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EXHIBIT 3

ACCIDENT INVESTIGATION BOARD REPORT

UNITED STATES AIR FORCE AGM-129
Advanced Cruise Missile
Serial Number 90-0061

10 December 1997
Dugway Proving Ground, Utah

Volume I of III

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND
LANGLEY AIR FORCE BASE, VIRGINIA

29 JUN 1998

OFFICE OF THE COMMANDER
205 DODD BOULEVARD SUITE 100
LANGLEY AFB VA 23665-2788

MEMORANDUM FOR ACC/JA

SUBJECT: AFI 51-503, Aircraft Accident Investigation Report, AGM-129, 49th TS, 53rd WG and 388th RS, 388th WG, S/N 90-0061, 10 December 1997

I have reviewed the Aircraft Accident Investigation Report regarding the AGM-129 mishap at Dugway Proving Ground, Utah, on 10 December 1997. The report was prepared by Colonel Charles M. Westenhoff and complies with the requirements of AFI 51-503. This report is approved.

RICHARD E. HAWLEY
General, USAF
Commander

Attachment:
Aircraft Accident Investigation

Global Power For America

AFI 51-503
REPORT OF MISSILE ACCIDENT INVESTIGATION

1. AUTHORITY AND PURPOSE

a. **Authority:** On 30 Jan 98, the Commander, USAF Air Warfare Center, pursuant to Air Force Instruction 51-503, appointed Colonel Charles M. Westenhoff and legal and technical advisors to conduct an investigation of the 10 Dec 97 crash of a USAF AGM-129 Advanced Cruise Missile.[1]

b. **Purpose:** This was an investigation into the facts and circumstances surrounding the 10 Dec 97 crash of a United States Air Force AGM-129 Advanced Cruise Missile number 90-0061 near Dugway, Utah. The missile crashed at the completion of Nuclear Weapons System Evaluation Program test 98-02. It hit the ground at a site occupied by a cosmic ray observatory operated by a consortium of universities. The crash damaged two trailers used to support telescope operations. The purpose of the investigation was to determine the relevant facts and circumstances of the accident and, if possible, to determine the cause or causes. The investigation obtained and preserved evidence for claims, litigation, disciplinary and administrative action, and for all other purposes deemed appropriate by competent authority.[2]

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[1] Y-1.
[2] The directive governing this investigation was Air Force Instruction 51-503 1 Jul 95.

