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A Preliminary Report of [redacted] (Dakota)
ROP-98 26 July 1956
Issued as 5714-JFE

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OPERATION REDWING

A PRELIMINARY REPORT

OF

[redacted] (DAKOTA)

Submitted by Task Group 7.1

5714JFE

26 July 1956

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[redacted]

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[redacted]

INTRODUCTION

This is a preliminary report, and therefore, does not give either complete or final results of the work of the various projects. No information on the construction of the device is included, in order that the classification may be kept to Secret Restricted Data.

DELETED

[redacted]

[redacted]

PART I

GENERAL INFORMATION

Observed Weather at Shot Time

Fig. O-1 - Bikini Atoll Map

Fig. O-2 - Bikini Atoll North Reef, Scientific Stations

Fig. O-3 - RadSafe Survey, D + 1

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

Fig. O-5 - RadSafe Survey, D + 3

[redacted]

[redacted]

DELETED

BIKINI OBSERVED WEATHER FOR 26 JUNE 1956

AT DETONATION TIME 0606M

Sea Level Pressure	1009.1 mbs
Free Air Surface Temperature	82.0°F
Dew Point Temperature	75.0°F
Relative Humidity	80.0%
Surface Wind	070° - 14 knots
Visibility	Over 10 Miles

CLOUDS:

3/10 altostratus, bases estimated at 12,000 feet.

7/10 cirrostratus, bases estimated at 35,000 feet. (5/10 opaque).

WEATHER:

No showers observed.

AREA WEATHER SUMMARY FROM AIRCRAFT:

The following weather was reported by Recon 60-80 NM NNE of NAN, 16,000 feet at 260530 Local: 3/8 cumulus, bases 2,000 feet, tops 6,000 feet. 8/8 cirrus, bases at 35,000 feet, tops at 36,000 feet (thin overcast). Visibility, 30-60 Nautical Miles. Photo aircraft reported ideal weather conditions over target and in all quadrants at shot time.

STATE OF SEA:

Ocean Side: Wave height 5 ft., period 8 seconds, direction 060 degrees.

Lagoon Side; Wave height less than 1 foot.

[redacted]

BIKINI UPPER AIR SOUNDING (Release time 0600M)

Pressure (Millibars)	Height (Feet)	Temperature (oC)	Dew Point (oC)
1000	270	26.5	22.8
912	2,920	18.8	15.2
893	3,494	19.5	08.5
878	3,937	18.2	10.5
850	4,900	17.2	04.2
837	5,298	16.5	00.8
810	6,250	14.2	08.2
785	7,152	13.2	02.8
764	7,874	11.2	05.8
700	10,230	06.8	02.5
666	11,597	04.5	00.5
652	12,139	03.2	-04.2
571	15,617	-03.2	-09.8
522	17,995	-07.2	-13.5
507	18,859	-07.5	-22.2
500	19,040	-08.2	-22.5
400	24,600	-19.5	-31.5
350	27,875	-25.5	-34.8
300	31,410	-34.5	M
250	35,500	-44.2	M
200	40,870	-57.0	M
150	46,040	-70.8	M
140	47,452	-73.5	M

WINDS ALOFT (Release time 0600M)

Height (Feet)	Direction (Degrees)	Speed (Knots)	Height (Feet)	Direction (Degrees)	Speed (Knots)
3,000	110	18	28,000	240	23
4,000	110	15	30,000	240	22
5,000	100	13	32,000	240	26
6,000	100	14	34,000	230	39
7,000	100	12	36,000	240	46
8,000	120	14	38,000	240	45
9,000	120	14	40,000	250	44
10,000	120	14	45,000	250	49
12,000	110	13	50,000	280	30
14,000	130	13	55,000	090	07
16,000	160	08	60,000	100	14
18,000	190	08	65,000	080	34
20,000	210	12	70,000	080	34
22,000	220	10	75,000	080	54
24,000	240	11	80,000	100	64
26,000	230	20	84,000	090	74

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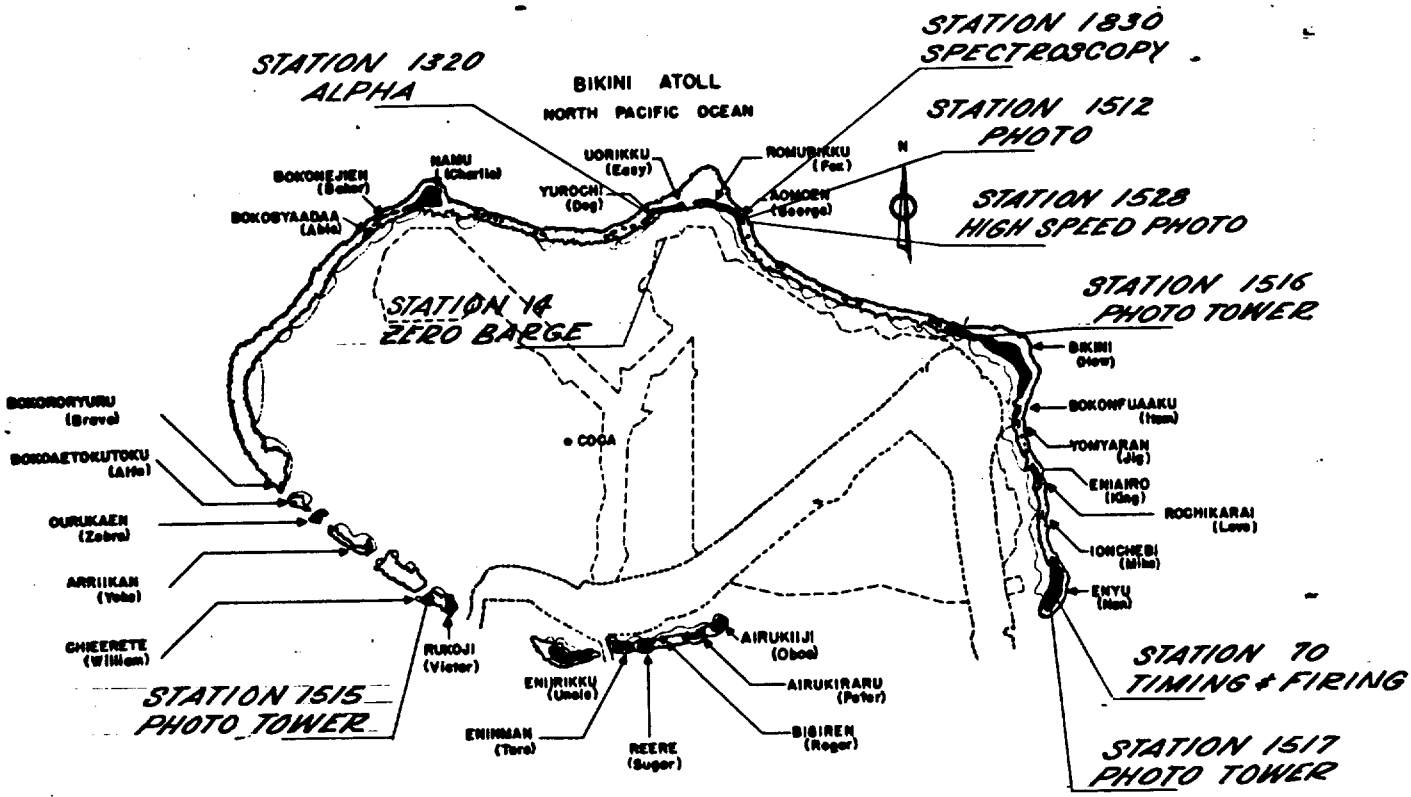


