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WS 107A-1 FLIGHT TEST WORKING GROUP

FLIGHT TEST REPORT

ATLAS MISSILE 8F (U)

GENERAL DYNAMICS | ASTRONAUTICS

19 September 1962

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FOREWORD

This report has been prepared to present preliminary information relative to the flight of Atlas Missile No. 8F. The information presented is based on visual observation and data evaluation to the extent permitted by time limitations. It should be considered as preliminary only, and the final reports on this flight referenced for further information. The technical content has been prepared and jointly agreed upon by members of the WS107A-1 Flight Test Working Group.

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SUMMARY

Atlas Missile 8F, the seventh "F" Series missile to be flight tested from AMR, was launched from Complex 11 at 1430 EST on 19 September 1962. The flight was successful and the Mark 4 Mod 1-8 Re-entry Vehicle impacted in target area at a range of 4,388 nautical miles. MILS data placed impact less than 0.5 nautical miles from the aim point. The re-entry vehicle data cassette was satisfactorily recovered.

The liftoff cameras and staging cameras were all ejected properly and were successfully recovered. The Number One Staging Camera failed to operate properly and no film coverage was obtained from this camera. The other staging camera and the two liftoff cameras provided satisfactory coverage.

The Mod II Decoy Ejection Mechanism ejected all decoys successfully.

Present indications are that the Scientific Passenger Pod did not separate at the proper time. However, the pod did apparently separate later in flight. Investigation is continuing.

FLIGHT TEST OBJECTIVES

The ~~primary~~ purposes of this flight were to obtain data for statistical determination of CEP, evaluate the Acoustica PU System, investigate the boattail heating and staging problems, evaluate AMRA inertial guidance system performance, ~~evaluate~~ the Re-entry Vehicle performance and to ~~evaluate~~ the performance of the arming and fuzing system.

Detailed objectives are listed on the following pages along with applicable comments relative to the degree of satisfaction.

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Serial Numbers of System Components	6a
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	OBJECTIVES	ORDER	YES	NO	PART	COMMENT
9.	Obtain radar and/or radiation data during re-entry.	3		X		Possible ballistic camera data from Station 12.
10.	Obtain data in the booster section prior to and during liftoff.	1	X			
11.	Evaluate decoy ejection system performance.	2	X			
12.	Obtain data on missile systems during staging.	1	X			

Non-weapon System

		ORDER	YES	NO	PART	COMMENT
1.	Obtain data on the experiments in the Scientific Passenger Pod.	2	X			

OBJECTIVES	ORDER	YES	NO	PART	COMMENT
1 - First 2 - Second 3 - Third					
Weapon System					
1. Obtain data on repeatability of all airborne and ground systems.	2	X			
2. Evaluate ARMA Inertial Guidance System performance.	1	X			
3. Evaluate the Re-Entry Vehicle Performance (heating, loading, stability and separation).	1			X	The loss of 2 commutators (7.35 and 14.5 kc) prevented total acquisition of Data pertinent to this objective.
4. Evaluate performance of Arming and Fuzing System.	1			X	Same as item 3.
5. Obtain Data for Statistical Determination of CEP.	1	X			
6. Evaluate the performance of the Acoustica Propellant Utilization System.	1	X			
7. Evaluate the ability of the MAPChE System and procedures to check out a missile in the MAB and at the launch pad.	2	X			
8. Determine compatibility between the decoy subsystem and the missile.	2	X			

Source	Miss Distance	95% Confidence Limits
Guidance/Mod III	0.26 NM Short	----------
Velocity Comparison	0.60 NM Left	----------

NOTE: Measured velocity, altitude and range at booster, sustainer and vernier cutoff, are from Azusa revised data. Impact range and co-ordinates are taken from MILS Splash Net Data. Measured times are taken from telemetry recordings of discrete generations. Impact time is taken from Azusa Impact Prediction Data. Altitude is height above launch horizontal. Velocity is speed relative to the earth's surface. Range is measured horizontal from the launch pad with the exception of impact range, which is measured along the surface.

Item	Unit	Nominal	Measured
Liftoff Weight	lbs.	268,597	---------
Pitch Plane Azimuth	Deg.	106.4	106.4
BCO Weight	lbs.	67,871	---------
BCO Velocity	ft/sec.	9,035	9050
BCO Altitude	ft.	205,829	205,341
BCO Range	nm	42.4	43.4
BCO Time	sec.	126.7	127.912
SCO Weight	lbs.	15,513	----------
SCO Velocity	ft/sec.	20,113	20,140
SCO Altitude	ft.	941,658	924,221
SCO Range	nm	384.8	382.05
SCO Time	sec.	292.5	293.495
VCO Weight	lbs.	15,318	----------
VCO Velocity	ft/sec.	19,992	20,041

FLIGHT TRAJECTORY

The flight of Missile 8F was planned for a range of 4388 nautical miles downrange with impact in the center of Ascension Missile Impact Location System (MILS) area.

A tabulation of miss distances and a comparison of nominal flight performance parameters from Flight Trajectory E XII, and measured test values from Azusa and telemetry data at significant times along the trajectory are presented below.

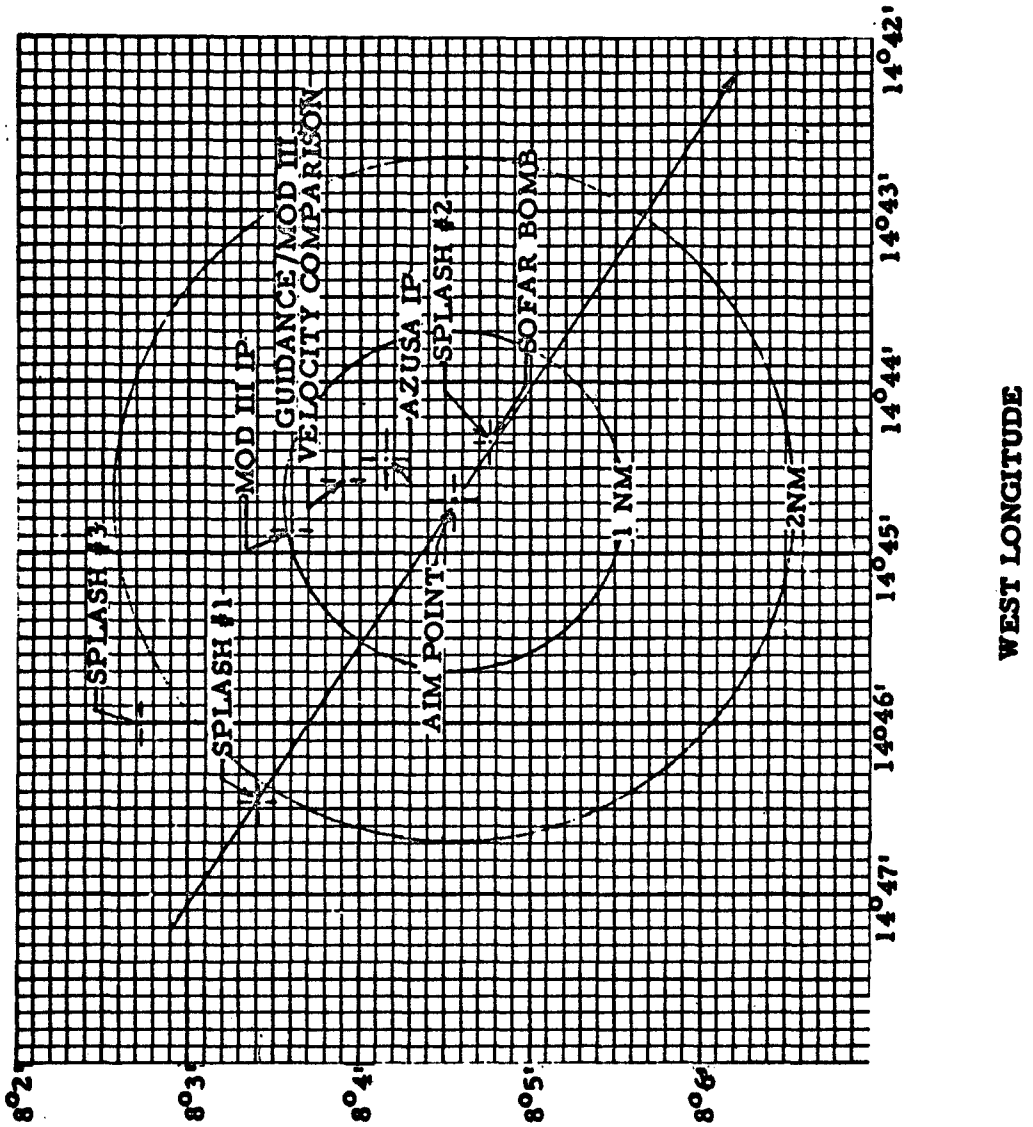
Figure 1 presents impact points as determined from several sources.

NOTE: All times in this report are based upon Range Zero Time which occurred at 1430:40 EST. One Inch Motion occurred at 1430:40.404 EST.

Source	Miss Distance	95% Confidence Limits
Azusa Mk II	0.02 NM Short 0.48 NM Left	Major Axis 0.046 NM Minor Axis 0.039 NM Azimuth 49.72°
Mod III	0.67 NM Short 0.70 NM Left	Major Axis 0.24 NM Minor Axis 0.09 NM Azimuth 123°
Splash No. 2	0.406 NM Long 0.019 NM Left	Major Axis 0.066 NM Minor Axis 0.047 NM Azimuth 5.2°
Splash No. 3	2.087 NM Short 0.797 NM Left	Major Axis 0.048 NM Minor Axis 0.042 NM Azimuth 354.7°
SOFAR Bomb	0.405 NM Long 0.019 NM Left	Major Axis 0.047 NM Minor Axis 0.045 NM Azimuth 34.9°

IMPACT POINT COMPARISON

FIGURE 1



Item	Unit	Nominal	Measured
VCO Altitude	ft.	1,044,120	1,014,049
VCO Range	nm	440.5	431.0
VCO Time	sec.	312.1	308.983
Impact Time	sec.	1,954.67	1,951.42
Impact Range	nm	4,388	4389
Impact Latitude (Geodetic)	deg, S	8° 4.56'	8° 4.77'
Impact Longitude (Geodetic)	deg, W	14° 44.69'	14° 44.35'

AIRFRAME

Missile structural integrity was satisfactorily maintained throughout powered flight and well beyond re-entry vehicle separation. Booster separation was satisfactorily initiated as indicated by M32X, Conax Valve Command. Re-entry vehicle separation was properly executed as indicated by Y1X, Separation Signal. Firing of the Atlas/Thor retrorockets was satisfactory as indicated by M79A, Missile Axial Acceleration Fine.

A major instrumentation modification has been incorporated into the remaining "F" Series R and D Missiles, including 8F, for the purpose of making a study of the booster staging sequence. The instrumentation modifications consist of measurement additions, rechannelization, the addition of a playback recorder, and a fourth telemetry package.

Due to the large amount of missile airframe instrumentation the measurements have been grouped under specific headings and are discussed in the following paragraphs.

Pressure Measurements

Booster section and thrust section environmental pressure conditions were monitored by four measurements throughout flight and by eight additional measurements from BCO to BCO + 10 seconds through the time delay playback recorder.

Measurements A290P, A355P, A971P, and A972P monitored environmental pressures throughout flight. All of these measurements indicated a normal decay from atmospheric pressure at liftoff to zero pressure by approximately 110 seconds. Measurements A290P and A355P indicated slight negligible pressure increases during staging. A969P and A970P were switched in at BCO and no apparent pressures were indicated by these measurements during the staging sequence.

Measurements A281P, A288P, A287P, A289P, A283P, and A284P, located on RF 3, monitored environmental pressures from BCO to BCO + 10 seconds. All of these measurements indicated minor, short duration, pressure increase during booster staging. The pressure increases were comparable to the increases shown by the same measurements on Missile 7F.

SYSTEM PERFORMANCE

Measurement No.	Description	Liftoff	BCO	SCO
A638 T	Aft Side A Frame Quad. II	101	109	133
P671 T	Thrust Section Ambient Quad IV	81	148	180

Eight thermistors, A350T High/Low, A353T High/Low, A361T High/Low, and A363T High/Low, were located in the thrust section to monitor any abrupt temperature changes in this area. Each temperature measurement utilized two individual sensors, calibrated separately, to cover a low and a high temperature range. The entire temperature range covered by these thermistors was from -100° F to 200° F. All of these measurements apparently provided valid data. A363T, Engine Environment - Sustainer Tube Tank High, data indicated an open thermistor at approximately 131 seconds and provided no data after this time. The temperature trends indicated by these measurements were, in general, comparable to the trends of the same measurements on Missile 7F. The data from these measurements indicated decreasing ambient temperatures from liftoff until about 60 seconds when aerodynamic heating began to have an effect. Maximum aerodynamic heating effects occurred between 75 and 90 seconds. After the MACH 1/maximum dynamic pressure regions of flight decreasing ambient temperatures were reflected by the thermistors. Temperature increases were reflected in the thermistor data during staging due to the sustainer engine flame flashback.

Rate Measurements

Two measurements, A356R and A357R, Pitch Rate Gyro and Yaw Rate Gyro respectively, were instrumented on the booster section for monitoring booster rates of movement in the pitch and yaw planes during staging. Both measurements apparently provided valid data. A357R began indicating slight movement in the yaw plane at approximately the time the aft "shoes" of the booster section left the jettison rails. A356R started indicating slight movement in the pitch plane just prior to the time the forward "shoes" of the booster section left the jettison rails. The data exhibited by these two measurements was comparable to the data presented by the same measurements on Missile 7F.

Breakwire Measurements

Six breakwire measurements were instrumented on the peripheral sustainer engine tubing and on the line fairings of the vernier engines to indicate possible collision or tube damage. Measurement A365X, Sustainer GG Fuel Line, indicated breakage at approximately 123.5 seconds. The cause of the wire breakage is not known at this time as all propulsion system parameters indicated proper operation. The other five breakwires, A351X, A352X, A364X, A278X, and A277X remained intact throughout flight.

Displacement Measurements

Two separation yo-yos were installed on this missile to determine axial motion of the booster section during staging. The two measurements were A358D, Booster Separation Yo-Yo 1, and A359D, Booster Separation Yo-Yo 2. The transducers consisted of eight inch circumferential spools mounted on rotating potentiometers. Axial motion of the booster section then appeared as a continuous sawtooth waveform with each cycle representing eight inches of travel. The yo-yos were designed to monitor the first 120 inches of travel of the booster section. As on Missile 7F, A359D did not operate and provided no data. A358D provided good data and indicated a smooth booster section separation. The last turn of the yo-yo spool while the booster section was still on the jettison rails indicated a booster section velocity of approximately 420 inches/second.

A displacement sensor, A428D, Sustainer Control Bottle/NAA Control Package, was provided to determine possible collision between the sustainer control bottle and the Rocketdyne sustainer engine control package. The installation of this measurement was such that it would indicate movement of the sustainer engine in the yaw plane. This instrumentation was initiated by the possibility that during staging the booster section deflected the Quadrant II rail enough to drive the bottle into the NAA control package or its tubing. No abnormal movement was indicated by this measurement during staging or throughout flight. When the sustainer engine was active in yaw this measurement indicated the sustainer engine movement.

Temperature Measurements

Two resistance type temperature measurements were located in the thrust section. The temperatures indicated by these measurements at selected times are listed in the following table in degrees F.

Planned versus actual events are presented below.

All times are referenced to BCO as zero time. Measured times have an accuracy of ± 0.05 seconds.

