[redacted]

410946

OPERATION REDWING

DELETED VERSION ONLY

A PRELIMINARY REPORT

OF

[redacted] (APACHE)

DELETED

Submitted by Task Group 7.1

JO-266

15 October 1956

[redacted]

[redacted]

BEST COPY AVAILABLE

CLASSIFICATION CANCELLED
WITH DELETIONS
BY AUTHORITY OF DOE/OC
Carl Wilson 2/7/83
REVIEWED BY DATE
J Diaz 2/12/86

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[redacted] (APACHE)

INTRODUCTION

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was detonated as the Apache shot on a barge in the Mike Crater off Teiteiripucchi Island, Eniwetok Atoll, at 0606:00.2 on July 9, 1956. It was shot in a Regulus nose-cone, since this offered the most stringent mass discontinuities. It was felt that such effects, which might degrade yield, should be included in the test.

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[redacted]

PART I

GENERAL INFORMATION

[redacted]

ENIWETOK OBSERVED WEATHER FOR 9 JULY 1956
APACHE SHOT TIME 0606M

Sea Level Pressure	1010.5 mbs
Free Air Surface Temperature	80.3°F
Wet Bulb Temperature	76.4°F
Dew Point Temperature	74.9°F
Relative Humidity	84%
Surface Wind	030° 15 knots
Visibility	Over 10 Miles

CLOUDS

2/10 cumulus; bases estimated 1500 feet, tops estimated 25,000 feet to south and west. 2/10 stratocumulus; bases at 2,000 feet, tops estimated 4,000 feet. Few altocumulus less than 1/10. 8/10 cirrostratus; estimated at 30,000 feet (very thin and transparent). Numerous contrails at 30,000 to 35,000 feet.

AREA WEATHER SUMMARY FROM AIRCRAFT

0610M: Scattered cumulus buildups approximately 50 miles to east topped at 20,000 to 25,000 feet. Scattered stratocumulus tops estimated at 8,000 to 10,000 feet. Very light rain shower at Eniwetok. GZ clear.

0615M: 10 miles north and west of ground zero. Stratus overcast based at 27,000 feet, tops unknown.

0620M: To east and sotheast of ground zero. 6/8 cumulus and stratocumulus with tops below 15,000 feet, occasional cumulus buildup to 25,000 to 30,000 feet.

STATE OF SEA

Ocean Side: Wave height 4 feet, period 7 seconds, direction 070°.
Lagoon Side: Wave height 1 foot.

[redacted]

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			

[redacted]

[redacted]

WINDS ALOFT (0720M)

Height Feet	Direction Degrees	Speed Knots	Height Feet	Direction Degrees	Speed Knots
1,000	060	17	24,000	140	06
2,000	070	20	25,000	160	08
3,000	070	21	26,000	170	07
4,000	080	22	28,000	240	07
5,000	100	21	30,000	250	08
6,000	110	19	32,000	220	14
7,000	120	18	34,000	200	15
8,000	120	19	35,000	210	13
9,000	130	20	36,000	220	12
10,000	140	20	38,000	290	10
12,000	140	11	40,000	280	06
14,000	110	05	42,500	270	09
16,000	060	04	45,000	260	15
18,000	350	04	47,500	240	21
20,000	020	06	50,000	230	32
22,000	100	05			

[redacted]

[redacted]