Fig. O-1 - Bikini Atoll Map

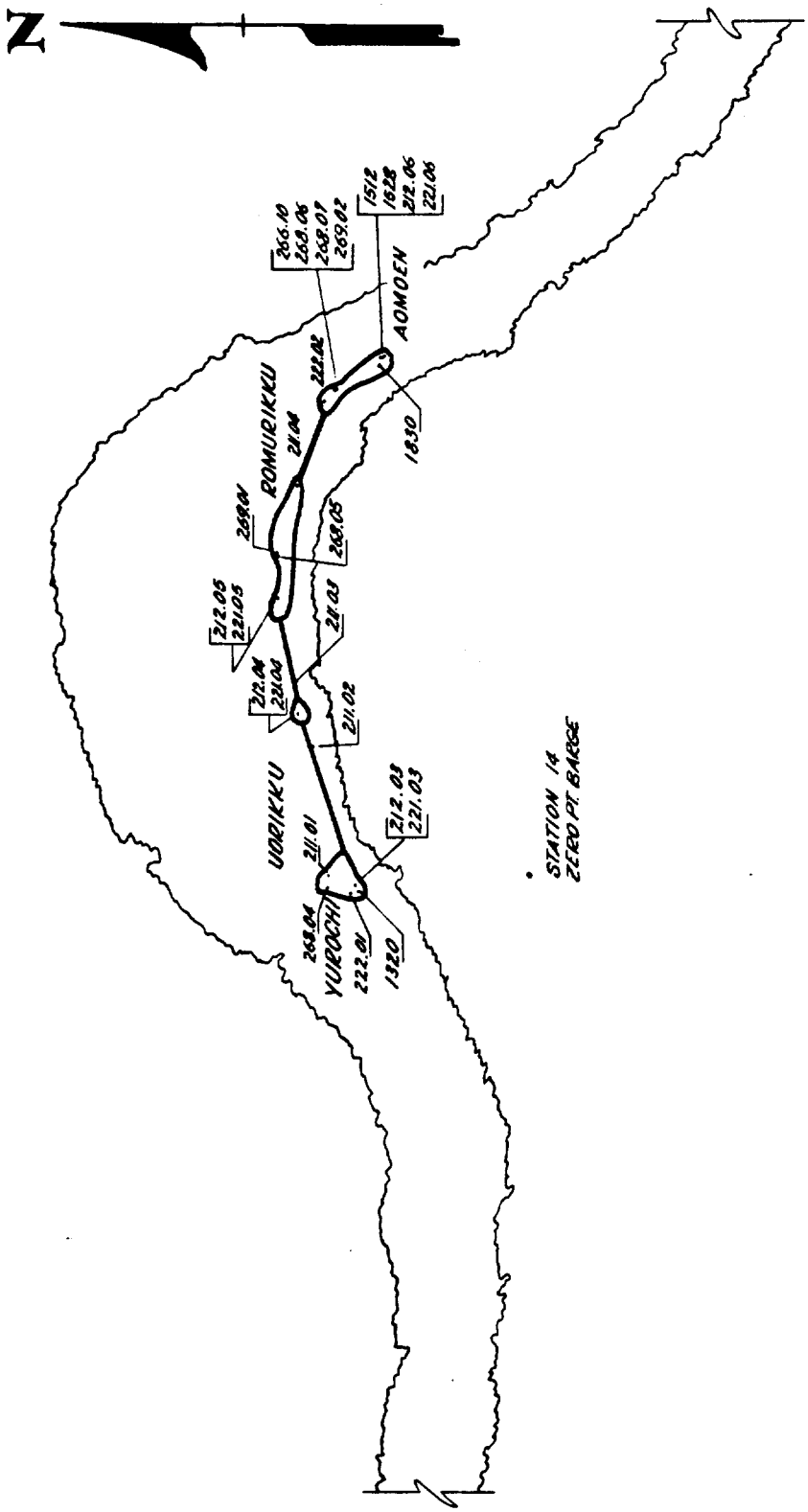
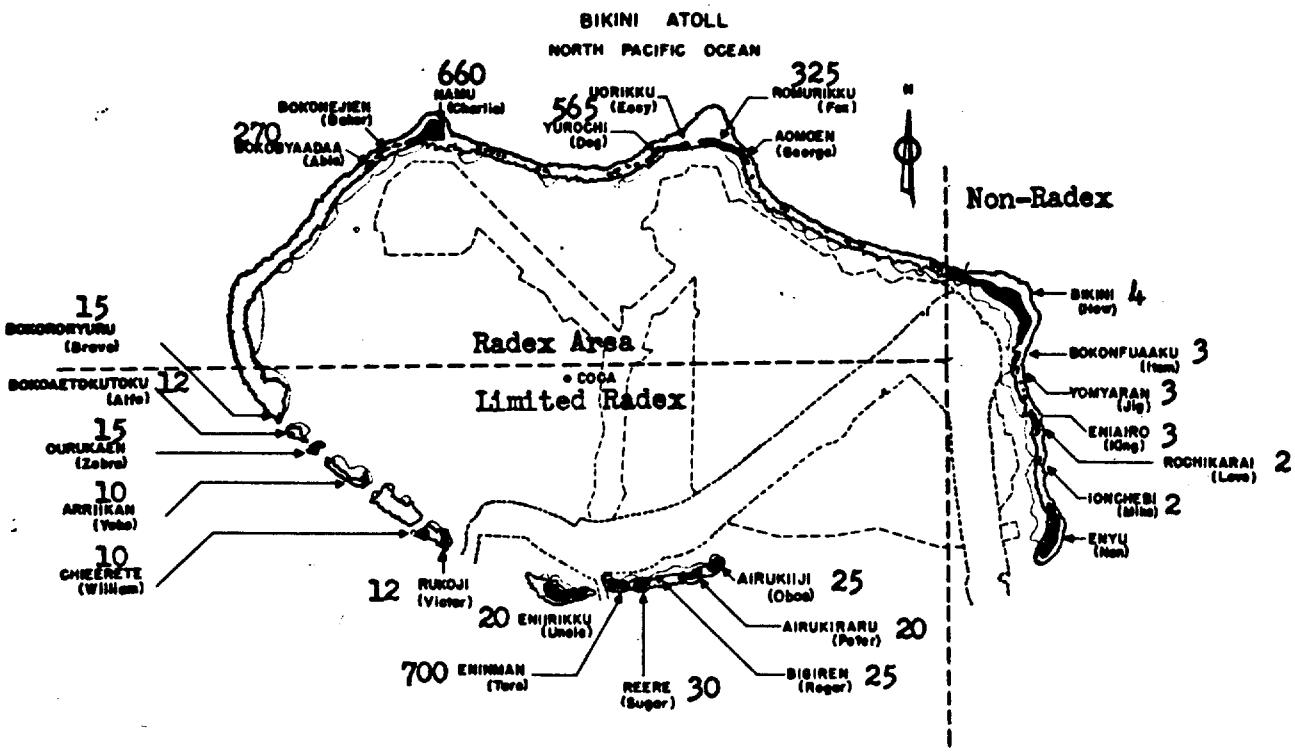


Fig. O-2 - Bikini Atoll North Reef, Scientific Stations

[redacted]

[redacted]

All readings in mr/hr
at 0800 hrs. on ground
D + 1, 27 June 1956



[redacted]

