~~T O P S E C R E T~~ 3001257
PRITY [redacted] CITE [redacted]

REF A [redacted]
B MSN 9051

ATTN: [redacted]

FOLLOWING IS FLIGHT SUMMARY REF MSN.

I. FLIGHT SUMMARY

FTV 1157 WAS LAUNCHED ON 7 JANUARY 1963 AT 13:09:49 PST FROM VAFB PAD 75-1-1. LAUNCH AND ASCENT EVENTS WERE NORMAL AND A SATISFACTORY ORBIT WAS ACHIEVED, WITH THE FOLLOWING ORBITAL PARAMETERS:

ELEMENT	PREDICTED	ACTUAL
PERIOD (MIN)	90.5	90.62
PERIGEE ALTITUDE (N.M.)	112.9	110
APOGEE ALTITUDE (N.M.)	218	222
ECCENTRICITY	0.0146	0.0155
INCLINATION ANGLE (DEG)	31.86	32.2

ORBITAL PERFORMANCE WAS SATISFACTORY WITH THE EXCEPTION OF LOSS OF ATTITUDE CONTROL AFTER PASS 3.9, WHICH AFFECTED S-BAND BEACON PERFORMANCE AND RECOVERY. THE RECOVERY SEQUENCE WAS INITIATED AS PLANNED ON PASS 65 ON 11 JANUARY 1963, BUT THE IMPACT POINT WAS APPROXIMATELY 365 N.M. DOWN RANGE FROM PREDICTED, CORRESPONDING TO A PITCH ERROR AT EJECTION OF ABOUT PLUS 60 DEG. AN AIR SEARCH WAS CONDUCTED IN THE CALCULATED IMPACT AREA (BASED ON [redacted] TIM-18 ANGLE TRACKING DATA) AND THE FLOATING CAPSULE WAS LOCATED AT 1902 PST. AT 1551 PST ON 12 JANUARY THE USNS LONGVIEW PICKED UP THE CAPSULE AND PARARESCUE TEAM, WHICH HAD PLACED THE CAPSULE ABOARD A RAFT SHORTLY AFTER DAWN. DETAILS OF THE RECOVERY WERE AS FOLLOWS:

ELEMENT	PREDICTED	[redacted] TRACKING PREDICTIONS	ACTUAL
PASS	65		65
LATITUDE	24 DEG N	9.58 DEG N	9.08 DEG N
LONGITUDE	157.62 DEG W	157.03 DEG	157.03 DEG W
TYPE	AIR		SURFACE

COMMUNICATIONS WITH THE VEHICLE WERE LOST FOLLOWING PASS 93 DUE TO BATTERY POWER DEPLETION. THE LIFEBOAT SYSTEM WAS NOT EXERCISED ON THIS FLIGHT.

II. SYSTEM PERFORMANCE

THE FOLLOWING PROBLEMS WERE ENCOUNTERED DURING THE FLIGHT.

A. GUIDANCE AND CONTROL

1. ATTITUDE CONTROL - INCONSISTENT DATA AVAILABLE PRIOR TO RECOVERY MADE IT DIFFICULT TO DETERMINE THAT AN ATTITUDE PROBLEM EXISTED. NORMAL ATTITUDE INDICATORS INVESTIGATED DURING FLIGHT (GYROS, HORIZON SENSOR, THERMAL, CONTROL GAS, TELEMETRY RECEPTION) FAILED TO REVEAL AN ABNORMAL ATTITUDE. POST FLIGHT ANALUSIS OF DATA OBTAINED FROM THE LIFEBOAT MAGNETOMETERS AND THE "PIGGY BACK" MOD III HORIZON SENSORS VERIFY THE VEHICLE ATTITUDE WAS PROPER THROUGH PASS 3.9 AT ASCENTION AND IMPROPER ON ALL SUBSEQUENT PASSES FOR WHICH DATA IS AVAILABLE. ALTHOUGH BOTH OF THE ABOVE SOURCES ARE RESTRICTED IN DETERMINING AN ACTUAL ATTITUDE OTHER THAN NORMAL, MAGNETOMETER DATA INDICATES PITCH ERRORS OF ROUGHLY -100 DEG DURING PASS 5 AT [redacted] AND ROUGHLY PLUS 110 DEG DURING PASSES 15 AND 31 AT [redacted]. THE MOD III HORIZON SENSOR INDICATED A GENERAL NOSE UP CONDITION DURING MOST OF THE FLIGHT, AND CONFIRMED THE NOSE DOWN ATTITUDE ON PASS 5.

