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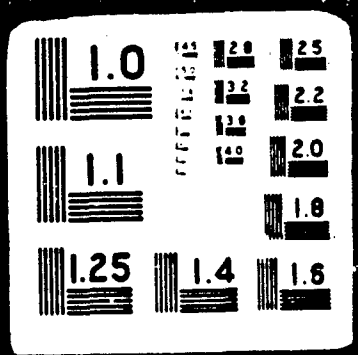

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AA 61-0146
12 October 1961

WS 107A-1 FLIGHT TEST WORKING GROUP

FLIGHT TEST REPORT

ATLAS MISSILE 30E

5 October 1961

Log No. T 61-2722 Copy No. 47

AMR RANGE TEST NUMBER 1804

ASTRONAUTICS TEST NUMBER P3-501-00-30

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FOREWORD

This report has been prepared to present preliminary information relative to the flight of Atlas Missile No. 30E. 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 WS 107A-1 Flight Test Working Group.

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SUMMARY

Atlas Missile 30E, the 14th "E" Series missile to be flight tested at AMR, was launched from Complex 13 at 0842 EST on 5 October 1961. The flight was successful and the Mark 4 Mod 1B Re-entry Vehicle impacted in the Indian Ocean target area at a range of 7,539 nautical miles. The ejectable data cassette was successfully recovered.

This was the first flight for the Mark 4 Re-entry Vehicle to a long range target. The prime objectives of the flight, which were to evaluate re-entry vehicle performance under conditions of maximum heating resulting from the flattened trajectory, and to demonstrate the long range capability of the "E" Series missile, were satisfied.

Performance of all missile systems was satisfactory.

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FLIGHT TEST OBJECTIVES

The primary purposes of this flight were to evaluate re-entry vehicle performance under conditions of extreme heating and to demonstrate the satisfactory performance of the airframe using a flattened trajectory.

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

OBJECTIVES	ORDER	YES	NO	PART	COMMENT
1 - First Order 2 - Second Order 3 - Third Order					
1. Obtain data on the repeatability of all* missile systems and associated GSE.	2	X			
2. Evaluate the performance of the re-entry vehicle when subjected to conditions of extreme heating.	1	X			
3. Determine the performance of the arming and fuzing system.	1	X			
4. Demonstrate the satisfactory performance of the airframe using a flattened trajectory.	1	X			
5. Evaluate the performance of the Acoustica PU System.	1	X			
6. Obtain spectrographic and infra-red data during the re-entry phase.	2		X		Range support not available.
7. Determine lateral drift during liftoff.	2	X			

* Except vernier solo operation.

FLIGHT TRAJECTORY DATA

Atlas Missile 30E was planned for a range of approximately 7539 nautical miles downrange with impact in the Indian Ocean at 38.2° S latitude and 34.0° E longitude.

A tabulation of miss-distances and a comparison of nominal flight performance parameters from Flight Trajectory Simulation Case E - XIII, 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 the impact predictions.

NOTE: All times in this report are based on range zero time which occurred at 0842:37 EST. One Inch Motion occurred at 0842:37.12 EST.

Source	Miss Distance	95% Confidence Limits
Mod III Impact Prediction	3.50 nm Long 9.40 nm Left	13.86 nm x 6.46 nm at 95°T
Mod III/Guidance Velocity Comparison @ VCO	2.56 nm Long 5.86 nm Left	-
Azusa Impact Prediction	19.63 nm Long 4.05 nm Left	1.44 nm x 0.14 nm at 93°T

Item	Unit	Nominal	Measured
Liftoff Weight	lbs	266,033	-
Pitch Plane Azimuth	deg	111.9	111.9
BCO Weight	lbs	68,256	-
BCO Velocity	ft/sec	8955	8935
BCO Altitude	ft	195,178	199,106

Item	Unit	Nominal	Measured
BCO Range	nm	42.2	42.5
BCO Time	sec	123.1	124.8
SCO Weight	lbs	11,921	-
SCO Velocity	ft/sec	23,146	23,116
SCO Altitude	ft	723,644	739,777
SCO Range	nm	452.1	443.2
SCO Time	sec	306.9	304.7
VCO Weight	lbs	11,921	-
VCO Velocity	ft/sec	23,146	23,116
VCO Altitude	ft	723,644	739,777
VCO Range	nm	452.1	443.2
VCC Time	sec	306.9	304.7
Impact Time	sec	2771.7	2786.9
Impact Range	nm	7539	7543
Impact Latitude (Geodetic)	deg S.	38.20	38.05
Impact Longitude (Geodetic)	deg E.	34.00	34.09

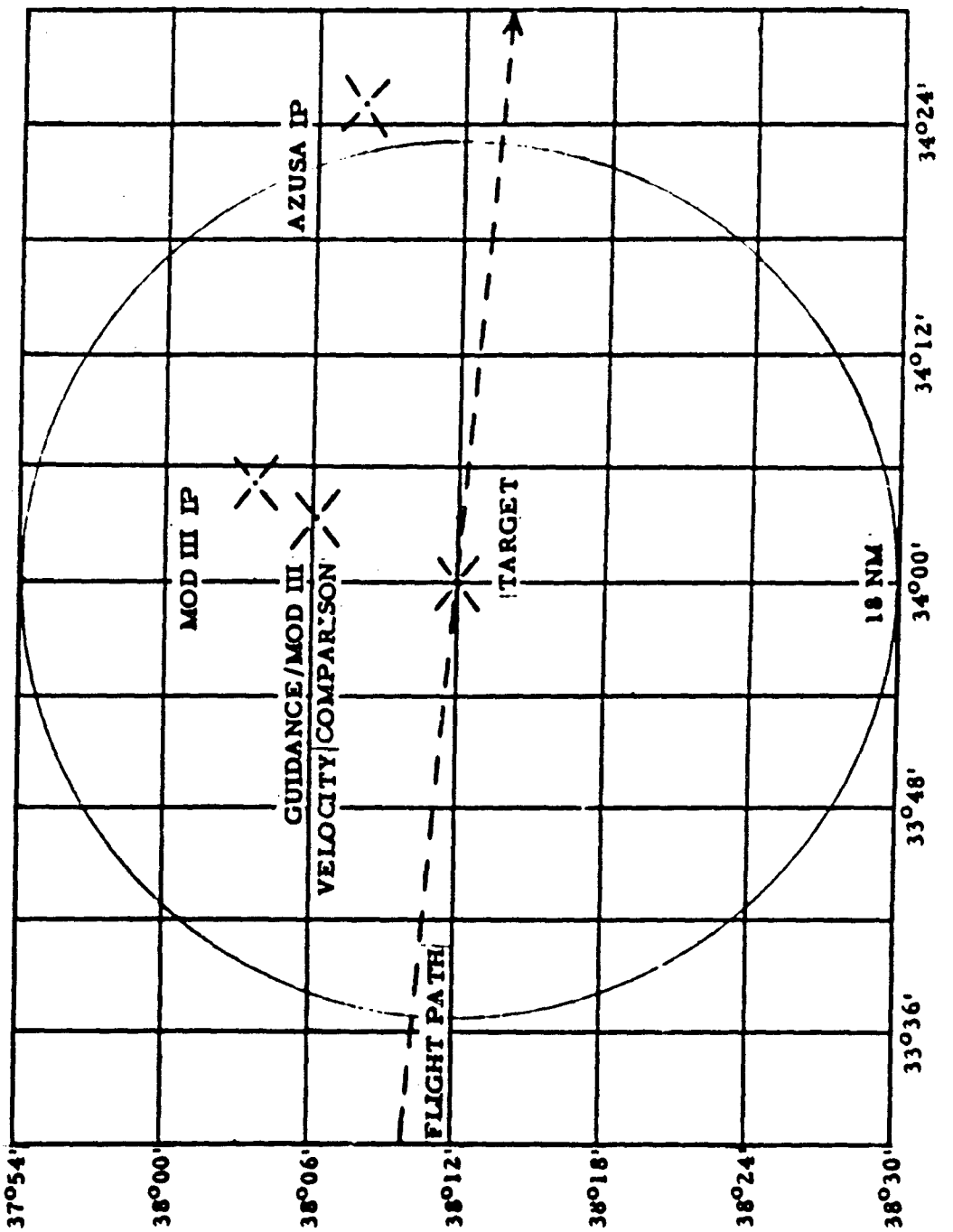
NOTE: Nominal times are corrected for the difference between range zero and one inch motion. Measured velocity, altitude, and range at booster, sustainer, and vernier cutoffs are from Azusa revised data. Impact range and co-ordinates are taken from Mod III data. Measured times are taken from telemetry recordings of discrete generation.

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.

IMPACT POINT COMPARISON



FIGURE

SYSTEM PERFORMANCE

AIRFRAME

Missile structural integrity was satisfactorily maintained throughout powered flight and well beyond re-entry vehicle separation. Booster separation appeared satisfactory as indicated by measurement M 32 X, Conax Valve Command, and Flight Control data. Re-entry vehicle separation was satisfactorily accomplished as recorded by measurement Y 1 X, Separation Signal.