Event	Planned	Measured
Camera in Thrust Section Start	0	0.03
Outside Camera Start	0.5	0.39
High Intensity Light On	2.0	2.06
Eject Signal	10.0	10.50
Inside Camera Conax Press. Rise	10.0	10.49
Outside Camera Conax Press. Rise	10.0	10.51
Inside Camera Disconnect Plug	10.0	10.52
Outside Camera Disconnect Plug	10.0	10.54

Camera No. 3 was mounted on the outside of the missile in Quad III at approximately Station 1133. The field of view included the booster thrust section to visually record the booster jettison event. As on 7F, the first three to five inche of booster section travel was observed before LO_2 vapor from the staging disconnect obscured the view. The booster section could not be seen again until after the section cleared the jettison rails. It was noted that the period of time the camera was being obscured by LO_2 vapor was slightly longer on 8F than on 7F. The booster section then could be seen dropping away from the missile and beginning to tumble mostly in the pitch plane. One small loose object was seen passing through the field of view immediately after the start of separation. After sustainer flame impingement on

Vibration Measurements

The missile thrust section was instrumented with 10 airframe accelerometer measurements to study vibration and shock characteristics during booster staging. These measurements, monitored on RF 3, were switched in at BCO for approximately 10 seconds. Valid data were obtained from all measurements and no excessive vibration or shock loads were apparent. Vibration levels indicated by these 10 accelerometers were comparable to levels indicated by the same measurements on Missile 7F.

Three accelerometers A2730, A2740, and A2750, were located at the missile tank apex and measured vibration in the X, Y, and Z directions respectively. Four accelerometers were located on the Quadrant II jettison rail. They were A2660 and A2700, tangential and radial, respectively, near the missile tank, plus A2600 and A2650, tangential and radial, respectively, located at the A-frame. Two accelerometers were located on the Quadrant IV jettison rail. These measurements were A2710 and A2720, tangential and radial, respectively, at the A-frame. One measurement, A2760, was located on the sustainer hydraulic pump discharge line.

Instrumentation Cameras

The two liftoff cameras were ejected properly after liftoff and were satisfactorily recovered. The liftoff cameras provided excellent data. Camera No. 5, viewing the sustainer "Y" duct, showed the usual vibration and shower of ice crystals at engine ignition. The shower of ice crystals was not as heavy on 8F as it was on 7F due to a better GN_2 purge being maintained in the thrust section during the countdown. Camera No. 4, viewing the Quadrant III section of the sustainer engine, ceased operation just following engine start. Neither of the liftoff cameras recorded any unusual occurrence.

The two staging cameras were properly ejected and satisfactorily recovered shortly after camera impact. The floatation balloon for Camera No. 1 had a small leak. The balloon and camera were slowly sinking at the time of recovery. The balloon was completely deflated by the time it reached the telemetry lab at Cape Canaveral. Camera No. 3 start and mechanical operation was satisfactory. No film coverage was provided by Camera No. 1 due to film jamming. The exact cause of film jamming was not known at the time of this report.

PROPULSION SYSTEM

Propulsion system performance was satisfactory. Sustainer engine start delay time was 560 milliseconds. The delay between sustainer ignition stage control solenoid activation and head suppression valve first movement was 52 $\pm$ 8 milliseconds (75 milliseconds maximum allowable). The engine thrust rises and decays appeared normal. Telemetered Vernier 2 chamber pressure data was qualitative only and evaluation of thrust rise and decay for this engine was precluded. This measurement exhibited slow response during engine start and a 40 psi drop and a very slow decay at engine cutoff. As other related data indicated normal engine operation, the measurement is considered invalid due to an instrumentation malfunction.

Special instrumentation to investigate sustainer engine performance during the staging blackout was again monitored on the delayed playback on RF 4. No unusual transients were noted.

The second attempt to launch this missile was aborted at approximately -3 seconds when the B1 LO_2 Pump Inlet Temperature was reported as one degree over redline. Investigation revealed that the LO_2 slug temperature was comparatively warm at -285.7°F. On the launch the LO_2 slugged was closer to normal at -291.3°F.

Examination of landline trailing wire propulsion measurements indicated normal MA-3 Engine start characteristics.

At time of trailing wire disconnect the RCC accelerometers indicated 13 "g"'s RMS on B2 and 2 "g"s RMS on the sustainer. The B1 RCC accelerometer did not provide valid data.

the booster section one fairly large object and other smaller objects could be observed out behind the booster section. Their origin or identification could not be determined. The sustainer engine plumbing and hardware were not visible. All that could be seen of the sustainer engine section after separation was approximately the last three feet of the engine bell. No discrepancies were noted.

Measurement No.	Description	Units	Nominal Values	L/L at Liftoff	TLM After Liftoff	TLM Prior to BCO	TLM Prior to SCO	TLM Prior to VCO
P 91 P	B1 LO_2 Inj Man	psia	-	595	670	700	-	-
P 92 P	B2 LO_2 Inj Man	psia	-	625	670	700	-	-
P 60 P	B1 Thrust Chm	psia	579*	565	560	600	-	-
P 59 P	B2 Thrust Chm	psia	575*	630**	563	605	-	-
P 1711 T	B1 Nacelle Ambient	dgf	-	51	-	-	-	-
P 1712 T	B2 Nacelle Ambient	dgf	-	58	-	-	-	-
Sustainer Engine								
P 337 P	SGG LO_2 Inj Man	psia	-	765	820	810	790	-
P 709 T	SGG Combustor Temp	dgf	1055	-	840**	840**	840**	-
P 341 P	S Lube Oil Man	psia	-	-	680	670	655	-
P 967 P	S LO_2 Reg Outlets	psia	875*	-	850	850	850	-
P 56 P	S LO_2 Pump Inlet	psia	-	63	68	110	72	-
P 530 T	S LO_2 Pump Inlet Temp	dgf	-	-285	-289	-286	-285	-
P 1055 P	S Fuel Pump Inlet	psia	-	61	-	-	-	-
P 349 B	Sus Pump Speed	rpm	10097	-	10110	10095	10205	-
P 529 D	S Main LO_2 Valve	deg	-	-	2?**	26**	21**	-
P 830 D	PU Valve	deg	27.8*	-	21	26	33	-

PROPULSION SYSTEM TIME SLICE DATA

Measurement No.	Description	Units	Nominal Values	L/L at Liftoff	TLM After Liftoff	TLM Prior to BCO	TLM Prior to SCO	TLM Prior to VCO
Booster Engines								
P 155 P	B1GG Combustor	psia	470*	453	-	-	-	-
P 184 P	B2GG Combustor	psia	469*	463	460	470	-	-
P 713 T	B1GG Combustor Temp	dgf	1275*	-	1280	1280	-	-
P 714 T	B2GG Combustor Temp	dgf	1285*	-	1270	1270	-	-
P 473 P	B1 Lo Pr Lube Oil Man	psia	-	-	127	112	-	-
P 279 P	B2 Lo Pr Lube Oil Man	psia	-	-	146	120	-	-
P 1020 T	B1 LO_2 Pump Inlet Temp	dgf	-	-286	-	-	-	-
P 1054 T	B2 LO_2 Pump Inlet Temp	dgf	-	-285	-	-	-	-
P 1002 P	B1 Fuel Pump Inlet	psia	-	60	-	-	-	-
P 1004 P	B2 Fuel Pump Inlet	psia	-	60	-	-	-	-
P 84 B	B1 Pump Speed	rpm	6075*	-	6095	6220	-	-
P 83 B	B2 Pump Speed	rpm	6095*	-	6120	6295	-	-
P 39 P	B1 Fuel Pump Disch	psia	890	787**	860	895	-	-
P 38 P	B2 Fuel Pump Disch	psia	890	750**	860	880	-	-

PROPELLANT UTILIZATION SYSTEM

The AA Propellant Utilization (PU) System operation was satisfactory. The PU valve positioned correctly in response to the computer output signal. The Head Supression (HS) valve data (Measurement P529D) was qualitative only; however, the information available was sufficient to determine that the direction of valve movement was correct with respect to both PU valve position and LO_2 acceleration head.

The fuel sensors uncovered first at the first five stations. Station 6 was a LO_2 first sensor uncovering. The following is a tabulation of sensor uncovering times and the angle to which the PU valve was positioned.

	Sensor Uncovering Time		Error		PU Valve Position		HS Valve Position
Station	Fuel	LO_2	Sense	Time	P 830D	U113V	(P 529D)
1	8.17	8.96	Fuel First	0.79	22.5	20.2	29.2*
2	48.35	48.45	FF	0.10	27.5	26.5	25.5*
3	86.25	87.15	FF	0.90	22.2	19.9	28.4*
4	118.30	118.83	FF	0.53	27.0	25.0	24.5*
5	193.18	195.63	FF	2.45	26.0	24.4	23.5*
6	248.63	247.63	LF	1.00	33.5	31.1	20.5*

* Data qualitative only.

The fuel DP Measurement (U 81 P) remained above the instrumentation limit (5 psid) until a few seconds prior to SCO. At this time the measurement decreased to 95% IBW and remained there for the duration of the test, providing no information on fuel head pressure or port uncovering. Calculation of residuals based on flow rates between Stations 5 and 6 corrected for valve angle changes at Station 6 and using Station 6 uncovering times indicated there were approximately 1500 pounds of LO_2 and 700 pounds of fuel remaining at SCO. These residuals represent 8.3 seconds additional burning time with 35 pounds of fuel remaining.

PU valve settings for this flight were as follows.

+15%	19.9°
Nominal	27.75°
-15Percent	43.5°

Measurement No.	Description	Units	Nominal Values	L/L at Liftoff	TLM After Liftoff	TLM Prior to BCO	TLM Prior to SCO	TLM Prior to VCO
P 330 P	S Fuel Pump Disch	psia	1013	-	975	945	900	-
P 351 P	S LO_2 Inj Man	psia	817	695**	800	790	745	-
P 6 P	S Thrust Chamber	psia	702	655	670	680	680	-
P 1710 T	S Eng Environment	dgf	-	44	-	-	-	-
P 463 P	SGG Fuel Inj Man	psia	-	-	810	800	790	-
P 517 P	S Fuel Inj Man	psia	877	-	820	830	840	-
P 474 P	Vern Ctl Press Reg Out	psia	590	590	570	560	560	560
P 30 P	Vernier LO_2 Tank	psia	590	-	40	600	640	545
P 27 P	Vernier Fuel Tank	psia	590	-	180	625	615	550
P 28 P	V1 Thrust Chamber	psia	357/304	-	322	325	345	288
P 29 P	V2 Thrust Chamber	psia	357/304	-	324	332	356	296
Miscellaneous								
P 1325 T	Eng Comb Amb	dgf	-	81	-	-	-	-
P 671 T	Thrust Section Ambient	dgf	-	-	81	148	160	175
P 1200 P	Eng Comp Ambient	psia	-	0	-	-	-	-

* Values from Engine Acceptance Test Log.
** Data Qualitative only.

PNEUMATIC SYSTEM TIME SLICE DATA

Measurement No.	Description	Units	L/L at Liftoff	After Liftoff	Prior to BCO	Prior to SCO	Prior to VCO
F 1 P	LO_2 Tank Helium	psia	40.1	37.5	25.0	25.5	26.0
F 3 P	Fuel Tank Helium	psia	73.7	70.3	59.4	39.4	38.4
F 145 P	S Ctl He Bottle Disch	psia	3055	2903	2720	2673	1913
F 246 P	B Tank He Bottles Hi	psia	2928	2590	965	-	-
F 115 T	LO_2 Press Reg Inlet	dgf	-	220	251	-	-
F 247 T	B Tank He Bottles	dgf	-	-329	-367	-	-

PNEUMATIC SYSTEM

Pneumatic System performance was satisfactory. Flight data indicated that propellant tank pressures were satisfactorily maintained and that sustainer control helium bottles pressure was adequate to perform all control functions.

Tank Pressurization System

The Calmec LO_2 boiloff valve operated satisfactorily during LO_2 tanking. The missile propellant tank pressures were satisfactorily maintained by the booster helium supply until jettison of the Fluidgenics pressurization regulators with the booster section. LO_2 and fuel tank pressures were maintained within their respective specifications of 23.0 to 25.5 psig and 57.0 to 62.0 psig during booster phase of flight. Fuel tank pressure specifications are 58.5 to 62.0 psig for the first 5 seconds after liftoff.

LO_2 boiloff continued to maintain LO_2 tank pressure during sustainer/vernier phase of flight. Due to the expected increased heat transfer between the fuel and LO_2 tanks the LO_2 tank pressure indicated a slight increase after BCO. The LO_2 tank pressure at VCO was 26.0 psia. The fuel tank pressure indicated a normal decrease to 38.4 psig by VCO.

Control Pressurization System

The controls helium bottle discharge pressure data indicated that adequate control pressure was maintained throughout flight. Control functions included pressurization of the booster section staging cylinders, and pressurization of the vernier solo propellant tanks.

Specific values from landline and telemetry data are presented on the following page.

HYDRAULIC SYSTEMS TIME SLICE DATA

Measurement No.	Description	Units	TLM After Lift Off	TLM Prior to BCO	TLM Prior to SCO	TLM Prior to VCO
H 224 P	B Hyd Syst Low Press	psia	100	99	-	-
H 33 P	B1 Hyd Accumulator	psia	3095	3025	-	-
H 185 P	S Hyd Pump Inlet	psia	72	84	78	-
H 130 P	S Hyd Pump Disch	psia	3010	3045	3045	-
H 191 P	S Hi Press to Man	psia	3075	3020	3000	-
H 212 P	Vern Return	psia	68	76	78	-
H 140 P	S/V Hyd System	psia	3045	3045	3045	1500

HYDRAULIC SYSTEMS

Performance of the Hydraulic Systems was satisfactory. Booster and sustainer oil evacuations were properly effected. Ground system pressure furnished to the Booster and Sustainer/Vernier Systems was approximately 2050 psia. Transfer from the ground to airborne systems appeared normal. Steady state airborne pressures were approximately 3030 psia in the Booster System and 3025 psia in the Sustainer System.

The Vernier Solo Accumulator bottomed out at 875 psia approximately 33 seconds after SCO.

Measurement H 185 P, Sustainer Hydraulic Pump Inlet Pressure, indicated a transient pressure surge at SCO to 530 psia. This was not reflected by any of the other sustainer hydraulic measurements.

MISSILE ELECTRICAL SYSTEM TIME SLICE DATA

Description	Units	-10 Sec	After BCO 130 Sec	After SCO 295 Sec	After VCO 310 Sec	Overall * Variation
Battery Voltage	Vdc	28.4	28.6	28.7	28.9	28.3 to 29.2
Inverter Frequency	cps	399.7	400.0	400.6	400.6	399.4 to 400.6
Phase A Voltage	vac	114.9	114.9	114.8	114.8	114.8 to 114.9
Phase C Voltage	vac	117.2	117.1	116.7	116.7	116.3 to 117.4

* Taken during the period from -10 seconds to R/V separation.

MISSILE ELECTRICAL SYSTEM

Missile Electrical System operation was satisfactory. All parameters remained within applicable specifications until well beyond re-entry vehicle separation.

Specific values from telemetry data are presented on the following page.

AZUSA SYSTEM

The Azusa System did not fulfill its expected coverage interval of fine automatic track from 35 seconds to VCO because of the need to resolve ambiguities from the system during the first 70 seconds of flight. These ambiguities entered the system as the result of erratic received signal strength as indicated on the Mark II ground receiver AGC data. From 70 seconds until 337 seconds, the system maintained fine automatic track. This test was conducted under unusual weather conditions which may have had a bearing on the signal propagation during the zero to 70 second period. Overall system performance was considered to be satisfactory throughout flight.

The date indicated a peak ground received signal strength of -93 DBW at approximately 60 seconds. The AGC data was as expected for the remainder of flight decreasing gradually to -123 DBW by 337 seconds. At this time Mark II became passive to allow Mark I, located at Station 3, to assume active control of the missileborne transponder. The Mark II system range parameter was in the fine mode at liftoff and the angle cosines were switched to fine at 2.9 seconds. Automatic track was achieved at 8.05 seconds. Resolution of ambiguities was necessary during the first 70 seconds of flight. One ambiguity was resolved from the ℓ angle cosine from 25.75 to 27.00 seconds. Ambiguities were resolved from the m angle cosine from 52.05 to 53.25 seconds and from 68.05 to 69.30 seconds. No other ambiguities occurred.

Azusa data was used for IIP by the 7090 Computer intermittently during the first 70 seconds of flight. The Azusa data was then used continuously from 70.2 to 324.2 seconds. The open loop ASCO signal generated by the 7090 Computer was received at Central Control at 293.50 seconds. This compared favorably with times of other SCO signals.

