410950

SE[redacted]

234

OPERATION REDWING

A PRELIMINARY REPORT

OF

[redacted] (APACHE)

INVENTORIED
DATE 12-20-61

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R & D FILES

Submitted by Task Group 7.1

RG 326 US ATOMIC ENERGY COMMISSION

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| Pressure Millibars | Height Feet | Temperature °C | Dew Point °C |
|---|---|---|---|
| 1000 | 310 | 25.5 | 24.2 |
| 850 | 4,960 | 18.2 | 14.8 |
| 740 | 8,858 | 12.2 | 07.2 |
| 727 | 9,318 | 08.2 | 03.8 |
| 700 | 10,340 | 08.5 | 03.2 |
| 691 | 10,696 | 08.5 | 03.2 |
| 682 | 11,122 | 05.5 | 00.5 |
| 600 | 14,440 | 01.2 | -03.2 |
| 500 | 19,230 | -07.2 | -09.5 |
| 400 | 24,840 | -18.2 | -20.5 |
| 300 | 31,650 | -34.2 | -34.5 |
| 274 | 33,760 | -38.8 | -38.8 |
| 200 | 40,550 | -55.0 | M |
| 150 | 46,390 | -68.5 | M |

WINDS ALOFT (0515M)

| Height Feet | Direction Degrees | Speed Knots | Height Feet | Direction Degrees | Speed Knots |
|---|---|---|---|---|---|
| 1,000 | 070 | 12 | 28,000 | 300 | 06 |
| 2,000 | 070 | 12 | 30,000 | 300 | 09 |
| 3,000 | 080 | 10 | 32,000 | 180 | 12 |
| 4,000 | 100 | 13 | 34,000 | 210 | 14 |
| 5,000 | 100 | 13 | 35,000 | 190 | 11 |
| 6,000 | 110 | 13 | 36,000 | 200 | 12 |
| 7,000 | 110 | 15 | 38,000 | 250 | 13 |
| 8,000 | 130 | 14 | 40,000 | 310 | 09 |
| 9,000 | 130 | 16 | 42,500 | 240 | 14 |
| 10,000 | 140 | 16 | 45,000 | 280 | 14 |
| 12,000 | 150 | 08 | 47,500 | 220 | 14 |
| 14,000 | 120 | 02 | 50,000 | 220 | 15 |
| 16,000 | 060 | 06 | 52,500 | 220 | 21 |
| 18,000 | 040 | 04 | 55,000 | 180 | 24 |
| 20,000 | 050 | 02 | 57,500 | 120 | 29 |
| 22,000 | 110 | 04 | 60,000 | 100 | 26 |
| 24,000 | 180 | 04 | 65,000 | 080 | 34 |
| 25,000 | 230 | 06 | 68,000 | 070 | 30 |
| 26,000 | 280 | 08 | | | |

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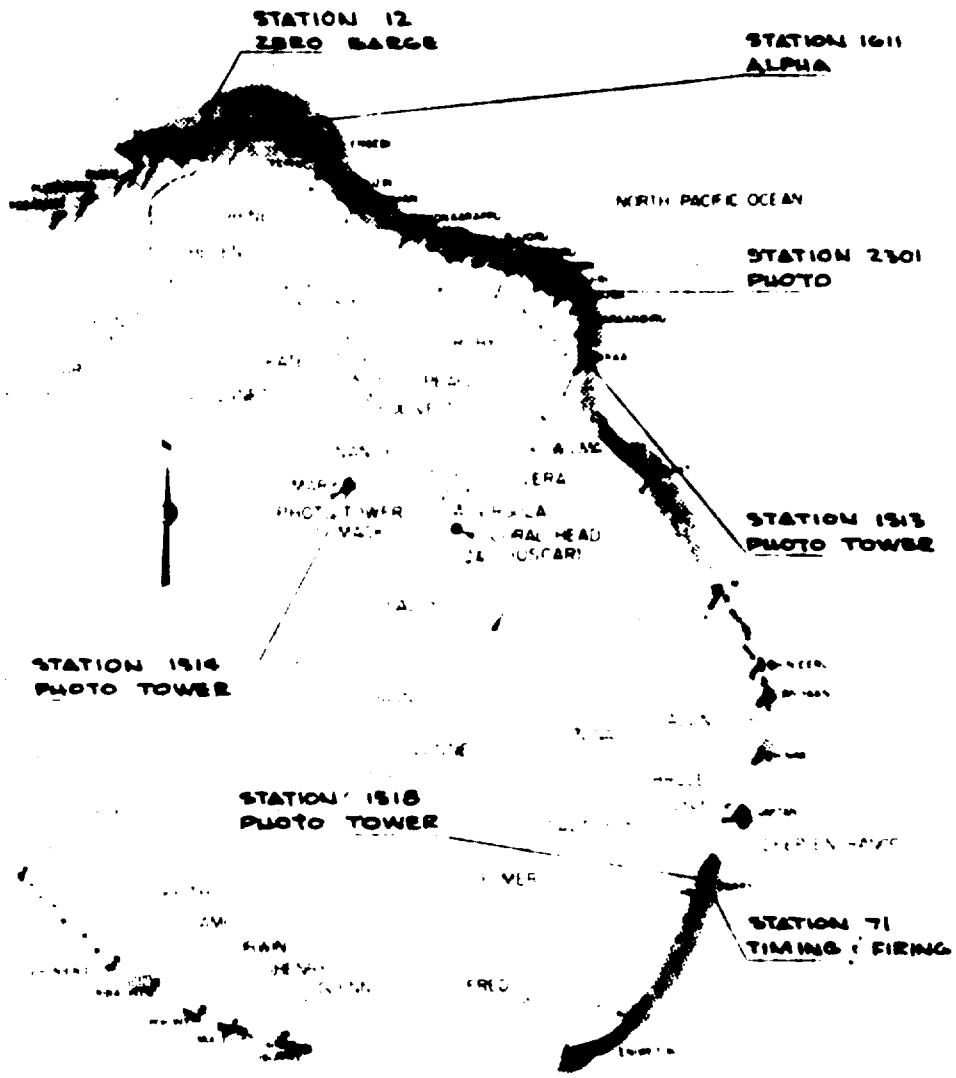