2. HORIZON SENSOR FAILURE - THE RANGE OF THE HORIZON SENSOR OUTPUTS WAS RECOGNIZED EARLY IN THE FLIGHT AS BEING MUCH NARROWER THAN ON PREVIOUS FLIGHTS, AND ALTHOUGH AN EVEN NARROWER RANGE WAS APPARENT ON PASS 5 AND SUBSEQUENT THAN WAS OBSERVED ON PASSES 1 AND 2, THIS WAS NOT CONSIDERED ABNORMAL IN VIEW OF THE DEAD-BAND REDUCTION FROM PLUS MINUS 1.25 DEG TO PLUS MINUS 0.5 DEG EFFECTIVE WITH THIS VEHICLE. CONTROL GAS CONSUMPTION, WHICH WAS SLIGHTLY HIGHER THAN FOR PREVIOUS [redacted]S-01A VEHICLES, WAS CONSIDERED NORMAL FOR THE SAME REASON. IN ORDER TO VERIFY PROPER OPERATION OF THE SYSTEMS, GYRO OUTPUTS WERE ANALYZED AND FOUND NORMAL. ALTHOUGH THE MOD III HORIZON SENSOR, WHICH WAS FLOWN AS A DRP EXPERIMENT, INDICATED AN APPARENT ATTITUDE DISCREPANCY AT PASS 5 AND ALL SUBSEQUENT, THE VALIDITY OF THIS DATA (LACKING CORROBRATION FROM OTHER SOURCES) WAS DISCOUNTED DUE TO THE UNPROVEN STATUS OF THE INSTRUMENT.

POST-FLIGHT DATA ANALYSIS REVEALS THAT THE HORIZON SENSOR TM OUTPUTS REMAINED STEADY AT PLUS 0.4 DEG IN PITCH AND ROLL AXES FROM PASS 5 THROUGH THE REMAINDER OF THE FLIGHT, THE VARIATION OF TM READOUTS APPARENTLY BEING A RESULT OF TRACKING STATION READOUT TOLERANCES. THIS SUBSTANTIATES THE LOSS OF ATTITUDE CONTROL FOLLOWING PASS 3.9 DUE TO HORIZON SENSOR FAILURE. VEHICLE ATTITUDE WAS THEN STABLE ABOUT THE REFERENCE PLANE, WHICH WAS ALLOWED TO DRIFT IN THE ABSENCE OF THE HORIZON SENSOR CORRECTIONS.

LABORATOTY SIMULATION OF POSSIBLE FAILURE MODES HAS DEMONSTRATED TWO POSSIBLITIES THAT PRODUCE HORIZON SENSOR OUTPUTS OF APPROXIMATLY PLUS 0.4 DEG, (A) LOSS OF -28V POWER WITHIN THE MIXER BOX, AND (B) LOSS OF 400 CYCLE, 115V POWER WITHIN THE MIXER BOX. CONDITION (A) PRODUCES TM MONITOR OUTPUTS AND CONTROL PUTPUTS OF PLUS 0.4 DEG IN BOTH AXES; CONDITION (B) PRODUCES ONLY TM OUTPUTS, NO CONTROL OUTPUTS. SINCE THE CONTROL OUTPUTS AS SUCH ARE NOT MONITORED, AND THE EFFECT OF CONSTANT CONTROL OUTPUTS OF THIS MAGNITUDE ARE NOT EASILY DISCERNIBLE IN THE GYRO TORQUING SIGNAL, IT CANNOT BE DETERMINED CONCLUSIVELY THAT CONTROL OUTPUTS WERE PRESENT. HOWEVER, A DETAILED ANALYSIS OF AVAILABLE DATA SUPPORTS THE PROBABILITY THAT CONTROL OUTPUTS WERE PRESENT AND THAT THE FAILURE OCCURRED IN THE -28V POWER [redacted] SUPPLY SECTION OF THE MIXEE BOX. THE COULD BE CAUSED BY FAILURE OF THE PROTECTIVE DIODE OF A 1/4 WATT RESISTOR, OPERATING AT 54 PERCENT OF ITS RATED CAPACITY, AND DERATED 50 PERCENT AT 100 DEG C. CALCULATIONS REVEAL THAT A POWER SURGE TO -37V AT THE INPUT WOULD PLACE ABOUT A 1/2 W LOAD ON THIS RESISTOR.

