410949

[redacted]

.01 Redwing

OPERATION REDWING

A PRELIMINARY REPORT

OF

[redacted] (INCA)

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JU[illegible] 1957

R & D FILES

6 US ATOMIC ENERGY COMMISSION

Submitted by Task Group 7.1

SNL CENTRAL Tech Files

IRT# 35389

1 Redwing - A Preliminary - INCA 10-15-56

JO-267

15 October 1956

COL No.
ACC. STAC
CARD
[illegible] No. O-1 Redwing
BM

CENTRAL M & R CONTROL NO. Q ~~82288~~

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[redacted] (INCA)

INTRODUCTION

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[redacted]

[redacted]

PART I

GENERAL INFORMATION

[redacted]

[redacted]

ENIWETOK OBSERVED WEATHER FOR 22 JUNE 1956
INCA SHOT TIME 0956M

Sea Level Pressure	1009.8 mbs
Free Air Surface Temperature	83.3°F
Wet Bulb Temperature	78.3°F
Dew Point Temperature	76.6°F
Relative Humidity	81.0%
Surface Wind	130° 11 knots
Visibility	Over 10 Miles

CLOUDS

2/10 cumulus; bases estimated at 1800 feet, tops 5-8,000 feet (moving from southeast). 10/10 cirrostratus; bases estimated at 23,000 feet, tops over 30,000 feet (all opaque).

WEATHER

No showers observed.

AREA WEATHER SUMMARY FROM AIRCRAFT

Narrow band of scattered cumulus clouds averaging 3/10 to 4/10 coverage to the southeast of ground zero. (Distance not reported). Tops of cumulus at 8,000 feet. Cirrostratus overcast based at 25,000 feet (measured) with tops at 31,000 feet. Cirrus opaque and dense. Target area was clear of cumulus clouds at 0931M.

STATE OF SEA

Ocean Side: Wave heights 6 feet, period 7 seconds, direction 090°.
Lagoon Side: Wave heights 1.5 feet.

[redacted]

Pressure Millibars	Height Feet	Temperature °C	Dew Point °C
1000	280	25.5	22.5
850	4,920	17.2	10.2
804	6,962	14.5	06.5
778	7,447	15.2	06.5
700	10,320	10.5	03.2
600	14,480	01.8	-07.5
580	15,420	-00.5	-08.2
500	19,240	-05.2	-20.5
496	19,423	-05.5	-22.2
474	20,636	-07.8	M
438	22,638	-13.2	-27.5
400	24,880	-17.8	-24.8
300	31,750	-31.5	-38.2
265	34,547	-38.2	-46.2
200	40,720	-55.0	M
150	46,560	-69.0	M
144	47,346	-71.0	M

Balloon burst.

WINDS ALOFT (0910M)

Height Feet	Direction Degrees	Velocity Knots	Height Feet	Direction Degrees	Velocity Knots
1,000	100	17	22,000	070	21
2,000	100	19	24,000	030	20
3,000	110	23	25,000	010	22
4,000	110	25	26,000	030	18
5,000	110	25	28,000	130	06
6,000	110	25	30,000	240	06
7,000	100	25	32,000	210	11
8,000	100	25	34,000	210	19
9,000	090	25	35,000	210	22
10,000	090	25	36,000	210	22
12,000	090	25	38,000	210	24
14,000	100	25	40,000	210	26
16,000	100	24	42,500	220	30
18,000	080	21	45,000	230	31
20,000	080	19	47,500	230	31