Fig. 0-1 - Enivetok Atoll Map

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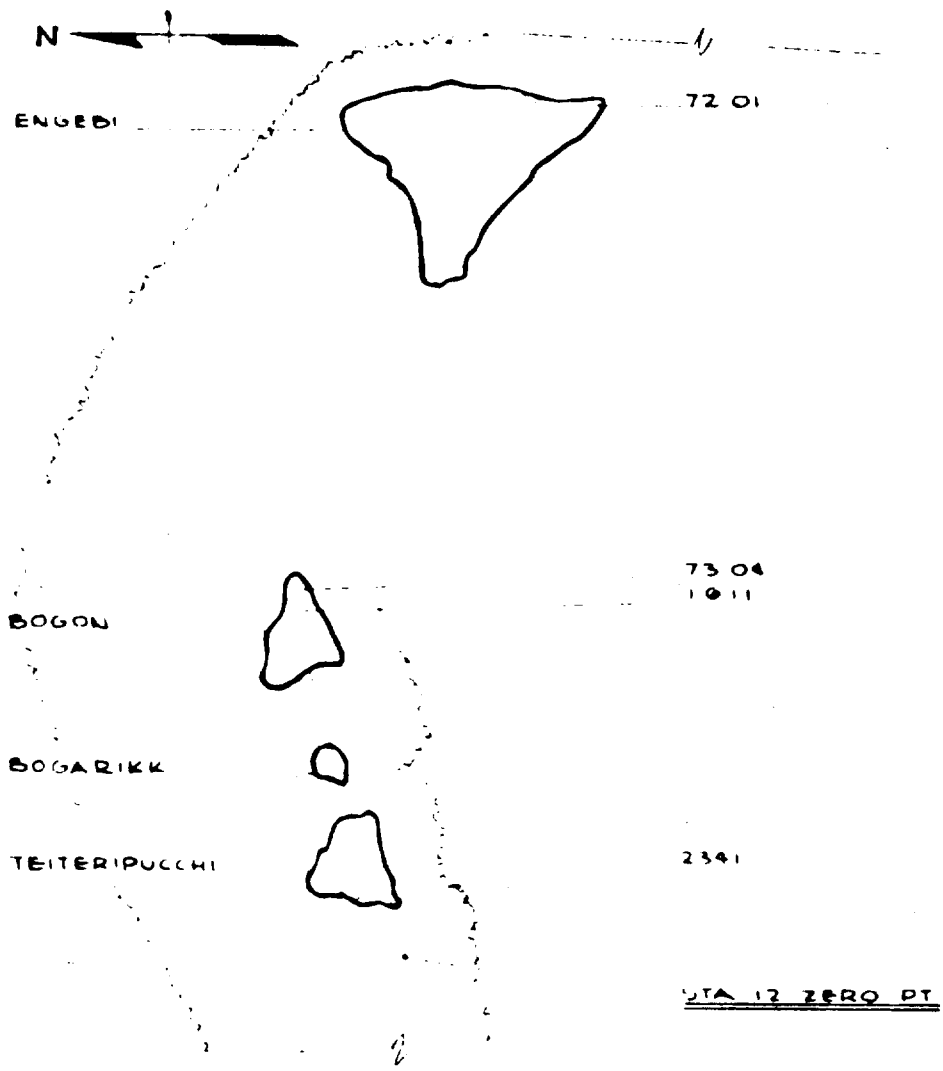


Fig. 0-2 - Scientific Stations and Zero Point

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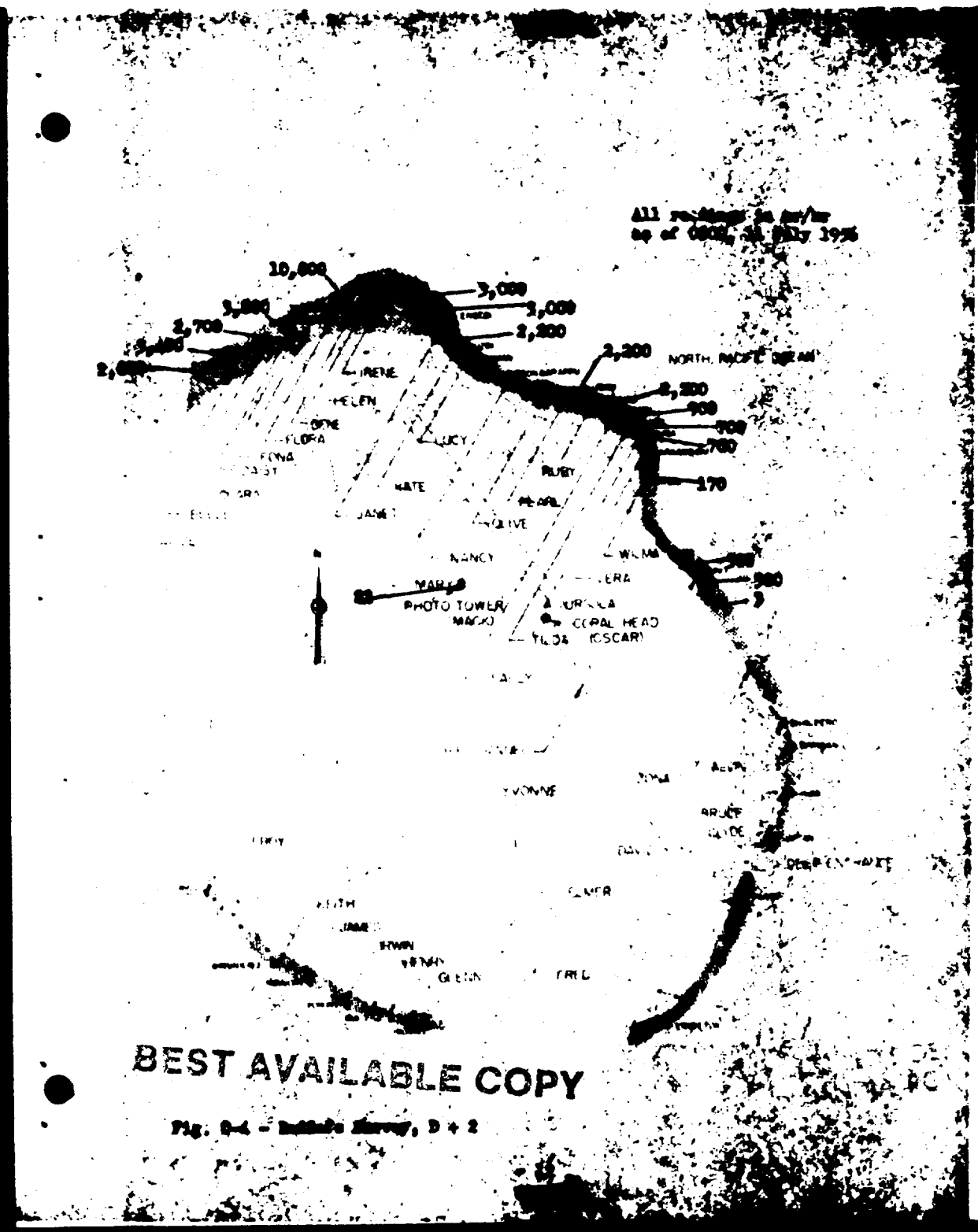