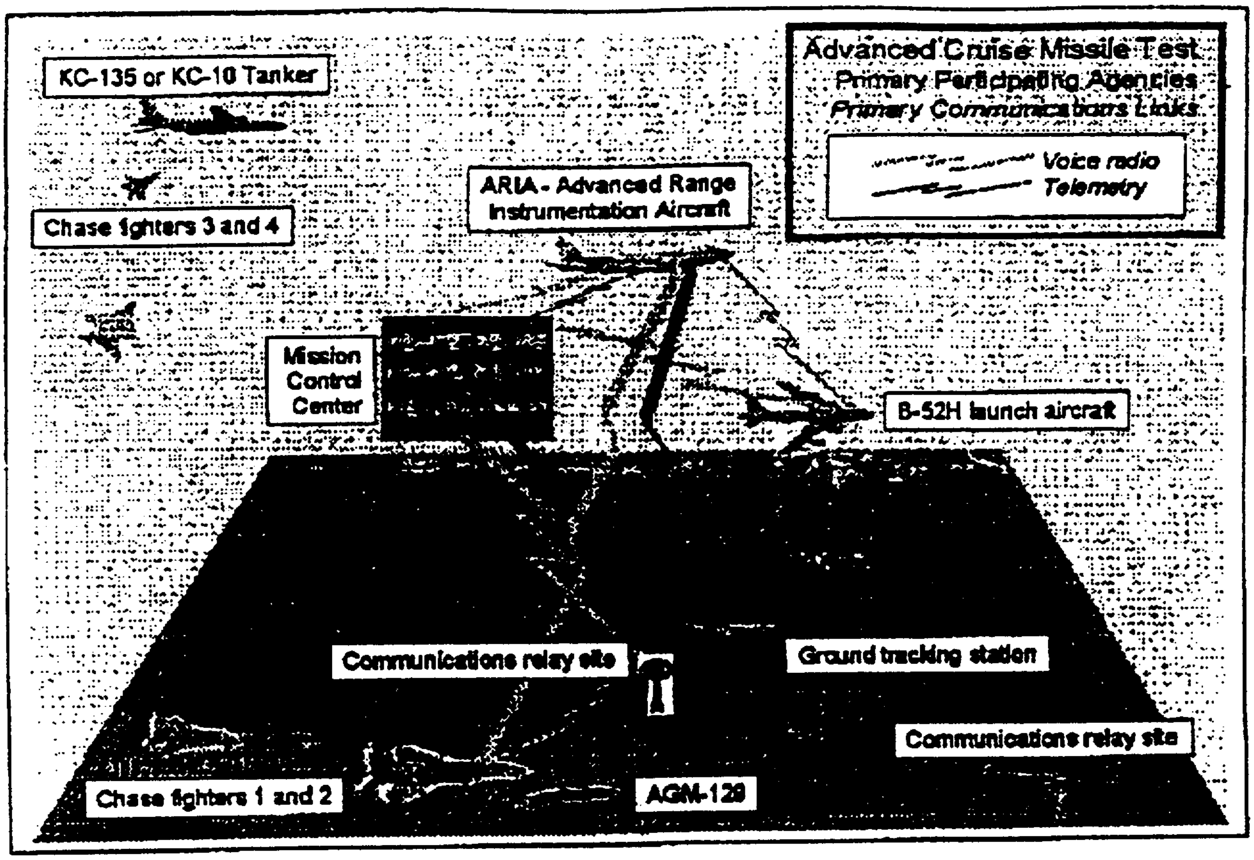
UT-39452

2. SUMMARY OF FACTS:

a. Mishap Summary. On 10 Dec 97 the United States Air Force conducted a test of AGM-129 serial number 90-0061, an Advanced Cruise Missile. The Test Director planned the missile flight trajectory to stay away from known avoidance areas and to remain within protected airspace, and supervisors thoroughly reviewed this trajectory and the test plan. Test planners were unaware that a consortium of universities had established an astrophysical observing array on Cedar Mountain, and that the missile trajectory would cross over that site at a critical point in the mission.[3] The test was delayed due to adverse weather on 9 Dec 97, but began as planned on the backup day, 10 December. After a series of pre-launch tests, a B-52 aircraft over the Utah Test and Training Range launched the missile. The missile flew its planned course, monitored by telemetry, tracking instruments, four chase aircraft, an Airborne Range Instrumentation Aircraft (abbreviated as ARIA), and the test range Mission Control Center. After three hours and 38 minutes of flight, the missile made a planned abrupt climb and simulated warhead firing to complete the profile programmed into the missile. Immediately after the warhead fired, in accordance with the mission plan the test Lead Engineer attempted to call test team members on the ARIA, instructing them to take control of the missile. Four separate indications appeared to confirm that the Lead Engineer was transmitting, but the communications configuration of the Mission Control Center blocked transmission of the calls. At the same time the Lead Engineer was trying to direct actions on the ARIA, the missile was nosing over into a steep dive. When the ARIA did not respond to two calls from the Lead Engineer, the Test Director again called for airborne controllers to control the missile. This radio call was transmitted, but it was too late to be effective. The missile descended rapidly and hit the ground before airborne controllers could establish control of the missile. The impact site was in the middle of an astrophysical observing array. The impact did not damage the observatory instruments, but did damage one trailer at the site and caused minor damage to another trailer. Utah Test and Training Range officials immediately secured the site and began recovering the simulated warhead and missile remains. The 388th Wing responded to the media attention generated by the mishap.

[3] Explained in detail at paragraph 2. C. (8) g. below

using similar test procedures.[5] Missile tests involve numerous participants to collect data and ensure the test is safe.[6] Primary elements and roles are:



Test Element	Role
B-52H bomber	Launches missile
EC-135 Airborne Range Instrumentation Aircraft (modified Boeing 707)	Monitors missile performance, operates remote control, flight termination systems
4 F-15/F-16 fighters	Provide visual observation, safety
KC-135 (707) or KC-10 (DC-10)	Refuels fighters
Mission Control Center	Directs, controls and monitors test
H-60 helicopter & Recovery Team	Recovers remains of warhead and missile

[4] O.2.U-150
[5] O.1.K-242
[5] O.1.B-18-38, O.1.D-106, O.1.D-113-115, O.2.M-55-84, O.2.N-109-117

Command's missile testing unit, the 49th Test Squadron, plans and conducts each test.[11] Tests are designed to verify weapons reliability and effectiveness, provide information on tactics, and assess performance of the total weapons system (to include mission planning tools, B-52, missile, software, logistics, and the warhead).[12] A Memorandum of Understanding between the USAF and the Department of Energy covers joint tests of nuclear-capable weapons systems.[13] Officials of Sandia National Laboratories and the Air Force install test instruments on test missiles in place of a functional warhead.[14] This permits verification of warhead electrical and mechanical functions as well as proper weapon handling, installation, instruments, transmitters to relay instrument data, tracking devices, a remote control kit, and a means of rapidly stopping the missile's flight in the event of an emergency.[16]

(2). **Cruise Missile Test Procedures.** The Air Force Flight Test Center established cruise missile test procedures for the AGM-86 Air Launched Cruise Missile in 1983.[17] Those procedures have guided 75 tests to date.[18] When tests of the AGM-129 Advanced Cruise Missile began, the Air Force Flight Test Center modified those proven

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[7] O.1.E-137.
[8] O.1.E-138, O.2.M-55, O.2.U-154
[9] Office of the Chairman, Joint Chiefs of Staff, MCM-22-90 28 Nov 90 (Classified CONFIDENTIAL)
[10] O.1.D-104, O.1.E-138 -142; see V.24-104-110 and V.25-111-112 for implementation in the subject test
[11] O.1.E-138, O.2.M-54, O.4.B-2-3
[12] O.1.D -104, O.1.E-137, -142, O.2.M-55
[13] O.1.E-137
[14] O.1.D-115, O.1.E-143, -181-183, 194-195
[15] O.1.E -142
[16] O.1.B-18 ff, O.1.D-106 -109
[17] O.1.A-1 -16
[18] O.1.K-242 -244

procedures for the new missile and accepted them after they passed formal safety review on 9 May 85.[19] The safety review included an Operational Hazard Analysis which established the following primary measures to minimize risks:

1. Missile preparation
2. Aircraft software preparation
3. B-52 preflight inspection
4. Missile loading by trained personnel, under supervision, with checklists
5. Software and missile fault tests
6. Missile ejection circuitry analysis
7. Real-time monitoring of launch circuitry by test personnel
8. Routes planned to avoid property and personnel
9. Remote Command and Control (RCC) capability to steer missile
10. Flight Termination System (FTS)
11. Weather minimums ensure chase aircraft can follow missile
12. ARIA aircraft relay of telemetry data to Mission Control Center (MCC)
13. MCC real-time picture for timely safety decisions
14. Remote control system and flight termination system parameters and plans keep missiles in safe areas
15. Flight termination system components are independent of missile normal control mode
16. ARIA Crew member training on RCC/FTS
17. ARIA relay of telemetry lets test conductor know if missile is receiving FTS carrier
18. ARIA permits radio relay from MCC to chase
19. ARIA monitors FTS signal and crew can warn chase or MCC of hazards
20. ARIA transmits FTS carrier signal
21. Weather criteria ensure chase can see missile & ground
22. Weather criteria ensure chase can refuel from tanker
23. Weather criteria for test execution prevent exceeding these limits
24. Four chase aircraft required (3 minimum for go)
25. Tanker for refueling required for go
26. ARIA aircraft required for go
27. Operational MCC required for go
28. Ground recovery team required for go
29. Helicopter for recovery team required for go
30. What-if procedures cover steps to take if elements drop out
31. Multiple tracking capabilities monitor flight path at all times

The organization responsible for conducting operational tests of the Advanced Cruise Missile (49th Test Squadron) published detailed test instructions specifying additional safety criteria, test team membership and duties, and detailed checklists.[20] In addition, they maintained a comprehensive lessons learned program from earlier tests.[21]

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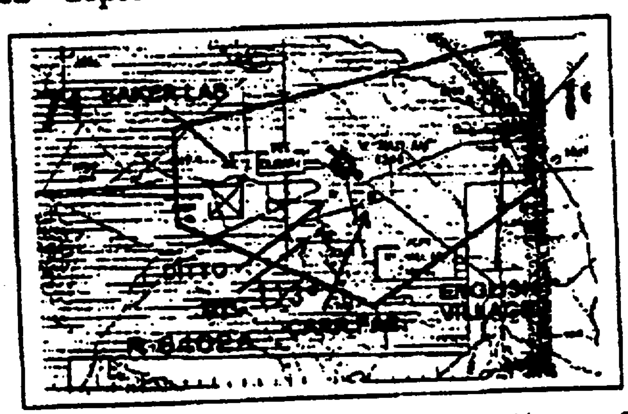
[19] O.1.B-21 -26
[20] O.1.D-113-115, O.1.Q-327 -332, O.2.B-3, O.2.D-9, O.2.I-31, O.2.L-36 -47, O.2.M-54 -84, O.2.N-109 - 120, O.2.T-138 -145
[21] O.1.F-217 -222, O.1.K-242 -244 are representative unclassified examples.

(3). **Utah Test and Training Range.** The armed forces have operated test and training ranges on the Salt Lake Desert since 1937.[22] The US Air Force has flown tests on these ranges since 1947. When the Air Force Flight Test Center first identified the requirement to test long range cruise missiles in 1976, it identified Utah as the most advantageous site.[23] The Utah range's isolation, barriers between the range and population centers (three mountain ranges), low electromagnetic interference, and instrumentation supported this conclusion.[24] The US Air Force organization responsible for the Utah Test and Training Range has changed several times in recent years.[25] The current organization, the 388th Range Squadron, belongs to the 388th Wing of Air Combat Command. The US Air Force controls the airspace over the Utah ranges.[26] The US Army's Dugway Proving Ground controls most of the land including all target areas for Advanced Cruise Missiles of the type tested on 10 Dec 97.[27] By a mutual Memorandum of Agreement of 2 Aug 90, Dugway Proving Ground establishes safety criteria and participates in Utah Test and Training Range test safety reviews.[28] The primary safety measure protecting Dugway Proving Ground facilities established in the Memorandum of Agreement is the "upside-down doghouse" flight avoidance area[29] depicted below:



"Doghouse" flight avoidance area at Dugway Proving Ground

22 O.4.A-1
23 O.4.C-4 -19, O.4.D-20 -21
24 O.4.F-37
25 V.2-14 -16, V.13-67 -72; note also organizations referred to in O.1.B17 -21, O.1.D-96 -99, O.1.H-225, O.1.O-254, O.1.P-291 ff, O.4.D-20 -21 & O.4.F-23 ff
26 O.3.A-1, O.3.B-3 -4
27 O.3.A-1, O.3.B-2 -13, O.4.A-1, V.24-105, V.25-112
28 O.3.B-2 -3
29 O.3.B-10, -13, O.1.P -314

Key capabilities of the Utah Test and Training Range used to support cruise missile tests are optical tracking, radar tracking, radio and telemetry relay, and ground stations capable of transmitting either remote control or flight termination instructions to the missile.[30] Test functions are remotely monitored and operated from the test Mission Control Center at Hill Air Force Base, Utah.[31] 388th Range Squadron cruise missile testing procedures developed by Air Force Flight Test Center require operational hazard analyses and formal safety reviews of all test programs as well as safety reviews of particular test missions.[32]

(4). Missile Termination/Command and Control.