Missile 30E was the first hard stripped, maximum heat type missile to be flight tested at AMR. The missile was stripped of equipment not absolutely necessary for accomplishing the primary objectives and maintaining range safety. The equipment removed from this missile included two telemetry packages, strobe light, the vernier LO2 and fuel solo tanks and associated plumbing, and the vernier solo accumulator. The insulation bulkhead was also deleted.

This missile was instrumented for measuring axial acceleration and temperature in the thrust section. Measurement U 101 A, Axial Acceleration, provided valid data. Satisfactory operation of the retro-rockets was indicated by this measurement. The axial acceleration at BCO was 6.84 G and 6.73 G at SCO/VCO.

Measurement P 671 T, Thrust Section Ambient, Quadrant 4, provided data that compared well with the information received on previous flights. The temperature rose to 95°F at BCO from 82°F at liftoff. The temperature at SCO was 154°F.

PROPULSION SYSTEM

Performance of the MA-3 Propulsion System was satisfactory throughout the flight. Engine thrust rise and decay were normal. Sustainer engine delay time was 550 milliseconds.

A trailing wire umbilical was added to this missile to evaluate propulsion parameters during the first 40 feet of rise. B1 and B2 LO2 dome accelerations were 10 G's and 15 G's at liftoff and 29 G's and 23 G's at 2.6 seconds. Sustainer accelerometer data was not valid. The B2 LO2 pump Inlet Pressure (Measurement Number P 1003 P) indicated two transient peaks of 170 and 150 pounds at 0.3 and 0.8 seconds prior to liftoff. Valid data for comparison has not been acquired from previcus "E" Series flights.

B1 Pump Speed (Measurement P 84 B) indicated approximately 1000 rpm below normal throughout engine operation. Since other parameters indicated normal engine operation the B1 pump speed measurement was considered qualitative only.

There was no vernier solo operation planned on this flight and sustainer and vernier cutoff was effected simultaneously. Vernier chamber pressures remained nearly constant throughout the flight without the step increase that normally occurs when the vernier tanks are pressurized at BCO. As there were no vernier propellant tanks aboard this missile the vernier tank fill flow requirement was eliminated thus allowing nearly constant propellant flow rates to the vernier engines throughout the flight. Between 171 and 208 seconds V2 Chamber Pressure (P 29 P) showed a gradual decrease from 378 psia to 358 psia. Since the chamber pressure was the only vernier engine function monitored, it is not known whether this was an instrumentation anomaly or an actual change in chamber pressure.

Time slices of Propulsion System Data are shown in the following tabulations.

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/VCO
Booster Engines							
P 155 P	B1GG Combustor	psia	468*	-	440	450	-
P 184 P	B2GG Combustor	psia	469*	-	450	460	-
P 713 T	B1GG Combustor Temp	dgf	1202*	-	1233	1339	-
P 714 T	B2GG Combustor Temp	dgf	1203*	-	1250	1374	-
P 473 P	B1 Lo Pr Lube Oil Man	psia	-	-	126	109	-
P 279 P	B2 Lo Pr Lube Oil Man	psia	-	-	124	121	-
P 1001 P	B1 LO2 Pump Inlet	psia	-	***	-	-	-
P 1003 P	B2 LO2 Pump Inlet	psia	-	67	-	-	-
P 1020 T	B1 LO2 Pump Inlet Temp	dgf	-	-289	-	-	-
P 1054 T	B2 LO2 Pump Inlet Temp	dgf	-	-287	-	-	-
P 1002 P	B1 Fuel Pump Inlet	psia	-	69	-	-	-
P 1004 P	B2 Fuel Pump Inlet	psia	-	68	-	-	-
P 84 B	B1 Pump Speed	rpm	6200*	-	**	**	-
P 83 B	B2 Pump Speed	rpm	6137*	-	6164	6280	-

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/VCO
P 39 P	B1 Fuel Pump Disch	psia	835*	-	750	820	-
P 38 P	B2 Fuel Pump Disch	psia	830*	-	780	810	-
P 91 P	B1 LO2 Inj Man	psia	677	-	650	680	-
P 92 P	B2 LO2 Inj Man	psia	677	-	660	700	-
P 60 P	B1 Thrust Chm	psia	582*	-	560	576	-
P 59 P	B2 Thrust Chm	psia	575*	-	560	584	-
P 1711 T	B1 Nacelle Ambient	dgf	-	57	-	-	-
P 1712 T	B2 Nacelle Ambient	dgf	-	73	-	-	-
P 1091 P	B1 LO2 Inj	psia	677	675	-	-	-
P 1092 P	B2 LO2 Inj	psia	677	630	-	-	-
P 1093 P	B1 Fuel Inj	psia	709	715	-	-	-
P 1094 P	B2 Fuel Inj	psia	709	752	-	-	-
Sustainer Engine							
P 337 P	SGG LO2 Inj Man	psia	850	-	870	840	850
P 709 T	SGG Combustor Temp	dgf	1052	-	***	***	***

PROPULSION SYSTEM TIME SLICE DATA

Measurement No.	Description	Units	Nominal Value	L/L at Liftoff	TLM After Liftoff	TLM Prior to BCO	TLM Prior to SCO/VCO
P 341 P	S Lube Oil Man	psia	-	-	675	645	630
P 56 P	S LO2 Pump Inlet	psia	-	-	73	109	79
P 530 T	S LO2 Pump Inlet Temp	dgf	-	-	-291	-286	-286
P 349 B	Sus Pump Speed	rpm	9950	-	10200	10160	10310
P 529 D	S Main LO2 Valve	deg	-	-	37.7	36.7	30.0
P 830 D	PU Valve	deg	-	-	29.5	27.5	41.0
P 330 P	S Fuel Pump Disch	psia	1000	-	***	***	***
P 351 P	S LO2 Inj Man	psia	806	-	810	810	790
P 6 P	S Thrust Chamber	psia	689*	-	690	690	690
P 1710 T	S Eng Environment	dgf	-	90	-	-	-
Vernier Engines							
P 1474 P	Vern Ctl Press Reg Out	psia	605	588	-	-	-
P 28 P	V1 Thrust Chamber	psia	355/305	-	359	359	363
P 29 P	V2 Thrust Chamber	psia	355/305	-	370	370	346

PROPULSION SYSTEM TIME SLICE DATA

Measurement No.	Description	Units	Nominal Value	L/L at Liftoff	TLM After Liftoff	TLM Prior to BCO	TLM Prior to SCO/VCO
Miscellaneous							
P 1325 T	Eng Comb Amb	dgf	-	89	-	-	-
P 671 T	Thrust Section Ambient	dgf	-	-	91	>1	149

* Final Acceptance Test values from engine log.
** Data qualitative only.

*** Data invalid.

PROPELLANT UTILIZATION

Operation of the Acoustica Propellant Utilization (PU) System was satisfactory. The PU valve responded correctly to the error signal and the Head Suppression Valve was also positioned properly. Significant PU System Parameters are shown in the following tabulation.

Station	Fuel Sensor Uncovering	LO2 Sensor Uncovering	Error Time	Corrected PU Valve Position
1	7.35	8.50	1.15	21.5°
2	47.55	47.55	0.00	47.0°/27.5°
3	86.26	86.35	1.09	21.5°
4	116.36	116.73	0.37	25.0°
5	202.85	203.52	0.67	26.0°
6	258.03	255.18	2.85	38.0°

As noted above the LO2 and fuel sensors at Station 2 uncovered at the same time. This simultaneous sensor uncovering was interpreted by the system as a LO2 only sensor uncovering. In response to this indication the computer set the PU valve at the open limit until automatic monostable reset. When the monostable reset without seeing a fuel sensor uncovering the computer automatically programmed the PU valve to the nominal position until Station 3 sensor signals were received.

Residuals determined by various methods were as follows:

Method	Flow Rates Used (lbs/sec) LO2	Fuel	Residuals (lbs) LO2	Fuel
Head Sensing Ports uncovering and engine acceptance data with corrected flow rates	178.2	89.8	660	200

Method	Flow Rates Used (lbs/sec) LO2	Fuel	Residuals (lbs) LO2	Fuel
Head Sensing Ports uncovering and flow rates between PU Stations 5 and 6 corrected for changes in valve angle at Station 6	185.2	80.2	547	259
Head Sensing Ports uncovering and flow rates between PU Station 6 and ports uncovering	186.6	94.3	581	167
PU Station 6 uncovering and engine acceptance data with corrected flow rates	184.3	87.8	768	346
PU Station 6 uncovering and flow rates between PU Stations 5 and 6 corrected for change in valve angle at Station 6	181.6	89.2	932	404

As can be seen, some discrepancies exist between the various methods of computation.

The following constants were applicable for this flight:

Acoustica Computer CA-108B (5 card) Serial No. 0114
LO2 Stillwell Model No. SL-192 ("F" Series)
Fuel Stillwell Model No. SF-191 ("F" Series)

PU Valve Angles:

Lower Limit	21.4 degrees
Nominal	27.5 degrees
Upper Limit	46.5 degrees

PNEUMATIC SYSTEM

Performance of the Pneumatic System was satisfactory. Missile tank pressures were normal prior to engine start and were satisfactorily maintained throughout the flight. This was the third "E" Series missile to be flight tested without the insulation bulkhead between the missile tanks. There were no adverse effects noted as a result of this configuration. F and G pneumatic regulators were utilized on this flight and operated satisfactorily.