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Fig. 9-4 - Bubble Survey, D + 2

PART II

TASK UNIT 3

DOD PROGRAMS

K. D. Coleman
Col. K. D. Coleman
CTU-3

| | |
|---|---|
| Program 5 - Aircraft Structures | CDR M. R. Dahl |
| Program 6 - Tests of Service Equipment and Materials | Lt Col C. W. Bankes |
| Program 9 - General Support | Lt Col J. G. James |

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[redacted]

sections of gray paint on aileron.

Gust: At time of shock arrival the gust load was 48% of limit wing bending at station 493.0, 38% at station 615.0, and 36% at station 144.0. No gust damage was sustained by the aircraft.

Overpressure: Peak overpressure measured was [redacted] at H + 67.75 seconds.

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[redacted]

[redacted] (APACHE)

Project 5.2 - In-Flight Participation of a B-52 - 1st Lt. F. L. Williams

OBJECTIVE

The objective of this test was to determine the delivery capability of the B-52 aircraft.

INSTRUMENTATION

Instrumentation of the B-52 for [redacted] (Apache) consisted of 310 oscillograph channels which recorded measurements from strain-gage bridges, accelerometers, roll and pitch gyros, radiometers, control position transducers, thermocouples, pressure transducers, and calorimeters. In addition, 14 cameras recorded photo-recorder instruments (14 channels), wing deflection, cloud coverage, and fireball rise and growth.

AIRCRAFT POSITION IN SPACE

The following chart shows the airplane's position at zero time and time of shock arrival:

| | Altitude (Abs ft) | Offset (ft) | Heading (True-deg) | Slant Distance (ft) | Velocity (fps) TAS | Velocity (fps) Ground |
|---|---|---|---|---|---|---|
| Conditions at Time Zero | 34000 | 2600 | 111 | 38700 | 740 | 730 |
| Condition at Shock Arrival | 34000 | 0 | 111 | 63800 | 757 | 747 |

RESULTS

Thermal Energy: [redacted] measured at BS 655 by a 160° field calorimeter pointed straight down.

Maximum Temperature: 213°F was measured on a bare, .025 aluminum lower surface elevator panel located at BS 230. The absorptivity of this panel was .50.

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[redacted]

16

[redacted]

**Gust:** 62% of allowable wing bending was measured at LBWS 444 and 39% of allowable tail bending moment was measured at SS 300.

**Overpressure:** [redacted] was measured at BS 340, left hand side.

**Instrumentation Failures:** Eleven oscillograph channels, and one N-9 camera failed during the [redacted] (Apache) mission. 96.5% of the total instrumentation was operative.

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[redacted]

17

[redacted]

[redacted] (APACHE)

Project 5.3 - In-Flight Participation of a B-66B Aircraft - R. W. Bachman

OBJECTIVE

The primary objective of this test was to measure the gust, thermal, overpressure and high Q field effects of a high yield megaton nuclear weapon on a B-66B aircraft in low altitude flight.

INSTRUMENTATION

Instrumentation on the B-66B for [redacted] (Apache) consisted of the following: 67 strain gages at 5 stations and 26 thermocouples at 7 stations on the L.H. wing; 16 strain gages at 1 station and 6 thermocouples at 2 stations on the R.H. wing; 25 strain gages at 4 stations and 12 thermocouples at 2 stations on the L.H. horizontal stabilizer; 9 strain gages at 1 station and 2 thermocouples at 1 station on the R.H. horizontal stabilizer; 3 strain gages at 1 station and 9 thermocouples at 3 stations on the L.H. elevator; 2 strain gages at 1 station and 6 thermocouples at 1 station on the R.H. elevator; 56 thermocouples at 11 stations on the fuselage; 17 accelerometers on the fuselage, empenage, and nacelle; 13 calorimeters and 1 radiometer together with 6 cameras in the tail; 5 calorimeters and 1 radiometer together with 6 cameras in the fuselage belly; wing and tail deflection cameras; 32 basic flight instruments on a photo recorder panel, and 8 correlation channels.

AIRCRAFT POSITION IN SPACE

Using the K-5 Radar system, the B-66B was positioned at an altitude of 8,000 feet, on a heading of 080 degrees, and a horizontal range of

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[redacted]

18

[redacted]

23,500 feet at time zero. At time of shock arrival, the horizontal range was 60,500 feet with the aircraft on the same heading and at the same altitude as before.

RESULTS

Thermal: Total thermal energy measured was [redacted] Maximum ΔT measured was 89°F on the .016 painted elevator panels, which gives a total temperature of 187°F on the elevator.

Gust: Maximum gust loading at time of shock arrival was 1.7 G's and a limit allowable of 57% on the wing using a dynamic magnification factor of 1.14.