(a). Termination. Before a bomber launches a test cruise missile, the Mission Control Center verifies that the missile's remote control and flight termination systems are working properly.[33] At all times throughout the flight the cruise missile flight termination system must detect a signal that in effect permits the missile to keep flying.[34] If the missile does not detect the signal for a preset time, the flight termination system activates, causing the missile to tumble and crash.[35] This arrangement is functionally equivalent to a dead-man switch. The missile transmits measurements which confirm it is receiving the authorizing signal (and the strength of that signal) to Mission Control throughout flight.[36] Safety officers can also activate the flight termination system in case of need at any time.[37] The Range Safety Officer at Mission Control and the Airborne Range Instrumentation Aircraft are both capable of terminating missile flight almost instantly.[38]

(b). Command and Control. The missile also relays any instructions its remote control system receives at the same time it carries out those instructions.[39] Mission Control at Hill Air Force

[30] O.4.B-2 -3, O.4.F-38 -40, O.1.D-116
[31] O.4.B-2 -3, O.4.F-38 -39
[32] O.1.B -17 ff, O.1.P-306, –308, –314, -318
[33] O.1.B -22 -24, O.1.C –51, -60, -68, -69, O.1.D-111, O.2.M –74 -75, O.2.N-91 -93
[34] O.1.C - 48 –57, O.1.B-28, O.2.N-89
[35] O.1.B-28, O.1.C-49, -86
[36] O.1.B-23 -24, O.1.C-51, -60, -68, -69
[37] O.1.B-28, O.1.C-61, O.1.P-318, O.2.N-89
[38] O.1.B-23 -28, O.1.P-320 -321
[39] O.1.B-22, O.1.C-60, -68, -75

Base and the Airborne Range Instrumentation Aircraft monitor these signals throughout the missile's flight.[40] The missile remote control system permits steering the missile to avoid weather and hazards, and allows manual intervention in case the missile malfunctions.[41] Mission Control at Hill Air Force Base and the Airborne Range Instrumentation Aircraft can control the missile.[42] Transmitters located on the range relay any commands from Mission Control.[43] These transmitters are on high terrain but they do not provide continuous line of sight to missiles at low altitude.[44] The preferred control platform is the ARIA aircraft, because its signals are less likely to be blocked by terrain.[45] Soon after the missile is launched on every test, ARIA takes manual command of the missile to check its response.[46] Because ARIA cannot see the missile, it works with chase aircraft to check the missile's performance.[47]

(c). **Chase aircraft.** Fighters chase the missile throughout flight to ensure safety.[48] They remain behind, monitoring the missile's performance and where it is heading.[49] If the missile is tracking toward a cloud, or if another aircraft enters the area, or any other problem exists, the chase pilot tells controllers on the ARIA how to steer the missile to keep it safe.[50] Chase aircraft follow the missile until it hits the ground.[51]

c. Summary of Events

(1) Mission. The mission was planned as a routine periodic test of the AGM-129 Advanced Cruise Missile in support of the Nuclear Weapon System Evaluation Program of Air Combat Command.[52]

[40] O.1.B-25 -26, O.1.D-112-118, O.1.P-320-321
[41] O.1.B-22, O.2.M-66-83
[42] O.1.B-23-24, O.1.D-119, O.1.E-148-150 & 200-214
[43] O.1.O-254-290
[44] O.1.O-254-290, O.1.Q-327-330, O.4.B-3; O.1.G-223 -224 illustrates coverage in color
[45] O.1.O-254-290, O.4.B-3
[46] O.1.B-18, O.2.M-76, O.2.N-112 -113
[47] O.1.B-25, O.1.I-230-232, O.2.M-62, O.2.N-112-113, -117
[48] O.1.B-18 & -25, O.2.M-62, O.2.N-112 –113, -117
[49] O.2.M-62, -76
[50] O.1.B-18, O.2.M-62, -76, O.2.N-117-120
[51] O.2.M-76, O.2.N-112-113, 117
[52] O.2.M-54; see also V.24-104-105 and V.25-111

Mission objectives were to:

Assess the terminal accuracy of the missile
Assess weapon system reliability
Assess the operational suitability of the carrier aircraft and missile
Assess the ability of aircraft navigation systems
Assess the effectiveness of the Air Force mission planning system
Assess the cruise missile free-flight performance
Evaluate the performance of Department of Energy components
Launch and execute using an Emergency Action Message promulgated by US Strategic Command

(2). **Planning.** Mission planning began with assignment of the test team on 17 Oct 97[53] and completion of the Air Operations Plan on 29 Oct 97.[54] Test members checked the missile trajectory on 5 Nov 97 and mailed trajectory documents to test participants the following week.[55] The test team published the Air Operations Plan for the mission, including detailed checklists, on 10 Nov 97.[56] Test planners mailed mission preparation packages to the chase pilots in mid-November[57] and briefed them via videoconference on 4 Dec 97.[58] On 1 Dec 97 the test team had a final meeting before travelling from Barksdale Air Force Base Louisiana to four other bases for their test duties.[59] Test participants completed a final conference call on 8 Dec 97 at 1400 Mountain Standard Time.[60]

(3). **Missile Flight Path.** The missile flight path was programmed to remain within protected airspace on the Utah Test and Training Range.[61] The map below depicts the flight path (in blue) and areas the flight path was designed to avoid (in red).[62]

[53] O.2.L-36
[54] O.2.C-4
[55] O.2.C-4
[56] O.2.C-4
[57] O.2.C-5
[58] O.2.L-36 -38
[59] O.2.C-5
[60] O.2.M-80
[61] O.2.C-4, O.2.U-161, O.2.K-35, O.2.L-47
[62] O.2.U-161

