARTH INJECTION (TEI) MANEUVER WAS SUCH THAT THE FIRST TRANSEARTH MIDCOURSE CORRECTION (MCC-5) ORIGINALLY SCHEDULED FOR 152:00 GET WAS NOT NECESSARY. THE WASTE WATER DUMP CONDUCTED AT 153:50 GET WAS ORIENTED TO REDUCE THE PROBABILITY OF MIDCOURSE CORRECTIONS. CHECKOUT OF THE ENTRY MONITOR SYSTEM WAS ACCOMPLISHED AT 154:35 GET TO ENSURE ITS READINESS FOR THE ENTRY PHASE.

A TEN-MINUTE COLOR TELEVISION BROADCAST WAS MADE AT APPROXIMATELY 147:23 GET. A TWENTY-NINE-MINUTE BROADCAST OF THE MOON, EARTH, AND SPACECRAFT INTERIOR WAS RECEIVED AT 152:00 GET. A NUMBER OF STAR-EARTH HORIZON NAVIGATION SIGHTINGS WERE TAKEN. THE CSM S-BAND HIGH-GAIN REFLECTIVITY TEST WAS CONDUCTED AT 168:00 GET. AN UNSCHEDULED LIVE COLOR TELEVISION TRANSMISSION OF THE EARTH AND THE COMMAND MODULE INTERIOR WAS RECEIVED AT 137:27 GET. THE SECOND TRANSEARTH MIDCOURSE CORRECTION (MCC-6) ORIGINALLY SCHEDULED FOR 176:50 GET WAS NOT NECESSARY.

SIXTH PERIOD

THE CREW WAS AWAKENED AT 185:00 GET AND INITIATED ENTRY PREPARATIONS. THE FINAL LIVE COLOR TELEVISION TRANSMISSION WAS RECEIVED AT 186:50 GET. MCC-7 WAS PERFORMED AT 188:49:57 GET. ENTRY INTERFACE WAS REACHED AT 191:48:54 GET WITH SPLASHDOWN IN THE MID-PACIFIC, AT APPROXIMATELY 15°S AND 165°W. FLIGHT CREW PERFORMANCE WAS OUTSTANDING. ALL THREE CREW MEMBERS REMAINED IN EXCELLENT HEALTH THROUGHOUT THE MISSION.

1.3 APOLLO PROGRAM IMPACT

SINCE THE FIRST SATURN FLIGHT, THE APOLLO PROGRAM HAS BEEN BUILDING FOR A LUNAR LANDING AND EXPLORATION OF THE LUNAR SURFACE. EACH SUCCESSIVE FLIGHT HAS EVALUATED THE PERFORMANCE AND OPERATIONAL CAPACITY OF SPECIFIC PIECES OF HARDWARE AND OPERATING PROCEDURES. THE FIRST APOLLO FLIGHTS, AS-201 THROUGH APOLLO 6, WERE LAUNCH VEHICLE AND SPACECRAFT DEVELOPMENT FLIGHTS. APOLLO 7, THE FIRST MANNED APOLLO FLIGHT, DEMONSTRATED CSM/CREW PERFORMANCE AND CSM RENDEZVOUS CAPABILITY. THE APOLLO 8 MISSION PROVIDED THE NEXT PHASE IN THE APOLLO PROGRAM BY SUCCESSFULLY DEMONSTRATING CSM OPERATIONS AND SELECTED BACKUP LUNAR LANDING MISSION ACTIVITIES IN LUNAR ORBIT. APOLLO 9 WAS AN EARTH-ORBITAL MISSION WHICH DEMONSTRATED CSM/LM OPERATIONS AND LM/CREW PERFORMANCE OF SELECTED LUNAR LANDING MISSION ACTIVITIES IN EARTH ORBIT. THE PURPOSE OF THE APOLLO 10 MISSION, A LUNAR-ORBITAL MISSION, WAS TO EVALUATE LM PERFORMANCE IN THE CISLUNAR AND LUNAR ENVIRONMENT AND TO DUPLICATE THE LUNAR LANDING PROFILE AS CLOSELY AS POSSIBLE WITHOUT ACTUALLY LANDING.

SUFFICIENT DATA WERE OBTAINED TO VERIFY THAT ALL PRIMARY OBJECTIVES WERE MET. NO MAJOR ANOMALIES WERE ENCOUNTERED WHICH WOULD IMPOSE A CONSTRAINT ON FUTURE MISSIONS.

THE SUCCESS OF THE APOLLO 10 MISSION VERIFIED THE PERFORMANCE OF THE SPACE VEHICLE AND SUPPORT SYSTEMS ENABLING THE PROGRAM TO PROCEED WITH THE ACTUAL LUNAR LANDING MISSION, APOLLO 11.

1.4 SUMMARY OF MISSION ACCOMPLISHMENT

PRIMARY MISSION OBJECTIVES

- o DEMONSTRATE CREW/SPACE VEHICLE/MISSION SUPPORT FACILITIES PERFORMANCE DURING A MANNED LUNAR MISSION WITH CSM AND LM.
- o EVALUATE LM PERFORMANCE IN THE CISLUNAR AND LUNAR ENVIRONMENT.

ALL OF THE APOLLO 10 MISSION PRIMARY OBJECTIVES WERE OBTAINED. ONE OF THE SECONDARY DETAIL TEST OBJECTIVES (6.9) WAS CANCELLED AND ANOTHER (20.80) EXPERIENCED SOME COMMUNICATION PROBLEM, BUT DID NOT IMPACT THE MISSION.

TABLE I IS A LIST OF EVENT TIMES COMPARING THE DIFFERENCE BETWEEN PRE-MISSION PLANNED EVENT TIMES AND ACTUAL MISSION TIMES. A DELAY OF THE FIRST MIDCOURSE CORRECTION TO THE MCC-2 OPTION CAUSED THE TRANSLUNAR TRAJECTORY TO BE LONGER THAN PLANNED THUS DELAYING LUNAR ORBIT EVENTS APPROXIMATELY 12 MINUTES. A LISTING OF LAUNCH VEHICLE AND SPACECRAFT DETAILED TEST OBJECTIVES, ALONG WITH THE RESPECTIVE DEGREE OF ACCOMPLISHMENT FOLLOWS:

LAUNCH VEHICLE

ACCOMPLISHMENT

OBJECTIVE

- | | |
|--|---|
| 1. (S) VERIFY J-2 ENGINE MODIFICATIONS. | NO PROBLEMS WERE ENCOUNTERED |
| 2. (S) CONFIRM J-2 ENGINE ENVIRONMENT IN S-II AND S-IVB STAGES. | NO PROBLEMS WERE ENCOUNTERED |
| 3. (S) CONFIRM LAUNCH VEHICLE LONGITUDINAL OSCILLATIONS ENVIRONMENT DURING S-IC STAGE BURN PERIOD. | THIS OBJECTIVE WAS SUCCESSFULLY DEMONSTRATED. |
| 4. (S) VERIFY THAT MODIFICATION INCORPORATED IN THE S-IC STAGE SUPPRESS LOW FREQUENCY LONGITUDINAL OSCILLATIONS. | THIS OBJECTIVE WAS SUCCESSFULLY DEMONSTRATED. |
| 5. (S) CONFIRM LAUNCH VEHICLE LONGITUDINAL OSCILLATION ENVIRONMENT DURING S-II STAGE BURN PERIOD. | THIS OBJECTIVE WAS SUCCESSFULLY DEMONSTRATED. |

OBJECTIVE

6. (S) DEMONSTRATE THAT EARLY CENTER ENGINE CUTOFF FOR S-II STAGE SUPPRESSES LOW FREQUENCY LONGITUDINAL OSCILLATIONS.

ACCOMPLISHMENT

SATISFACTORILY DEMONSTRATED. EARLY SHUTDOWN SUCCESSFULLY ELIMINATED THE PROBLEM.

SPACECRAFT

OBJECTIVE

P(20.78) DEMONSTRATE CSM/LM RENDEZVOUS CAPABILITY FOR A LUNAR LANDING MISSION.

ACCOMPLISHMENT

THIS OBJECTIVE WAS SATISFACTORILY DEMONSTRATED.

P(16.10) PERFORM MANUAL AND AUTOMATIC ACQUISITION, TRACKING, AND COMMUNICATIONS WITH MSFN USING THE STEERABLE S-BAND ANTENNA AT LUNAR DISTANCE.

COMPLETED SATISFACTORILY, SOME DIFFICULTIES DURING REV. 13.

P(20.121) PERFORM LUNAR LANDMARK TRACKING FROM THE CSM WHILE IN LUNAR ORBIT.

THIS OBJECTIVE WAS SATISFACTORILY PERFORMED.

P(20.91) PERFORM LUNAR LANDMARK TRACKING IN LUNAR ORBIT FROM THE CSM WITH THE LM ATTACHED.

THIS OBJECTIVE WAS SATISFACTORILY PERFORMED.

P(16.14) OPERATE THE LANDING RADAR AT THE CLOSEST APPROACH TO THE MOON AND DURING DPS BURNS.

THIS OBJECTIVE WAS COMPLETED SATISFACTORILY.

P(20.66) OBTAIN DATA ON THE CM AND LM CREW PROCEDURES AND TIMELINE FOR THE LUNAR ORBIT PHASE OF A LUNAR LANDING MISSION.

THIS DATA WAS OBTAINED.

P(11.15) PERFORM PGNCs/DPS UNDOCKED DESCENT ORBIT INSERTION (DOI) AND A HIGH THRUST MANEUVER.

THIS OBJECTIVE WAS PERFORMED.

OBJECTIVES

ACCOMPLISHMENTS

S(16.17)	DEMONSTRATE LM/CSM/MSFN COMMUNICATIONS AT LUNAR DISTANCE.	DATA OBTAINED SOME PROBLEMS DUE TO PROCEEDUAL ERRORS.
S(16.12)	COMMUNICATE WITH MSFN USING THE LM-S-BAND OMNIANTENNAS AT LUNAR DISTANCE	DATA OBTAINED, SOME PROBLEMS DURING REV. 13.
S(16.15)	OBTAIN DATA ON THE RENDEZVOUS RADAR PERFORMANCE AND CAPABILITY NEAR MAXIMUM RANGE.	DATA OBTAINED.
S(13.14)	OBTAIN SUPERCRITICAL HELIUM SYSTEM PRESSURE DATA WHILE IN STANDBY CONDITIONS AND DURING ALL DPS ENGINE FIRINGS.	DATA OBTAINED.
S(12.9)	PERFORM AN UNMANNED AGS-CONTROLLED APS BURN.	THIS OBJECTIVE WAS PERFORMED SATISFACTORILY.
S(20.77)	OBTAIN DATA ON THE OPERATIONAL CAPABILITY OF VHF RANGING DURING A LM-ACTIVE RENDEZVOUS.	DATA OBTAINED.
S(20.86)	OBTAIN DATA ON THE EFFECTS OF LUNAR ILLUMINATION AND CONTRAST CONDITIONS ON CREW VISUAL PERCEPTION WHILE IN LUNAR ORBIT.	DATA OBTAINED.
S7.26)	OBTAIN DATA ON THE PASSIVE THERMAL CONTROL (PTC) SYSTEM DURING A LUNAR ORBIT MISSION.	DATA OBTAINED.
S(20.79)	DEMONSTRATE CSM/LM PASSIVE THERMAL CONTROL MODES DURING A LUNAR ORBIT MISSION.	DATA OBTAINED SATISFACTORILY.
S(12.8)	DEMONSTRATE RCS TRANSLATION AND ATTITUDE CONTROL OF THE STAGED LM USING AUTOMATIC AND MANUAL AGS/CES CONTROL.	THIS OBJECTIVE WAS SATISFACTORILY DEMONSTRATED.

	<u>OBJECTIVES</u>	<u>ACCOMPLISHMENTS</u>
S (12.10)	EVALUATE THE ABILITY OF THE AGS TO PERFORM A LM-ACTIVE RENDEZVOUS.	COMPLETED.
S (20.82)	MONITOR PGNC/AGS PERFORMANCE DURING LUNAR ORBIT OPERATIONS.	DATA OBTAINED.
S (20.80)	DEMONSTRATE OPERATIONAL SUPPORT FOR A CSM/LM LUNAR ORBIT MISSION.	SOME COMMUNICATION PROBLEMS.
S (13.13)	PERFORM A LONG DURATION UNMANNED APS BURN.	THIS OBJECTIVE WAS PERFORMED SATIS- FACTORILY.
S (20.117)	PERFORM LUNAR ORBIT INSERTION USING SPS GNCS-CONTROLLED BURNS WITH A DOCKED CSM/ LM	THIS OBJECTIVE WAS PERFORMED SATIS- FACTORILY.
S (11.17)	OBTAIN DATA TO VERIFY IMU PERFORMANCE IN THE FLIGHT ENVIRONMENT.	DATA OBTAINED.
S (6.9)	PERFORM A REFLECTIVITY TEST USING THE CSM S-BAND HIGH-GAIN ANTENNA WHILE DOCKED.	CANCELLED WHILE DOCKED.
S (20.46)	PERFORM CSM TRANSPOSITION, DOCKING, AND CSM/LM EJECTION AFTER THE S-IVB TLI BURN.	COMPLETED.
S (20.95)	PERFORM TRANSLUNAR MIDCOURSE CORRECTIONS.	COMPLETED-ONLY ONE OF FOUR MIDCOURSE CORRECTIONS REQUIRED.
S (12.6)	OBTAIN AGS PERFORMANCE DATA IN THE FLIGHT ENVIRONMENT.	DATA OBTAINED.
S (1.39)	PERFORM STAR-LUNAR LANDMARK SIGHTINGS DURING THE TRANSEARTH PHASE.	DATA OBTAINED.
S (20.83)	OBTAIN DATA ON LM CONSUMABLES FOR A SIMULATED LUNAR LANDING MISSION, IN LUNAR ORBIT, TO DETERMINE LUNAR LANDING MISSION CONSUMABLES.	DATA OBTAINED.

TABLE I APOLLO 10 SEQUENCE OF EVENTS

<u>EVENT</u>	<u>ACTUAL TIME</u> (HR:MIN:SEC)	<u>PLANNED TIME</u> (HR:MIN:SEC)	<u>DIFF</u> (MIN:SEC)
Liftoff	0:00:00	0:00:00	0:00
Pitch and Roll Start	0:00:13	0:00:12	+ 0:01
Roll Complete	0:00:32	0:00:30	+ 0:02
S-IC IBECO	0:02:15	0:02:15	0:00
Begin Tilt Arrest	0:02:37	0:02:37	0:00
S-IC OBECO	0:02:42	0:02:40	+ 0:02
S-IC/S-II Separation	0:02:42	0:02:41	+ 0:01
S-II Engine Start	0:02:43	0:02:42	+ 0:01
S-II Second Plane Separation	0:03:12	0:03:11	+ 0:01
LET Jettison	0:03:18	0:03:16	+ 0:02
S-II Cutoff	0:09:13	0:09:14	-0:01
S-II/S-IVB Separation	0:09:13	0:09:15	-0:01
S-IVB Engine Start	0:09:14	0:09:15	-0:01
S-IVB Cutoff	0:11:44	0:11:44	0:00
Insertion	0:11:54	0:11:54	0:00
TLI (S-IVB)	2:39:21	2:39:17	+0:04

TABLE I APOLLO 10 SEQUENCE OF EVENTS

<u>EVENT</u>	<u>ACTUAL TIME</u> (HR:MIN:SEC)	<u>PLANNED TIME</u> (HR:MIN:SEC)	<u>DIFF</u> (MIN:SEC)
Evasive Maneuver (SPS)	4:39:10	4:28:48	+0:22
MCC-1 (SPS)	Not Required	9:38:46	----
MCC-2 (SPS)	26:32:57	26:39:17	-7:40
MCC-3 (SM RCS)	Not Required	53:45:43	----
MCC-4	Not Required	70:45:43	----
LOI-1 (SPS)	75:55:54	75:45:43	+10:11*
LOI-2 (SPS)	80:25:07	80:10:46	+14:21
Undock (SM RCS)	98:22:00	98:05:16	+16:44
CSM/LM Separation Maneuver (SM RCS)	98:47:16	98:35:15	+12:00
DOI (LM DPS)	99:46:01	99:33:57	+12:04
Phasing (LM DPS)	100:58:25	100:46:21	+12:04
Staging (LM RCS)	102:45:00	102:33:18	+11:42
Insertion (LM APS)	102:55:01	102:43:13	+11:43
CSI (LM RCS)	103:45:55	103:33:46	+12:09
CDH (LM RCS)	104:43:52	104:31:42	+12:09

* Omission of MCC-1 delayed lunar orbit event times.

TABLE I APOLLO 10 SEQUENCE OF EVENTS

<u>EVENT</u>	<u>ACTUAL TIME</u> (HR:MIN:SEC)	<u>PLANNED TIME</u> (HR:MIN:SEC)	<u>DIFF</u> (MIN:SEC)
TPI (LM RCS)	105:22:55	105:08:57	+13:58
Docking (SM RCS)	106:22:08	106:15:00	+ 7:08
APS Depletion (LM APS)	108:51:01	108:38:57	+12:04
TEI (SPS)	137:36:28	137:20:22	+16:06
MCC-5	Not Required	152:20:22	----
MCC-6	Not Required	176:50:32	----
MCC-7	188:49:57	188:50:32	-00:35
Entry Interface (400,000 feet)	191:48:54	191:50:32	-01:38
Splashdown	192:03:23	192:04:27	-01:04

2.0 ANOMALY LISTING

THIS SECTION CONTAINS A LISTING OF ANOMALIES OR PROBLEMS RESULTING FROM THE MISSION. THEY ARE LISTED ACCORDING TO LAUNCH VEHICLE AND SPACECRAFT (COMMAND/SERVICE MODULE AND LUNAR MODULE). THE GROUND SYSTEM SUPPORTING THE APOLLO 10 COUNTDOWN AND LAUNCH PERFORMED SATISFACTORILY AND THERE WERE NO SIGNIFICANT ANOMALIES.

LAUNCH VEHICLE (MSFC)

- 2.1.1 FAILURE OF IU AIR/GN₂ PURGE DUCT
- 2.1.2 S-IVB OSCILLATIONS
- 2.1.3 S-IVB AUXILIARY HYDRAULIC PUMP ABNORMAL OPERATION
- 2.1.4 S-IVB APS MODULE HELIUM LEAK

SPACECRAFT - COMMAND/SERVICE MODULE (MSC)

- 2.2.1 CM RCS HELIUM LEAK
- 2.2.2 CM RCS OXIDIZER LINE BURST DIAPHRAGM FAILURE
- 2.2.3 PRIMARY ECS EVAPORATOR DRIED OUT
- 2.2.4 WATER PROBLEM
- 2.2.5 LOW PRESSURE FROM WATER GUN
- 2.2.6 THERMAL COATING ON FORWARD HATCH FLAKED OFF
- 2.2.7 TUNNEL WOULD NOT VENT
- 2.2.8 SIMPLEX-A NOT OPERATING
- 2.2.9 CM RENDEZVOUS RADAR TRANSPONDER FAILED TO OPERATE
- 2.2.10 CM SEQUENCE CAMERA
- 2.2.11 FUEL CELL 1 AC CIRCUIT BREAKER OPEN
- 2.2.12 CONDENSER EXIT TEMPERATURE FLUCTUATIONS - FUEL CELL 2
- 2.2.13 CRYOGENIC HYDROGEN AUTOMATIC HEATER CONTROL FAILURE TO TURN OFF
- 2.2.14 OVERPRESSURE OF REACTANTS IN FUEL CELL 1 WHEN PURGE VALVE CLOSED
- 2.2.15 EDS MODULE LIGHT BULBS FAILED INTERMITTENTLY
- 2.2.16 ENTRY MONITOR SYSTEM STOPPED SCRIBING WHEN INITIALIZED
- 2.2.17 VHF BEACON ANTENNA DID NOT DEPLOY
- 2.2.18 TWO RETAINING SPRINGS ON TUNNEL CHARGE HOLDER RING DID NOT CAPTURE
- 2.2.19 SLOW-DOWN OF ONBOARD TAPE RECORDER DURING ENTRY

- 2.2.20 EVA STRUT BRACE NOT IN STOWED POSITION FOR LAUNCH
- 2.2.21 GYRO DISPLAY COUPLER PERFORMANCE
- 2.2.22 CHLORINE AMPULE LEAKAGE
- 2.2.23 DIGITAL EVENT TIMER MISCOUNTS
- 2.2.24 SUIT HEAT EXCHANGER WICK DIFFICULT TO SERVICE

LUNAR MODULE

- 2.2.25 CREW REPORTED LM WATER CONTAINED AIR
- 2.2.26 HIGH NOISE LEVEL IN LM CABIN
- 2.2.27 YAW RATE GYRO OUTPUT ERROR
- 2.2.28 INSTRUMENTATION DISCREPANCIES
- 2.2.29 BACKUP VOICE NOISE ON OMNI IN REVOLUTION 13
- 2.2.30 DROP IN SIGNAL STRENGTH ON S-BAND STEERABLE ANTENNA
- 2.2.31 DPS GIMBAL DRIVE PITCH ACTUATOR FAILED
- 2.2.32 COMMANDERS OXYGEN PURGE SYSTEM HEATER LIGHT DID NOT COME ON
- 2.2.33 LARGE LM ATTITUDE EXCURSIONS DURING STAGING
- 2.2.34 OPTICAL SYSTEM PROBLEMS
- 2.2.35 ABNORMAL RISE IN CO₂ INDICATIONS ON PRIMARY LIOH CARTRIDGE
- 2.2.36 LM CABIN DEPRESSURIZED AT FINAL SEPARATION
- 2.2.37 CAMERA FAILURES
- 2.2.38 FAILURE TO GET ADEQUATE DATA DUMPS
- 2.2.39 APS LOW LEVEL INDICATIONS
- 2.2.40 LEFT-HAND HEAD STRUT LOCKOUT HANDLE
- 2.2.41 FLASHING LIGHT FAILURE

GROUND SYSTEMS

NONE

ANOMALY REPORT

NO. 2.1.1

TITLE: FAILURE OF IU AIR/GN₂ PURGE DUCT

SYSTEM: IU

MISSION: APOLLO 10

SUBSYSTEM: ECS

EVENT TIME: T-8:57

PROBLEM: AFTER SWITCHOVER FROM AIR TO GN₂, A REDUCTION WAS OBSERVED IN PRESSURE IN THE IU/S-IVB PURGE GASES. THE PRESSURE TRANSDUCER READING ON THE RTG COOLING NOZZLE DECREASED FROM 0.37 PSIG AT T-9:00 TO ALMOST ZERO GAGE PRESSURE AT T-8:30. THE CORRESPONDING GROUND SUPPORT EQUIPMENT (GSE) FLOWRATE INCREASED FROM AN INITIAL VALUE OF 200 LB/MIN TO AN OFF-SCALE VALUE OF MORE THAN 225 LB/MIN. THE UPSTREAM INLET PRESSURE DECREASED FROM 2.15 PSIG TO 1.66 PSIG. THE LOW PRESSURE AT THE INLET TO THE RTG NOZZLE INDICATED LOSS OF FLOW THROUGH THE NOZZLE. THE INCREASE IN FLOWRATE FROM THE GSE WITH A CORRESPONDING DECREASE IN INLET PRESSURE INDICATED THAT AN OPENING HAD OCCURRED SOMEWHERE IN THE PURGE DUCTING. THE ECS PURGE SYSTEM CONTINUED TO FUNCTION ADEQUATELY AS INDICATED BY A STABLE COMPARTMENT TEMPERATURE; THE DUCT FAILURE WAS ASSESSED AS NON-CRITICAL FOR THE APOLLO 10 LAUNCH, AND THE COUNTDOWN PROCEEDED.

MSFC TESTS INDICATE THE ECS AIR/GN₂ PURGE DUCT HAD A MASSIVE GAS LEAK AT THE DUCT JOINT APPROXIMATELY 4 INCHES INSIDE THE STAGE SKIN. THIS JOINT CONSISTED OF A FIBERGLASS DUCT WHICH FIT OVER A SHORT METAL DUCT STUB ATTACHED TO THE IU SKIN. THE FIBERGLASS DUCT WAS RETAINED BY A MARMAN CLAMP, WHICH WAS TORQUED TO 7+1 INCH-POUNDS.

ACTION: AS A RESULT OF THE MSFC TESTS, A SECOND MARMAN CLAMP WILL BE ADDED, AND BOTH CLAMPS WILL BE TORQUED TO 20+2 INCH-POUNDS. THIS CONFIGURATION HAS BEEN TESTED TO 9 TIMES THE NORMAL OPERATING PRESSURE WITH NO FAILURES. THIS CHANGE (IBM ECP 1905) HAS BEEN COMPLETED ON APOLLO 11, AND IT WILL BE ACCOMPLISHED ON ALL SUBSEQUENT LAUNCH VEHICLES.

ORGANIZATION: 5-2490

REFERENCES: MSFC 5-DAY REPORT, PP. 4,5
APOLLO 11 FRR

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.1.1

TITLE: FAILURE OF IN AIR/GN₂ PURGE DUCT

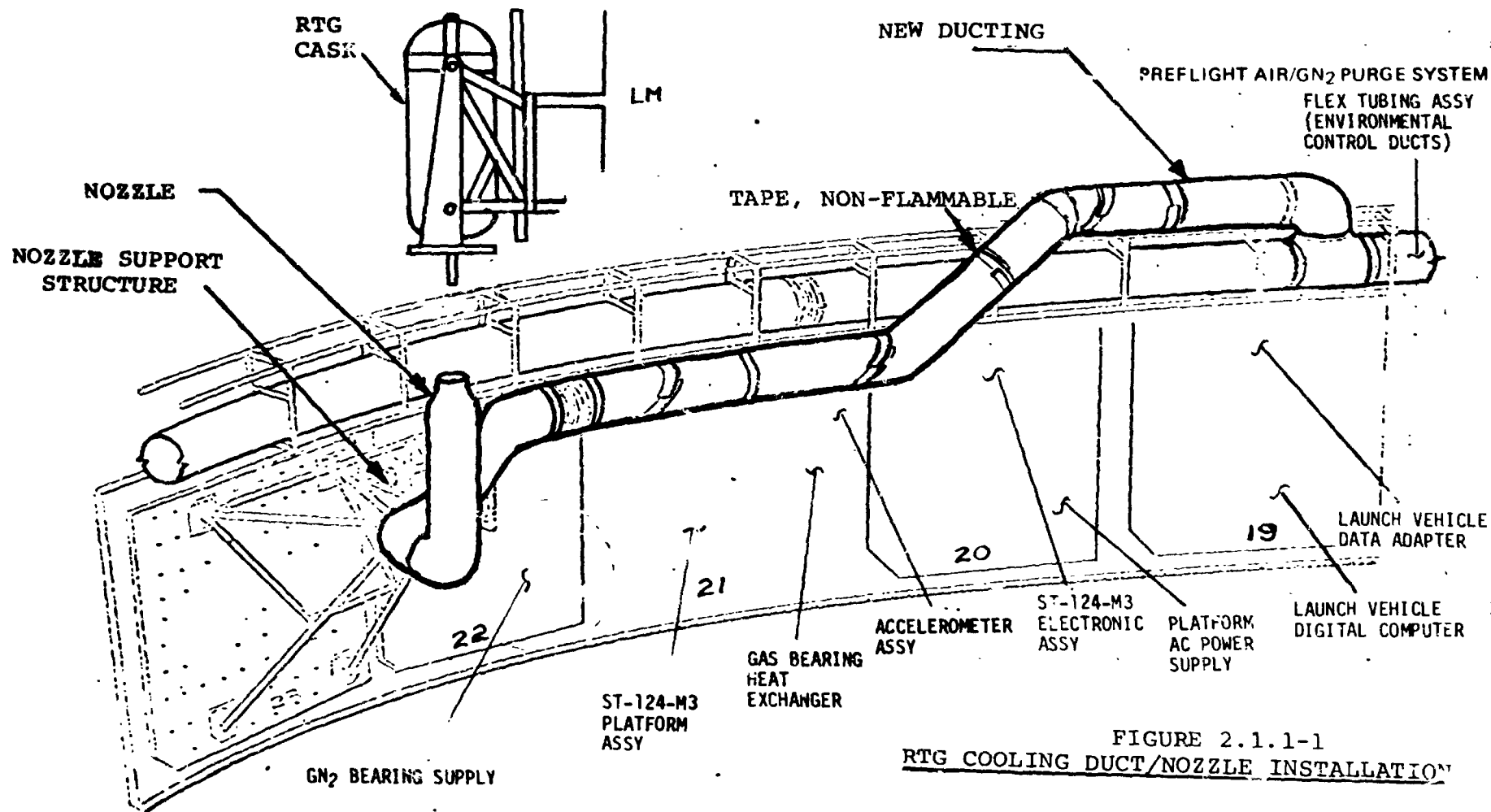


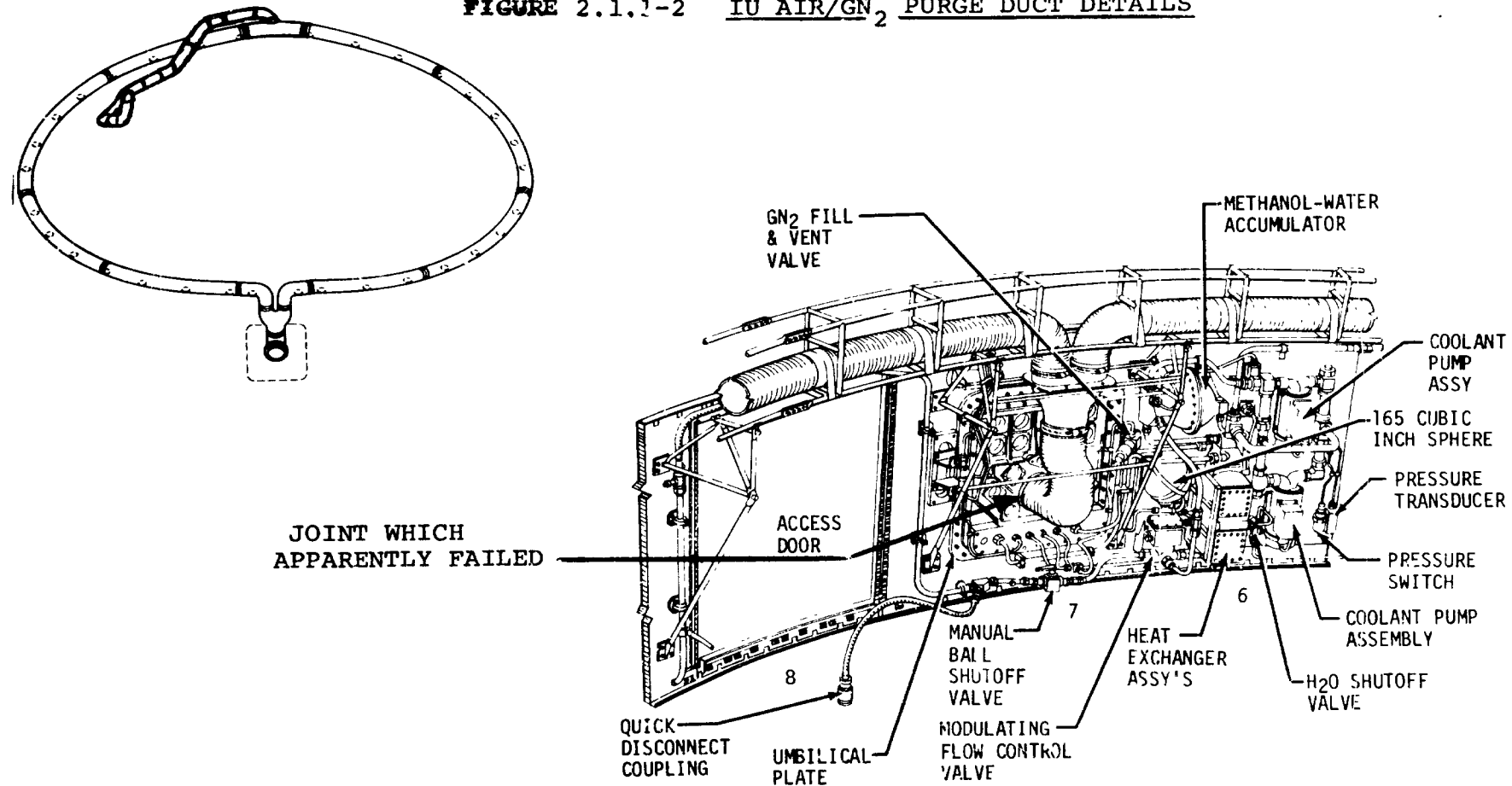
FIGURE 2.1.1-1
RTG COOLING DUCT/NOZZLE INSTALLATION

DETAIL SHEET

ANOMALY 2.1.1

TITLE: FAILURE OF IU AIR/ GN_2 PURGE DUCT

FIGURE 2.1.1-2 IU AIR/ GN_2 PURGE DUCT DETAILS



ANOMALY REPORT

NO. 2.1.2 TITLE: S-IVB OSCILLATIONS

SYSTEM: S-IVB

MISSION: APOLLO 10

SUBSYSTEM: PROPULSION

EVENT TIME: 0:09 AND 2:39

PROBLEM: DURING THE FIRST S-IVB BURN, 19 HERTZ LONGITUDINAL OSCILLATIONS OF APPROXIMATELY +0.25 G WERE OBSERVED AT THE ENGINE GIMBAL BLOCK. A SLIGHT CHANGE IN OSCILLATORY THRUST, DERIVED FROM CHAMBER PRESSURE, WAS ALSO EVIDENT DURING THIS TIME PERIOD. A REVIEW OF THE APOLLO 8 FLIGHT DATA SHOWED SIMILAR THRUST OSCILLATIONS AS ON APOLLO 10, BUT AT APPROXIMATELY 1/2 THE G LEVEL. THIS ACTIVITY IS WITHIN THE NORMAL J-2 ENGINE UNCOUPLED THRUST LEVEL, AND IT DOES NOT REPRESENT CONCERN FOR FUTURE APOLLO MISSIONS.

LOW FREQUENCY, LOW AMPLITUDE VIBRATION WAS ALSO PRESENT THROUGHOUT THE SECOND BURN. SHORTLY AFTER STEP PRESSURIZATION, A PREDOMINANT HIGH FREQUENCY OSCILLATION OF 46 HERTZ OCCURRED AND REMAINED UNTIL CUTOFF. THE MOST PROBABLE CAUSE WAS SEQUENTIAL VENTING OF THE DUAL VENT VALVES IN THE FORWARD SKIRT AREA, WHICH TENDS TO EXCITE THE FORWARD SKIRT RING MODE. TESTS WERE RUN AT AEDC TO ATTEMPT TO DUPLICATE THE FLIGHT DATA. APOLLO 11 WAS NOT CONSTRAINED BECAUSE THERE WAS NO ADVERSE EFFECT ON EITHER THE STRUCTURE OR THE VENTING SYSTEM DURING THE APOLLO 10 MISSION.

ORGANIZATION: 5-2490
REFERENCES: MSFC 5-DAY REPORT, PP. 5, 6
APOLLO 11 FRR

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.1.2

TITLE: S-IVB OSCILLATIONS

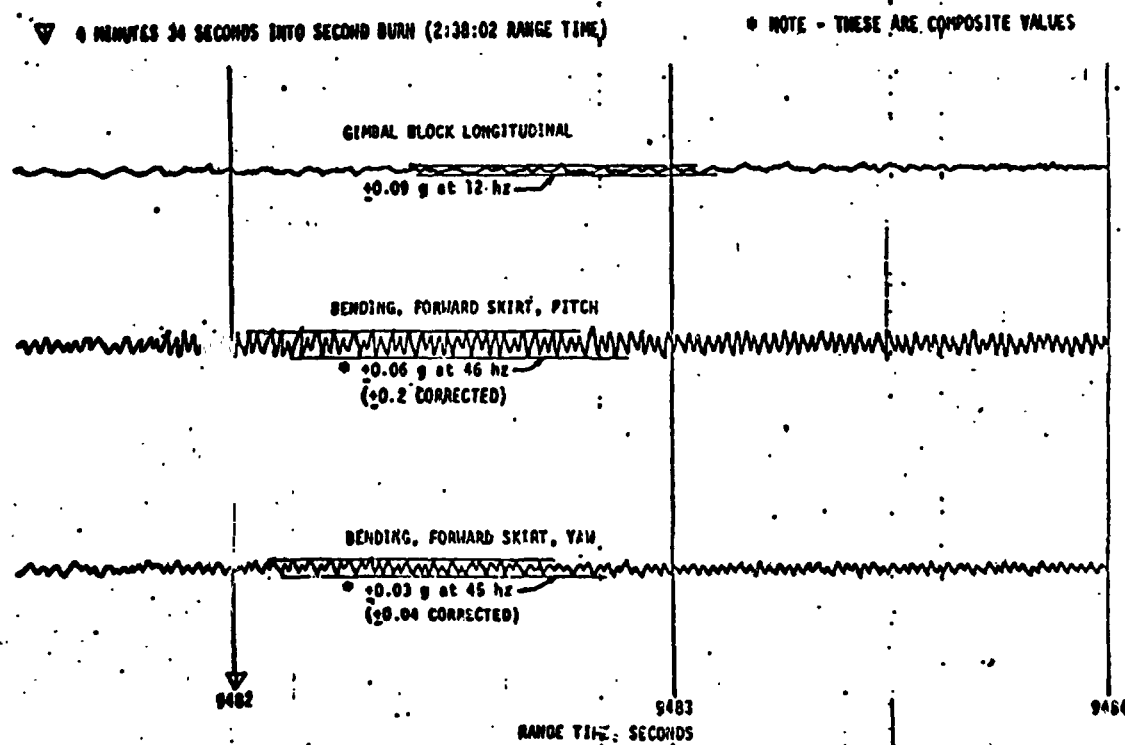


FIGURE 2.1.2-1 S-IVB SECOND BURN LONGITUDINAL AND LATERAL OSCILLATIONS

DETAIL SHEET

ANOMALY 2.1.2

TITLE: S-IVB OSCILLATIONS

FIGURE 2.1.2-2
APOLLO 10 (AS-505) AND APOLLO 8 (AS-503) SECOND BURN VIBRATION COMPARISON

MEASUREMENT	g at 45 HERTZ		g at 13 - 15 HERTZ		
	277 SEC. TO CUTOFF		321 SEC. TO CUTOFF	321 SEC	344 SEC
	503	505	503	505	505
Spacecraft Longitudinal	*	± 0.05	*	*	*
Spacecraft Pitch	*	*	*	± 0.04	± 0.05
Spacecraft Yaw	*	*	*	*	± 0.05
IU Longitudinal	*	*	*	*	*
IU Pitch	*	*	*	*	*
IU Yaw	*	*	*	*	*
Forward Skirt Pitch	*	± 0.2	± 0.24	*	*
Forward Skirt Yaw	*	± 0.04	± 0.27	*	*
Gimbal Block Longitudinal	*	± 0.03	± 0.07	± 0.12	± 0.10
Gimbal Block Pitch	*	**	*	**	**
Gimbal Block Yaw	*	*	*	*	*

*Data in noise floor.