THE RESISTOR MENTIONED ABOVE WILL BE REPLACED WITH ONE OF HIGHER RATED CAPACITY, AND A SECOND DIODE WILL BE ADDED IN PARALLEL WITH THE EXISTING ONE. IN ADDITION, INSTRUMENTATION WILL BE ADDED TO MONITOR OPERATION OF THE INDIVIDUAL SENSOR HEADS. THE COMPONENT CHANGES WILL BE IMPLEMENTED PRIOR TO LAUNCH OF THE NEXT PROGRAM [redacted] VEHICLE (THE DIODE WILL BE REPLACED BY A JUMPER UNTIL PARALLEL DIODES CAN BE INCORPORATED WITHOUT AFFECTING FLIGHT SCHEDULES); THE ADDITIONAL INSTRUMENTATION IS BEING EXPEDITED BUT AN EFFECTIVITY HAS NOT BEEN ESTABLISHED. DURING FUTURE FLIGHTS, MAGNETOMETER DATA WILL BE ANALYZED, UTILIZING THE COMPUTER FACILITY IN THE STA, AND COMPARED WITH PREDICTIONS ON A DAILY BASIS.

[redacted] BASIS.

3. CONTROL GAS PRESSURE REGULATOR FLUCTUATIONS - POST-FLIGHT DATA ANALYSIS REVEALED THAT THE REGULATOR PRESSURE HAD AVERAGED 10 TO 31 PSI HIGHER THAN NOMINAL DURING THE FLIGHT. DURING THE PASS 2 ACQUISITION AT [redacted] THE PRESSURE CYCLED SEVERAL TIMES TO 40 PSI (5 PSI IS NOMINAL). DATA FROM PASS 6 AT [redacted] INDICATED PRESSURES RANGING FROM 13 PSI TO 19 PSI. GAS VALVE IMPLUSE CALCULATED FROM THE SAME DATA WAS ABOUT 3 TIMES THE NORMAL IMPLUSE, SUBSTANTIATING THAT THE MALFUNCTION WAS IN THE REGULATOR AND THE TRANSDUCER APPEARED TO BE SATISFACTORY. REGULAR OPERATION DURING PASS 65 WAS NEARLY NORMAL, INCLUDING THE SWITCH TO HIGH PRESSURE FOR THE PITCH MANEUVER, AND THE RETURN TO LOW PRESSURE (HIGHER THAN NOMINAL BUT STEADY).

BASED ON A COMPARISON OF FLIGHT DATA WITH OPERATING CHARACTERISTICS DERIVED FROM DEVELOPMENT AND QUALIFICATION TESTS, IT HAS BEEN DETERMINED THAT THIS MALFUNCTION WAS CAUSED BY INTERNAL LEAKAGE AT A LOW RATE. THIS DATA ALSO INDICATES THAT LEAKAGE OCCURRED AT SEVERAL POINTS WITHIN THE REGULATOR, ESTABLISHING CONTAMINATION AS THE PROBABLE CAUSE. IT IS ALSO KNOWN THAT CONTAMINATION HAD BEEN PRESENT IN THIS SYSTEM, AS INDICATED BY THE HIGH DEGREE OF CONTAMINATION FOUND IN A REGULATOR REMOVED FROM THIS VEHICLE EARLIER, DUE TO FAILURE.