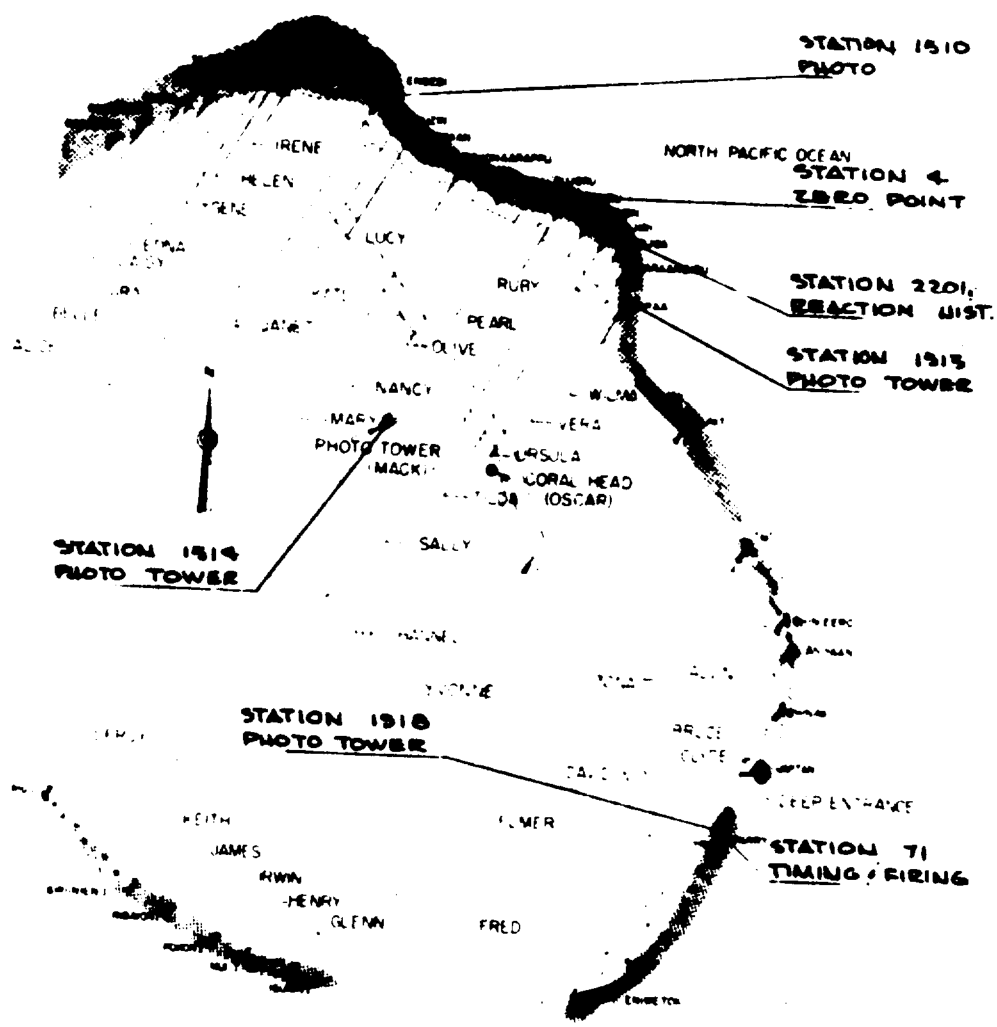


Fig. 0-1 - Eniwetok Atoll Map

[redacted]