**Data questionable.

DETAIL SHEET

ANOMALY 2.1.2

TITLE: S-IVB OSCILLATIONS

DESCRIPTION:

THE CREW REPORTED A LOW FREQUENCY LATERAL AND LONGITUDINAL OSCILLATION DURING BOTH S-IVB BURNS, WITH A HIGHER FREQUENCY VIBRATION SUPERIMPOSED ON IT BEGINNING 4 MINUTES AND 40 SECONDS INTO THE SECOND BURN. LONGITUDINAL 19 HZ OSCILLATIONS WERE EXPERIENCED DURING THE FIRST BURN AT A MAXIMUM AMPLITUDE OF +0.25 G ON THE LONGITUDINAL GIMBAL BLOCK ACCELEROMETER. A FREQUENCY ANALYSIS OF THE CHAMBER PRESSURE (Pc) SHOWS A CHANGE IN THE THRUST OSCILLATIONS DURING THE SAME TIME OF FLIGHT. THE AS-503 S-IVB DATA SHOWED 19 HZ LONGITUDINAL OSCILLATIONS SIMILAR TO AS-505 AT ABOUT ONE-HALF THE AMPLITUDE. S-IVB-201 AND S-IVB-204 THRUST DATA SHOWED 18-19 HZ OSCILLATIONS EQUAL IN AMPLITUDE TO AS-505. LONGITUDINAL VIBRATIONS WHICH ARE RESPONSES TO UNCOUPLED THRUST OSCILLATIONS ALSO OCCURRED DURING S-IC AND S-II MAINSTAGE BURNS. THE AMPLITUDE OF THE 19 HZ THRUST OSCILLATIONS CALCULATED FROM Pc IS WITHIN THE NORMAL J-2 UNCOUPLED THRUST LEVELS (NOISE LEVEL THRUST OSCILLATIONS). THE OSCILLATIONS ARE CONSISTENT WITH THE ENGINE NOISE LEVEL THRUST OSCILLATIONS AND THEY ARE OF NO CONCERN FROM STABILITY CONSIDERATIONS. SIMILAR VIBRATION LEVELS WERE ALSO PRESENT THROUGHOUT THE SECOND BURN. AN INCREASE IN THE PITCH & YAW VIBRATION LEVEL OCCURRED DURING THE SECOND BURN 4 SECONDS BEFORE THE ASTRONAUT COMMENT. THE PREDOMINANT FREQUENCY WAS 46 HZ WHICH REMAINED UNTIL ENGINE CUTOFF. THE FUEL STEP PRESSURIZATION AND VENT SEQUENCE OCCURRED 3 SECONDS BEFORE THIS VIBRATION LEVEL INCREASE. THE PROBABLE CAUSE IS THE PROXIMITY (0.1 PSI) OF THE DUAL VENT VALVE SETTINGS.

IT HAS BEEN CONCLUDED THAT THE 19 HZ LONGITUDINAL VIBRATION IS A LOW LEVEL RESPONSE TO ENGINE THRUST OSCILLATIONS, SIMILAR TO THE VIBRATIONS EXPERIENCED BY OTHER SATURN STAGES DURING POWERED FLIGHT. THE 46 HZ OSCILLATION IS OF NO CONCERN WITH REGARD TO THE STRUCTURE OR THE VENTING SYSTEM. TESTS WERE PERFORMED AT AEDO TO ATTEMPT TO DUPLICATE THE 46 HZ RESPONSE. COMPLETION OF THIS TESTING WAS NOT A CONSTRAINT FOR APOLLO 11.

ANOMALY REPORT

NO. 2.1.3	TITLE: S-IVB AUXILIARY HYDRAULIC PUMP ABNORMAL OPERATION	
SYSTEM: S-IVB	MISSION: APOLLO 10	
SUBSYSTEM: HYDRAULIC	EVENT TIME: 2:37	
PROBLEM:	<p>DURING THE TLI BURN AND THE PROPELLANT DUMP, THE AUXILIARY HYDRAULIC PUMP OPERATED ABNORMALLY. THE PUMP WAS CAVITATING, HEATING UP, PRESSURIZING THE SYSTEM TOO SLOWLY, AND DRAWING 19 AMPS INSTEAD OF THE EXPECTED 40 AMPS. DURING THE PRESSURIZATION CYCLE AFTER SECOND BURN AND DURING THE PROPELLANT DUMP, THE PUMP CURRENT WAS 15 TO 16 AMPERES AND THE SYSTEM PRESSURE WAS LESS THAN THE 1500 PSI LOWER LIMIT OF THE MEASURING SYSTEM. THERE WAS ENOUGH PRESSURE AVAILABLE, HOWEVER, TO CENTER THE J-2 ENGINE DURING THESE PERIODS.</p>	
ACTION:	<p>TESTS WITH A FAILED COMPENSATOR SPRING GUIDE REPRODUCED THE FLIGHT DATA. THE SPRING GUIDES WERE REDESIGNED SOME TIME AGO, BUT IT IS SUSPECTED THE OLD DESIGN FLEW ON AS-505 THE COMPENSATOR SPRING GUIDE ON S-IVB-506 WAS REPLACED BEFORE CDDT TO INSURE ADEQUATE PERFORMANCE DURING THE APOLLO 11 MISSION.</p>	
ORGANIZATION: 5-2490	RESOLUTION: CLOSED	DATE: 8/7/69
REFERENCES: MSFC 5-DAY REPORT, PP. 2-4 APOLLO 11 FRR		REV:

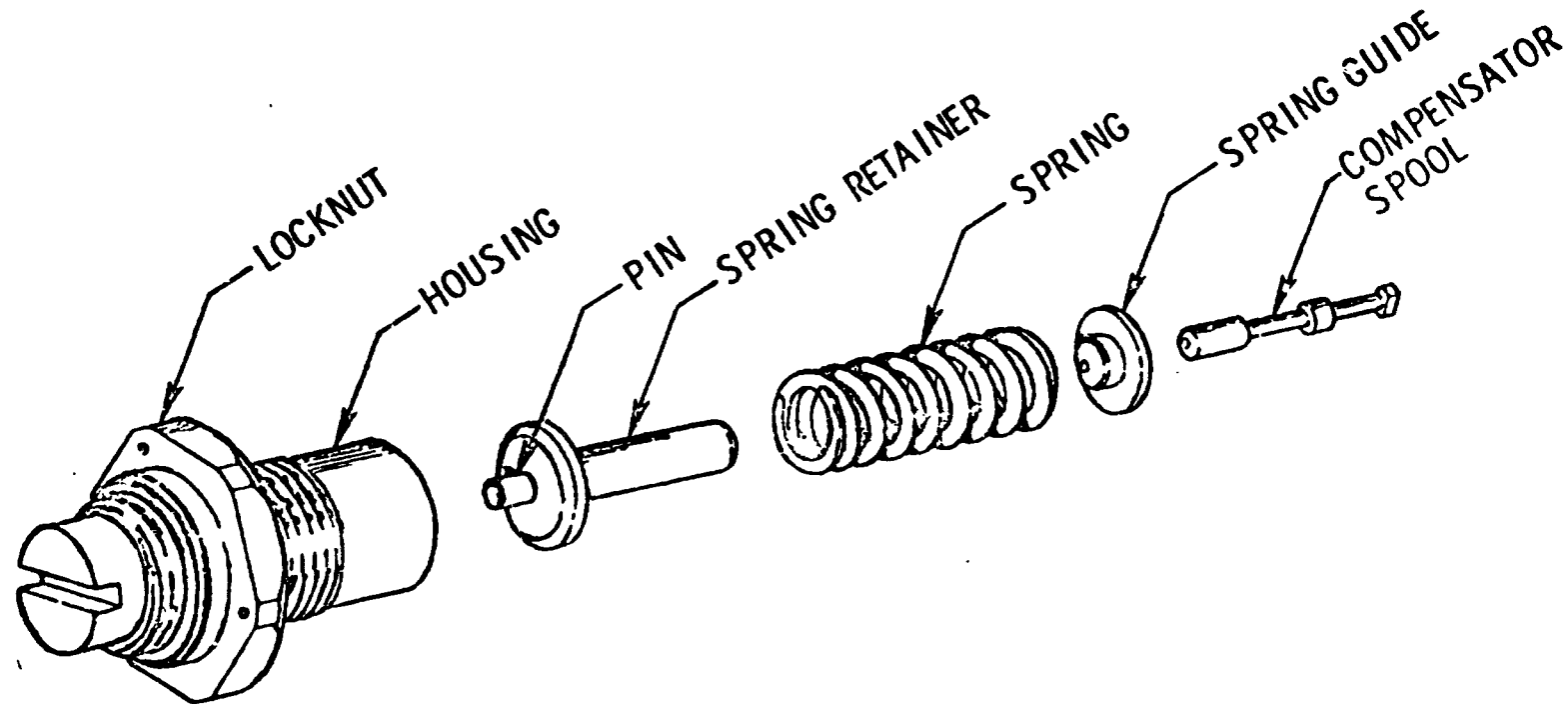
24

DETAIL SHEET

ANOMALY 2.1.3

TITLE: S-IVB AUXILIARY HYDRAULIC PUMP ABNORMAL OPERATION

FIGURE 2.1.3-2 PRESSURE COMPENSATOR ASSEMBLY

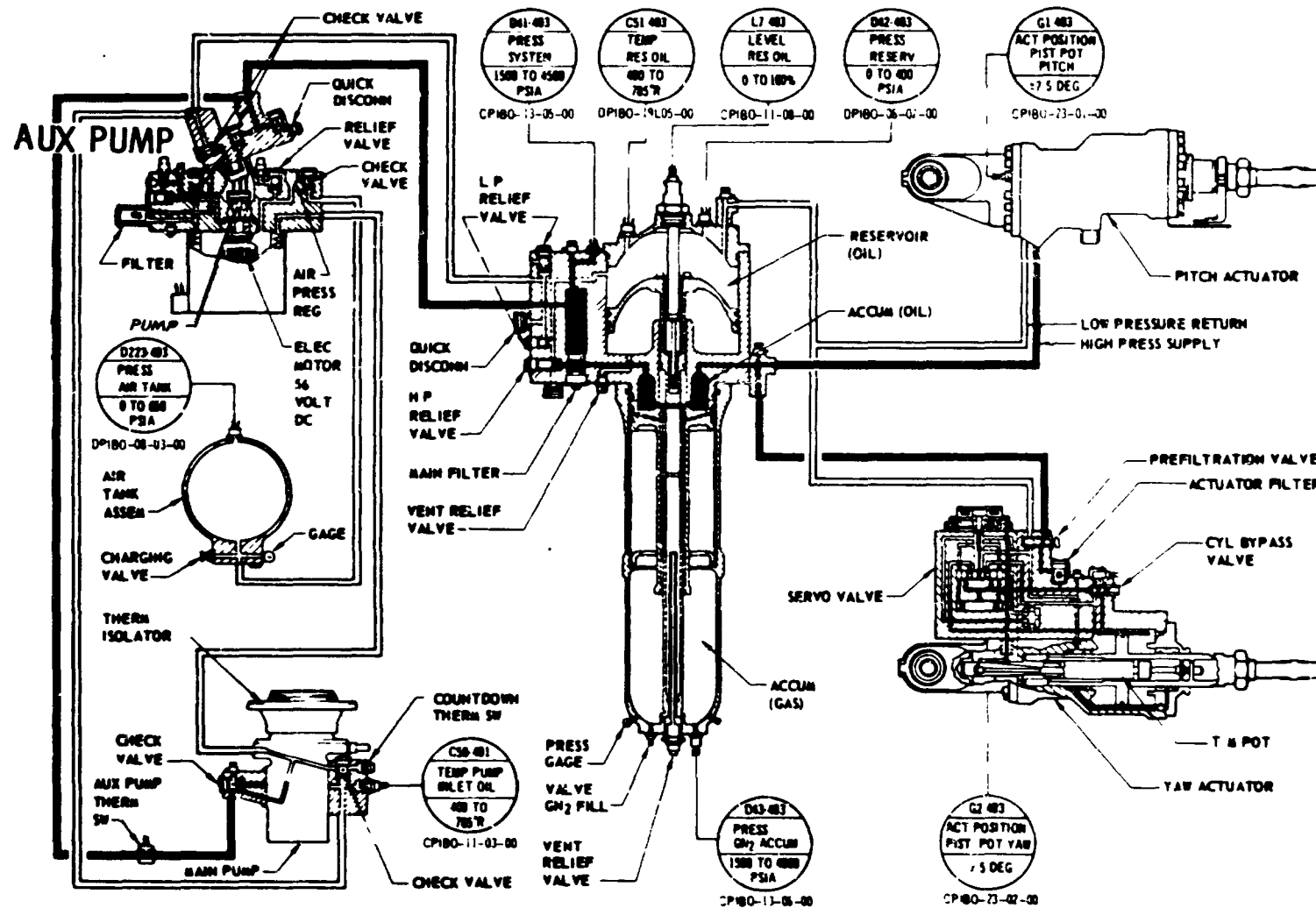


DETAIL SHEET

ANOMALY 2.1.3

TITLE: S-IVB AUXILIARY HYDRAULIC PUMP ABNORMAL OPERATION

FIGURE 2.1.3-1. S-IVB HYDRAULIC SYSTEM



DETAIL SHEET

ANOMALY 2.1.3

TITLE: S-IVB AUXILIARY HYDRAULIC PUMP ABNORMAL OPERATION

BACKGROUND: THE AUXILIARY HYDRAULIC PUMP IS A FIXED ANGLE, VARIABLE DELIVERY PUMP WITH A RATED FLOW OF 1.5 GPM AT A MINIMUM OF 3,500 PSIA. THE PUMP IS DRIVEN BY A 56 VDC MOTOR REQUIRING EITHER A GROUND SERVICE POWER OR STAGE POWER. THE MOTOR CAVITY IS FILLED WITH DRY AIR. THIS AIR MAINTAINS A POSITIVE PRESSURE WITHIN THE MOTOR TO PREVENT EXCESSIVE BRUSH WEAR; IT ALSO TRANSFERS MOTOR-GENERATED HEAT TO THE HYDRAULIC FLUID. THE HEAT THERMALLY CONDITIONS THE FLUID DURING PRELAUNCH PROPELLANT LOADING OPERATIONS AND DURING THE ORBITAL COAST PHASE. FOR THE COAST PHASE, THE PUMP TURNS ON AT PRE-PROGRAMMED INTERVALS FOR HEATING AND CIRCULATING THE FLUID.

DESCRIPTION: HYDRAULIC PUMP OPERATION WAS NORMAL DURING PRELAUNCH ACTIVITIES, BOOST, FIRST BURN, AND THROUGH SECOND BURN RESTART PREPARATIONS.

THE AUXILIARY HYDRAULIC PUMP WAS TURNED ON 6 MINUTES PRIOR TO SECOND BURN. THE ACTUATORS CENTERED THE J-2 ENGINE IN RESPONSE TO THE 3635 PSIA SYSTEM PRESSURE. AT ENGINE IGNITION, THE ACTUATORS RESPONDED NORMALLY TO THE APPLIED GUIDANCE SIGNALS. THE AUXILIARY PUMP RESPONDED BRIEFLY WITH HIGH FLOW TO MEET THIS DEMAND WHILE THE ENGINE DRIVEN PUMP WAS BROUGHT UP TO SPEED. SHORTLY AFTER ENGINE IGNITION, THE ENGINE DRIVEN PUMP OUTPUT PRESSURE EXCEEDED THE NORMAL 3635 PSIA BY 3 PERCENT. THE AUXILIARY PUMP RESPONDED TO THIS EXCESS PRESSURE BY FEATHERING TO THE NO-FLOW CONDITION WITH A CORRESPONDING DROP TO A CONTINUOUS 21 AMPERE DEMAND. AT ABOUT 2:37 GET, THE AUXILIARY PUMP CURRENT DECREASED UNEXPECTEDLY TO 19 AMPERES. THE CURRENT REMAINED AT THIS LEVEL DURING THE 4.1 SECOND INTERVAL FOLLOWING ENGINE CUTOFF INSTEAD OF RISING TO THE NORMAL 40 TO 70 AMPERES.

DETAIL SHEET

ANOMALY 2.1.3

TITLE: S-IVB AUXILIARY HYDRAULIC PUMP ABNORMAL OPERATION

ONE PRESSURIZATION WAS PROGRAMMED BETWEEN SECOND BURN AND THE CHILL DOWN EXPERIMENT/PASSIVATION EVENT. NO MEASURABLE SYSTEM PRESSURE WAS OBSERVED (TRANSDUCER RANGE AND SYSTEM CHARACTERISTICS DO NOT ALLOW DETECTION BELOW 1500 PSI). HOWEVER, THE ACTUATORS CENTERED THE ENGINE WHICH INDICATES THAT THE AUXILIARY PUMP PRODUCED SOME PRESSURE AND FLOW.

THE LOX LEAD EXPERIMENT AND PASSIVATION WERE CONTINUED USING THE AUXILIARY PUMP TO CENTER THE J-2 ENGINE. DURING THIS PERIOD THE ENGINE REMAINED CENTERED, THE ENGINE DRIVEN PUMP INLET TEMPERATURE DECREASED STEADILY, AND RESERVOIR TEMPERATURE INCREASED. THESE EVENTS INDICATE THAT FLUID FLOW WAS BEING PRODUCED. THE AUXILIARY PUMP MOTOR CURRENT DRIFTED IN THE 15 TO 16 AMPERE RANGE DURING OPERATION UNTIL THE PUMP TURNED OFF BY GROUND COMMAND AT ABOUT 4948 SECONDS INTO TIME BASE 8.

AN AUXILIARY PUMP GROUND TEST WAS RUN IN AN ATTEMPT TO DUPLICATE THE FLIGHT DATA BY INTRODUCING KNOWN FAILURES. THE PRIME SUSPECT, STRUCTURAL FAILURE OF THE COMPENSATOR SPRING GUIDE, DID PRODUCE SIMILAR DATA. ADDITIONAL FAILURE TESTS (COMPENSATOR SPRING BREAKAGE, VALVE PLATE TORSION SPRING FRACTURE, AND STOP PIN FAILURE) DID NOT DUPLICATE FLIGHT DATA.

THERE IS NO INDICATION OF ANY MISSION OR PROGRAM IMPACT.

ANOMALY REPORT

NO. 2.1.4

TITLE: S-IVB APS MODULE HELIUM LEAK

SYSTEM: S-IVB

MISSION: APOLLO 10

SUBSYSTEM: APS

EVENT TIME: 6:30

PROBLEM: THE OPERATIONS OF THE APS PRESSURIZATION SYSTEM WAS SATISFACTORY WITH THE EXCEPTION OF A HELIUM LEAK IN MODULE NO. 1. THE LEAK STARTED APPROXIMATELY 6.5 HOURS AFTER LIFTOFF AND EXTENDED THROUGH LOSS OF DATA (10:54:00). THE LEAK RATE AT LOSS OF DATA WAS APPROXIMATELY 3278 SCCM (200 SCIM).

ACTION: AS A RESULT OF A SIMILAR LEAK WHICH OCCURRED ON AS-504 (APOLLO 9), FIVE "O" RINGS IN THE HIGH-PRESSURE HELIUM PLUMBING WERE CHANGED ON APOLLO 10 AND SUBSEQUENT. THE LEAKAGE RATES EXPERIENCED ON APOLLO 9 AND APOLLO 10 WOULD NOT IMPAIR THE ACCOMPLISHMENT OF THE S-IVB PORTION OF THE APOLLO 11 MISSION.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 11 FRR

FLIGHT EVALUATION REPORT - AS-505

APOLLO 10 MISSION MPR-SAT-FE-69-7

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.1.4

TITLE: S-IVB APS MODULE HELIUM LEAK

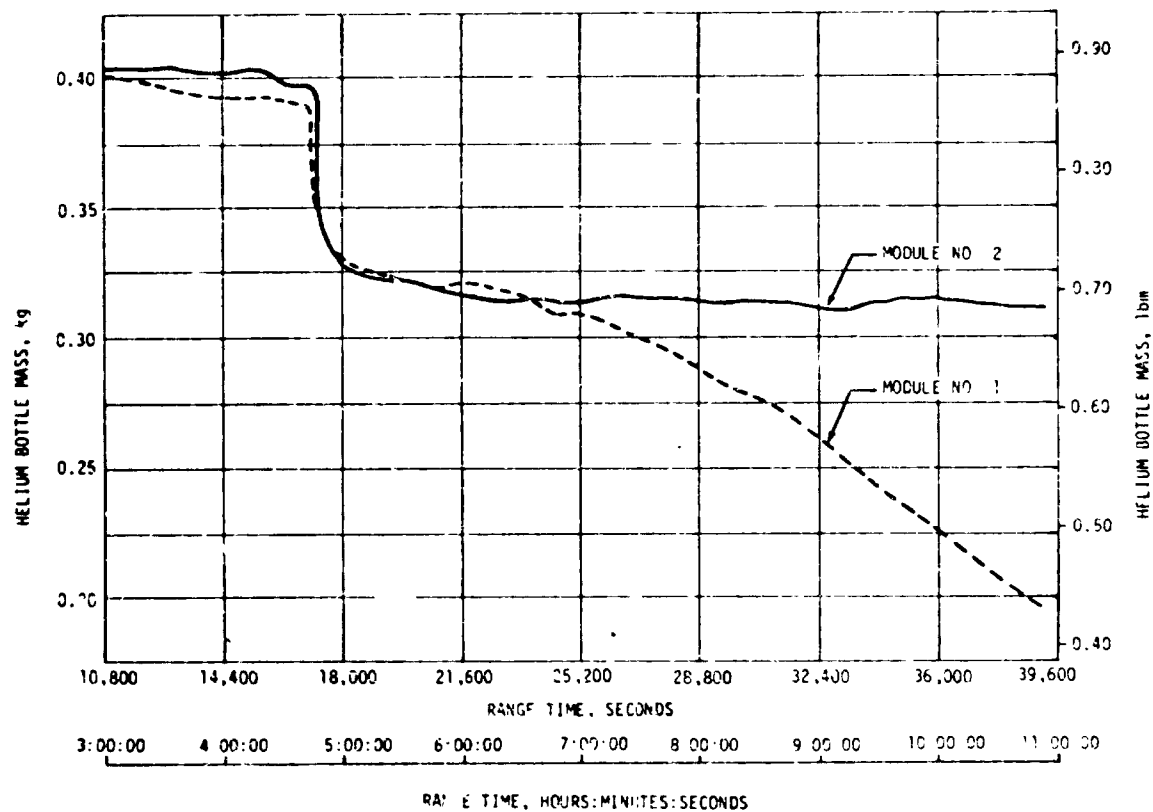


FIG. 2.1.4 S-IVB APS HELIUM BOTTLE MASS

ANOMALY REPORT

NO. 2.2.1

TITLE: CM RCS HELIUM LEAK

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: RCS

EVENT TIME: PRELAUNCH

PROBLEM 1: THE HELIUM MANIFOLD PRESSURE IN CM RCS SYSTEM 1 BEGAN TO DECAY AT A RATE OF 0.13 PSIA/HR FOLLOWING HELIUM SERVICING 3.5 DAYS PRIOR TO LAUNCH. AFTER 2.5 DAYS, THE PRESSURE HAD DROPPED FROM 45 TO 37 PSIA. THE PRESSURE IN THE HELIUM MANIFOLDS BETWEEN THE PROPELLANT TANKS AND THE CHECK VALVES WAS CHECKED; THE OXIDIZER SIDE WAS AT THE INITIAL PRESSURE, BUT THE FUEL SIDE WAS LOW. NEITHER A HELIUM LEAK NOR A FUEL LEAK COULD BE DETECTED; HOWEVER, A FUEL LEAK OF SUFFICIENT MAGNITUDE TO CAUSE THE PRESSURE DROP DEFINITELY WOULD HAVE BEEN DISCOVERED. THE CONCLUSION WAS THAT THE LOW PRESSURE HELIUM MANIFOLD IN THE FUEL LEG WAS LEAKING SLIGHTLY BUT AT A RATE ACCEPTABLE FOR THE MISSION. THE SYSTEM WAS THEN REPRESSURIZED TO 49 PSIA. THE LEAK RATE DECREASED AS THE MISSION PROGRESSED, REACHING 0.04 PSIA/HR BY THE END OF THE MISSION. ONLY PART OF THIS DECREASE RESULTED FROM THE REDUCED SYSTEM PRESSURE; THUS, THE LEAK CORRECTED ITSELF TO SOME EXTENT AND/OR THE CHARACTERISTICS OF THE HELIUM CHANGED AS IT BECAME DILUTED BY PROPELLANT PERMEATING THE BLADDER.

ACTION: POSTFLIGHT TESTING OF THE COMMAND MODULE INCLUDED A VERY THOROUGH MASS SPECTROMETER LEAK CHECK ON SYSTEM 1, AT BOTH 50 AND 285 PSIG. NO LEAKS WERE DETECTED; HOWEVER, DURING THE POSTFLIGHT DECONTAMINATION PROCEDURES, CERTAIN TYPES OF LEAKS COULD BE ELIMINATED.

FOR FUTURE MISSIONS, THE SYSTEM WILL BE PRESSURIZED TO 100 PSIA ABOUT 30 DAYS PRIOR TO FLIGHT TO INSURE THAT ANY LEAKS CAN BE DETECTED AND APPROPRIATE CORRECTIVE ACTION TAKEN PRIOR TO START OF THE LAUNCH COUNTDOWN.

ORGANIZATION: 5-2490
REFERENCES: MSC 5-DAY REPORT, P. 9
 MSC FAILURE AND ANOMALY LISTING

RESOLUTION. CLOSED

DATE:

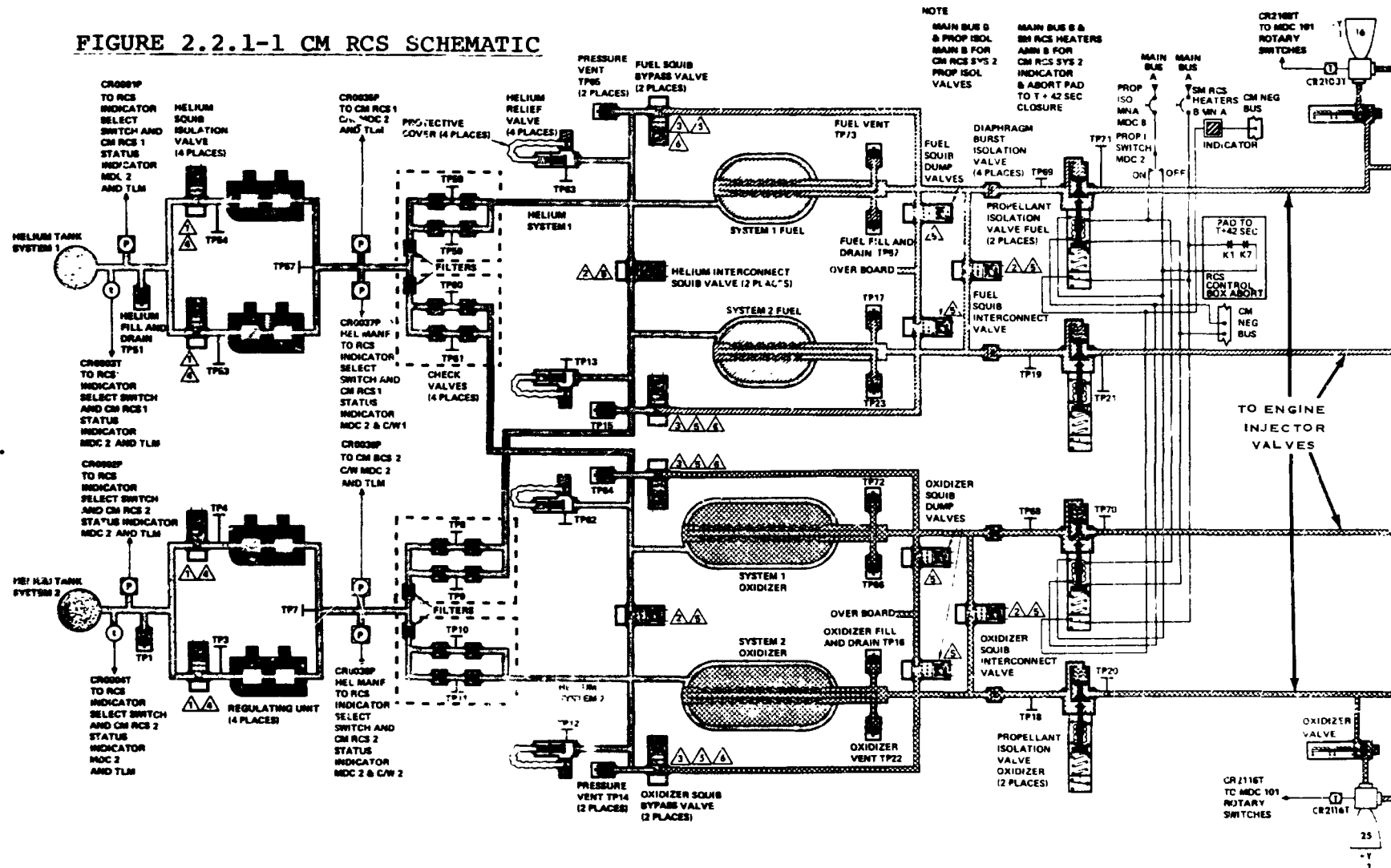
REV:

DETAIL SHEET

ANOMALY 2.2.1

TITLE: CM RCS HELIUM LEAK

FIGURE 2.2.1-1 CM RCS SCHEMATIC



ANOMALY REPORT

NO. 2.2.2

TITLE: CM RCS OXIDIZER LINE BURST DIAPHRAGM FAILURE

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: RCS

EVENT TIME: T-9:26

PROBLEM: DURING THE FINAL SWITCH LIST VERIFICATION, WHEN THE PROPELLANT ISOLATION VALVES OF THE COMMAND MODULE RCS SYSTEM WERE OPENED, THE PRESSURE IN THE CM RCS HELIUM SYSTEM 2 DROPPED FROM 44 PSIA TO 37 PSIA. THIS INDICATED THAT THE OXIDIZER PROPELLANT BURST DIAPHRAGM WAS RUPTURED, ALLOWING OXIDIZER TO FLOW FROM THE TANK INTO THE MANIFOLD WHEN THE ISOLATION VALVE WAS OPENED. THE OXIDIZER ISOLATION VALVE BACKED UP BY THE ENGINE VALVES PREVENTED LOSS OF OXIDIZER, AND THE SYSTEM WAS VISUALLY VERIFIED TO BE LEAK-TIGHT; THEREFORE, IT WAS DECIDED THAT THE SYSTEM WAS ACCEPTABLE FOR FLIGHT. THE ISOLATION VALVES WERE CLOSED AFTER ORBITAL INSERTION. THE ENGINE VALVES WERE THEN OPENED BY MEANS OF THE REACTION CONTROL HEATER CIRCUITS, AND THE OXIDIZER WAS VENTED FROM THE MANIFOLD FOR 25 MINUTES. FOUR PERCENT OF THE OXIDIZER IN SYSTEM 2 WAS LOST, HOWEVER, THE MAXIMUM PREVIOUS PROPELLANT USAGE DURING A MISSION WAS 35% OF ONE SYSTEM. AFTER THE MISSION, THE OXIDIZER AND FUEL BURST DISCS WERE SIMILAR IN PHYSICAL APPEARANCE, INDICATING THAT THE OXIDIZER BURST DISC HAD FAILED BECAUSE OF PRESSURE.

ACTION: CAUTION NOTES HAVE BEEN ADDED TO THE PRELAUNCH CHECKOUT PROCEDURES IN THE PLACES WHERE THE ALLOWABLE LIMITS ON THE BURST DISC (241 +16 PSID IN THE FLOW DIRECTION AND 10 PSID IN THE REVERSE DIRECTION) COULD BE EXCEEDED. TO ALLOW EARLY DETECTION OF ANY SIMILAR PROBLEM IN THE FUTURE, A LEAK CHECK OF THE BURST DISC HAS BEEN ADDED AFTER REACTION CONTROL SYSTEM PROPELLANT SERVICING.

ORGANIZATION: 5-2490

RESOLUTION: CLOSED

DATE:

REFERENCES: MSC 5-DAY REPORT, PP. 9, 15

APOLLO 11 FRR

MSC FAILURE AND ANOMALY LISTING, P. 1

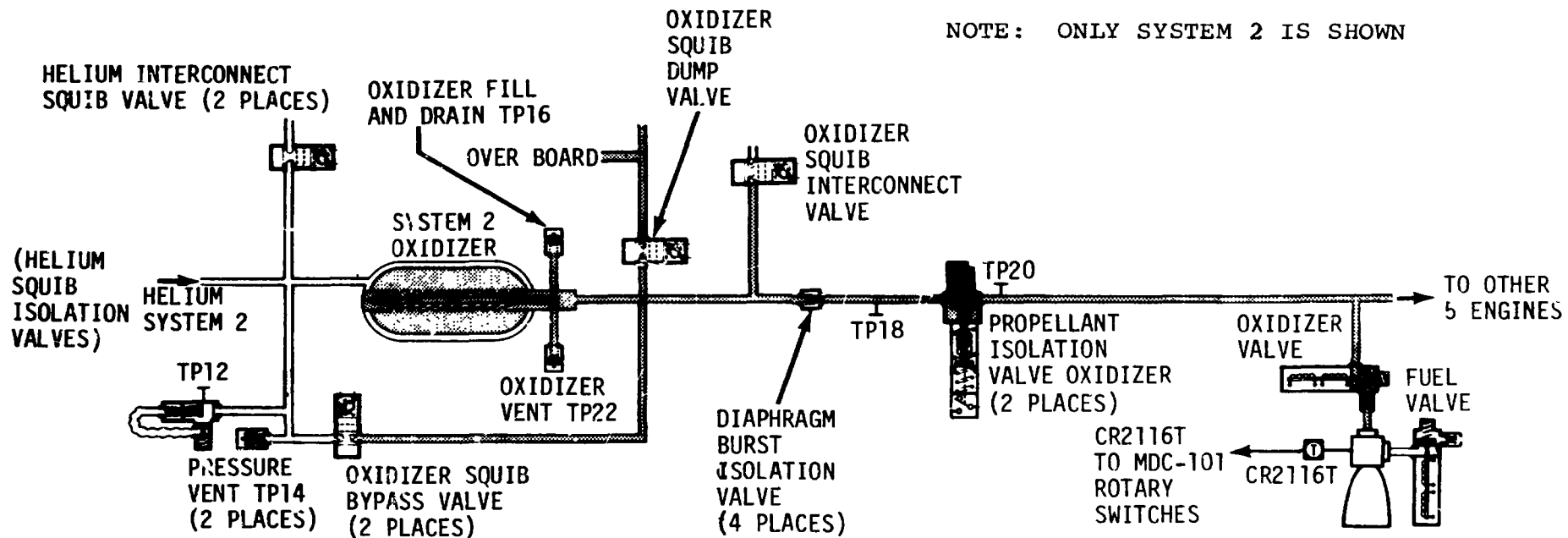
REV:

DETAIL SHEET

ANOMALY 2.2.2

TITLE: CM RCS OXIDIZER LINE BURST DIAPHRAGM FAILURE

Figure 2.2.2-1. CM RCS OXIDIZER SUPPLY



THE BURST DIAPHRAGMS CONFINE THE PROPELLANTS TO AS SMALL AN AREA AS POSSIBLE. THEY ASSURE AGAINST DOWNSTREAM LEAKAGE OF PROPELLANT ISOLATION VALVES, ENGINE INJECTION VALVES OR PLUMBING.

ANOMALY REPORT

NO. 2.2.3

TITLE: PRIMARY ECS EVAPORATOR DRIED OUT

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: ECS

EVENT TIME: 0:08 AND 78:38 GET

PROBLEM: THE PRIMARY EVAPORATOR IN THE ENVIRONMENTAL CONTROL SYSTEM BEGAN OPERATION SOON AFTER LIFT-OFF BUT DRIED OUT AFTER ONLY A FEW MINUTES. THE SECONDARY COOLING SYSTEM WAS ACTIVATED AND FUNCTIONED NOMINALLY. THE PRIMARY EVAPORATOR WAS DEACTIVATED AND WAS NOT RESERVICED WITH WATER UNTIL JUST PRIOR TO LUNAR ORBIT INSERTION. IT DRIED OUT AGAIN DURING THE SECOND LUNAR ORBIT. JUST PRIOR TO ENTRY, THE EVAPORATOR WAS SERVICED AGAIN. DURING ENTRY, IT FUNCTIONED NORMALLY, BUT INFORMATION IS NOT AVAILABLE TO INDICATE WHETHER OR NOT ADDITIONAL WATER WAS AUTOMATICALLY PROVIDED TO THE EVAPORATOR.

ACTION: A CHECK OF THE SWITCH ASSEMBLY REVEALED THAT THE ACTUATOR MOVED AS LITTLE AS 0.0008 INCH BEYOND THE POINT AT WHICH THE SWITCH SHOULD HAVE OPENED. WITH CHANGES IN ENVIRONMENT, THE ACTUATOR TRAVEL WAS AT TIMES NOT SUFFICIENT TO OPEN THE SWITCH. ACTUATOR RIGGING PROCEDURES WILL BE MODIFIED TO ASSURE PROPER OVERTRAVEL.