Overpressure: Peak overpressure measured was [redacted]

Operability: Of the 296 total data recording channels, 97% were operable.

DAMAGE

The tail radome had been replaced with a standard production part, sent as a spare and was coated with XP-104 Hypalon anti-erosion compound. The only visual damage was the bubbling of some of the Hypalon on this article.

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[redacted]

[redacted]

[redacted] (APACHE)

Project 5.4 - In-Flight Participation of a B-57B - 1st Lt. H. M. Wells, Jr.

OBJECTIVE

The objective of this test was to measure the effects of a nuclear detonation on an in-flight B-57B aircraft weapons system.

INSTRUMENTATION

Out of 210 channels being recorded, 14 data channels were lost for various reasons and have been repaired or replaced by spares.

AIRCRAFT POSITION IN SPACE

The JB-57B was flying at an absolute altitude of 10,390 feet, on a 052° T heading in a 2° nose left position at H + 0. Horizontal range to ground zero at H + 0 was 28,516 feet (aircraft traveling at 304 ft/sec). Aircraft position at time of shock arrival (H + 33.4 sec) was 46,711 feet beyond ground zero. Heading same as H + 0, altitude 10,290 feet, speed 282 ft/sec.

RESULTS

Thermal: Total energy measured was [redacted] normal to a horizontal receiver. [redacted]

Gust: Total gust load at time of shock arrival was 43% ± 5% of allowable limit for the B-57B.

Overpressure: Peak overpressure was [redacted] at H + 33.4 sec.

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[redacted]

20

Project 5.5 - In-Flight Participation of F-84F Aircraft - Lt. J. A. Sabatella

OBJECTIVE

Waiter (Capabilities F-84F) - This participation was an attempt to determine the capability of the F-84F aircraft by subjecting it to both thermal and symmetric blast loads.

Barley (Sideloads F-84F) - The object of this participation was to study the dynamic response of fighter structures to anti-symmetric blast loads.

INSTRUMENTATION

Waiter - 100 data channels were available to record moment, shear, and torsion loads; accelerations; overpressure; temperature; thermal strain; and aircraft attitude. All of these channels were successfully recorded. However, a flap camera failed to operate properly.

Barley - 100 data channels were available to record essentially the same information as above. Out of these 100 channels, there was only one channel that failed.

AIRCRAFT POSITION IN SPACE

Waiter - At time zero, the aircraft was flying at an altitude of 31,614 ft on an inbound heading of 070°. The horizontal range was 18,614 ft with a left offset of 246 ft. The shock arrival position (at H + 15.05 sec) was 31,317 ft altitude, 61,041 ft horizontal range, and 1,760 ft offset to the right. The true air speed was 800 fps.

Barley - At time zero, the aircraft was flying at an altitude of 35,749 ft on an inbound heading of 060°. The horizontal range and offset were -26,973 ft and 34,808 ft respectively. At shock arrival (H + 37.26 sec)

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the aircraft was at 36,026 ft altitude; 2,686 ft horizontal range; and 34,850 ft offset to the right. The true air speed was 800 fps.

RESULTS

Waiter

Thermal - 140° temperature rise in the aluminum skin of the wing flap.

Gust - Not available at this time.

Overpressure - [redacted]

Barley

Thermal - Negligible.

Gust - 52% limit load in side fuselage bending.

Overpressure - [redacted]

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[redacted]

[redacted] (APACHE)

Project 5.6 - In-Flight Participation of an F-101A Aircraft - Capt M. H. Levin

OBJECTIVE

The objective of Project 5.6 is to determine the responses of an in-flight F-101A aircraft to the thermal blast and gust effects of a nuclear detonation. A correlation of the responses, combined with known characteristics of any weapon, will be used to define the maximum safe delivery capability of the aircraft.

INSTRUMENTATION

The aircraft was instrumented with radiometers, calorimeters and pressure transducers to measure the thermal and blast inputs and with strain gages, thermocouples and various other instruments to measure the aircraft response to the inputs. For [redacted] (Apache) shot, the aircraft was positioned to receive a high caloric input, [redacted] at a low angle of incidence. At this position the aircraft would theoretically receive a $\Delta T$ of 350°F on the .020 inch skin covered honeycomb surfaces based on positioning yield and the on-time position. At this position the aircraft would receive 40% design limit load on the stabilator.

AIRCRAFT POSITION IN SPACE

The aircraft was to fly at 15,000 feet absolute altitude on an inbound heading of 040° at a ground speed of 950 fps. It was planned that the aircraft would be 19,100 feet beyond ground zero at time zero with the shock arriving 24 seconds later at a horizontal range of 59,000 feet. Actual shot position was 900 feet beyond and 50 feet to the right of planned position at time zero, with shock arriving 71.52 seconds later at a horizontal range of 70,200 feet.

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[redacted]

23

RESULTS

Damage: The only damage to the aircraft was a slight blistering to the black rain erosion coating on the radome sample, and a slight blistering of the white paint on the left stabilator plastic tip.

Instrumentation: There was no apparent damage to the instrumentation of the 50 oscillograph recorded parameters, 48 produced usable data. Two thermocouples produced unreliable readings. One wing deflection camera shutter was out of synchronization and the film resulting was blurred and unreadable.

Gust Data: Overpressure measured was about [redacted] Gust responses were less than 10% for shear, bending and torque.

Thermal Data: Temperatures were considerably less than predicted. A $\Delta T$ of about 160°F was experienced on the unpainted honeycomb. The white honeycomb on the stabilator experienced a $\Delta T$ of about 125°F, while white painted honeycomb on the wing experienced a $\Delta T$ of about 35°F.

Nuclear Radiation: No indication of nuclear radiation was recorded on the pilots film badge.

General: The participation was again considered successful although disappointing due to the disparity between the positioning yield and the actual yield estimates.

DISCUSSION

The contents of this post shot report are preliminary, tentative and approximate. They are subject to change pending further evaluation of the data collected. They were reported at this time to provide early test results to those concerned with effects of nuclear weapons.