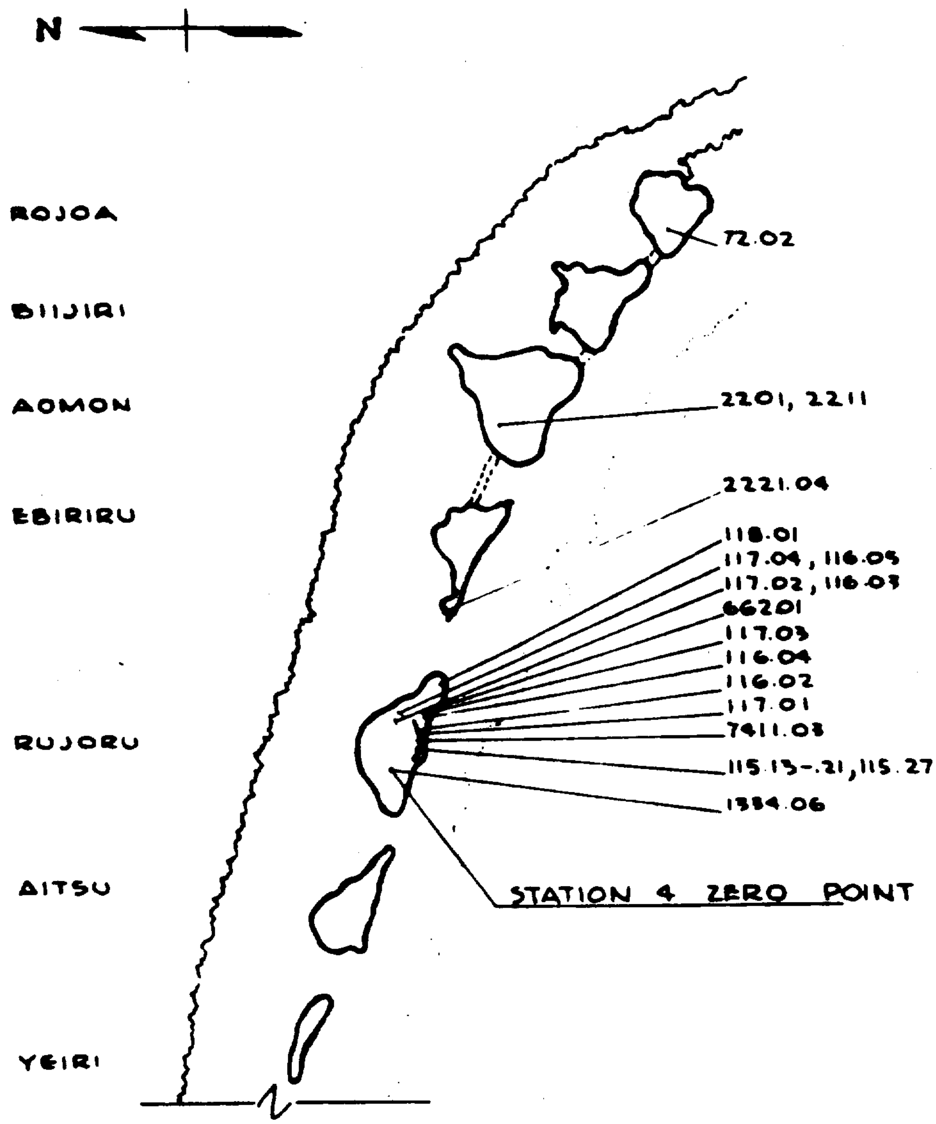


Fig. 0-? - Scientific Stations and Zero Point

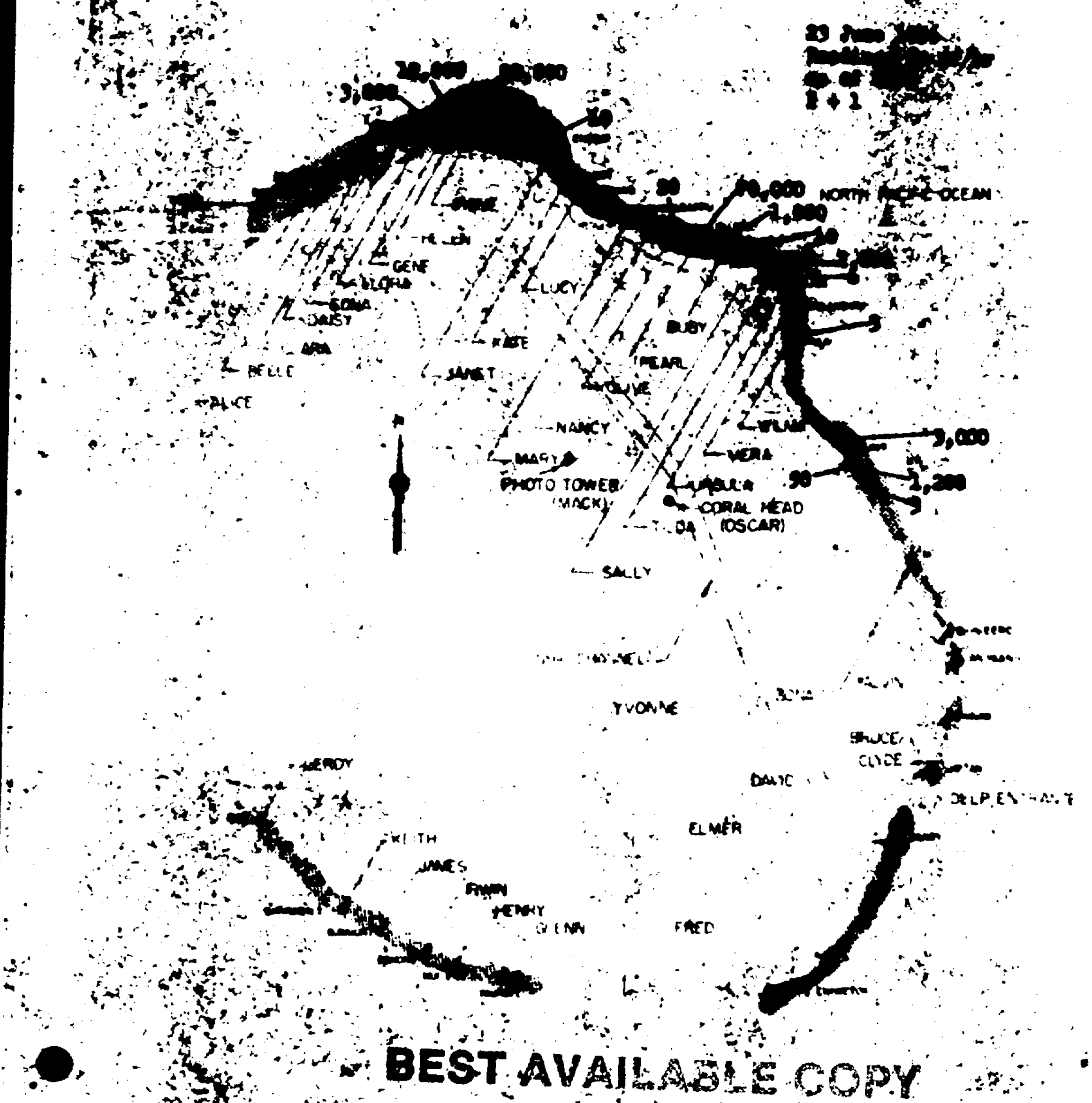
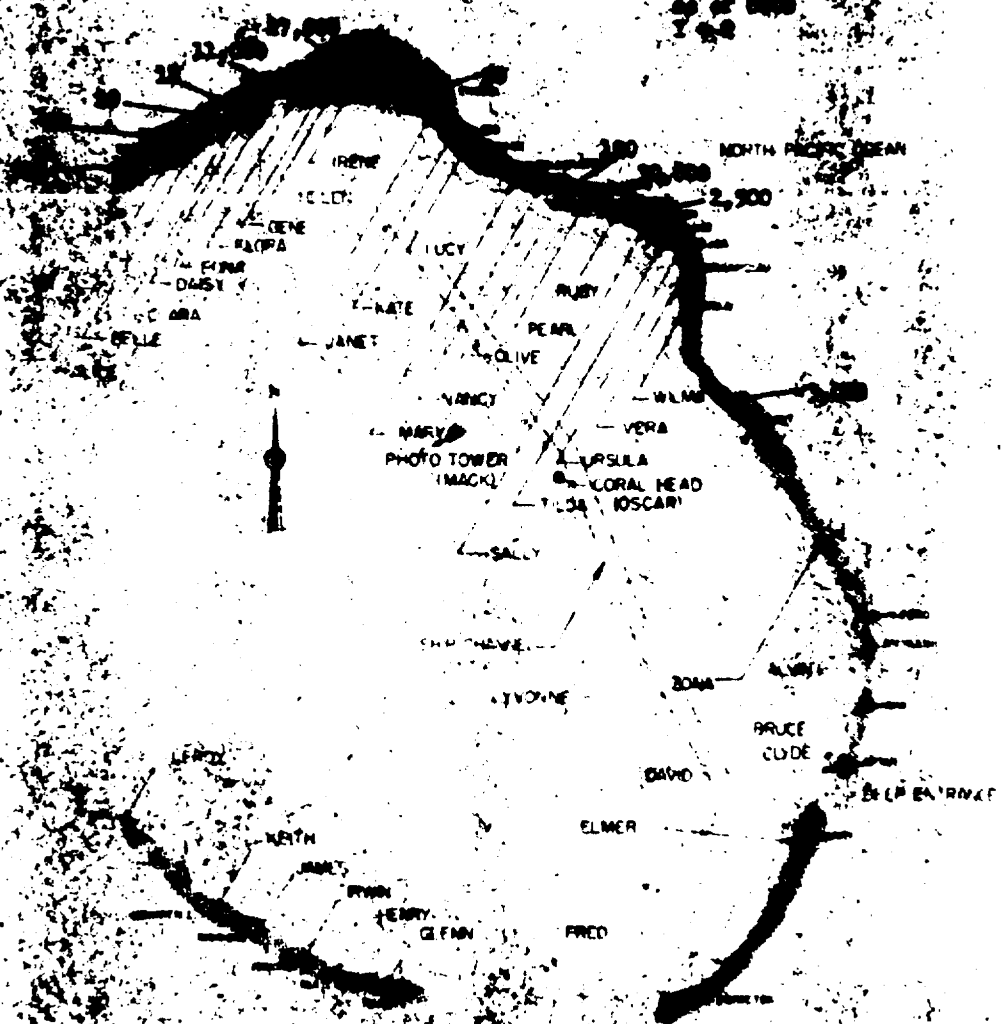