ORGANIZATION: 5-2490

REFERENCES: MSC 5-DAY REPORT, P. 10
FRR-APOLLO 11 JUNE 17, 1969
MSC FAILURE AND ANOMALY LISTING,
JUNE, 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.3

TITLE: PRIMARY ECS EVAPORATOR DRIED OUT

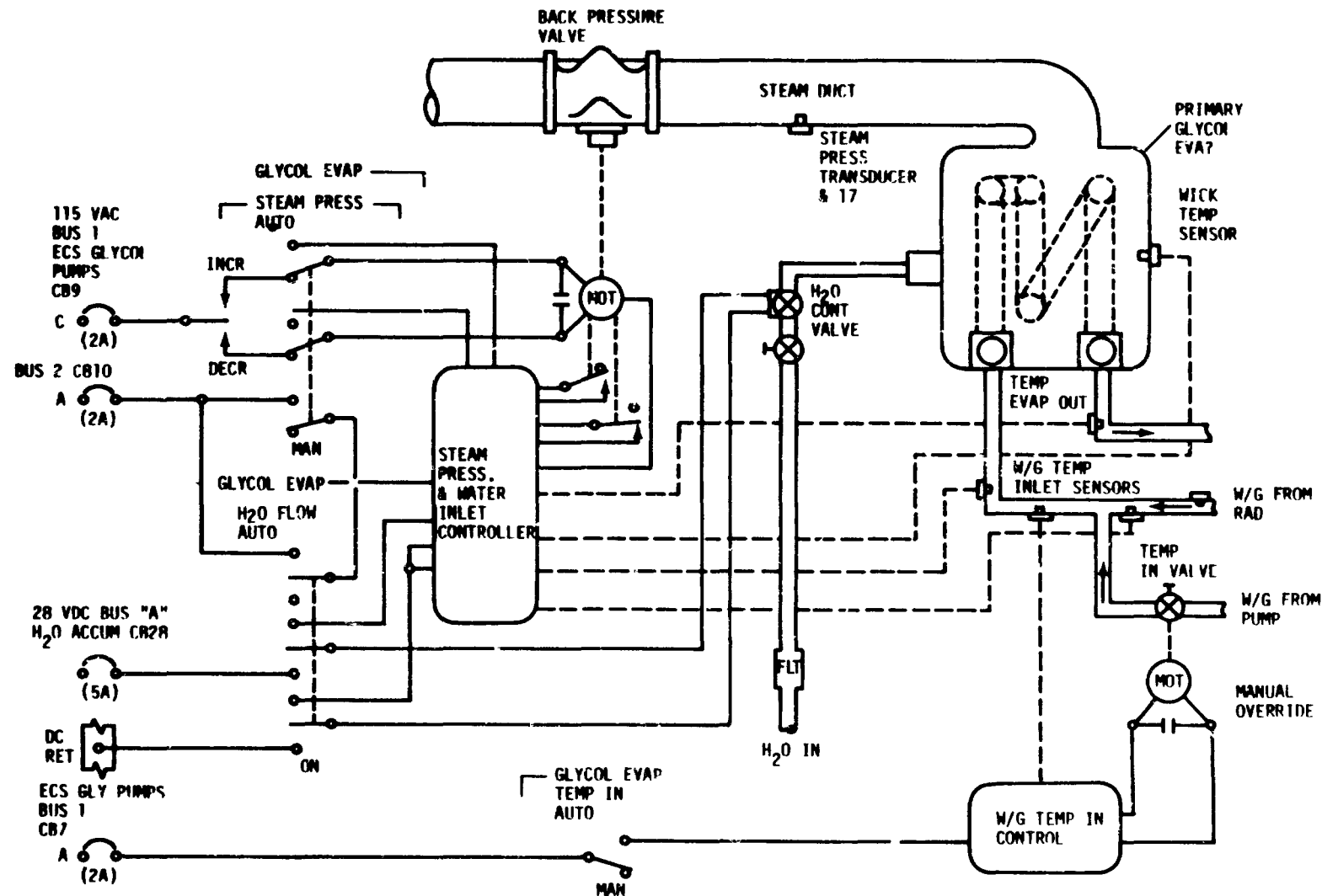


FIG. 2.2.3-1

PRIMARY WATER GLYCOL EVAPORATOR CONTROL

DETAIL SHEET

ANOMALY 2.2.3

TITLE: PRIMARY ECS EVAPORATOR DRIED OUT

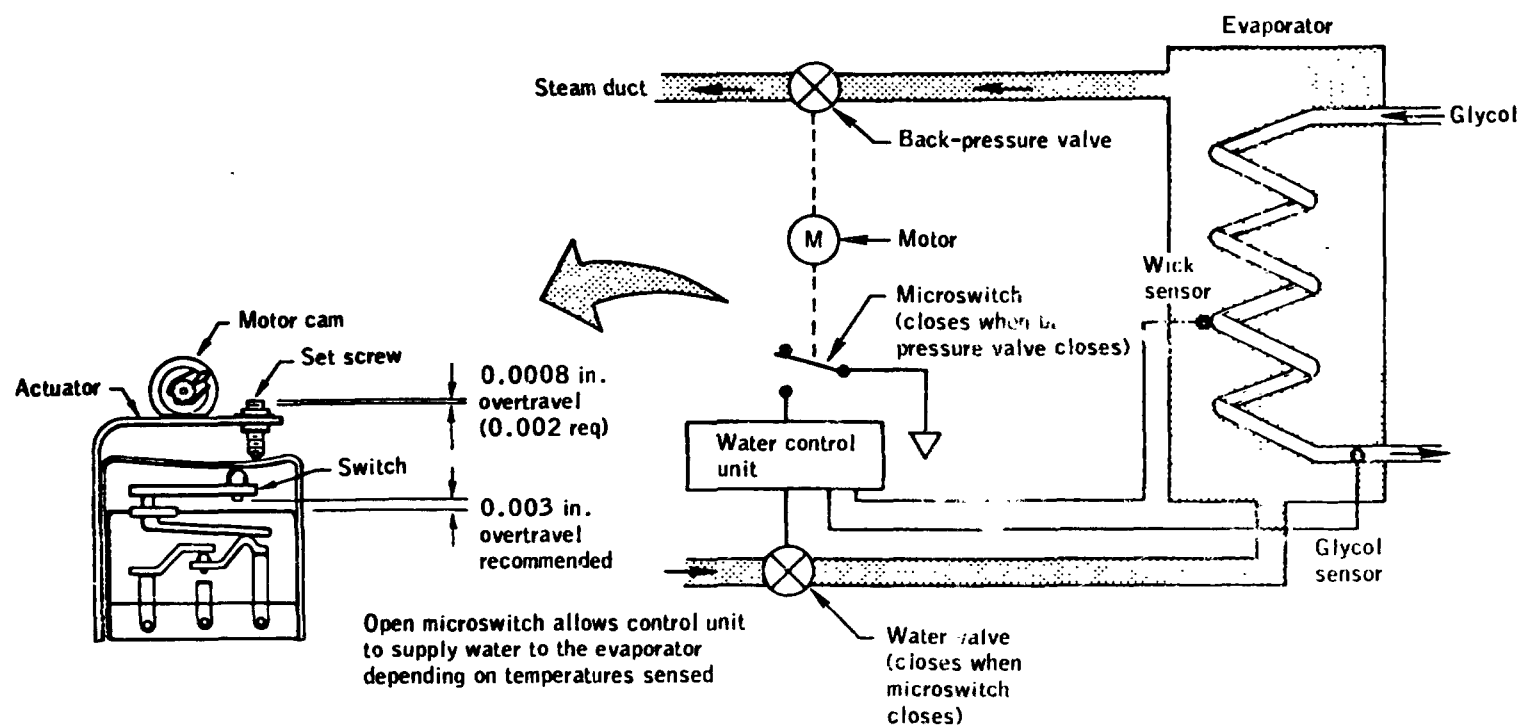


FIG. 2.2.3-2 WATER CONTROL CIRCUIT

ANOMALY REPORT

NO. 2.2.4

TITLE: WATER PROBLEM

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: ECS

EVENT TIME:

PROBLEM: DURING THE INITIAL PHASES OF THE FLIGHT, THE CREW STATED THAT THE GROUND-SERVICED POTABLE WATER CONTAINED GAS. THE TANK IS SERVICED WITH AERATED WATER WHICH IS FORCED INTO THE SYSTEM BY NITROGEN AT APPROXIMATELY 20 PSIA. WHEN THE WATER, WHICH WAS SATURATED WITH GAS AT 20 PSIA, IS DRAWN FROM THE TANK INTO THE CABIN AT 5 PSIA, SOME GAS IS RELEASED FROM SOLUTION BUT REMAINS MIXED WITH THE WATER. TO ALLEVIATE THE PROBLEMS, A TWO-COMPARTMENT BAG WITH A HANDLE FOR WHIRLING THE BAG IN A CIRCULAR MOTION WAS PROVIDED. THIS BAG HAD BEEN DEVELOPED RAPIDLY WITH INSUFFICIENT TIME FOR A COMPLETE TEST PROGRAM. IT DID NOT FUNCTION AS INTENDED IN FLIGHT.

ACTION: NEW BAG DESIGNS BEING DEVELOPED SHOW MUCH IMPROVEMENT IN TESTS. A MEMBRANE DEVICE; WHICH ATTACHES TO THE EXIT PORT OF THE WATER GUN AND ALLOWS THE GAS TO PASS INTO THE CABIN SHOWS PROMISE. OPERATIONAL PROCEDURES ARE BEING PREPARED FOR POSSIBLE USE ON APOLLO 11.

ORGANIZATION: 5-2490

REFERENCES: MSC 5-DAY REPORT PP. 10, 14
MSC FAILURE AND ANOMALY
LISTING JUNE 1969

RESOLUTION: CLOSED

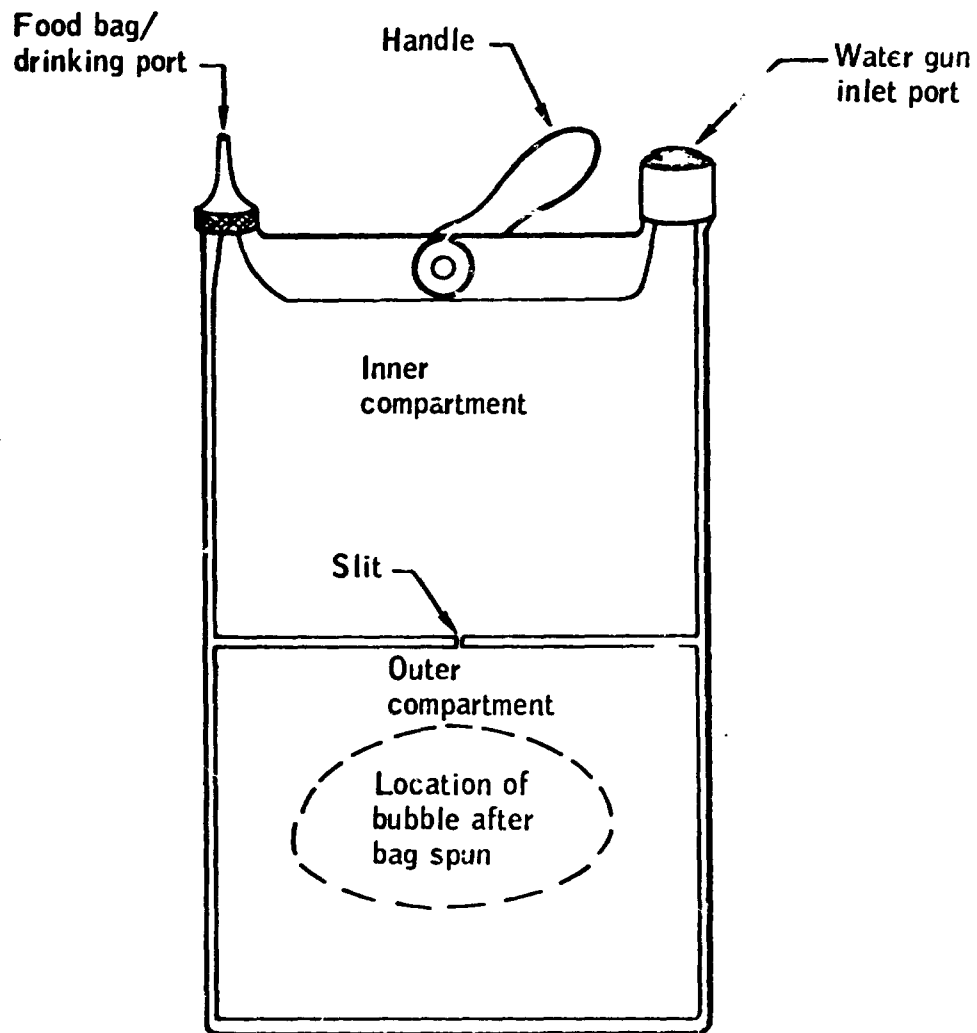
DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.4

TITLE: WATER PROBLEMS



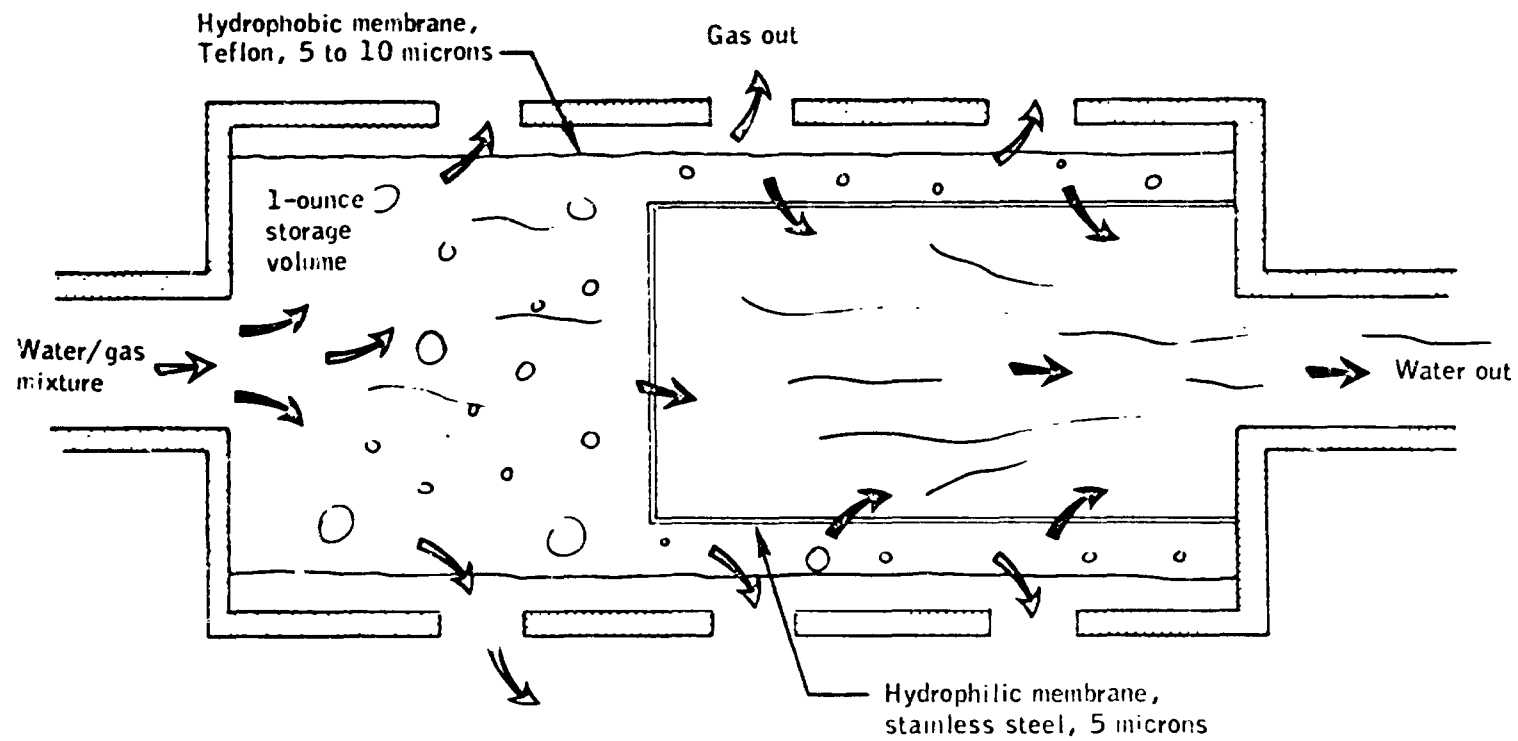
THIS KIND USED ON
APOLLO 10

FIG. 2.2.4-1 WATER/GAS
SEPARATION BAG

DETAIL SHEET

ANOMALY 2.2.4

TITLE: WATER PROBLEM



FOR USE ON APOLLO 11 AND SUBS.

FIG. 2.2.4-2 WATER/GAS SEPARATION MEMBRANE.

ANOMALY REPORT

NO. 2.2.5

TITLE: LOW PRESSURE FROM WATER GUN

SYSTEM: CSM

MISSION: APOLLO 10

SUBSYSTEM: CREW SYSTEM

EVENT TIME:

PROBLEM: FOR ABOUT 2 HOURS ON THE SEVENTH DAY OF THE FLIGHT, THE FLOW FROM THE COMMAND MODULE WATER DISPENSER APPEARED TO BE LESS THAN NORMAL. AN 0.03-INCH ORIFICE WITHIN THE DISPENSER NORMALLY LIMITS FLOW TO APPROXIMATELY 6 CC/SEC (SEE FIG. 2.2.5-1). A REDUCTION IN FLOW AT THE FOOD PREPARATION PANEL COULD NOT BE VERIFIED. THE DRIVING FORCE FOR THE WATER IS OXYGEN AT 20 PSIA, AND THIS PRESSURE WAS NORMAL. THE LUBRICANT IS THE MOST LIKELY SUSPECT FOR THE CLOGGING.

ACTION: PROCESSING SPECIFICATIONS ARE BEING REVIEWED TO ASSURE THAT EXCESS LUBRICANT IS NOT USED. SHOULD THE GUN BECOME CLOGGED IN FLIGHT, SEVERAL ALTERNATIVES ARE AVAILABLE FOR DRINKING WATER. TWO GUNS ARE CARRIED ABOARD THE LUNAR MODULE AND COULD BE USED. ALSO, WATER IS AVAILABLE AT THE FOOD PREPARATION PANEL OF THE COMMAND MODULE, AS WELL AS AT THE FIRE-FIGHTING NOZZLE ON THE GUN (THE NOZZLE IS UPSTREAM OF THE METERING ORIFICE).

ORGANIZATION: 5-2490

REFERENCES: MSC FAILURE AND ANOMALY
LISTING JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.5

TITLE: LOW PRESSURE FROM WATER GUN

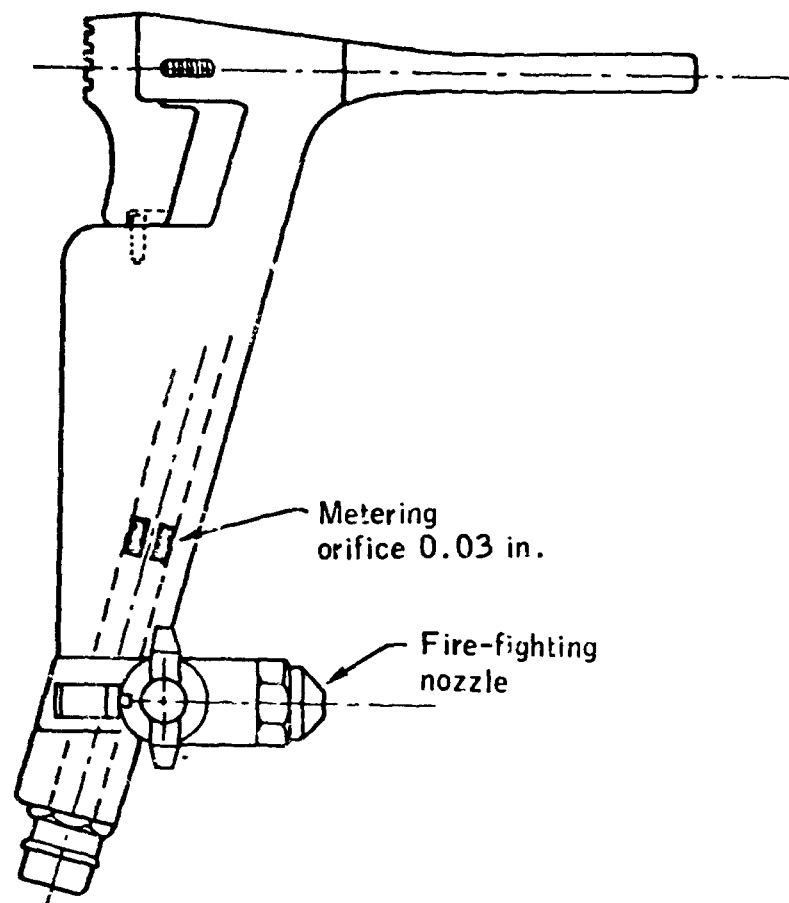


FIG. 2.2.5-1 WATER GUN.

ANOMALY REPORT

NO. 2.2.6

TITLE: THERMAL COATING ON FORWARD HATCH FLAKED OFF

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: STRUCTURE

EVENT TIME: 3:54

PROBLEM: WHEN THE LUNAR MODULE CABIN WAS FIRST PRESSURIZED THE THERMAL COATING ON THE COMMAND MODULE HATCH CAME OFF IN PIECES. THE INSULATION BLANKET VENT HOLES WERE PLUGGED, PRODUCING THE DAMAGE. ONE POSSIBILITY IS THAT THE PREFLIGHT BAKING OF THE HATCH AT 900°F FOR 15 HOURS WEAKENED THE INSULATION TO THE EXTENT THAT INTERNAL PIECES OF INSULATION BROKE LOOSE AND PLUGGED THE HOLES DURING TUNNEL DEPRESSURIZATION. ANOTHER POSSIBILITY IS THAT THE VENT HOLES WERE INADVERTENTLY SEALED WHEN THE INSULATION BLANKET WAS POTTED WITH RTV OR WHEN THE H-FILM TAPE WAS INSTALLED ON THE HATCH SURFACE.

ACTION: ON THE APOLLO 11 COMMAND MODULE, THE INSULATION HAS BEEN DELETED BECAUSE OF THE EFFECTS NOTED AND BECAUSE A REEVALUATION OF THERMAL CONDITIONS HAS SHOWN THAT THE INSULATION IS NOT NECESSARY. HOWEVER, TO MINIMIZE CONDENSATION, A SINGLE LAYER OF H-FILM TAPE HAS BEEN APPLIED OVER THE EXTERIOR SURFACE OF THE HATCH ABLATOR. SOME WATER AND ICE CAN BE EXPECTED ON APOLLO 11 BUT TO A LESSER DEGREE THAN OBSERVED ON APOLLO 10.

ORGANIZATION: 5-2490
REFERENCES: MSC 5-DAY REPORT, P. 6
FRR-APOLLO 11 JUNE 17, 1969
MSC FAILURE AND ANOMALY
LISTING JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.6

TITLE: THERMAL COATING ON FORWARD HATCH FLAKED OFF

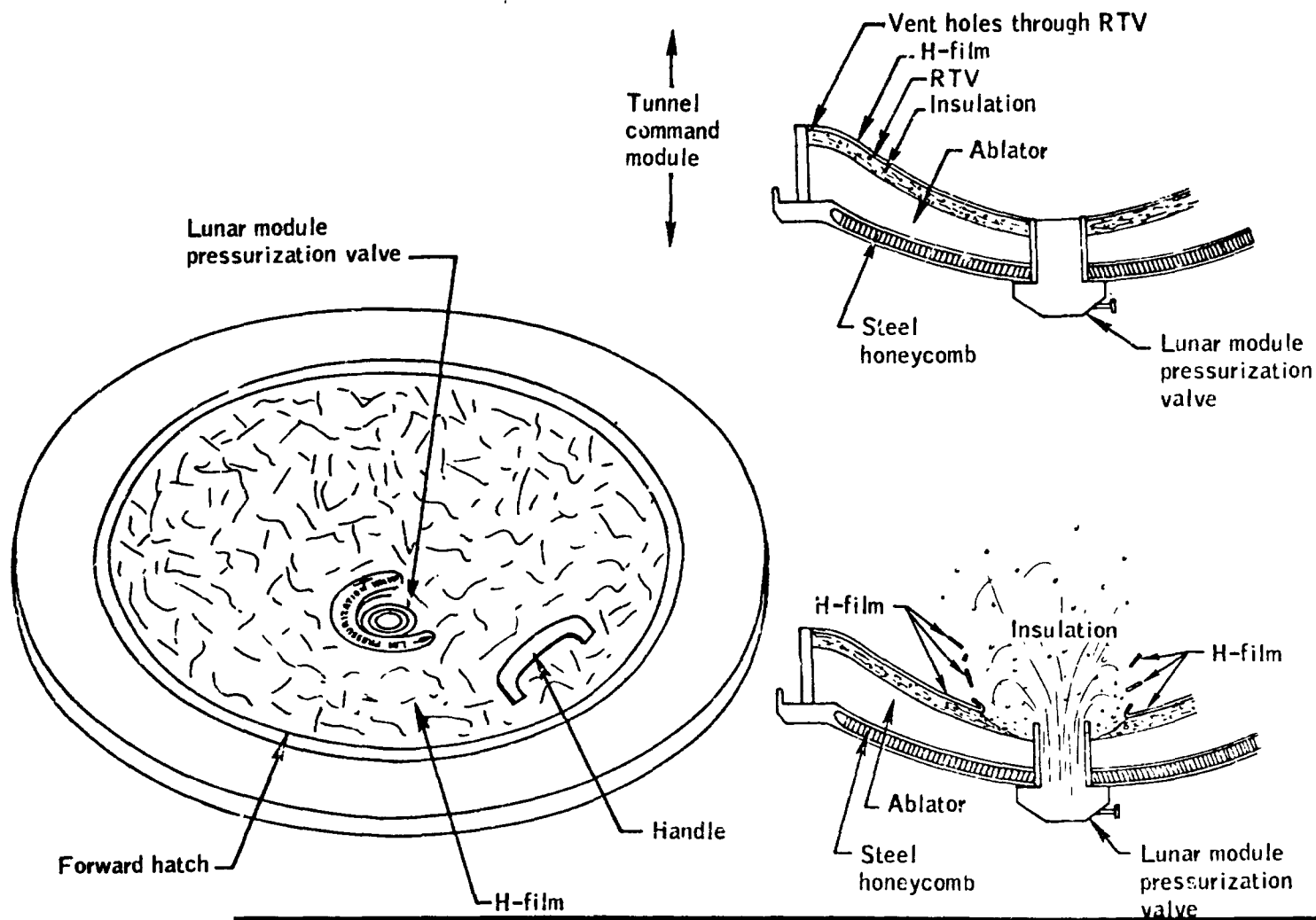


FIG. 2.2.6-1 FORWARD HATCH THERMAL COATING.

ANOMALY REPORT

NO. 2.2.7

TITLE: TUNNEL WOULD NOT VENT

SYSTEM: CSM/LM
STRUCTURE

MISSION: APOLLO 10

SUBSYSTEM:

EVENT TIME: 96:27

PROBLEM: THE PRESSURE IN THE TUNNEL BETWEEN THE COMMAND MODULE AND THE LUNAR MODULE COULD NOT BE LOWERED TO AMBIENT PRESSURE THROUGH THE TUNNEL VENT SYSTEM. POSTFLIGHT INSPECTION OF THE VENT SYSTEM REVEALED THAT AN INCORRECT FITTING HAD BEEN INSTALLED ON THE VENT. THE PROPER PART WAS SPECIFIED IN THE INSTALLATION PROCEDURES.

ACTION: FOR APOLLO 11 AND SUBSEQUENT FLIGHTS, AN END-TO-END TEST WILL BE PERFORMED TO VERIFY THE SYSTEM. ON APOLLO 10, THIS TEST HAD BEEN WAIVED.

ORGANIZATION: 5-2490
REFERENCES: MSC FAILURE AND ANOMALY
LISTING JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.7

TITLE: TUNNEL WOULD NOT VENT

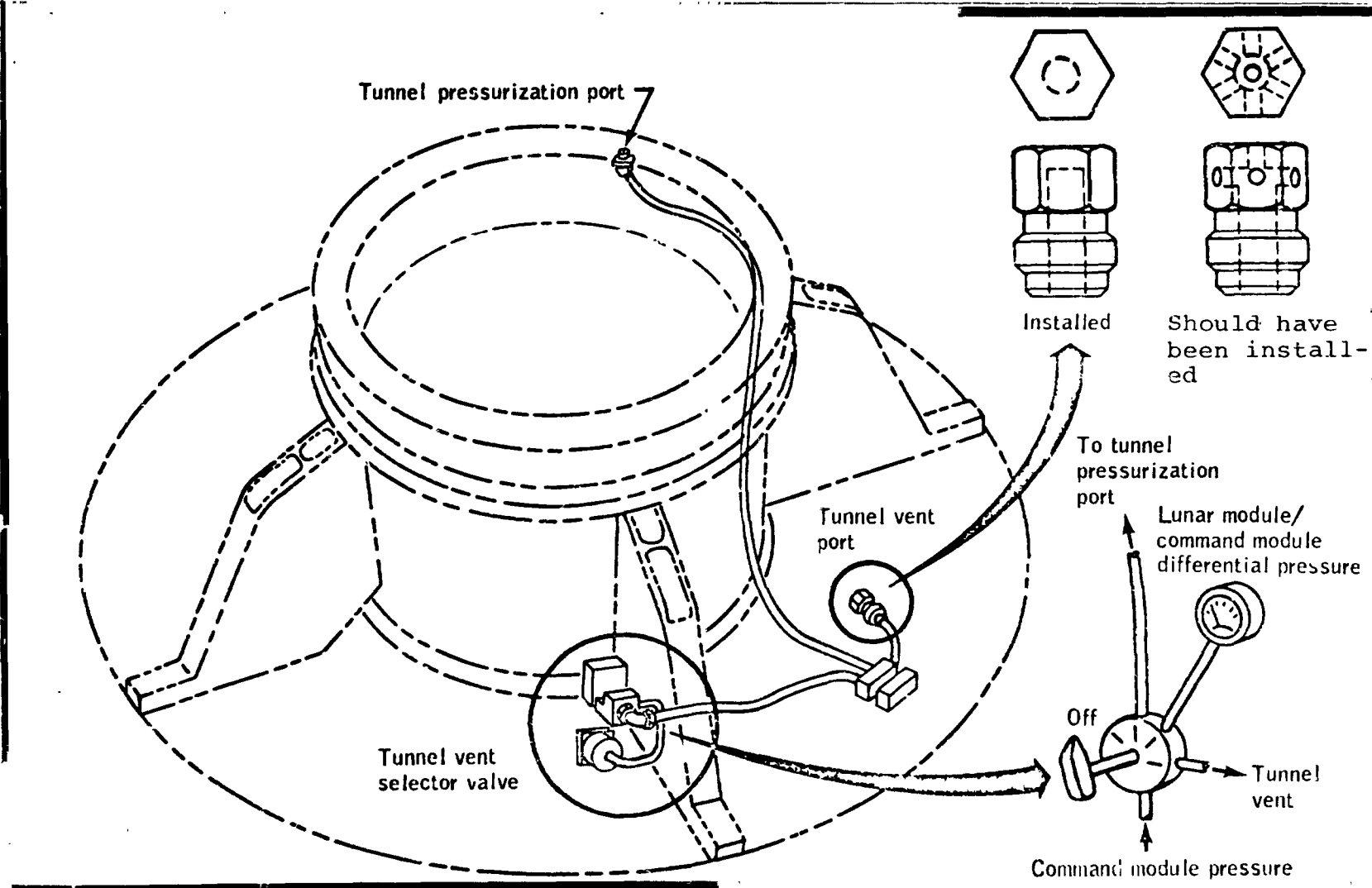


FIG. 2.2.7-1 TUNNEL VENT SYSTEM.

ANOMALY REPORT

NO. 2.2.8

TITLE: SIMPLEX-A NOT OPERATING

SYSTEM: CM/LM

MISSION: APOLLO 10

SUBSYSTEM: COMMUNICATIONS

EVENT TIME: 94:46 AND 95:16

PROBLEM: AT 94 HOURS 46 MINUTES, THE COMMANDER ATTEMPTED A TRANSMISSION ON SIMPLEX-A; HOWEVER, THE CIRCUIT BREAKER SUPPLYING POWER FOR THE KEYING RELAY WAS OPEN, RENDERING VHF SIMPLEX-A INOPERATIVE. TRANSMISSION ON SIMPLEX-A WAS ATTEMPTED AGAIN AT 95 HOURS 16 MINUTES. A CHECK OF SWITCH POSITIONS FOR BOTH SPACECRAFT WAS PERFORMED. BOTH LUNAR MODULE CREWMEN ATTEMPTED UNSUCCESSFULLY TO TRANSMIT ON SIMPLEX-A. THE COMMANDER THEN TRIED SIMPLEX-B WITH NO SUCCESS; HOWEVER, HIS SIMPLEX-B SWITCH HAD BEEN LEFT IN THE "RECEIVE" POSITION FROM THE PREVIOUS CHECK, AND HE COULD NOT TRANSMIT AT THAT TIME. THE COMMANDER THEN SWITCHED TO "TRANSMIT/RECEIVE" AND SIMPLEX-B PERFORMED SATISFACTORILY. WITH THE PRESS OF TIME, THE CREW DECIDED TO USE SIMPLEX-B. HOWEVER, DURING THE BACKSIDE PASS OF REVOLUTION 11, VHF SIMPLEX-A WAS TRIED AGAIN, AND IT PERFORMED SATISFACTORILY. THE "A" TRANSMITTER WAS USED FOR BOTH VOICE AND RANGING FOR THE REMAINDER OF THE FLIGHT.

ACTION: THE MOST PROBABLE CAUSE FOR THE APPARENT FAILURES OF VHF SIMPLEX-A WAS THE NUMEROUS SWITCH CONFIGURATION CHANGES IN BOTH VEHICLES. THE TWO VEHICLES WERE NOT CONFIGURED SIMULTANEOUSLY FOR COMMUNICATIONS ON SIMPLEX-A.

ORGANIZATION: 5-2490
REFERENCES: MSC 5-DAY REPORT, PP. 4,11
MSC FAILURE AND ANOMALY
LISTING JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.9

TITLE: CM RENDEZVOUS RADAR TRANSPONDER FAILED TO OPERATE

SYSTEM: CSM

MISSION: APOLLO 10

SUBSYSTEM: RENDEZVOUS RADAR

EVENT TIME: 98:51

PROBLEM: FOLLOWING UNDOCKING, THE RENDEZVOUS RADAR TRANSPONDER IN THE COMMAND MODULE WOULD NOT OPERATE. AN EARLIER SELF-TEST HAD BEEN CONDUCTED SUCCESSFULLY. THE COMMAND MODULE PILOT CHECKED THE CIRCUIT BREAKER AND INITIATED THE SELF-TEST; ALL READINGS WERE ZERO. THE THREE-POSITION PWR-OFF-HEATER SWITCH WAS CYCLED TO OFF AND BACK TO PWR. THE TRANSPONDER THEN WORKED PROPERLY FOR THE REMAINDER OF ITS USE.

ACTION: DURING POSTFLIGHT TESTS OF THE SWITCH AND WIRING, NO DEFECTS WERE FOUND, AND THE ANOMALY CANNOT BE ATTRIBUTED TO ANY CM HARDWARE.

ORGANIZATION: 5-2490
REFERENCES: MSC 5-DAY REPORT, P. 14
MSC FAILURE AND ANOMALY LISTING, P. 2

RESOLUTION: CLOSED

DATE:

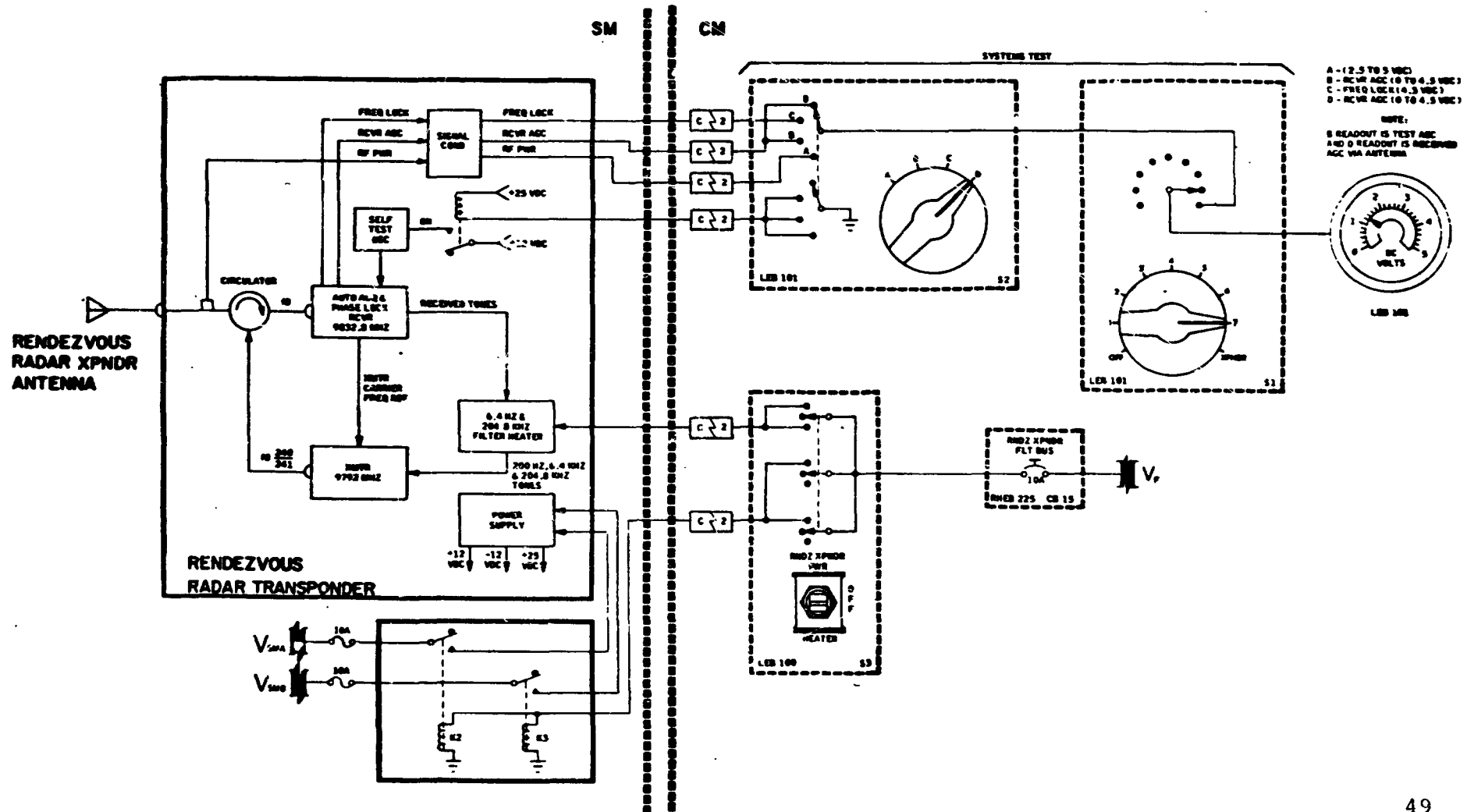
REV:

DETAIL SHEET

ANOMALY 2.2.9

TITLE: CM RENDEZVOUS RADAR TRANSPONDER FAILED TO OPERATE

FIGURE 2.2.9-1 RENDEZVOUS RADAR TRANSPONDER CONTROL CIRCUITRY



ANOMALY REPORT

NO. 2.2.10

TITLE: CM SEQUENCE CAMERA

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: CAMERA

EVENT TIME: 173

PROBLEM: AT APPROXIMATELY 173 HOURS, DURING TRANSEARTH COAST, THE COMMAND MODULE 16-MM CAMERA CEASED TO OPERATE IN THE PULSE MODE BECAUSE THE MAGAZINE INTERLOCK MICROSWITCH FAILED. THE SWITCH WAS NOT A HIGH RELIABILITY ITEM AND FAILED BECAUSE OF INTERNAL CONTAMINATION AND A FAULTY PLUNGER.