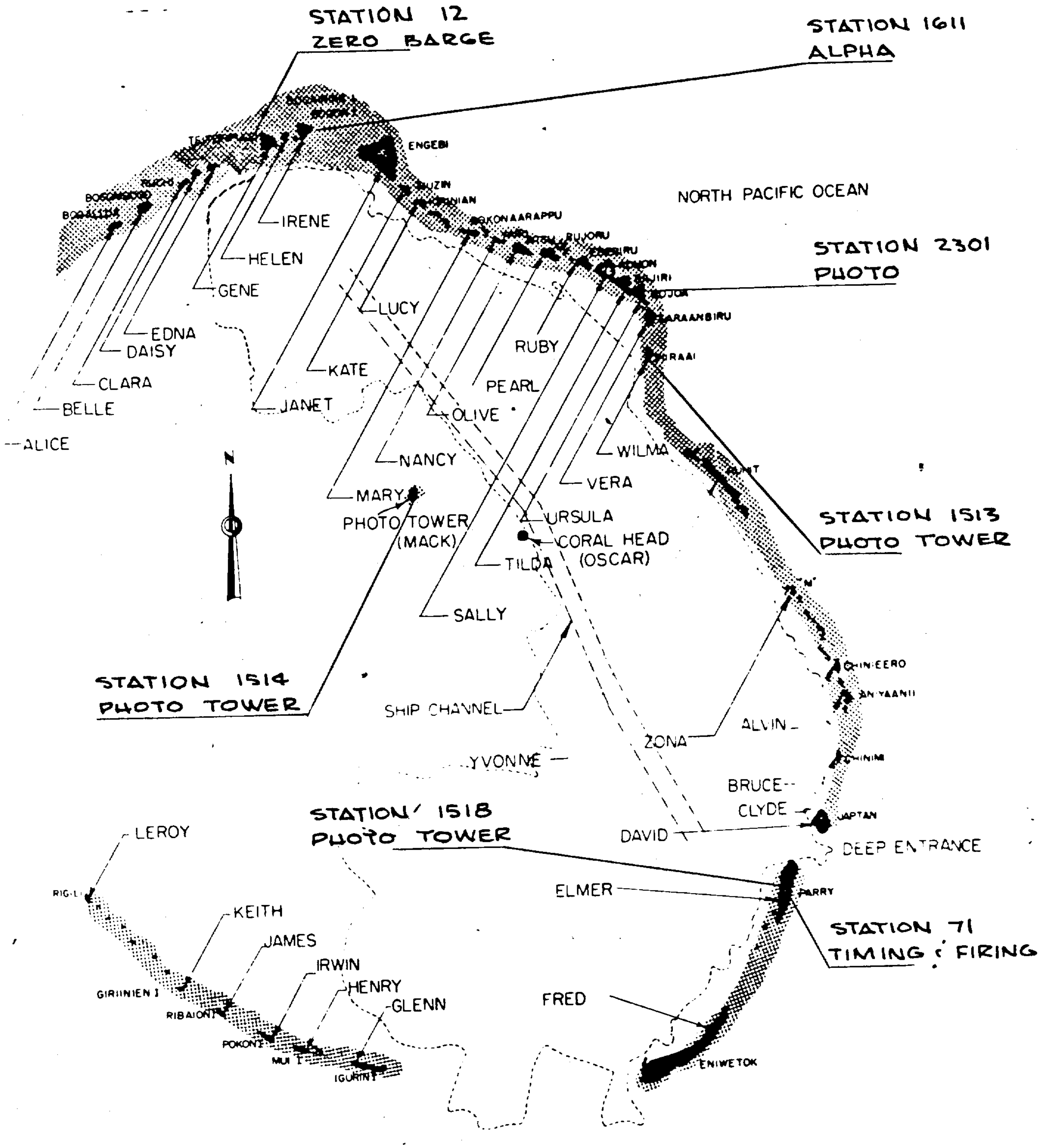

Fig. 0-1 - Eniwetok Atoll Map

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[redacted]