Fig. [illegible] - [illegible] Survey, D+1


NORTH PACIFIC OCEAN
2,500
IRENE
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DAVID
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KEITH
HENRY
GLENN
FRED

PART II

TASK UNIT 3

DOD PROGRAMS

Col. K. D. Coleman
CTU-3

Program 1 - Blast and Shock Measurements	Maj H. T. Bingham
Program 5 - Aircraft Structures	CDR M. R. Dahl
Program 6 - Test of Service Equipment and Materials	Lt Col C. W. Bankes

[redacted]

[redacted] (INCA)

Project 1.1 - Basic Blast Measurements - J. J. Meszaros

OBJECTIVE

The objective of Project 1.1 during [redacted] (Inca) was to observe the differences in propagation of the precursor shock over a vegetated surface and a clear surface.

INSTRUMENTATION

Five identical gage stations were placed on each surface at distances ranging from 900 feet to 1600 feet from ground zero. Each station consisted of one self-recording "Q" gage and two self-recording pressure-time gages. Also, ten experimental radiation-initiated gages were placed at various stations.

RESULTS

Due to the unexpected high yield of the shot, many of the gages failed to give significant records. In all the gages the pressure-sensitive capsules had been subjected to pressures estimated at 200 to 300 percent above their rated values. In addition, the high pressures displaced several "Q" gage mounts and caused considerable chipping of the glass record discs. Only one of the radiation-initiated gages gave a pressure-time record.

A pressure-distance plot of the overpressure values obtained by the pt gages is shown in Figure 1.1-1. There appears to be no significant difference in the overpressures of the vegetated surface and the clear surface.

[redacted]

[redacted]

[redacted] (INCA)

TABLE 1.1-1

Overpressure Results

DELETED

[redacted]

[redacted]

DELETED

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Fig. 1.1-1 - Overpressure Vs Distance - Ground Baffle Gages, [redacted] (Inca)

DELETED

[redacted]

15

[redacted]

[redacted] (INCA)

Project 1.3 - Shock Photography - J. Petes

OBJECTIVE

To obtain blast pressure-distance information by means of direct shock photography.

INSTRUMENTATION

High speed cameras were used to photograph the shock directly.

RESULTS

The photography was successful, and should satisfy the objective for this shot. Film analysis will be made at NOL, and the results will be available in a few weeks.

[redacted]

[redacted]

[redacted] (IMCA)

Project 1.10 - Measurement of Blast Parameters Over Vegetated and Cleared Areas - C. D. Broyles

OBJECTIVE

To determine the difference in blast effects, in the precursor region, over a vegetated area and over a cleared sandy surface.