ACTION: HIGH RELIABILITY MICROSWITCHES HAVE BEEN INSTALLED IN THE CAMERAS FOR APOLLO 11 AND SUBSEQUENT.

ORGANIZATION: 5-2490
REFERENCES: MSC FAILURE AND ANOMALY
LISTING JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.10

TITLE: CM SEQUENCE CAMERA

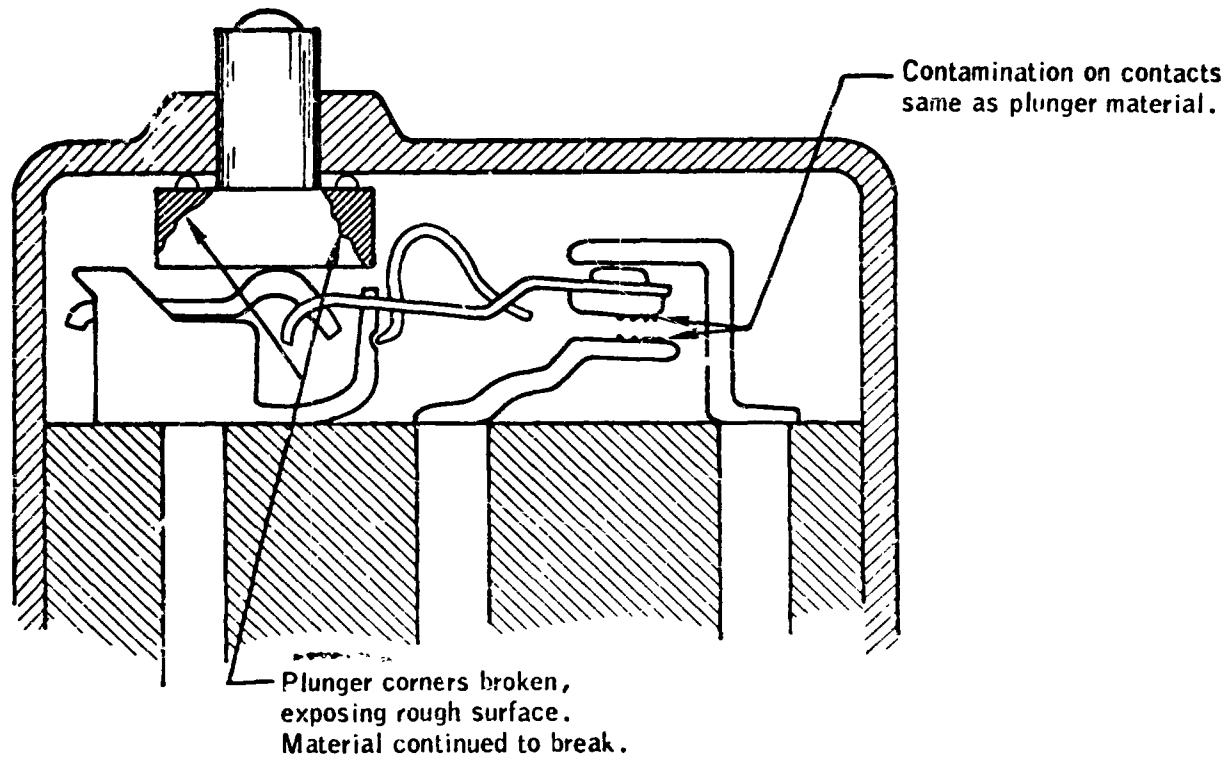


FIG. 2.2.10-1 MAGAZINE INTERLOCK SWITCH.

ANOMALY REPORT

NO. 2.2.11

TITLE: FUEL CELL 1 AC CIRCUIT BREAKER OPEN

SYSTEM: SM

MISSION: APOLLO 7

SUBSYSTEM: ELECTRIC POWER

EVENT TIME: 120:47

PROBLEM: AT 120 HOURS 47 MINUTES, A SHORT CIRCUIT IN THE AC PUMP PACKAGE OF FUEL CELL 1 CAUSED THE ASSOCIATED CIRCUIT BREAKER TO TRIP. FUEL CELL 1 PERFORMANCE WAS NORMAL UP TO THIS TIME. FIG. 2.2.11-1 SHOWS THE OBSERVED CURRENT AND VOLTAGE VARIATIONS. THE BREAKER COULD NOT BE RESET: THEREFORE, FUEL CELL 1 WAS REMOVED FROM THE BUS BECAUSE BOTH THE HYDROGEN AND THE COOLANT PUMPS WERE INOPERATIVE. THE FUEL CELL WAS THEREAFTER PLACED ON THE BUS ONLY WHEN THE SKIN TEMPERATURE DECREASED TO 370°F; THIS PROCEDURE KEPT THE FUEL CELL OPERATIVE.

ACTION: CIRCUIT ANALYSIS AND INVERTER TESTING INDICATED THAT THE FAILURE WAS A PHASE-TO-PHASE SHORT EITHER IN THE HYDROGEN PUMP OR IN THE GLYCOL PUMP. GLYCOL PUMPS, WHICH HAVE CANNED STATORS, HAVE NEVER FAILED ELECTRICALLY. EXCEPT FOR A MAJOR REDESIGN OF THE HYDROGEN PUMP, NO PROCEDURAL OR DESIGN CHANGES HAVE BEEN IDENTIFIED WHICH WOULD FURTHER IMPROVE THE RELIABILITY OF THE HYDROGEN PUMP.

ORGANIZATION: 5-2490

REFERENCES: MSC FAILURE AND ANOMALY
LISTING JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.11

TITLE: FUEL CELL 1 AC CIRCUIT BREAKER OPEN

FAILURES OF THIS NATURE HAVE BEEN OBSERVED ON HYDROGEN PUMPS DURING ENDURANCE TESTING UNDER NORMAL OPERATING TEMPERATURES. OF FIFTEEN DEVELOPMENT POWER PLANTS THAT EXHIBITED AN INSULATION RESISTANCE EQUAL TO OR LESS THAN THE APOLLO 10 UNIT, SIX HAD SHORTS IN THE HYDROGEN PUMP STATOR WINDINGS. FOUR OF THESE SIX WERE PHASE-TO-PHASE, AND THE OTHER TWO WERE PHASE-TO-GROUND. THIS KIND OF FAILURE IS CAUSED BY THE HOT, MOIST HYDROGEN FLOWING ACROSS THE WINDINGS; THE INSULATION IS DEGRADED AND PHASE-TO-PHASE-TO-PHASE SHORTS RESULT. IN THESE TESTS, NO STATOR FAILED IN LESS THAN 1000 HOURS, AND THE MAXIMUM TIME TO FAILURE WAS 3960 HOURS. THE UNIT FLOWN ON APOLLO 10 HAD OPERATED APPROXIMATELY 300 HOURS.

DETAIL SHEET

ANOMALY 2.2.11

TITLE: FUEL CELL 1 AC CIRCUIT BREAKER OPEN

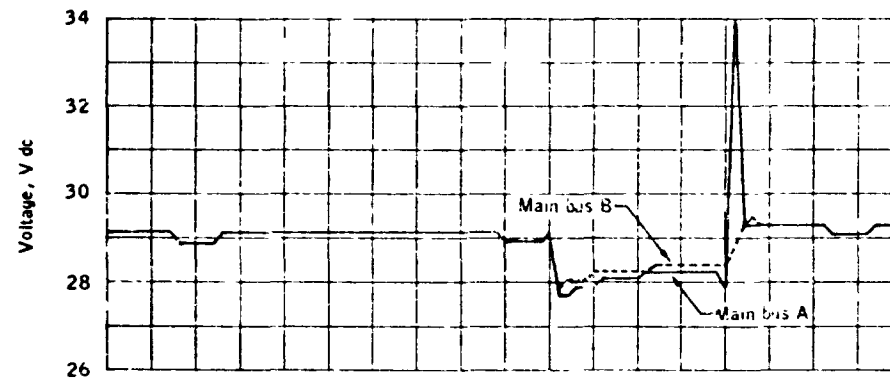
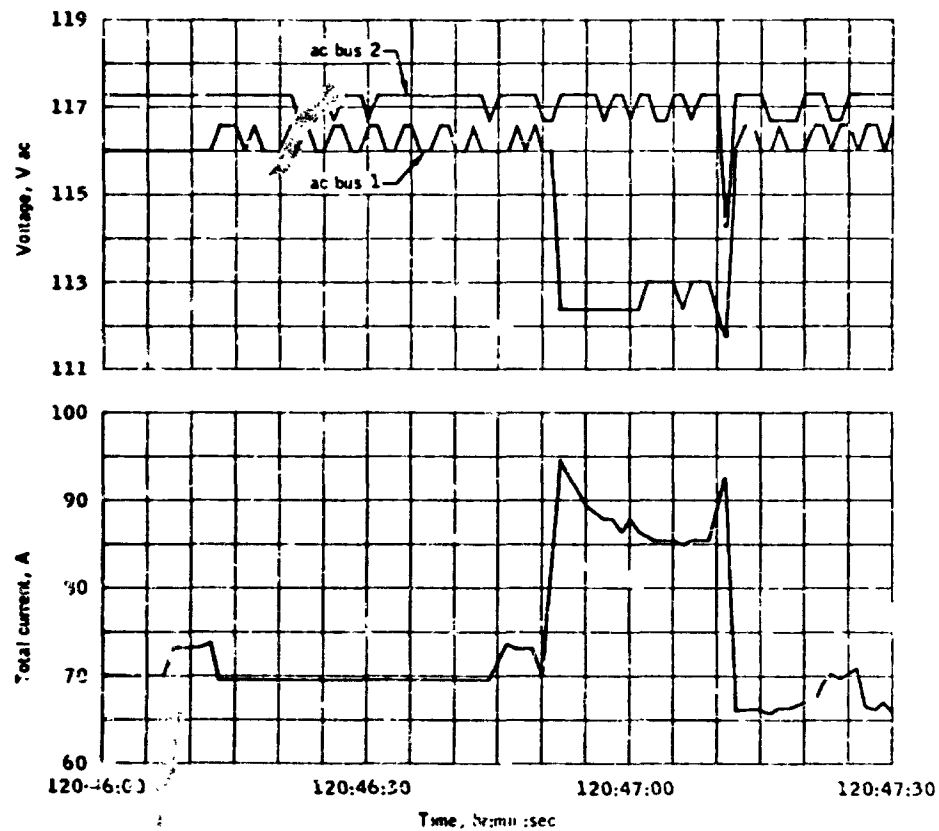


FIG. 2.2.11-1 POWER VARIATIONS AT PUMP FAILURE.

ANOMALY REPORT

NO. 2.2.12

TITLE: CONDENSER EXIT TEMPERATURE FLUCTUATIONS - FUEL CELL 2

SYSTEM: SM

MISSION: APOLLO 10

SUBSYSTEM: ELECTRIC POWER

EVENT TIME: 134

PROBLEM: AT 134 HOURS, THE CREW REPORTED THAT THE CONDENSER EXIT TEMPERATURE ON FUEL CELL 2 HAD BEEN CYCLING BETWEEN 149° AND 168°F AT THE RATE OF 2 CYCLES/MINUTE FOR 30 TO 40 MINUTES WHILE THE SPACECRAFT WAS BEHIND THE MOON AND THAT THE CAUTION AND WARNING ALARM FOR LOW TEMPERATURE HAD BEEN TRIGGERED ABOUT EVERY TENTH CYCLE. THE NORMAL RANGE OF OPERATION IS 155° TO 165°F. THIS DATA SHOWS CYCLING EARLIER AND LATER IN THE FLIGHT, BUT THE TEMPERATURE REMAINED WITHIN THE CAUTION AND WARNING LIMITS.

THE FUEL CELL 2 TEMPERATURE VARIED PERIODICALLY BEFORE AND AFTER FUEL CELL 1 WAS REMOVED FROM THE BUS. THIS INDICATES THAT PERFORMANCE WAS ABNORMAL WELL BEFORE THE SUSTAINED OSCILLATIONS.

ACTION: THE OBSERVED BEHAVIOR, ALTHOUGH ABNORMAL, IS NOT DETRIMENTAL TO FUEL CELL COMPONENT LIFE OR PERFORMANCE BUT DOES REPRESENT A NUISANCE TO THE CREW BECAUSE THE CAUTION AND WARNING MUST BE RESET MANUALLY.

ORGANIZATION: 5-2490
REFERENCES: MSC FAILURE AND ANOMALY
LISTING JUNE 1969

RESOLUTION: OPEN

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.12

TITLE: CONDENSER EXIT TEMPERATURE FLUCTUATIONS - FUEL CELL 2

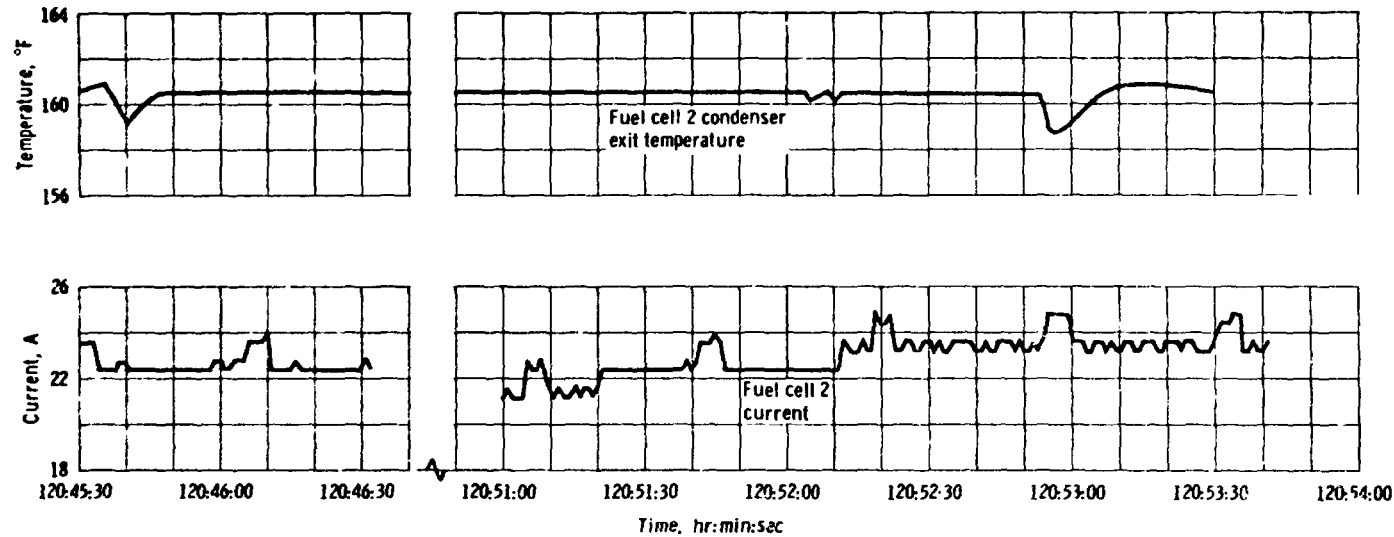


Figure 6 Typical fuel cell 2 behavior prior to fuel cell 1 removed.

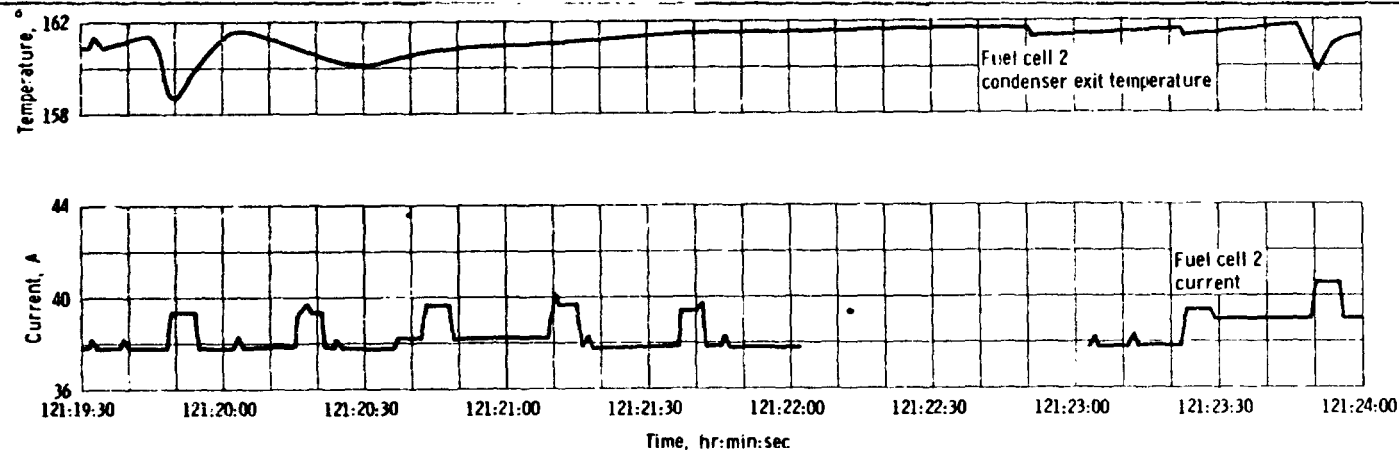


FIG. 2.2.12-1 TYPICAL FUEL CELL 2 BEHAVIOR AFTER FUEL CELL 1 REMOVED.

ANOMALY REPORT

NO. 2.2.13

TITLE: CRYOGENIC HYDROGEN AUTOMATIC HEATER CONTROL FAILURE TO TURN OFF

SYSTEM: SM

MISSION: APOLLO 10

SUBSYSTEM: ELECTRIC POWER

EVENT TIME: 170:56

PROBLEM: DURING THE 3-HOUR PURGE OF FUEL CELL 1, THE AUTOMATIC PRESSURE CONTROL SYSTEM WAS BELIEVED TO HAVE FAILED TWICE TO TURN THE HYDROGEN TANK HEATERS OFF (FIG. 2.2.13-1). AFTER 170-1/2 HOURS, THE HEATERS WERE SWITCHED ON AND OFF MANUALLY.

FOR AUTOMATIC OPERATION, THE PRESSURE SWITCHES IN BOTH TANKS MUST CLOSE IN ORDER TO ACTUATE THE HEATERS, BUT ONLY ONE PRESSURE SWITCH MUST OPEN TO DEACTIVATE THEM AS SHOWN IN FIG 2.2.13-2 THE HEATERS IN TANK 1 WERE IN AUTO AND THOSE IN TANK 2 WERE IN OFF BEFORE THE PURGE WAS STARTED. ALSO, THE PRESSURE SWITCH FOR TANK 1 WAS OPEN AND THAT OF TANK 2 WAS CLOSED. SHORTLY AFTER THE PURGE WAS STARTED, THE HEATERS IN TANK 1 WERE SWITCHED TO OFF AND IN TANK 2 TO AUTO; THIS CHANGE WAS MADE TO BALANCE THE QUANTITY IN THE TWO TANKS. AFTER 5 MINUTES OF PURGING, THE PRESSURE SWITCH IN TANK 1 CLOSED AT 236 PSIA, ACTIVATING THE HEATERS IN TANK 2 AND AFFECTING PRESSURES IN THE MANNER EXPECTED. SINCE THE PRESSURE IN TANK 1 CONTINUED TO DROP AND A MASTER ALARM WAS RECEIVED, THE HEATERS IN TANK 1 WERE TURNED TO AUTO. AS SHOWN IN FIG 2.2.13-1, THE PRESSURES WERE AT A MAXIMUM OF 8 PSIA ABOVE THE SWITCHING LEVEL WHEN THE HEATERS WERE MANUALLY TURNED OFF.

ACTION: THE TRANSDUCERS ON APOLLO 10 WERE SUBJECTED TO TEMPERATURES BETWEEN MINUS 100° AND MINUS 140°F DURING THE EXTENDED PURGE; THE TRANSDUCER OUTPUT DRIFTED UPWARD AND CREATED AN APPARENT LOSS OF AUTOMATIC PRESSURE CONTROL. LONG-DURATION PURGES WILL NOT BE PERFORMED ON FUTURE FLIGHTS. THE APOLLO OPERATIONS HANDBOOK HAS BEEN CHANGED APPROPRIATELY.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.13

TITLE: CYROGENIC HYDROGEN AUTOMATIC HEATER CONTROL FAILURE TO TURN OFF

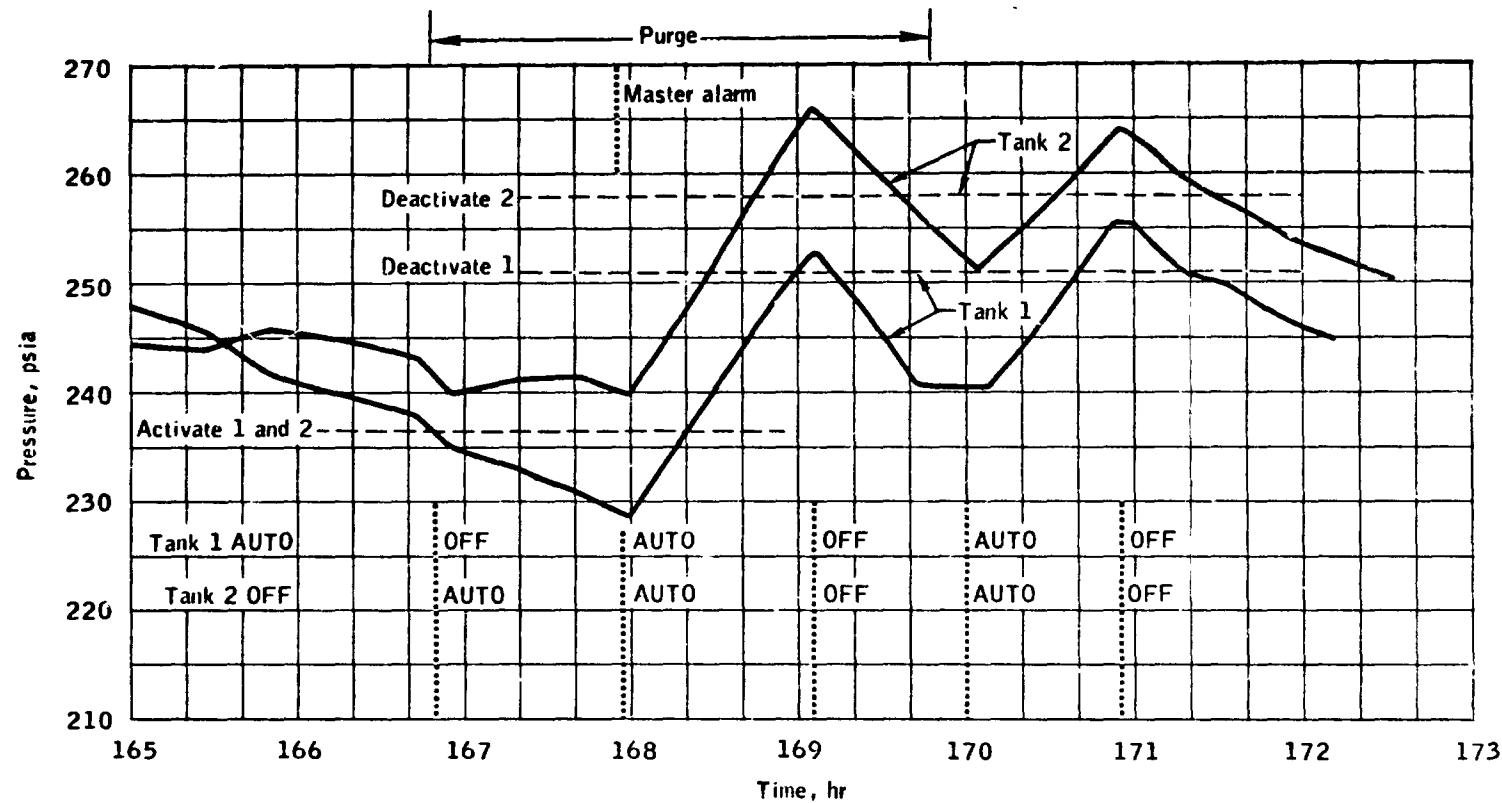


FIG. 2.2.13-1 HYDROGEN PRESSURES DURING APPARENT FAILURE OF AUTOMATIC PRESSURE CONTROL

DETAIL SHEET

ANOMALY 2.2.13

TITLE: CYROGENIC HYDROGEN AUTOMATIC HEATER CONTROL FAILURE TO TURN OFF

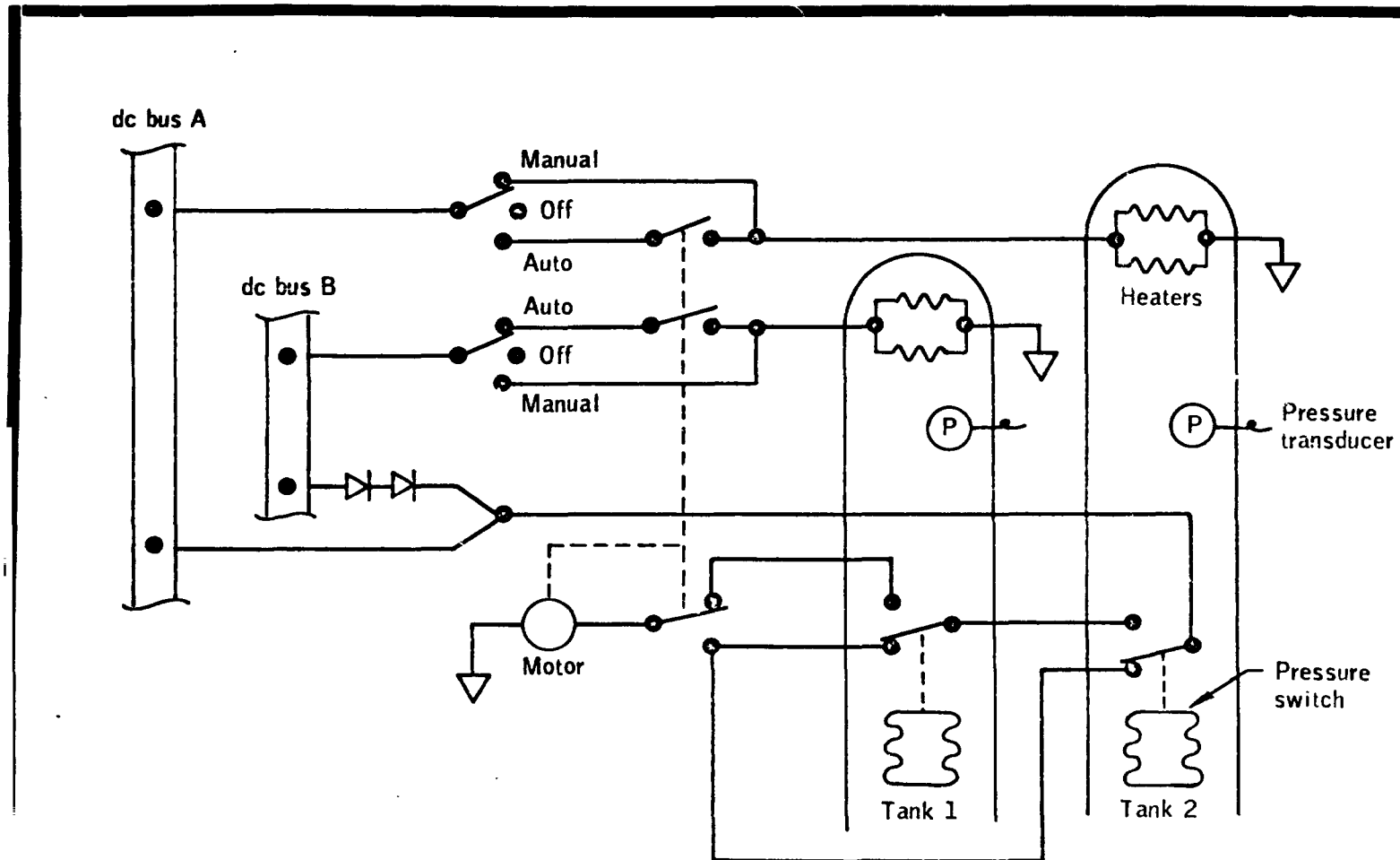


FIG. 2.2.13-2 HYDROGEN TANK PRESSURE CONTROL

ANOMALY REPORT

NO. 2.2.14

TITLE: OVERPRESSURE OF REACTANTS IN FUEL CELL 1 WHEN PURGE
VALVE CLOSED

SYSTEM: SM

MISSION: APOLLO 10

SUBSYSTEM:

EVENT TIME: 169:56

PROBLEM: AT 166 HOURS 49 MINUTES, THE SKIN TEMPERATURE OF FUEL CELL 1 WAS 420°F, AND A CONTINUOUS HYDROGEN PURGE WAS INITIATED TO REDUCE THE CONCENTRATION OF WATER IN THE ELECTROLYTE. THREE HOURS LATER, THE FUEL CELL WAS SUFFICIENTLY DRY AND HOT, THE PURGE WAS TERMINATED, AND THE HEATER FOR THE HYDROGEN VENT LINE WAS TURNED OFF. HOWEVER, HYDROGEN FLOW TO THE FUEL CELL DECAYED VERY SLOWLY (FIG.2.2.14-1), NORMALLY, FLOW DECAYS TO ZERO IN LESS THAN 1 MINUTE. THE PURGE VALVE WAS REOPENED, AND THE FLOW RATE INCREASED TO THE UPPER LIMIT, INDICATING THAT THE PURGE VALVE WAS FUNCTIONING. THE VALVE WAS CLOSED AGAIN BUT THE FLOW DECREASE WAS STILL VERY SLOW. AS THE FLOW RATE WAS APPROACHING ZERO AFTER ABOUT 30 MINUTES, THE REGULATED HYDROGEN PRESSURE FOR THE FUEL CELL BEGAN TO INCREASE REACHING A MAXIMUM OF 72 PSIA BEFORE SLOWLY DECAYING TO THE NORMAL 62 PSIA.

AS SHOWN IN FIGURE 2.2.14-2, THE REGULATOR OPERATION DEPENDS ON A REGULATED NITROGEN REFERENCE PRESSURE. THE NITROGEN PRESSURE DID NOT CHANGE DURING THE HYDROGEN PRESSURE EXCURSION, NOR DID THE REGULATED OXYGEN PRESSURE, ELIMINATING THE POSSIBILITY OF A REFERENCE PRESSURE CHANGE.

ACTION: GROUND TESTS DEMONSTRATE THAT THE EXTENDED HYDROGEN PURGE IN FLIGHT CREATED LOW TEMPERATURES ON THE REGULATOR; THE CONSEQUENT REGULATOR LEAKAGE EXPLAINS THE CONTINUED FLOW. WITH THE HEATER OFF, THE VENT LINE BECAME BLOCKED, LEADING TO THE INCREASE IN REGULATED HYDROGEN PRESSURE.

FOR FUTURE MISSIONS, EXTENDED HYDROGEN PURGING FROM CRYOGENIC TANKS WILL NOT BE PERFORMED. FOR A GREATER MARGIN OF OPERATIONAL ASSURANCE, THE VENT LINE HEATER WILL BE LEFT ON FOR 10 MINUTES AFTER TERMINATION OF A HYDROGEN PURGE. THIS CHANGE HAS BEEN INCORPORATED INTO THE APOLLO OPERATIONS HANDBOOK.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.14

TITLE: OVERPRESSURE OF REACTANTS IN FUEL CELL 1 WHEN PURGE VALVE CLOSED

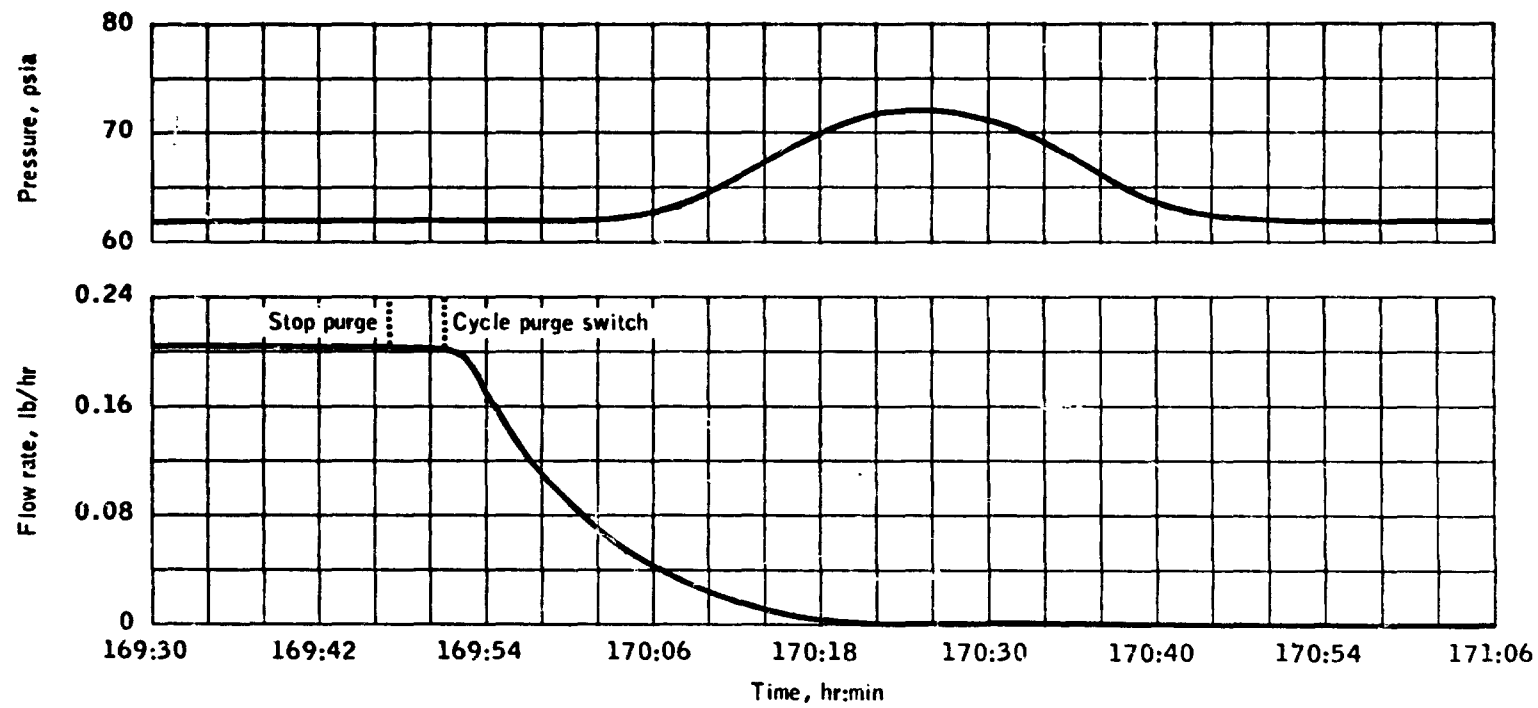


FIG. 2.2.14-1 FLOW RATE AND PRESSURE AFTER PURGE

DETAIL SHEET

ANOMALY 2.2.14

TITLE: OVERPRESSURE OF REACTANTS IN FUEL CELL 1 WHEN PURGE VALVE CLOSED

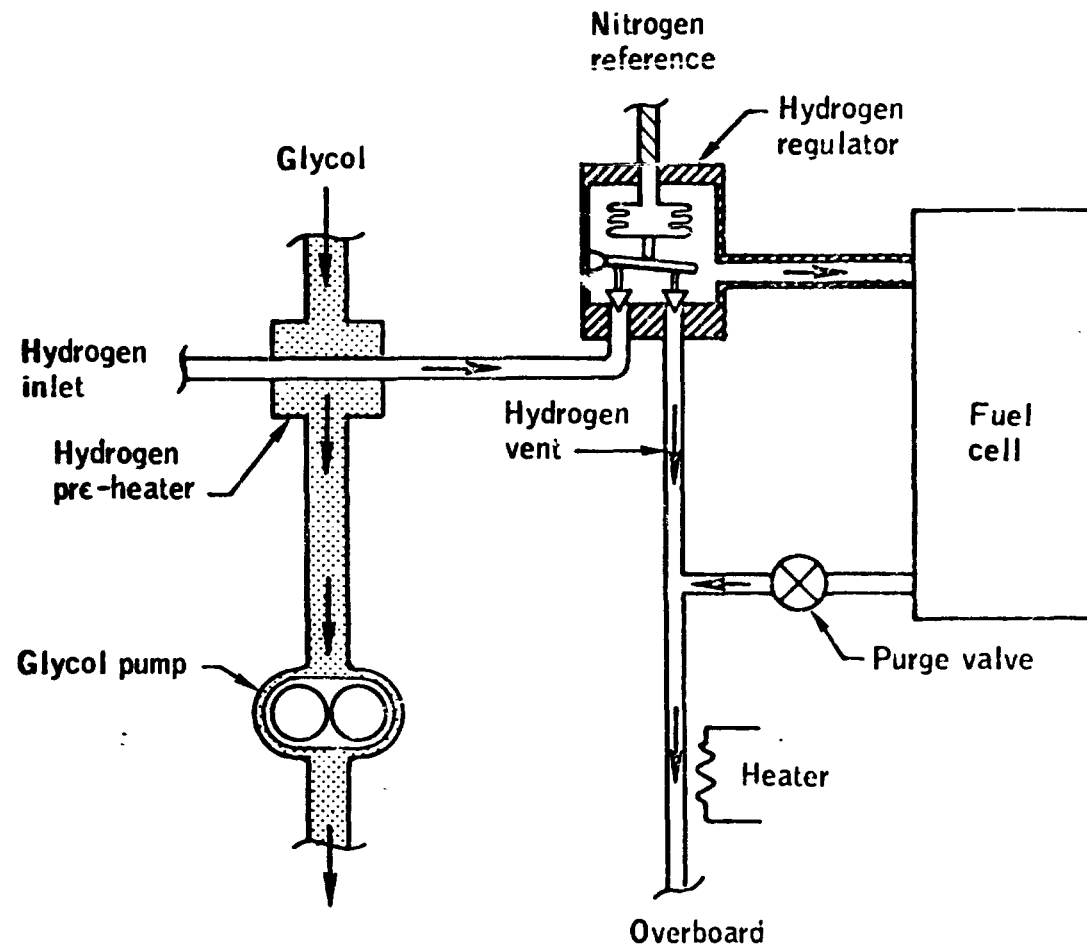


FIG. 2.2.14-2 FUEL CELL HYDROGEN SYSTEM

ANOMALY REPORT

NO. 2.2.15

TITLE: EDS MODULE LIGHT BULBS FAILED INTERMITTENTLY

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: EDS

EVENT TIME: PRE-LAUNCH

PROBLEM: DURING SPACECRAFT TESTING PRIOR TO LAUNCH, THE LAUNCH VEHICLE ENGINE WARNING INDICATORS OPERATED INTERMITTENTLY. THE INDICATOR FOR EACH OF THE FIVE ENGINES HAS TWO REDUNDANT MINIATURE LAMPS, AND ONE LAMP IN FOUR OF THE INDICATORS WAS INTERMITTENT.