LO2 and fuel tank pressures were satisfactorily regulated within booster phase specification of 23 to 25.5 psig and 57.0 to 62.0 psig, respectively. LO2 boiloff maintained LO2 tank pressure at 24 psig during sustainer phase and well beyond re-entry vehicle separation. Fuel tank pressure started to decay after the regulator was jettisoned with the booster section, and reached 40 psig by SCO/VCO. Tank pressures and trends were similar to those observed on Missiles 22E and 18E, the two previous "E" Series flights, without insulation at the intermediate LO2/fuel tank bulkhead. Fuel tank pressures were from 8 to 10 psi lower by SCO without bulkhead insulation as compared to "E" Series flights with bulkhead insulation.

Booster tank helium bottles Measurements F 246 P and F 247 T reflected normal pressure and temperature decreases during booster phase. Bottle pressure at booster jettison was 650 psig.

Sustainer controls helium bottle discharge pressure remained steady during booster phase at 2925 psia and supplied adequate pressure for activation of the separation mechanism at the time of booster section jettison. Pressure remained at approximately 2840 psia during sustainer phase. Since there was no vernier engine solo operation on this flight, bottle pressure did not drop after sustainer engine cutoff.

PNEUMATIC SYSTEM TIME SLICE DATA

Measurement No.	Description	Units	Landline	After Liftoff	Prior to BCO	Prior to SCO/VCO
F 1001 P	LO2 Tank Helium	psia	39.6	39	24	24
F 1003 P	Fuel Tank Helium	psia	74.7	74	60	40
F 1246 P	B Tk He Bottles Hi	psia	2969	2654	729	-
F 247 T	B Tk He Bottles	°F	-	-330	-378	-
F 115 T	LO2 Press Reg Inlet	°F	-	139	248	-
F 1145 P	S Ctls He Btl Disch	psia	2985	2923	2860	2817
F 1050 P	PCU LO2 Sensor Line	psia	38.7	-	-	-
F 1047 P	PCU LO2 Sensor Line	psia	76.8	-	-	-
F 1194 P	Facility GN2 Supply	psia	1897	-	-	-

HYDRAULIC SYSTEMS

Performance of the Hydraulic Systems was satisfactory. Booster and sustainer/vernier system pressure were properly maintained throughout flight. There was no vernier solo accumulator on this missile as no vernier engine solo operation was required. All high and low pressure system instrumentation yielded valid data and indicated satisfactory operation.

Booster and sustainer hydraulic pressures rose from ground levels of 1960 psia and 1955 psia at engine start to stable flight pressures of 3080 psia and 3000 psia respectively. The booster and sustainer low pressure systems remained between 90 and 100 psia throughout flight.

HYDRAULIC SYSTEMS TIME SLICE DATA

Measurement No.	Description	Units	Landline	+5 After Liftoff	+123 Prior to BCO	+303 Prior to SCO/VCO
H 33 P	B1 Hyd Accumulator	psia	-	3080	3080	-
H 224 P	B Hyd Sys Lo Press	psia	-	88	92	-
H 140 P	Sus/Vern Hyd Press	psia	-	3010	3010	3010
H 191 P	S Hi Press to Manifold	psia	-	2988	2988	2988
H 130 P	S Hyd Pump Disch	psia	-	3007	3007	3007
H 185 P	S Hyd Pump Inlet	psia	-	90	99	99
H 212 P	Vernier Return	psia	-	90	92	92

MISSILE ELECTRICAL SYSTEM

Operation of the Missile Electrical System was satisfactory. All parameters remained within specification throughout flight. Normal transients, reflecting changing load conditions, were evident during flight.

Main missile battery voltage remained between 27.9 and 29.2 vdc. The inverter frequency remained between 399.4 and 400.0 cps. Phase A and Phase C voltages varied between 114.3 and 115.1 vac and between 113.4 and 114.8 vac respectively.

RANGE SAFETY COMMAND SYSTEM

Operation of the Range Safety Command System was satisfactory. Telemetered RF input/AGC data indicated adequate signal strength to ensure proper operation of the system until well beyond nose cone separation. The Automatic Sustainer Cutoff (ASCO) signal and the Manual Fuel Cutoff (MFCO) signal were satisfactorily generated and transmitted by the ground equipment and properly received and decoded at the missile. It could not be determined whether the guidance sustainer cutoff discrete or the ASCO signal initiated cutoff. The ASCO signal was decoded at 304.808 $\pm$0.10 seconds. The MFCO signal had been requested for 350 seconds and was decoded at 351.234 $\pm$0.10 seconds.

AZUSA SYSTEM

Operation of the Azusa System was satisfactory. The range parameter was in the fine mode at liftoff and the angle cosines, which were in the intermediate mode at liftoff, had switched into the fine mode by 4.4 seconds. Automatic track was established at 4.4 seconds. One ambiguity was resolved from the ℓ angle cosine at 24 seconds and an ambiguity was resolved from the m angle cosine at 27.5 seconds. The estimate for reducible data was from 12 to 408 seconds.

Telemetered Input/AGC data and ground receiver AGC data indicated adequate signal strength to ensure proper operation of the system. The ground receiver AGC data experienced a 10 db drop from -100 dbw to -110 dbw during the period from 130 to 139 seconds. The signal did not recover from this drop. This received signal strength drop, seen only at the ground station, was believed to be the result of a change in look angle caused by the 11 degree pitch down of the missile after guidance steering enable. The system switched to the high power mode of operation at 100 seconds and loss of signal was at 434 seconds.

The system experienced loss of phase lock 56 times between 0 and 300 seconds. These intermittent occurrences involved from 1 to 3 data points each. A similar occurrence was observed on another range operation and this condition is apparently associated with the ground equipment.

The 7090 Computer generated an open loop Automatic Sustainer Cutoff (ASCO) signal based on Azusa data at 304.590 seconds. This was 236 milliseconds before Mod III generated the closed loop ASCO function.

Azusa data was utilized by the 7090 Computer for I.P. information during the periods from 50.95 to 54.15 seconds, 55.15 to 208.35 seconds, and 208.75 to 375.25 seconds. The following I.P. was derived from the Azusa System.

	Miss Distance	95% Confidence Limits
Downrange	19.63 nm	1.44 nm x 0.14 nm
Crossrange	4.05 nm	at 93°T

FLIGHT CONTROL SYSTEM

Performance of the Flight Control System was satisfactory. Data showed that response to the guidance roll maneuver was satisfactory and that the pitch program was accomplished satisfactorily. All guidance discrete commands were acted upon properly and response to guidance steering commands was satisfactory. Data indicated that all programmer switch functions occurred properly. There were no missile bending mode buildups during the flight and propellant slosh during booster phase was small. Engine displacements at engine start were within the allowable tolerance of $\pm$ 0.6 degrees. Liftoff and staging transients appeared normal as did the staging sequence. The missile harness was modified such that SCO, VCO and pre-arm were effected simultaneously.

A 0.9 volt drop of Measurement S 391 X (Thor Retro-rocket Command) for one segment at 322.57 seconds indicated that the retro-rocket igniter squib wiring probably shorted as usual following retro-rockets firing. However, the programmer was protected from burnout by the switch current limiter.

INERTIAL GUIDANCE SYSTEM

Performance of the Inertial Guidance System was satisfactory. The roll maneuver and the steering signals were generated properly. The discrete commands were issued properly. No target spotting offsets were required on this flight.

Inertial Mode Start occurred at 0842:31.000 EST.

Missile Behavior

Missile axial acceleration at sustainer cutoff was as follows:

	Nominal	Actual
Thrust Acceleration	6.76	6.8
Net Acceleration	6.47	6.5

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

Conditions at Guidance Enable

Function	Units	Actual	Nominal	Difference*	3 Sigma Limits
Time**	sec	136.5625	134.0	±2.56	±6.5
$\dot{X}$	ft/sec	9411.25	9412.5	-1.25	±70
$\dot{Y}$	ft/sec	2064.25	2057.75	±6.50	±600
$\dot{Z}$	ft/sec	4018.50	3947.5	±71.0	±900
X	ft	464,000	450,112	±13,888	±19,500
Y	ft	147,264	142,848	±4,416	±25,500
Z	ft	222,720	213,632	±9,088	±28,500

Function	Units	Actual	Nominal	Difference*	3 Sigma Limits
CEF	rad	-0.000213	-0.00027	∕0.000057	-
REF	rad	4.587645	4.6003	-0.012655	-

* Actual minus nominal
** Referenced from Inertial Mode Start

Abnormalities -

A minor disturbance at 43 seconds on the azimuth resolver signal was indicated by a 0.8° step, possibly indicating left roll of the missile. The roll displacement gyro data also showed a minor disturbance at the same time. The cause of these disturbances is unknown.

Residual Missile Thrust at SCO/VCO-

Telemetered guidance velocity data yielded the following approximate values for residual thrust. Decay from 6.8 g's to 0.3 g's occurred within 0.2 seconds. During the next 3 seconds, the decay from 0.3 to 0 g's appeared linear. The total thrust velocity gained between SCO plus 0.4 seconds and SCO plus 3 seconds was approximately 12 ft/sec.