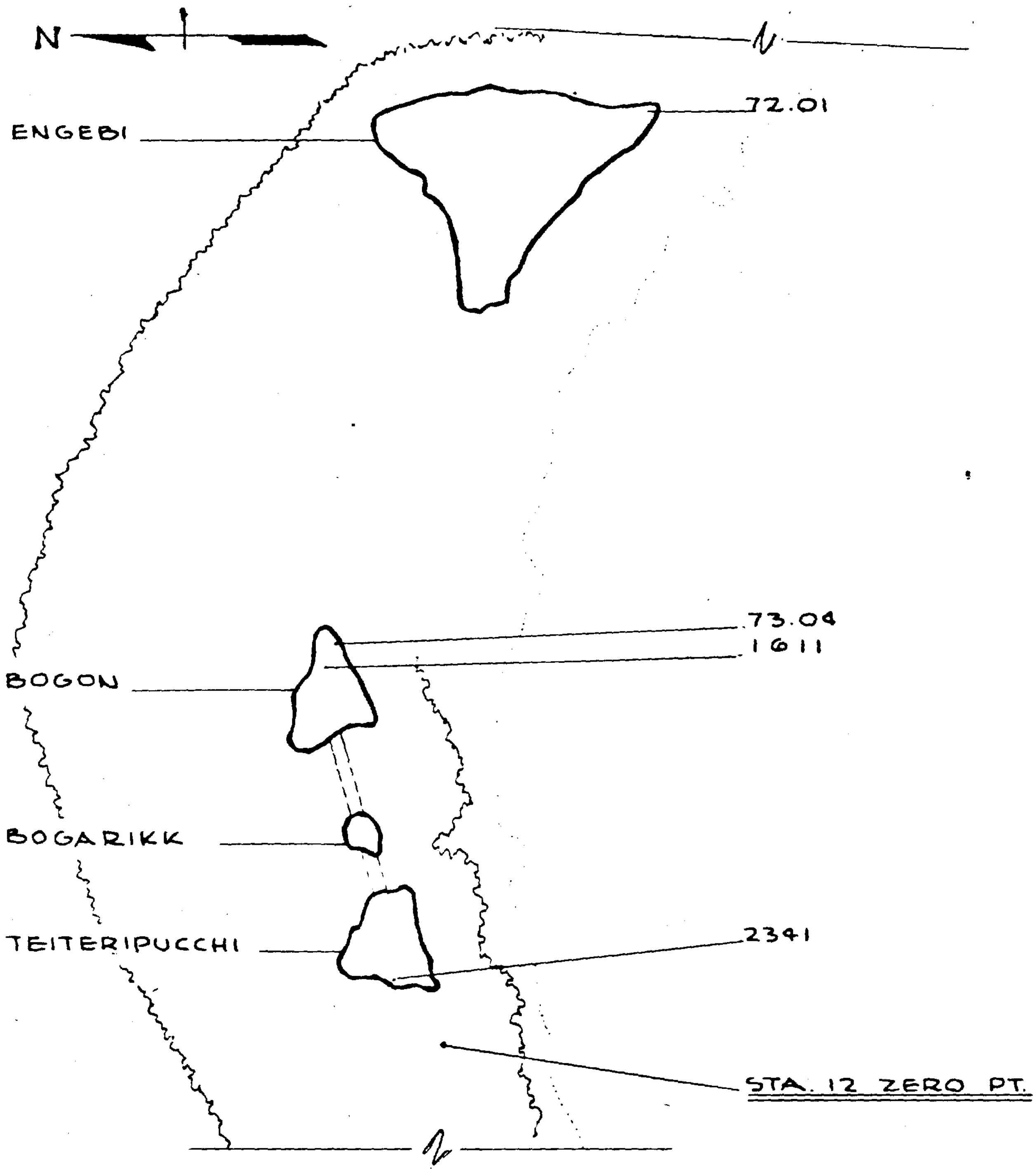

Fig. 0-2 - Scientific Stations and Zero Point

[redacted]

[redacted]