INSTRUMENTATION

Detailed instrumentation is apparent from Tables 1.10-1 and 1.10-2. Gage designations are as follows: First 3 numerals are station number; 4th and 5th digits describe gage, i.e., G3—ground baffle, P3—pressure-time at 3 foot height, q3—dynamic pressure at 3 foot height; last letter denotes V—vegetated or C—cleared area.

RESULTS

An attempt was made to correlate the difference in blast effects with measurements of preshock sound speed, however the instrumentation malfunctioned and no sound speed records were obtained. The vegetation reduced the severity of the precursor, showing later arrival times and smaller dynamic pressures than the cleared area. Over the vegetation the overpressures were the same at the 3 foot level as at ground level while the cleared area showed much higher overpressures at the 3 foot level than at the ground surface.

The data are presented in the accompanying tables.

[redacted]

TABLE 1.10-1

OVERPRESSURE RESULTS

DELETED

TABLE 1.10-2

DYNAMIC PRESSURE RESULTS

DELETED

[redacted]

[redacted]

[redacted] (TMCA)

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

OBJECTIVE

The primary objective of this test was to measure the gust effects of a [redacted] nuclear device on a B-66B aircraft in flight.

INSTRUMENTATION

Instrumentation on the B-66B for [redacted] (Inca) consisted of the following: 67 strain gages at 5 stations and 26 thermocouples at 7 stations on the left hand wing, 16 strain gages at 1 station and 6 thermocouples at 2 stations on the right hand wing, 25 strain gages at 4 stations and 12 thermocouples at 2 stations on the left hand horizontal stabilizer, 9 strain gages at 1 station and 2 thermocouples at 1 station on the right hand horizontal stabilizer, 3 strain gages at 1 station and 9 thermocouples at 3 stations on the left hand elevator, 2 strain gages at 1 station and 6 thermocouples at 1 station on the right hand elevator, 24 thermocouples at 9 stations on the fuselage, 26 channels of engine information, 3 pressure pickups on wing, 3 pressure pickups on empenage and 9 pressure pickups on the fuselage, 17 accelerometers on the fuselage, empenage and nacells, 16 calorimeters and 2 radiometers in the tail and 3 calorimeters in the fuselage belly, wing and tail deflection cameras, 32 basic aircraft flight instruments on a photo recorder panel and 8 correlation channels.

AIRCRAFT POSITION IN SPACE

The K-5 Radar system was used to position the aircraft. At H - 1:30 minutes the navigator indicated a 5 second late position and the aircraft was obliged to abort the mission.

[redacted]

RESULTS

As a result of the abort, the aircraft was at too great a distance at zero time to record any data whatsoever.

Project 5.4 - In-Flight Participation of a B-57B - 1st Lt E. 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 weapon system.

INSTRUMENTATION

All oscillograph power switches located in the bomb bay were in the off position, resulting in complete loss of data, with the exception of cameras and "temp tapes". This error was a result of extremely abnormal and adverse conditions prior to takeoff; in that, sufficient time was not available to perform the instrumentation checkout in the normal manner. Adequate precautions have been taken to prevent a similar future occurrence under any conditions.

AIRCRAFT POSITION IN SPACE

The B-57B was flying at an absolute altitude of 10,000 feet on a 050°T heading at zero time. Horizontal range beyond ground zero at zero time was 2624 feet (aircraft traveling at 665 ft/sec ground speed). Aircraft position at the time of shock arrival (H + 12.9 sec) was 11,572 feet beyond ground zero. Heading, altitude and speed were the same as at zero time.

RESULTS

Since the recording equipment did not run, there was no data from this test, with the exception of temperature tapes and cameras. However, the mere fact that the aircraft was at its given position in space, relative to ground zero, at zero time and time of shock arrival (H + 12.9 sec), and returned with no damage, provides positive proof of its delivery capabilities. Based on predicted response, and known position and preliminary information on yield, it is probable that the aircraft received 100 ± 5% of the limit allowable gust input. A fairly accurate measurement of temperature can be made by comparing temperature tape reading on the [redacted] (Inca) shot with the temperature tapes from the [redacted] (Erie) shot and the [redacted] (Zuni) shot for which the actual temperatures are known.

DELETED [redacted] (INCA)

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 responses to the inputs. For [redacted] (Inca), the aircraft was positioned to receive maximum gust inputs consistent with minimum nuclear radiation. By positioning to theoretically receive 3.6 R, the maximum expected gust response was about 75%.

AIRCRAFT POSITION IN SPACE

The aircraft was to fly at 9,000 feet absolute altitude on an inbound heading of 040° at a ground speed of 920 feet per second. It was planned that the aircraft would be 5800 feet short of ground zero at zero time with shock arrival occuring 6.3 seconds later directly over ground zero. Actual shot position was on time and 120 feet to the right of the planned ground zero position with the shock arriving 6.4 seconds later 550 feet beyond ground zero and 200 feet to the right of the desired position at time of shock arrival.