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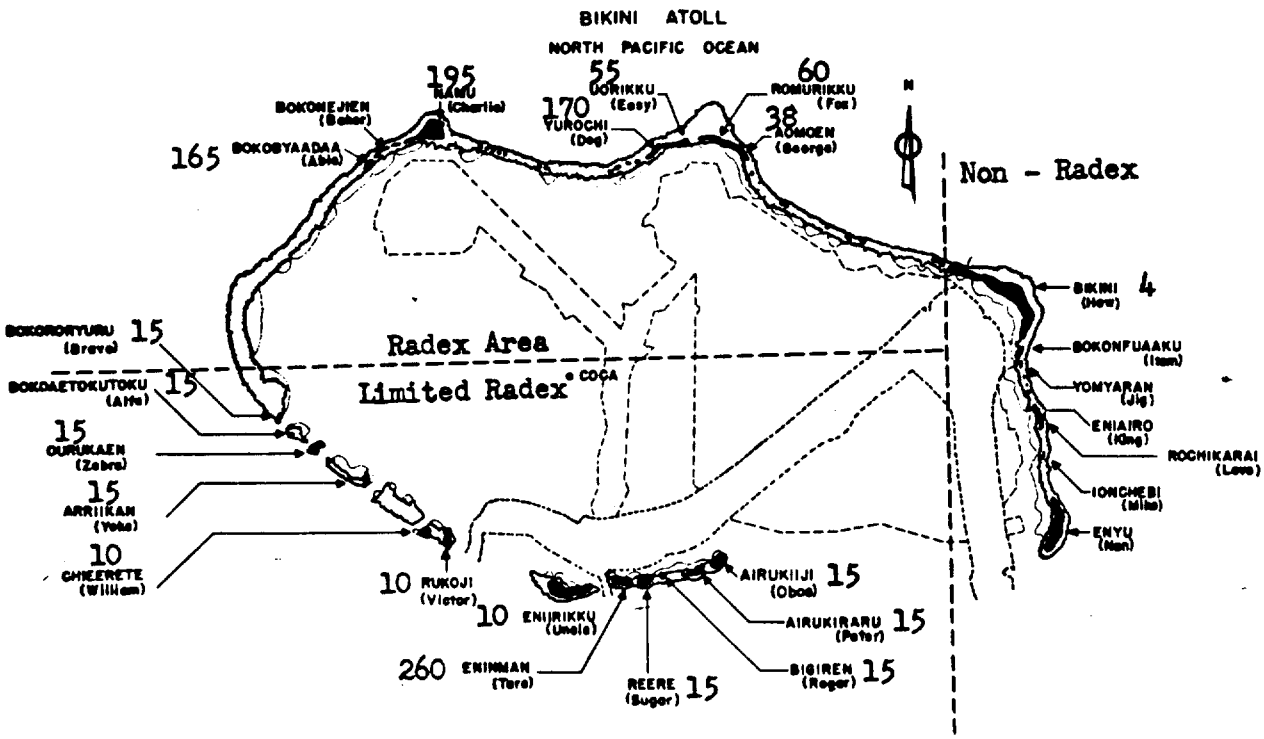
Fig. 0-3 - RadSafe Survey, D + 1

[redacted]

[redacted]

All readings in mr/hr
at 0800 hrs. 28 June 1956



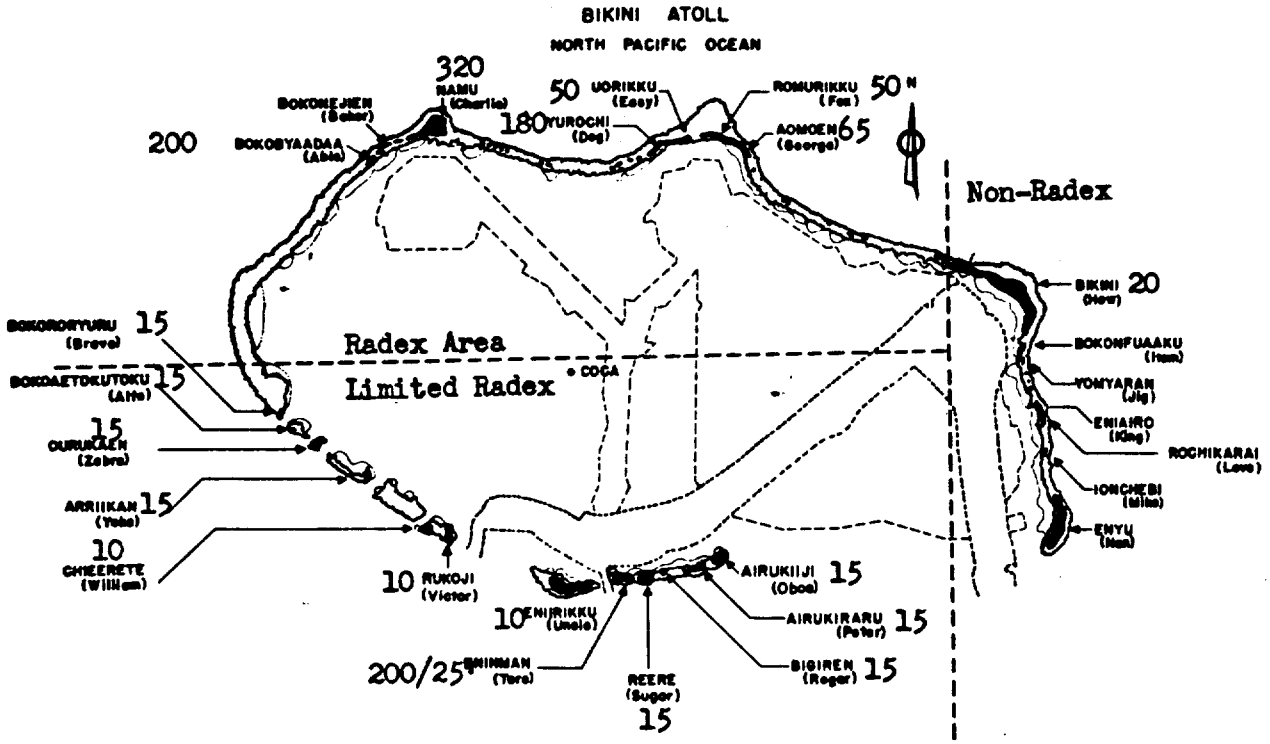
[redacted]

Fig. O-4 - RadSafe Survey, D ∕ 2

[redacted]

[redacted]

All readings in mr/hr
at 0800, 29 June 1956



[redacted]

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Fig. 0-5 - RadSafe Survey, D / 3

PART II

TASK UNIT 3

DOD PROGRAMS

K. D. Coleman

Col. K. D. Coleman
CTU-3

Program 1 - Blast and Shock Measurements	Maj. H. T. Bingham
Program 2 - Nuclear Radiation and Effects	CDR D. C. Campbell
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

[redacted]

[redacted] (DAKOTA)

Project 1.9 - Water Wave Studies - L. W. Kidd

Results

Eight wave measuring stations in Bikini lagoon yielded useful data. Four of these stations were the shore recording type and the remaining four were the open lagoon type station. Two long period wave recorders at Eniwetok and Ailinginae participated in this event, and the data appears to be of good quality. The Eniwetok lagoon station was running for this event. Examination of the record does not reveal the presence of wave action resulting from [redacted] Wave heights observed at two shore installations in Bikini lagoon are given below:

Airukiiji

Max crest	+ 1.9 feet
Max. trough	- 3.4 feet
Max. period	110 seconds

Chieerete

Max. crest	+ 1.5 feet
Max. trough	- 2.4 feet
Max. period	96 seconds

An inundation survey was conducted following the shot. There was minor up rush along all shores except the Yurochi - Aomoen area. In this area it is difficult to distinguish between blast and water wave damage. A detailed study at a later date of photographs of this area should help distinguish between the two.

[redacted]

DELETED (DAKOTA)

Project 2.66 - Early Cloud Penetration - Col. E. A. Pinson

Objectives:

To collect and evaluate data relating to radiation dose rate vs time in radioactive clouds from thermonuclear weapons.