All readings in mr/hr
as of 1500 hrs., 9 July

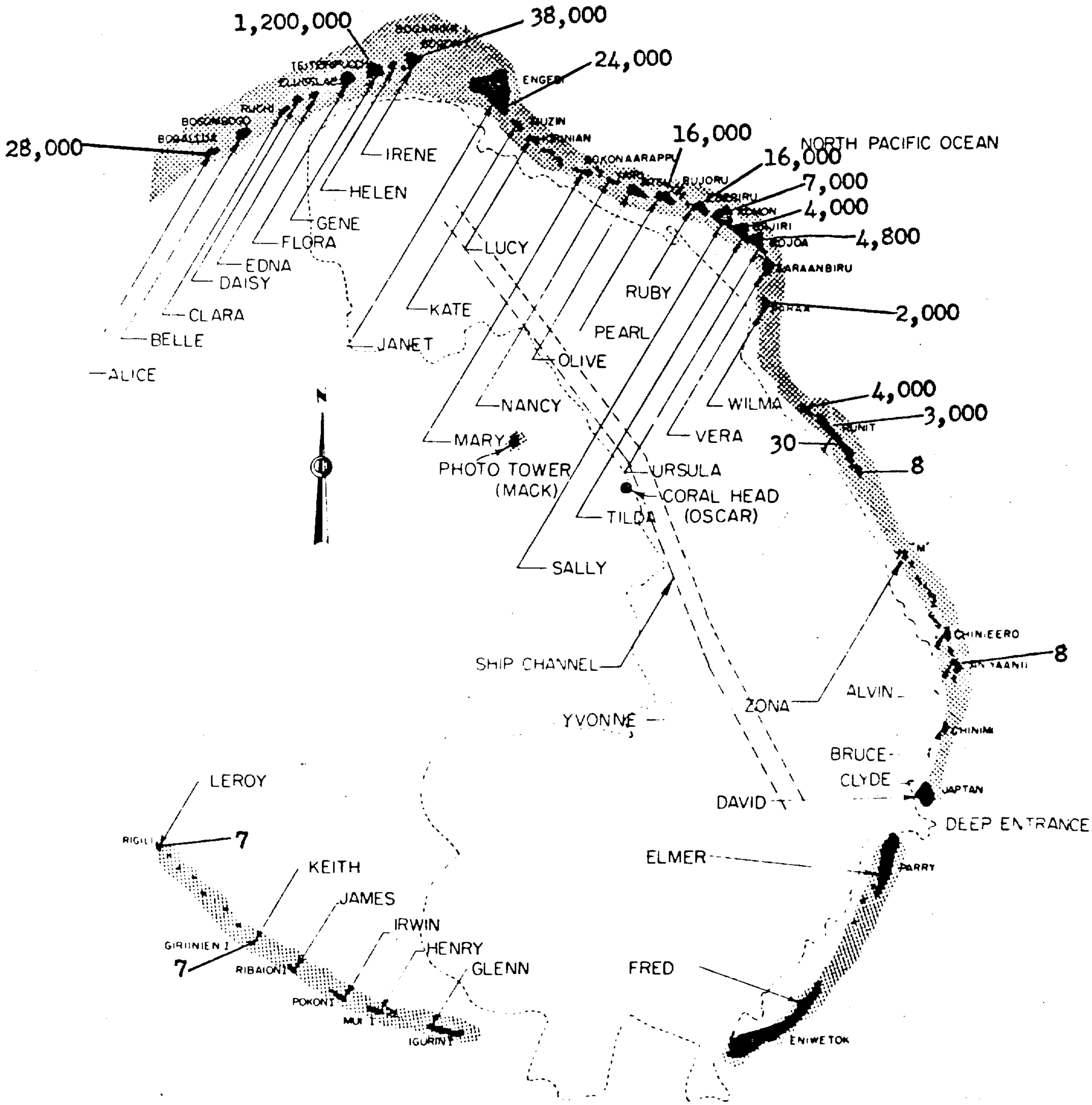

Fig. O-3 - RadSafe Survey, D-Day

[redacted]