RESULTS

Damage: There was no significant damage that could definitely be attributed to effects of the shot. Some items noted were:

The lower ventral fairing plating on both engines showed some shift at the fasteners and joints from aft of the engine to the parabrake. The plating is built to expand with increase of engine heat so that this is not really in the category of damage. It is felt that it was an effect since it is the opinion of the project that the weapon caused the definite shift noted.

The stainless steel fingers on the trailing edge of the aft engine doors were sprung on the underside and some of the keyholes were cracked. Although this is not of any consequence, it is mystifying how this happened with the gust hitting from below rather than aft. No explanation is offered here.

There were minor skin buckles of no consequence forward of the fingers on the underside of the left engine. Some doubt exists as to whether the buckles were effects of the shot or whether they were present before the flight.

The forward Hartwell fastener on the left hand starter exhaust door was unlatched. Again, it cannot be definitely determined if the fastener was latched prior to flight or not. It is believed it was and that the overpressure caused this.

The rubberised sealer on the left wing tip was blistered by heat but it was not discolored. This was a new tip put on the aircraft since the last participation. The tip was installed as it was received. It was not cleaned before installation and it was packed in greased preservative paper. The surface was oily during the participation and it is suspected that this caused the blistering. Similar parts on the stabilator showed no effects.

Upon landing, the pilot complained of low speed yaw. This was attributed to the fact that the instrumentation pod under the aircraft was extended. Similar yaw had been previously experienced with the pod down. (An FTF since the mission with the pod flush has proven the assumption correct.)

Instrumentation: There was no apparent damage to the instrumentation. All of the 50 oscillograph recorded parameters produced usable data. One of the wing deflection cameras was fuzzy until just before shock arrival when it cleared up and produced usable data. The photopanel camera, recording 26 parameters, functioned properly but the data collected was not entirely satisfactory in that the film quality was poor rendering it difficult to read and interpret. The film apparently suffered from exposure to weather.

Gust Data: Overpressure measured was about [redacted] Gust response was about 68% for shear and bending and about 89% for torque.

Thermal Data: Thermal response was again considered less than predicted. A ΔT of about 66° F on the unpainted and about 95° F on the black painted honeycomb was recorded. This was not primarily a thermal shot.

Nuclear Radiation: A reading of [redacted] was recorded on the pilot's film badge. Based on positioning yield, [redacted] was predicted.

General: The participation was highly successful from this project's standpoint. It produced our best gust data to date.

[redacted]

[redacted](IMCA)

Project 5.7 - Thermal Flux and Albedo Measurements from Aircraft - Capt R. L. Dresser

OBJECTIVE

The objective of this shot was to obtain thermal flux and albedo information from a nuclear detonation with airborne calorimeters, radiometers, and 16mm motion picture cameras.

INSTRUMENTATION

Instrumentation within the purview of Project 5.7 which was installed in the B-57 included 19 NRDL calorimeters and 2 NRDL radiometers for measuring the direct and surface reflected thermal radiation. These instruments possessed various fields of view and were suitably filtered to obtain qualitative spectral distribution information. Six GSAP N-9 cameras were utilized to obtain photographic coverage of the fireball, the earth's surface, and of clouds beneath the aircraft. Two of the cameras oriented toward ground zero were equipped with spectroscopic attachments to obtain continuous spectra in the visible region. Of the other two tail position cameras, one camera had a blue filter and the other had a red filter for the purpose of obtaining pictures at both extremes of the visible region of the spectrum. The remaining two cameras were oriented vertically for the purpose of obtaining photographic coverage of the earth's surface and of clouds beneath the aircraft.

Instrumentation installed in the B-66 consisted of the basic 21 thermal instruments, and 12 cameras.

Two cameras equipped with spectroscopic attachments were operated in the EG&G Parry photo tower.

[redacted]

AIRCRAFT POSITION IN SPACE

Due to malfunction of the K-5 system the B-66 aborted the mission. The B-57 is believed to have attained its position with a good degree of accuracy. More detail of the aircraft position in space for each aircraft is contained in the post-shot reports of the following projects:

Project 5.3 - B-66 Project 5.4 - B-57

RESULTS

Thermal: The preliminary value of total thermal input to the aircraft is normally included in the post-shot report of the appropriate project indicated above. However in this event no thermal data were obtained because of the abort of the B-66 and because no recorders were turned on in the B-57.

Photographic Data: Of the 20 cameras under the purview of Project 5.7 all cameras were run. Of the 12 cameras on the B-66, one camera suffered film breakage. Of the six cameras on the B-57, all cameras appeared to have operated satisfactorily except that all cameras had about 20 feet of film remaining on the counters. This was occasioned because the cameras are connected through a time delay with the switch on the oscillograph recorders. It is extremely unlikely that any pictures of the phenomena were obtained. The B-66, because of the abort, was too far out of position to obtain pictures. The time in relation to zero time in which the cameras on the B-57 were operated is uncertain. The two cameras in the Parry photo tower apparently operated satisfactorily. The film of this event has not been developed at present, therefore the completely negative results assumed above cannot be verified as yet.