POSTFLIGHT, ONLY THREE OF THE FOUR LAMPS WERE INTERMITTENT. THE ANNUNCIATOR WAS REMOVED FROM THE SPACECRAFT AND DISASSEMBLED. ON SIX OF THE TEN LAMPS, INCLUDING THE FOUR INTERMITTENT ONES, COLD-SOLDER JOINTS WERE FOUND WHERE THE LAMP LEAD WAS ATTACHED TO THE PRINTED CIRCUIT BOARD. THE COLD-SOLDER JOINT WOULD HAVE CAUSED INTERMITTENT LAMP OPERATION.

THERE ARE ALSO THREE OTHER STATUS LIGHTS IN EACH ANNUNCIATOR: LAUNCH VEHICLE OVERRATE, S-II SEPARATION, AND LAUNCH VEHICLE GUIDANCE FAIL. THE SIX BULBS IN THESE LIGHTS WERE NOT INTERMITTENT PRIOR TO LAUNCH NOR WERE ANY FAULTS FOUND IN THEM DURING POSTFLIGHT EXAMINATION.

ACTION: THE UNITS FOR APOLLO 11 AND SUBSEQUENT VEHICLES HAVE BEEN SCREENED, WHEREAS THE APOLLO 10 UNIT HAD NOT BEEN.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.15

TITLE: EDS MODULE LIGHT BULBS FAILED INTERMITTENTLY

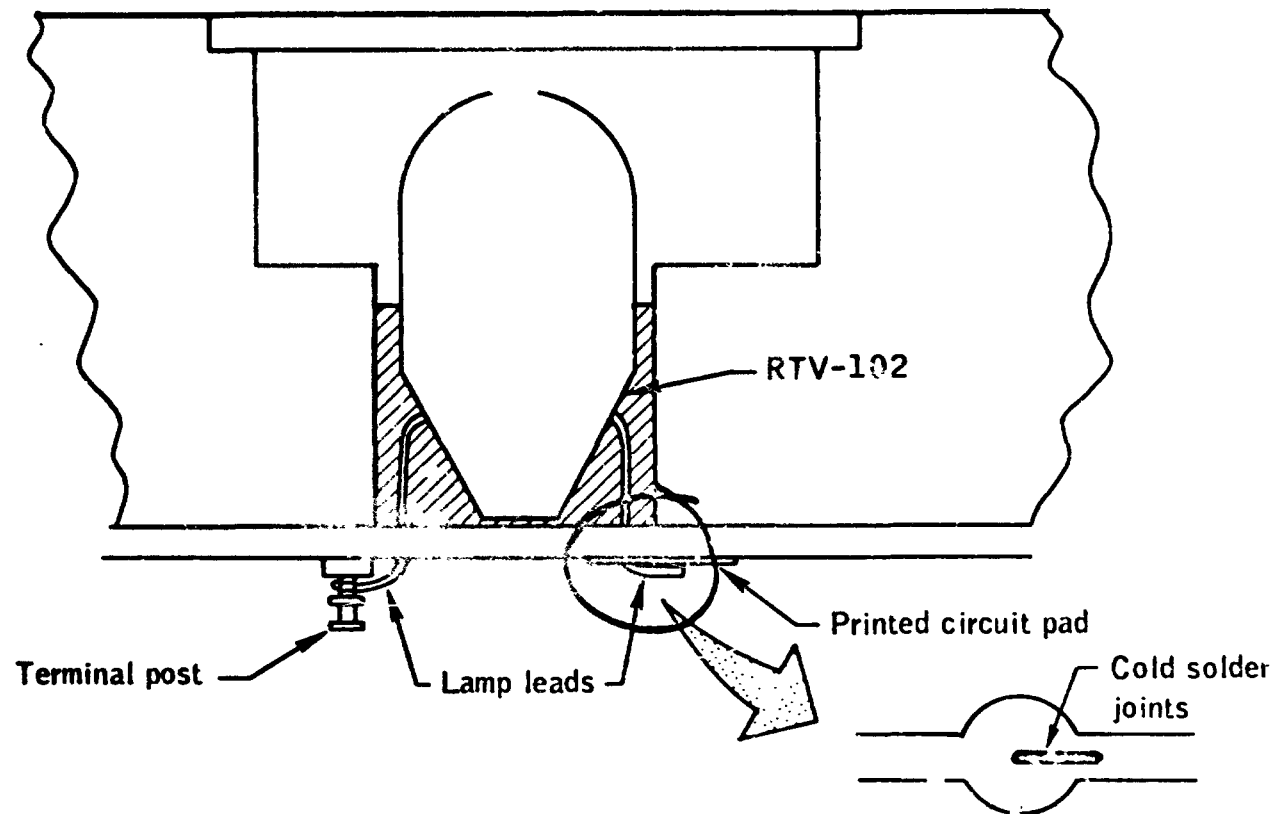


FIG. 2.2.15-1 LAMP ASSEMBLY

ANOMALY REPORT

NO. 2.2.16

TITLE: ENTRY MONITOR SYSTEM STOPPED SCRIBING WHEN INITIALIZED

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: EMS

EVENT TIME: 190:30

PROBLEM: THE STYLUS OF THE ENTRY MONITOR STOPPED SCRIBING WHILE THE SCROLL WAS BEING DRIVEN TO THE ENTRY PATTERN FOLLOWING A SUCCESSFUL COMPLETION OF THE PRE-ENTRY TESTS. THE SCROLL WAS SLEWED BACK AND FORTH, AND THE STYLUS BEGAN TO CUT THROUGH THE EMULSION ON THE SCROLL. THE TRACE OF ACCELERATION VERSUS VELOCITY WAS NORMAL THROUGHOUT ENTRY.

THE EMULSION USED ON THE SCROLL FILM IS A LATEX RUBBER/SOAP BASE. THE FORMULATION OF THE SOAP, WHICH WAS COMMERCIALY PROCURED, WAS RECENTLY CHANGED WITH URIC ACID BEING ADDED. THIS ADDITION CAUSES THE EMULSION TO HARDEN BY A CHEMICAL REACTION WITH THE GELATINOUS FILM ON THE MYLAR SCROLL.

ACTION: NO CHANGE WAS PLANNED FOR APOLLO 11 OR 12, HOWEVER, FOR SUBSEQUENT VEHICLES, EITHER THE SCROLL EMULSION BASE WILL BE MADE USING THE ORIGINALLY FORMULATED SOAP OR PRESSURE-SENSITIVE PAPER WHICH WAS RECENTLY QUALIFIED WILL BE USED FOR THE SCROLL.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.17

TITLE: VHF BEACON ANTENNA DID NOT DEPLOY

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: TELECOMMUNICATIONS

EVENT TIME: 192:03

PROBLEM: THE VHF RECOVERY BEACON ANTENNA DID NOT PROPERLY DEPLOY. RECOVERY PHOTOGRAPHS SHOW THAT THE RADIATING ELEMENT AND THREE GROUND-PLANE RADIALS WERE NOT PROPERLY DEPLOYED. HOWEVER, RF SIGNALS FROM THE BEACON WERE RECEIVED BY THE RECOVERY FORCES.

THE ANTENNA DID NOT DEPLOY BECAUSE ONE RADIAL WAS CAUGHT UNDER THE OUTBOARD EDGE OF RAMP SHOWN IN FIGURE 2.2.17-1.

ACTION: NO CHANGE IS REQUIRED FOR APOLLO 11; HOWEVER, AN ENGINEERING STUDY HAS BEEN INITIATED TO CONSIDER MODIFICATION OF THE RAMP.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.17

TITLE: VHF BEACON ANTENNA DID NOT DEPLOY

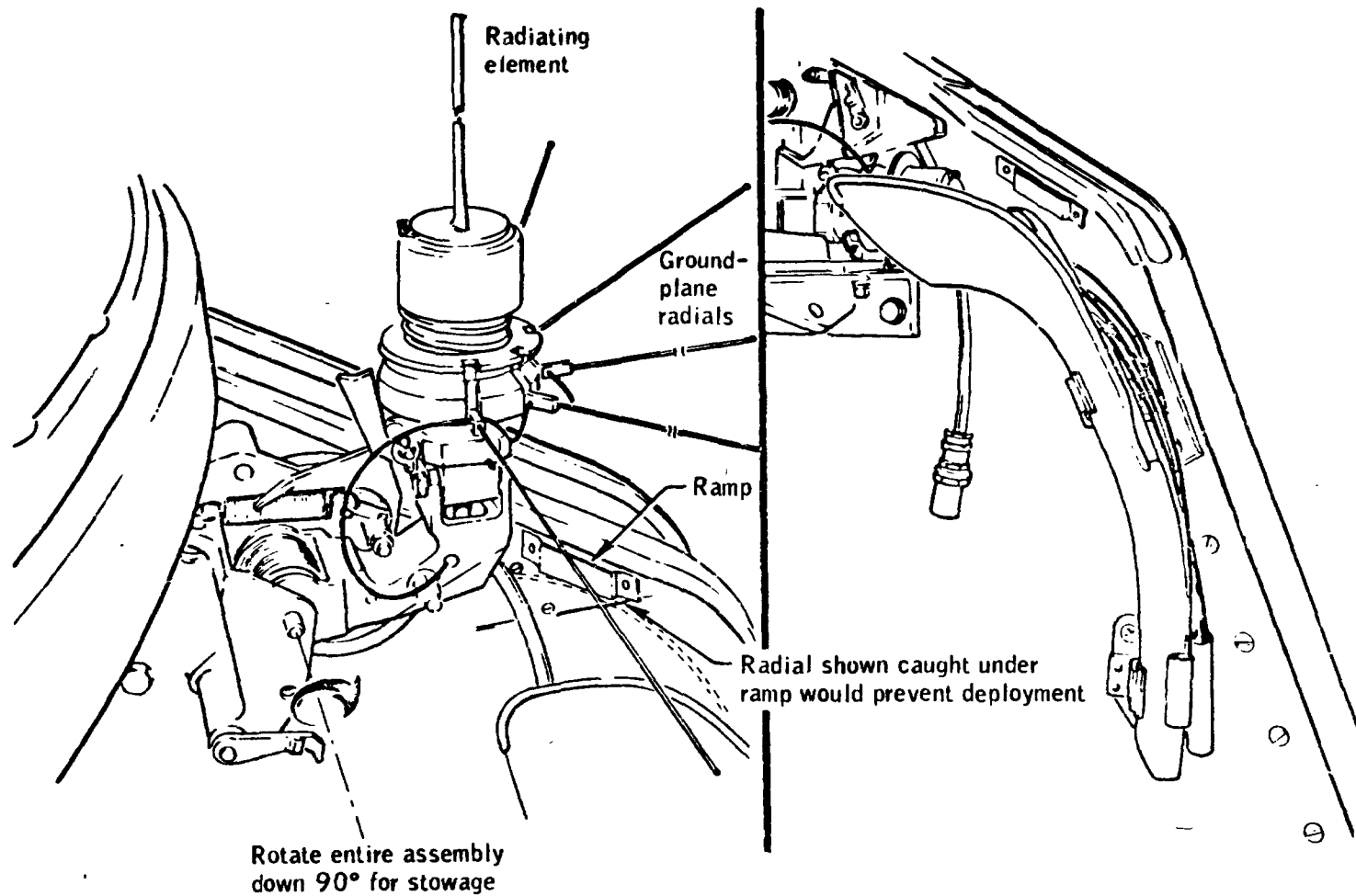


FIG. 2.2.17-1 VHF RECOVERY BEACON ANTENNA DEPLOYED

ANOMALY REPORT

NO. 2.2.18

TITLE: TWO RETAINING SPRINGS ON TUNNEL CHARGE HOLDER RING DID NOT CAPTURE

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: STRUCTURE

EVENT TIME: 108:24

PROBLEM: THE MINUS Y CHARGE HOLDER RING WAS NOT CAPTURED BY THE RETENTION SPRINGS, WHILE THE PLUS Y HOLDER WAS CAPTURED (FIG. 2.2.18-1). ALTHOUGH THE HOLDER WAS NOT CAPTURED, IT REMAINED IN A POSITION ABOVE THE GROOVE, RESTING ON TOP OF THE SPRINGS WITHIN A NONHAZARDOUS ENVELOPE AREA.

EVEN THOUGH THE TWO CHARGE HOLDER SEGMENTS ARE RESTRAINED AT ONE END, THERE IS A REMOTE POSSIBILITY OF A FREE CHARGE HOLDER DAMAGING THE FABRIC COMPONENTS OF THE EARTH LANDING SYSTEM. AS A RESULT OF ONE OF THE HOLDERS ON APOLLO 9 COMING FROM THE GROOVE AND BEING IN THE HAZARDOUS ENVELOPE, FOUR SPRING RETENTION DEVICES WERE INSTALLED ON APOLLO 10 TO INCREASE THE PROBABILITY OF CAPTURING THE CHARGE HOLDERS.

A MARGINAL SITUATION EXISTED ON APOLLO 10 SINCE TWO OF THE SPRINGS CAPTURED AND THE OTHER TWO DID NOT. A MATHEMATICAL ANALYSIS INDICATES THAT PRESSURE IN THE TUNNEL AREA WILL MAKE THE RING FOLLOW THE TUNNEL. ALTHOUGH THE PRESSURE WAS WORSE ON APOLLO 10 THAN IT WILL BE FOR A NORMAL SEPARATION, THE MATH MODEL ITSELF DOES NOT INDICATE THAT THE SITUATION WILL BE MARKEDLY IMPROVED. TESTING WITHOUT ANY PRESSURE IN THE TUNNEL HAS SHOWN THAT THE SPRINGS WILL WORK.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.18

TITLE: TWO RETAINING SPRINGS ON TUNNEL CHARGE HOLDER RING DID NOT CAPTURE

ACTION: BASED ON THE APOLLO 10 FLIGHT EXPERIENCE, GROUND TESTS, AND ANALYTICAL RESULTS, THERE IS STILL A PROBABILITY THAT THE SPRINGS WILL NOT CAPTURE. THE PROBABILITY OF CAPTURE MAY BE HIGHER ON APOLLO 11 THAN IT WAS ON APOLLO 10. IN ANY EVENT, THE RISK OF A CATASTROPHIC FAILURE IS EXTREMELY SMALL. THE CHARGE HOLDERS ARE UNLIKELY TO DETACH COMPLETELY AND, THEREFORE, CANNOT CAUSE MAJOR DAMAGE TO THE PARACHUTES. THE POSSIBILITY OF ABRASION OF A RISER LINE EXISTS; BUT, BASED ON ANALYSIS AND THE EXPERIENCE OF APOLLO 9 AND APOLLO 10, THIS ALSO IS SMALL.

ON IN-LINE VEHICLES, A BETTER MEANS OF RETAINING THE CHARGE HOLDER IS BEING STUDIED.

DETAIL SHEET

ANOMALY 2.2.18

TITLE: TWO RETAINING SPRINGS ON TUNNEL CHARGE HOLDER RING DID NOT CAPTURE

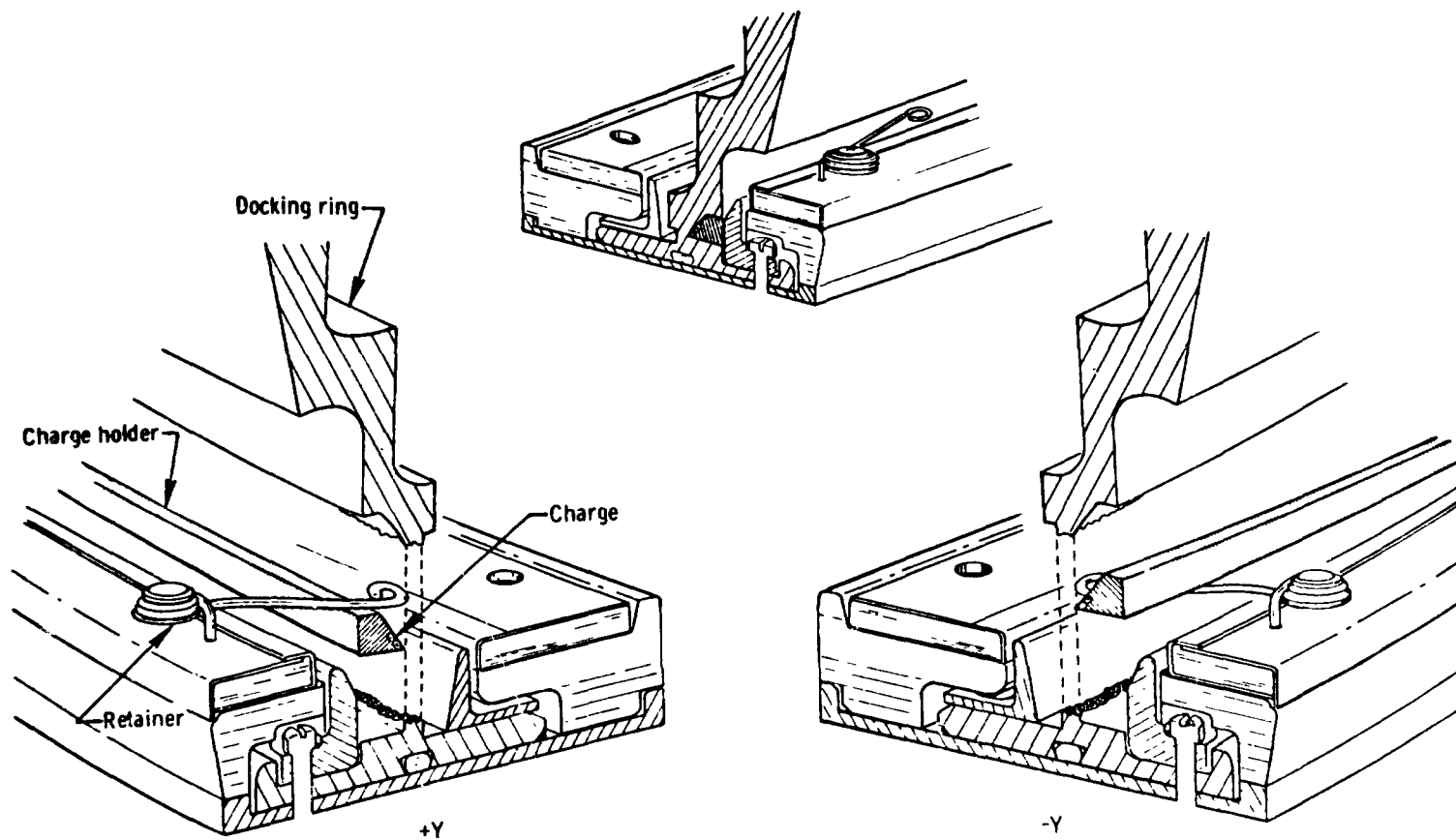


FIG. 2.2.18-1 CHARGE HOLDER RETENTION

ANOMALY REPORT

NO. 2.2.19

TITLE: SLOW-DOWN OF ONBOARD TAPE RECORDER DURING ENTRY

SYSTEM. CM

MISSION: APOLLO 10

SUBSYSTEM: INSTRUMENTATION

EVENT TIME: RE-ENTRY

PROBLEM: THE DATA STORAGE EQUIPMENT EXPERIENCED LOSS OF DATA THREE TIMES DURING ENTRY, WHICH RESULTED IN A LOSS OF APPROXIMATELY 33 SECONDS OF RECORDED PCM DATA AND 2 SECONDS OF RECORDED VOICE DATA.

TESTING OF THE RECORDER HAS REVEALED THAT AN OUTSIDE-TO-INSIDE PRESSURE DIFFERENTIAL OF 2.25 PSI IS SUFFICIENT TO DEFORM THE COVER, CAUSING IT TO CONTACT THE TAPE REELS.

THE RECORDER VENT VALVE IS SPECIFIED TO OPERATE AT 2.0 \pm 0.5 PSI DIFFERENTIAL PRESSURE. ACCEPTANCE TEST DATA ON THE APOLLO 10 VENT VALVE SHOWS A CRACKING PRESSURE OF 2.40 PSID. HOWEVER, THIS PRESSURE DEFORMED THE COVER SUFFICIENTLY TO CONTACT THE REEL AND SLOW IT.

ACTION: AN IN-LINE CHANGE WILL BE IMPLEMENTED TO SELECT VALVES THAT CRACK ON THE LOW SIDE OF THE SPECIFICATION TO INSURE NO RECURRENCE OF THIS PROBLEM.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.20

TITLE: EVA STRUT BRACE NOT IN STOWED POSITION FOR LAUNCH

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: EVA

EVENT TIME: LAUNCH

PROBLEM: THE STABILIZER, WHICH MAINTAINS COUCH POSITIONING WHEN THE FOOT STRUT OF THE CENTER COUCH IS REMOVED, WAS CONNECTED DURING THE LAUNCH (FIG.2.2.20-1). THE STABILIZER SHOULD HAVE BEEN IN THE STOWED POSITION TO ALLOW STROKING OF THE COUCH STRUTS FOR AN ABORT LANDING. THE CREW PROPERLY STOWED THE STABILIZER PRIOR TO ENTRY.

ACTION: A SPECIFIC MANDATORY INSPECTION POINT HAS BEEN ADDED TO THE PREINGRESS CHECKLIST FOR SUBSEQUENT MISSIONS.

ORGANIZATION 5-2490

REFERENCES MSC SUMMARY OF MISSION PROBLEMS

TECHNICAL DEBRIEFING

APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.20

TITLE: EVA STRUT BRACE NOT IN STOWED POSITION FOR LAUNCH

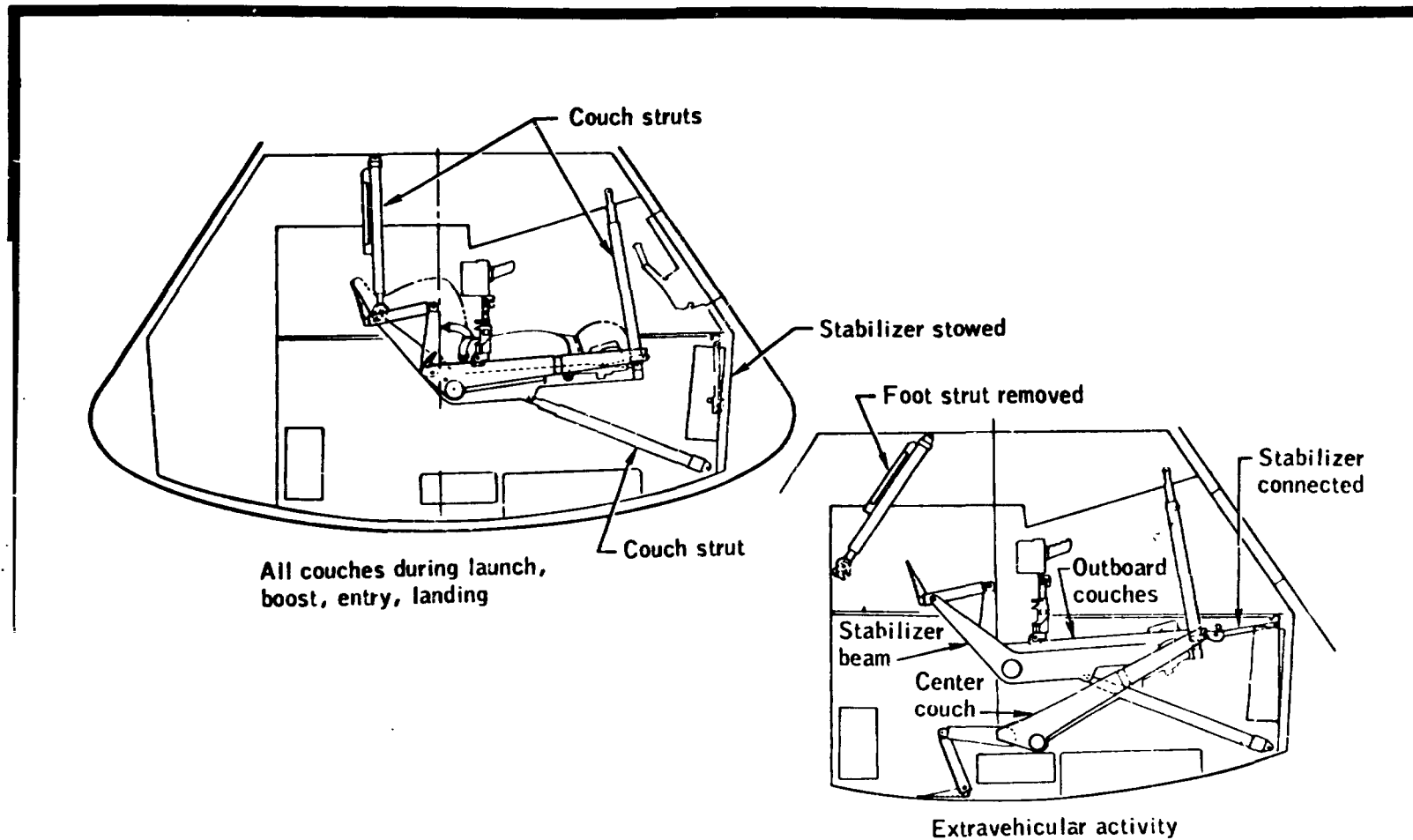


FIG. 2.2.20-1 STABILIZER USAGE

ANOMALY REPORT

NO. 2.2.21

TITLE: GYRO DISPLAY COUPLER PERFORMANCE

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: INSTRUMENTATION

EVENT TIME: MISSION

PROBLEM: THE GYRO DISPLAY COUPLER WAS REPORTED TO DRIFT EXCESSIVELY IN ROLL AND YAW (APPROXIMATELY 5 DEGREES IN 20 MINUTES). ATTITUDES DISPLAYED BY THE GYRO DISPLAY COUPLER AND THE INERTIAL MEASUREMENT UNIT WERE COMPARED AFTER EARTH ORBITAL INSERTION, INDICATING DIFFERENCES OF LESS THAN 0.1 DEGREES IN ALL AXES. THESE VALUES AND CREW COMMENTS INDICATE PROPER PERFORMANCE EARLY IN THE MISSION.

A SIMPLIFIED BLOCK DIAGRAM OF THE STABILIZATION AND CONTROL SYSTEM SHOWING THE FUNCTIONS OF THE GYRO DISPLAY COUPLER AND THE SPACECRAFT CONTROL LOOPS IS SHOWN IN FIGURE 2.2.21-1. ONE OF THE TWO GYRO ASSEMBLIES PROVIDES ONLY RATE INFORMATION AND IS NORMALLY USED TO DRIVE THE GYRO DISPLAY COUPLER. THE OTHER GYRO ASSEMBLY CAN PROVIDE EITHER RATE OR ATTITUDE ERROR, AT CREW OPTION, AND CAN BE SELECTED TO DRIVE THE GYRO DISPLAY COUPLER.

THE APOLLO 10 GYRO DISPLAY COUPLER WAS DRIVEN BY BOTH GYRO ASSEMBLIES, AND THE CREW REPORTED SIMILAR INDICATIONS FROM EACH, THEREFORE ISOLATING THE CAUSE OF THE DRIFT TO THE GYRO DISPLAY COUPLER.

THE SPECIFICATION FOR THE GYRO DISPLAY COUPLER CONTAINS ALLOWABLE ATTITUDE DISPLAY DEVIATIONS FOR ATTITUDE AND TRANSLATION MANEUVERS, FOR ASCENT, AND FOR ENTRY. IT DOES NOT CONTAIN AN ALLOWABLE VALUE FOR LONG-TERM CONSTANT ATTITUDE DRIFT. A VALUE OF 10 DEG/HOUR IS CONSIDERED REASONABLE FOR THE SYSTEM.

ORGANIZATION: 5-2490

REFERENCES: MSC SUMMARY OF MISSION PROBLEMS

TECHNICAL DEBRIEFINGS

CREW BRIEFING

APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.21

TITLE: GYRO DISPLAY COUPLER PERFORMANCE

ACTION: THE GYRO DISPLAY COUPLER IS NOT USED TO CONTROL ANY SPACECRAFT MANEUVERS. IF THE INERTIAL MEASUREMENT SYSTEM IN THE PRIMARY GUIDANCE FAILS, THE CREW CAN MANUALLY MANEUVER TO THE DESIRED INERTIAL ATTITUDE AND THEN ALLOW THE STABILIZATION AND CONTROL SYSTEM TO AUTOMATICALLY MAINTAIN ATTITUDE. TO MINIMIZE DRIFT EFFECT WHEN THE GYRO DISPLAY COUPLER IS TO BE USED FOR A MANEUVER, IT SHOULD BE ALIGNED AS NEAR IN TIME TO THE MANEUVER AS IS PRACTICABLE

THE TWO GYRO ASSEMBLIES AND THE GYRO DISPLAY COUPLER WERE REMOVED FROM THE SPACECRAFT AND RETURNED TO THE VENDOR FOR INDIVIDUAL ACCEPTANCE TESTS AND A SYSTEM TEST.

ALL THREE UNITS PASSED INDIVIDUAL TESTS WITH NO DISCREPANCIES WHICH COULD HAVE CAUSED THE REPORTED INFLIGHT PERFORMANCE. THE GYRO DISPLAY COUPLER WAS THEN OPERATED ALONE WITH THE INPUTS SET AT ZERO. DRIFT RATES WERE 2, 4, AND 1 DEG/HR FOR PITCH, YAW, AND ROLL, RESPECTIVELY. A GYRO PACKAGE WAS THEN CONNECTED, AND THE SYSTEM WAS OPERATED ON A TEST STAND. UNDER QUIESCENT OPERATION, WITH NO GYRO INPUTS, THE PERFORMANCE WAS THE SAME AS THAT RECORDED ABOVE. FINALLY, A RUN WAS MADE SIMULATING PASSIVE THERMAL CONTROL IN WHICH A 20 DEG/HR ROLL RATE WAS INTRODUCED. THE DRIFTS RECORDED WERE 5.1 AND 5.0 DEG/HR FOR PITCH AND YAW, RESPECTIVELY. THE DRIFT RATES EXPERIENCED DURING THESE TESTS ARE NOT INDICATIVE OF THE PERFORMANCE REPORTED INFLIGHT. IT IS POSSIBLE THAT THE ACTUAL DIVERGENCE OF THE ATTITUDE INDICATOR WAS NOT AS RAPID AS IT APPEARED BECAUSE NO ATTEMPT WAS MADE TO MEASURE DRIFT ACCURATELY.

DETAIL SHEET

ANOMALY 2.2.21

TITLE: GYRO DISPLAY COUPLER PERFORMANCE

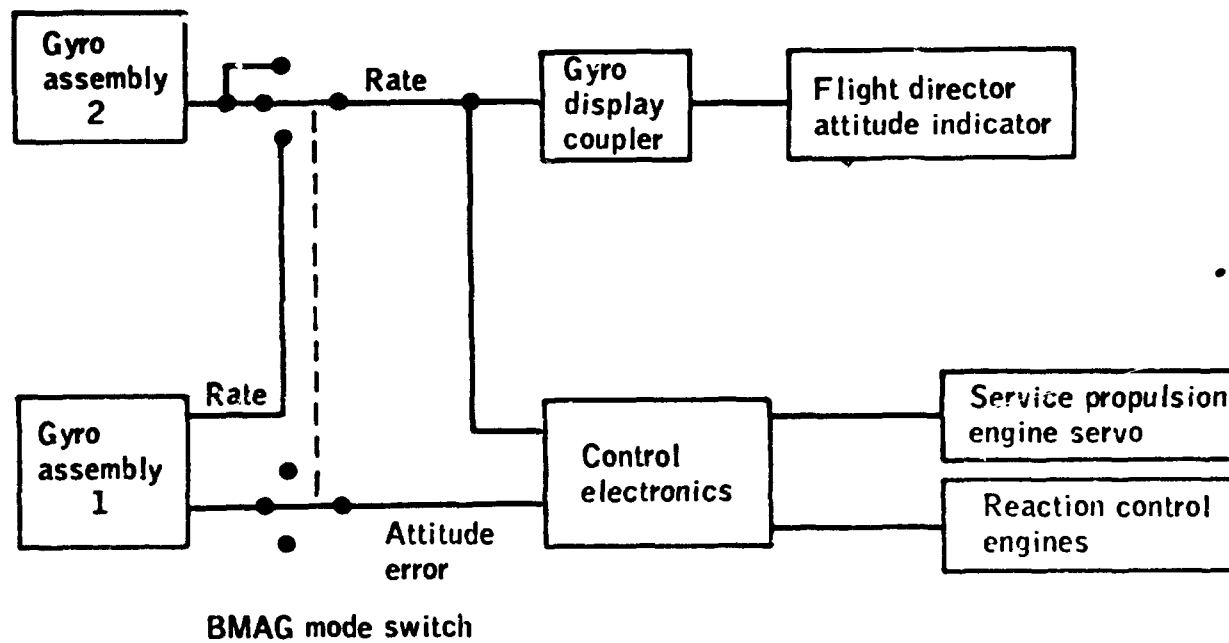


FIG. 2.2.21-1 STABILIZATION AND CONTROL SYSTEM

ANOMALY REPORT

NO. 2.2.22

TITLE: CHLORINE AMPULE LEAKAGE

MISSION: APOLLO 10

SYSTEM: CM

SUBSYSTEM: LIFE SUPPORT

EVENT TIME:

PROBLEM: DURING ONE CHLORINE INJECTION, CHLORINE SOLUTION LEAKED FROM THE FITTING AND THE BUFFER AMPULE WOULD NOT BACK-FILL WITH WATER WHEN THE PLUNGER WAS UNSCREWED.

ACTION: THE FLIGHT AMPULES USED AND UNUSED, WERE EXAMINED FOR DEFECTS, AND NO ANOMALOUS CONDITIONS WERE FOUND.

THE PROBLEM WAS PROBABLY CAUSED BY A PROCEDURAL ERROR; THE NEEDLE WAS NOT FULLY INSERTED INTO THE RUBBER GLAND AND DID NOT PENETRATE INTO THE WATER. THIS COULD ACCOUNT FOR BOTH THE LEAKAGE OF THE CHLORINE AND FAILURE TO OBTAIN WATER IN THE BUFFER AMPULE.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 10 MISSION FAILURE AND ANOMALY LISTING

MSC 30-DAY REPORT

MSC SUMMARY OF MISSION PROBLEMS

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.23

TITLE: DIGITAL EVENT TIMER MISCOUNTS

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM:

EVENT TIME:

PROBLEM: THE DIGITAL EVENT TIMER ON PANEL 1 ADVANCED A TOTAL OF 2 MINUTES DURING THE COUNTDOWN FOR FIRST MIDCOURSE CORRECTION. AT OTHER TIMES, THE TENS OF SECONDS FAILED TO ADVANCE.

THE INCREMENTS OF TIME ARE ELECTRICALLY ADVANCED THROUGH A CIRCUIT ACTIVATED WHEN A CONDUCTOR SEGMENT CONTACTS A BRUSH IN EACH REVOLUTION OF THE UNITS WHEEL.

THE TENS OF SECONDS PROBLEM WAS DUPLICATED POSTFLIGHT IN THE COUNTUP AND THE COUNTDOWN MODES. INSPECTION DISCLOSED THAT THE UNITS WHEEL HAD BEEN RUBBED BY THE MOTOR GEAR; PAINT HAD FLAKED AND CONTAMINATED THE UNITS TAB AND BRUSH ASSEMBLY (SEE FIG.2.2.23-1).CONTAMINATION BETWEEN THE TAB AND BRUSH WOULD HAVE PREVENTED ELECTRICAL CONTACT.

ACTION: THE 2-MINUTE JUMP WAS NOT DUPLICATED, AND NO CONDITION WAS FOUND IN THE TIMER THAT COULD HAVE PRODUCED THE JUMP. SINCE THIS TIMER IS SENSITIVE TO ELECTRICAL NOISE, THE MOST PROBABLE CAUSE WAS A SPURIOUS NOISE INPUT.

A SCREENING TEST HAD BEEN DEVELOPED FOR THE TIMERS INSTALLED IN FUTURE SPACECRAFT; HOWEVER THE CAPABILITY OF THE TEST TO ISOLATE UNRELIABLE TIMERS HAS NOT YET BEEN PROVEN.