To measure and evaluate the radiation hazards associated with the residual contamination on aircraft which have flown through thermonuclear clouds at early times after detonation.

To measure the turbulence in a thermonuclear cloud at early times after detonation.

Radiation dose rate inside the cloud vs time after detonation.

The extent and quality of the residual contamination on the aircraft after landing.

Instrumentation and Techniques:

There was no change in instrumentation from previous shots. The contamination studies were conducted in the same manner as before.

Four B-57 aircraft penetrated the cloud. A fifth B-57 was in the air as a standby penetration aircraft in the event of an aborted mission by one of the primary aircraft.

Penetrations were made at 35,000 feet at ∠ 28 minutes, 40,000 feet at ∠ 34 minutes, 45,000 feet at ∠ 38 minutes and at 50,000 feet at ∠ 41 minutes. The altitudes listed are indicated altitudes. All penetrations were made from north to south.

[redacted]

77

Results:

Dose rates in the mushroom portion of the cloud were exactly as predicted. Dose rates in the stem of the cloud below the mushroom were a factor of ten below predicted dose rates in the cloud at the times of penetration.

The highest dose rate was recorded by the aircraft which penetrated at an altitude of 50,000 feet at +41 minutes. The average dose rate in the cloud which this aircraft experienced was about 150 R/Hr. The time in the cloud was about 3 minutes, giving a dose of 7.5 to the pilot while in the cloud and 1.3 R on the return flight. The contamination factor on the airplane was computed to be 0.5 per cent/minute in the cloud. The total dose recorded by a Rad-Safe film badge was 7590 mr.

The duration of the penetration made at 45,000 feet was two minutes and 50 seconds. It began at + 38 minutes. The average dose rate in the cloud was about 75 R/Hr, yielding a total dose in the cloud of about 3 R. The contamination factor on the aircraft was computed to be 0.6% /minute in the cloud. This corresponded to a come home dose of about 0.5 R. The total dose recorded by a Rad-Safe film badge was 2230 mr.

The dosages received by the two aircraft which penetrated at 35,000 feet and 40,000 feet were quite low. The total mission dose was 150 and 260 mr respectively. These aircraft were in the radiation field of the cloud for from 60 to 180 seconds.

Again on this shot, as on the [redacted] (CHEROKEE) and the DELETED it was noted that the dose rate was lower in the stem of the cloud than in the mushroom by a factor of at least ten.

The pilots reported none to slight turbulence in the cloud. The only

23

[redacted]

mention was made by the pilot who penetrated at 50,000 feet. He reported slight turbulence upon first entering the cloud, but none thereafter.

The data presented in the foregoing paragraphs is summarized in the attached Table 2.66-1.

The spare aircraft measured the maximum dimension of the cloud with the following results:

TIME	MAXIMUM WIDTH	INDICATED ALTITUDE	DIRECTION
~~35~~ to ~~41~~	42 miles	50,000 to 55,000 feet	E to W
~~45~~ to ~~52~~	45 miles	50,000 to 55,000 feet	N to S
~~47~~ to ~~49~~	14 miles	42,000 feet	N to S

Preliminary analysis of the contamination study indicates that the results will agree with those of Operation TEAPOT. More detailed information on the contamination study will be presented in the interim test report.

[redacted]

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TABLE 2.66-1

SUMMARY OF DATA FROM PENETRATION ON THE DELETED (DAKOTA) SHOT

Alt. of Pen.	Time	Time in Cloud	Max Dose Rate	Ave. Dose Rate	Cloud Dose	Return Dose	Turb.
35,000 feet	∠28 minutes	60 seconds	20 R/Hr	10 R/Hr	150 mr	50 mr	None
40,000 "	∠34 "	192 "	15 "	8 "	250 "	50 "	None
45,000 "	∠38 "	170 "	200 "	75 "	3 R	0.5 R	None
50,000 "	∠41 "	185 "	300 "	150 "	7.5 R	1.3 R	Slight to none

[redacted]

DELETED (DAKOTA)

Project 5.1 - In-Flight Participation of B-47 Aircraft -

Lt Robert 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

Three hundred and 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 94.7% of these channels were operating satisfactorily. Since the last participation one angular accelerometer and one elevator camera have been added.

AIRCRAFT POSITION IN SPACE

The B-47 was flying at an absolute altitude of 24,000 feet, a speed of Mach 0.70, and on a heading of 270° at both T and shock arrival. At T_o the horizontal range beyond ground zero was 11,000 feet, and at shock arrival it was approximately 31,600 feet.

RESULTS

Thermal

A [redacted] temperature rise was measured in the 0.020 in. 24ST aluminum right aileron test panel painted with 1.0 absorptivity black paint. A [redacted] temperature rise was recorded on the 0.025 in. aluminum right

24

right elevator painted entirely black. These surfaces received minor buckling and the paint was blistered. In some cases, the paint had been scorched from the surface, leaving the aluminum skin or undercoat exposed in small, dotted areas. The heat in the elevator caused failure in approximately 30 elevator channels measuring strain. Two elevator thermocouples and a convection calorimeter also failed.

DELETED

Overpressure

Peak overpressure measured was [redacted] at H + 26.95 seconds.

DISCUSSION

The gust results check very well with predictions for the yield experienced. Thermal data was less than predicted and further analysis will be necessary. The loss of the elevator instrumentation was anticipated for the high temperature received. Instrumentation in other areas of the aircraft will be recorded in place of the elevator instrumentation.

[redacted]

DELETED (DAKOTA)

Project 5.2 - In Flight Participation of a B-52 - Lt. Francis L. Williams

Objectives:

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

Instrumentation:

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

Aircraft Position in Space:

	Altitude (ft) (Absolute)	Offset (ft)	True Heading (degrees)	Slant Distance (ft)	Velocity (fps) TAS	GROUND
Condition at Zero Time	22,000	470	282	24,800	785	760
Condition at Gust Arrival	22,000	0	281	39,400	791	760

Results:

Thermal Energy measured by a 160° field calorimeter pointing straight down was DELETED

Maximum Temperature measured on a black 0.032 magnesium, lower body panel was

Gust DELETED

[redacted]

28

[redacted]

The Peak Overpressure:

Measured on the left side of the fuselage at B.S. 340 was DELETED

Instrumentation Failures:

Eleven oscillograph channels, one photo recorder channel (OAT), and one W.L. Camera failed during the Dakota mission. Approximately 96.2% of the total instrumentation was operative during DELETED (DAKOTA).

Flaps:

A thorough inspection and functional test revealed that the flaps were not damaged during the test.

[redacted]

[redacted]

DELETED (DAKOTA)

Project 5.3 - In-Flight Participation of a B66B - Richard W. Bachman

Objective:

The primary objective of this test was to measure the gust and thermal effects of a DELETED nuclear device on a B-66B Aircraft.

Instrumentation:

Instrumentation on the B-66B for the DELETED (DAKOTA) shot consisted of the following: 67 strain gages at 5 stations and 26 T.C. at 7 stations on the L.H. Wing, 16 strain gages at 1 station and 6 T.C. at 2 stations on the R.H. Wing, 25 strain gages at 4 stations and 12 T.C. at 2 stations on the L.H. horizontal stabilizer, 9 strain gages at 1 station and 2 T.C. at 1 station on the R.H. horizontal stabilizer, 3 strain gages at 1 station and 9 T.C. at 3 stations on the L.H. elevator, 2 strain gages at 1 station and 6 T.C. at 1 station on the R.H. elevator, 32 T.C. at 10 stations on the fuselage, 17 accelerometers on the fuselage, empenage and nacelle, 13 calorimeters and 2 radiometers in the tail, together with 6 cameras, 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 channels of correlation.