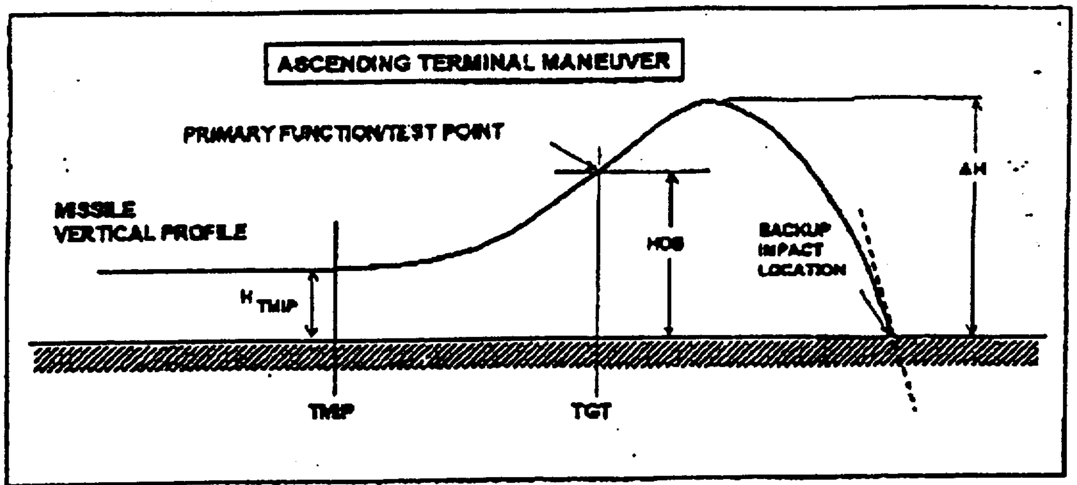
Advanced Cruise Missile Test 98-02 Programmed Trajectory

UT-39461

The 388th Range Squadron reserved the required ranges for exclusive use throughout the period of the test.[63] The primary criterion used to minimize risk was avoiding known occupied sites and no-fly areas by a minimum of one nautical mile (6,076 feet) as established by regulation.[64] In practice, 49th Test Squadron and 388th Range Squadron safety increased this buffer by employing a two mile rule.[65] Test personnel and chase pilots were informed of known avoidance areas.[66] The missile was programmed to fly at low altitude throughout the cruise phase of flight. Four chase aircraft (capable of passing steering commands to ARIA in order to avoid weather, steer around any aircraft intruding in the protected airspace, or to address any other hazard) were scheduled to accompany the missile throughout its flight, two at a time.[67]

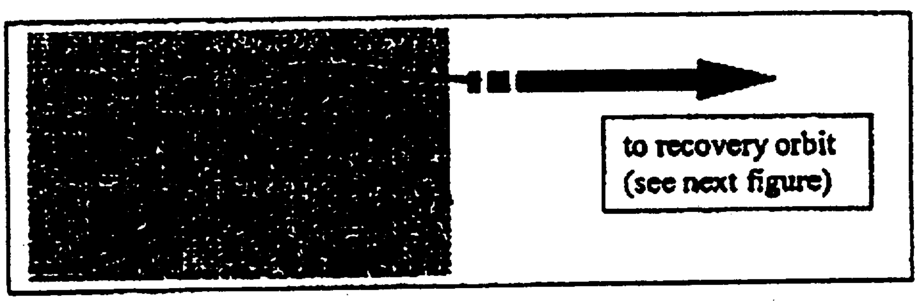
(4). **Missile Termination Plan.** The most important part of the flight for Sandia National Laboratories was the simulated warhead test. Advanced Cruise Missiles can end their flights in three programmed ways.[68] For mission 98-02, the test plan called for a climb to the point where the warhead test would take place (labeled primary function/test point in the illustration below).[69] Test planners designed the final programmed flight segment to arrive at the programmed test position while maintaining two nautical miles of separation from established avoidance areas.[70] They were unaware that a high-value site had been built on the extended flight path.[71] After the warhead test the missile would dive rapidly to earth, in accordance with the missile's programmed backup termination instructions (to arrive at the backup impact location as illustrated below).[72]

[63] O.2.P-132
[64] O.1.P-306
[65] O.2.N-119, V.21-94
[66] O.2.K-35, O.2.T-138 -145, O.2.U-161, -163 –164, O.1.P-310
[67] O.1.B-25, O.2.B-3, O.2.C-5, O.2.K-35, O.2.M-57 -58
[68] O.1.L-245 -246
[69] V.9-43, V.10-54, V.24-104 -110, V.25-112 -118
[70] V.21-94
[71] See para (8)g; V.24-107
[72] O.1.L-245 -246



Ascending Terminal Maneuver Profile

To prevent that and speed recovery of the missile, test planners devised a checklist to take remote control after the warhead test and fly the missile to an optimum recovery site instead.[73]



Planned termination using remote control

(5). **Missile Termination Checklist.** On 24 Nov 97 the Test Director and Lead Engineer developed a checklist for taking control of the missile after simulated warhead firing.[74] The checklist called for the Lead Engineer to call remote control commands to the Airborne Range Instrumentation Aircraft for the latter to execute.[75] While every position in the Mission Control Center was equipped to make these radio calls, the Test Director understood that the Lead Engineer had the best ability to execute the plan.[76] Information available to the Lead Engineer included missile telemetry, two separate precision tracking systems and