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[redacted] (APACHE)

Project 5.7 - Thermal Flux and Albedo Measurements from Aircraft -

Capt. R. L. Dresser

OBJECTIVE

The objective of Project 5.7 participation on this shot was to obtain thermal flux and albedo information of a nuclear detonation with airborne calorimeters, radiometers, and sixteen millimeter motion picture cameras.

INSTRUMENTATION

Instrumentation within the purview of Project 5.7 which was installed in the B-47 included nineteen NRDL calorimeters and two NRDL radiometers for measuring the direct and surface reflected thermal radiation. Six calorimeters were utilized to measure thermal radiation which was back-scattered toward the cockpit. Seven GSAP M-9 cameras were utilized to obtain photographic coverage of the fireball, the earth's surface, and of clouds beneath the aircraft, and also of any reflecting surface such as a cloud which could contribute to the back-scattered radiation.

Project 5.7 instrumentation on the B-52 included the twenty-one basic instruments for thermal radiation measurements, but only an additional two instruments were utilized for back-scatter measurements. Eight GSAP cameras were installed for photo-graphic coverage.

Project 5.7 instrumentation on the B-57 consisted of the basic twenty-one instruments and six cameras.

Project 5.7 instrumentation on the B-66 consisted of the basic twenty-one instruments and twelve cameras.

Neither tactical bomber (B-66, B-57) was instrumented for measuring back-scattered thermal radiation. The twenty-one basic thermal instruments

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[redacted]

possessed various fields of view and were suitably filtered to obtain qualitative spectral distribution information. All channels were recorded on Consolidated Recorders except the six back-scatter channels in the B-47 which were recorded on magnetic tape. The cameras were equipped with red and blue filters to obtain information at each end of the visible region of the spectrum. Several cameras were equipped with spectroscopic attachments to obtain continuous spectra in the visible region. Two of these spectrographs were operated at the EG&G Parry photo tower.

AIRCRAFT POSITION IN SPACE

Information of the position in space of each aircraft is contained in the post shot reports of the following projects:

| | |
|---|---|
| Project 5.1 - B-47 | Project 5.3 - B-66 |
| Project 5.2 - B-52 | Project 5.4 - B-57 |

RESULTS

Thermal: The preliminary value of total thermal input to the aircraft obtained by Project 5.7 instrumentation is included in the post shot report of the appropriate project indicated above.

Back-scatter Measurements on the B-47: The back-scatter inputs were unexpectedly low on the basis of predicted direct thermal inputs, and in consequence, readable signals were obtained on only three of the six channels. The uncorrected values of these inputs is on the order of from 15 to 20 millicalories.

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Photographic Data: A total of thirty-five cameras were operated by Project 5.7 on this event. Thirty-three of these were airborne in four aircraft. Of these, three failed to operate properly. It is impossible to state at this time how many of the remaining thirty films may subsequently prove to be unsuitable for analysis as the films have not been developed. It is believed that nearly all of these cameras obtained satisfactory records.



COPIED DOE CAMBRIDGE

[redacted]

D[redacted] (APACHE)

Project 5.8 - In-Flight Participation of the A3D-1 Aircraft - LCDR P.S. Harward

**OBJECTIVE**

The objective of this test was to investigate the A3D-1 aircraft capability for the delivery of high yield nuclear weapons by the measurement and correlation of the in-flight effects of a nuclear detonation.

**INSTRUMENTATION**

Instrumentation of the A3D-1 aircraft consisted of 96 oscillograph recording channels, one photo recorder, four GSAP cameras, and three dosimeters. The data recorded included temperature rise, thermal input, rate of thermal input, overpressure, gust loading, aircraft response, engine response, and gamma radiation.

**AIRCRAFT POSITION IN SPACE**

The A3D-1 aircraft was flying at an absolute altitude of 26,000 feet, heading 276°T in a tail-on position at H + 0. Slant range to ground zero at H + 0 was 36,780 feet, (aircraft TAS 830 fps) aircraft position at time of shock arrival (H + 67.9 sec.) was 85,500 feet slant range on a heading of 276°T at 25,500 feet absolute altitude.

**RESULTS**

Thermal: Temperture rise on critical aircraft structure was 51°F.

Gust: Total gust load at time of shock arrival was 0.72 g's at C.G. (57 percent allowable load factor).

Overpressure: Peak overpressure measured was [redacted] at H + 67.9 sec.

Gamma: Approximately 0.001 roentgens of radiation was received in the cockpit of the A3D-1 aircraft.

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[redacted]

27

Project 6.1 - Accurate Location of an Electromagnetic Pulse Source - E.A. Lewis

**OBJECTIVE**

To utilize the electromagnetic signal originating from nuclear weapon detonations to determine ground zero of detonation. Secondarily to obtain the yield data that is available in the bomb pulse.

**PROCEDURE**

Location of ground zero is made by use of an inverse Loran principle. The exact time the bomb pulse is received at various stations is recorded. The exact time difference in receipt of the electromagnetic pulse between two stations will be used to determine a hyperbolic curve which runs through ground zero. The point of intersection of two or more curves determines ground zero.

There are two systems. One of the systems is known as the long base line system and the other the short base line system. Each system has two sets of stations. The long base line has one set of stations located in the Hawaiian Islands (Midway, Palmyra and Maui) with synchronizing antenna station at Haiku, Maui, and the other set of stations in the States (Harlington, Texas; Blytheville, Arkansas; Kinross, Michigan and Rome, New York) with synchronizing antenna station at Cape Fear, North Carolina. The short base lines have one set of stations located in the Hawaiian area (Kona, Hawaii; Papa, Hawaii; and Red Hill, Maui) the other set in California (Pittsburg, Woodland, and Maryville).

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**RESULTS**

All stations in both the long and short base lines successfully received and recorded the wave form of the electromagnetic pulse emanating from the bomb detonation. Line of position and fix errors will be reported in the Project 6.1 report.