ORGANIZATION: 5-2490

REFERENCES: MSC FAILURE AND ANOMALY LISTING,
JUNE 1969

RESOLUTION: CLOSED

DATE:

RE:

DETAIL SHEET

ANOMALY 2.2.23

TITLE: DIGITAL EVENT TIMER MISCOUNTS

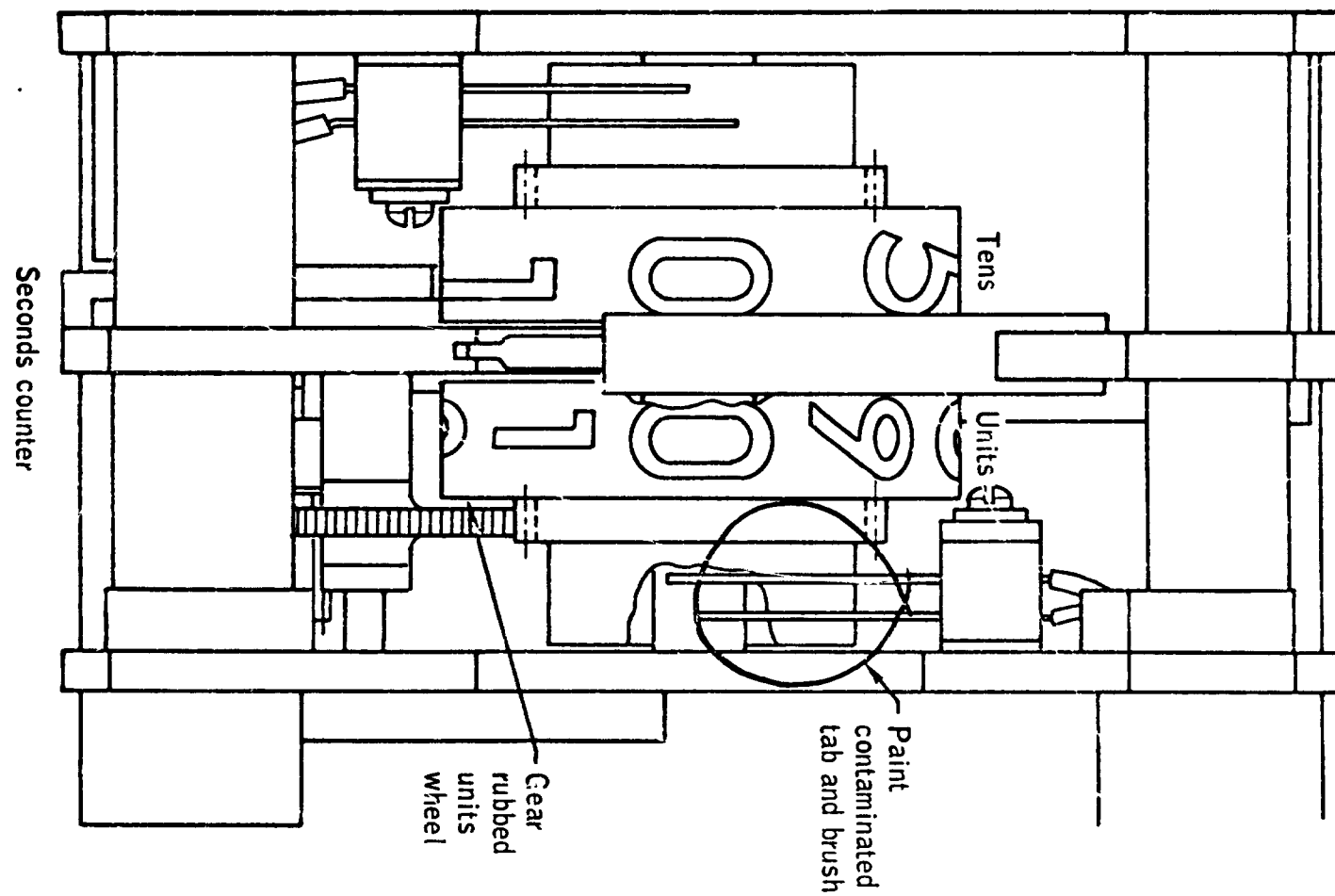


FIG. 2.2.23-1 DIGITAL EVENT TIMER

ANOMALY REPORT

NO. 2.2.24

TITLE: SUIT HEAT EXCHANGER WICK DIFFICULT TO SERVICE

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: ECU

EVENT TIME: T-38:45

PROBLEM: BETWEEN T-38:45 AND T-20:11 AN EXCESSIVE AMOUNT OF WATER WAS REQUIRED DURING THE WICK WETTING PROCEDURE FOR THE SUIT HEAT EXCHANGER OF THE ENVIRONMENTAL CONTROL UNIT. DIFFICULTY WAS EXPERIENCED IN OBTAINING COMPLETE WETTING OF THE "AIR-BLOCKING SINTERED PLATE", IN THE SUIT HEAT EXCHANGER. FOLLOWING EACH ATTEMPT, UNACCEPTABLE GAS LEAKAGE OCCURRED. A SERVICING WITH WATER INJECTION PRESSURE HIGHER THAN NORMAL WAS SUCCESSFUL IN PREVENTING GAS BREAKTHROUGH. THE TIME REQUIRED FOR RESERVICING OPERATIONS CAUSED THE PERFORMANCE OF THE SUIT LOOP PURGING AND SAMPLING, FINAL CREW CHECKLIST, AND COMMUNICATION TESTS TO BE ACCOMPLISHED DURING THE BUILT-IN HOLD AT T-9:00.

ACTION: TEST CHANGE NOTICE CS-219 HAS BEEN ISSUED WHICH CONTAINS SERVICING PROCEDURES. THE WICK WILL BE LEFT WETTER AFTER THE ALTITUDE CHAMBER TESTS, AND THE WICK BREAKTHROUGH PRESSURE WILL BE DETERMINED.

ORGANIZATION: 5-2490

REFERENCES: MSC 5-DAY REPORT, P. 10
APOLLO 11 FRR

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.25

TITLE: CREW REPORTED LM WATER CONTAINED AIR

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: CREW SYSTEM

EVENT TIME:

PROBLEM: THE CREW REPORTED THAT THE LUNAR MODULE DRINKING WATER CONTAINED GAS. THE NITROGEN USED TO PRESSURIZE THE WATER SYSTEM PERMEATES THE TANK BLADDER, AND THE WATER BECOMES SATURATED WITHIN 100 HOURS AFTER SERVICING. AS THE ABSOLUTE PRESSURE IS REDUCED THE DISSOLVED NITROGEN IS RELEASED. THE FIRST WATER WITHDRAWN SHOULD HAVE CONTAINED ABOUT 12 PERCENT OF GAS. AT STAGING, THE MIXTURE SHOULD HAVE CONTAINED 6.3 PERCENT NITROGEN BECAUSE OF THE REDUCED WATER TANK PRESSURE AT THAT TIME. THE WATER HOSE, WATER GUN, AND CONNECTING PLUMBING WERE NOT SERVICED AND THIS ENTRAPPED AIR WOULD INITIALLY ADD TO THE PROBLEM.

ACTION: PRELAUNCH PROCEDURES HAVE BEEN CHANGED TO INCLUDE SERVICING THE WATER HOSE AND CONNECTING PLUMBING.

CONSIDERATION IS BEING GIVEN TO EMPLOYING A GAS SEPARATOR WHICH FITS IN THE DRINKING LINE.

ORGANIZATION 5-2490

REFERENCES MSC FAILURE AND ANOMALY LISTING
JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.25

TITLE: CREW REPORTED LM WATER CONTAINED AIR

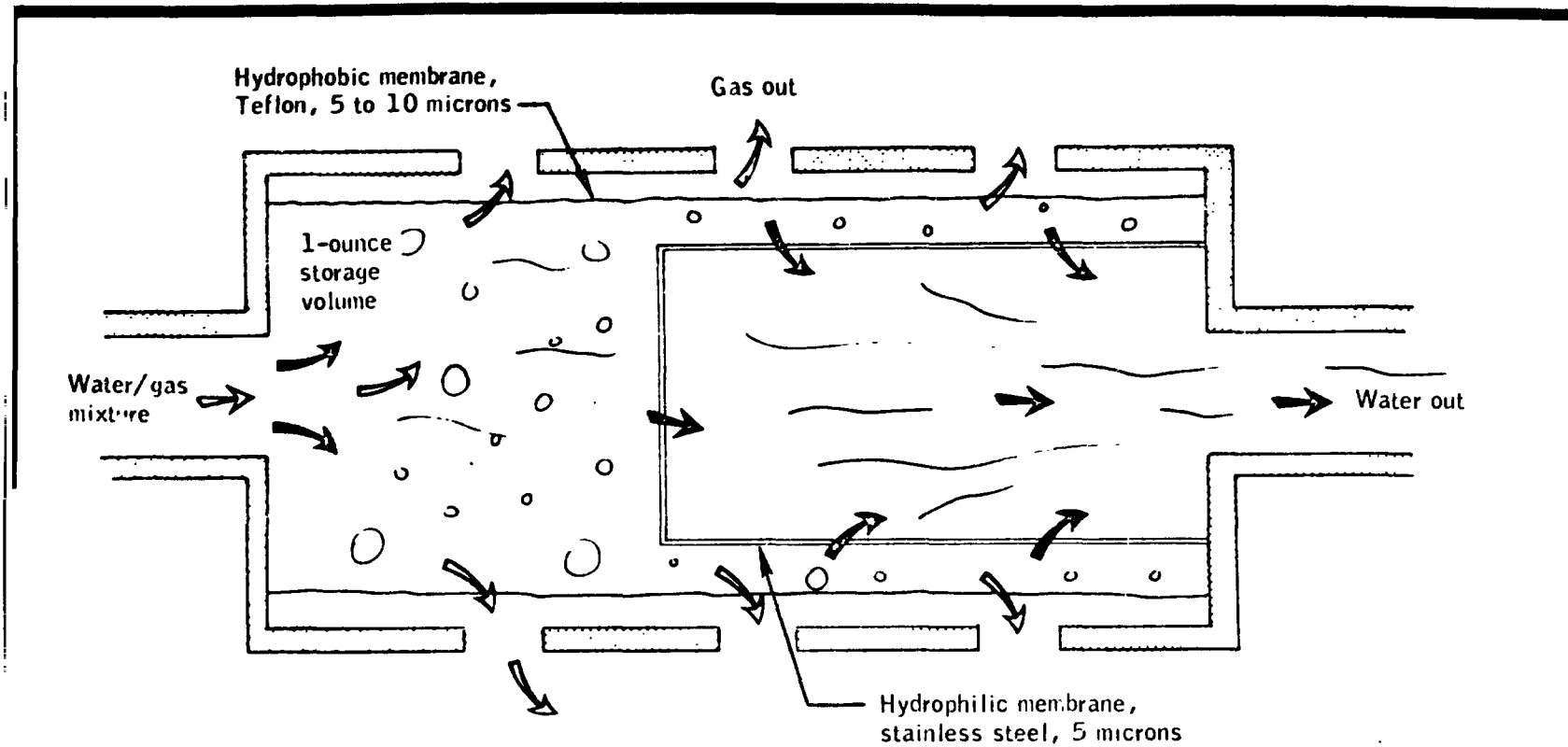


FIG. 2.2.25-1 WATER/GAS SEPARATION MEMBRANE.

ANOMALY REPORT

NO. 2-2.26

TITLE: HIGH NOISE LEVEL IN LM CABIN

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: STRUCTURE

EVENT TIME:

PROBLEM: THE NOISE LEVEL WAS HIGH IN THE LM.

1. THE S-BAND ANTENNA SOUNDED AS IF IT HAD BAD BEARINGS AND IT SHOOK THE LM WHENEVER IT WAS MOVED.

THE STEERABLE ANTENNA WAS PARTICULARLY NOISY IN THE SLEW MODE DURING ALTITUDE CHAMBER TESTS; THE LM-4 ANTENNA IS NOT PECULIAR IN THIS RESPECT. THIS WAS NOT NOTICED ON LM-3, BECAUSE THE ANTENNA WAS NOT USED IN FLIGHT.

2. THE CABIN AIR FANS WERE EXCESSIVELY NOISY; THE CREW TURNED THEM OFF AFTER 30 MINUTES.

THE CREW STATED THAT THE CABIN FANS WERE NOT NEEDED.

3. THE GLYCOL PUMPS WERE EXCESSIVELY NOISY.

TESTS WERE PERFORMED ON LUNAR MODULE 8 TO VERIFY THE USE OF FLEXIBLE HOSES TO ISOLATE THE PUMP FROM THE TUBING AND ACT AS AN ATTENUATOR; HOWEVER, NOISE WAS ONLY SLIGHTLY REDUCED. FURTHER MODIFICATION TO THE LUNAR MODULE HARDWARE DOES NOT APPEAR PRACTICAL. THEREFORE, EAR PLUGS WILL BE OBTAINED FOR THE CREW TO USE DURING SLEEP PERIODS.

ORGANIZATION: 5-2490
REFERENCES: MSC-FAILURE AND ANOMALY LISTING
JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.27 : TITLE: YAW RATE GYRO OUTPUT ERROR

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: INSTRUMENTATION

EVENT TIME: 98:47 GET

PROBLEM: THE OUTPUT FROM THE YAW RATE GYRO DID NOT ALWAYS CORRESPOND TO ACTUAL VEHICLE YAW RATE DURING THE 50 SECOND PERIOD PRIOR TO STAGING AND SEVERAL SECONDS AFTER STAGING. FOR EXAMPLE IN ONE 12 SECOND PERIOD, THE GYRO APPEARED TO HANG UP AT MINUS 1.7 DEG/SEC. DURING THIS PERIOD, THE ACTUAL VEHICLE RATE WAS 0.2 DEG/SEC. THE GYRO OUTPUT APPEARS NORMAL BOTH BEFORE AND AFTER THE PERIOD OF ATTITUDE EXCURSIONS ON ABORT GUIDANCE SYSTEM AROUND STAGING.

ACTION: THE HISTORY OF THE GYROS ON APOLLO 11 WAS ANALYZED AND FOUND TO HAVE NO DISCREPANCIES. THE POSSIBILITY OF PERFORMING ADDITIONAL TESTS ON FOLLOW-ON UNITS AFTER INSTALLATION IS BEING CONSIDERED.

ORGANIZATION: 5-2490
REFERENCES: MSC FAILURE AND ANOMALY
LISTING, JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.27

TITLE: YAW RATE GYRO OUTPUT ERROR

PRIOR TO INSTALLATION, EACH GYRO IS SUBJECTED TO "STICTION" AND CROSS-COUPLING TESTS WHICH EXERCISE IT WELL BEYOND THE RATES NORMALLY EXPERIENCED IN FLIGHT. ONCE INSTALLED, THE ONLY TESTS PERFORMED ARE ELECTRICAL TORQUING TESTS USING THE BUILT-IN TEST CIRCUITS.

A MECHANICAL CAUSE OF THE TROUBLE APPEARS MORE LIKELY, SINCE CLEARANCES OF 0.0002 TO 0.0003 INCH EXIST BETWEEN THE FLOAT AND CASE. IF A PARTICLE OF CONTAMINATION BECAME LODGED IN THIS SPACE, IT COULD CAUSE A TEMPORARY OFFSET AND COULD HAVE BEEN REMOVED DURING THE HIGH RATES FOLLOWING STAGING.

NO GYRO FAILURES CAUSED BY CONTAMINATION HAVE OCCURRED AFTER ACCEPTANCE; HOWEVER, EIGHT REJECTIONS ASSOCIATED WITH CONTAMINATION HAVE BEEN EXPERIENCED BY THE VENDOR. ONE OF THOSE OCCURRED ON THIS GYRO DURING BUILDUP WHEN IT FAILED A "STICTION" TEST. THE UNIT WAS REBUILT BUT AGAIN FAILED BECAUSE OF A BELLOWS LEAK. FINALLY, AFTER A SECOND REBUILDING, IT PASSED ACCEPTANCE. BECAUSE OF THIS HISTORY, THE SUSPECTED CAUSE OF THE MALFUNCTION IS CONTAMINATION.

ANOMALY REPORT

NO. 2.2.28

TITLE: INSTRUMENTATION DISCREPANCIES

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM:

EVENT TIME:

PROBLEM: CHAMBER PRESSURE SWITCHES. - CHAMBER PRESSURE SWITCHES IN THE REACTION CONTROL SYSTEM FAILED CLOSED. SWITCH B3D FAILED CLOSED DURING THE INITIAL HOT-FIRE CHECKOUT. SHORTLY AFTER UNDOCKING, SWITCH B4U FAILED FOR APPROXIMATELY 2 HOURS, THEN LATER FAILED CLOSED PERMANENTLY. DURING THE ASCENT PROPULSION FIRING TO DEPLETION, SWITCH B2U FAILED CLOSED FOR APPROXIMATELY 2 MINUTES, THEN RECOVERED AND OPERATED PROPERLY. AFTER THE ASCENT PROPULSION FIRING TO DEPLETION, SWITCH A2D FAILED CLOSED FOR 13 SECONDS, AND LATER, SWITCH A1U BECAME ERRATIC.

GLYCOL TEMPERATURE. - DURING THE FIRST MANNING, THE WATER/GLYCOL PUMP SWITCH WAS IN THE PUMP 2 POSITION, AND THE INDICATED GLYCOL TEMPERATURE WAS ZERO. AT 94 HOURS, THE SELECTOR SWITCH WAS SET TO PUMP 1, AND THE TEMPERATURE READING WAS NORMAL.

REACTION CONTROL MANIFOLD PRESSURES. - AT 103 HOURS, THE INDICATED FUEL MANIFOLD PRESSURE IN REACTION CONTROL SYSTEM - A DROPPED FROM 181 TO 168 PSIA AND THEN RETURNED TO 181 PSIA AT 106-1/2 HOURS. AT 108-1/2 HOURS, THIS MEASUREMENT DROPPED TO ZERO. SATISFACTORY OPERATION OF THE REACTION CONTROL SYSTEM INDICATES A MEASUREMENT ANOMALY. THE MOST PROBABLE CAUSE OF THIS ANOMALY IS EITHER A DEFECTIVE SPLICE IN THE 26-GAGE WIRING ASSOCIATED WITH THE TRANSDUCER OR AN INTERMITTENT CONNECTION INTERNAL TO THE TRANSDUCER.

CASK THERMAL SHIELD TEMPERATURE. - THE TEMPERATURE MEASUREMENT OF THE THERMAL SHIELD FOR THE RADIOISOTOPE THERMAL GENERATOR CASK READ UPPER LIMIT THROUGHOUT THE LUNAR MODULE PORTION OF THE FLIGHT. THE TELEMETRY IS SWITCHED TO THIS MEASUREMENT FROM CASK TEMPERATURE BY A BARO-SWITCH AT 10000 FOOT ALTITUDE (FIGURE 2.2.28-2).

ORGANIZATION: 5-2490

REFERENCES: MSC FAILURE AND ANOMALY
LISTING, JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.28

TITLE: INSTRUMENTATION DISCREPANCIES

CHAMBER PRESSURE SWITCHES. - THE B2U AND A2D FAILURES ARE UNIQUE, IN THAT THE SWITCHES CLOSED WITHOUT THE PRESENCE OF CHAMBER PRESSURE, WHEREAS ALL THE OTHER FAILURES WERE INITIATED BY ENGINE FIRINGS. THE FORMER FAILURES OCCURRED WHEN THE ENGINE CLUSTERS REACHED HIGH HEAT-SOAK-BACK TEMPERATURES AFTER THE EXTREMELY HIGH FIRING ACTIVITY ASSOCIATED WITH THE ASCENT PROPULSION FIRING. THE FAILURE MODE FOR THESE FIVE SWITCHES IS BELIEVED TO BE THE SAME AS THAT OF ONE LM-3 UNIT AND SEVERAL OTHERS DURING GROUND TESTING. PARTICULATE CONTAMINATION AND/OR PROPELLANT RESIDUE IS FORCED UNDER THE SWITCH DIAPHRAGM BY CHAMBER PRESSURE AND HOLDS THE DIAPHRAGM DEFLECTED AND THE ELECTRICAL CONTACTS CLOSED (SEE FIGURE 2.2.28-1). THE SMALL STROKE OF THE DIAPHRAGM (0.007 INCH) AND THE LOW DIAPHRAGM RESTORING FORCE GENERATED BY THE RETURN SPRING MAKE THE SWITCH EXTREMELY SUSCEPTIBLE TO FAILURE BY CONTAMINATION. REACTION CONTROL SYSTEM PERFORMANCE WAS UNAFFECTED BY THESE SWITCH FAILURES. THE ONLY CONSEQUENCE WAS THE LOSS OF CAPABILITY TO DETECT AN ENGINE FAILED OFF. NO CORRECTIVE ACTION FOR RESOLUTION OF THE CHAMBER PRESSURE SWITCH FAILURES IS PLANNED.

GLYCOL TEMPERATURE. - THE COOLANT PUMP SWITCH IS USED TO ROUTE EITHER THE PRIMARY OR THE SECONDARY COOLANT TEMPERATURE TO THE DISPLAY. A JUMPER ACROSS THE PUMP 1 AND PUMP 2 CONTACTS ALLOWS DISPLAY OF THE PRIMARY TEMPERATURE WHEN THE SWITCH IS IN EITHER POSITION. THEREFORE, THE MOST LIKELY CAUSE OF THE PROBLEM WAS A BROKEN JUMPER OR AN INCOMPLETE CONTACT IN THE PUMP 2 SWITCH POSITION.

CASK THERMAL SHIELD TEMPERATURE. - THE PROBABLE CAUSES OF THE FAILURE WERE A BROKEN WIRE IN THE SHIELD TEMPERATURE MEASUREMENT, A FAILED TRANSDUCER, OR A FAILURE OF THE BAROSWITCH TO TRANSFER. THE TRANSDUCER AND BAROSWITCH WERE TESTED PRIOR TO INSTALLATION AT THE LAUNCH SITE. AFTER INSTALLATION, WORK WAS PERFORMED IN THE AREA, AND NO FURTHER CHECKOUT WAS PERFORMED. FOR FUTURE MISSIONS, THE INSTRUMENTATION WIRING WILL BE CHECKED AFTER FINAL INSTALLATION. THE MEASUREMENT IS NOT MANDATORY FOR FLIGHT OPERATIONS, AND NO FURTHER CHANGES WILL BE MADE. COOLING AIR IS FURNISHED TO THE CASK FROM THE LAUNCH VEHICLE INSTRUMENT UNIT THROUGH A 5-INCH DUCT. PRELAUNCH, INDICATIONS WERE THAT AIR WAS NOT BEING SUPPLIED. SINCE THE CASK ON THIS MISSION WAS NOT ACTIVATED, THE REQUIREMENT WAS WAIVED AND NO CORRECTIVE ACTION TAKEN. TESTS AT MARSHALL SPACE FLIGHT CENTER INDICATE THE MOST PROBABLE CAUSE WAS A RUPTURE OF THE DUCT AT THE UMBILICAL INTERFACE INSIDE THE INSTRUMENT UNIT WALL. DESIGN CHANGES TO CORRECT THE PROBLEM HAVE BEEN MADE BY MARSHALL.

DETAIL SHEET

ANOMALY 2.2.28

TITLE: INSTRUMENTATION DISCREPANCIES

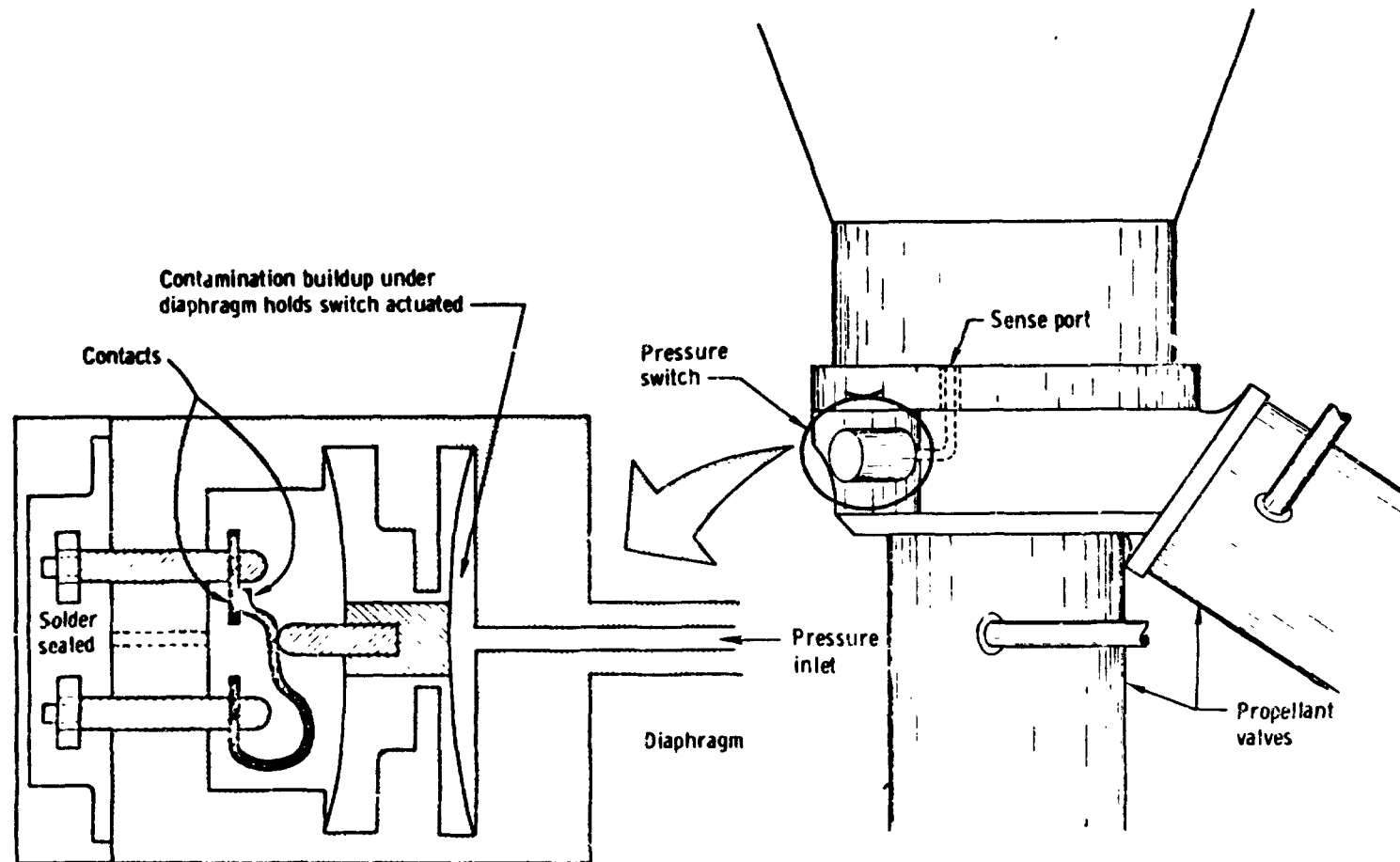


FIG. 2.2.28-1 LUNAR MODULE REACTION CONTROL SYSTEM THRUST CHAMBER SWITCH.

DETAIL SHEET

ANOMALY 2.2.28

TITLE: INSTRUMENTATION DISCREPANCIES

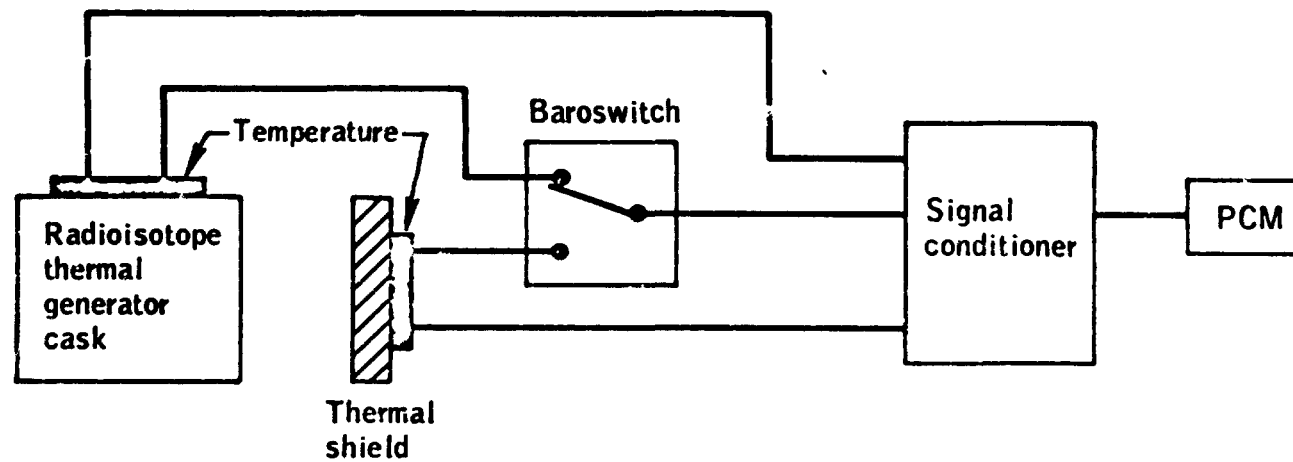


FIG. 2.2.28-2 CASK TEMPERATURE

ANOMALY REPORT

NO. 2.2.29

TITLE: BACKUP VOICE NOISE ON OMNI IN REVOLUTION 13

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: S-BAND

EVENT TIME:

PROBLEM: DURING LUNAR REVOLUTION 13, THE BACKUP DOWNVOICE RECEIVED FROM THE LUNAR MODULE AT THE MISSION CONTROL CENTER WAS UNUSABLE BECAUSE OF LOW SPEECH LEVELS. PLAYBACK OF THE VOICE TAPE RECORDED AT THE GOLDSTONE STATION SHOWED THAT EXCELLENT QUALITY BACKUP VOICE WAS RECORDED AT THE OUTPUT OF THE DEMONSTRATION SYSTEM. HOWEVER, THE SPEECH LEVELS ON THE GOLDSTONE LUNAR MODULE AIR-TO-GROUND AND NETWORK 1 LOOPS WHICH INTERFACE WITH THE LINES TO THE MISSION CONTROL CENTER WERE EXTREMELY LOW.

ACTION: INVESTIGATION SHOWED THAT THE ONLY WAY THE PROBLEM COULD BE DUPLICATED WAS BY SIMULTANEOUSLY REMOTING BOTH NORMAL AND BACKUP DOWNVOICE FROM GOLDSTONE TO THE MISSION CONTROL CENTER. THIS IS NOT A STANDARD CONFIGURATION. THUS, THE INVESTIGATION RESULTS INDICATE THAT THE RECEIPT OF UNUSABLE BACKUP VOICE WAS CAUSED BY AN OPERATOR ERROR WITHIN THE GOLDSTONE STATION.

ORGANIZATION: 5-2490
REFERENCES: MSC FAILURE AND ANOMALY
LISTING, JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.30

TITLE: DROP IN SIGNAL STRENGTH ON S-BAND STEERABLE ANTENNA

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: S-BAND

EVENT TIME: 13TH REV.

PROBLEM: DURING THE BEGINNING OF REVOLUTION 13, THE S-BAND STEERABLE ANTENNA DID NOT PROPERLY TRACK. AT ACQUISITION OF SIGNAL, THE RECEIVED SIGNAL STRENGTH AT THE GROUND STATION INDICATED NEAR-BORESIGHT CONDITION FOR THE ANTENNA. OVER THE NEXT 13 MINUTES, THE SIGNAL STRENGTH GRADUALLY DECREASED 20 DB. A PLOT OF EXPECTED SIGNAL STRENGTH (FIG.2.2.30-1), CONSIDERING SPACECRAFT ATTITUDE CHANGES AND ANTENNA GAIN PATTERNS, SHOWED THAT THE ANTENNA WAS NOT MOVING AT THIS TIME. THE ANTENNA PERFORMED WELL BOTH BEFORE AND AFTER THIS PERIOD. THE POSSIBLE CAUSES FOR FAILURE OF THE ANTENNA TO MOVE WERE EITHER THAT THE SERVO SYSTEM CIRCUIT WAS OPEN OR THE ANTENNA TRACK-MODE SWITCH WAS IN THE SLEW OR OFF POSITION.

ACTION: THE TRACK-MODE SWITCH FOR THE STEERABLE ANTENNA IS A THREE-POSITION SWITCH (DOWN-SLEW; CENTER - OFF; UP - AUTO). THE CREW REPORTED THAT THE SWITCH MAY HAVE INADVERTENTLY BEEN SWITCHED TO OFF INSTEAD OF TO AUTO AT THE TIME ACQUISITION HAD BEEN ESTABLISHED.

ORGANIZATION: 5-2490

REFERENCES: MSC FAILURE AND ANOMALY
LISTING JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.30

TITLE: DROP IN SIGNAL STRENGTH ON S-BAND STEERABLE ANTENNA

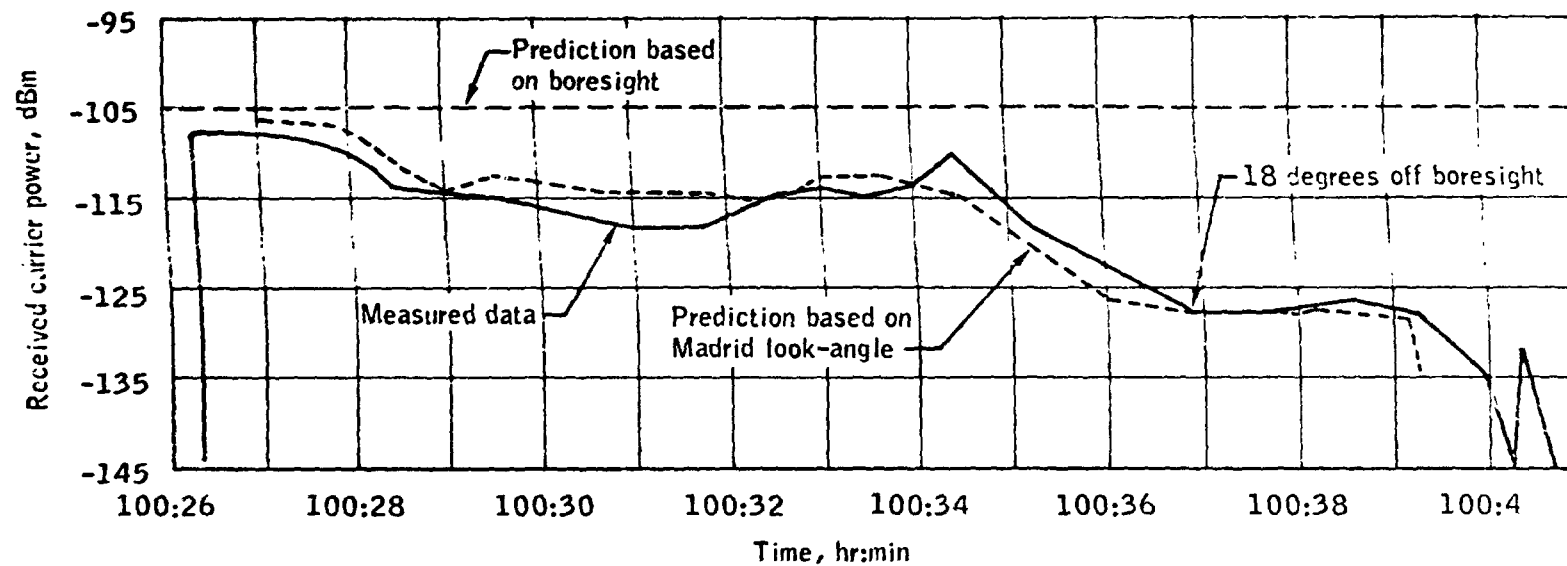


FIG. 2.2.30-1 SIGNAL STRENGTH FROM STEERABLE ANTENNA

ANOMALY REPORT

NO. 2.2.31

TITLE: DPS GIMBAL DRIVE PITCH ACTUATOR FAILED

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: DPS

EVENT TIME: 100:58

PROBLEM: A MASTER ALARM AND ASSOCIATED ENGINE PITCH GIMBAL FAIL WARNING WERE RECEIVED DURING THE PHASING MANEUVER. "COASTING", AN UNCOMMANDED GIMBAL MOVEMENT WHICH RESULTS WHEN THE SPRING-LOADED BRAKE FAILS TO ENGAGE AFTER REMOVAL OF DRIVE SIGNALS, HAD OCCURRED DURING CHECKOUT OF THIS GIMBAL. A RECURRENCE OF THE COASTING, WHICH IS NOT DETRIMENTAL, WAS NOT UNEXPECTED. THE TELEMETRY DATA INDICATE THAT THE PITCH AND YAW ACTUATORS BOTH DROVE AS EXPECTED. THE SMALL NUMBER OF THRUSTER FIRINGS ALSO DEMONSTRATE THAT THRUST VECTOR CONTROL WAS MAINTAINED USING THE ACTUATORS. DURING THE MANEUVER, THE GIMBAL FAIL WAS INDICATED AT THE TIME OF A REVERSAL IN PITCH GIMBAL MOTION.

BECAUSE OF THE SAMPLE RATE OF THE TELEMETRY DATA, THE TIME OF THE GIMBAL FAIL INDICATION CANNOT BE PRECISELY ESTABLISHED, BUT THE DATA ENCOMPASS A PERIOD DURING WHICH THE GIMBAL COMMAND REVERSED (FIG.2.2.31-1)THUS,THE COASTING COULD HAVE ALLOWED GIMBAL MOVEMENT FOR 0.25 SECOND WITHOUT A COMMAND WHICH CAUSES THE FAIL INDICATION. FIGURE 2.2.31-2, SHOWS THE DESCENT ENGINE TRIM CONTROL FAILURE DETECTION LOGIC.

ACTION: FOR APOLLO 11 AND SUBSEQUENT, THE BRAKE MECHANISM HAS BEEN REDESIGNED, AND THE ALLOWABLE TIME FOR MOVEMENT WITHOUT COMMAND HAS BEEN INCREASED TO 0.50 SECOND.