Film Summary:

Number of magazines loaded	Number of magazines run	Number of magazines for analysis	Number of magazines for destruction
20	[illegible]	uncertain (probably 2)	Probably 18

[redacted] ...IFIED [redacted] (INCA)

Project 6.1 - Accurate Location of an Electromagnetic Pulse Source - L. 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 a 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

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 6.5 nautical miles. Maximum field strength [redacted]

California - All stations in the Woodland net received and recorded the wave form of the electromagnetic pulse emanating from bomb detonation. Line of positioning error was 5 nautical miles.

Long Base Line

Hawaii - Palmyra had equipment failure but other two stations operated successfully. Line of position error 3400 yards.

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

Griffiss AFB equipment operated satisfactorily.

The above line of position errors may be changed considerably by further evaluation of the data.

[redacted]

[redacted] (IBCA)

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

OBJECTIVE

The objective of Project 6.3 is 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 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.

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 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° to the east of magnetic north.

Ionosphere recorder site (C-97 airplane)

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

Ground stations at Rongerik and Kusaie, using 15 second sweep operated on normal 24 hour schedule: 5 sweeps per hour until H-15 minutes; thence continuous until H + 8 hours; thence routine.

Airborne Station C-97: Routine operation until H-15 minutes; thence continuous using a 30 second sweep time until approximately H + 5 hours.

RESULTS

All stations operated successfully during this test. There were no noticeable effects on the Ionosphere from this test.

[redacted]

[redacted] (TNCA)

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 whip antenna	1 sequence camera
1 synchroniser	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 led directly to the recorder. The sequence camera photographs the blast directly for use in correlation of previous data. Distance was approximately 62 miles.

RESULTS

The signal was received and recorded by one fiducial antenna and one scope.

No photohead data was obtained because of a bulb failure in the recorder.

[redacted]

[redacted]

[redacted] (IMCA)

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

OBJECTIVE

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

INSTRUMENTATION

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

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

The wide-band receiver consists of one primary and four secondary cathode follower amplifiers. An antenna, frequency insensitive in the range of interest is fed directly into the primary cathode follower. The primary cathode follower is then connected to four individual cathode followers by a 50-ohm coaxial cable. Only three secondary cathode followers are utilized, the fourth serving as a spare.

The number one and two cathode followers feed oscilloscopes with sweep speeds of approximately 30 microseconds per centimeter and 10 microseconds/centimeter respectively. The number three cathode follower is connected to the third oscilloscope through a 2 microsecond delay line. The third oscilloscope has a sweep speed of 1.0 microseconds/centimeter. All oscilloscopes were triggered simultaneously by the DC trigger device located

CONFIDENTIAL

[redacted]

34

in the primary cathode follower and connected directly to the receiving antenna. The 2 microsecond delay line was added to permit the leading edge of the waveform to be recorded.

In order to establish a definite time relationship between the reception of the signal and the triggering of a given device such as a counter or transmitter, a time marker pip, generated by the delay trigger and from one of the oscilloscopes, is fed through the 2 microsecond delay line and superimposed on the initial portion of the received waveform.

PROCEDURE

All oscilloscopes are calibrated against a known frequency standard for sweep linearity.

The cathode follower triggering system is set to trigger approximately 6db. above the noise level. The vertical deflectors of the oscilloscopes are set to receive the predicted field strength.

RESULTS

Station A - Parry Island

Positive results were recorded on two of three oscilloscopes. The predicted field strength for this shot was [redacted] and the measured field strength was [redacted] The wave forms were of good quality and also show an ionospheric reflection of the signal.

Station B - Kwajalein

Positive results were recorded on two of three oscilloscopes. Film has not been processed completely for analysis but the field strength from preliminary examination was approximately [redacted] The predicted value was [redacted]

[redacted]

[redacted] (IMCA)

Project 6.6 - Electromagnetic Attenuation Measurements - T. D. Hanscome

OBJECTIVE

To make electromagnetic attenuation measurements as a function of time at S-band (2160 MC) and X-band (9400 MC).

PROCEDURE

Equipment used at this shot consisted of a transmitter installed at approximately 5000 feet from the tower on a line to the receiver in a tower on Parry. The receiver output was delayed 2 microseconds and displayed on oscilloscopes having sweep speed of 5 microseconds per centimeter, 50 microseconds per centimeter, 200 microseconds per centimeter and on a Brush recorder (resolving time 10 milliseconds). Sweeps were triggered by "blue box" signals. One receiving antenna was aimed at the shot tower to observe direct electromagnetic effect. The receiver scope on this system was swept at 5 microseconds per centimeter.

RESULTS

All equipment operated. Previously observed interference on S-band did not hamper experiment. X-band signal dropped out in 3 to 4 microseconds and recovered to within 10 db of full signal in 90 milliseconds. S-band data not interpreted. Shock arrived at about 400 milliseconds.

[redacted]

PART III

TASK UNIT 1

LASL PROGRAMS

Keith Boyer
Advisory Group

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

[redacted]

D[redacted]ED (IKCA)

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.

Equipment was operated to attempt to measure alpha, the rate of rise of the nuclear reaction. Mild radio interference was experienced, which makes it difficult to determine whether or not the radiated signal followed alpha.