[redacted]

D[redacted] (APACHE)

Project 6.3 - Effects of Atomic Explosions on the Ionosphere - M. Hawn

OBJECTIVE

The objective of Project 6.3 was to obtain data on the effects of high yield nuclear explosions on the ionosphere. Principally, to investigate the area of absorption, probably due to the high altitude radioactive particles, and to study the effect of orientation relative to the earth's magnetic field on F2 layer effects.

INSTRUMENTATION

The system comprised:

Two Ionosphere recorders, type C-2, operating on pulse transmission, installed in 6 ton trailer vans, one located at Rongerik Atoll and one located at Kusaie in the Caroline Islands.

One Ionosphere recorder, type C-3, operating on pulse transmission, installed in a C-97 plane based at Eniwetok Island.

Detailed Description:

Ionosphere recorder site (Rongerik Atoll)

site (Kusaie)

AN/CPQ-7, type C-2 Ionosphere recorder with a power output of 10 KW peak pulse alternately transmitting and receiving automatically over the range of frequencies from 1 to 25 megacycles. This equipment measures and records at vertical incidence the virtual height and critical frequencies of ionized regions of the upper atmosphere.

A 600 ohm multiple wire antenna designed and erected, so that the direction of maximum intensity of radiation will be at the

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[redacted]

29

desired vertical angle over all of the operating frequency range from 1 to 23 megacycles. The transmitting and receiving antennas and the ground plane were in mutual perpendicular planes with the plane of the transmitting antenna oriented 53 degrees to the east of magnetic north.

Ionosphere recorder site (C-97 aircraft)

Same as for Rongerik and Kusaie, except that a C-3 ionosphere recorder was used. This recorder is the same as the C-2, except for a few modifications and improvements.

The transmitting antenna in the C-97 was a single wire delta fastened to the lateral extremities of the tail assembly.

OPERATIONAL

Kusaie: Routine operation until H-15 minutes; thence once per minute until H + 22 minutes: thence twice per minute, alternating the receiving and transmitting antennas at the end of each 15 second sweep, until approximately H + 93 minutes; thence once per minute until H + 8 hours; thence routine.

Rongerik: Routine until H-15 minutes, thence once per minute until H + 8 hours; thence routine.

C-97 Airborne Station: This station successfully participated in this test and some data were obtained. Recorded data for this station has not been available for review at the time of this writing due to the planes return to Hickam AFB for maintenance.

RESULTS

All stations operated successfully for this shot.

Kusaie: At H + 17 minutes a pronounced disturbance, similar to that observed during [redacted] (Cherokee) and [redacted] Zuni), was observed in the F region apparently moving towards Kusaie at about the height of the

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F2 layer. The data indicates a continued disturbance in the F region for about H + 4 hours.

Rongerik: Very little effect was observed at Rongerik from this shot. From about H + 30 until H + 40 minutes slight interruptions in the one hop and two hop traces occurred. These interruptions were over different frequency ranges of not more than 1 MC in band width.

C-97 Airborne Station: Absorption on [redacted] (Apache) was more severe than on [redacted] (Cherokee) and [redacted] (Zuni), but the disturbance to the shape of the ionosphere layers was small in comparison. The disturbance to the layers consisted chiefly of the traces looking ragged or rough, instead of disintegrating and moving large virtual heights as they did during [redacted]

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[redacted] (APACHE)

Project 6.4 - Determination of Characteristics of Airborne Flush Mounted Antennas and Photo Tubes for Yield Determination at Extended Ground-to-Air Ranges - A. J. Waters

OBJECTIVES

To determine the effectiveness of flush mounted airborne antennas and phototubes at various ground-to-air ranges in detecting characteristic low frequency electromagnetic radiation and visible radiation, respectively.

To determine the temporal and amplitude characteristics of the low frequency electromagnetic radiation at various ground-to-air ranges.

To determine the temporal and intensity characteristics of visible radiation at various ground-to-air ranges.

To determine the effects of ambient conditions upon the satisfactory measurement of the parameters specified in the first two items.

INSTRUMENTATION

| | |
|---|---|
| 2 fiducial antennas | 2 scope cameras |
| 1 synchroniser | 1 sequence camera |
| 2 photoheads | 1 recorder |

2 DuMont Scopes (1 a dual beam, 1 a sirgle beam)

TECHNIQUE

Signal is received by antenna fed through an amplifier and then to the scope. The signal is then photographed. Photohead output is led directly to the recorder. The sequence camera photographs the blast directly for use in correlation of previous data. Distance was approximately 43½ miles.

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RESULTS

Signals were received on both antennas. Light was admitted to one of the cameras destroying the picture of the trace. However, the other camera recorded the other trace.

Photohead data was obtained.

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[redacted]

[redacted] (APACHE)

Project 9.1 - Technical Photography - Lt Col Jack O. James

Three RB-50 aircraft, Carter 1, 2, and 3, participated on this event. Aircraft were positioned at 70 nautical miles from ground zero in east, south and west quadrants. At H-hour Carter 1 was on orbit east of GZ at 20,000 feet. His first 15 minute leg of photography was interrupted at plus 8 minutes by towering cumulus. The aircraft diverted and returned to zero starting point. A second 15 minute leg was successful. Carter 2, south of GZ, had an unrestricted view from 20,000 feet from zero time to plus one hour fifteen minutes. Three 15 minute photo runs were made.

Carter 3, west of GZ, climbed to 30,000 feet attempting to avoid natural cloud obscuration but at zero time was in heavy thunderstorm activity and was unable to photograph either the detonation or the resulting cloud.

Carter 1 and Carter 2 were favorably positi ned for triangulation photography and results from this mission are expected to be good.

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[redacted]

PART III

TASK UNIT 1

LASL PROGRAMS

Keith Beyer

Keith Beyer
Advisory Group

Program 16 - Physics & Electronics & Reaction History

B. F. Watt

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Project 16.3 - Electromagnetic Investigations - R. Partridge

Project 16.3 measures the time interval between the primary and secondary reactions in multi-stage devices by direct oscilloscopic recording of the electromagnetic radiation in the radio frequency range. In addition, methods of obtaining other diagnostic information from this radiation are investigated.