Aircraft Position in Space:

Using a combination of the K-5 Radar System and the Raydist System, the B-66 was positioned at an altitude of 16,000 feet, on a true heading of 127° and a horizontal range of 13,100 feet at time zero. At time of shock arrival, the horizontal range was 35,050 feet, with the A/C on the same heading and at the same altitude as before. The ground speed between time zero and shock arrival position was 772 ft./sec.

3[

[redacted]

Results:

Thermal

Total thermal energy field measured was DELETED Maximum Δ T measured was [redacted] on the painted 0.016 elevator panel, which gives a total temperature of [redacted] for the elevator. This is [redacted] above Phase I calculated restrictions for TAC use of the B-66 and resulted in permanent buckles in the elevator skin. Special absorptivity paint was used to increase the temperature rise in these instrumented elevator critical areas. Maximum temperature rise measured on the nose radome was [redacted] with it's normal white Hypalon configuration.

Gust

Maximum gust loading at time of shock arrival was [redacted] and a limit DELETED

Overpressure

Peak overpressure measured was DELETED

Operability

Of the 295 total data recording channels, 94% were operable.

Damage

The thermal energy field caused DELETED

DELETED

[redacted]

31

[redacted]

DELETED

Project 5.4 - In-Flight Participation of a B-57B - Lt Harold 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 240 channels being recorded, 14 data channels were lost for various reasons. They have been repaired or replaced by spares.

Aircraft Position in Space

The JB-57B was flying at an absolute altitude of 18,050 feet, on a 120° T heading in a less than 2° nose left position at H ≠ 0. Horizontal range to ground zero at H ≠ 0 was 16,960 feet (aircraft traveling at 736 ft/sec). Aircraft position at time of shock arrival (H ≠ 34.9 sec) was 43,630 feet beyond ground zero. Heading same as H ≠ 0, altitude 18,050 feet, speed 730 ft/sec.

Results

Thermal

Total thermal energy measured was DELETED normal to a horizontal receiver. [redacted] of allowable limit).

Gust

Total gust load at time of shock arrival was DELETED allowable limit for the B-57B.

Overpressure

Peak overpressure was DELETED

1148

[redacted]

DELETED (DAKOTA)

Project 5.5 - In-Flight Participation of F-84F Aircraft - Lt R. F. Mitchell

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 objective 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 the channels were successfully recorded.

Barley - Out of the 100 channels available to record essentially the same information as above, there were 5 channels that failed. In addition, the two fireball cameras were inoperative.

Aircraft Position in Space

Waiter - At time zero, the aircraft was flying at an altitude of DELETED ft and zero offset. The shock arrival position DELETED DELETED horizontal range, and zero offset. DELETED DELETED

Barley - At time zero, the aircraft was flying at an altitude of DELETED) The horizontal range and offset were DELETED respectively. At shock arrival DELETED

3

[redacted]

the aircraft was DELETED DELETED

Results

Waiter

Thermal [redacted] temperature rise in the gray test panel in the wing flap.

Gust - Not available at this time.

DELETED

Barley

Thermal DELETED DELETED

Gust - DELETED design limit in side fuselage bending.

Overpressure DELETED

Special - Damage

Waiter

Flap - The paint DELETED

Stabilator - Damage to the gray test panel of the stabilator was comparable to that received in the flap.

Fuselage - DELETED DELETED

[redacted]

DELETED (DAKOTA)

Project 5.6 - In-Flight Participation of an F-101A Aircraft -

Capt H. M. 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 responses to the inputs. For the [redacted] (Dakota) Shot, the aircraft was positioned to theoretically receive a DELETED

DELETED

and the on time position.

DELETED

AIRCRAFT POSITION IN SPACE

The aircraft was to fly at DELETED absolute on an inbound heading of

DELETED

[redacted]

Results

Damage

Radome Sample.

DELETED

Pitot Mast

DELETED

Free Air Temperature Probe

Same as Pitot Mast.

Right Nose Gear Door

DELETED

Forward Stores Mount Access Doors

DELETED

Aft Stores Mount Cover

DELETED

The forward Hartwell

DELETED

[redacted]

[redacted]

DELETED (INCA) shot. This is an effect of the overpressure. It is believed that this particular fastener DELETED

Fuselage Insignia Paint

DELETED

Fire Extinguisher Access Doors

DELETED

Grommets

DELETED

Turbine Warning Stripe

DELETED

Wing and Fuselage Seal

The red rubber seal between the wing and fuselage on the right side was DELETED The seal was painted white but the paint was in poor repair.

Wing Insignia Paint

The blue insignia paint on the under side of both wings DELETED

DELETED

[redacted]

DELETED The right wing paint was a thinner, smoother coat.

Left Wing Flap Trailing Edge Extrusion

The aluminum paint DELETED

Right Wing Tip Honeycomb

DELETED

Stabilator Honeycomb

The aluminum paint DELETED There was no unbonding of the DELETED

Stabilator Tips

Flaps

Instrumentation

The only apparent damage DELETED They broke away from the panel when the panel unbonded and thus did not record after that time. Of the 49 oscillograph recorded parameters, 45 produced usable data. One of the calorimeters moved too quickly and its trace went out of focus.

Two thermocouples malfunctioned; one shorted out and the other became unpeened. One accelerometer developed an open bridge. The photo panel, recording 26 parameters, functioned properly.

Gust Data

Overpressure measured was about [redacted] Gust responses were about 53% for shear and bending and about 62% for torque.

Thermal Data

The highest temperature rise to date were recorded on this shot. A ΔT of about [redacted] was experienced on the unpainted honeycomb of the wing. The stabilator honeycomb experienced a ΔT of about [redacted] The black painted honeycomb was DELETED The three thermocouples in the black panel DELETED

Nuclear Radiation

The final film badge readings have not been received as of this date. There was no indication of any dosage on the pilot's dosimeter.

General

The participation was considered highly successful by this project. It produced our best thermal data of the operation.

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]

DELETED

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 Chieerete 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: One channel of the six back-scatter channels failed. Signals were received on the other five. These signals indicate a rough, uncorrected value of about DELETED as the thermal energy back-scattered to the cockpit.

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, two are known to have failed to operate properly. The degree of success of the B-52 cameras will not be known until the film is returned from Hawaii. A report on the operation of the two cameras in the Chieerete photo tower has not as yet been received. Best estimate, at present, is that thirty three magazines should have obtained records suitable for analysis. Verification of this estimate is not possible until these films have been developed.

[redacted]

DELETED

Project 6.1 - Accurate Location of Electromagnetic Pulse Source -

Dr. 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 (Harlingen,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).

[redacted]

Results

Short Base Line

Hawaii - All stations in the Kona net received and recorded the wave form of the electromagnetic pulse emanating from bomb detonation. Line of position error was 5.6 nautical miles, Maximum field strength DELETED

California - All stations in the Woodland net operated satisfactorily. Line of position error 8.5 nautical miles. Maximum field strength DELETED

Long Base Line

Hawaii - Midway did not receive correct time but all other stations in Lahaina operated satisfactorily. Line of position error was 3030 yards.

Stateside - All stations in the Harlingen net received and recorded form of the electromagnetic pulse emanating from the bomb detonation.

Griffiss AFB station equipment was operating at shot time.

The above position errors may change considerably during further examination of the data.

[redacted]

[redacted]

DELETED

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

Objectives

The objective of Project 6.3 is to obtain data on the effects of DELETED DELETED 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 comprises:

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.

Preliminary Results

All stations operated successfully during this test.