Platform and Control

The roll maneuver, as indicated on the azimuth resolver data, was executed properly from 2 to 19 seconds.

The pitch resolver came into the instrumented range at guidance enable plus 3 seconds and settled at zero 21 seconds later.

Servo errors were normal and less than ∕0.5 minutes deviation. Azimuth servo was not instrumented on this flight.

Gyro drifts measured prior to launch were:

Gross Azimuth	∕ 2.07 deg/hr	Precountdown
Roll Fixed	- 0.066 deg/hr	X-1 Day
Gross Pitch	- 0.399 deg/hr	X-1 Day

These values were consistent with previous measurements. Redundant gyro torquing currents were normal. Maximum amplitude oscillation occurred at 80 seconds and was 80 deg/hr peak to peak.

Gyro temperatures were not instrumented for this flight.

Accelerometer scale factors measured during the precount and countdown were as follows:

X	Y	Z
2.00026	1.99858	2.00023

These values were consistent with previous measurements.

Computer

Computer operation was satisfactory. All discretes and yaw steering were properly generated. Pre-arm was not issued, demonstrating the azimuth resolver inhibit capability. SCO was issued prior to Mod III ASCO.

Yaw steering was saturated left polarity at liftoff, diminishing slowly in amplitude to a crossover at 57 seconds, and then continuing to right saturation at BCO. At guidance enable a right command caused the missile to yaw 7.6° right and to stabilize on this heading at guidance enable plus 26 seconds.

The tests of the Range tape recorded during the countdown indicated that, by visual inspection, the quality of the telemetered MGS signals was satisfactory. A normal data checker run could not be made because the accelerometer strings were not instrumented on telemetry.

Computer voltages were not instrumented for this flight.

Alignment Countdown Set

The Alignment Countdown Set (A-CS) operation was satisfactory. Accelerometer zeros were within the specified tolerances before launch, as measured with the A-CS, indicating proper operation of the zeroing loops.

Function	Nominal	Computed	Measured	Error
X Offset	0.667	.638885	.640800	±0.001915
X Zero	1.000	-	1.00067689	±0.000677
Y Zero	1.000	-	1.00149338	±0.00149
Z Zero	65.25407	65.26227	65.26007	-0.0022

Instrumentation

All instrumented channels of the Analog Signal Converter (ASC) operated satisfactorily. ASC temperature was not instrumented for this flight.

The Digital Signal Converter performance was satisfactory.

Telemetry quality on this flight was good, with the normal dropout due to booster separation. Only one telemetry link was flown on this flight.

MOD III RANGE SAFETY AND INSTRUMENTATION SYSTEM

Performance of the Mod III Range Safety and Instrumentation System was satisfactory; however, monopulse tracking errors after 60 seconds were larger than were expected. Also, the noise in the lateral rate data after BCO was higher than anticipated. These unexpected conditions are being investigated. The Mod III System provided range safety and impact prediction functions and was primary for the generation of the Automatic Sustainer Cutoff (ASCO) signal.

A good IIP plot was presented to the Range Safety Officer from approximately liftoff through SCO/VCO. The ASCO Inhibit Switch remained in the "Off" position for the entire flight and the ASCO signal was generated properly at 304.826 seconds.

Missile position data were available from liftoff to 393.6 seconds. Rate data were available from liftoff until 425.2 seconds. Track and Rate Subsystem data were interrupted momentarily after booster staging.

Performance of the individual subsystems was as follows:

Track Subsystem

Performance of the Track Subsystem was satisfactory; however, larger than normal monopulse tracking errors were encountered from 60 seconds for the remainder of the flight. The cause of the large tracking errors is still under investigation.

The Track Subsystem was in monopulse mode from liftoff until all signal was lost, excluding two seconds of selected conical track near booster staging. Lock was intentionally broken at 393.6 seconds in order to reposition the range gate back in an attempt to reacquire the missile beyond the normal range limit of the equipment. Reacquisition was unsuccessful.

Tracking errors following the major portion of the pitch program and just prior to booster cutoff were 0.20 mils peak to peak. The track console operator selected conical hold mode for two seconds near booster staging to confirm the reliability of the monopulse lock. There was no change in tracking. Monopulse tracking errors were 0.25 mils peak to peak through sustainer phase.

Signal strength during sustainer phase averaged -60 dbm. The signal strength averaged -68 dbm when lock was broken at 393.6 seconds.

Rate Subsystem

Performance of the Rate Subsystem was satisfactory. Intermittent lock was encountered following liftoff for the first 35 seconds. Thereafter, lock was continuous until 425.2 seconds except for the usual loss at staging.

The rate received signal strength during the sustainer phase averaged -95 dbm. All signal was lost at 425.2 seconds, 32 seconds after the Track Subsystem began the missile reacquisition procedure.

Noise in the lateral rate data after booster engine cutoff was more severe than was anticipated. The cause of this phenomenon is under investigation. Postflight checks revealed no equipment malfunction.

Mod III Computer

The Mod III Computer operated satisfactorily during the countdown and ensuing flight with no malfunctions observed. The simulated flight re-run was made without deviations from the realtime results.

Data obtained near SCO/VCO were extremely noisy on this flight. The following impact point was calculated from data gathered between SCO/VCO and retro-rockets firing and reflects the noise encountered.

	Mean-Miss Distance	Standard Deviation	Deviation of the Mean
Crossrange	9.40 Left	± 7.25 nm	±1.32nm
Downrange	3.50 Long	±15.52 nm	±2.83nm

RE-ENTRY VEHICLE

A Mark 4 Mod 1B was flown on Missile 30E.

Re-entry vehicle systems operation was satisfactory. Separation appeared normal and the vehicle satisfactorily survived re-entry. Both the C-band radar beacon and the telemetry system functioned normally. The data cassette was ejected as programmed and recovered.

Re-entry vehicle functions during the flight were as follows:

Function	Time
Range Zero	0
Lockout Switch No. 2	53.6
Lockout Switch No. 1	58.2
Guidance Pre-arm	304.8
PSA Battery No. 1	305.7
PSA Battery No. 2	305.7
Separation	320.9

PROPELLANT TANKING

Fuel was tanked to flight level on X-2 Day. Flight level was obtained by tanking to the overfill PLCU probe. Replacement of a propulsion line on X-1 Day necessitated the drainage of an unknown quantity of fuel from the engine fuel plumbing. Fuel was retopped to the overfill PLCU probe. As a result of this unknown quantity of fuel drainage, an ignition fuel density cannot be determined.

Based on the fuel density as determined during X-2 Day tanking there were approximately 76,200 pounds of fuel aboard the missile.

Fuel API Rating	43.6 Degrees
Fuel Temperature	87.0 dgf
Fuel Density on X-2 Day	49.68 lbs/ft^3

LO2 tanking was concluded with a satisfactory LO2 slug transfer of 42.9 seconds duration as measured from the activation of the topping high probe to the activation of the 100 per cent slug cutoff probe. Slug discharge pressure peaked at 260.9 psig, decayed to 226.1 within 6 seconds and returned to 260.3 psig prior to activation of the 100 per cent slug cutoff probe.

The 100 per cent slug cutoff probe uncovered 1.36 seconds after ignition. This indicated that there were approximately 850 pounds of LO2 above the 100 per cent probe at ignition.

Based on tank volume and an ignition LO2 density of 70.32 lbs/ft^3 there were approximately 175,450 pounds of LO2 aboard the missile at ignition

Weather Data

	Fuel Tanking	Ignition
Barometric Pressure	29.850 Inches of Hg	30.020 Inches of Hg
Ambient Temperature	81.3°F	73.3°F
Relative Humidity	64 Per cent	91 Per cent
Wind - Velocity and Direction	3 Knots - West	4 Knots - East
Cloud Cover	1/10	8/10

AIRFRAME INTERNAL INSTRUMENTATION

Operation of the Telemetry System was satisfactory. Good signals were received at the AMR Ground Station well beyond powered flight. The normal dropout of telemetry signal occurred after staging and lasted for 0.6 seconds. The signal for D 1 V, RSC Cutoff, was not received on Channel 1 - 6, although it activated satisfactorily on the commutated segment.

There were three measurements that did not operate properly:

P 709 T	SGG Combustor	Remained at zero during flight.
P 330 P	S Fuel Pump Disch	Remained at zero during flight.
P 84 B	B2 Pump Speed	Qualitative only.

Missile 30E contained one Bendix Mod 7 FM Telemetry package. Basic telemetry channel assignment is given in General Dynamics/Astronautics report ACZ-27-059-30.

LANDLINE INSTRUMENTATION

Landline measurements on Brown recorders and E-A sequence recorders provided satisfactory data. The following minor discrepancies were noted:

Measurement No.	Description	Discrepancy
F 1047 P	PCU Fuel Sensor Line	Out of ink at liftoff.
P 1712 T	B2 Nacelle Ambient	Out of ink at liftoff.
P 1325 T	Engine Compartment Amb.	Timing Pen out of ink at liftoff.
P 1710 T	Sustainer Eng Environment	Timing pen out of ink at liftoff.
P 1020 T	B1 LO2 Pump Inlet	Irregular paper motion at liftoff.
P 1054 T	B2 LO2 Pump Inlet	Irregular paper motion at liftoff.
H 1360 P	HPU Pressure	Provided qualitative data only. The transducer will be replaced.