THE METHODS USED FOR CONTROL OF CONTAMINATION ON THE ATTITUDE CONTROL SYSTEM DURING TESTING OPERATIONS ARE BEING REVIEWED FOR POSSIBLE DEFICIENCIES, WHICH WILL BE CORRECTED. VENDOR PACKAGING REQUIREMENTS WILL BE REVISED TO INCLUDE CAPS OR PLUGS AT ALL OPENINGS TO PREVENT ENTRY OF CONTAMINANTS DURING LMSC HANDLING PRIOR TO INSTALLATION. IN ADDITION, TEST PROCEDURES WILL BE REVISED TO REQUIRE TESTS OF LONGER DURATION AT HIGH INLET PRESSURES, THEREBY DEMONSTRATING PROPER OPERATION MORE CONCLUSIVELY THAN AT PRESENT.

4. CONTROL GAS TEMPERATURE TRANSDUCER FAILURE - THIS TRANSDUCER WAS KNOWN TO BE INOPERATIVE PRIOR TO LAUNCH AND READ "OUT-OF-BAND LOW" THROUGHOUT THE FLIGHT. FAILURE HISTORY INDICATES THE PROBABLE CAUSE TO BE BREAKAGE OF A PIG-TAIL LEAD BETWEEN THE TRANSDUCER AND ITS CONNECTOR. RECOMMENDATION HAS BEEN MADE TO THE AGENA D ENGINEERING TO REPLACE THIS WITH A MORE RELIABLE TRANSDUCER CURRENTLY BEING USED IN ANOTHER LOCATION. THE RECOMMENDED TRANSDUCER DOES NOT HAVE PIG-TAIL LEADS. THE [redacted] PROGRAM OFFICE WILL TAKE THIS ACTION PRIOR TO THE NEXT FLIGHT IF IT IS NOT ACCOMPLISHED BY AGENA D.

5. CONTROL GAS PRESSURE TRANSDUCER, LOW RANGE - THIS MEASUREMENT DROPPED FROM A NORMAL OUT-OF-BAND-HIGH TO AN OUT-OF-BAND-LOW INDICATION DURING SEVERAL RANDOM ACQUITIONS THROUGHOUT THE FLIGHT. OPERATION WAS NORMAL AT ALL OTHER TIMES. DATA FROM FAILURE MODE ANALYSIS GROUND TESTS INDICATES SEVERAL POSSIBLE OPEN LEADS OR SHORTED COMPONENTS THAT WOULD PRODUCE THE OBSERVED RESULTS, THE MOST PROBABLE CONSIDERED TO BE INTERNAL SHORTING OF A DIODE IN THE TRANSDUCER DEMODULATER, CAUSED BY SOME FORM OF CONTAMINATION. A MORE RELIABLE TRANSDUCER, OF THE TYPE NOW BEING USED FOR HIGH RANGE CONTROL GAS PRESSURE, WILL BE USED ON FUTURE FLIGHTS. VEHICLE 1159 WIL USE THE EXISTING TRANSDUCER, BUT WITH X-RAY TESTED DIODES.

REVISED STUDIES.

B. COMMUNICATIONS AND CONTROL

1. S-BAND BEACON ACQUISITION DELAYS - BEACON OPERATION APPEARED NORMAL ON PASSES 1, 2 AND 5, BUT ON PASSES 6 AND 7 [redacted] REPORTED A DELAY IN BEACON ACQUITION AS WELL AS COMMAND PROBLEMS. THE NEXT FEW PASSES PRESENTED A PATTERN OF ROUGHLY 100 SECONDS DELAY FROM BEACON INDEX (TIMER FUNCTION, TRANSMITTER PLATES ON) TO INITIAL ACQUISITION, FOLLOWED BY A GRADUAL INCREASE TO NORMAL SIGNAL STRENGTH, ROUGHLY 40 SECONDS. THIS LED TO THE BELIEF THAT THE FILAMENTS WERE TURNED ON WITH THE PLATES AT BEACON INDEX, ELIMINATING THE PROGRAMMED 120 SECOND WARM-UP PERIOD. SINCE THIS CONDITION COULD CAUSE DAMAGE TO THE TRANSMITTER, A PRECAUTIONARY PROCEDURE WAS IMPLEMENTED ON PASS 9 BY REMAINING PASSIVE WITH VERLOFT UNTIL 120 SECONDS AFTER BEACON INDEX, THEREBY PREVENTING A COLD START. ON PASSES 10 AND 11 AT [redacted] (THE BEACON REMAINED ON FROM [redacted] ACQUISITION IMMEDIATELY PRIOR) DELAYS OF GREATER THAN 100 SECONDS WERE EXPERIENCED, INDICATING THAT A DIFFERENT TYPE OF PROBLEM EXISTED. SUBSEQUENT MONITERING OF THE RECEIVER SIGNAL LEVEL REVEALED A PRF, INDICATING THAT THE FILAMENTS WERE ON, PRIOR TO BEACON INDEX. FOLLOWING THIS DETERMINATION THE PROCEDURE WAS CHANGED TO REMAIN PASSIVE UNTIL RECEIVER SIGNAL LEVEL ACTIVITY WAS DETECTED.