The time interval equipment was operated, using this device for a dry run. One antenna was partially incapacitated by rain water getting into electronic equipment at its base, but two of three channels operated correctly. The leak has since been corrected.

[redacted]

PART IV

TASK UNIT II

UCRL PROGRAMS

W. D. Gibbins

W. D. Gibbins
Dep for UCRL

Program 21 - Radiochemistry	R. H. Goeckermann
Program 22 - History of the Reaction	L. F. Wouters
Program 23 - Scientific Photography	H. P. Keller

[redacted]

[redacted](INCA)

Project 21.1 - Radiochemical Analysis - R. Goeckermann

DELETED

[redacted]

[redacted] (INCA)

Project 21.2 - Sample Collection - R. Batzel

The Air Force Special Weapons Center supplied five F-84G and one B-57 to take samples on this device. The B-57 acting also as control plane.

Aircraft	Time after shot (Hrs.)	Alt. Collected (Thousand Ft.)	Fission (One Wing)	Pilot Radiation (MR)
032	1.00 - 1.15	40 - 41.5	[illegible].44 x 10^{15}	
051	1.10 - 1.40	39.5 - 41	0.62 x 10^{15}	
043	1.20 - 1.30	30 - 32	1.88 x 10^{15}	
038	1.50 - 2.20	37 - 39	0.78 x 10^{15}	
054	1.50 - 2.10	35 - 37	1.01 x 10^{15}	
502	2.15 - 2.45	39 - 42	1.66 x 10^{15}	

The cloud on [redacted] (Inca) topped at 42,000 feet. The base of the cloud was obscured by cloud cover, but was at least down to 28,000 feet.

The sample size was small but was sufficient since the device was a success. If the device had been a failure more fissions would have been needed. The samples were small due to the unexpected height of the cloud. The success of this sampling was due to the cooperation and interest shown by the Air Force personnel.

[redacted]

[redacted](INCA)

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

DELETED

Another phase of 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

[redacted]

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

[redacted]

[redacted] (INCA)

Project 22.1 - Measurement of Alpha and Boost - L.F. Wouters

EXPERIMENTAL TECHNIQUE

The gamma rays produced by the nuclear reaction were detected by fluor-photocell detectors located in a lead lined "doghouse" 3,390 feet from the zero point. A 27 foot lead pipe served to collimate the gamma rays onto an array of four fluors. The four fluors were positioned in tandem along the gamma path and were observed by a total of three photo-diodes and four photomultiplier units. Combinations of gamma attenuators between fluors and optical attenuators between different detector units on the same fluor enabled the attainment of complete coverage from the 36th generation level to well above the peak expected gamma signal. The detector outputs were transmitted by cable to recording oscillographs located in the blockhouse where cameras provided a permanent film record of the signals.

RESULTS

The reaction history experiment was successful in measuring the high explosive transit time and the reaction rate of the [redacted] (Inca) device.

H.E. Transit Time

The high explosive transit time was measured to be [redacted] from the X-unit pulse to the time of 50th generation level of the fission reaction.

Alpha and Boost

Preliminary reaction history results are indicated in Fig. 22.1-1 and 22.1-2. Fig. 22.1-1 is a plot of the gamma flux (gamma mev per cm^2-sec) incident at the detector station vs time as obtained from a slope - amplitude fit of the individual pieces of data. Fig. 22.1-2 is an alpha vs time curve derived from Fig. 22.1-1. Note that neither curve has

[redacted]

been corrected for the distortions contributed by the long cable runs (about 4,000 feet) and the finite resolution time of the system. These corrections will not change the early alpha but will tend to peak the boost signal.

DELETED

Fig. 22.1-1 - Inca Reaction History

DELETED

Fig. 22.1-2 - Alpha vs Time (Inca)

[redacted] (INCA)

Project 22.3 - S-Unit Monitoring - 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] (Inca) 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 first S-unit pulse = [redacted]

Yield of first S-unit = [redacted]

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

Yield of second S-units = [redacted]

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

Yield of third S-unit = [redacted]

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

[redacted]

[redacted] (INCA)

Project 23.1 - Fireball and Bhangmeter - H. Grier

D. J. Barnes

FIREBALL

Preliminary yields based on three fireball films, one each from Parry, Mack, and Piirani, are:

Parry

Mack

Piirani

DELETED

The preliminary fireball yield is DELETED

BHANGMETER

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

[redacted]

51 E

[redacted]

DELETED

Fig. 23.1-1

[redacted]

DELETED

Fig. 23.1-2

PART V

TASK UNIT 4

SC PROGRAMS

E L Jenkins
E. L. Jenkins
CTU-4

Program 31 - Microbarograph R. Heppelwhite

[redacted]

D[redacted](IMCA)

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. Five sites were operated: Ujelang, Wotho, Rongerik, Bikini, 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.

O[redacted](IMCA) good shot records were obtained from all stations except Rongerik, which had high ambient wind noise. The satisfactory Bikini record will allow ozonosphere resolution but no temperature and wind vectors are yet available.

[redacted]

[redacted]

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