The [redacted] (Apache) gave good clear traces on all channels. The time interval measured was [redacted]

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PART IV

TASK UNIT II

UCRL PROGRAMS

W. D. Gibbins
Dep for UCRL

| | |
|---|---|
| Program 21 - Radiochemistry | R. H. Goeckermann |
| Program 23 - Scientific Photography | H. B. Keller |

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[redacted] (APACHE)

Project 21.1 - Radiochemical Analysis - R. Goeckermann

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[redacted]

DE[redacted](APACHE)ED

Project 21.2 - Sampling - R. Batzel

The Air Force Special Weapons Center supplied two F-84G and four B-57 to take samples on this device. An additional B-57 was provided to act as control plane.

| Aircraft | Time after shot Hours | Alt Collected Thousand Feet | Fission One Wing | Pilot Radiation mr |
|---|---|---|---|---|
| 051 | 1.30 - 1.50 | 38 | $9.45 \times 10^{15}$ | |
| 049 | 1.40 - 2.06 | 41 - 44 | $5.51 \times 10^{15}$ | |
| 495 | 2.00 - 2.16 | 51 - 54 | $2.62 \times 10^{15}$ | |
| 500 | 2.00 - 2.30 | 47 - 48 | $7.68 \times 10^{15}$ | |
| 502 | 2.30 - 3.00 | 52 | $10.00 \times 10^{15}$ | |
| 504 | 3.00 - 4.20 | 50.5 - 54 | $1.88 \times 10^{15}$ | 5 |

DE[redacted](Apache)ED

The cloud on [redacted] (Apache) topped at about 85,000 feet and the base of the cloud was at 30,000 feet.

The samples collected on this device were very good. A sufficient amount of fissions were collected to make all measurements necessary. The success of this project can be attributed to the interest shown and cooperation given by the Air Force personnel.

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Project 21.3 - Short Half-life Activities - F. Moeyer

Project 21.3 was engaged in finding total tritium in the cloud. This was done in the following manner: Carrier amounts of heavy water, krypton and xenon were added to the collection bottles prior to the program. The collection system consisted of filters for particulate matter and collection bottles mounted on the sampling planes. Gas samples were collected at various altitudes and times following the detonation and returned to Parry for separation. Krypton, xenon, water and carbon dioxide were separated from the gas sample and molybdenum was separated from the filter sample. Krypton, xenon and molybdenum were collected to determine fissions per collection bottle. The remaining activities, $C^{14}$ and $H^{3}$ were returned to the laboratory, as barium carbonate and water for the determination of total tritium and possibly $C^{14}$ yield.

The fission bottle data are shown in Table 21.3-1.

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[redacted] (APACHE)

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TABLE 21.3-1

FISSION BOTTLE DATA

TIME - 0606 7/9/56

| Bottle | RW-Ap - BP-146 | RW-Ap - FP-114 | RW-Ap - BP-144 | RW-Ap - BP-140 |
|---|---|---|---|---|
| Flt | Hot Shot 4 | Tiger Red 2 | Hot Shot 3 | Hot Shot 2 |
| Alt | 50,000 | 42,000 | 50,000 | 46,000 |
| Coll Time* | +177 - 259 | +99 - 166 | +146 - 173 | +121 - 179 |
| Net Sample Wt | 17 oz | 41 oz | 5 oz | 15½ oz |
| PSI** | 945 | 900 | 1050 | 850 |

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* Time of collection after shot time (Minutes)

** Final pressure of gas collected (PSI)

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[redacted]

41

[redacted]

[redacted] (APACHE)

Project 22.2 - Measurement of Primary Alpha and Nuclear Time Interval - H. Grier

E. C. Woodward

Measurements of the reaction rate prior to the break in the rate curve and of the [redacted] (Apache) device, and measurements of the time interval between the nuclear reactions of the two stages of the device were made by EG&G (Patten).

DESIGN OF THE EXPERIMENT

The device was located on a barge in the Mike crater some 750 feet from Station 1611 on Bogon, Eniwetok Atoll. One LASL fluor - photomultiplier detector, one UCRL fluor - photomultiplier detector (containing two banks of photomultipliers) and three EG&G fluor- photodiode detectors were used to view the gamma radiation from the device. Some collimation was provided by pipes 24 inches in diameter in front of the detectors some 20 feet long and covered with about 5 feet of earth fill. The pipes in front of the LASL photomultiplier detector and the most sensitive photodiode detector were stopped down to about 12 inches. It was desirable that the primary signal strength could be better understood, and that the results could be correlated with the [redacted] results. Therefore, a lead shield approximately five feet square and several inches thick with a central four inch diameter hole on the line-of-sight between the primary of the device and the detectors was installed on the barge about six feet from the device. The system was designed so that the signals from the photomultiplier detectors and the most sensitive photodiode detector would provide information on the operation of the [redacted] primary and the two less sensitive photodiode detectors would provide nuclear time interval information on the [redacted] (Apache) device.

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[redacted]

42

[redacted]

PRIMARY REACTION HISTORY

Reaction history data on the [redacted] primary was obtained from about [redacted] Fig. 22.2-1 shows a plot of the reaction history and Fig. 22.2-2 shows a plot of alpha versus time as derived from the reaction history data. These results are in quite good agreement with corresponding data obtained for the [redacted]

NUCLEAR TIME INTERVAL

Good records were obtained from both oscillographs used to obtain time interval data. This data is as follows:

| Indicator No. | Nuclear Time Interval (Shakes) |
|---|---|
| 27 | [redacted] |
| 37 | |

An uncertainty of [redacted] is assigned to these values at the present time.

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[redacted]

43

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Fig. 22.2-1 - Apache Reaction History

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Fig. 22.2-2 - Alpha vs Time (Apache)



BEST AVAILABLE COPY [redacted]

[redacted]

[redacted] (APACHE)

Project 22.3 - S-Unit Monitoring and High Explosive Transit Time - C. E. Ingersoll

E. C. Woodward

The technique used for monitoring the S-unit consisted of telemetering signals from signal sources in the immediate neighborhood of the [redacted] (Apache) device by high frequency radiofrequency methods to a receiving and recording station located on Parry. The signals were then recorded on oscillographs.