A trailing wire umbilical provided data during the first forty feet of motion. Out of twelve measurements, ten provided good data. P 1206 O, Sustainer Engine LO2 Dome, and P 1001 P, B1 LO2 Pump Inlet, were invalid.

Aft-end Motion Determination

Satisfactory photographic data were obtained from the lights mounted on the missile skin for determination of aft-end motion during the first 25 feet of rise.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. The flight was successful.

2. All systems performed satisfactorily.

Recommendations

1. Resolve discrepancies in flow rates used to compute propellant residuals.

COUNTDOWN TIME VERSUS EVENTS

This test was scheduled for a 150 minute countdown and began on time at 0530 EST. There were two unscheduled holds resulting in 42 minutes hold time. Total countdown time was 192 minutes. The holds were as follows:

1. At -35 minutes (0725 EST) for 41 minutes due to poor weather conditions. Rain in the area was adversely affecting camera coverage. As soon as the camera lenses were wiped dry the count was resumed at -35 minutes at 0806 EST.

2. At -3:30 minutes (0837 EST) for approximately 1 minute to compiete liquid oxygen topping. Count was resumed at -3:30 minutes at 0838 EST.

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

EST	Countdown Time	Countdown Procedure	Event
0530	T-150	T-150	Telemetry Radiation Test.
			Computer Warmup Test Started.
0535	T-145	T-150	Acoustica Sensor Response Check Completed.
0536	T-144	T-144	Telemetry Battery Activation Started.
0538	T-142	T-145	All GAP Test Support Systems to Channel 5.
0539	T-141	T-147	Telemetry Coming Up for GAP Test.
0547	T-133	T-144	GAP Test Completed - "Go".
			Telemetry Off.
0548	T-132		Securing Hydraulics.
0550	T-130	T-144	Telemetry Internal Power Checks.

EST	Countdown Time	Countdown Procedure	Event
0553	T-127	T-135	RSC Tests Started.
0604	T-116	T-125	RSC Tests Completed.
			Begin Red Box Installation.
0613	T-107	T-125	Red Box and Retro-rockets are Installed.
0616	T-104	T-115	Start Nose Cone Arming and Fusing Checks.
0619	T-101	T-100	Flight Control Systems Test Started.
			Activate Main Missile Battery.
0621	T-99	T-105	Remove Landlines.
0622	T 98		Arming and Fusing Checks Completed.
0630	T-90		Flight Control Tests Completed.
			Begin Gyro Drift Test.
0644	T-76		Fuel Level Between 100 Per cent and Overfill.
0654	T-66		Started GE Beacon Tests.
0656	T-64	T-65	Started Landline Calibrations.
			Weather Report.
0659	T-61	T-70	Helium Storage Started.
0702	T-58	T-55	Begin GAP Test Preparations.
		T-55	Started Telemetry Warmup.
0704	T-56	T-52	Readiness Callout by Flight Control - All "Go".
		T-52	Begin GAP Test.

EST	Countdown Time	Countdown Procedure	Event
0711	T-49	T-52	GAP Test Completed - "Go".
			Landline Calibrations Completed.
			All Personnel Clear Test Stand Area.
			Remove All Private Vehicles.
			LO2 Tanking Preparation Started.
0719	T-41		LO2 Tanking Preparation Completed.
0725	T-35H		Holding for Camera Coverage - Estimated Twenty Minutes.
0731	T-35H		Securing Helium Storage for Duration of Hold.
0735	T-35H		GE Reports ARMA Liftoff Pulse is Now Correct and GE Is "Go".
0806	T-35C		Resume Helium Storage and LN2 Flow.
			Begin LO2 Tanking.
			Begin Final Guidance Computer Check.
0810	T-31	T-30	Begin Flight Control Systems Final Checks.
0818	T-23	T-25	Begin Final Azusa and Range Safety Command Checks.
0821	T-20		Retract Hooks.
			Start Telemetry Final Warmup.
0828	T-13		Station 3 ICOR Estimates 0 Per cent Coverage.

EST	Countdown Time	Countdown Procedure	Event
0829	T-12	T-12	Telemetry and Nose Cone to External Power.
			Azusa is "Go".
			Begin Telemetry/RSC AGC Check.
0831	T-10	T-10	Flight Control System Final Checks Completed - "Go".
			Final Acoustica Check.
0832	T-9		RSC Final Check Completed - "Go".
0833	T-8		Acoustica Final Check Completed - "Go".
			Final Range Clearance.
			Started Guidance Final Checks.
0835	T-6	T-6	All Personnel Remain in Present Position.
0836	T-5	T-5	All Communications to Channel 1.
0836	T-4:30	T-4:30	Squibs Disarm Switch to "Off".
0837	T-3:50	T-3:50	Status Check - All "Go".
0837	T-3:30H		Holding for LO2 Tanking.
0838	T-3:30H		Status Check - "Go".
0839	T-3:30C	T-3:30	Resume Count.
			Telemetry to Internal.
0839	T-3:00	T-3:00	Timer "Off" - Ready Switch to Ready.

EST	Countdown Time	Countdown Procedure	Event
0839	T-2:45	T-2:45	Shut Down Power Switch to Arm.
0840	T-2:05	T-2:05	Commands to Internal.
0840	T-2:00	T-2:00	Nose Cone Beacon and Telemetry to Internal.
			Nose Cone to Ready.
0840	T-1:55	T-1:55	Autopilot to Arm.
0840	T-1:50	T-1:50	Turning Water Systems "On".
0840	T-1:45	T-1:45	Commands to Arm.
0840	T-1:40	T-1:40	Range Ready Switch "On".
0840	T-1:35H	T-1:35H	T-1:35 and Holding - All Pre-start Lights are Green.
			Slug Start.
0841	T-1:35C	T-1:35	T-1:35 and Counting.
			Proceeding to Flight Pressurization.
0841	T-1:10	T-1:10	Missile to Internal Power.
0841	T-1:05	T-1:05	Missile Helium to Internal.
0842	T-0:60	T-0:60	T-60 Seconds and Holding
			T-60 Seconds and Counting.
0842	T-0:50	T-0:50	Water Full Flow.
0842	T-0:35	T-0:35	Status Check - All "Go".

EST	Countdown Time	Countdown Procedure	Event
0842	T-0:20	T-0:20	All Launch Commit Lights Are Correct.
0842	T-0:05H	T-0:05H	T-5 Seconds and Holding.
			All Recorders to Fast.
0842	T-0:05C	T-0:05C	T-5 Seconds and Counting.
0842:37	T-0	T-0	Liftoff

MISSILE CONFIGURATION

Airframe

The SM-65E Missile is approximately 71 feet long from the re-entry vehicle interface to the aft surface of the thrust chambers. The missile structure is comprised of the booster structure and the main propellant tank structure. With the re-entry vehicle attached, the complete missile is approximately 81 feet long. The insulation bulkhead was removed for this flight.

Azusa System

Type B-1A coherent carrier transponder in conjunction with the Mark II Ground Station. Utilized a tripod-mounted, elliptical horn antenna mounted in missile Quad IV.

Electrical System

Remotely activated, primary type, Eagle-Picher main missile battery and Leland rotary inverter.

Flight Control System

Square canister configuration with forward rate gyro canister containing pitch and yaw rate gyros. This was the second flight using the 27-41000-831 "Transistors" Servo Canister (previously flown on Missile 25E). The -831 "Transistors" Servo Canister was functionally the same as the -831 Servo Canister previously flown on Missile 2F, but incorporated changes to certain transistors (manufacturer only). This was the third "E" Series flight and the fourth flight using the 27-45202-801 Gyro Canister and the 27-45045-5 Forward Rate Gyro Canister which incorporated the Spin Motor Rotation Detector (SMRD) System (previously flown on Missiles 2F, 25E, and 26E). This was the fifth "E" Series flight using the 27-41001-929 Programmer Canister (previously flown on Missiles 12E, 17E, 18E, and 22E). Missile harness was modified to provide simultaneous SCO, VCO, and pre-arm functions.

Guidance System

ARMA Lot IV Missile Guidance Set in conjunction with Lot II_m Ground Equipment.

Hydraulics Systems

Comprised of two independent systems which provide hydraulic pressure for booster operation and sustainer/vernier operation. Hydraulic tubing was of aluminum except that directly associated with the sustainer engine, which was of corrosion resistant steel. A 25 cubic inch accumulator for vernier solo operation was not required for this flight.

Impact Predictors

Azuca System and Mod III Instrumentation and Range Safety System.

Pneumatic System

Basic Astronautics system of five shrouded main propellant tank pressurization titanium helium bottles, and one unshrouded bottle for booster jettison and vernier control. Utilized F and G fuel and LO2 tank pressurization regulators.

Propulsion System

Rocketdyne MA-3 Liquid Engine Propulsion System. Vernier - solo capability was deleted by removal of solo tanks and associated propellant fill and pressurization hardware.