C-97 Airborne Station: The same effects as experienced on the DELETED (CHEROKEE) and the DELETED (ZUNI) were present but to a much smaller extent. Complete absorption was experienced when the aircraft was inside the absorbed region. However this region of absorption was not as large as for the DELETED Also the disturbance to the Ionosphere echo shape was relatively minor in comparison. Abnormal echoes lasted less than forty minutes.

Kusaie: The same effect occurred in the F region as was observed during the DELETED tests but of lesser duration and magnitude.

4

These effects lasted for approximately 1 & 1/4 hours.

Rongerik: No apparent effect was observed at Rongerik as a result of this test.

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[redacted]

DELETED (DAKOTA)

Project 6.4 - Determination of Characteristics of Airborne Flush Mounted Antennas and Photo Tubes for Yield Determination at Extended Ground-to-Air Ranges - Allan 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 items 1 and 2 above.

Instrumentation

2 fiducial antennas	2 scope cameras
1 whip antenna	1 sequence camera
1 synchronizer	1 recorder
2 photoheads	
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 let directly to the recorder. The sequence camera photographs the blast directly for use in correlation of previous data. Distance was approximately 92 miles.

[redacted]

4

[redacted]

Results

Signal was received by one antenna only. Photography was taken. Antennas were swapped from their previous position indicating that antennas and amplifiers work satisfactory and trouble lies in the scope (333 dual-beam). Photohead data was recorded on both channels.

[redacted]

[redacted]

DELETE (DAKOTA)

Project 6.5 - Analysis of Electromagnetic Pulse Produced by Nuclear Explosion - Charles J. Ong

Objective

The objective of Project 6.5 is to obtain waveforms of the elect magnetic radiation for all the detonations during Operation REDWING. This data is to be used in connection with a continuing study relatin the waveform parameters to the height and yield of the detonation.

Instrumentation

Two identical stations are used to record data, one at Eniwetok one at Kwajalein.

The instrumentation consists of a wide-band receiver with separa outputs connected to each of the three oscilloscopes. Mounted on eac oscilloscope is a Polaroid Land Camera for recording the transient di

Results

Station A - PARRY ISLAND

Positive results were recorded on all three oscilloscopes a this station. The predicted field strength was DELETED a the measured field strength was DELETED The data gives complete signal and should give the desired information when analyzed

Station B - KWAJALEIN

Positive results were recorded on two oscilloscopes at this station. The third oscilloscope was inoperative due to tube failure a replacement was not available at Kwajalein. The film has not been processed but preliminary examination indicates a field strength of a imately [redacted] The predicted field strength was DEL per meter.

DELETED

[redacted]

[redacted]

DELETED (DAKOTA)

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

Three RB-50 Aircraft, Carter 1, 2, and 3, participated on this event. Positioning at H Hour was as follows: Carter 1, 70 Nautical Miles East of GZ at 20,000 feet; Carter 2, 70 Nautical Miles South of GZ at 20,000 feet; Carter 3, 50 nautical miles at 20,000 feet. Carter 1 had an unrestricted view of the detonation and resulting cloud. Two photo runs of 15 minutes each were made with all cameras operating without malfunction. Carter 2 in the South Quadrant photographed the rise of the cloud up to 35,000 feet where the still rising cloud fused into a high cirrus layer. A second 15 minute leg was flown at 25,000 feet. Measurable results on this leg are probably negligible. All cameras functioned with the exception of the 16mm Color GSAP which had a film jam at plus 15 seconds.

Carter 3, accomplished one and a half 15 minute photo runs before being blocked by a cirrus layer estimated at 40,000 feet. There were no camera malfunctions.

All three air crews reported an extreme rapid rate of rise with the cloud starting to lose its identity at about plus 30 minutes.

[redacted]

4

PART III

TASK UNIT 1

LASL PROGRAMS

Keith Boyer
Advisory Group

Program 10 - Thermal Radiation and Hydrodynamics	H. Hoerlin
Program 11 - Radiochemistry	G. Cowan
Program 13 - Fission Reaction Measurements	J. S. Malik
Program 15 - Photo-Physics	G. L. Felt
Program 16 - Physics & Electronics & Reaction	B. E. Watt
Program 18 - Thermal Radiation	H. Hoerlin

5

[redacted]

DELETED (DAKOTA)

Project 10.1 - Fireball Hydrodynamics - J. F. Mullaney

The total hydrodynamic yield of the [redacted] (DAKOTA) has been determined on the basis of diameter-time data from three Eastman films, 36326 (Aomoen), 36327 (Aomoen), and 36336 (Enyu). DELETED

In addition to the three films noted above, an Eastman film 36329 (Chieerete) was also provided by E.G.&G. but was omitted from the yield calculations due to the somewhat inferior quality of the photographic image. Furthermore, it was thought desirable to apply a proximity correction to the Aomoen films which reduced the measured diameters by about 0.4%. This correction improved the consistency of yield among the three films, so that the resultant maximum scatter was only about $\pm$ 2% to - 1%. The consistency of yield within each film was also good; film 36326 varied about a mean yield by about $\pm$ 1%, film 36327 showed a scatter of about $\pm$ 1.5% to - 3%, and film 36336 scattered from approximately $\pm$ 2.5% to - 2%.

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[redacted]

51

Table 10.2-1

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[redacted]

DELETED (DAKOTA)

Project 10.2 - Time of Arrival - J. F. Mullaney

L. N. Blumberg

Atmospheric conditions of interest, provided by U.S.S. CURTISS, at shot time, are:

Pressure: 1009.2 mb

Temperature: 81.5°F

Wind: 19 Knots from 080°

Dew Point: 74.0°F

From these data, a sound speed of 1146.3 fps was calculated.

Position of the ship, relative to Station 70 (ENYU), as determined by radar, was:

Range: 49,950 ft

Bearing: 318°T

The results of the time-of-arrival calculation are presented in Table 10.2-1

TABLE 10.2-1

RANGE (ft)	BEARING	RANGE, WIND-CORRECTED (ft)	TIME INTERVAL (Seconds)

DELETED

DELETED

DELETED

[redacted]

53

[redacted]

DELETED

[redacted]

DELETED (DAKOTA)

Project 11.1 - Radiochemical Analysis - G. Cowan

DELETED

[redacted]

[redacted]

DELETED (DAKOTA)

Project 11.2 - Cloud Sampling - H. F. Plank

P. F. Moore

Equipment:

Nine Aircraft equipped for cloud sampling as described in the DELETED report were used on this mission: "A" Flight, Tiger Red one (F-84); "B" Flight, Tiger Red Two (F-84); "C" Flight, Hotshot 1 (B-57); "D" Flight, Hotshot II (B-57); "E" Flight, Hotshot III (B-57); "F" Flight, Hotshot IV, (B-57); Control, Cassidy (B-57); and Tiger Spare 1 & 2 (2 F-84's).

Weather:

There was a thick cirrus overcast from 37,000 to 45,000 ft. which largely obscured the bomb cloud at most altitudes in which sampling aircraft were operating. Wind shears were not particularly favorable for sampling, and velocities were moderately high.

Cloud Description:

The cloud rose through the cirrus layer at 37,000 to 45,000 feet where it was completely obscured and was almost impossible to see above that level due to haze and condensation of natural clouds around the bomb cloud. Only a very small tail extended below the cirrus at 37,000 ft. Cloud color was very light, which increased the confusion with natural clouds. The upper umbrella of the cloud extended back almost all the way from Bikini to Eniwetok and sampling aircraft returning to Eniwetok at higher altitudes encountered patches of radioactive cloud material, Cassidy estimated the maximum cloud height at 62,000 ft. plus or minus 2,000 ft.