The Mark I ground facility first received signal at 86 seconds. The angle cosines were resolved to the fine mode at 151 seconds. At 337 seconds, Mark I became active. At 405 seconds, Mark I again became passive and Mark II became active. Mark II, operating in the fine mode, furnished additional data from approximately 600 to 655 seconds.

[redacted]

RANGE SAFETY COMMAND SYSTEM

Operation of the Range Safety Command System was satisfactory. Data indicated that missileborne received signal strength was adequate to ensure proper operation of the system.

The Automatic Sustainer Cutoff (ASCO) signal initiated by the Mod III Computer, was satisfactorily decoded at 293.545 seconds, 0.05 seconds after the generation of the sustainer cutoff signal by the Guidance System. The Manual Fuel Cutoff (MFCO) signal was planned and requested for 340 seconds. This signal, initiated by the Range Safety Officer, was satisfactorily decoded at 341.1 ± 0.1 seconds.

The MFCO signal was not discernible on the telemetry Measurement DIV (RSC Cutoff Output) which was superimposed as a "blib" on continuous telemetry channel 1-6. The signal was recorded satisfactorily on Measurement DIV which was monitored on commutated telemetry channel 1-13 segment 7.

[redacted]

Measurement No.	Function	Time	Remarks
304	Orientation Tube #4	330.40	Plus 1.5 Degrees Deviatio
305	Orientation Tube #5	310.10	Minus 2.5 Degrees Deviation
306	Orientation Tube #6	304.85	Zero Degree Deviation
307	Orientation Tube #7	306.10	Minus 2.5 Degrees Deviation
308	Orientation Tube #8	330.75	Minus 2.0 Degrees Deviation
310	Orientation Tube #10	309.60	Minus 4.0 Degrees Deviation
411	Eject Sure and Velocity Tube #1	330.90	6.0 FPS Velocity
722	Eject Sure Tube #2	329.60	Normal
723	Eject Sure Tube #3	329.85	Normal
404	Eject Sure and Velocity Tube #4	330.10	12 FPS Velocity
725	Eject Sure Tube #5	330.35	Normal
726	Eject Sure Tube #6	330.60	Normal
727	Eject Sure Tube #7	330.90	Normal
728	Eject Sure Tube #8	331.10	Normal
730	Eject Sure Tube #10	331.80	Normal

PENETRATION SYSTEM

A single Mod II Pod, Serial No. PA-01011, was flight tested on 8F. Operation of the pod was such that all test objectives were met. The orientation for tubes 1, 4, 5, 7, 8 and 10 were erratic and required longer than normal time for completion. These discrepancies are under investigation.

No pod fairing motions in excess of 0.12 inches were noted prior to fairing ejection. The fairing temperature measurements indicated a normal fairing temperature transient during the flight. All fairing instrumentation indicated normal fairing ejection at BCO plus 31 seconds.

Data indicated that operation of the power supplies was normal.

Measurement 223, one of sixteen measurements monitoring fairing and pod static pressures, dropped out at 53.5 seconds.

The following is an analysis of the flight instrumentation.

Measurement No.	Function	Time	Remarks
731	Timer Start/Stop/Restart	293.65	Normal
		307.65	Normal
		324.85	Normal
732	"G" Switches	35.15	Normal
		128.45	Normal
		187.45	Normal
		282.15	Normal
301	Orientation Tube #1	330.40	Zero Degree Deviation
302	Orientation Tube #2	295.10	Plus 1 Degree Deviation
303	Orientation Tube #3	301.75	Minus 5 Degrees Deviation

INERTIAL GUIDANCE SYSTEM

Performance of the Inertial Guidance System was satisfactory. The roll maneuver and pitch and yaw steering signals were properly generated. All discretes were issued at the proper times. All Inertial Mode Start occurred at 1430:34.65 EST.

This was a lofted flight with planned impact coordinates of 8.076 degrees South latitude and 14.745 degrees West longitude. Target offsets of -0.0057 degrees latitude and ± 0.0001 degrees longitude were inserted in the Inertial Guidance System to compensate for re-entry vehicle parameters and vernier thrust decay.

Missile Behavior

Missile axial acceleration at sustainer cutoff was as follows:

	Nominal	Actual
Thrust Acceleration	5.22	5.25
Net Acceleration	4.74	4.77

A comparison of the telemetered velocities and positions with those listed in Trajectory E-XII at the approximate time of guidance enable was as follows:

Function	Units	Actual	Nominal	Difference **	3 Sigma Limits
Time*	sec.	139.56	138.00	± 1.56	± 6.5
$\dot{X}$	ft/sec	9,665.75	9,666.50	- 0.75	± 70
$\dot{Y}$	ft/sec	450.75	483.25	- 32.50	± 600
$\dot{Z}$	ft/sec	4,165.00	4,233.00	- 68.00	± 900
X	ft	497,344	494,528	± 2,816	± 19,500
Y	ft	58,880	58,304	± 576	± 25,500
Z	ft	230,849	234,176	- 3,328	± 28,500

FLIGHT CONTROL SYSTEM

Operation of the Flight Control System was satisfactory. Missile stability was maintained throughout powered flight. Data indicated satisfactory response to the guidance roll maneuvers and to the programmed pitch maneuver. Booster and vernier engine movements during booster phase were normal for missiles carrying Scientific Passenger Pods. There were no missile bending mode buildups. Propellant slosh was moderate and was satisfactorily damped before booster cutoff. The liftoff and staging transients were normal and were satisfactorily damped.

Response to guidance steering and discrete commands was satisfactory. All monitored programmer switching functions occurred properly. The open-loop tank fragmentation signal was not monitored. Both the Atlas and Thor retrorockets fired properly at 21.5 seconds after vernier cutoff. The Atlas retrorocket signal was activated for three data segments and then dropped out. This has been normal in the past and has been attributed to shorting of the igniter wires causing the programmer current limiter to burn out. However, on this test, the signal activated again for one data segment approximately 8. seconds later. The reason for this occurrance has not been determined.

The sustainer pitch engine position data indicated slippage of the telemetry transducer at ignition and again during the staging sequence.

These values are consistent with previous measurements.

Computer

Computer operation was satisfactory. Yaw steering was transmitted and all discretes were issued at the proper time. The data checker tests of the range tape recorded during the countdown and flight indicated that the computer operation was normal until staging. The telemetry subcarrier transmitting the X and Z accelerometer string measurements was switched to other missile measurements from staging plus 0.25 seconds until staging plus 10 seconds. The data checker was unable to "fill" this loss of data. Therefore, no comparison of the range tape was made beyond staging.

Computer voltages were normal. Computer temperature increased from 31.0°C to 36.0°C.

Alignment Countdown Set

The Alignment-Countdown Set operation was satisfactory. Accelerometer zeroes were within the specified tolerances before launch, indicating proper operation of the zeroing loops. Measurement units are cps.

Function	Nominal	Computed Nominal	Measured	Error
X Offset	0.667	0.6079562	0.6044705	-0.003485
X Zero	1.000	---------	1.001502	±0.001502
Y Zero	1.000	---------	1.000524	±0.000524
Z Zero	65.25407	65.27994	65.28332	±0.00338

Instrumentation

All channels of the Analog Signal Converter (ASC) operated satisfactorily. ASC temperature remained constant at 22.5°C throughout the flight.

The Digital Signal Converter performance was satisfactorily.

Telemetry quality was good with almost no dropout at staging

Function	Units	Actual	Nominal	Difference **	3 Sigma Limits
CEF	rad.	-0.001724	-0.00024	- 0.001484	----------
REF	rad.	4.0222	4.0156	∮ 0.0066	----------

* Time referenced to Inertial Mode Start.

** Actual minus Nominal.

Examination of the double discriminated accelerometer string data showed a disturbance on all three axes at VCO plus 48 seconds.

Platform and Control

All steering signals were transmitted properly by the MGS. Missile response to these signals was proper and all servo errors were very small.

Redundant gyro torquing currents were normal. Maximum amplitude oscillation of 87 degrees/hr peak-to-peak occurred during the period of propellant slosh. During the sustainer phase, the oscillation was 32 degrees/hr peak-to-peak.

Gyro drifts measured prior to launch were:

Gross Azimuth	∮ 0.10°/Hr	Precountdown
Roll Fixed	∮ 0.26°/Hr	Precountdown
Gross Pitch	∮ 0.08°/Hr	Hangar N

Gyro temperature remained stable throughout the flight with the following deviations from buoyancy temperature at launch:

Roll/Azimuth	- 0.6°C
Pitch	∮ 0.5°C

Accelerometer scale factors measured during the pre-count were as follows:

X	Z
2.00039	2.00077

MOD III RANGE SAFETY AND INSTRUMENTATION SYSTEM

Performance of the Mod III System was satisfactory. The system was primary for the generation of the ASCO discrete, backup for Range Safety, and provided instrumentation. The ASCO discrete was generated properly at 293.505 seconds (1435:33.505 EST).

Telemetered data indicated satisfactory operation of the Missileborne Mod III E Beacons.

Performance of the individual subsystems was as follows:

Track Subsystem

Satisfactory performance of the Track Subsystem was maintained throughout the countdown and missile flight test. The Track Subsystem was locked on-missile at liftoff in automatic monopulse mode. Tracking was continuous until a slow roll-off of received signal into noise occurred at 394 seconds, eighty-four seconds after VCO. Thereafter, pulse beacon signal returns were sporadic and tracking was intermittent until 399 seconds when final signal loss occurred. The received signal level, during the sustainer/vernier phase of flight averaged -56 DBM with the associated azimuth and elevation tracking errors averaging 0.12 mils peak-to-peak. At 340 seconds, ten seconds after retro-firing, the Extended Range Tracker (ERT) was switched in-line at a range of 547 nautical miles. The maximum range recorded at final signal loss was 735 nautical miles. Performance of the ERT was normal.

Rate System

Performance of the Rate Subsystem was satisfactory. All good rate flags were recorded at 7.5 seconds and continuous rate lock was maintained until 388.5 seconds when all rate beacon signal was lost. The usual signal disturbance was noted at staging; however, signal attenuation was not sufficient to cause a rate unlock condition.

During the sustainer/vernier phase the received rate beacon signal averaged -95 DBM. The central rate and lateral rate readout characteristics were normal, not exceeding 2 bits peak-to-peak.

Computer

The computer operated satisfactorily during the countdown, the missile flight, and post-flight simulation. A simulated flight rerun was made with no deviations from realtime results.

The blockhouse Sanborn recorder was found to have a bias in the pitch and roll pendulum channels. Comparison with a phase angle voltmeter for various pendulum inputs yielded the following results:

Pitch Pendulum Channel	- 6 sec. bias
Roll Pendulum Channel	+ 7.3 sec. bias

These were considered to be instrumentation biases and should be subtracted from the Sanborn recorder values.

RE-ENTRY VEHICLE

The re-entry vehicle separated and satisfactorily survived re-entry. The C-band radar beacon functioned normally. The data cassette 560 ejection signal and cassette recovery aid signals were received and the cassette was recovered and on shipboard approximately 28 minutes after impact. Commutation was lost on channels 7.35 kc and 14.5 kc at approximately T + 40 seconds.

Acceptable data for IIP calculations were received continuously from lift-off to 336 seconds, six seconds after firing of retro-rockets. The following impact point was calculated from data recorded between VCO and retro-rocket firing.

	Mean Miss Distance	Standard Deviation	Deviaton of The Mean
Down Range	0.67 NM Short	± 0.62 NM	± 0.10 NM
Cross Range	0.70 NM Left	± 0.28 NM	± 0.04 NM

PROPELLANT TANKING

Fuel was tanked on 13 September 1962. Tanking was secured with the fuel level 12 gallons above the 100 Percent Probe. Pressurization to Sequence II for leak checks opened the pre-valves lowering the fuel level below the 100 Percent Probe. Topping was necessary on 14 September, first attempted launch, and a final level 15 gallons over the 100 Percent Probe was acquired. Again on the 15th and 17th, topping was required and a level 15 gallons above the 100 Percent Probe was established each time. On launch day, during precount, fuel was topped to the overfill probe. Most of the topping was necessary due to the heat transfer during LO_2 tanking on attempted launches; however, replacement of the sustainer igniter fuel line did require draining an unknown amount of fuel prior to starting the launch countdown. Nominal calculations of the amount of fuel aboard at ignition based on an approximate density of 49.9 pound per cubic foot yielded 76,000 pounds.

FUEL DENSITY DATA

Degrees API	43.1°
Temperature at Tanking	92°F
Density at Tanking	49.70 lbs/ft^3
Estimated Density at Ignition	49.9 lbs/ft^3

LO_2 tanking was successfully concluded with a LO_2 slug transfer of 46 seconds duration. The 100 Percent Slug Cut-off Probe uncovered 0.25 seconds before One Inch Motion. At ignition, the LO_2 weight was computed to be 174,250 pounds. The LO_2 density was computed to be 70.14 pounds per cubic foot based on the Sequence II ullage pressure just prior to closing the boil-off valve (4.84 psig).

TELEMETRY SYSTEM

Satisfactory data were obtained from all four telemetry RF's and the special switching of RF No. 3 at BCO. The staging dropout was 10 milliseconds.

Measurement A359D, Booster Separation Yo Yo No. 2, indicated movement from 27 per cent to 36 per cent IBW during booster phase, but did not yield valid data during separation.

Measurement Y518P, ADF A223, failed at plus 53 seconds.

Measurement H412O, NAA Control Y Axis, failed at plus 204.6 seconds. Due to the failure of H412OO, the D1V (MFCO), RSC cutoff output blip, on RF No. 1 Channel 6 was not discernible.

Measurement U81P, Fuel Tank Head, remained at or above 95 per cent IBW throughout flight.

Measurement P29P, V2 Thrust Chamber Pressure data, exhibited excessively slow response to pressure changes at ignition and shutdown.

Measurement A363T, Engine Environment Sustainer Lube Tank High Temperature, opened at plus 130.8 seconds.

Measurement P529D, Sustainer Main LO2 Valve, exhibited excessive fluctuation and low readings throughout the flight.

Measurement P 709 T, SGG Combustor Temperature, exhibited excessively low oscillatory temperature data.

Measurement S257O, Sustainer Pitch Engine Position, indicated transducer slippage at ignition and during staging.

Measurements A 36 A, Booster Thrust Section Longitudinal Acceleration, and P 531 O, Gas Generator Fuel Check Valve Vibration, were deleted prior to flight.

RF No. 3 data exhibited noisy characteristics during two time periods. These periods were between from approximately 99 to 121 seconds and from 261 to loss of signal.

RF No. 1 Channel 12, 13 A and E had a slight shift in transducer power supply at plus 217 seconds.

Missile 8F contained three Bendix Mod 7 FM telemetry packages and one Time Transposition Telemetry Package which included a Speidel Corporation Mod 003 Recorder Reproducer System. Basic telemetry channel assignment is given in General Dynamics/Astronautics Report AE 61-0123-08.

LANDLINE INSTRUMENTATION

The Landline Instrumentation System provided satisfactory data. Brown recordings and EA sequence recordings were satisfactory, with the exceptio of F1246P, Booster Tank Helium Bottles, U1306V, AA Control Coil Drive-ETC., and U1307V, AA Control Coil Drive Feedback. The timing pen did n ink on these records for the last 16 minutes of the countdown.

Twenty-three propulsion parameters were monitored through a trailing wire umbilical and recorded on FM tape. This instrumentation provided data for approximately 35 feet of missile rise (2.17 seconds). Measurement P12080 B1 Engine LO_2 Dome Accelerometer, did not provide valid data. Four pres sure Measurements, P1059P, B2 Thrust Chamber, P1351P, Sustainer LO_2 Injection Manifold, P1038P, B2 Fuel Pump Discharge, and P1039P, B1 Fue Pump Discharge, provided qualitative data only.

WEATHER DATA

	Fuel Tanking	Ignition
Date	13 September 1962	19 September 1962
Time	2000 EST	1430 EST
Pressure	30.035 Inches of Hg	29.900 Inches of Hg
Temperature	74.8 Degrees F	75.0 Degrees F
Relative Humidity	96 Percent	95 Percent
Wind	3 Knots, SE	9 Knots, WNW
Total Cloud Cover	10/10	10/10

COUNTDOWN TIME VERSUS EVENTS

This test was scheduled for a 150-minute countdown starting at 1030 EST. Countdown start was delayed until 1200 EST in order to replace a sustainer igniter fuel line and the RF No. 1 and RF No. 2 packages. The RF packages were replaced because of two commutators running at slow speeds. The countdown was effected without holds or recycles.