ORGANIZATION: 5-2490

REFERENCES: MSC 5-DAY REPORT, P. 12

MSC FAILURE AND ANOMALY LISTING

JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.31

TITLE: DPS GIMBAL DRIVE PITCH ACTUATOR FAILED

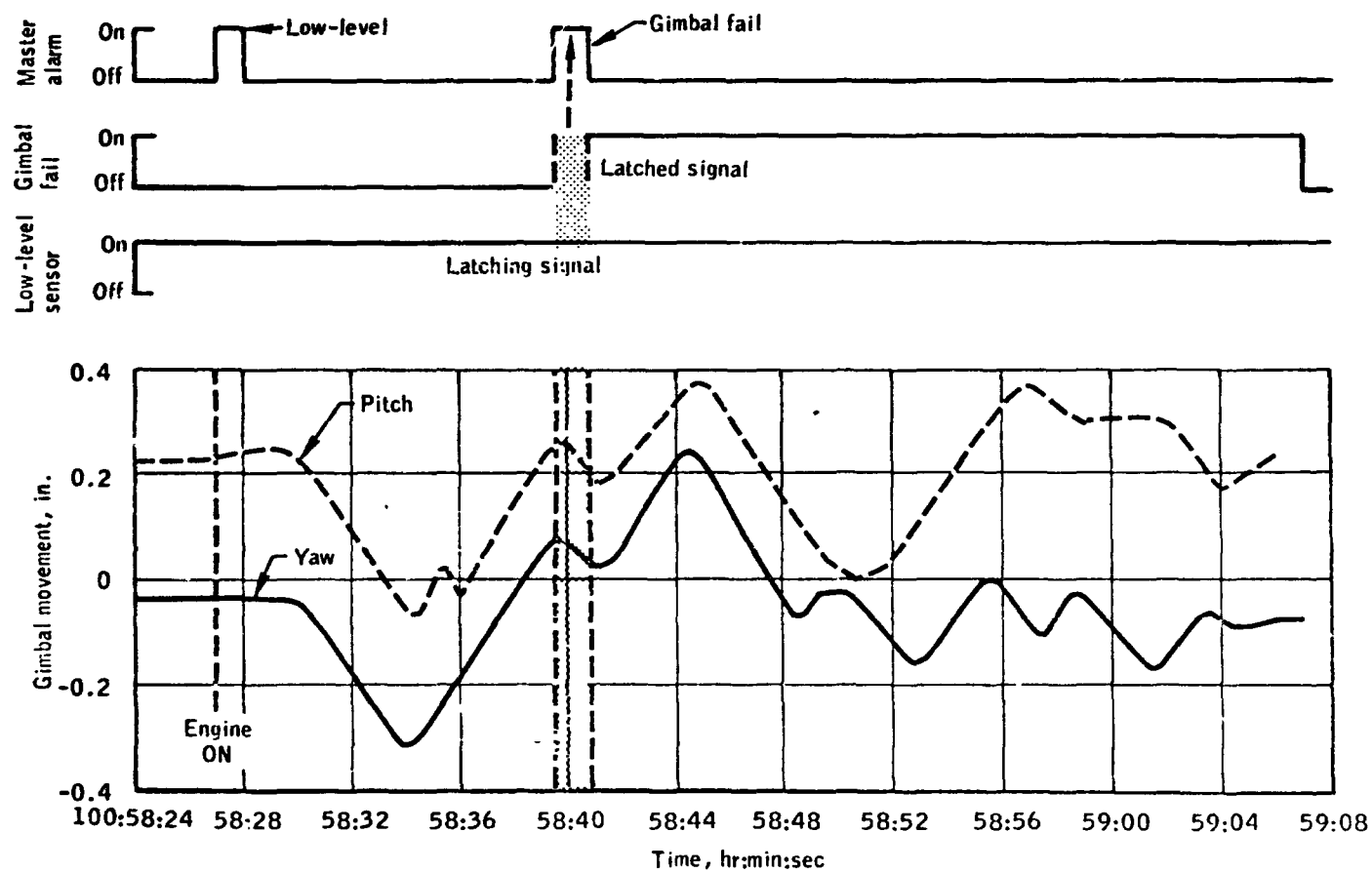


FIG. 2.2.31-1 GIMBAL DRIVE ACTUATOR OPERATION

ANOMALY 2.2.31

TITLE: DPS GIMBAL DRIVE PITCH ACTUATOR FAILED

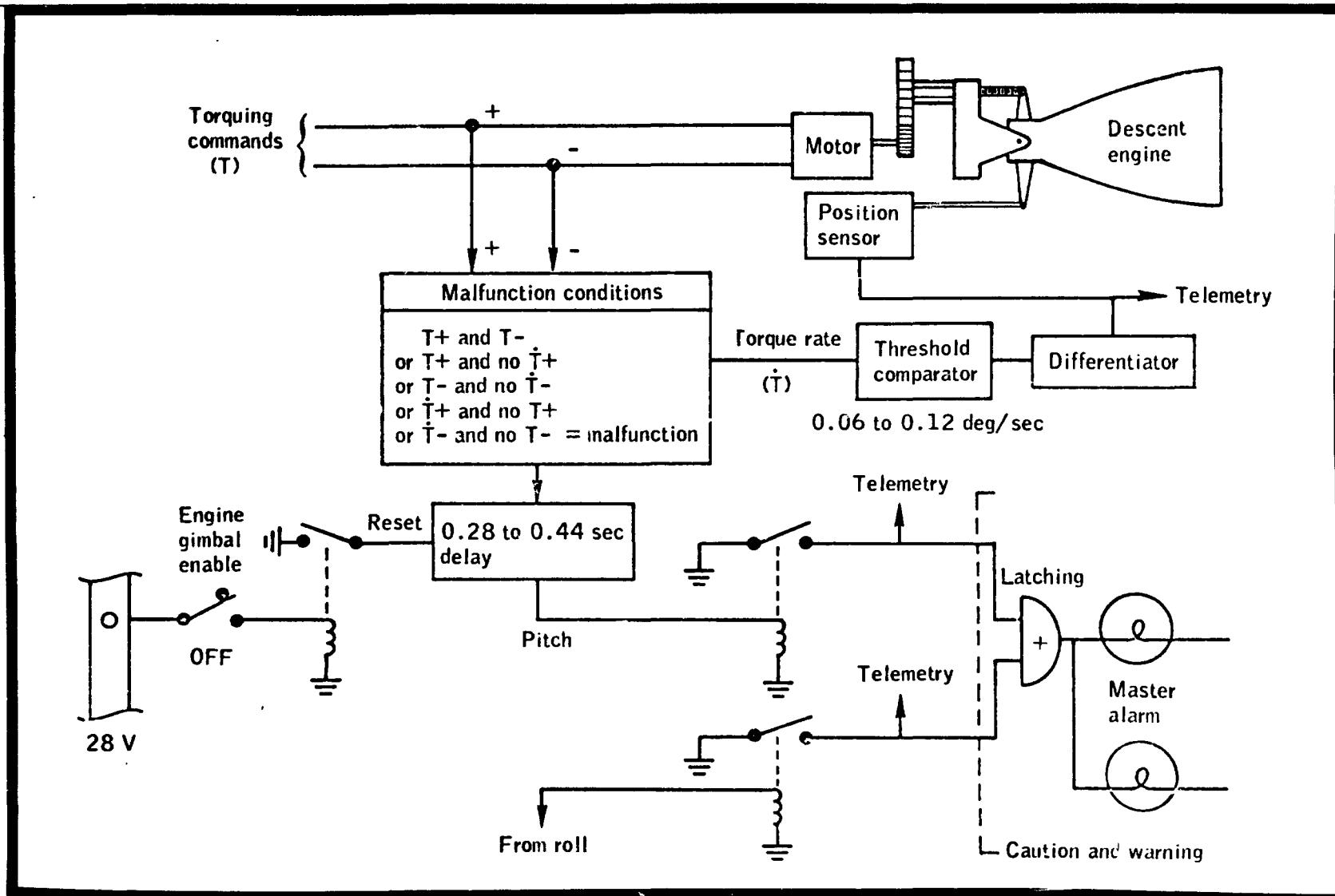


FIG. 2.2.31-2 DESCENT ENGINE TRIM CONTROL

ANOMALY REPORT

NO. 2.2.32

TITLE: COMMANDERS OXYGEN PURGE SYSTEM HEATER LIGHT DID
NOT COME ON

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: INSTRUMENTATION

EVENT TIME:

PROBLEM: DURING CHECKOUT OF THE COMMANDER'S OXYGEN PURGE SYSTEM, THE HEATER LIGHT DID NOT COME ON. COMPONENT AND CIRCUIT ANALYSES DO NOT INDICATE A DESIGN DEFECT. ALSO, COMPONENTS WERE VIBRATION-TESTED TO FAILURE AND THE SYSTEM WAS VIBRATION TESTED USING FLIGHT TYPE BRACKETS, BUT THESE TESTS DID NOT DUPLICATE THE FAILURE. ANALYTICAL STUDIES HAD INDICATED THAT WITHOUT THE HEATERS, THE MINIMUM TEMPERATURE OF THE GAS AT THE HELMET WILL BE ABOUT MINUS 10° F. MANNED TESTS INDICATE THAT THIS TEMPERATURE IS ACCEPTABLE FOR COMFORT AND THAT THE HEATER IS NOT NEEDED.

ACTION: WITHOUT THE HEATERS, NO MECHANICAL PROBLEMS WITHIN THE SYSTEM WERE ENCOUNTERED. NO HARDWARE CHANGE IS REQUIRED FOR APOLLO 11.

ORGANIZATION: 5-2490
REFERENCES: MSC FAILURE AND ANOMALY
LISTING, JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.33

TITLE: LARGE LM ATTITUDE EXCURSIONS DURING STAGING

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: STABILIZATION & CONTROL

EVENT TIME: 102:42 GET

PROBLEM: LARGE ATTITUDE EXCURSIONS OCCURRED PRIOR TO AND DURING STAGING (FIG. 2.2.33-1). BODY RATES OF 19 DEG/SEC IN PITCH AND GREATER THAN 25 DEG/SEC IN ROLL AND YAW WERE RECORDED. SMALL YAW ATTITUDE EXCURSIONS OCCURRED APPROXIMATELY 40 SECONDS PRIOR TO STAGING. THE MODE SWITCHING, TELEMETRY, AND ASSOCIATED ATTITUDE COMMANDS INDICATE THAT THE ABORT GUIDANCE MODE CHANGED FROM "ATT HOLD" TO "AUTO" COINCIDENT WITH THE VEHICLE GYRATIONS. THE ATTITUDE CONTROL SWITCHES ON PANELS 3 AND 4 ARE SHOWN IN FIGURE 2.2.33-3 AND A SIMPLIFIED FUNCTIONAL SWITCHING DIAGRAM IS SHOWN IN FIGURE 2.2.33-2. APPROXIMATELY 4 MINUTES BEFORE STAGING, WITH THE GUIDANCE SELECT SWITCH IN AGS AND THE ATTITUDE CONTROL SWITCHES IN PULSE, THE CREW VERIFIED THAT THE ABORT GUIDANCE MODE CONTROL SWITCH WAS IN "ATT HOLD" SINCE THE INTENT WAS TO PERFORM STAGING IN AGS "ATT HOLD." AFTER SOME DISCUSSION, THEY SELECTED MAX DEADBAND TO SAVE PROPELLANT.

ACTION: THE ANOMALY WAS PROCEDURAL. THE CREW, IN DIAGNOSING THE EARLIER YAW RATE GYRO PROBLEM, AND IN REACTING TO IT, TRANSFERRED THE ABORT GUIDANCE MODE SWITCH TO THE AUTO POSITION. THIS RESULTED IN THE HIGH VEHICLE RATES EXPERIENCED.

ORGANIZATION: 5-2490

REFERENCES: MSC 5-DAY REPORT, P. 12
MSC FAILURE AND ANOMALY LISTING
JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.33

TITLE: LARGE LM ATTITUDE EXCURSIONS DURING STAGING

THE ABORT GUIDANCE SYSTEM STEERING LOGIC WAS SET TO Z-AXIS STEERING THROUGHOUT THE STAGING SEQUENCE. IF AUTO MODE IS SELECTED, Z-AXIS LOGIC WILL PRODUCE THE STEERING COMMANDS REQUIRED TO POINT THE Z-AXIS AT THE COMMAND MODULE. IF THE GUIDANCE SELECT SWITCH IS IN AGS AND ATTITUDE CONTROL SWITCHES IN "MODE CONT," THE Z-AXIS STEERING COMMANDS ARE ACCEPTED AND ACTED UPON BY THE CONTROL SYSTEM.

THE ATTITUDE CONTROL SWITCHES WERE SEQUENTIALLY THROWN TO "MODE CONT," AS SHOWN IN FIGURE 2.2.33-3, 51 SECONDS BEFORE STAGING. FIVE SECONDS AFTER THE SELECTION OF "MODE CONT," THE MODE CONTROL SWITCH INDICATION CHANGED FROM "ATT HOLD TO AUTO," REMAINED IN AUTO FOR 3 SECONDS, THEN RETURNED TO "ATT HOLD." DURING THIS PERIOD, THE VEHICLE MOVED IN ALL THREE AXES IN RESPONSE TO Z-AXIS STEERING COMMANDS. AFTER THE MODE INDICATION RETURNED TO "ATT HOLD," THE DYNAMICS AGAIN RETURNED TO NORMAL FOR WIDE DEADBAND. (NOTE: THE YAW RATE GYRO OUTPUT WAS INCORRECT DURING THIS PERIOD, AS SHOWN IN FIGURE 2.2.33-1). THE GYRO PROBLEM WAS PROBABLY DIAGNOSED BY THE CREW AFTER A NUMBER OF HAND CONTROLLER OPERATIONS.) AFTER APPROXIMATELY 40 SECONDS, THE MODE INDICATION AGAIN RETURNED TO AUTO, AND THE VEHICLE RESPONDED TO Z-AXIS STEERING COMMANDS. THE VEHICLE WAS STAGED 4 SECONDS LATER, AND THE DYNAMIC RESPONSE INCREASED ABRUPTLY. THE DATA INDICATE THAT STAGING WAS COINCIDENT WITH A MINUS X TRANSLATION AND THAT THE PRIMARY GUIDANCE SYSTEM MODE CONTROL SWITCH WAS THROWN TO AUTO 7 SECONDS LATER. BECAUSE OF THE RELATIVE SCALING OF THE HAND CONTROLLER, RATE GYROS, AND ATTITUDE ERRORS, ATTEMPTS TO MANUALLY CONTROL THE MOTION WERE INEFFECTIVE, AND THE VEHICLE STABILIZED WITH THE Z-AXIS POINTING TOWARD THE COMMAND MODULE. APPROXIMATELY 24 SECONDS AFTER STAGING, THE ATTITUDE CONTROL SWITCHES RETURNED TO "DIR," AND THE TWO MODE CONTROL SWITCH INDICATIONS RETURNED TO "ATT HOLD."

DETAIL SHEET

ANOMALY 2.2.33

TITLE: LARGE LM ATTITUDE EXCURSIONS DURING STAGING

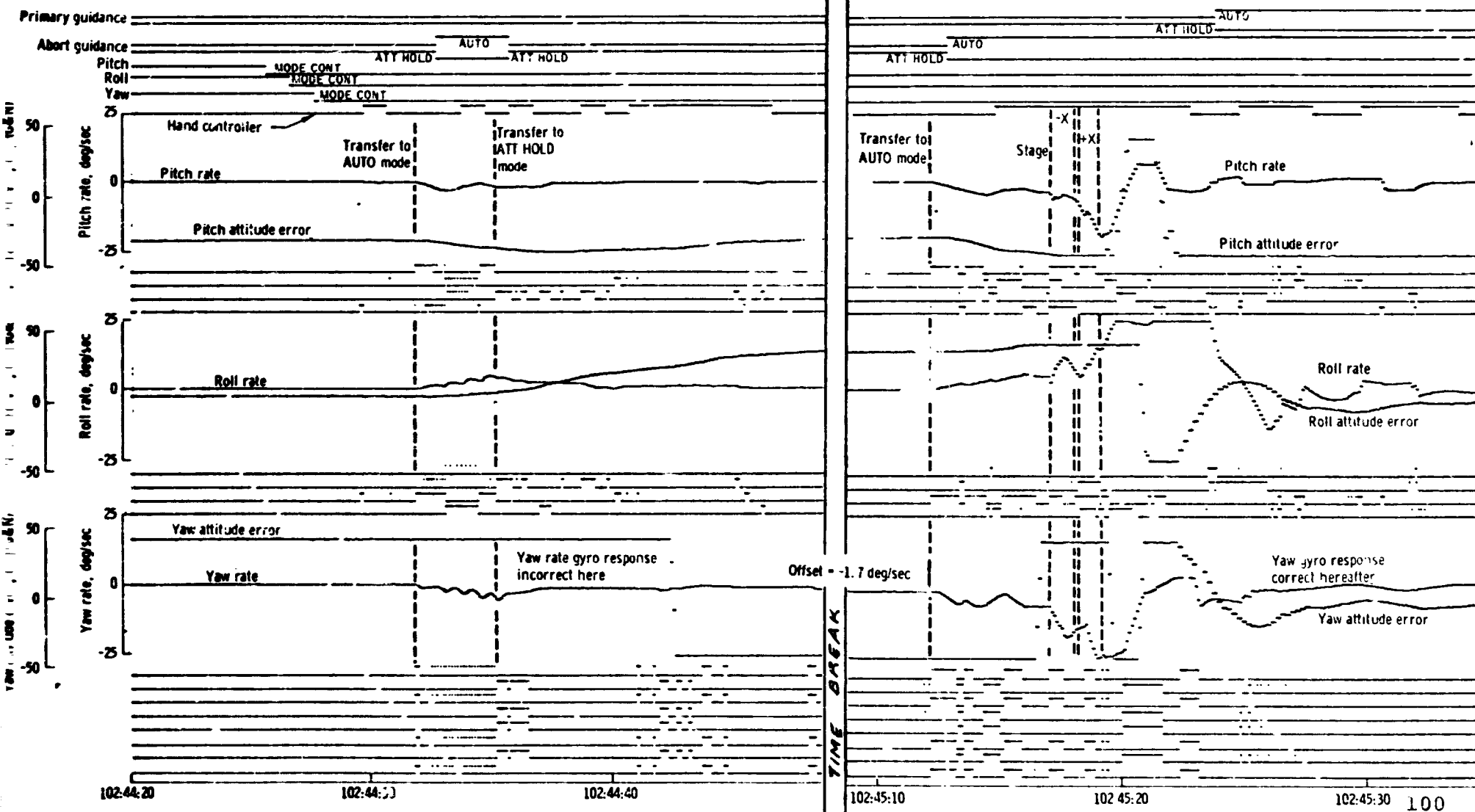
THREE CONDITIONS DURING THE STAGING SEQUENCE WERE APPARENTLY ABNORMAL:

1. THE ABORT GUIDANCE MODE CONTROL TRANSFERRED FROM ATTITUDE-HOLD AUTOMATIC.
2. THE YAW RATE GYRO WAS INDICATING MINUS 1.7 DEG/SEC.
3. NO INDICATION OF DIRECT FIRING OF REACTION CONTROL ENGINES WERE RECEIVED. (THE CREW RECALLED ENABLING THE DIRECT FUNCTION AND ACTUATING THE HAND CONTROLLER TO THE HARD STOPS.)

IT IS, THEREFORE, CONCLUDED THAT THE ANOMALY WAS CAUSED BY THE INADVERTENT CYCLING OF THE ABORT GUIDANCE MODE CONTROL SWITCH, FOLLOWED IMMEDIATELY BY AN INCORRECT OUTPUT OF THE YAW RATE GYRO. IN DIAGNOSING THE YAW RATE GYRO PROBLEM, AND IN REACTING TO IT, THE ABORT GUIDANCE MODE CONTROL SWITCH WAS TRANSFERRED TO THE AUTO POSITION, RESULTING IN HIGH VEHICLE RATES DURING THE STAGING SEQUENCE.

ANOMALY 2.2.33

FIG. 2.2.33-1 ATTITUDE EXCURSIONS



DETAIL SHEET

ANOMALY 2.2.33

TITLE: LARGE LM ATTITUDE EXCURSIONS DURING STAGING

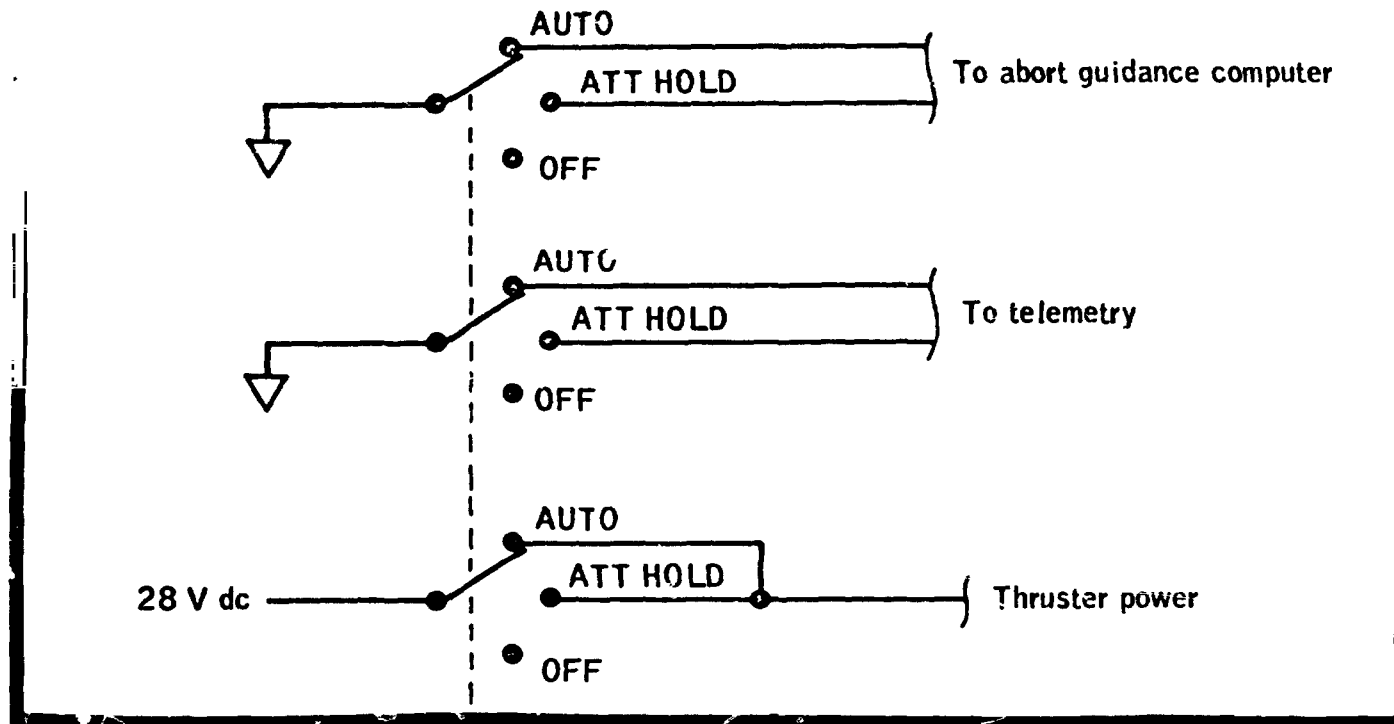


FIG. 2.2.33-2 MODE CONTROL SWITCH OPERATION

DETAIL SHEET

ANOMALY 2.2.33

TITLE: LARGE LM ATTITUDE EXCURSIONS DURING STAGING

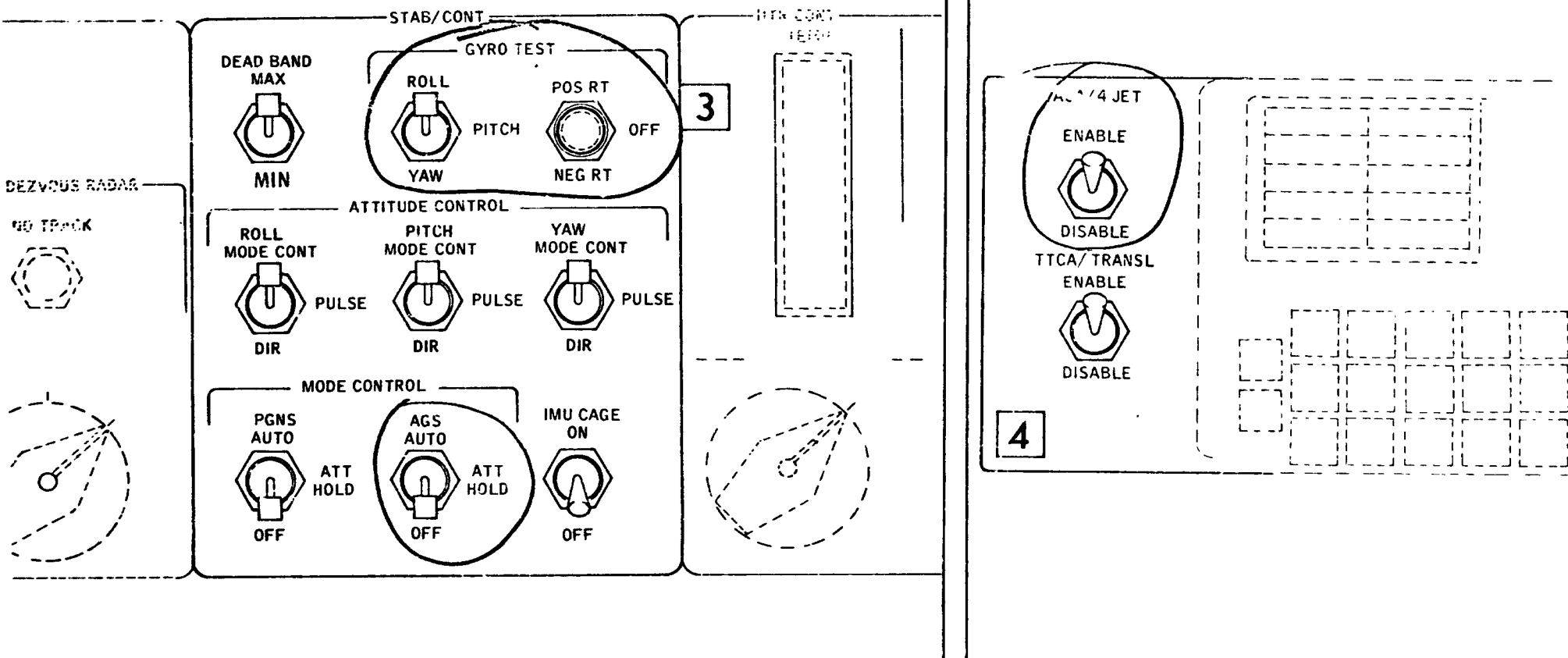


FIG. 2.2.33-3 LUNAR MODULE GUIDANCE SWITCH LOCATIONS

ANOMALY REPORT

NO. 2.2.34

TITLE: OPTICAL SYSTEM PROBLEMS

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: OPTICAL SYSTEM

EVENT TIME:

PROBLEM: THREE OPERATIONAL ANOMALIES IN USE OF THE LUNAR MODULE OPTICAL SYSTEM WERE REPORTED BY THE CREW.

RETICLE CONTAMINATION. - THE CREW REPORTED HAIR-LIKE OBJECTS ON THE RETICLE OF THE ALIGNMENT OPTICAL TELESCOPE. SEVERAL MECHANICAL CLEARANCES IN THE TELESCOPE CAN PROVIDE PATHS FOR CONTAMINATION. THE FIXED REDIRECTIONAL MIRROR AT THE ELBOW OF THE TELESCOPE (FIG.2.2.34-2) HAS AN AIR GAP OF 0.0005 TO 0.0007 INCH TO ALLOW THERMAL EXPANSION OF THE MIRROR. OTHER POSSIBLE PATHS ARE LOCATED OUTSIDE THE CABIN AND WOULD REQUIRE THAT PARTICLES FILTER THROUGH LUBRICATED BEARINGS TO REACH THE FOCAL PLANE OF THE TELESCOPE.

COMPUTER CONTROL AND RETICLE DIMMER. - THE CREW REPORTED MECHANICAL DIFFICULTY WITH THE DIMMER CONTROL OF THE COMPUTER CONTROL AND RETICLE DIMMER. THE RHEOSTAT CONTROL KNOB (THUMBWHEEL) WOULD PHYSICALLY FALL FORWARD FROM THE BRIGHT POSITION TO MAXIMUM BRIGHTNESS, THUS REQUIRING MANUAL HOLD TO MAINTAIN THE DIMMER CONTROL IN POSITION. THE OPERATION DESCRIBED BY THE CREW IS NORMAL.

STAR DISAPPEARANCE. - THE CREW REPORTED THAT AT APPROXIMATELY SIX STAR DIAMETERS FROM THE CENTER OF THE RETICLE, STARS DISAPPEARED FROM VIEW. NO IMPERFECTIONS EXISTED IN THE RETICLE OR OTHER ELEMENTS OF THE OPTICAL TRAIN THAT WOULD CAUSE THE PROBLEM. HOWEVER, THE SURFACE OF THE PRISM MAY HAVE BEEN CONTAMINATED (SUCH AS A FINGERPRINT SMUDGE) DURING FINAL INSTALLATION OF THE TELESCOPE SUNSHADE.

ORGANIZATION: 5-2490

REFERENCES: MSC FAILURE AND ANOMALY
LISTING, JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.34

TITLE: OPTICAL SYSTEM PROBLEM

ACTION:

RETICLE CONTAMINATION. - PREFLIGHT RECORDS SHOW THAT THE TELESCOPE WAS ASSEMBLED, TESTED, AND STORED IN A CLASS 10 CLEAN ROOM (PARTICLE SIZE ALLOWABLE IS 0.00001-INCH DIAMETER PER 10 000 CUBIC FEET OF VOLUME) UNTIL INSTALLED IN THE VEHICLE. ONCE INSTALLED, COVERS WERE PROVIDED AND THE TELESCOPE WAS INSPECTED AND CLEANED PERIODICALLY. THE LAST CLEANING WAS ON THE DAY BEFORE LAUNCH, AND AT THAT TIME, THE FIELD OF VIEW WAS NOT CONTAMINATED.

COMPUTER CONTROL AND RETICLE DIMMER. - THE THUMBWHEEL OPERATES A VARIABLE RESISTOR THROUGH A SHAFT/CAM MECHANICAL INTERFACE (FIG. 2.2.34-1). FRICTIONAL FORCE GENERATED BY THE ARM OF THE MICROSWITCH IS PRESENT FROM THE FULLY COUNTERCLOCKWISE POSITION (FULL DIM) THROUGH 270 DEGREES OF CLOCKWISE ROTATION (80 PERCENT BRIGHTNESS). THE TYPICAL TORQUE REQUIRED TO OVERCOME THE FRICTIONAL FORCE IN THE 270-DEGREE SECTOR IS 1.5 INCH/OUNCES. WHEN THE MICROSWITCH DEPRESSES INTO THE 60-DEGREE DETENT AREA OF THE CAM, THE FRICTIONAL FORCE DECREASES. ALTHOUGH THE THUMBWHEEL CAN ROTATE THROUGH AN ADDITIONAL 60-DEGREES, RETICLE BRIGHTNESS IS NOT CHANGED, SINCE THE MICROSWITCH HAS BYPASSED POTENTIOMETER CONTROL OF THE CIRCUIT AND HAS APPLIED FULL VOLTAGE TO THE RETICLE LAMPS (FIG. 2.2.34-1). IN THE DEPRESSED AREA OF THE CAM, ANY MOTION IMPARTED TO THE THUMBWHEEL WILL CONTINUE UNTIL THE MECHANICAL STOPS OF THE VARIABLE RESISTOR ARE REACHED. THIS FEATURE INCREASES THE RELIABILITY OF THE RETICLE LAMP CONTROL BY INCLUDING A MECHANICAL OVERRIDE THAT WILL ASSURE RETICLE BRIGHTNESS IF AN ELECTRICAL COMPONENT FAILS.

STAR DISAPPEARANCE. - THE LM-5 PRISM AND RETICLE WERE CLEANED AND INSPECTED WHEN THE SUNSHADE WAS INSTALLED. A TEST CHANGE NOTICE IS BEING WRITTEN TO REQUIRE A SIMILAR CLEANING FOR SUBSEQUENT VEHICLES.

DETAIL SHEET

ANOMALY 2.2.34

TITLE: OPTICAL SYSTEM PROBLEM

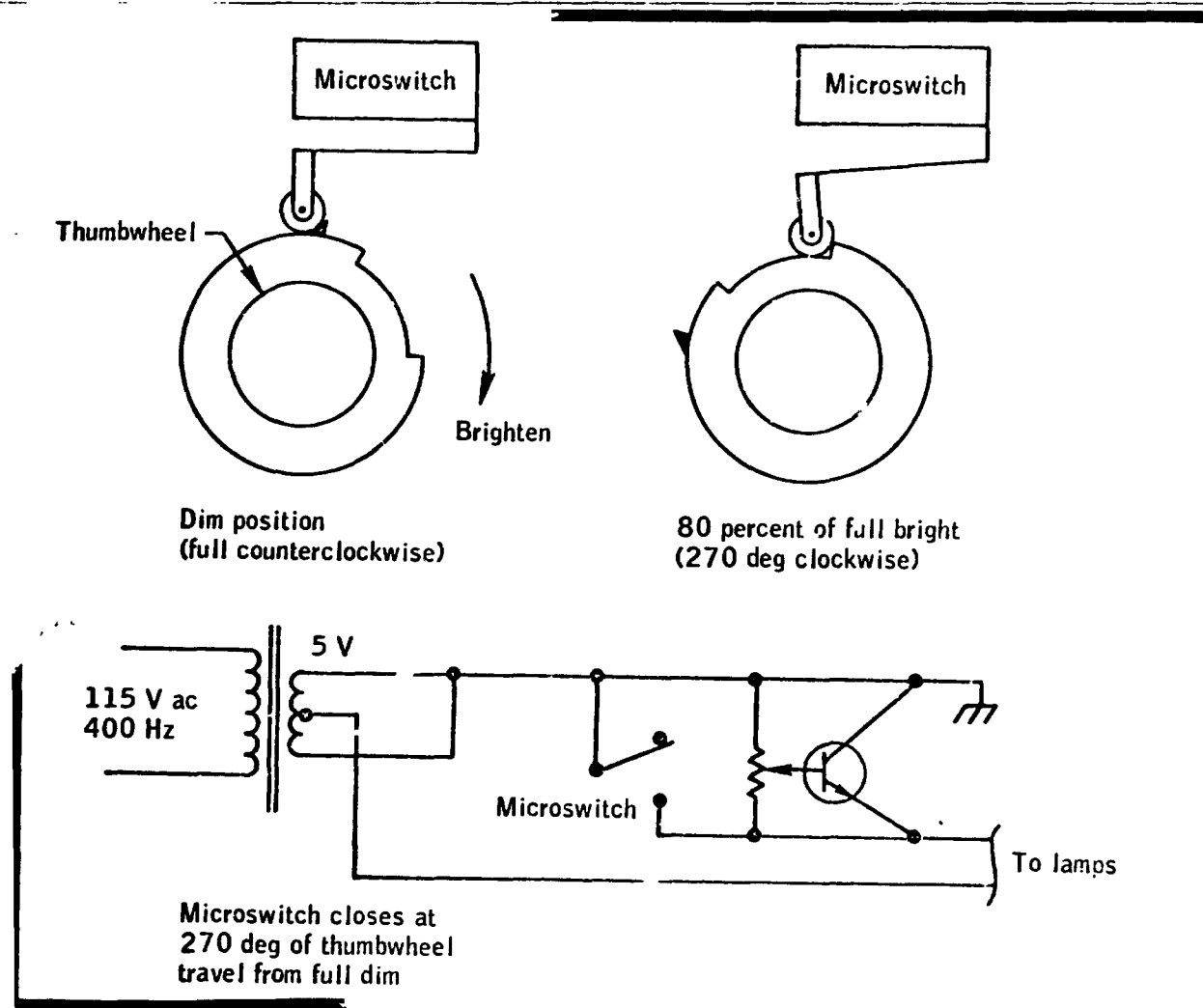


FIG. 2.2.34-1 OPTICS RETICLE DIMMER

DETAIL SHEET

ANOMALY 2.2.34

TITLE: OPTICAL SYSTEM PROBLEM

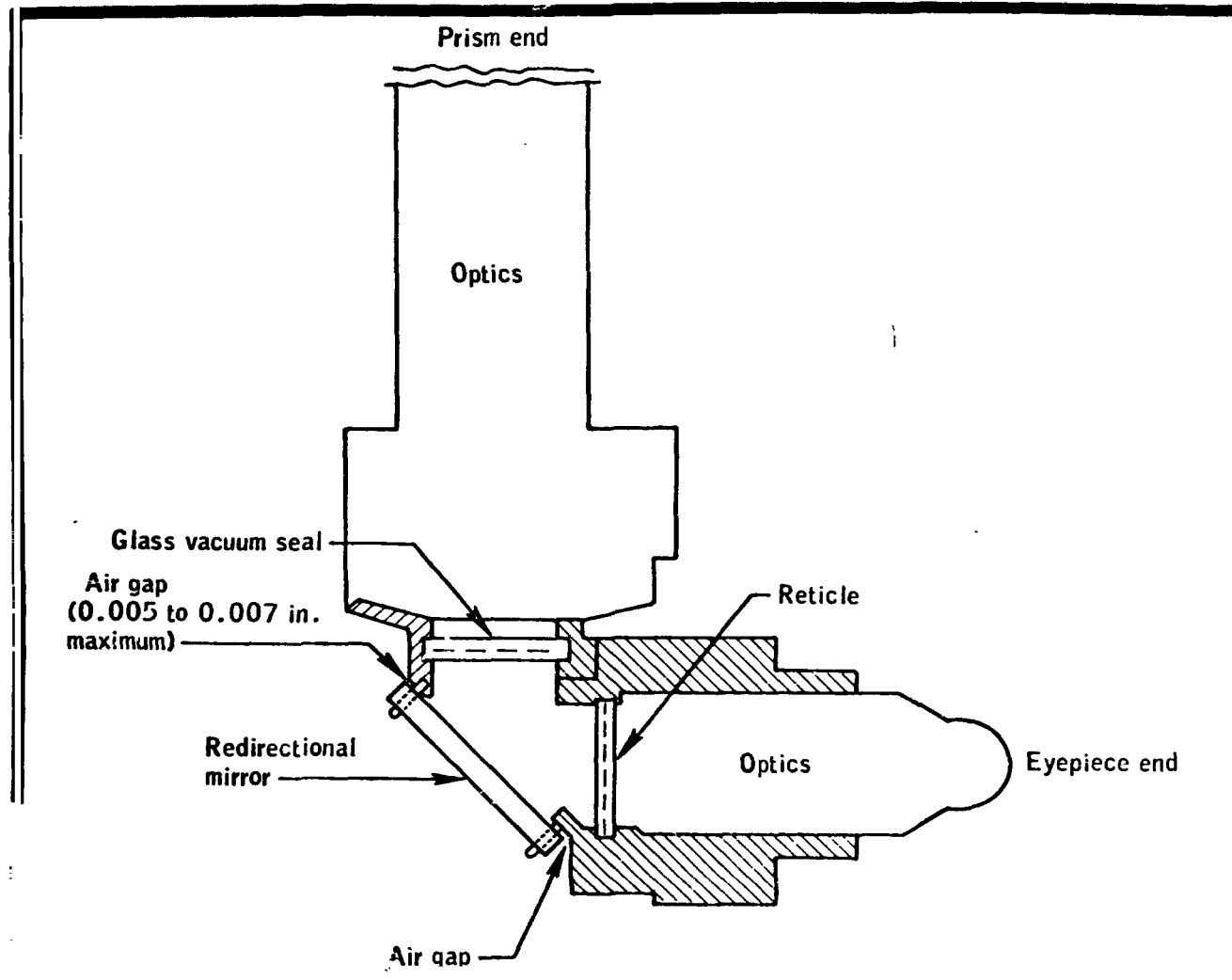


FIG. 2.2.34-2 ALIGNMENT OPTICAL TELESCOPE

ANOMALY REPORT

NO. 2.2.35

TITLE: ABNORMAL RISE IN CO₂ INDICATIONS ON PRIMARY
LIOH CARTRIDGE

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: ECS

EVENT TIME: 97-106 GET

PROBLEM: TWO ASPECTS OF THE INDICATED CARBON DIOXIDE LEVEL WERE CONSIDERED ANOMALOUS. FIRST, THE RATE OF CARBON DIOXIDE INCREASE FROM 97 TO 101 HOURS EXCEEDED THE PREDICTED BY A FACTOR OF APPROXIMATELY 8. SECONDLY, THE LEVEL REMAINED CONSTANT FOR THE NEXT 5 HOURS.