The signal sources were the load ring pulse of the X-unit and the output of a fluor - photomultiplier detector near the S-unit which measured both the S-unit output and the gamma rays from the nuclear reaction.

The oscillograph displays consisted of a raster scope display containing all signals and a linear sweep display on a 517 oscillograph which showed greater detail of the load ring pulse signal and the S-unit signal.

The results of the measurement are as follows:

Time from beginning of X-unit load ring pulse to beginning of S-unit pulse = [redacted]

Yield of S-unit = [redacted]

Time from beginning of X-unit load ring pulse to breakaway of gamma signal pulse = [redacted]

Time from beginning of X-unit load ring pulse to equipment cutoff = [redacted]

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[redacted]

N6

[redacted] (Apache)

Project 23.1 - Fireball and Bhangmeter - H. Grier

D. J. Barnes

**FIREBALL**

Preliminary fireball yields have been computed from four high speed Eastman films, one each from Parry and Mack and two from Piiraai, with the following results:

Parry $\phi$ =

Mack $\phi$ =

Piiraai $\phi$ =

Piiraai $\phi$ =

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The preliminary fireball yield is therefore [redacted] An ambient air density of 1.12 grams/liter has been assumed for these calculations.

**BHANGMETER**

Four Bhangmeters at the control point gave time to minimum as [redacted] with a resultant yield of [redacted]

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Fig. 23.1-2



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[redacted]

[redacted] (APACHE)

Project 23.2 - Cloud Photography - H. E. Orier

D. Berkowitz

Approximate measurements on 70mm cloud camera film indicates the following cloud dimensions at stabilization, roughly six minutes after zero time:

| | |
|---|---|
| Height above cloud horizon | 60,000 feet |
| Top of clouds | 10,000 feet |
| Cloud error | 12,000 feet |
| Height of cloud | 82,000 feet |
| Diameter | 100,000 feet |

The "cloud error" is due to measuring from the cloud horizon rather than from where the stem pops out of the clouds.

Measurements were made on film #36442 exposed in cloud camera #6 in aircraft #7135.

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[redacted]

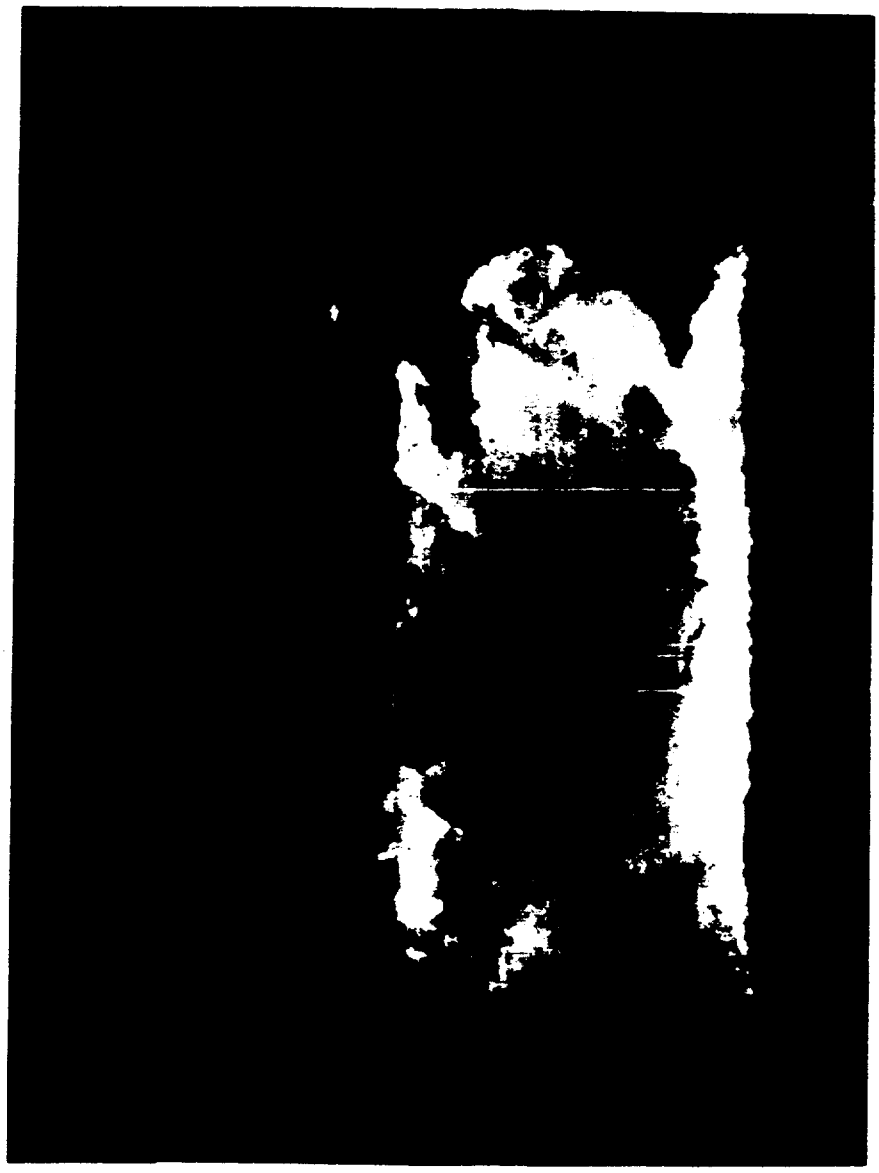

Fig. 23.2-1



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Fig. 22.2-2

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[redacted]

[redacted] (APACHE)

Project 23.3 - Time Interval Measurements - H. B. Keller

The only photographic diagnostics done on the [redacted] (Apache) device was the standard Christmas tree experiment. The long base line (9 1/2 miles) from Station 2301 to zero site was a novelty, but results indicate that this was of no significance. Seven cameras were used on the experiment because it was as easy to set and run seven cameras as two or three. Visibility over the 9 1/2 mile range was good, and all seven cameras produced good records.

**Interstage Time**

Observed [redacted]

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[redacted]

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