[redacted]

Sampling Mission:

Red 1 was directed into the small portion of the cloud visible belo the overcast at 35,000 ft. and Red 2 was directed to go in blind at 38,0 ft. at the estimated position of the cloud at that level. Red 1 was abl to collect a major portion of his assigned sample, while Red 2 was low by a factor of three. Hotshot II aborted so Hotshot I was started climb ing for II's assigned altitude at 48,000 ft. and a call sent to base for the Tiger Spare aircraft to come out and take over the 42,000 ft level. Hotshot I was able to collect about 2/3 the desired sample, but the Tig Spares at 41,000 ft. were unable to catch up with much cloud material, were down in sample size by a factor of thirty. Hotshot III was able t collect the desired sample in the light and variable layer at 51,000 ft. Hotshot IV aborted and Cassidy endeavored to make up for both Hotshot II and IV by starting at the eastern border of the cloud at 44,000 ft. and working west and up for about 250 miles, emerging at 52,000 ft. near the landing field on Eniwetok, very low on fuel. Cassidy collected a sample size equivalent to both Hotshot II and IV's assignments; at, of course, appreciable increase in dosage.

[redacted]

DELETED

Project 13.2 - Measurement of Alpha, Boosting and Time Interval -

H. Grier

J. Malik

DELETED

[redacted]

DELETED

[redacted]

DELETED

DELETED

DELETED

[redacted]

DELETED (DAKOTA)

Project 13.3 - ENS Monitoring - D. Henry

[redacted] J. Malik

DELETED

[redacted]

[redacted]

DELETED (DAKOTA)

Project 15.1 - EG&G PHOTOGRAPHY - H. Grier

D. J. Barnes

CLOUD DIMENSIONS

DELETED

FIREBALL YIELDS

DELETED

BHANGMETERS

DELETED

[redacted]

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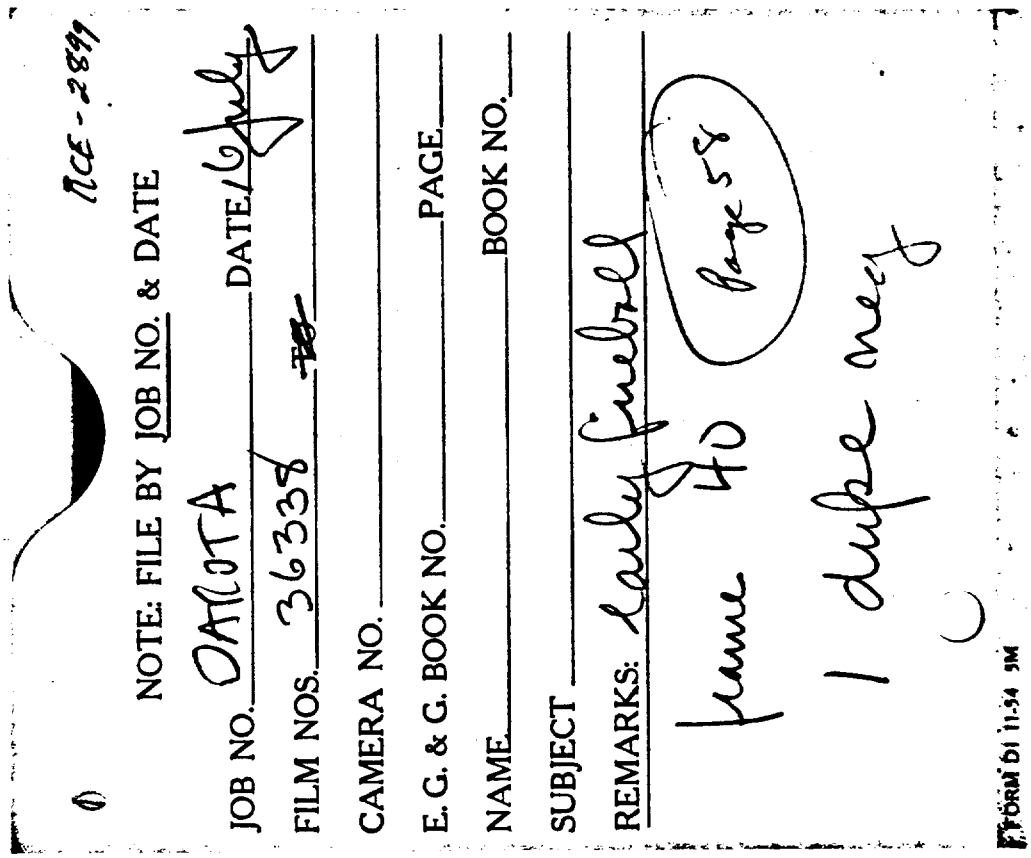

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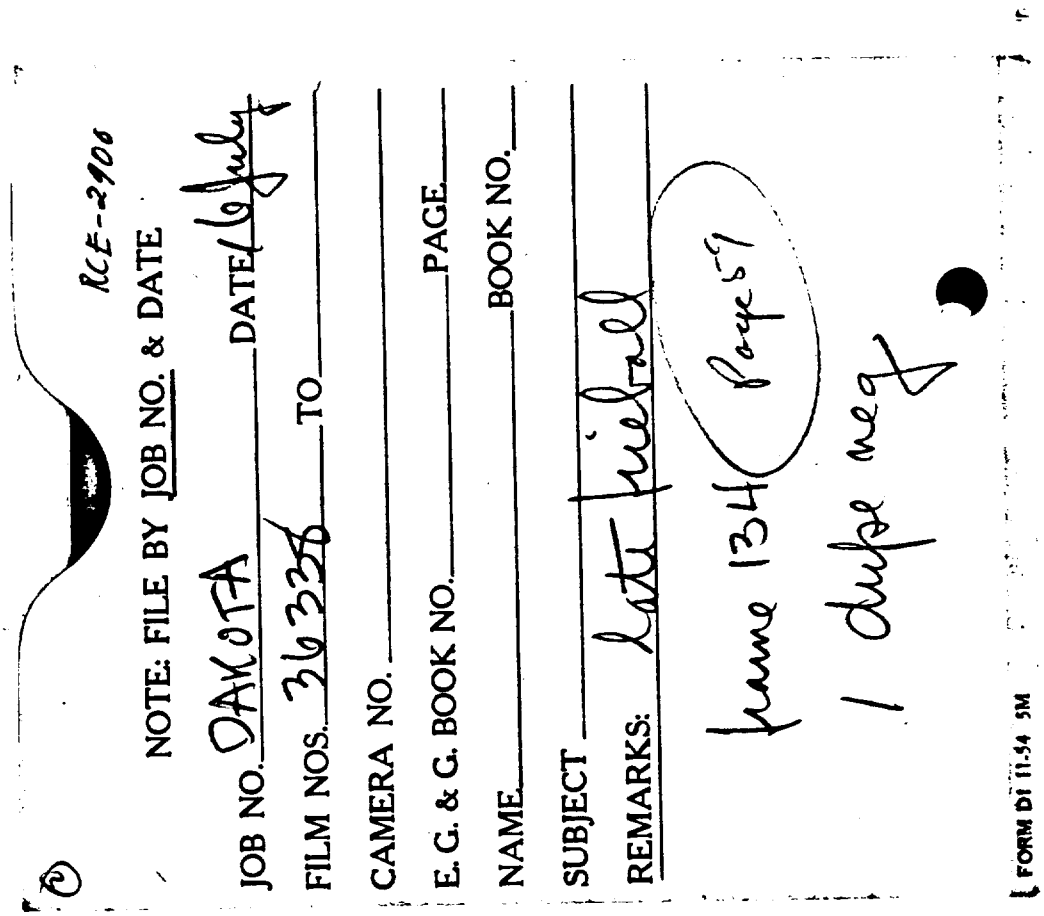