ACTION: LITHIUM HYDROXIDE CARTRIDGE VARIATIONS, COMBINED WITH CARBON DIOXIDE SENSOR TOLERANCES, COULD ACCOUNT FOR THE FLIGHT PERFORMANCE. THE PREDICTION FOR FUTURE FLIGHT WILL BE MODELED AROUND MORE REALISTIC OPERATIONAL CHARACTERISTICS.

ORGANIZATION: 5-2490

REFERENCES: MSC FAILURE AND ANOMALY
LISTING, JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.36

TITLE: LM CABIN DEPRESSURIZED AT FINAL SEPARATION

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: STRUCTURE

EVENT TIME: 108:23

PROBLEM: WHEN FINAL LM/CSM SEPARATION OCCURRED, THE LM CABIN PRESSURE DROPPED FROM 4.8 PSIA TO 0.7 PSIA WITHIN A 12-SECOND PERIOD. THE DECAY RATE WAS MUCH GREATER THAN THE CABIN PRESSURE RELIEF CAPABILITY OF ANY OF THE CABIN OVERBOARD DUMP VALVES. THE LM SEPARATED FROM THE CSM SO RAPIDLY THAT THE CREW LOST SIGHT OF IT. THE CREW ALSO REPORTED "A LOT OF SNOW" OUTSIDE AT SEPARATION. SEPARATION VELOCITY WAS 4.8 FT/SEC. ALONG THE X AXIS, WITH ESSENTIALLY NO MOTION ALONG OR ROTATION ABOUT THE OTHER AXES.

ACTION: THE ANALYSES INDICATE THAT THE LOADING ON THE LUNAR MODULE HATCH AT SEPARATION EXCEEDED THE CAPABILITY OF THE LATCH. THE HATCH THEN OPENED AND CLOSED RESULTING IN A CABIN PRESSURE DECAY AS SHOWN IN FIGURE 2.2.36-2 AND SEPARATION DISTANCE.

NO CORRECTIVE ACTION IS REQUIRED SINCE THE CONDITIONS AT SEPARATION WERE NOT NORMAL.

ORGANIZATION: 5-2490
REFERENCES: MSC 5-DAY REPORT; PP. 11, 14
MSC FAILURE AND ANOMALY
LISTING, JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.36

TITLE: LM CABIN DEPRESSURIZED AT FINAL SEPARATION

MOTION PICTURES OF THE FINAL SEPARATION WERE TAKEN FROM THE COMMAND MODULE. A BROWN MATERIAL WAS SHOWN PROJECTING FROM THE TUNNEL AND FLAPPING; THIS WAS THE INSULATION AROUND THE COMMAND MODULE DOCKING RING. THE LUNAR MODULE HATCH WAS CLOSED IN THE FIRST FRAME IN WHICH IT WAS VISIBLE. THIS FRAME WAS TAKEN 2 SECONDS AFTER INITIATION OF SEPARATION.

THE IMPULSE FROM DUMPING THE CABIN THROUGH THE HATCH IS CONSISTENT WITH THE DIRECTION AND MAGNITUDE OF THE LUNAR MODULE VELOCITY CHANGE (5 FT/SEC IN MINUS X DIRECTION) NOTED FROM THE FLIGHT DATA. FURTHER, THE ONLY ITEM ON TOP OF THE LUNAR MODULE THAT COULD OPEN AND CLOSE, ALLOWING THE CABIN TO VENT WHILE SATISFYING THE PRESSURE HISTORY, IS THE UPPER HATCH. THE HATCH HAS A MAXIMUM AREA OF 838 SQUARE INCHES, WHICH IS MORE THAN ENOUGH TO VENT THE CABIN FROM 4.8 TO LESS THAN 1.0 PSIA IN 0.3 SECOND.

THE MECHANISM POSTULATED TO VENT THE CABIN IS AS FOLLOWS. THE PYROTECHNIC DIFFERENTIAL PRESSURE BROKE THE HATCHLATCH TO ALLOW THE CABIN TO VENT THROUGH THE DOCKING TUNNEL. THE OUTFLOW CLOSED THE HATCH 0.3 SECOND AFTER SEPARATION BUT DID NOT SEAL IT COMPLETELY. THE GAP REMAINING (ABOUT 1.4 SQUARE INCHES) ALLOWED A SLIGHT PRESSURE DECREASE, AS INDICATED BY CABIN PRESSURE DATA.

ON APOLLO 9, THE CABIN PRESSURE WAS MAINTAINED AFTER SEPARATION. THE ONLY DIFFERENCE BETWEEN APOLLO 9 AND 10 WAS THAT THE APOLLO 10 TUNNEL COULD NOT BE VENTED BECAUSE THE VENT LINE WAS CAPPED. AT THE TIME SEPARATION PYROTECHNICS WERE FIRED ON APOLLO 9, THE TUNNEL PRESSURE WAS LESS THAN THE LUNAR MODULE CABIN PRESSURE; THUS, THE DYNAMIC PRESSURE IN THE TUNNEL WAS NOT SUFFICIENT TO FAIL THE HATCH LATCH. ON APOLLO 10, WITH THE TUNNEL PRESSURIZED TO 4.86 PSIA, THE DIFFERENTIAL PRESSURE WHEN THE PYROTECHNICS WERE FIRED WAS ENOUGH TO FAIL THE LATCH.

DETAIL SHEET

ANOMALY 2.2.36

TITLE: IM CABIN DEPRESSURIZED AT FINAL SEPARATION

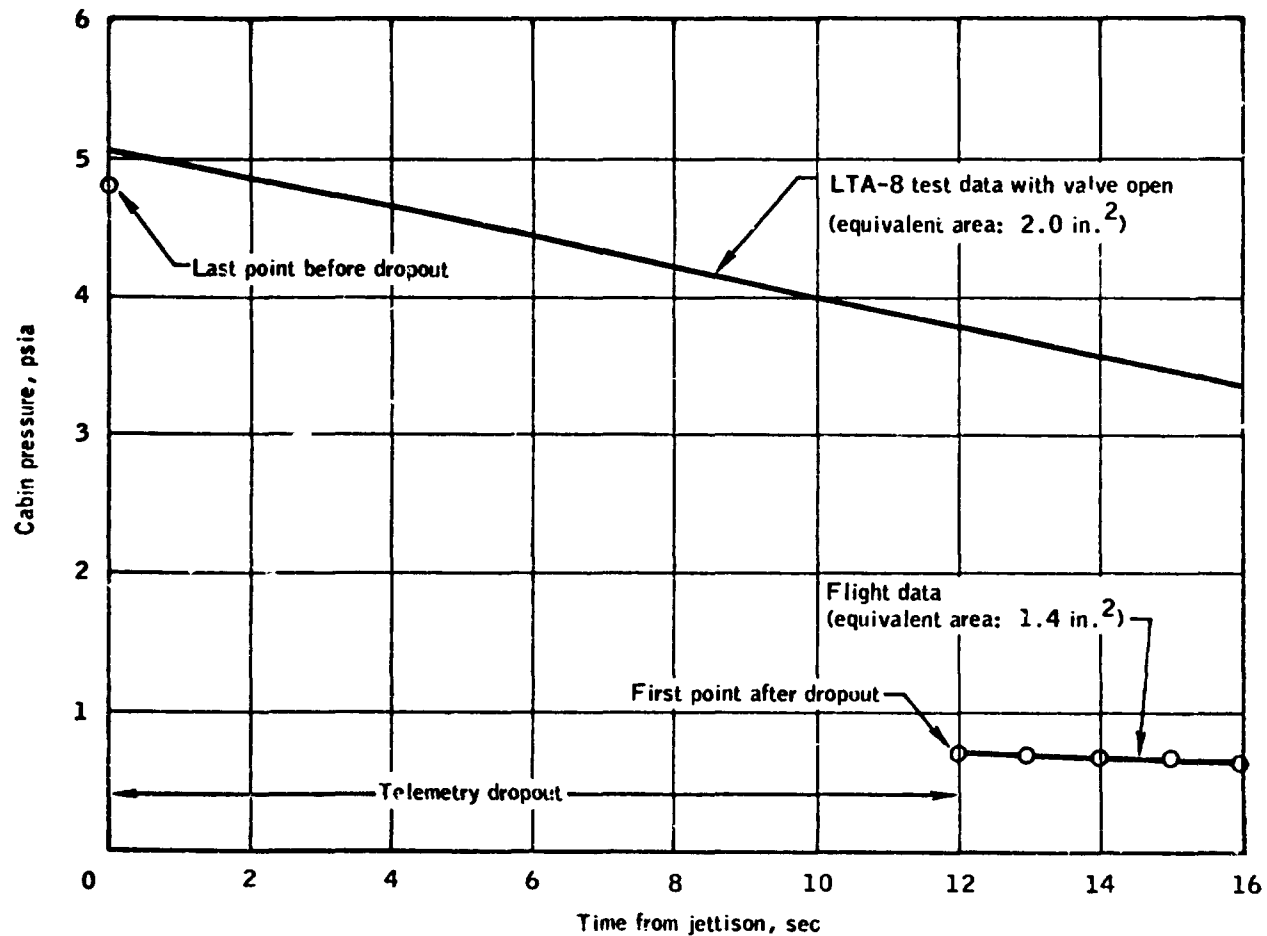
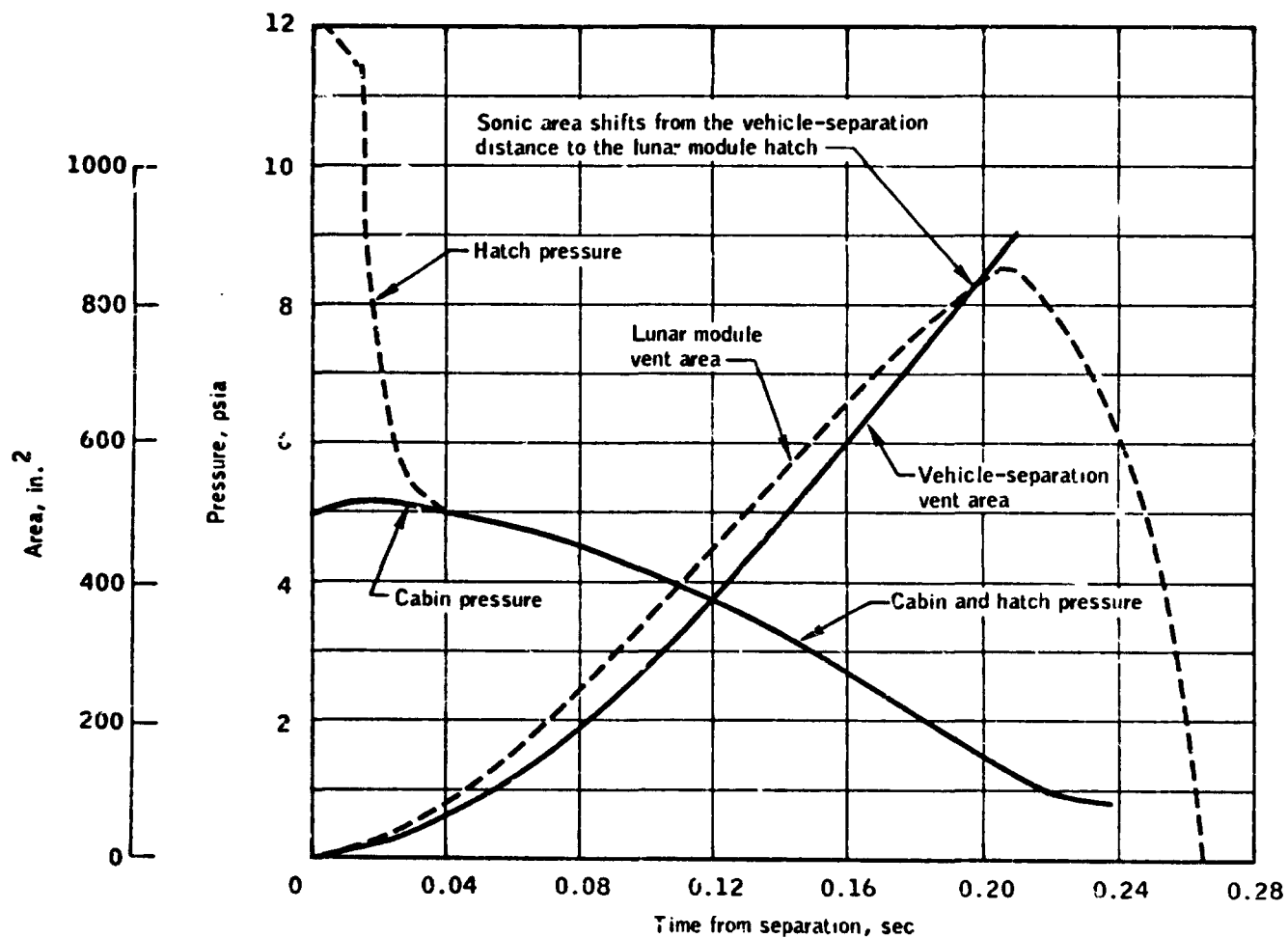


FIG. 2.2.36-1 MEASURED CABIN PRESSURE DURING JETTISON

DETAIL SHEET

ANOMALY 2.2.36

TITLE: LM CABIN DEPRESSURIZED AT FINAL SEPARATION



111

FIG. 2.2.36-2 PRESSURES AND VENT AREAS DURING SEPARATION SEQUENCE

DETAIL SHEET

ANOMALY 2.2.36

TITLE: LM CABIN DEPRESSURIZED AT FINAL SEPARATION

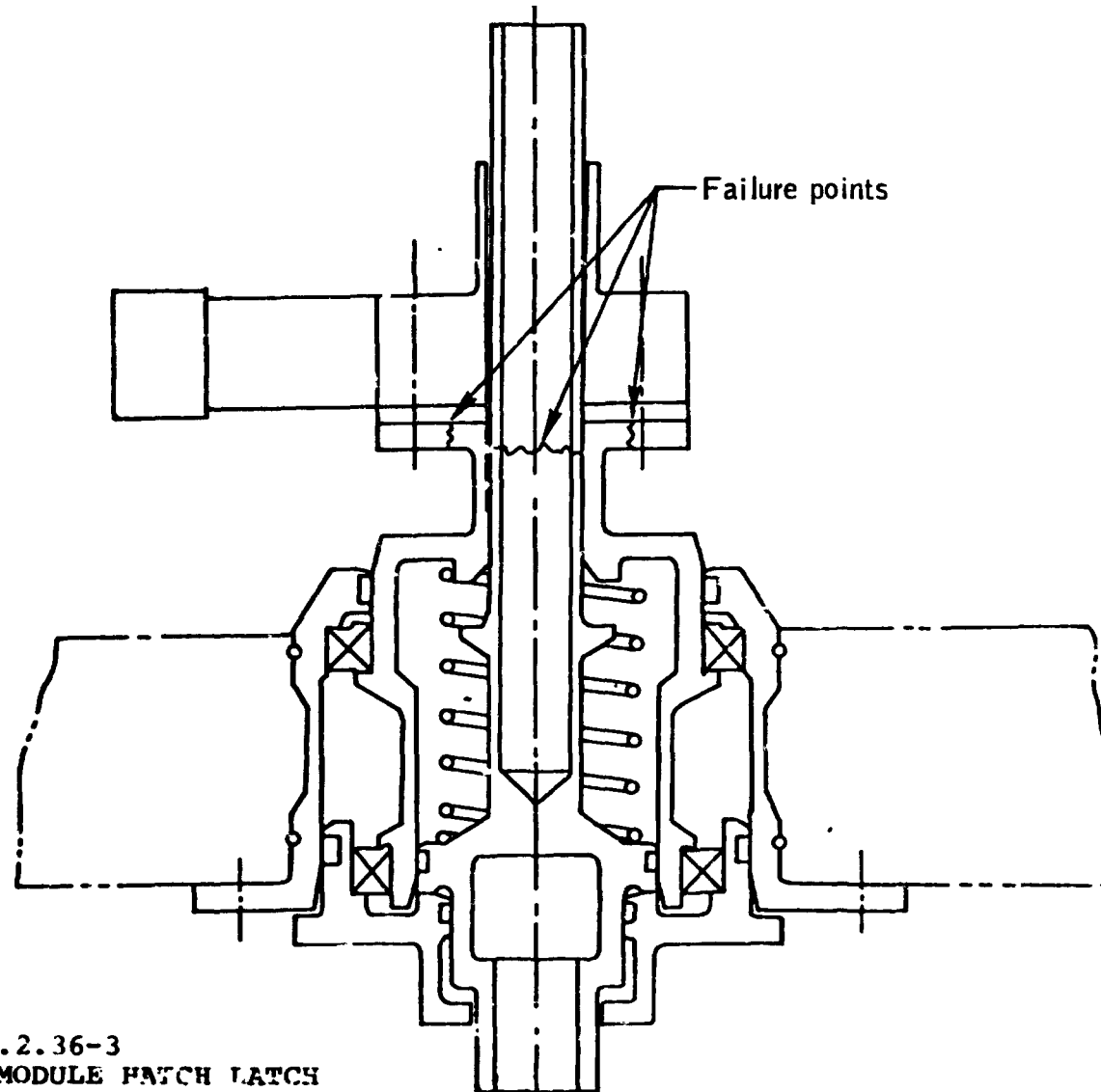


FIG. 2.2.36-3
LUNAR MODULE HATCH LATCH

ANOMALY REPORT

NO. 2.2.37

TITLE: CAMERA FAILURES

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: GOVERNMENT-FURNISHED EQUIPMENT

EVENT TIME:

PROBLEM: DURING THE LOW-ALTITUDE LUNAR PASS, THE HASSELBLAD 70-MM CAMERA, WHICH HAD THE LAST MAGAZINE INSTALLED, STOPPED BECAUSE OF FILM BINDING IN THE MAGAZINE. THE BINDING RESULTED FROM INTERNAL DAMAGE TO THE FILM-ADVANCE MECHANISM, INCLUDING BURRS ON THE FILM GUIDE (SEE FIG. 2.2.37-1). THE EMULSION SCRAPED FROM THE FILM BY THE BURRS BUILT UP ON THE ROLLERS, DECREASING THE CLEARANCE. THIS CONDITION CONTINUOUSLY OVERLOADED THE DRIVE MOTOR UNTIL THE MOTOR FAILED APPROXIMATELY FIVE FRAMES FROM THE END OF FILM. THE 1.6-AMPERE FUSE IN THE CAMERA WOULD HAVE PROTECTED THE MOTOR AGAINST A DIRECT SHORT, BUT NOT AGAINST A CONTINUOUS OVERLOAD.

ACTION: FOR FUTURE MISSIONS A HIGH-RELIABILITY, 1.2 AMPERE FUSES WILL BE INSTALLED (EACH CAMERA WILL HAVE ONE FUSE AND SLUG).

PROBLEM: DURING THE LOW-ALTITUDE PASS, THE LUNAR MODULE 16-MM CAMERA FAILED TO OPERATE WITH MAGAZINE F INSTALLED. MAGAZINE F WAS REPLACED IMMEDIATELY WITH MAGAZINE G, AND THE CAMERA OPERATED SATISFACTORILY. MAGAZINE F WAS REINSTALLED LATER FOR STAGING AND THE TERMINAL PHASE OF THE RENDEZVOUS, AND THE CAMERA OPERATED SATISFACTORILY.

ACTION: ALL MAGAZINES FOR SUBSEQUENT MISSIONS WILL BE SELECTED FOR ADEQUATE CLEARANCE ON THE INTERFACE EDGES FOR A SATISFACTORY FIT TO EITHER CAMERA.

ORGANIZATION: 5-2490

REFERENCES: MSC 5-DAY REPORT

MSC FAILURE AND ANOMALY LISTING, JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

DETAIL SHEET

ANOMALY 2.2.37

TITLE: CAMERA FAILURES

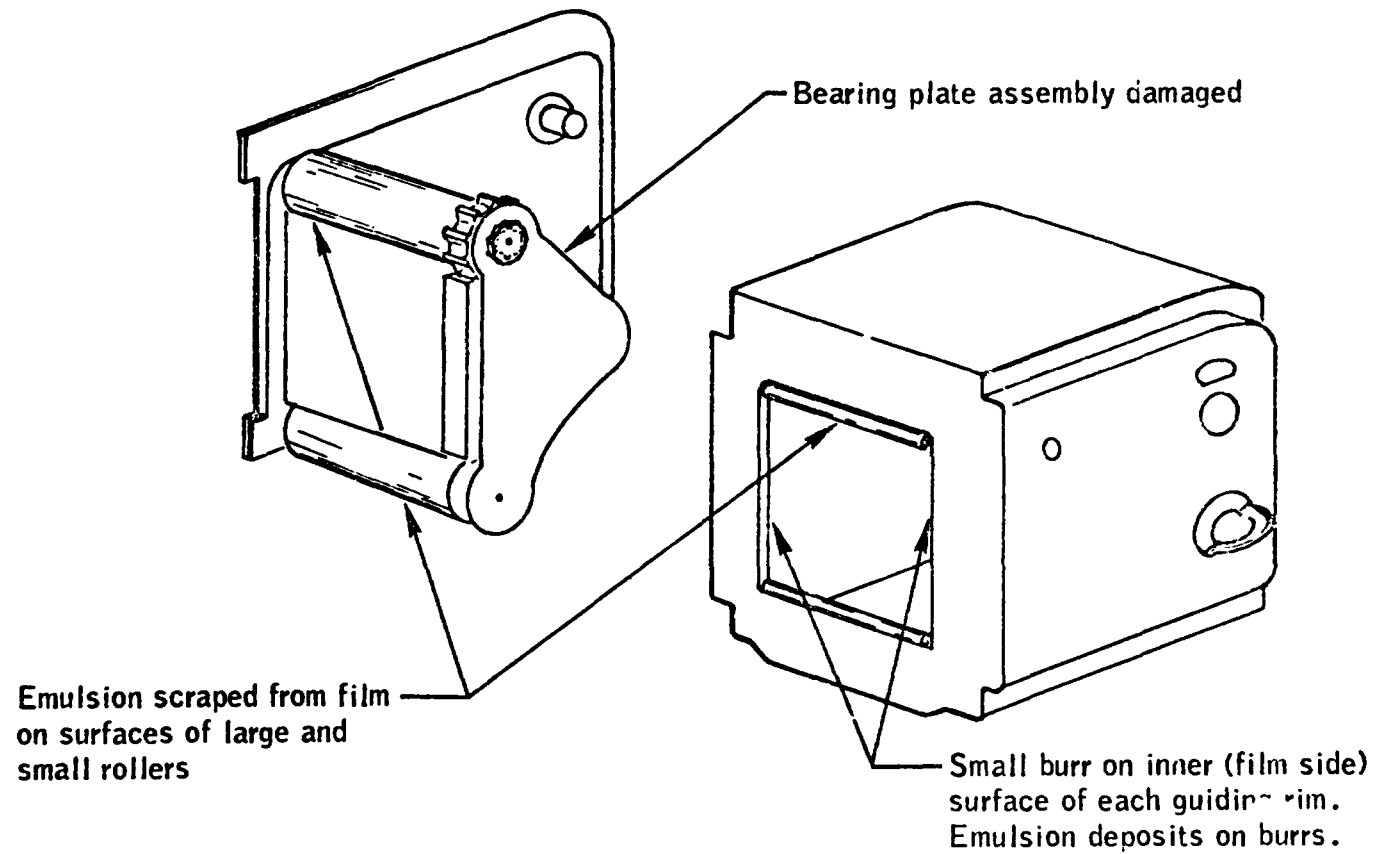


FIG. 2.2.37-1

FAILURE OF 70-MM CAMERA

DETAIL SHEET

ANOMALY 2.2.37

TITLE: CAMERA FAILURES

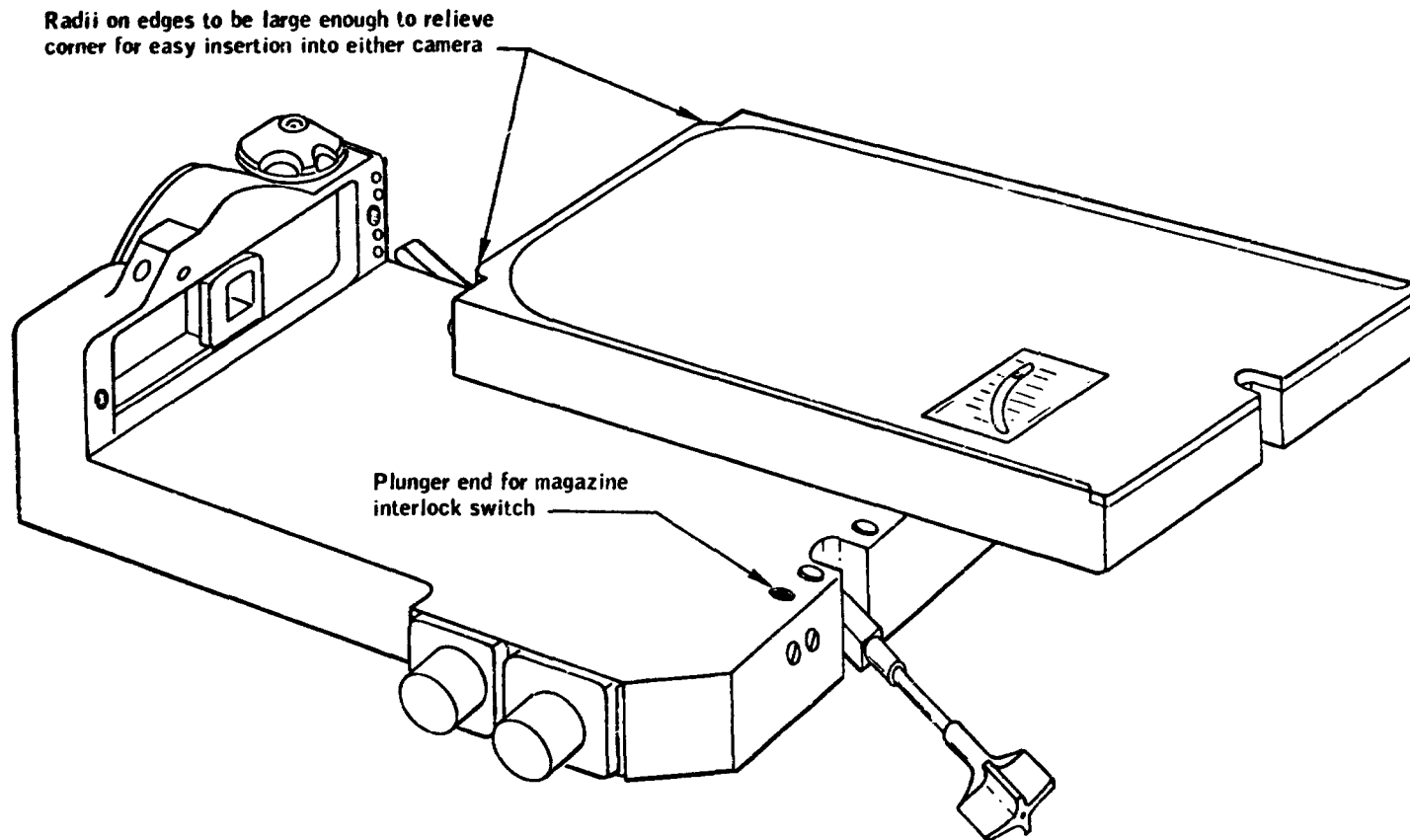


FIG. 2.2.37-2 MAGAZINE INSTALLATION IN 16-MM CAMERAS

ANOMALY REPORT

NO. 2.2.38

TITLE: FAILURE TO GET ADEQUATE DATA DUMPS

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: COMMUNICATIONS

EVENT TIME: 99_39 GET

PROBLEM: THE DUMP OF THE LUNAR MODULE LOW-BIT-RATE PCM DATA RECORDED IN THE COMMAND MODULE CEASED ABRUPTLY AT 99:38:52. THE DATA SHOULD HAVE CONTINUED THROUGH THE DESCENT ORBIT INSERTION MANEUVER AT APPROXIMATELY 99:46:00. A REVIEW OF THE DATA FROM 99:35:10 TO 99:38:52 VERIFIED THAT THE COMMAND MODULE WAS CONFIGURED FOR VHF SIMPLEX-A VOICE AND VHF SIMPLEX-B DATA. THE FLIGHT PLAN REQUIRED THAT THE COMMAND MODULE BE RECONFIGURED FROM THIS MODE TO VHF/AM DUPLEX-B/RANGING AT APPROXIMATELY 99:37:00.

ACTION: SINCE THE FLIGHT PLAN TIMES WERE INCORRECT BY APPROXIMATELY 12 MINUTES, THE RECONFIGURATION SHOULD HAVE BEEN AT 99:49:00.

ORGANIZATION: 5-2490
REFERENCES: MSC 5-DAY REPORT
MSC FAILURE AND ANOMALY
LISTING, JUNE 1969

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.39

TITLE: APS LOW LEVEL INDICATIONS

SYSTEM: LM

MISSION: APOLLO 10

SUBSYSTEM: APS

EVENT TIME: 102:55

PROBLEM: THE APS WARNING LIGHT INDICATING LOW PROPELLANT LEVEL CAME ON APPROXIMATELY ONE SECOND AFTER THE START OF THE FIRST APS FIRING AND TRIGGERED A MASTER ALARM. THE LOW-LEVEL LIGHT WENT OUT ONE SECOND LATER, AND THE MASTER ALARM WAS SUBSEQUENTLY RESET. DATA INDICATE THAT THE LOW-LEVEL LIGHT AND MASTER ALARM WERE TRIGGERED BY THE OXIDIZER SENSOR. EACH OF THE TANKS, OXIDIZER AND FUEL, CONTAINS ONE SENSOR. ONE LOW-LEVEL WARNING LIGHT MONITORS BOTH SENSORS, AND THIS LIGHT IS ENABLED ONLY WHILE THE ASCENT ENGINE IS FIRING. NEITHER THE SENSORS NOR THE LOW-LEVEL WARNING LIGHT ARE LATCHING, SO THE WARNING LIGHT WILL COME ON WHEN THE SENSOR IS UNCOVERED AND WILL EXTINGUISH WHEN THE SENSOR IS RE-COVERED WITH PROPELLANT. DATA INDICATE THAT THE SENSORS FUNCTIONED PROPERLY FOR THE REMAINDER OF THE MISSION. BOTH LOW-LEVEL INDICATIONS CAME ON AT THE CORRECT TIME DURING THE SECOND ASCENT ENGINE FIRING, THE FIRING TO DEPLETION. THIS INDICATES THAT THE FIRST WARNING WAS VALID AND CAUSED BY THE SENSOR BEING UNCOVERED BY A GAS BUBBLE. THE ASCENT PROPELLANT TANKS WERE FILLED APPROXIMATELY 50 PERCENT. THE +X TRANSLATION REQUIRED TO SETTLE THE PROPELLANTS TO PREVENT HELIUM INGESTION INTO THE ENGINE WAS CALCULATED TO BE 3 SECONDS. BASED ON THE APOLLO 10 DATA, THE PREDICTION TECHNIQUE WILL BE REVISED, AND THE +X TRANSLATION FIRING TIME WILL BE INCREASED TO PREVENT A RECURRENCE OF THE LOW-LEVEL MASTER ALARM AT IGNITION.

ACTION: NO CORRECTIVE ACTION IS REQUIRED FOR APOLLO 11 AND SUBSEQUENT. FOR NOMINAL MISSIONS, ONLY ONE ASCENT ENGINE FIRING IS PLANNED. THIS WILL OCCUR FROM THE LUNAR SURFACE (1/6-g FIELD), AND THE PROPELLANTS WILL BE WELL SETTLED.

ORGANIZATION: 5-2490

REFERENCES: APOLLO 10 MISSION REPORT, AUGUST 1969

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.40 TITLE: LEFT-HAND HEAD STRUT LOCKOUT HANDLE

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: STRUCTURE

EVENT TIME: POSTFLIGHT

PROBLEM: POSTFLIGHT, THE LEFT-HAND HEAD STRUT LOCKOUT HANDLE WAS IN THE READY (LOCKED) POSITION. DURING LEVER FORCE CHECKS, IT WAS DETERMINED THAT THE LEVER SPRING DID NOT HAVE SUFFICIENT FORCE TO PREVENT THE HOOD FROM RETURNING TO THE LOCKED POSITION. DISASSEMBLY SHOWED THAT THE SPRING HAD BEEN IMPROPERLY INSTALLED. A REVIEW OF MANUFACTURING RECORDS INDICATED THAT THE LOCKING MECHANISM HAD BEEN MODIFIED AND THAT NO INSPECTION OR TEST HAD BEEN PERFORMED SUBSEQUENT TO THIS MODIFICATION.

ACTION: A MANDATORY INSPECTION POINT HAS BEEN ADDED TO THE MANUFACTURING PROCESS TO ASSURE PROPER ASSEMBLY. THE APOLLO 11 AND 12 SPACECRAFT AT THE LAUNCH SITE HAVE BEEN INSPECTED.

ORGANIZATION: 5-2490
REFERENCES: APOLLO 10 MISSION REPORT, AUGUST 1969

RESOLUTION: CLOSED

DATE:

REV:

ANOMALY REPORT

NO. 2.2.41

TITLE: FLASHING LIGHT FAILURE

SYSTEM: CM

MISSION: APOLLO 10

SUBSYSTEM: ELS

EVENT TIME: LANDING

PROBLEM: THE RECOVERY FORCES OBSERVED THAT THE FLASHING LIGHT WAS OPERATING WHILE THE SPACECRAFT WAS DESCENDING ON THE MAIN PARACHUTES BUT NOT AFTER THE SPACECRAFT LANDED. POSTFLIGHT, THE GLASS TUBE WHICH CONTAINS THE FLASHING ELEMENT WAS FOUND TO BE CRACKED. THE BULB ASSEMBLY, PART OF THE FLASHING RECOVERY BEACON, WAS REPLACED, AND THE BEACON OPERATED PROPERLY. FURTHER ANALYSIS IS BEING PERFORMED.

ACTION:

ORGANIZATION: 5-2490
REFERENCES: APOLLO 10 MISSION REPORT, AUGUST 1969

RESOLUTION: OPEN

DATE:

REV:

2.3.0

THE GROUND SYSTEMS SUPPORTING THE APOLLO 10 COUNTDOWN AND LAUNCH PERFORMED SATISFAC-
TORILY. THERE WERE NO SIGNIFICANT FAILURES OR ANOMALIES. SEVERAL SYSTEMS EXPERIENCED
COMPONENT FAILURES AND MALFUNCTIONS, BUT THESE PROBLEMS DID NOT CAUSE ANY HOLDS OR
SIGNIFICANT DELAYS IN THE SCHEDULED SEQUENCES OF LAUNCH OPERATIONS. SOME OF THE NOTABLE
FAILURES WERE:

- o LOSS OF RP-1 FAST FILL VALVE OPEN INDICATION
- o RP-1 LEVEL ADJUST VALVE CLOSE COMMAND WAS ISSUED LATE.
- o LOX LOADING WAS DELAYED APPROXIMATELY 50 MINUTES DUE TO A BLOWN FUSE IN THE
4160-VAC PUMP MOTOR STARTER CIRCUIT.
- o SERVICE ARM NUMBER 1 UMBILICAL CARRIER WITHDRAWAL TIME WAS 0.43 SECONDS GREATER
THAN SPECIFIED MAXIMUM.
- o SERVICE ARM NUMBER 8 UMBILICAL WAS NOT WITHDRAWN.

REFERENCES

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2. MISSION DIRECTOR'S SUMMARY REPORT-APOLLO 10, NASA-APO LETTER NO. MAO, MAY 26, 1969.
3. APOLLO 10 MISSION 5-DAY REPORT, NASA-MSR REPORT NO. MSR-PT-R-69-14, MAY 1969.
4. APOLLO 10 ANOMALIES WHICH COULD AFFECT APOLLO 11 AND SUBS., NASA-MSR TWX NO. PF2-0/375-69, MAY 28, 1969.
5. SATURN AS-505 M+5 DAY REPORT, NASA-MSFC REPORT, JUNE 3, 1969.
6. CSM-107 FLIGHT READINESS REVIEW: NASA-MSR, NORTH AMERICAN ROCKWELL CORP. REPORT NO. AP69-24, JUNE 9, 1969.
7. APOLLO 11 FLIGHT READINESS REVIEW, NASA-APO LETTER NO. MAT, JUNE 17, 1969.
8. APOLLO/SATURN V GROUND SYSTEMS EVALUATION REPORT; APOLLO 10, AS-505; JULY 11, 1969.
9. APOLLO 10 MISSION FAILURE AND ANOMALY LISTING JUNE 1969; MSR-00127.
10. SATURN V LAUNCH VEHICLE FLIGHT EVALUATION REPORT AS-505 APOLLO 10 MISSION; JULY 15, 1969.
11. APOLLO 10 MISSION REPORT (60-DAY) AUGUST 1969; MSR-00R6.