The following notations were made by an observer in the blockhouse:

EST	Countdown Time	Countdown Procedure	Event
1200	T-150	T-150	Countdown Started.
	T-150	T-150	Guidance Telemetry Check Started.
	T-150	T-150	Nose Cone Telemetry and Beacon on External.
	T-150	T-150	Acoustica Sensor Response Checks Started.
1206	T-144		Acoustica Sensor Response Checks Completed.
1209	T-141		Guidance Telemetry Check Completed.
1210	T-140	T-140	GAP Test Preparations Started.
1215	T-135		Nose Cone Telemetry and Beacon Off.
1216	T-134	T-134	GAP Test Started.
1219	T-131	T-131	Telemetry Batteries 1, 2, and 3 Activated.
1225	T-125		GAP Test Completed.
1230	T-120	T-120	RSC Tests Started.
1241	T-109		RSC Test Completed.
1242	T-108	T-110	Electrical Connection of Red Destruct Boxes and Retro-Rockets Started.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS:

1. The flight was successful.
2. The field of view of Staging Camera No. 3 did not cover the sustainer engine as planned.
3. The film in Camera No. 1 jammed after camera start.
4. Commutation of the re-entry vehicle 7.35 kc and 14.5 kc subcarrier oscillators was lost at T + 40 seconds.

RECOMMENDATIONS:

1. Reposition Staging Camera No. 3 to provide coverage of the sustainer engine.
2. Investigate reasons for the jamming of film in Staging Camera No. 1.
3. Investigate possible causes for malfunction of re-entry vehicle commutator.

EST	Countdown Time	Countdown Procedure	Event
1357	T- 33	T- 35	LO2 Tanking Started.
1357	T- 33		Guidance Computer and Programmer Check Completed.
1401	T- 29		Holddown Hooks Retracted.
1405	T- 25	T- 30	Azusa Final Check Started.
1408	T- 22	T- 22	RSC Final Test and Telemetry Warmup Started.
1412	T- 18		RSC Final Test Completed.
1414	T- 16	T- 13	Azusa Final Check Completed.
1415	T- 15	T- 13	Nose Cone Beacon and Telemetry on External.
1420	T- 10	T- 10	Acoustica Final Checks Started.
1420	T- 10	T- 10	Telemetry RSC AGC Check Started.
1421	T- 9		Telemetry RSC AGC Check Completed.
1422	T- 8		Autopilot Systems Final Test Completed.
1425	T- 5	T- 5	All Communications Switch to Channel 1.
1427	T- 3:50	T- 3:50	Status Check - All "Go".
	T- 3:30	T- 3:30	3 Minutes 30 Seconds and Counting - Mark.
	T- 3:15	T- 3:15	SP Pod to Internal.
1427	T- 3:00	T- 3:00	Timer Switch to Ready.
	T- 2:45	T- 2:45	Shutdown Power Switch to Arm.
	T- 2:10	T- 2:10	Nose Cone Beacon and Telemetry to Internal.
	T- 2:05	T- 2:05	Commands to Internal.

EST	Countdown Time	Countdown Procedure	Event
1245	T-105	T-105	Nose Cone Arming and Fusing Checks Started.
1248	T-102	T- 95	Nose Cone Arming and Fusing Checks Complete
1249	T-101		Main Missile Battery Activated.
1251	T- 99		Electrical Connection of Red Destruct Boxes and Retro-Rockets Completed.
1256	T- 94		Guidance Landlines Removed.
1300	T- 90	T- 90	Flight Control Systems Test Started.
1308	T- 82		Flight Control Systems Tests Completed.
1311	T- 79		Service Tower Removal Started.
1313	T- 77	T- 85	Helium Storage Preparations Started.
1321	T- 69		Helium Storage Preparations Completed.
1325	T- 65	T- 65	Landline Electrical Calibrations Started.
1326	T- 69	T- 45	LO2 Tanking Preparation Started.
1330	T- 60		Staging Camera Batteries Activated.
	T- 60		Helium Storage Started.
1335	T- 55		Landline Electrical Calibrations Completed.
1339	T- 51		LO2 Tanking Preparation Completed.
1342	T- 48		Mod III Beacon Lock On Checks Completed.
1344	T- 46	T- 35	LO2 Tanking Started.
1350	T- 40	T- 40	Guidance Computer and Programmer Check Started.

MISSILE CONFIGURATION

Airframe

GD/Astronautics "F" Series Airframe. Thor retro-rockets were installed in the modified vernier engine fairings. Staging shut off valves were added to the fuel and LO_2 low pressure ducting in the booster section. Vernier tunnel slots were expanded in thrust section and the tunnels were structurally strengthened. The lower Quad II step was removed. The lanyard for 600P12 had a reinforcing washer installed on the heat shield and a backup lanyard was attached to the Quad IV side of the thrust section.

An ADF Mod II Penetration System Pod was attached to the fuel tank on Quad II.

Azusa System

A type B-1A coherent carrier transponder operated in conjunction with the Mark I and Mark II Ground Stations. An elliptical horn antenna was mounted on the tripod boom in missile Quad IV.

Electrical System

Missile electrical power was supplied by a remotely-activated, primary-type, Eagle-Picher main missile battery and Leland rotary inverter.

Flight Control System

The square cannister configuration with forward rate gyro canister containing pitch and yaw rate gyros was flown on Missile 8F. The main gyro canister incorported the Phase Rotation Detector System in addition to the Spin Motor Rotation Detector (SMRD) System. Atlas and Thor retro-rocket switch actuation times were programmed to occur at VCO + 21.5 seconds instead of VCO + 17.0 seconds as used on previous flights.

Guidance System

An ARMA Lot IV Missile Guidance Set (MGS) was flown on Missile 8F. Lot III Ground Equipment was used for preflight checkout of the MGS. The computer constants board assembly used on this flight was a diode board.

EST	Countdown Time	Countdown Procedure	Event
1428	T- 2:00	T- 2:00	Nose Cone to Ready.
	T- 1:55	T- 1:55	Autopilot to Arm.
	T- 1:50	T- 1:50	Turning Water Systems On.
	T- 1:45	T- 1:45	Commands to Arm.
	T- 1:40	T- 1:40	Range Ready Switch On.
1429	T- 1:35	T- 1:35	T-1 Minute 35 Seconds and Holding. All Pre-start Lights are Green. Slug Start. Mark T-1 Minute 35 Seconds and Counting. Starting Flight Pressurization.
	T- 1:35	T- 1:35	Missile to Internal Power.
	T- 1:05	T- 1:05	Missile Helium to Internal.
1429	T- 0:60	T- 0:60	T-60 Seconds and Holding. T-60 seconds and Counting.
	T- 0:55	T- 0:55	Water Full Flow.
	T- 0:50	T- 0:50	Status Check - All "Go".
	T- 0:30	T- 0:30	Close LO2 Fill and Drain Valve. All Launch Commit Lights are Green.
	T- 0:05	T- 0:05	T-5 Seconds and Holding Momentarily. Commit Armed Light. All Recorders to Fast.
1430	T- 0:05	T- 0:05	T-5 Seconds and Counting - Mark.
1430:40			Range Zero.

Range Safety Command System

The standard system employed two ARW-62 receivers, a power and signal control unit, arming switch, and destruct package. System electrical power was supplied by two manually-activated, secondary-type, Yardney batteries.

Telemetry System

PAM/FM/FM System was comprised of four telemetry packages, three Bendix R and D telemetry packages and one Time Transposition Telemetry package which included a Speidel Corporation Recorder Reproducer System. One accessory package was carried to furnish transducer excitation and signal conditioning circuits. The antenna system consisted of two diplexers, a ring coupler, and two cavity-type antennas.

RF No. 4 retransmitted RF No. 1 data after a 1.5 second time delay to obtain data during the booster staging RF blackout period. Additional staging data were obtained by utilizing transducers which were switched into RF No. 3 at BCO. Signals from these transducers were transmitted in real time from BCO until BCO $\neq$ 2.8 seconds. Between BCO $\neq$ 2.8 seconds and BCO $\neq$ 10 seconds the signals were transmitted with a 1.5 second time delay. After BCO $\neq$ 10 seconds these signals were switched out and RF No. 3 was again monitored for the remainder of the flight.

The four airframe telemetry links were operational at 227.7, 229.9, 232.4, and 235.5 mc. System electrical power was supplied by three remotely-activated, primary-type, Yardney batteries.

Mod III Range Safety and Instrumentation System

The missileborne Mod III E Instrumentation Beacon System operated in conjunction with the Mod III Ground Station. The missileborne antenna was mounted on the tripod boom in Missile Quad IV.

Hydraulic System

The Hydraulic System is comprised of independent booster, sustainer/vernier, and vernier-solo subsystems. The booster and sustainer/vernier subsystems are comprised of a hydraulic pump, engine actuators, accumulators, fluid reservoir, relief valves, disconnects, and associated plumbing. The vernier-solo subsystem incorporates a precharged accumulator-type hydraulic power supply. This was the second GD/A stainless steel Hydraulic System flown from AMR.

Impact Predictors

Azusa System and Mod III Range Safety and Instrumentation System was utilized for impact prediction purposes.

Pneumatic System

Basic Astronautics System of six shrouded main propellant tank pressurization helium bottles with modified Fluidgenics pneumatic regulators for LO2 and fuel tank pressure control. This was the second AMR launched missile with all stainless steel pneumatic plumbing.

A Calmec "F" Series LO2 boiloff valve was flown.

Propellant Utilization System

The Acoustica Propellant Utilization System was utilized on this missile and is essentially the same as the system flown on Missiles 26E and on. This system uses a 400 cps signal for excitation of the PU valve position feedback transducer and a 5-card computer.

Propulsion System

The Rocketdyne MA-3 Liquid Propulsion Engine System was used on this flight. The booster engines were modified by installation of copper baffles on the injectors and replacement of the stainless steel injector rings with copper rings. Engine weight was increased 36 pounds.

A second camera (No. 3) was mounted on the outside of the missile at approximately Station 1133 in Quadrant III. This camera faced aft. The camera started at approximately BCO + 0.5 seconds and operated until BCO + 10 seconds at which time it was ejected simultaneously along with camera No. 1.

Two liftoff cameras (No. 4 and 5) were mounted externally on the booster section. The purpose of these cameras was to obtain pictorial information in the thrust section during liftoff. Camera No. 4 was located in Quadrant III at Station 1253. Its field of view included the sustainer turbopump and associated plumbing in the adjacent areas. Camera operation was to be from T-158 seconds to T + 5 seconds. Camera No. 5 was located in Quadrant III at Station 1195. Its field of view was primarily the sustainer Y duct. Camera operation was to be from T-10 seconds to T + 5 seconds. Both cameras were ejected and chuted from the missile at T + 5 seconds at an altitude of approximately 220 feet.

Scientific Passenger Pod

SP Pod No. 17 was assigned to the NASA-Lewis Research Center, Cleveland 25, Ohio. The experiment consisted of two vacuum jacketed spheres (one 9 inch dia. and one 22 inch dia.) filled approximately 30% by volume with liquid hydrogen. This experiment measured the heat transfer rates to liquid hydrogen with radiant heat flux rates in the order of average space rates at zero gravity conditions. The experiment was also utilized to provide information on the effect of scale on the total heat input rate. The spheres were instrumented to obtain heat sink temperatures, pressure buildup and vacuum levels.

Propellant Tanking

Astronautics "E" Series Propellant Tanking System incorporated four ultrasonic fuel sensors, four LO_2/GO_2 detectors, a Propellant Loading Control Unit (PLCU) in the blockhouse, and 200-400 gallon LO_2 slug unit. An E Series LO_2 probe was used.

Penetration System

The Mod II Pod was attached to the missile airframe in Quad II. The pod instrumentation system was powered by a secondary type battery which was contained within the pod. An instrumentation interface was provided to transfer pod generated signals to the missile Telemetry System. The T1 and T2 signals were provided to the pod by the Flight Control System programmer at BCO ∕ 0.1 seconds and VCO ∕ 16.0 seconds, respectively. The T1 signal was used to activate the two pod primary-type batteries one of which was used for the sequential timer functions and the other for the activation of pod pyrotechnics. The decoy complement consisted of 4 re-entry decoys and 5 Mark 3 vacuum balloon decoys. Three of the re-entry decoys were Internal Reflector Cone with Augmenter Grid and the other was an AVCO Nike-Zeus decoy.

Re-entry Vehicle

A Mark 4 Mod I-8 Re-entry Vehicle was carried aboard Missile 8F and comprised of the following:

An ablation shielded self stablizing sphere cone cylinder flare structure; a passive righting and spin system for re-orienting R/V during re-entry; an arming and fuzing system; a separation system; a telemetry system; a "C" Band tracking beacon; a four pound non-ejectable SOFAR Bomb and a recoverable data cassette.

Staging Studies

A high speed recoverable camera (No. 1) was mounted in the thrust section on the aft end of the jettison rail in Quadrant IV. The purpose of this camera was to obtain qualitative pictorial information which could possibly assist in resolving the staging problem. This camera started at BCO and continued to operate until BCO ∕ 10 seconds. A high intensity light was switched on at BCO ∕ 2 seconds and remained on until BCO ∕ 3.75 seconds.

A total of three attempted launches were performed on Missile 8F. An observer's notes concerning these attempts follows:

Countdown Time Versus Events, Test P1-601-00-8, 14 September 1962

The countdown was scheduled to start at 1090 EST. The countdown start was delayed 210 minutes until 1400 EST in order to replace and checkout the Guidance Computer. The countdown was held at minus 70 minutes to resolve an Autopilot Programmer problem. During the first GAP Test the Autopilot Programmer failed to generate the re-entry vehicle pre-arm back-up signal. No signal was evident on the panel lights, EA pens, or telemetry. An electrical check or the monitoring circuitry revealed the malfunction lay in the programmer and test was terminated at 1527 EST.

The following notations were made by an observer in the blockhouse.

EST	Countdown Time	Countdown Procedure	Event
1400	T-150	T-150	Countdown Started. Nosecone and beacon on external power. Acoustica sensor response checks started.
1410	T-140	T-140	Guidance telemetry check completed.
1410	T-140	T-140	GAP Test prep started.
1418	T-132	T-132	GAP Test Started.
1425	T-125	T-125	GAP Test completed.
1426	T-124	T-124	Beacon and nosecone telemetry off.
1446	T-105	T-104	Nosecone arming and fusing checks started.
1446	T-120	T-104	Range Safety Command checks started.

EST	Countdown Time	Countdown Procedure	Event
	T-100	T-100	Nosecone arming and fusing checks completed.
1453		T-97	Range Safety Command checks completed.
1455	T-110	T-95	Electrical installation of red destruct boxes completed.
1500	T-90	T-90	Electrical installation of retro-rockets and SP Pod pyrotechnics.
1515		T-75	Retro-rockets and SP Pod pyro-technics installation completed.
1520	T-70		T-70 and holding to investigate flight control discrepancy.
1527			Test terminated.

Countdown Time Versus Events, Test P1-602-00-8, 15 September 1962

This test was planned for a 150 minute countdown and started at 0630 EST as planned. There were four holds and two recycles required before the test was terminated. As this test was conducted on a non-inteference basis with another range operation, test termination was effected because it was not possible to recycle and launch in sufficient time so that the Range aircraft could support staging camera recovery downrange.

The holds and recycles were as follows:

1. At minus 45 minutes (0815 EST) for 60 minutes. This hold was called for staging camera look angle requirements. It was felt a later launch would preclude the possibility of direct sunlight obscuring the staging camera view. The count was resumed at 0915 EST.

2. At minus 35 minutes (0925 EST) for 81 minutes. This hold was called because difficulty was experienced in obtaining sequence II pressures. Investigation revealed the check valve in the primary helium supply line downstream from the helium trailer was reseating improperly. The check valve was by-passed and the count resumed at 1046 EST.