All readings in mr/hr
as of 0800, 11 July 1956

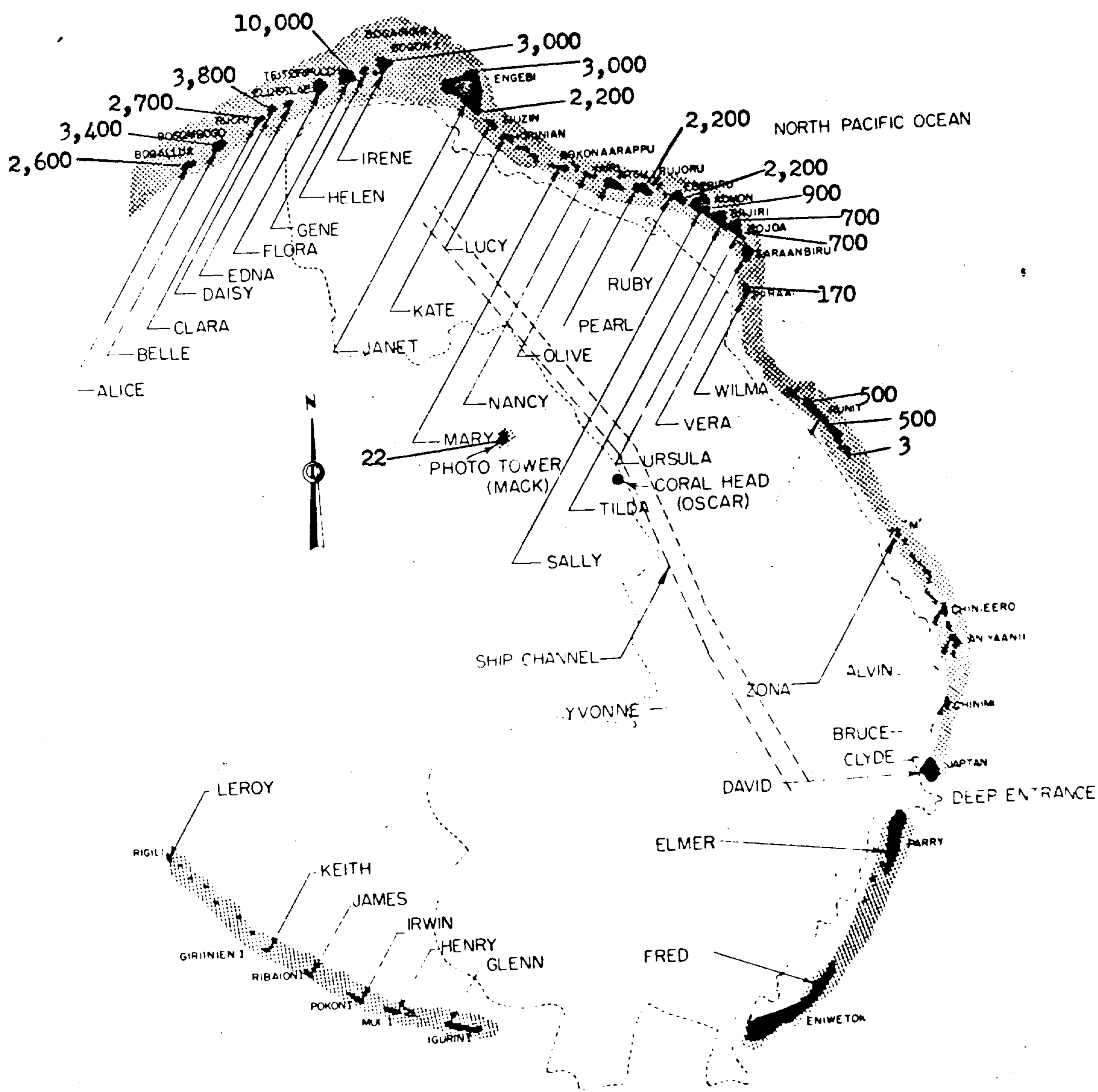

Fig. O-4 - RadSafe Survey, D + 2

[redacted]

PART II

TASK UNIT 3

DOD PROGRAMS

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]

[redacted]

[redacted](APACHE)

Project 5.1 - In-Flight Participation of a B-47 Aircraft - Lt. R. C. Laumann

OBJECTIVE

The objective of this project is to measure the blast, gust, and thermal effects of a nuclear detonation on an in-flight B-47 aircraft. With the recorded data the criteria and method used in the B-47 Weapon Delivery Handbook may be verified or corrected. In addition, the project will provide basic research data for the design criteria of future USAF aircraft.