Propellant Utilization System

The Acoustica Propellant Utilization system was utilized on this missile. This system uses a 400 cps signal for excitation of the PU valve position feedback transducer and a 5-Card computer. No specific gravity biases were used. The stillwells utilized were "F" Series types.

Range Safety Command System

Standard system employed two ARW-62 receivers, a power and signal control unit, arming switch, and destruct package. Two manually activated, secondary type, Yardney batteries were utilized.

Telemetry System

The airframe telemetry canister utilized a remotely activated, primary type, Eagle-Picher battery. One airframe telemetry link was operational at 227.7 mc.

Mod III Instrumentation and Range Safety System

Mod III E Instrumentation Beacon System in conjunction with the Mod III Ground System utilized the "twisted" missileborne antenna (Part No. 27-136010-3) mounted on the tripod boom in missile Quad IV.

Propellant Tanking

Astronautics "E" Series Propellant Tanking System incorporated four ultrasonic fuel sensors, four LO2/GO2 detectors, a Propellant Loading Control Unit (PLCU) in the blockhouse, and 200-400 gallon LO2 slug.

Re-entry Vehicle

Mark 4 Mod 1B Re-entry Vehicle contained a C-band tracking beacon, a non-ejectable four pound SOFAR bomb and a recoverable data cassette. The telemetry system utilized one link, transmitting at 252.4 mc.

HISTORY OF SM-65E MISSILE NO. 30

Atlas Missile 30E arrived at AMR by air on 22 August 1961 and placed in Hangar "K" to receive a minimum of hangar checkout. On 11 September Missile 30E was weighed. Missile erection was accomplished on Complex 13 on 12 September. Pre-flight testing was accomplished in accordance with planning documented in report AA 61-0117, Flight Test Directive, Atlas Missile 30E.

Significant events concerning Atlas Missile 30E from arrival at AMR to launch are delineated below:

Date	Event
22 August 1961	Arrived at AMR.
11 September 1961	Missile Weighing.
12 September 1961	Transferred to Complex 13 and erected.
21 September 1961	Successful propellant tanking.
27 September 1961	Successful Flight Acceptance Composite Test.
5 October 1961	Flight.

A brief description of significant difficulties encountered in system preparation and testing accomplished at AMR is as follows:

Landline Instrumentation

Considerable delay was encountered in checking out and calibrating the engine LO2 dome accelerometers due to unavailability of calibrated transducers. These transducers must be mated with amplifiers and calibrated as matched sets.

Missile Electrical

No significant problems were encountered.

Range Safety Command

Upon attempting to electrically connect the Range Safety Command batteries, it was found that one battery had a loose connector at the connector mounting. The problem was corrected by replacement of the battery.

Azusa

No significant problems were encountered.

Telemetry

The RF Canister, Serial No. 011-0006 and the Accessory Canister, Serial No. 103-0017, were returned to San Diego for a transistor check, prior to any tests being performed on the system. After the return of the canisters, tests were satisfactory.

IR 662923 was written on the Pod I Telemetry/RSC antenna because the bonding fingers between the top of the antenna and the tapered fairing above the antenna did not make good RF contact. Bonding fingers were re-shaped and the antenna re-installed per the IR. This is a recurring problem and should be corrected in missile assembly at the factory.

Due to Missile 30E configuration containing only one RF canister, TPS 13-1464 was written to confirm that none of the deleted wires in the telemetry power and control circuitry were grounded.

The transducers, 27-11956-1, for the booster pump speeds, Measurements P 83 B and P 84 B, were SPACE transducers. IR's 645665 and 645666 were written to replace these transducers with flight certified articles.

Routine inspection of the missile revealed that the separation lanyard attached to Plug 100P11 on harness 27-12649-1 was too short to allow proper installation of the plug. IR 645680 was written to relocate the anchor holes for the lanyard so as to acquire sufficient slack to allow proper installation of Plug 100P11.

During routine inspection it was revealed that the Landline Instrumentation Plug 201MT1341P1 was connected to the sustainer lube oil manifold pressure transducer and Plug 201MT341P1 was capped and tied back. Since the requirement for Measurement P 1341 P was deleted for 3E and ON and the requirement

existed for Measurement P 341 P on Missile 30E, the Plug 201MT1341 P1 was removed, capped and tied back and the Plug 201MT341P1 was installed on the transducer. TPS 13-1493 verified that Plug 201MT341P1 was connected to the telemetry harness.

Due to the lack of potting compound at AMR, the installation of P 830 D could not be accomplished per planning card 27-12646-9001-C. TVA A32608B was released locally to substitute GD/A 894531 high temp wire and pro seal 777 potting compound for this installation.

During hydraulic checks, Measurement H 224 P transducer developed a leak and was replaced per IR 653411. The replacement transducer was too short for the mounting bracket, and problem was corrected per IR 653531 and TVA A 32609.

TVA A32655 was released locally on 29 September to add Measurement U 134 X, AA Time Shared Oscillation Output. The operation of this measurement was verified by TPS 13-1515.

TVA A35982 was released locally to delete the Guidance Measurement I 527 X, pre-arm relay and added I 525 X, Pre-arm Signal No. 1.

Flight Control

Vernier I yaw engine went to a $+70^{\circ}$ position upon initial application of auto-pilot power with hydraulics at 3000 pounds. The V1Y engine position wire was broken on the feedback transducer plug P605-B. The defective harness was replaced.

The sustainer yaw actuator was replaced due to hydraulic fluid seepage.

Mod III E Instrumentation Beacon

No significant problems were encountered.

Hydraulics

During normal Booster Hydraulic System testing, the booster return pressure transducer (H 224 P Measurement) 27-01243-11 was leaking hydraulic fluid around the indexing pin. A new -11 transducer manufactured by Colvin Labs was sent to AMR as a replacement. TVA 32609 "B" was initiated to make a new transducer bracket as the one installed (P/N 27-11854) could not be

utilized because the Colvin Labs -11 transducers have a much shorter body length than Bourns transducers.

Missile 30E arrived at AMR with three vernier actuators, manufactured by Bohannan. These actuators were replaced with reworked Clemco actuators.

Sustainer yaw actuator 27-85314-817 was replaced due to a hydraulic leakage between actuator body and end cap retaining rings.

Propellant Utilization

On X-2 Day, the PU valve mechanical stop was reset from 20.4 degrees to 21.4 degrees per Rocketdyne's request. This entailed re-running 27-90480, Acoustica PU System Calibration during which the MO-200 error time generator malfunctioned. The error time generator was BOI'd from Complex 11 for completion of test.

As a result of Missile 25E flight, special attention was given to the Propellant Utilization System at San Diego's request. The PU harnesses were visually inspected for possible damage and poor workmanship and all PU measurements were monitored on telemetry while harnesses were moved and shaken. No discrepancies were detected.

Propulsion

GMA 12907, Engine Electrical System Modification was sold, but had not been completed. GMA should have replaced a 500124 mount bracket with 500126 bracket which accommodates an additional electrical plug. Installation was IR'd and correct bracket was installed.(Ref. IR 662927)

27-02403-801 VE Fuel Supply Line was replaced for a blowing leak. A new line had to be removed and dimensionally checked per Inspection Survey 54. Applicable leak check was satisfactorily re-run.

One LO2 topping system Marmon clamp was replaced for distortion (Reference: IR 653408) when T-bolts were inspected per SFTO-184-185 dated 9-14-61. System was re-leak checked.

27- 02404-803 VE LO2 Supply Line was IR'd (Reference: IR 653430) for blowing leak and was replaced with 27-02427-1 Line during LO2 self-referencing regulator modification. After modification was complete, the 27-24011-69 LO2 Regulator Bleed Line interfered with the sustainer low pressure fuel duct. (Reference: IR 653532) The structural integrity of the modification was questionable and system was returned to original configuration.

V-1 engine was replaced for excessive hydraulic leakage at the gimbal shaft bleed port. (Reference: IR 645689) The replacement engine also developed a flight hydraulic seep, but it was within allowable limits for launch. (Reference: IR 653540)

Following readiness day fuel tanking, a very slight fuel dampness was found at the vernier fuel manifold to fuel tank flange. (Reference: IR 653539) Flange bolts were re-torqued, but seepage continued. Although dampness was not excessive and was cleared for flight, any leak at this flange is a serious problem. The seal cannot be replaced without removing the sustainer engine and apex to gain access to the inside of the fuel tank in order to disconnect solo fuel tank fill and bleed line so vernier fuel manifold can be removed.

B-2 gas generator fuel supply line was found rubbing on the B-2 turbine exhaust duct (Reference: IR 669811). Line mounting flange was loosened and line was rotated to provide clearance. This necessitated re-leak checking B-2 chamber.

Complex Mechanical

While performing LO2 tanking preps the seal in the slug unit LO2 manual drain valve was blown. The valve was removed from the system and the line plugged with a pressure rated LO2 clean plug. LO2 Tanking Test was satisfactorily accomplished with the slug unit in this configuration. This valve failure is a recurring problem. Reference reliability action report 9B-56-603. This valve was not replaced for launch; however, the system performed satisfactorily.