3. At minus 3 minutes 30 seconds (1118 EST) for 6 minutes to complete LO2 topping.

4. At approximately minus 3 seconds (1128 EST) due to a redline callout, on the B1 pump inlet temperature. The temperature was at -281° F, which was one degree warmer than the redline of -282° F. The count was immediately recycled to minus 3 minutes 30 seconds and holding, and LO2 detanking was commenced. A calibration check was performed on measurement P1020T, B1 LO2 Pump Inlet Temperature which indicated temperature readings were correct. At 1157 EST the count was recycled to minus 45 minutes. The test was then terminated at 1225 EST.

The following notations were made by an observer in the blockhouse.

EST	Countdown Time	Countdown Procedure	Event
0630	T-150	T-150	Countdown started. Guidance telemetry check started. Acoustica sensor response checks started. Nosecone telemetry and beacon on external power.
0635	T-145		Acoustica sensor response checks completed.
0639	T-141		Guidance telemetry check completed.
0640	T-140	T-140	GAP Test prep started.
0649	T-136	T-134	Nose cone beacon and telemetry off.
	T-134	T-134	GAP Test started.
0658	T-127		GAP Test completed.
0655	T-125		Telemetry batteries 1, 2, and 3 activated.

EST	Countdown Time	Countdown Procedure	Event
0657	T-123		Telemetry internal battery voltage checked.
0700	T-120	T-120	Range Safety Command Test started.
0709	T-111		Range Safety Command Test completed.
0709	T-111	T-110	Electrical connection of red destruct boxes started.
0723	T-97		Main missile battery activated
0726	T-94		Red destruct box and retro-rocket installation completed.
0737	T-83		Guidance landline removed.
0748	T-72		Acoustica computer replacement completed.
0755	T-65		Landline electrical calibrations started.
0807	T-53		Tower platform raising started.
0810	T-50		Mod III Missile lock-on test completed.
0815	T-45H		Hold for 1 hour called for staging camera window requirements.
0826	T-45H		Tower removal started.
0841	T-45H		Flight control system test started.
08[illegible]	T-45H		Tower secured.

EST	Countdown Time	Countdown Procedure	Event
0855	T-45H		Helium storage preparations started.
0859	T-45H		Flight control systems completed.
0900	T-45H		LO2 tanking preparations started.
0915	T-45		T-45 and counting.
0920	T-40		Guidance computer and programmer check started.
0925	T-35H		T-35 and holding to check sequence II pressurization.
1046	T-35		T-35 and counting.
1051	T-30		Start LO2 tanking.
1051	T-30		Autopilot system final check started.
1059	T-22		RSC final test started. Telemetry warmup started.
1102	T-19		RSC final checks completed.
1105	T-16		Holddown hooks retracted.
1107	T-14	T-12	Nose cone TLM and beacon on external.
1109	T-12		Autopilot system test completed.
1111	T-10	T-10	Acoustica final checks started.
1111	T-10	T-10	TLM/RSC AGC check started.
1112	T-9		TLM/RSC AGC checks completed.

EST	Countdown Time	Countdown Procedure	Event
1112	T-9		Acoustica final checks completed.
1116	T-5	T-5	All communications switch to Channel 1.
1117	T-3:50	T-3:50	Status check - all go
1118	T-3:30H	T-3:30	T-3:30 and holding to complete LO_2 topping.
1124	T-3:30	T-3:30	3 minutes and 30 seconds and counting - Mark.
	T-3:15	T-3:15	SP Pod to internal.
1125	T-3:00	T-3:00	Timer switch to ready.
	T-2:45	T-2:45	Shutdown power switch to arm.
	T-2:10	T-2:10	Nose cone beacon and TLM to internal.
	T-2:05	T-2:05	Commands to internal.
1126	T-2:00	T-2:00	Nose cone to ready.
	T-1:55	T-1:55	Autopilot to arm.
	T-1:50	T-1:50	Turning water systems on.
	T-1:45	T-1:45	Commands to arm.
	T-1:40	T-1:40	Range Ready switch on.
	T-1:35	T-1:35	T-1 minute, 35 seconds and holding. All pre-start lights are green. Slug start. Mark - T-1 minute and 35 seconds counting. Starting flight pressurization.
	T-1:35	T-1:35	Missile to internal power.
	T-1:05	T-1:05	Missile helium to internal.

EST	Countdown Time	Countdown Procedure	Event
1127	T-0:60	T-0:60	T-60 seconds and holding. Mark - T-60 seconds and counting.
	T-0:55	T-0:55	Water full flow.
	T-0:50	T-0:50	Status check - all go.
	T-0:30	T-0:30	Close log fill and drain valve. All launch commit lights are green.
1128	T-0:05	T-0:05	T-5 seconds and holding momentarily. Commit armed light. All recorders to fast. T-5 seconds and counting - Mark.
1128	T-0:03	T-0:03	Cutoff - recycle to T-3:30 and holding.
1157	T-45H		Recycle to T-45 minutes and holding.
1225	T-45H		Test terminated.

Countdown Time Versus Events, Test P1-603-00-8, 18 September 1962

The test was planned for a 150 minute countdown and started as planned at 1030 EST. The test lasted for 327 minutes and was terminated at 1557 EST. During this period five holds and two re-cycles occurred as follows:

1. At minus 70 minutes (1150 EST) a 20 minute hold was called to complete clean-up operations in the thrust section.

2. At minus 45 minutes (1235 EST) a 5 minute hold was called to complete replacement of the isolation amplifier for the V1 Yaw Feedback transducer recorder channel. Oscillations had been noted on this measurement during the countdown Flight Control Systems Test. This action resolved the discrepancy and the count was resumed.

3. At minus 35 minutes (1250 EST) the count was held for 76 minutes when the 800 amp critical power circuit breaker in the blockhouse dropped out.

Emergency power was utilized for approximately 2 minutes until critical power was restored. During the hold the countdown was recycled to minus 45 minutes. The countdown was resumed after a power change over to split bus operation was effected (only critical power units using critical power -- other units remaining on industrial power).

4. At minus 25 minutes (1426 EST) the count was held for 15 minutes to investigate an indication that the critical power recorder limited at over 800 amps. The countdown was resumed after it had been determined that the critical power recorder was monitoring the total of both critical power and industrial power.

5. At minus 21 minutes (1445 EST) the countdown was held and recycled to -45 minutes in order to investigate an indication that filament voltage was not being supplied to the R.F packages. After LO2 was detanked a circuit breaker in PS No. 2 was found to have dropped out. During the hold the Sustainer/Vernier Hydraulic Pressure Measurement H140P was noted to be intermittent. This measurement was considered mandatory and required resolution. Also the staging camera batteries five hour stand activation limit had expired at 1555 EST. Since resolution of these discrepancies could not be accomplished in time to allow meeting the staging camera downrange recovery requirements the test was terminated.

The following notations were made by an observer in the blockhouse.

EST	Countdown Time	Countdown Procedure	Event
1030	T-150	T-150	Countdown started. Guidance telemetry checks started. Nose cone telemetry and beacon on external power. Acoustica sensor response checks started.
1033	T-147		Acoustica sensor response checks completed.
1039	T-141		Guidance telemetry check completed.
1040	T-140	T-140	GAP test preps started.
1045	T-135		Nose cone telemetry and beacon off.

EST	Countdown Time	Countdown Procedure	Event
1047	T-135	T-134	GAP Test started.
1049	T-131	T-131	TLM batteries 1, 2, and 3 activated.
1054	T-126		GAP test completed.
1055	T-125		TLM battery internal checks completed.
1100	T-120	T-120	RSC checks started.
1111	T-109		RSC checks completed.
1112	T-108		Electrical connection of red destruct boxes started.
1115	T-105	T-105	Electrical installation of retro-rockets started.
1122	T-98		Red destruct boxes and retro-rocket installation completed.
1123	T-97		Main missile battery activated.
1125	T-95		Nose cone arming and fusing checks completed.
1129	T-91		Guidance landlines removed.
1145	T-75	T-102	Tower platform raising started.
1150	T-70H		T-70 minutes and holding.
1204			Tower removal started.
1205			Flight Control Systems test started.
1210	T-70		T-70 and counting
1215	T-65	T-65	Mod III beacon checks started.

EST	Countdown Time	Countdown Procedure	Event
1215	T-65	T-65	Landline electrical calibrations started.
1222	T-58		Helium storage preps completed.
1223	T-57		Landline electrical calibrations completed.
1234	T-46		Mod III beacon lock-on check completed.
1235	T-45H		T-45 and holding to complete replacement of isolation amplifier in transfer room.
1240	T-45		T-45 and counting.
1241			LO_2 tanking started.
1246	T-39		Flight Control Systems test completed.
1249	T-36		Guidance computer and programmer check started.
1250	T-35H		T-35 and holding - complete power loss - on emergency. Power on - circuit breaker in blockhouse.
1300			LO_2 detanked.
1302			Re-step to sequence I pressures.
1309			On split bus
1310			Switch over from emergency to critical power.
1351			Fuel topping completed. countdown re-cycled to T-45.
1406	T-45		T-45 and counting.

EST	Countdown Time	Countdown Procedure	Event
1409	T-42		Helium storage started.
1411	T-40	T-40	Guidance computer and programmer check started.
1413	T-38		LO_2 tanking started.
1418	T-33		Critical power fluctuating over 800 amps.
1422	T-29	T-35	Autopilot system final check started.
1426	T-25H		T-25 minutes and holding to investigate electrical power.
1441	T-25		T-25 and counting.
1444	T-22	T-22	RSC final test and TLM warm-up started.
1445	T-21H		Re-cycle to T-45 and holding to investigate heater voltage to RF package. Detank LO_2. Secure LN_2 flow.
1557	T-45H		Test terminated.

A brief compilation of significant difficulties encountered during system testing is presented on the following pages.

AIRFRAME

The following fiberglass closures required re-work:

An A. I. G. pod broken latch fitting was replaced per B/P by IR 772414.

The Pod I cooling duct was relocated per B/P to avoid interference with the pod door, per IR 846681.

Due to Pod I warping, the forward edge of the door bent and broke the antenna pod bonding fingers, which were replaced per IR 846683.

Pod I interference along the latching edge of the door resulted in 14 chipped corners on the 4-latch access slots. The chipped corners were dispositioned acceptable per IR 846748.

Pod I interference also broke the rubber sealing strip along the latching surface. It was replaced per IR 834610.

The B-2 turbine spinner access door was chipped and broken requiring repair with epoxy resin per IR 846725.

The horizontal line of sight access door in Quad II was warped away from the missile requiring hinge re-work per IR 846769.

There were several problems concerning damage to the missile structure itself. They were as follows:

The fuel tank pressurization line had two low radius dents. They were dispositioned acceptable for flight per IR 846661.

The lower edge of the thrust cylinder stiffeners were bent and cracked on erection. They were drilled to stop the high stress concentration per IR 846662.

Extensive rust spots were found in Quads III and IV. The rust flakes were polished out and covered with W.D. 40 per IR 846668.

Transducer (A287P) installation required the removal of a fireshield clip and bolt which turned freely in the fireshield. The bolt was removed and the transducer installed. The fireshield was repaired with a patch installed on the lower surface of the fireshield per IR 846677.

The form-fitting vernier post fairing metal plates rubbed against a hydraulic line on both V-1 and V-2 plates. They were reformed per IR's 834601 and 834602.

The vernier engine fairing bracket (V-1) mounted on the tank skin was bent at one corner. The bend was straightened per IR 846686.

Several seeping fuel leaks were found on the tank bosses. IR's 83640 and 870851 were worked by tightening the fuel boss in Quad II to standard torque. The final seepage was dispositioned acceptable for flight.

The PLCU stillwell probe developed a seeping leak, but was dispositioned acceptable for flight per IR 834631.

The horizontal fuel drain valve (AN 6204-1) located behind V-2 was retorqued for a seeping leak and dispositioned acceptable for flight per IR 846678.

PROPULSION

One launch countdown was aborted because of the propulsion redline on B-1. The LO2 inlet temperature rose above the redline value of -282°F at T-5 seconds. It was later determined that the slug temperature was 5°F above normal.

The booster directional control valves were IR'd (846029 and 846030) and replaced with Serial No. 305 or greater D.C. valves by Rocketdyne personnel.

A LO2 self-referencing regulator retaining bolt (AN 4-7A) had no safety locking wire. The IR (813546) was dispositioned acceptable for flight. This is a recurrent item since the retaining bolt has no provision for lockwire.

The check valve for the sustainer LO2 regulator was marked and chipped indicating poor torquing or over-torquing. The check valve was replaced per IR 846031. The B2 LO2 topping line check valve also had a chipped hex head. The burr was filed off and the check valve dispositioned acceptable for flight per IR 846676.

The vernier LO2 supply flex line was leaking at the union during checkout. The fitting was retorqued and dispositioned acceptable for flight per IR 846695.

[redacted]

FORM A1000-1

The V1 engine LO2 hard supply line had a small sharp dent. The dent was polished out and dispositioned acceptable for flight per IR 846716. The V1 engine fuel flex line also developed a seeping leak at the union. A flare saver was installed and the fitting retorqued. The IR (834663) was dispositioned acceptable for flight.

The B2 chamber was dented to approximately 30 per cent closure on three tubes located above the firewall, in Quadrant IV of the chamber. Two dents were pulled out and one was patched per IR 846726 by Rocketdyne personnel. Another small dent was found in the B2 chamber in Quad II of the chamber above the fireshield. The dent was dispositioned as acceptable for flight (IR 834643) after a dye-penetrant check.

The propellant utilization valve mechanical stop was out of specification per log book setting. The check nut on the mechanical stop shaft was not properly torqued, which may have contributed to the mechanical stop being out of specification. The mechanical stop was reset to the correct log book setting and the check nut torqued to the proper value per IR 846721.

The flex lines to the hydraulic control package were IR'd for suspected failure. They were replaced with proof pressure tested lines as follows: fuel control line IR 846742; fuel sensing line IR 846741, and LO@ sensing line IR 846740.

The B1 engine liquid propellant gas generator igniter port was burred and threaded off center. The burr and the interference was removed with a rotary file per IR's 834618 and 834670. Several igniters were broken in the process of reworking the GG. They were IR'd as follows: 834621, 834622, 834623, 834624, 834625, 834628, 834667, and 834668.

The V1 engine hypergolic cartridge retaining pin assembly was missing on Missile 8F. The engine was IR'd (834620) and the retaining pin replaced.

Two igniters were IR'd for bent pins, (One booster and one sustainer liquid propellant gas generator igniters.) The sustainer igniter was replaced; the B2 igniter was straightened. The final disposition was acceptable for flight per IR 834633.

Two solid propellant gas generators were faulty. A booster SPGG was replaced per IR 834629 because the heater failed to operate properly. Another booster SPGG was dented and dispositioned acceptable per IR 834661.

The engine relay box was IR'd (846708) when the vernier ignition timer was found to pick up at 3.38 seconds instead of the ~~specified~~ required value of 3.5±0.1 seconds. The Rocketdyne requirement was found to be 3.5±0.5 seconds for field test operations. The print is being changed and the engine relay box was dispositioned acceptable for flight.

The sustainer fuel igniter line was erroneously over-torqued to stop a seeping leak. The line was replaced per blueprint by IR 870003. First indications were that the line was cracked. Following a dye penetrant check and inspection by STL, GD/A, and Rocketdyne, it was determined that there was a tool mark and a flare imperfection rather than a crack.

LIFTOFF AND STAGING CAMERAS

During liftoff camera capsule fit check on 24 August 1962, SK-10-2408-805 cable was discovered to be too long. IR 846694 was written and cable reworked to proper length.

An inspection of Camera No. 1 harness discovered that SK-10-2315 collar was not on 27-45484 harness. IR 846694 was written to remove plugs and install proper plug with collar.

While performing procedure 27-43843-BK 3 it was discovered that K2 relay in control box SK-15-6102-51 was sticking. IR 846714 was written and box routed to San Diego for repair.

On 17 August 1962, during precount Camera No. 1 Conax Squib connecting the SK 10-2203-5 assembly was discovered to have a loose igniter squib. The assembly was IR'd and replaced with new assembly.

Installation of SK 10-2408 cables on liftoff camera for fit check showed SK 10-2418 drives to be too long and were extending into the cable cutter opening. Inspection of cables disclosed that SK 10-2418-11 and SK 10-2418-13 drives were not to latest configuration. The cables were routed to the machine shop for modification.