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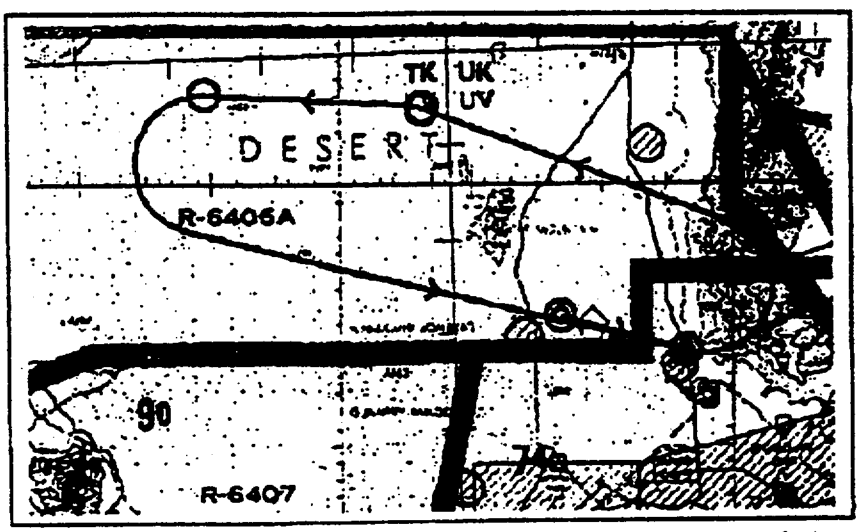
[73] O.2.D-9; see also O.2.S-137, O.2.K-35, V.19-89, V.24-105, V.25-112
[74] O.2.I-31, V.19-89, V.20-92, V.21-94, V.22-96, V.23-99, V.24-105 –106, V.25-112 -113
[75] O.2.D-9, V.19-89, V.20-92, V.21-94, V.22-96, V.23-99, V.24-105-106, V.25-112 -113. Reviews of the profile by Air Force and contractor missile engineers uniformly indicate there was time to take control of the missile, as previous tests featuring successful manual termination profiles further confirm.
[76] V.25-120, V.24-106, O.1.J-233 -241, O.1.M-247

real-time video relayed from ground tracking stations.[77] In response to the scripted calls from the Lead Engineer, the Airborne Range Instrumentation Aircraft would then fly the missile to a planned impact point.[78] The Lead Engineer had access to controls which theoretically would have permitted him to take remote control of the missile from the Mission Control Center.[79] However, test planners knew that ground transmitters had less reliable coverage and that procedures consequently established ARIA as the primary control station because of its unobstructed radio line of sight.[80] The checklist called for ARIA controllers to fly the missile to the west, slow it, fly an orbit over the mud flats, and then point it towards the selected impact point.[81] The test team selected an optimum impact point to ensure recovery of depleted uranium in the warhead and all pieces of the stealth missile body.[82] The Lead Engineer coordinated these procedures within the test team, with the Airborne Range Instrumentation Aircraft crew on 24 Nov 97, and with the chase pilots on 4 Dec 97.[83]



Planned missile trajectory after warhead test (recovery orbit)

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[77] V.21-95, O.1.M-247, O.4.B-2-3 O.4.F-38 -39
[78] V.21-94 -95, V.22-96 -97, V.23-99 -102, V.24-106 –108, V.25-118, O.2.D-9, O.2.M-61, O.2.S-137
[79] O.1.B-25 -26, O.1.D-106, O.1.J-233 -241
[80] O.1.G-223 -224, O.1.O-254 -290, O.2.M-62, O.1.Q-327; added risks this would entail are described at V.23-101 -102 and V.24-108
[81] O.2.D-9, O.2.I-31, O.2.K-35,
[82] V.9-43, V.21-94, V.24-105, V.25-112, O.2.D-9, O.2.E-16 -17
[83] O.2.C-4 -7, O.2.I -31, O.2.L-36 -39, V.19-89, V.22-96, V.23-99, V.24-106, V.25-112 –113

(6). **Preflight preparation.** The Test Director, Captain David G. Salomon, conducted a telephone conference with participating unit project officers on 16 Nov 97.[84] On 2 Dec 97 the 388th Range Squadron sent a memo asking Dugway Proving Ground to prohibit access to the test site and nearby areas throughout the test.[85] Weapons technicians performed initial tests of the ACM missile on 3 Dec 97, monitored Sandia's non-nuclear verification of the weapon on 4 Dec and completed additional pre-mission checks of the missile on 5 Dec.[86] Test participants confirmed all components were mission ready via teleconference on 8 Dec 97.[87] The team had scheduled the test for 9 Dec 97 but postponed it for 24 hours due to weather.[88] Chase pilots completed a detailed mission briefing.[89] The Mission Control Center was activated and checked before the mission.[90] The B-52 crew planned their mission thoroughly and filed their flight plan two hours and thirty minutes prior to takeoff.[91]

(7). **Missile Activity.** The B-52 arrived at the range at 0900 Mountain Standard Time, one hour before missile launch.[92] The Airborne Range and Instrumentation Aircraft and Mission Control Center checked the operation of safety and control systems on the missile, as well as tracking instrumentation and telemetry.[93] Five minutes prior to missile launch, with all aircraft in the test area, the Mission Control Center conducted a pre-launch safety check and confirmed the range was safe.[94] After missile launch at 1008, chase pilots verified it was flying well and checked the effectiveness of the remote control system.[95] The missile then flew its planned course within protected airspace for three hours