During readiness fuel tanking, fuel transfer unit valve FB-1 would not activate. Tanking was accomplished with Pump FB on 150 gpm flow and pump FA at full flow (500 gpm). The failure was traced to a grounding of solenoid actuation voltage which resulted from a faulty conduit installation during solenoid valve replacement per EO235739 on 7-29-038-B/N 3A.

It was decided, with San Diego concurrence to flow 10,000 gpm in the flame bucket on the launch of 30E. During the test which was run to obtain this configuration it was found that there was no flow in the top jacket of the flame bucket. Upon investigation it was found that the TWD manifolds which control the flow had been restricted to an almost full closed position. This had been done to restrict the flow to an acceptable condition while the flow rate was 27,000 ≠ gpm. These manifolds were opened to approximately 1/4 open position to give an acceptable flow coverage of the jacket area.

Complex Electrical

Elimination of telemetry cans 2 and 3 from Missile 30E necessitated circuit revisions at the blockhouse to enable RF ready signal to be received by the Test Conductor.

Due to hurricane alert on 9-18-61, preparation was made for removal of the missile from the complex. Umbilicals, lateral motion lights and sight tube were removed from the missile and then replaced when the alert was terminated.

Guidance pod air conditioner failed to operate on 9-18-61 because of a burned-out fan motor which was then replaced by Facility Maintenance.

During fuel tanking, the fuel totalizer failed to operate. Correction was made by subsequent test prep sheet 13-1428.

During FAC Test, umbilical 600U8 failed to eject electrically. Umbilical Adapter 600U4 did eject but exhibited high moisture content. Umbilical Adapter 600U8 was replaced by IR 653446 and subsequent investigation by Reliability of the rejected adapter indicated corrosion on the solenoid retaining collett prevented mechanical ejection.

During performance of Complex Electrical Pre-Readiness Test, B1 and Sustainer SPGG heater dc voltages were found to be below specifications. GN2 purge brought sustainer SPGG heater voltages within specifications indicating moisture in the umbilical adapter had created leakage paths. GN2 purge did not correct B1 SPGG heater voltage problem which was caused by two shorted pins in Umbilical Adapter 600U4. Adapter 600U4 was replaced by IR 653549.

During Pre-readiness Fuel Tanking, a shorted wire was found in FP1 solenoid valve in the fuel area. This fault was corrected after completion of fuel tanking.

Propellant Tanking

No significant problems were encountered.

Airframe

The vernier fairings were modified to close the excessive gap around the engine gimbal housings to prevent aerodynamic heating inside the fairing. The vernier pitch actuator clamshell fairings were modified by closing the opening around the gimbal housing.

When Missile 30E arrived at AMR, the VE LO2 solo tank bleed extension duct attached to the fireshield was installed and the LO2 bleed line was removed for weight reduction. EO 235807, (CIC 95353) was written locally to remove the solo tank bleed extension duct and install a 27-79090-19 plate.

EO 216448 (CIC 95353 was written on 27-79060 to plug two holes in booster thrust section to prevent aerodynamic heating. The holes were left by removal of booster pneumatic control lines for booster shut-down kit. The lines were removed for weight reduction.

Pneumatics

The ullage bottles were rejected for rusty inside surfaces after they had been returned from cleaning. It was decided to use the bottles for testing and to check a launcher duct in each system to determine if particles had migrated. The ducts were found to be within acceptable cleanliness specifications.

The Haskel compressor charge panel and several associated tubes toward the PCU had to be replaced due to rusty sleeves.

A nut on a launcher LO2 pressurization duct assembly Part No. 27-80185-127, was found to be cracked, immediately prior to missile erection. This N.A.S. nut appears to be of insufficient thickness to withstand a launch environment in which LO2, LN2 and extremely high temperature could exist. The tube assembly was located below the Quad III and IV riseoff disconnect panel.

Two ullage pressure hoses were IR'd for being frayed.

Inertial Guidance

On 15 September 1961, commenced System Test (CTP-42B). While scaling X in a minus G field, the XF2 string dropped out. Since a heavy rain shower had occurred prior to this test, the problem was believed to be in the umbilical connector. The umbilical was pulled and purged. Umbilical reinserted and the XF2 problem appeared to be corrected. The platform would not align in scale X - 1G field configuration. Also the pitch axis was drifting.

On 18 September 1961, continued System Testing (CTP-42B). Trouble shot 4th pendulum problem. Found Sandwich Plug P24011 not installed on JA2 box. The same was repaired. Pod cooling unit failed. All testing stopped on Complex to facilitate Phase III hurricane warning.

On 19 September 1961, Phase III hurricane alert lifted. Continued System Tests (CTP-42B). Umbilicals re-installed into missile and pod cooling failure was repaired. Ran three computer problems with "No-Go" results. After the initial three, all remaining problems were "Go". The three "No-Go's" were attributed to the heavy rains received for four days and that the pod air conditioner was off for approximately 19 hours due to hurricane warnings.

While scaling, the XF2 string dropped out. During preparations for trouble shooting, the string came back in. The platform was not holding in roll.

On 20 September 1961, continued System Checks (CTP-42B). Ran Computer Problem No. 120 and received a "No-Go". Re-ran the problem and received a "Go".

Reached proper temperature and went into alignment. The XF2 string dropped out intermittently.

On 20 September 1961, checked all pod wiring associated with the XF2 string and found it to be satisfactory. It was decided to replace the Platform. Platform Serial No. 7210050 was removed and Platform Serial No. 7210008 was installed. This failure later confirmed in Hangar N.

On 21 September 1961, commenced checkout of new platform. The pitch gimbal would not travel past -129°. Platform Serial No. 7210008 was removed and returned to ARMA, Hangar N, Component Checkout Lab. Interference was found to be a slipped gimbal weight. Repaired same and re-installed. Platform Serial No. 7210008 into the missile.

On 22 September 1961, completed a satisfactory MGS System Test.

On 25 - 26 September 1961, conducted eleven Azimuth Gyro Drift Tests in an effort to establish cause of non-repeatable Azimuth gyro drift measurements.

On 27 September 1961, replaced Computer Serial No. 7230015 with Computer Serial No. 7230052 at the completion of the FAC Test. Computer Serial No. 7230015 was out of spec on reset line impedance measurement.

On 29 September 1961, commenced Readiness Checks (CTP-39). Ran several Azimuth Gyro Drift Tests. After Platform was slewed into stops, a change was noted in drift readings. It was decided to change the Platform. Platform Serial No. 7210008 was replaced by Platform Serial No. 7210007.

On 2 October 1961, commenced MGS System Tests (CTP-42 and CTP-39) to verify new platform operation. System Test complete satisfactorily.

On 3 October 1961, commenced Pre-readiness Checks (CTP-42 and CTP-39). During the test, a 1 degree drift difference occurred in the Azimuth Gyro Drift. Ran additional Drift Tests at various inductosyn settings. Slewed Platform into stops and ran additional drifts. One degree change occurred again. Pulled umbilical connector and purged for possible dampness. Still received shifting drift measurements. Checked Inductosyn and drift circuits and they were all satisfactory.

On 4 October 1961, continued Azimuth Gyro Drift measurements. Still received shifting Azimuth Gyro Drift measurements. Completed combination Pre-readiness and Readiness Test. It was decided that despite shifting drift measurements, the Platform was suitable for flight.

APPENDIX

FLUID CHEMICAL ANALYSIS

	Unit	Sample	Specification
Liquid Oxygen			
Purity	Per cent	99.5	99.2 Minimum
Hydrocarbons			
As Methane	ppm by vol.	18	66.7 Total Maximum
As Acetylene	ppm by vol.	None	0.62 Maximum
Particle Count			
50 - 175	Microns	95	No solid particles
175 /	Microns	0	greater than 175
Fibers	Microns	5	microns. (Fibers not acceptable.)

This item is acceptable.

Gaseous Helium			
Purity	Per cent	99.9	99.9/ Minimum
Hydrocarbons			
As Methane	ppm by vol.	4	58.3 Total Maximum
As Acetylene	ppm by vol.	None	0.5 Maximum

This item is acceptable.

Gaseous Nitrogen			
Purity	Per cent	98.72*	99.5 Minimum
Hydrocarbons	ppm by vol.	None	Methane - 58.3 Maximum Acetylene - 0.62 Maximum

* This item is out of specification.