On FAC Test Camera No. 1 ran twenty to thirty feet of film then jammed. Checkout in the lab proved the camera to function properly. However, results from flight indicate the camera jammed again. To date the cause is indeterminate.

[redacted]

COMPLEX MECHANICAL

During the second countdown trouble was encountered with the Transfer Room air-conditioning equipment. First the compressor (P/N 3P300C) failed. This motor was replaced with a new item. After the Compressor and a new pump motor were installed, a complete electrical and mechanical functional test was conducted and the unit checked out properly. The unit performed satisfactorily during launch.

HYDRAULICS

Thirty-three leaks were found in the hydraulic system. All were recorded by F & C and were retorqued; if leaking continued, F & C's were changed to IR's and flare savers installed.

The unions on the servo cylinder assembly (27-85314-821) were IR'd for not being per B/P. They were replaced per B/P per IR 870255.

PNEUMATICS

During the Launch Countdown of 8F on 15 September 1962, the proper Step II pressures could not be attained. Investigation revealed that the check valve at the Primary trailer stub-up was restricting the flow to the PCU. This check valve was originally installed by PAA to prevent contamination of the Helium trailers. This check valve was removed and lines reconnected to permit Step II pressure in the Fuel Tank.

During the performance of the missile Helium Bottle Chill portion of the 8F launch countdown, the Helium Bottle temperature gauge failed to come off of the pegged position. Investigation revealed that the Temperature Transducer for ground recorders was open. However, the A/B Telemetry transducer was good. During the remaining countdowns, the Helium Bottle Temperature was monitored through A/B Telemetry.

The two problems that developed in the LN2 system are recurring problems. The dents in the bottle shrouds appear to be a result of people standing and kneeling on same during the camera installations. The LN2 leaks at the 27-80249-13 gasket joint between bottle shroud and bellows appear to be a result of improper sealing technique or improper installation.

COMPLEX ELECTRICAL

At T-30 minutes during launch countdown on 18 September 1962, the critical power input to the complex was overloaded causing loss of all AC circuits. Facility power was changed over to split Industrial/Critical bus and the count was resumed.

After liftoff on 19 September 1962 launch, the PS3 28 VDC power supply ceased to operate. Later investigation revealed that PS3 could be caused to cut out by a mild blow of the hand on the cabinet. Hangar maintenance personnel state this is a common characteristic of the K1 relay at other complexes. Investigation of this unacceptable condition continues.

Temperature regulation of the Thrust Section Heater did not function as specified in the instruction manual. However, satisfactory thrust section temperatures were obtained by use of the Blockhouse remote control switch. Proper regulation at 200 ± 5° F usually did occur after the heater had run for some time and then had been cycled off/on.

INERTIAL GUIDANCE

The following list presents a chronological history of the significant events relating to the Missile Guidance Set in Missile No. 8F from the time of its arrival at Complex 11, AFMTC, Cape Canaveral, Florida, until the time of launch.

On 16 August 1962, Missile 8F erected.

On 20-21 August 1962, a Periodic Validation Procedure CTP-34C was started. A problem was encountered with the 14 bit network in 1A1A2 Serial No. 5 which was traced to a faulty relay K-10. The 1A12 Serial No. 5 drawer was returned to Hangar N for repair. Installed 1A1A2 Serial No. 6 drawer. The remainder of CTP-34C was completed. The repaired 1A1A2 Serial No. 5 drawer was reinstalled.

On 22-23 August 1962, several computer problems were run with NO/GO results. Investigation revealed the simulated YF1 input to the computer was shorted. The shorted YF1 simulated string input to the computer was traced to a shorted coax connector in 302 J104 cable and it was replaced.

On 24 August 1962, the installation of new 302 J104 cable was checked by making a continuity check. Still obtained NO/GO computer runs. 1A1A1 drawer Serial No. 41 was replaced with Serial No. 42. The computer runs were all GO's with this drawer. 1A1A1 Serial No. 41 was returned to Hangar N for repair. It was reported from Hangar N that transistor Q1 1A1A3A5 was defective. It appears that this was caused by the YF1 line short in the defective 302 J104 cable.

On 30 August 1962, the Control Central Serial No. 7220053 was removed and buffer amplifiers were installed at Hangar N. Control Central with the buffer was reinstalled and CTP-54, Torque to Ready Mode Test, was completed.

On 31 August 1962, CTP-37 was started but computer YSS dropouts were experienced. CEC tapes were run and returned to Hangar N. Analyses indicated that X and Y velocities started out incorrectly (F & C 846718). Computer Serial No. 7230059 was replaced with Serial No. 7230073. Four computer problems were satisfactorily completed.

On 4 September 1962, CTP-52, Computer Reset Impedance Test was performed. The computer reset line impedance was 1/2 ohm below specification. Low end of the specification is 35.1 ohms. As per GCY request, the computer was rejected because of the measured low computer reset impedance (F & C 846760). Computer Serial No. 7230073 was replaced with Serial No. 7230068.

On 5 September 1962, the 1A1A2 drawer Serial No. 5 was replaced with Serial No. 6 to perform CTP-44 since the Gurley Table run with drawer Serial No. 5 was out of specification. A peak to peak oscillation in roll pendulum blockhouse Sanborn Channel of approximately 12 seconds at 1/2 cps was noticed.

On 6 September 1962, Several countdowns were completed in an attempt to duplicate the roll pendulum oscillation of 5 September. The oscillation on the Sanborn did not occur. An instrumentation problem was suspected. The large roll and pitch pendulum error measured on the Blockhouse Sanborn was investigated. It was determined that there is an instrumentation bias on these two channels. The roll bias is +7.3 seconds and the pitch bias is -6 seconds.

On 7 September 1962, CTP-37F was completed in preparation to support the FAC Test. A manual step complete in 5-12 was not received. Inductosyn loop may be noisy or meridian cam switch needs adjustment. This will be investigated. Noticed the following pendulum alignment error in normal align position. Roll 11 seconds; Pitch 17 seconds (Gradient on Blockhouse Sanborn 1.6 sec/mm.) The FAC Test was scrubbed due to A/P and Telemetry problems.

On 10 September 1962, the OGE would not pass M.P. 6 in ACSIG. The problem was traced to accelerometer loop No. 1. Loop No. 2 is functioning properly. F & C 870879 was written to replace 1A1A6 drawer Serial No. 7510004 with Serial No. 7510041. Air conditioning was lost in the transfer room. A/C was back on at 11:00 a.m. A decision was made to perform an automatic checkout in order to pick up the FAC countdown in the shortest possible time. Data was taken during the automatic checkout.

M.P. 5 A.S.P. 12 did not pass during automatic checkout. After completion of the FAC Test, it was necessary to adjust the switch. 5-12 was then functioning properly.

On 12 September 1962, it was noticed that Z zero (+ 1G) readings were oscillating in and out of red line. Suspected a high gain loop. It was decided to replace 1A1A6 drawer Serial No. 7510041 with Serial No. 7510004 (F & C 870887).

A manual checkout in accelerometer steps was completed using 1A1A6 drawer Serial No. 7510004. Storages, Z zero (/ 1G) and X offset were all in specification. No oscillations were experienced while zeroing Z in /1G.

On 13 September 1962, per BSD request, the buffer amplifier amplifier assembly was removed from Control Central Serial No. 7220053 (GMA 10879B).

On 14 September 1962, CTP-37G, System Readiness Test was started in preparation for the launch operation. The first two computer problems were NO/GO. Runs No. 53 and No. 54. BECO was early at 35 seconds, YSS cross over at 140 seconds and SECO, and VECO occurred at T. Both runs exhibited the same symptoms. Two additional problems were run. Both were NO/GO's. During these two runs, the G levels into the computer were checked and were correct as far as G levels and signal amplitude. Hangar N analyses of the tapes, runs No. 53 and No. 54, indicated that the X input was very high (7 G's) and that all velocities were incorrect. In M.P. 13 (Ready Mode), an AIG non-inertial type problem was performed and YSS appeared normal. A synchronous problem was conducted with GO results. Another synchronous problem was run. It was also GO. Umbilical 600U7 was checked for moisture or water. The umbilical connections were dry.

F & C 870850 was written to replace computer Serial No. 7230068 with Serial No. 7230028. The computer was replaced and with trouble experienced on one computer shock mount. F & C 834637 was written to replace the one computer shock mount.

A YSS NO/GO at R was experienced with computer Serial No. 7230028 (Digital GO). Tried adjusting YSS amplifier gain but this only transformed the YSS NO/GO time to T. The Blockhouse Sanborn YSS profile did not indicate a problem with computer YSS level, Dig. GO. Drawer 1A1A1 Serial No. 41 was replaced with Serial No. 42 (F & C 834639).

A YSS NO/GO was experienced during the countdown at T-105. It was discovered that Range Safety had issued complete cutoffs within 20 seconds of R. This would account for the YSS NO/GO. The countdown was repeated satisfactorily.

On 19 September 1962 CTP-37G, System Readiness Test was conducted to support launch operation. The launch operation was completed at approximately 1430 EST.

MISSILE ELECTRICAL

On 20 August 1962, during RF systems blockhouse compatibility procedure, the voltage readout for RF No. 1 could not be seen in the blockhouse. Loss of readout was contributed to wires D 4027A20 and D 4028A20 from 600J6 umbilical to RF No. 1 10101P7 not being installed completely. This problem was a result of splicing 27-11493 harness into 28VDC source for RF No. 4. ECN 157804 on 27-61827 was written against 27-61827 to complete circuit.

During Missile Electrical Blockhouse Compatibility Test, a low battery simulator voltage after changeover to internal was noticed. This was resolved to be due to copper losses in LCS modifications recently completed. After LCS modification was changed, a power changeover was again performed and all systems operated properly.

An ordinance ringout of destructor accomplished on 18 September 1962, discovered backup destructor would not arm and safe with 28 VDC order. IR 846714 was written against box and reliability was informed to perform failure analysis.

AZUSA

No significant problems were encountered.

RANGE SAFETY COMMAND

No significant problems were encountered.

FLIGHT CONTROL

All vernier engine plugs were x-rayed because of problems which were encountered with Missile 179D and two were replaced.

Immediately after the GAP Test during the FAC Test, it was noticed that Vernier No. 1 was hard over in the negative pitch direction. Investigation revealed that there was an open splice in Wire ZN63B20. When the harness was opened to reach the splices, the splice in Wire ZN109B20 also fell apart. The splices were replaced and operation was normal. The remaining splices on the vernier feedback transducers were inspected and three were replaced on the Vernier No. 2

pitch transducer because their condition was such that they presented possible problem areas.

On 7 September 1962, all Servo canisters were returned to the factory to have power transformers checked. The cans were returned on 10 September 1962, and Serial No. 217 was installed on the missile.

During system tests on Servo No. 217, it was noticed that the vernier and booster engines were biased in negative roll. This bias disappeared after approximately one hour. Upon reapplying power the next morning, the same bias problem reappeared. The canister was changed and a recorder was connected to 305U2P2-K and was run for thirty hours. All records showed normal operation. System tests were completed satisfactorily.

While performing the GAP Test during countdown operations on 14 September 1962, it was noted that there was no pre-arm backup output from the programmer. The programmer was changed and checked out satisfactorily. It was found in the Lab that there was an output from the armed side of the ARM/SAFE Switch, but no output from the safe side.

Two Isolation Amplifiers were changed in the Vernier No. 1 Yaw channel during the countdown of 18 September 1962, because of non-linearity.

MOD III INSTRUMENTATION BEACON

During the waveguide calibration there was no output from the pulse beacon. The problem was determined to be in the COTS (Checkout Test Set) equipment. A plug 303U4P1, Rate Beacon Power Plug, had a broken pin. The plug was IR'd and replaced.

PROPELLANT UTILIZATION

Prior to picking up the count of Missile 8F on 14 September 1962, it was noted that Station No. 3 did not have limit voltage out of the error counter with a limit error signal induced. After termination of the operation, STL directed a computer change because of the unexplained low error counter output. Computer Serial No. 107 was routed to the Acoustica Lab for further checks and was found to have a low VFO at Station No. 3, although it was within specifications.

PROPELLANT TANKING

During the dual tanking test, the LO2 ground fill and drain valve and the fuel ground fill and drain valve were found to operate abnormally. The closing solenoid on the LO2 valve was found to be continually venting. An IR was written and this valve was replaced. The cable leading to the fuel valve was found to be damaged. This was IR'd and replaced and dual tanking was completed with no further trouble.

Data was reviewed before and after Missile 8F launch and found to be normal. Slug time was 46 seconds for the launch and 41 seconds for the launch attempt. Slug Discharge Temperature for the launch attempt was 285.7° and for the launch 290°. Slug Discharge Pressure for the launch attempt was 280 psi and 290 psi for the launch.

TELEMETRY

During the running of the R. F. Systems Blockhouse Compatibility Test, 27-94579-BK-2, no reading could be obtained on the blockhouse meter for RF No. 1 ∕ 28VDC or ∕ 6.3 VDC. Wires No. D4027A22 and D4028A22 were found pigtailed in Pod I. IR 846689 and 846720 were written to connect Wire No. D4028A22 and ECN 15784 against 27-61827 was written to connect Wire No. D4027A22. Also during this test the ∕ 28VDC power for RF No. 1 and RF No. 2 was found to be shorted together. TPS 8F144T and TPS 8F147T were written to troubleshoot and the problem was found to be caused by the Accessory Package. IR 778324 repaired the can and TPS 8F152T found grounded pigtails on 101V2P1-E and 101V2P3-D. These pins carry ∕28VDC for RF No. 1 and RF No. 2 and caused the power supply in the Accessory Package to short out. IR 846704 corrected the grounded pigtails. The procedure was then completed with no further problems.

Measurement A356P was routed to 101V1P6-D. The pigtail on this pin was found open at the solder joint and repaired per IR 846682 and IR 846688.

TPS 8 F134T was written to determine why all measurements routed through 100P/J357 were not functioning. The harness was wired to the plug approximately 120° out. Jack 100J357 and part of the harness was replaced per IR 846690. This same problem was found to exist on Missile 14F in the factory and was repaired by factory personnel.

The transducer for measurement P530T was missing with no open paper when missile arrived at AMR. IR 846692 was written to install transducer. This problem existed on Missile 7F,

Measureme nt A971P had the signal wire grounded inside plug 102V1P2 at pin m. This was corrected per IR 846696, ECN 15880 on 27-12305 and ECN 15881 on 27-12252

Measurement P28P had the excitation wire open inside the E1009 Bus. IR 846728 corrected this problem.

A pin was bent on the transducer for measurement S204D when the plug was installed and punctured a hole in the rubber gromet. IR 846730 and IR 846731 corrected this problem.

IR 846722; IR 834612; IR 834634 and IR 834636 were written in an attempt to correct problems with P5310 and A36A. The two measurements were short transducers at launch and were deleted by the Flight Test Working Group.

Measurement A2600 transducer had no bias and the transducer was replaced per IR 846723.

The transducer for measurement U81P had a low output with a full tank of fuel and was replaced per IR 846724.

Because of the fragility of the present design of breakwire, four IR's were written to repair one measurement during three weeks of stand time. The breakwires were protected per TPS 8F97T but A365X had to be repaired by IR 846685; IR 846765; IR 834615 and IR 834632.

The target on the helium bottle for measurement A 428 D was found to be improperly installed. This was corrected by IR 834619.

Measurement A364X read out of band on RF No. 1 Serial No. 011-0009 and was found to have divider missing. This was corrected in the lab.

Measurement A283P could not be activated and was found to be wired to the wrong pin for the input for 3-E-21. This was corrected by ECN 15884.

Channels 2-C and 3-11 had their negative gate levels to shift from time to time. The apparent cause for this problem was moisture in the plugs. This problem did not re-occur during flight.

During the countdown, Channels 1-A and 1-E commutators exhibited evidence of slowing down RF No. 1, Serial No. 108-0026 and RF No. 2, Serial No. 203-0023. These were changed and corrected the problem.