DURING THE REMAINDER OF THE FLIGHT SEVERAL INTERROGATION PROCEDURES WERE EMPLOYED FOR DIAGNOSTIC PURPOSES, BUT NO CONCLUSIONS RESULTED, AND NO CONSISTANT PATTERN WAS EVIDENT.

AFTER RECOVERY WHEN A DEFINITE ATTITUDE CONTROL PROBLEM BECAME KNOWN, IT WAS DETERMINED THAT THE ACQUITION PROBLEMS WERE CONSISTENT WITH THE PREDOMINANTLY NOSE-UP ATTITUDE. INTENSIVE ANALYSIS OF FLIGHT DATA DID NOT REVEAL ANY S-BAND BEACON PROBLEMS IN THE VEHICLE .

C. SPECIAL PROJECTS

1. MOD III HORIZON SENSOR - THIS INSTRUMENT, OF A NEW TYPE DEVELOPED FOR LMSC BY [redacted], WAS FLOWN FOR EVALUATION PURPOSES AND WAS INDEPENDENT OF THE ATTITUDE CONTROL SYSTEM. PERFORMANCE APPEARED TO BE NORMAL THROUGHOUT THE FLIGHT. DATA OBTAINED SHOWS A CLOSE CORRELATION WITH THAT OBTAINED FROM THE PRIMARY HORIZON SENSOR [redacted] DURING THE PASSES PRIOR TO ITS FAILURE. DATA FROM LATER PASSES ROUGHLY AGREES WITH THE MAGNETOMETER DATA, BUT THE NATURE OF THE MAGNETOMETER DATA DOES NOT PERMIT AN ACCURATE COMPARISON.

NO OTHER SPECIAL PROJECTS EXPERIMENTS WERE FLOWN AS SECONDARY PAYLOADS.

D. RECOVERY

1. CAPSULE OVERTURNED - THE CAPSULE APPARENTLY INVERTED DURING THE FLOTATION PERIOD AT 0448 PST 12 JANUARY AS INDICATED BY ABRUPT LOSS OF RF SIGNALS. THE FLOATING CAPSULE IS HELD UPRIGHT BY A WEIGHT THAT EXTENDS ON A FLEXIBLE ARM AT IMPACT. POST-FLIGHT EXAMINATION REVEALED THAT THE BALLAST ARM FRACTURED AT THE BREAKAWAY BRACKET DESIGNED TO RELEASE THE BALLAST IN THE EVENT OF INADVERTENT LATCH RELEASE DURING OR PRIOR TO AN AIR RECOVERY ATTEMPT. APPARENTLY THE BREAKAGE WAS DUE TO FATIGUE CAUSED BY WAVE ACTION. WITHOUT THE BALLAST, THE CAPSULE INVERTED AND DID NOT RIGHT ITSELF.

REDESIGN IS IN PROCESS TO ELIMINATE THE BREAKAWAY BRACKET AND RESTRICT MOVEMENT OF THE BALLAST DURING FLOATION. THE NEW DESIGN WILL BE QUALIFIED BY A SERIES OF AIR SNATCH AND IMPACT TESTS AND WILL BE INCORPORTATED ON FTV 1159.

2. MARKER FLOATED AWAY - THE PARACHUTE ATTACHED TO THE FLOATING CAPSULE ACTED AS A SEA ANCHOR, CAUSING THE CAPSULE TO DRIFT AS A DIFFERENT RATE THAN THE MARKER BUOYS. CAPSULE AND MARKERS WERE SEVEN MILES APART AT FIRST SIGHTING AFTER LOSS OF RF SIGNALS.