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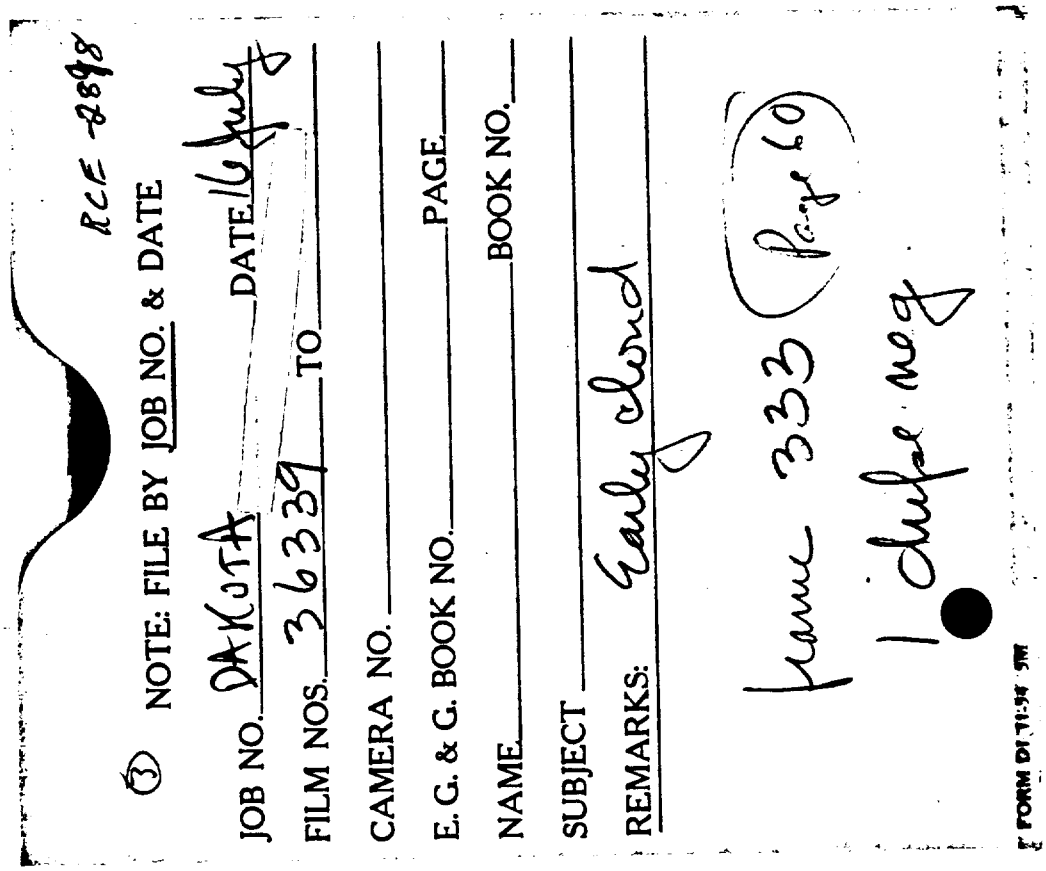

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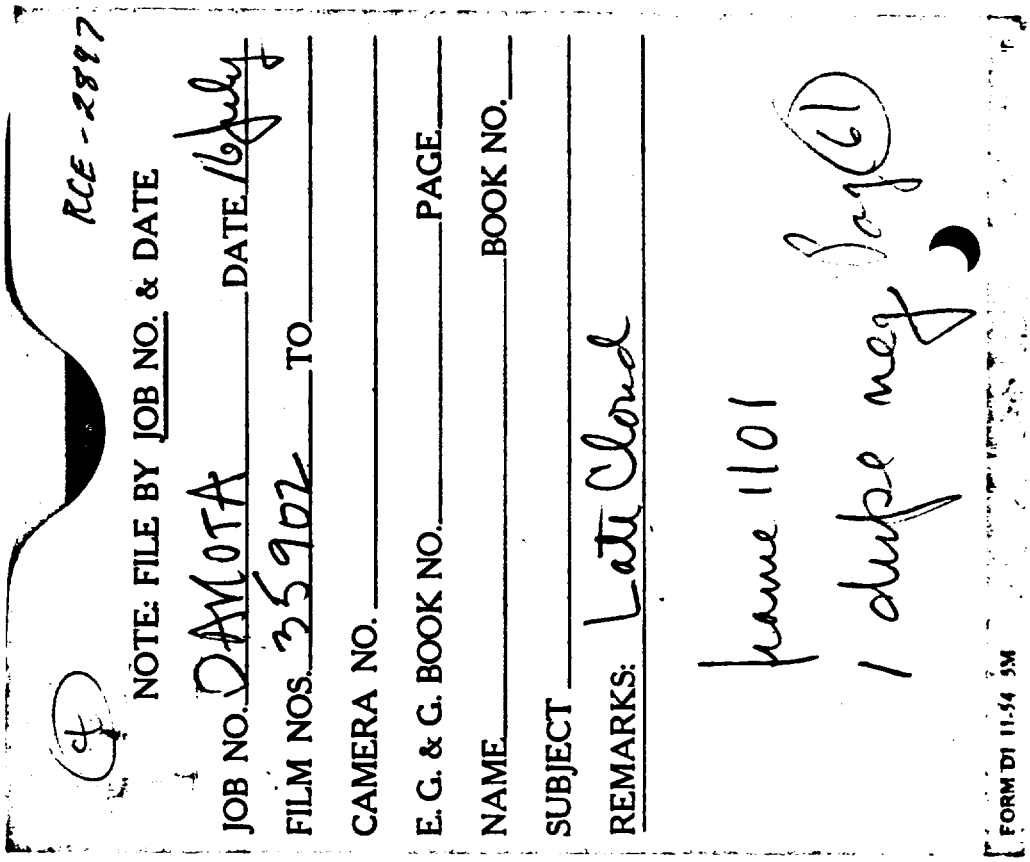

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Project 15.2 - High Speed Photography (Time Interval, Fluor Study, Early Fireball) - G. Felt

L. Allen

DELETED

[redacted]

DELETED

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DELETED

[redacted]

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Project 16.3 - Electromagnetic Measurements - R. Partridge

DELETED

[redacted]

[redacted]

DELETED (DAKOTA)

Project 18.3 - Spectroscopy - H. Stewart

For purposes of intercomparison all results obtained by Project 18.3 are presented and discussed in the Navajo report where a description of instrumentation is also included.

All equipments gave good exposures except the U of R spectrographs which were out of line because of a mechanical defect.

[redacted]

[redacted]

DELETED (DAKOTA)

Project 18.4 - Chord Experiment and Time-Interval - H. Hoerlin

Westervelt, Bennet, Day, Hoerlin

DELETED

Time Interval

DELETED

D

DELETED

[redacted]

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PART IV

TASK UNIT 4

SC PROGRAMS

E. L. Jenkins
CTU-4

Program 31 - Microbarography R. Heppelwhite

91

[redacted]

DELETED

Project 31.1 - Microbarograph - W. A. Gustafson

The purpose of this project was to measure winds in ozone layer of the atmosphere. This was accomplished by measuring at several sites the arrival times of the shock wave reflected from the ozone layer. Four sites were operated: Ujelang, Wotho, Rongerik, and Eniwetok. At each site two stations were operated about one mile apart. The difference in arrival times gives the angle of incidence of the shock and information from several stations may be combined to give the winds.

DELETED (DAKOTA) good shot records were obtained from all stations but no temperature and wind vectors for the ozonosphere are yet available.

[redacted]

[redacted]

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