LANDLINE INSTRUMENTATION

During launch attempt on 14 September 1962, booster helium bottle transducer (FM-247) failed to record a temperature change. Investigation of the transducer found it to be open. An IR was dispositioned to launch as is due to back up signal on telemetry. On the launch attempt of 15 September 1962, B-1 LO2 pump inlet temperature (P-1020T) approached redline condition which caused test to be terminated. A re-calibration of transducer proved there was no appreciable shift in calibration.

RE-ENTRY VEHICLE

Mark 4 Mod 1-8 was received at FMTS on 23 August 1961 and was prepared and accepted as a backup for Re-entry Vehicles Mark 4 Mod 1B 12 and 13 on 28 September and 17 October 1961 respectively.

The telemetry shelf and canister were returned to RAD on 11 December 1961 for repairs and were returned on 16 January 1962 and checkout proceeded. Final systems tests were performed on 10 September 1962 and the re-entry vehicle was accepted for flight on 12 September 1962 as the prime vehicle for AFMTC Test No. 103, and was subsequently mated to Missile 8F on 12 September 1962.

APPENDIX

FLUID CHEMICAL ANALYSIS

	Unit	Sample	Specification
Liquid Oxygen			
Purity	Per cent	99.3	99.2 Minimum
Hydrocarbons			
As Carbon	ppm by wt	None	75.0 Total Maximum
As Acetylene	ppm by wt.	None	1.5 Maximum
Particle Count			
350 - 500	Microns	None	20 per liter Maximum
500/	Microns	None	0 Maximum
Particle and fiber weight	mg	None	2.5 per liter Maximum
Appearance		Good	Report
Dew Point	^{o}F	-68	-63.5 Maximum

This item is within specifications.

Gaseous Helium			
Purity	Per cent	99.95/	99.95 Minimum
Hydrocarbons			
As Acetylene	ppm by wt.	None	1.5 Maximum
Particle Count			
500/	Microns	None	0
Fibers, 4000/	Microns	None	0
Inert Solids	mg	None	0.01 mg
Dew Point	^{o}F	-87	-70 Maximum

This item is within specifications.

Gaseous Nitrogen			
Purity	Per cent	99.9	99.5 Minimum
Hydrocarbons			
As Carbon	ppm by wt.	None	75.0 Total Maximum
As Acetylene	ppm by wt.	None	1.5 Maximum
Dew Point	^{o}F	-85	-63.5 Maximum

This item is within specifications.

	Unit	Sample	Specification
Lubricating Oil			
Viscosity at 100°F	Centistokes	12.7	11.0 Minimum
Viscosity at 210°F	Centistokes	3.4	3.0 Minimum
Flash Point	°F	420	400 Minimum
Color		Clear	Report
Trichlorethylene			
Appearance		Clear	Clear
Color		Pass	Clear
Specific Gravity	@68°F	1.456	1.454 to 1.476
Distillation			
Initial	°F	187.7	187.7 Minimum
End Point	°F	189.5	189.5 Maximum
Water Content	@14.0°F	Pass	Cloudless
Residue	Per cent		.002 Maximum
IR Absorbance	Per cent	None	.0002 Maximum
Particle Count			
500/	Microns	None	0
Fibers, 6000/	Microns	None	0

This item is within specifications.

Fuel - RP-1 - Sustainer L. P. Duct			
Initial Boiling	°F	344	Report
10 Per cent	°F	380	365 - 410
50 Per cent	°F	416	Report
90 Per cent	°F	452	Report
End Point	°F	484	525 Maximum
Residue	Per cent	1.0	1.5 Maximum
Loss	Per cent	1.0	1.5 Maximum
Flash Point	°F	136	110 Minimum
Gravity	°API	43.2	42.0 - 45.0
Water: 75°F	Per cent	0.0029	0.0064 Maximum

This item is within specifications.

	Unit	Sample	Specification
Hydraulic Fluid - Booster			
Flash Point	°F	208	200.0 Minimum
Color		Clear	Clear
Viscosity	Centistokes	8.6	8.0 to 10.0
Dye		Red	Red
Particle Count			
10 - 25	Microns	2169	5,500 Maximum
26 - 50	Microns	1200	1,200 Maximum
51 - 100	Microns	5	300 Maximum
100 - 500	Microns	4	20 Maximum
500/	Microns	None	0 Maximum
Fibers, 100 - 1000	Microns	2	20 Maximum
Fibers, 1000/	Microns	None	0 Maximum
Water Content	mg/ml	0.05	0.10 mg/ml

This item is within specifications.

	Unit	Sample	Specification
Hydraulic Fluid - Sustainer			
Flash Point	°F	211	200.0 Minimum
Color		Clear	Clear
Viscosity	Centistokes	9.4	8.0 to 10.0
Dye		Red	Red
Particle Count			
10 - 25	Microns	1220	5,500 Maximum
26 - 50	Microns	339	1,200 Maximum
51 - 100	Microns	1	300 Maximum
100 - 500	Microns	None	20 Maximum
500/	Microns	None	0 Maximum
Fibers, 100 - 1000	Microns	2	20 Maximum
Fibers, 1000/	Microns	None	0 Maximum
Water Content	mg/ml	0.06	0.10 mg/ml

This item is within specifications.

REFERENCE DOCUMENTS

Flight Test Plan - Missile 8 F	AE 61-0737
Flight Test Program, SM-65 Series F, R & D Missiles	AE 60-0944
Detailed Test Requirements (AFBMD/STL)	6101-0028-OC-000
Flight Test Directive (FTWG)	AA 61-0224 A

Additional reports which may be referenced for further information regarding this missile are listed below:

Reports	Approximate Issue Date (time after test)
General Dynamics/Astronautics, San Diego, Calif.	
Flight Test Evaluation Report	14 days
AFBMD/STL, Inglewood, Calif.	
Flight Summary Report	8 - 12 weeks
ARMA, CCO	
CCO Quick Look Report	7 - 10 days
American Bosch ARMA Co., Garden City, N. Y.	
Flight Test Evaluation Report	30 days
AVCO RAD, Wilmington, Mass.	
Evaluation Report	30 days
General Electric, Syracuse, N. Y.	
Evaluation Report of Mod III Instrumentation System with Missile 8F	6 - 10 weeks
Acoustica Associates, Inc., Los Angeles, Calif.	
Flight Test Evaluation Report	30 days
Aeronutronics, Newport Beach, Calif.	
Flight Test Report	30 days

SERIAL NUMBERS OF SYSTEM COMPONENTS

Azusa Transponder

Canister, Part No. 26-11000-827, Serial No. 731-0053

Range Safety Command System

Receiver No. 1, Part No. AD 319600MK1, Serial No. AF 61-202
Receiver No. 2, Part No. AD 319600MK1, Serial No. AF 61-241
Receiver No. 1 Battery, Part No. 7-06380-3, Serial No. 005-0038
Receiver No. 2 Battery, Part No. 7-06380-3, Serial No. 101-0324
Power and Signal Control Unit, Part No. 27-36236-5, Serial No. Not Available

Electrical System

Inverter, Part No. 27-06178-3, Serial No. 122-0431
Main Missile Battery, Part No. 27-06160-3, Serial No. 111-0722
Power Changeover Switch, Part No. 27-06177-3, Serial No. 106-0168

Flight Control System

Gyro Canister, Part No. 27-41002-855, Serial No. 103-0086 (332)
Rate Gyro Canister, Part No. 27-45045-5, Serial No. 112-0136 (130)
Servo Canister, Part No. 27-41000-831, Serial No. 110-0132 (259)
Programmer Canister, Part No. 27-41001-985, Serial No. 011-0040 (374)

Pneumatics System

LO2 Tank Pressure Regulator, Part No. 27-08101-43, Serial No. 205-0417
Fuel Tank Pressure Regulator, Part No. 27-08102-33, Serial No. 204-0431
LO2 Boiloff Valve, Part No. 271-501, Serial No. 1

Telemetry System

RF Canister No. 1, Part No. 27-12571-901, Serial No. 011-0009
RF Canister No. 2, Part No. 27-12572-835, Serial No. 108-0018
RF Canister No. 3, Part No. 27-12573-885, Serial No. 011-0002
RF Canister No. 4, Part No. 27-12413-815, Serial No. 207-0002
RF Canister No. 1 Battery, Part No. 27-06161-1, Serial No. 106-0296
RF Canister No. 2 Battery, Part No. 27-06161-1, Serial No. 106-0300
RF Canister No. 3 Battery, Part No. 27-06161-1, Serial No. 106-0292
Accessory Canister, Part No. 27-12581-805, Serial No. 103-0015
Switching Unit, Part No. 27-12456-1, Serial No. 4

Propellant Utilization System

Computer, Model CA-108B, Part No. 101670-2, Serial No. ACA 0096
LO2 Stillwell, Model SL-192, Serial No. ASL 0148
Fuel Stillwell, Model SF-191, Serial No. ASF 0148

Inertial Guidance System

Platform, Part No. 2-00029-005, Serial No. 721-0080
Control, Part No. 2-00031-061, Serial No. 722-053
Computer, Part No. 2-00031-539, Serial No. 723-0028
Analog Signal Converter, Part No. 2-00010-501, Serial No. 715-0047
Digital Signal Converter, Part No. 2-00012-640, Serial No. 714-0049

Mod III E Instrumentation Beacon System

Pulse Beacon, Part No. 7641086G1, Serial No. EBB01012
Rate Beacon, Part No. 7641226G8, Serial No. ECD08023

Propulsion System

Sustainer, Part No. 100116, Serial No. 222774
Booster No. 1, Part No. 100651, Serial No. 112849
Booster No. 2, Part No. 100651, Serial No. 112852
Vernier No. 1, Part No. 350300, Serial No. 332858
Vernier No. 2, Part No. 350300, Serial No. 332742

Penetration System

Pod, Mod II, Serial No. PA 01011

Re-entry Vehicle

Mark 4 Mod I, Serial No. L 24656

Scientific Passenger Pod

Pod, Serial No. 17

SIGNIFICANT DATES DURING TESTING OF "A" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
4A	12-8-56	14	3-22-57	6-3-57	6-11-57	895	Engine shut down at 29.9 seconds of flight. Missile destroyed at 50.1 seconds.
6A	4-4-57	14	8-2-57	9-20-57	9-25-57	1422	Engine shut down at 47.7 seconds of flight. Missile destroyed at 74 seconds.
12A	11-1-57	14	11-20-57	12-11-57	12-17-57	2148	Successful flight. Impacted approximately 490 nm downrange.
10A	7-18-57	12	9-27-57 10-27-57 11-6-57	*11-27-57 **12-10-57 1-4-58	1-10-58	10	Successful flight. Impacted approximately 542 nm downrange.
13A	12-4-57	14	1-17-58	***1-31-58	2-7-58	222	Engine shut down prematurely at 117.8 seconds of flight due to flight control system failure. Missile broke up at 167 seconds.
11A	12-28-57	12	1-25-58	2-8-58	2-20-58	449	Engine shut down prematurely at 124 seconds of flight due to flight control system failure. Missile broke up at 125.5 seconds.
15A	1-6-58	14	2-26-58	3-22-58	4-5-58	634	Engine shut down prematurely at 105 seconds of flight due to B1 turbopump failure. Missile remained intact and impacted approximately 200 miles downrange.
16A	2-5-58	12	3-17-58	****4-18-58 5-22-58	6-3-58	1261	Successful flight. Impacted approximately 480 nm downrange.

* Premature cutoff at 8 seconds. Both booster chambers damaged, necessitating replacement.

** Full duration, but damaged B1 chamber, necessitating replacement.

*** FRF terminated prematurely, but considered satisfactory.

**** Prematurely terminated due to APS shutdown.

SIGNIFICANT DATES DURING TESTING OF "B" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
3B	4-12-58	11	5-29-58	*6-23-58 **6-27-58 7-8-58	***7-12-58 7-19-58	1564	Missile broke up at 42 seconds of flight. Due to failure of the yaw rate gyro.
4B	5-31-58	13	6-13-58	7-15-58	8-2-58	1382	Successful flight. Impacted approximately 2345 nm downrange.
5B	5-30-58	11	7-22-58	8-20-58	8-28-58	1383	Successful flight. Impacted approximately 2853 nm downrange. First completely closed loop guidance system flight.
8B	7-31-58	14	8-4-58	9-6-58	9-14-58	1511	Successful flight. Impacted approximately 3151 nm downrange.
6B	7-17-58	13	8-14-58	9-10-58	9-18-58	1512	B1 turbopump failed at 80.8 seconds after lift-off. Missile exploded two seconds later.
9B	8-7-58	11	9-12-58 ##9-30-58	#10-4-58 ###10-26-58 ###R0-27-58	11-17-58	1513	Depletion of fuel supply caused simultaneous premature sustainer and vernier shutdown. Missile impacted 800 to 900 nm short of intended impact point. First flight of modified booster turbopumps.
12B	9-4-58	14	11-8-58	11-24-58	11-28-58	1730	Successful flight. Impacted approximately 5506 nm downrange.
10B	10-22-58	11	11-20-58	****11-29-58 ****12-10-58 12-12-58	12-18-58	1729	Successful flight. Missile placed into orbit.
13B	12-4-58	14	12-5-58	12-22-58	1-15-59	30	Flight prematurely terminated due to unexplained difficulties starti ¿ at 100 seconds after liftoff. Missile impacted 170 nm downrange. There was no telemetry system aboard this missile.
11B	8-22-58	11	12-23-58	1-20-59	2-4-59	29	Successful flight. Impacted approximately 3122 nm downrange.

* Automatic cutoff initiated by sustainer overspeed/underspeed trip 1.96 seconds after BGG links break.

** Automatic cutoff initiated by sustainer overspeed/underspeed trip 1.08 seconds after BGG links break.

*** Prematurely terminated by an automatic cutoff 4.98 seconds after BGG links break.

**** Vernier ignition only.

\# Manual cutoff at 6.69 seconds.

After installation of "C" Series power pack in Hangar "J".

Automatic cutoff initiated by sustainer overspeed/underspeed trip 1.0 seconds after BGG links break.

Full duration, but engine compartment fire delayed schedule approximately 10 days.

SIGNIFICANT DATES DURING TESTING OF "C" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
3C	10-31-58	12	11-4-58 *11-25-58	12-17-58	12-23-58	2501	Successful flight. Impacted approximately 3803 nm downrange.
4C	11-9-58	12	1-6-59	1-19-59	1-27-59	10	Although impact was close to intended point, the guidance system did not function.
5C	1-31-59	12	2-4-59	None	2-20-59	251	Missile exploded at 174 seconds due to a malfunction at staging. Probable cause was improper operation of the fuel staging valve.
7C	2-12-59	12	2-23-59	None	3-18-59	761	Booster engine shutdown prematurely at 131 seconds of flight. Missile was unstable for remainder of flight.
8C	5-7-59	12	5-11-59	**5-22-59 **7-9-59	#7-15-59 7-21-59	2103	Successful flight. Impacted in target area 4385 nm downrange. RVX-2 Re-entry Vehicle recovered.
11C	7-15-59	12	7-25-59	8-14-59	8-24-59	2121	Successful flight. Impacted almost 5 miles long in MILS net due to residual thrust after vernier cutoff. Re-entry vehicle was recovered.

* After power pack modification.

** Two successful Flight Readiness Firings performed.

\# Ignition achieved twice. Manual cutoff for 1st. attempt in vernier ignition phase. Second attempt terminated by release timer.