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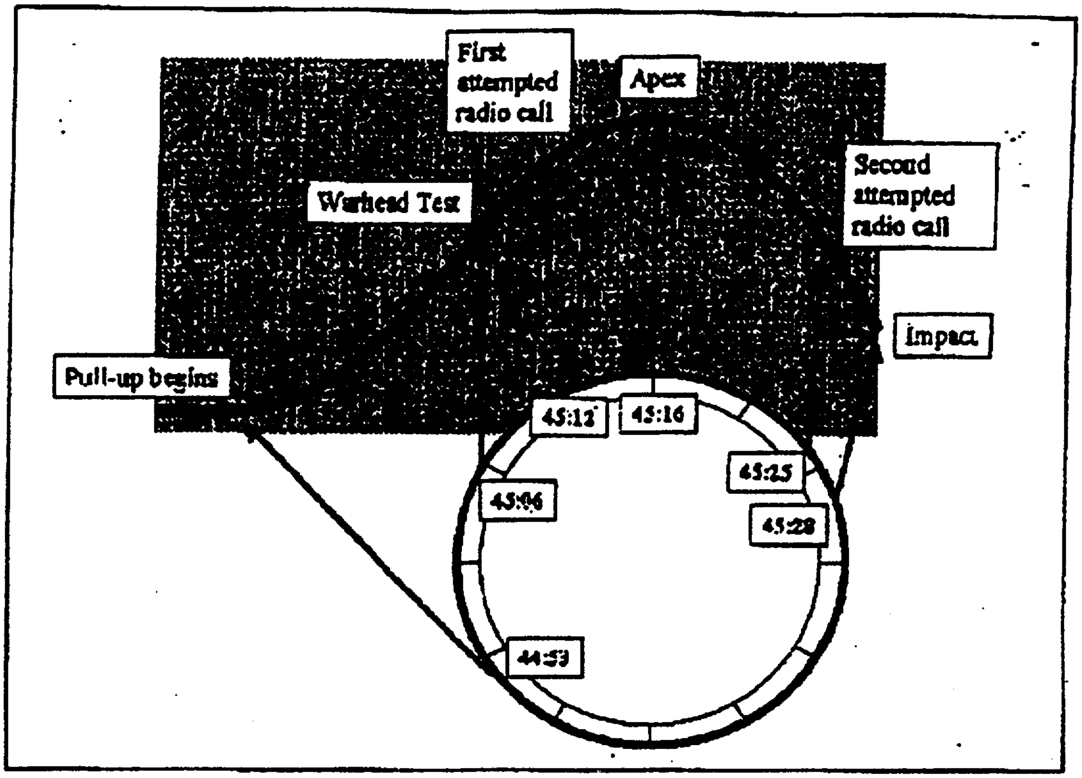
[84] Participating units included 49th Test Squadron, AFFTC, 388th Range Squadron, 422 TES, and 5th Bomb Wing. O.2.L-36, -39
[85] O.2.P-132
[86] O.2.A-2
[87] O.2.M-83
[88] O.2.M-54, W-2
[89] O.2.K-35, O.2.T-138 -145
[90] O.2.Q-133 -134, V.25-113
[91] K-1
[92] O.2.M-74
[93] O.2.M-75
[94] O.2.M-75, O.2.Q-133-134
[95] O.2.M-76, V.15-78

and 38 minutes.[96] During these three-plus hours the missile flew in protected airspace, heading generally north and south except during turns.[97] The final segment of the programmed missile trajectory took it to a point in space chosen for camera tracking and signal reliability to ensure the mission met warhead test objectives.[98] At 1342:29, two minutes before the warhead test, the missile turned east to a heading of 105.6 degrees, maintaining an altitude of 4800 feet above Mean Sea Level.[99] The sequence of events that followed is explained in the following table and graphically depicted below in relation to a sixty second clock:

Time	Event
1344:53	Missile began a 2 G pull up for warhead kit test
(thirteen seconds)	Missile maintained the 2 G pull-up
1345:06	Warhead kit test occurred
1345:08	Missile began pushing over from its climb at minus one G
Once telemetry showed warhead kit test complete	Engineer from Sandia National Laboratories informed the Lead Engineer
1345:13	Test Lead Engineer called "THIRTY-ONE ROMEO - - LEVEL, COME LEFT TO A HEADING OF TWO NINE ZERO DEGREES" (on MCC interphone – call was not transmitted over radio – ARIA did not hear)
1345:16	Missile reached its highest altitude of 9971 feet
	Continued to push over into a steep dive
1345:25	Test Lead Engineer made a second call, "THIRTY-ONE ROMEO --, LEVEL, COME LEFT TO A HEADING OF TWO NINE ZERO DEGREES NOW" (on interphone)
	Missile continued to dive until its nose was 59 degrees below the horizon
1345:29	Missile hit the ground
1345:30	Test Director called the ARIA with the instruction "THIRTY-ONE ROMEO LEVEL COMMAND LEFT TURN NOW"
1345:34	Controllers on ARIA acknowledged the Test Director's call

Test sequence of events

[96] V.21-96, V.22-97, V.23-102, V.25-114, O.2.M-76, O.2.O-125-131
[97] V.21-96, V.22-97, V.23-102, V.25-114, O.2.U-161
[98] V.9-43, O.2.E-16
[99] O.2.E-16, O.2.O-125 -131; V.20-93 when paired with O.2.G-19-22 establishes a precise timing reference



Test sequence of events compared to sixty seconds (Missile apex at twelve o'clock)

Narration of the data depicted above: At 1344:53, thirteen seconds before it reached the test point, the missile began a 2 G pull up for the warhead test. The missile maintained the 2 G pull-up from 1344:53 until the warhead test occurred at 1345:06. After the simulated warhead test the missile continued to climb in a ballistic arc for two seconds. At 1345:08 the missile began pushing over from its climb at minus one G. As soon as telemetry showed the warhead test was complete, the engineer from Sandia National Laboratories informed the Lead Engineer. The Lead Engineer made the call "THIRTY-ONE ROMEO - - LEVEL, COME LEFT TO A HEADING OF TWO NINE ZERO DEGREES" at 1345:13. In the Mission Control Center the Lead Engineer's call sounded like it was being transmitted over the radio, but it was not in fact transmitted. The missile reached its highest altitude of 9971 feet at 1345:16 and continued to push over into a steep dive. At 1345:25 the Lead Engineer made a second call, "THIRTY-ONE ROMEO -- LEVEL, COME LEFT TO A HEADING OF TWO