INSTRUMENTATION

Two hundred seventy three data channels were available on this shot to record bending, shear, and torsion in the wing and horizontal stabilizer, thermal inputs to the aircraft, thermally induced strain, temperature measurements, and overpressure. Prior to shot participation 97.0% of these channels were operating satisfactorily. There has been no newly added instrumentation since the last participation.

AIRCRAFT POSITION IN SPACE

The B-47 was flying at an absolute altitude of 30,000 feet, a speed of Mach 0.75, and on a heading of 320° at both T_o and shock arrival. The aircraft was oriented tail to the shot; at T_o the horizontal range beyond ground zero was 29,000 feet, and at shock arrival it was approximately 80,500 feet.

RESULTS

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[redacted]

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[redacted]

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[redacted]

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

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[redacted]

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[redacted]

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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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

DELETED

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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 46,311 feet beyond ground zero. Heading same as H + 0, altitude 10,290 feet, speed 282 ft/sec.

RESULTS

DELETED

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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 35,649 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)

[redacted]

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

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[redacted]

[redacted] (APACHE)

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

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, 101 Cal/cm^2, at a low angle of incidence. At this position the aircraft would theoretically receive a ΔT 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]

RESULTS

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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.

[redacted]

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 N-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 photographic 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 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

DELETED

[redacted]

[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

DELETED

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).

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.

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

[redacted]

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

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[redacted]

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[redacted]

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31

[redacted]

[redacted]

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 synchronizer	1 sequence camera
2 photoheads	1 recorder

2 DuMont Scopes (1 a dual beam, 1 a single 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 $43\frac{1}{2}$ miles.

[redacted]

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.

[redacted]

Project 9.1 - Technical Photography - Lt Col Jack G. 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 positioned for triangulation photography and results from this mission are expected to be good.

[redacted]

PART III

TASK UNIT 1

LASL PROGRAMS

Keith Boyer

Keith Boyer
Advisory Group

Program 16 - Physics & Electronics & Reaction History — B. E. Watt

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[redacted]

[redacted] (APACHE)

Project 16.3 - Electromagnetic Investigations - R. Partridge

Project 16.3 measures the time interval between the primary and secondary reactions [redacted] 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]

[redacted]

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

[redacted]

([redacted](APACHE)

Project 21.1 - Radiochemical Analysis - R. Goeckermann

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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	9.45×10^{15}	3,160
049	1.40 - 2.06	41 - 44	5.51×10^{15}	2,325
495	2.00 - 2.16	51 - 54	2.62×10^{15}	2,880
500	2.00 - 2.30	47 - 48	7.68×10^{15}	2,732
502	2.30 - 3.00	52	10.00×10^{15}	3,335
504	3.00 - 4.20	50.5- 54	1.88×10^{15}	2,595

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 attritbuted to the interest shown and cooperation given by the Air Force personnel.

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

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)

TABLE 21.3-1

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[redacted]

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[redacted]

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Fig. 22.2-1 - Apache Reaction History

[redacted]

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

[redacted]

[redacted]

([redacted] APACHE)

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

E. C. Woodward

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[redacted]

[redacted]

[redacted] (Apache)

Project 23.1 - Fireball and Bhangmeter - H. Crier

D. J. Barnes

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[redacted]

[redacted]

DELETED

Fig. 23.1-1

[redacted]

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Fig. 23.1-2

[redacted] (APACHE)

Project 23.2 - Cloud Photography - H. E. Grier

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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Fig. 23.2-1

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[redacted] (APACHE)

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

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6-7A - DMA, USAEC (A. D. Starbird)
8-9A - Chief AFSWP (A. R. Ludecke)
10-14A - Report Library, LASL
15-19A - UCRL (H. York)
20-24A - Field Command, AFSWP (F. O'Beirne)
25-29A - Sandia Corp (R. A. Bice)
30A - ALOO, USAEC (J. E. Reeves)

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