SIGNIFICANT DATES DURING TESTING OF "D" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
3D	2-25-59	13	2-27-59	3-27-59	4-14-59	1002	Booster section exploded 27 seconds after liftoff due to failure of airborne LO2 fill and drain valve to close. Missile destroyed at 37 seconds.
7D	3-20-59	14	4-13-59	5-8-59	*5-15-59 5-18-59	1754	Missile exploded at 65 seconds due to improper launcher operation which resulted in loss of fuel tank pressure.
5D	3-8-59	13	4-28-59	5-15-59	6-6-59	1753	Missile exploded at 160 seconds due to a malfunction at staging. Probable cause was improper operation of the fuel staging valve.
11D	4-10-59	11	5-11-59	**7-14-59 7-22-59	7-28-59	2002	Successful flight. Impacted 4384 nm downrange less than 1/2 mile from target in MILS net.
14D	5-7-59	13	6-10-59	7-28-59	8-11-59	2003	Successful flight. Impacted in MILS net less than 1 mile from target.
17D	5-27-59	13	6-17-59	9-9-59	9-16-59	2106	Successful flight. Impacted 2 miles short of target in MILS net due to failure of vernier solo hydraulic package.
18D	5-27-59	11	9-2-59	None	10-6-59	2120	Successful flight. Impacted in MILS net less than 1/2 mile from target.
22D	8-26-59	13	9-21-59	None	10-9-59	3505	Successful flight. Impacted in MILS net less than 1 1/2 miles from target.
26D	9-18-59	11	10-8-59	None	10-29-59	2344	Due to malfunction of V2 engine at staging, impacted approximately 14 miles short of target point.
28D	9-18-59	13	10-14-59	None	11-4-59	4203	Unsuccessful. A/B IP failure prevented Station 5 IP system from acquiring the missile. Range safety cutoff caused R/V to impact approximately 260 miles short of target.
15D	5-9-59	11 14 13	7-11-59 9-23-59 11-7-59	None	11-24-59	2105	Successful although re-entry vehicle did not seperate. Impacted in MILS net.
31D	10-10-59	13	11-28-59	None	12-8-59	4205	Successful flight. Impacted 1/2 mile from target in MILS net.

SIGNIFICANT DATES DURING TESTING OF "D" SERIES FLIGHT MISSILES AT AMR (Cont'd)

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Report No.	Comments
40D	11-20-59	13	12-10-59	None	12-18-59	16	Successful flight. Delivered a Mk-2 Re-entry Vehicle within 3 nm of target over a 5500 nm range.
43D	12-8-59	13	12-22-59	None	1-6-60	32	Successful flight. Delivered a Mk-3 Re-entry Vehicle within 3 miles of target over a 5500 nm range.
44D	12-17-59	13	1-11-60	None	1-26-60	54	Successful flight. RVX4-A2 Re-entry Vehicle impacted approximately 1/2 mile from target in MILS net.
49D	1-5-60	13	1-28-60	None	2-11-60	320	Successful flight. Mk-3 Re-entry Vehicle impacted less than 1 1/2 nm from target over a 5500 nm range.
42D	12-5-59	11	12-21-59	#2-4-60 2-23-60	##3-4-60 3-8-60	17	Successful flight. First missile to use all-inertial guidance system open loop.
51D	1-29-60	13	2-15-60	None	3-10-60	775	Destroyed by fire and explosion immediately after liftoff.
48D	2-19-60	11	3-10-60	None	4-7-60	301	Destroyed in the stand by fire and explosion during a launch attempt.
56D	3-3-60	12	4-11-60	None	####5-12-60 5-20-60	1885	Successful flight. Delivered Mk-3 Re-entry Vehicle within 4 nm of target over an extended range of 7859 nm.
54D	2-25-60	11	5-13-60	None	6-11-60	615	Successful flight. Delivered Mk-3 Re-entry Vehicle 4306 nm downrange within 2.2 nm of target. First flight with AIG system providing active guidance functions.
62D	4-19-60	14	5-26-60	None	6-22-60	801	Impacted approximately 18 nm long due to failure of the vernier engines to shutdown when the guidance cutoff discrete was received.
27D	5-27-60	12	6-4-60	None	6-27-60	1002	Successful flight. Impacted within 1 nm of target in MILS net 4383 nm downrange.
60D	4-5-60	11	6-14-60	None	7-2-60	803	Inadvertent pressurizations of the engine tanks caused premature depletion of control helium. Re-entry vehicle impacted 40 nm short.
32D	6-22-60	12	7-1-60	None	####2-8-60 8-9-60	1003	Successful flight. Impacted within 4 nm of target in South Atlantic Ocean over the intermediate range of 6350 nm.

SIGNIFICANT DATES DURING TESTING OF "D" SERIES FLIGHT MISSILES AT AMR (Cont'd)

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
66D	6-14-60	11	7-7-60	None	8-12-60	1004	Successfully impacted re-entry vehicle within 2 nm of target. First Atlas to use AIG system with impact programmed for Station 12 MILS net.
76D	7-6-60	11	8-15-60	None	9-16-60	2817	Successfully placed RVX-2A Re-entry Vehicle within 5 nm of target. Second Atlas to use AIG System with impact in Station 12 MILS net.
79D	7-13-60	14	8-26-60	None	***9-15-60 9-19-60	832	Successful flight. Second Atlas to deliver a Mark 3 Re-entry Vehicle to target over an extended range of 7863 nm.
71D	8-19-60	11	9-26-60	None	10-13-60	1582	Successful flight. Impacted within 2 nm of target 4387 nm downrange. Last D-AIG Missile to be flight tested. RVX-2A Re-entry Vehicle recovered.
55D	2-27-60	12	3-7-60 5-24-60 10-3-60	None	10-22-60	613	Successful flight. Impacted within 1 nm of target 6350 nm downrange. The missile was flown without insulation and insulation bulkhead at the intermediate bulkhead with no adverse results.
83D	10-6-60	12	10-27-60	None	11-15-60	3503	Successful flight. Impacted less than 1 nm from target 4388 nm downrange. Data cassette recovered.
90D	12-14-60	12	12-20-60	None	1-23-61	3505	Successful flight. Last of "D" Series Weapon System flights. Impacted Mk-3 Mod 1B Re-entry Vehicle within 1/2 nm of target 4394 nm downrange.

* Launch aborted due to faulty release timer which initiated automatic cutoff.

** Test terminated by sustainer rough combustion cutoff circuitry.

*** Launch aborted 5.45 seconds after sustainer flight lockin because no release signal was generated.

\# Rerun due to Guidance System difficulties.

\## Engine cutoff prior to release due to erroneous callout in blockhouse.

\### Terminated by erroneous output from B2 primary RCC accelerometer.

\#### Terminated 1.53 seconds after sustainer flight lockin by the sustainer RCC system.

SIGNIFICANT DATES DURING TESTING OF "E" SERIES FLIGHT MISSILES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
3E	5-19-60	13	7-29-60	*9-23-60 10-3-60	10-11-60	1502	Malfunction in sustainer hydraulic system caused loss of missile after staging.
4E	7-15-60	13	10-21-60	None	11-29-60	2800	Sustainer hydraulic pressure was lost at 41 seconds and caused missile to become unstable at booster cutoff. Sustainer thrust was lost at about 150 seconds.
8E	10-25-60	13	12-5-60	None	1-24-61	3504	Missile stability was not maintained after 161.8 seconds due to loss of engine servo control in flight control system. Sustainer engine shutdown at 249 seconds.
9E	11-11-60	13	1-30-61	None	2-24-61	3803	Successful flight. Impacted Mark 3 Mod II B Re-entry Vehicle within 600 yds. of aim point.
13E	1-13-61	13	2-27-61	None	3-13-61	403	Malfunction in PU system caused fuel depletion and premature shutdown of sustainer engine at 252 seconds.
16E	3-10-61	13	3-14-61	None	3-24-61	811	Failed to jettison the booster section because of premature depletion of engine control bottle helium pressure.
12E	12-20-60	11	2-16-61	None	5-12-61	404	Successful flight. Impacted Mark 5 Mod I Reentry Vehicle within 0.5 mile of target at a range of 4388 miles. First "E" Series from Complex 11.
18E	3-30-61	13	4-5-61	None	5-26-61	813	Successful flight. Impacted Mark 4 Mod IV Re-entry Vehicle 1 mile of target at a range of 4388 nautical miles. First "E" Series missile flown without insulation and insulation bulkhead at the intermediate bulkhead with no adverse results.
17E	3-21-61	11	5-18-61	None	6-22-61	812	Unsuccessful flight. Malfunction in the Flight Control System caused loss of missile after 101 seconds.

* B2 lube oil pump shaft sheared. Test duration 14 seconds.

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
22E	6-4-61	13	6-14-61	None	7-6-61	1251	First "E" Series missile to be successfully flown to a maximum range target of 7863 nautical miles with impact within 2.1 nautical miles of target.
21E	6-24-61	11	7-5-61	None	7-31-61	1360	Impacted a Mark 5 Mod I Re-entry Vehicle within 3.1 nautical miles of target at a range of 4388 nautical miles.
26E	7-7-61	13	8-9-61	None	9-8-61	1803	Flight prematurely terminated when the sustainer engine shut down during booster jettison sequence. Operation of all other systems was satisfactory.
25E	7-18-61	11	8-14-61 9-7-61*	None	10-2-61	1252	Impacted a Mark 5 Mod I Re-entry Vehicle within 1.5 nautical miles of target. A scientific passenger pod containing Centaur Guidance System was carried for the first time. * Re-erected after complex modification to "F" Series.
30E	8-22-61	13	9-12-61	None	10-5-61	1804	Fourteenth "E" Series missile to be flight tested at AMR. First flight for a Mark 4 Re-entry Vehicle to a long range target of 7539 nautical miles. All prime objectives were satisfied.
32E	10-5-61	13	10-9-61	None	11-10-61	3203	Unsuccessful flight due to a premature shutdown of the sustainer engine. Missile was destroyed by Range Safety Officer at 35 seconds.
35E	10-17-61	13	11-10-61	None	12-1-61	5462	Sixteenth "E" Series missile to be flight tested at AMR. Successfully impacted Mark 4 Mod 4 Re-entry Vehicle within 2.1 nautical miles of target.
36E	11-22-61	13	12-2-61	None	12-19-61	5464	Impacted a Mark 5 Mod 1A Re-entry Vehicle within 1.2 nautical miles of target at a range of 6000 nautical miles in the Mid Ocean Target Array.
40E	12-15-61	13	12-27-61	None	2-13-62	101	Eighteenth "E" Series missile to be flight tested at AMR. Successfully impacted a Mark 4 Mod 2A re-entry vehicle at a range of 6000 nautical miles in the Broad Ocean Area within 0.75 nautical miles of target. Re-entry vehicle data cassette was not recovered.

SIGNIFICANT DATES DURING TESTING OF "F" SERIES FLIGHT MISSILES AT AMR

MISSILE	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
2F	7-2-61	13	7-12-61	None	8-8-61	1805	First "F" Series Missile to be flight tested. Impacted Mark 5 Mod I Re-entry Vehicle 4388 nautical miles within 2.1 nautical miles of aim point.
4F	8-12-61	11	10-6-61	None	11-25-61	3751	Impacted a Mark 5 Mod 2 Re-entry vehicle within 1.2 nautical miles of target at a range of 4,388 nautical miles. First flight with dual Scientific Passenger Pods on board.
5F	9-15-61	11	11-24-61	None	12-12-61	3752	Unsuccessful flight. Guidance computer failure resulted in premature command shutdown of the sustainer and vernier engines. Operation of all other systems was satisfactory.
6F	12-2-61	11	12-13-61	None	12-20-61	4501	Unsuccessful flight. Loss of sustainer hydraulic pump inlet pressure and vernier return pressure at staging resulted in loss of missile stability at 226 seconds.
11F	3-13-62	11	3-15-62	None	4-9-62	71	Unsuccessful flight. Failure of the sustainer during engine start resulted in missile self-destruction shortly after liftoff.
7F	12-20-61	11	1-4-62 7-14-62*	None	8-13-62	102	Impacted a Mark 4 Mod 4 re-entry vehicle within 2 nautical miles of aim point at a range of 4388 nautical miles.

* Erected second time due to telemetry modifications on 7F in San Diego.

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
10D	4-10-59	14	6-2-59 7-22-59*	9-3-59	9-9-59	2119	Successful flight although booster section failed to jettison. Project Mercury Capsule recovered.
50D	5-17-60	14	6-30-60	7-21-60	7-29-60	1505	Unsuccessful. Missile apparently destroyed after 60 seconds of flight. Mercury Capsule remained intact until impact.
67D	7-8-60	14	11-4-60	11-19-60	2-21-61	419	Successful MA-2 mission. Impacted Mercury Capsule as planned. First closed loop flight for ASIS. Capsule recovered.
100D	3-14-61	14	3-27-61	None	4-25-61	835	Unsuccessful. Missile was destroyed by range safety action 40 seconds after lift-off. This action was necessitated by the absence of the roll and pitch-over maneuvers.
88D	7-16-61	14	7-19-61	None	9-13-61	1254	Flight was successful. Capsule was placed in orbit; after one scheduled orbit capsule was recovered east of Bermuda. All objectives were satisfied.
93D	8-12-61	14	10-6-61	None	11-29-61	1810	Successfully placed a Mercury Capsule, containing a chimpanzee, into orbit. After two of three planned orbits the capsule was successfully recovered in the planned recovery area near Bermuda.
109D	11-30-61	14	12-2-61 12-20-61**	None	2-20-62	5460	Successfully placed a Mercury Capsule, containing an Astronaut, into orbit. The capsule, after completing three orbits, landed within visual range of a destroyer and was successfully recovered.

* Returned to hangar for booster power package replacement.
** Returned to hangar to facilitate work on launcher heads.

SIGNIFICANT DATES DURING TESTING OF MERCURY/ATLAS VEHICLES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
107D	3-8-62	14	3-14-62	None	5-24-62	65	Successfully placed a Mercury capsule, containing an Astronaut, into orbit. The capsule, after completing three orbits, landed 250 miles down range of the planned area. The Astronaut and capsule were successfully recovered.

SIGNIFICANT DATES DURING TESTING OF MIDAS VEHICLES AT AMR

Month	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
2SD	10-10-59	14	1-18-60	None	2-26-60	304	MIDAS I Booster shot. Atlas portion of flight was successful.
4SD	1-26-60	14	3-3-60	None	5-24-60	619	MIDAS II Booster shot. Atlas portion of flight completely successful.

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SIGNIFICANT DATES DURING TESTING OF RANGER VEHICLES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
111D	5-27-61	12	5-29-61	None	8-23-61	5050	Atlas/Agena Booster portion of flight was successful. Agena spacecraft orbit was not satisfied due to a malfunction in upper stage operation.
117D	9-17-61	12	9-19-61	None	11-18-61	4507	Atlas/Agena Booster portion of flight was successful. Agena spacecraft orbit was not satisfied due to a malfunction in upper stage operation.
121D	12-19-61	12	12-21-61	None	1-26-62	125	Primary objective to place Ranger Spacecraft into a moon collision orbit was not satisfied due to an Atlas Guidance System failure. Due to excessive velocity being imparted to the spacecraft, it passed the moon at a distance of approximately 22,000 miles and went into a solar orbit. Operation of all other systems was satisfactory.
133D	3-15-62	12	3-19-62	None	4-23-62	821	The primary objective to place the Ranger 4 Spacecraft into a moon collision trajectory was accomplished and the spacecraft impacted the moon. All Atlas Systems performed satisfactorily.

SIGNIFICANT DATES DURING TESTING OF MARINER VEHICLES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
145D	6-9-62	12	6-12-62	None	7-22-62	2900	The primary objective to place the Spacecraft in the vicinity of Venus was not accomplished. The missile was destroyed by Range Safety action after 294 seconds, due to trajectory deviation which occurred as a result of an error in the guidance equations.
179D	6-18-62	12	7-24-62	None	8-26-62	3731	The spacecraft was injected successfully into an orbit well within its midcourse correction capability to achieve the Venus flyby. During boost phase, loss of vernier engine No. 2 pitch-roll control resulted in 35 roll revolutions before the vehicle was stabilized. This anomaly had apparently little effect on the resulting space-craft trajectory.

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SIGNIFICANT DATES DURING TESTING OF ATLAS/ABLE LUNAR PROBES AT AMR

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
9C	4-4-59	12	4-15-59 *8-17-59	9-24-59		2944	Destroyed by fire and explosion following premature cutoff during flight readiness firing.
20D	9-10-59	14	10-19-59	None	11-26-59	4122	Atlas/Able IV Lunar Probe. Atlas portion of flight was successful. Portions of Able failed at 47 seconds.
80D	8-13-60	12	9-2-60	None	9-25-60	2801	Atlas/Able V Lunar Probe. Atlas portion of flight was successful. Second stage engine operation unsatisfactory.
91D	10-15-60	12	11-17-60	None	12-15-60	4508	Unsuccessful. Flight was terminated after 74.5 seconds when the vehicle destroyed itself.

* Erected twice due to cancellation of test and subsequent return to hangar for storage.