NINE ZERO DEGREES NOW." Again, in the Mission Control Center the call sounded like a radio transmission but was not in fact transmitted. The missile continued to dive until its nose was 59 degrees below the horizon. Twelve seconds after the peak of its flight, at 1345:29, the missile hit the ground. At 1345:30 the Test Director called the ARIA with the instruction "THIRTY ONE ROMEO LEVEL COMMAND LEFT TURN NOW," and controllers on ARIA acknowledged the call at 1345:34.[100]

(8). **Impact.** The missile hit the ground in the center of an astrophysical observatory site and was destroyed.[101] The missile sheared the southeast corner off the observatory control trailer and hit graded ground four feet east of the trailer.[102] The chase pilot remained above the impact site momentarily and confirmed impact while the missile recovery crew flew to the scene in a helicopter.[103]

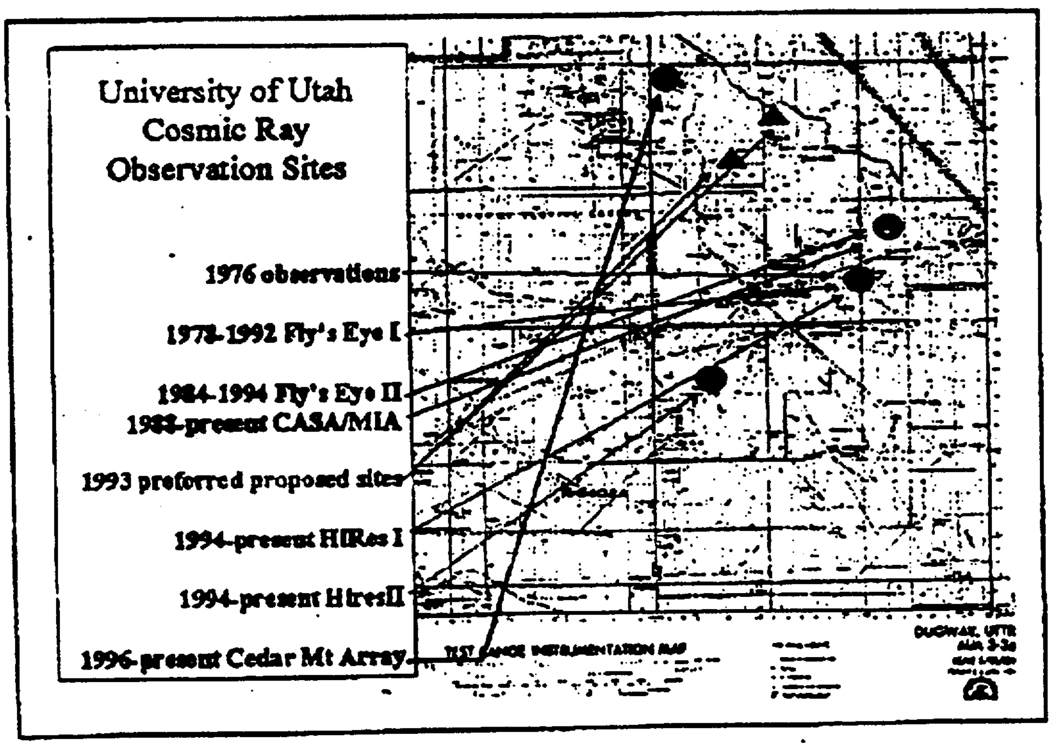
(9). **Crash Response.** The missile recovery crew aboard the helicopter included the on-scene commander, two radiation officers, a missile technician, an explosives disposal technician, and a missile recovery technician.[104] The team observed no explosion or fireball from the impact, but found a small fire four meters from the impact crater and extinguished it.[105] The Explosives Ordnance Disposal technician performed an initial inspection of the site and declared it safe.[106] The team immediately secured all visible pieces of the missile and recovered all discernible pieces of depleted uranium.[107] The radiation officers surveyed the site with radiation survey meters and calibrated probes.[108] Although access to Dugway Proving Ground is controlled and access to the range is further restricted, the on-scene commander posted a security team at the site for the duration of the effort to recover sensitive materials.[109] All soil

[100] O.2.G-19 -22, O.2.O-125 -131, Videotape 84716, O.2.Q-133 -134
[101] O.7.A-1, S.2 through S.11, R-2
[102] S.2 through S.11, O.7, R-2
[103] V.15-77, V.25-114, O.7.A-1 -2
[104] O.2.F-18
[105] O.7.A-1
[106] O.7.A-1 -2
[107] O.7.A-1 -3, V.11-58 -59
[108] O.7.A-1, -3
[109] V.11-58 -59

from the vicinity of the crater was excavated, samples were taken, and the soil was transported to a secure storage site.[110] Tests of the soil samples indicated traces of missile rivet material but no other contaminants.[111] Once the area was snow-free, the site was covered with four inches of soil to complete its restoration.[112]

(10). **Fly's Eye Cosmic Ray Observatory on Cedar Mountain.**

a. **Background.** Extremely powerful cosmic rays occasionally enter the earth's atmosphere and resulting radiation can be detected by sensitive instruments, particularly on clear moonless nights. These rays are of interest for three reasons. They have more energy than can be produced in any particle accelerator, their origin is unknown, and accumulated observation may provide data on profound astrophysical questions.[113]



Cosmic Ray Observation Sites on Dugway Proving Ground

[110] O.7.A-3,1 V.11-58-59
[111] O.7.A-3, V.11-59 m-61
[112] V.11-59
[113] O.6.A-2, V.1-2