	Unit	Sample	Specification
Lubricating Oil			
Viscosity at 100°F	Centistokes	12.2	11.0 Minimum
Viscosity at 210°F	Centistokes	3.2	3.0 Minimum
Flash Point	°F	417	400.0 Minimum
Viscosity Index		146	80.0 Minimum
Appearance		Pass	
This item is acceptable.			
Tricloroethylene			
Appearance		Pass	Clear and Free
Color		Pass	Not Red, Blue, Green or Purple Dyed.
Odor		Pass	Characteristic
Specific Gravity	@68°/68°F	1.466	1.454 to 1.476
Distillation	°C	86.5 - 87.5	86.5 to 87.5
Water Content	@14.0°F	Pass	Cloudless
Non-volatile	Per cent	.0007	0.002 Maximum
This item is acceptable.			
Fuel, RP-1			
Initial Boiling	°F	362	Report
10 Per cent	°F	390	365 - 410
50 Per cent	°F	422	Report
90 Per cent	°F	460	Report
End Point	°F	490	525 Maximum
Residue	Per cent	1.0	1.5 Maximum
Loss	Per cent	1.0	1.5 Maximum
Flash Point	°F	138	110 Minimum
Gravity	°API	43.5	42.0 to 45.0
Particle Count			
10 - 20	Microns	7,920	No solid particles
20 - 40	Microns	3,360	greater than 175
40 - 80	Microns	360	microns. (Fibers
175 /	Microns	0	not defined.)
Fiber Count		3	
Moisture Content	Per cent	None	
This item is acceptable			

	Unit	Sample	Specification
Hydraulic Fluid - Booster			
Flash Point	°F	214	200.0 Minimum
Viscosity	Centistokes	8.8	8.5 Minimum
Color		Clear	
Dye		Red	
Particle Count			
10 - 25	Microns	2,940	5,500 Maximum
26 - 50	Microns	120	2,400 Maximum
51 - 100	Microns	60	300 Maximum
Over 100	Microns	1	20 Maximum
Fibers	Microns	2	20 Maximum

This item is acceptable.

Hydraulic Fluid - Sustainer			
Flash Point	°F	208	200.0 Minimum
Viscosity	Centistokes	8.7	8.5 Minimum
Color		Clear	
Dye		Red	
Particle Count			
10 - 25	Microns	2,280	5,500 Maximum
26 - 50	Microns	240	2,400 Maximum
51 - 100	Microns	60	300 Maximum
Over 100	Microns	1	20 Maximum
Fibers	Microns	3	20 Maximum

This item is acceptable.

REFERENCE DOCUMENTS

Flight Test Plan - Missile No. 30E	AE 60-0801
Flight Test Program - SM-65 Series E, R & D Missiles	AZC-27-005
Detailed Test Requirements (AFBMD/STL)	STL/OR-60-0000-19028
Flight Test Directive (FTWG)	AA 61-0117

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

Reports	Approximate Issue Date (time after test)
Acoustica Associates, Inc., Los Angeles, Calif.	
Flight Test Evaluation Report	30 days
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, Wilmington, Mass.	
Final Flight Report	30 days
General Electric, Syracuse, N.Y.	
Evaluation Report of Mod III Instrumentation System with Missile 30E	6 - 10 weeks

SERIAL NUMBERS OF SYSTEM COMPONENTS

Azusa Transponder

Canister, Serial No. 731-0080

Re-entry Vehicle, Mark 4 Mod 1B - 12

Range Safety Command System

Range Safety Command Receiver No. 1, Serial No. AF 60-151
Range Safety Command Receiver No. 2, Serial No. AF 60-152
Range Safety Command Receiver No. 1, Battery, Serial No. 009-0057
Range Safety Command Receiver No. 2, Battery, Serial No. 009-0045
Range Safety Command Power and Signal Control Unit, Serial No. 101-0244

Propulsion System

Sustainer, Serial No. 222733
Booster No. 1, Serial No. 112781
Booster No. 2, Serial No. 112800
Vernier No. 1, Serial No. 332832
Vernier No. 2, Serial No. 332735

Electrical System

Main Missile Battery, Serial No. 107-0474
Inverter, Serial No. 002-0060
Power Changeover Switch, Serial No. 007-0058

Mod III E Instrumentation Beacon System

Rate Beacon, Serial No. 6E8027
Pulse Beacon, Serial No. 6E1022

Telemetry System

Telemeter RF, Serial No. 107-0023
Telemeter RF, Battery, Serial No. 104-0559
Accessory Canister, Serial No. 103-0017

Flight Control System

Gyro Canister, Serial No. 108-0185 (217)
Forward Rate Gyro, Serial No. 107-0089 (86)
Servo Canister, Serial No. 107-0059 (204)
Programmer Canister, Serial No. 108-0110 (213)

Propellant Utilization System

Computer, Model CA-108B

Pneumatics System

LO2 Tank Pressure Regulator, Serial No. 905-0298
Fuel Tank Pressure Regulator, Serial No. 905-0312

Inertial Guidance System

Platform, Serial No. 7210007
Control, Serial No. 7220063
Computer, Serial No. 7230052
Analog Signal Converter, Serial No. 021
Digital Signal Converter, Serial No. 7140083

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	095	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	12-20-57	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 126.5 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	1302	Successful flight. Impacted approximately 2345 nm downrange.
5B	5-30-58	11	7-22-58	8-20-58	8-28-58	1303	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	8-16-58	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	#10-6-58 ###10-24-58 ####10-27-58	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	9-6-58	14	11-6-58	11-24-58	11-28-58	1730	Successful flight. Impacted approximately 5506 nm downrange.
10B	10-22-58	11	11-20-58	****12-9-58 ***12-10-58 12-12-58	12-18-58	1729	Successful flight. Missile placed into orbit.
13B	12-4-58	14	12-6-58	12-22-58	1-15-59	30	Flight prematurely terminated due to unexplained difficulties starting 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 BCO Make break.

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

*** Prematurely terminated by an automatic cutoff 4.98 seconds after BCO 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 BCO 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	14	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	14	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	14	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	14	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 7" SERIES FLIGHT MISSILE VEHICLES

Missile	Arrival	Complete	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.
9D	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	6-16-59	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	6-16-59	7-28-59	8-11-59	2003	Successful flight. Impacted in MILS net less than 1 mile from target.
17D	5-27-59	13	8-17-59	9-y-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	11-6-59	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	10-16-59	13	11-28-59	None	12-8-59	4205	Successful flight. Impacted 1/2 mile from target in MILS net.

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CONVAIR-ASTRONAUTICS

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

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
4[illegible]D	11-20-59	13	12-10-59	None	12-16-59	16	Successful flight. Delivered a Mk-2 Re-entry Vehicle within 3 nm of target over a 5600 nm range.
4[illegible]D	12-8-59	13	12-28-59	None	1-6-60	32	Successful flight. Delivered a Mk-3 Re-entry Vehicle within 3 miles of target over a 5600 nm range.
4[illegible]D	12-17-59	13	1-11-60	None	1-26-60	94	Successful flight. RVX-A2 Re-entry Vehicle impacted approximately 1/2 mile from target in MILS net.
4[illegible]D	1-8-60	13	1-20-60	None	2-11-60	320	Successful flight. Mk-3 Re-entry Vehicle impacted less than 1 1/2 nm from target over a 5600 nm range.
4[illegible]D	12-8-59	11	12-21-59	[illegible]-4-60 2-23-60	[illegible]-4-60 3-8-60	17	Successful flight. First missile to use all-inertial guidance system open loop.
51D	1-29-60	13	2-18-60	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	304	Destroyed in the stand by fire and explosion during a launch attempt.
56D	3-3-60	12	4-11-60	None	[illegible]-12-60 5-20-60	1006	Successful flight. Delivered Mk-3 Re-entry Vehicle within 4 nm of target over an extended range of 7069 nm.
54D	3-25-60	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	601	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	6-6-60	None	6-27-60	1002	Successful flight. Impacted within 1 nm of target in MILS net 4306 nm downrange.
60D	6-6-60	11	6-14-60	None	7-2-60	906	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	[illegible]-2-60 8-9-60	1008	Successful flight. Impacted within 4 nm of target in South Atlantic Ocean over the intermediate range of 4350 nm.

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

Missile	Arrival	Complex	Erection	FRF	Flight	AMR Range No.	Comments
64D	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	7-4-60	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	502	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	1502	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.
56D	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	3683	Successful flight. Impacted less than 1 nm from target 4388 nm downrange. Data cassette recovered.
90D	12-16-60	12	12-30-60	None	1-23-61	3018	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 5.48 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	1902	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	3603	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 3 Mod I Re-entry Vehicle within 0.5 mile of target at a range of 4386 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 4386 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.

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

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.
24E	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.

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

MISSILE	Arrival	Complete	Erection	FRF	Flight	AMR Range No.	Comments
F7	7-3-61	13	7-13-61	None	8-8-61	1005	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.

C

SIGNIFICANT DATES DURING TESTING OF MERCURY/ATLAS VEHICLES AT AMR

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.

* Returned to Hangar for booster power package replacement.

SIGNIFICANT DATES DURING TESTING OF MIDAS VEHICLES AT AMR

Missile	Arrival	Complete	Erection	FLY	Flight	AMR Issue No.	Comments
29D	10-10-59	14	1-15-60	None	2-26-60	304	MIDAS I Booster shot. Atlas portion of flight was successful.
46D	1-26-60	14	3-3-60	None	5-24-60	615	MIDAS II Booster shot. Atlas portion of flight completely successful.

FORM AI936-3

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

Missile	Arrival	Cannister	Erection	FRF	Flight	AMR Hours Hr.	Comments
5C	4-4-59	12	4-13-59 5-17-59	9-24-59		2944	Destroyed by fire and explosion following premature cutoff during flight readiness firing.
20D	9-18-59	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.
62D	6-13-60	12	9-2-60	None	9-25-60	3001	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	4566	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.