[redacted]

331

OPERATION REDWING

A PRELIMINARY REPORT

OF

[redacted] (MOHAWK)

Submitted by Task Group 7.1

JO-265

15 October 1956

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[redacted] (MOHAWK)

INTRODUCTION

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PART I

GENERAL INFORMATION

[redacted]

[redacted]

MOHAWK
ENIWETOK OBSERVED WEATHER FOR 3 JULY 1956
AT DETONATION TIME 0606M

Sea Level Pressure	1010.2 mbs
Free Air Surface Temperature	79.6°F
Wet Bulb Temperature	74.9°F
Dew Point Temperature	73.0°F
Relative Humidity	81 %
Surface Wind	100° 16 Knots
Visibility	10 miles

CLOUDS:

1/10 cumulus; based at 1,300 ft., tops estimated 3,000 ft.
1/10 stratocumulus; based at 4,800 ft., tops unknown.
10/10 altostratus; measured bases at 6,500 ft. (all opaque), tops at 15,000 ft.

WEATHER:

Intermittent light rain and overcast skies.

AREA WEATHER SUMMARY FROM AIRCRAFT:

0555M; Entered clouds at 1,600 ft. Solid to 30,000 ft. 32 miles WNW of Eniwetok.

0644M: 40 to 50 miles to southwest of Eniwetok, reported moderate rime icing at 15,000 ft.

0700M: Scattered to broken cumulus based at 1,000-1,200 ft., tops 8,000 ft. Entered solid overcast at 9-10,000 ft. and "broke out" at 44,000 ft. Occasional rain in spots. Light to moderate icing 17-24,000 ft. going up and moderate to severe icing 25-18,000 ft. coming down. "Broke out" at 14,000 ft. to the east.

STATE OF SEA:

Ocean Side: Wave heights 6 feet, period 7 seconds, direction 110°.
Lagoon Side: Wave heights approximately 1½ feet.

[redacted]

[redacted]

ENIWETOK UPPER AIR SOUNDING (Release time 0557M)

Pressure (Millibars)	Height (Feet)	Temperature (°C)	Dew Point (°C)
1000	340	26.2	24.2
850	4,950	18.2	13.5
700	10,370	09.2	01.2
600	14,500	01.2	-06.5
500	19,260	-06.2	-13.2
400	24,880	-16.5	-23.2
300	31,760	-32.0	-39.5
268	34,983	-38.8	-46.5
200	40,690	-56.2	M
188	41,995	-61.0	M
Balloon burst. 0840M sounding follows:			
150	46,460	-68.9	M
100	54,310	-73.9	M
088	56,758	-76.0	M
085	57,447	-72.0	M
058	64,895	-68.0	M
050	67,850	-62.9	M
020	82,290	-51.0	M
016	91,995	-44.0	M

WINDS ALOFT (Release Time 0557M)

Height (Feet)	Direction (Degrees)	Speed (Knots)	Height (Feet)	Direction (Degrees)	Speed (Knots)
1,000	110	16	35,000	180	21
2,000	120	20	36,000	190	22
3,000	110	13	38,000	230	30
4,000	110	26	40,000	230	38
5,000	110	32	42,500	220	40
6,000	120	30	Balloon burst. 0840M sounding follows:		
7,000	120	25	45,000	230	35
8,000	120	19	47,500	260	38
9,000	100	14	50,000	260	28
10,000	060	13	52,500	230	8
12,000	070	16	55,000	150	6
14,000	050	16	57,500	110	20
16,000	350	12	60,000	110	25
18,000	280	8	65,000	090	30
20,000	210	3	70,000	100	42
22,000	200	6	75,000	100	47
24,000	170	4	80,000	100	57
25,000	160	5	85,000	100	53
26,000	150	6	90,000	090	64
28,000	140	8	95,000	090	69
30,000	150	12	100,000	090	76
32,000	160	18	102,000	090	77
34,000	170	20			

[redacted]

[redacted]

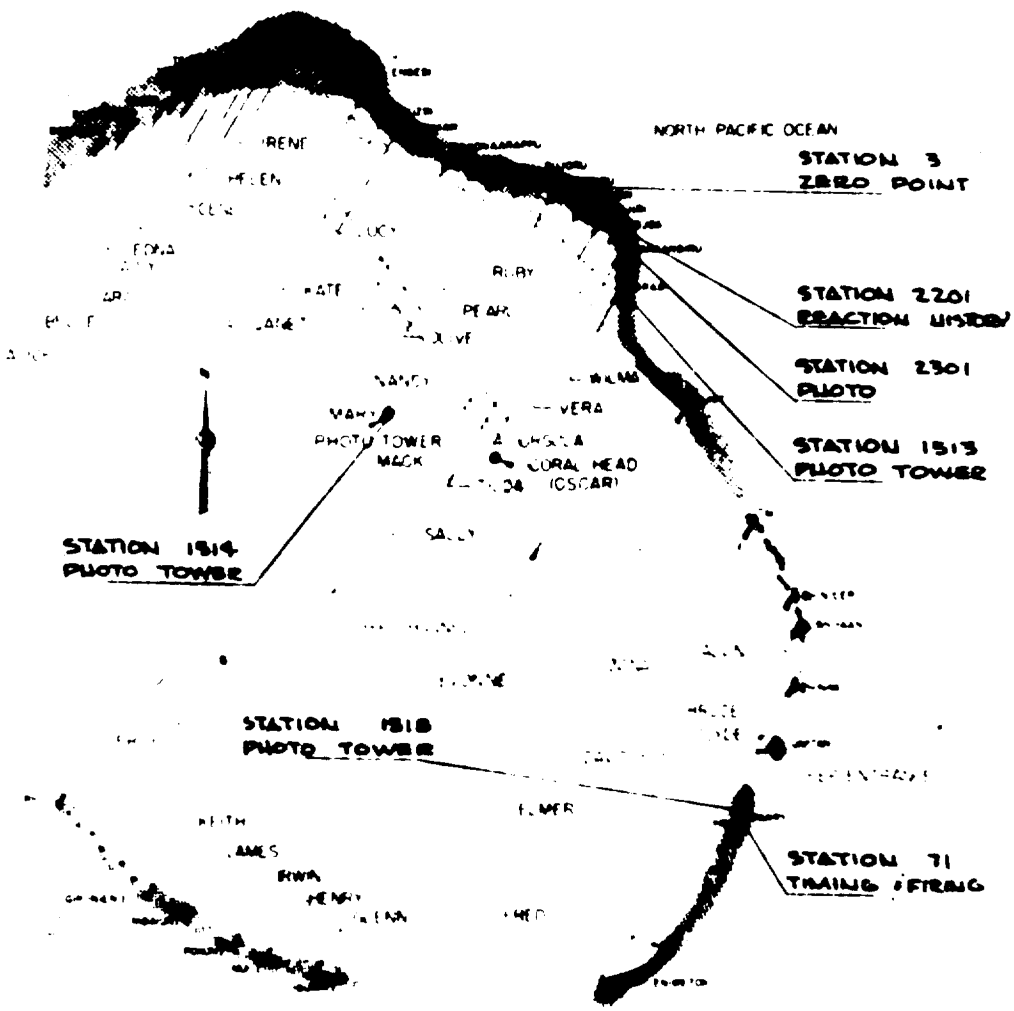

Fig. 0-1 - Eniwetok Atoll Map

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[redacted]

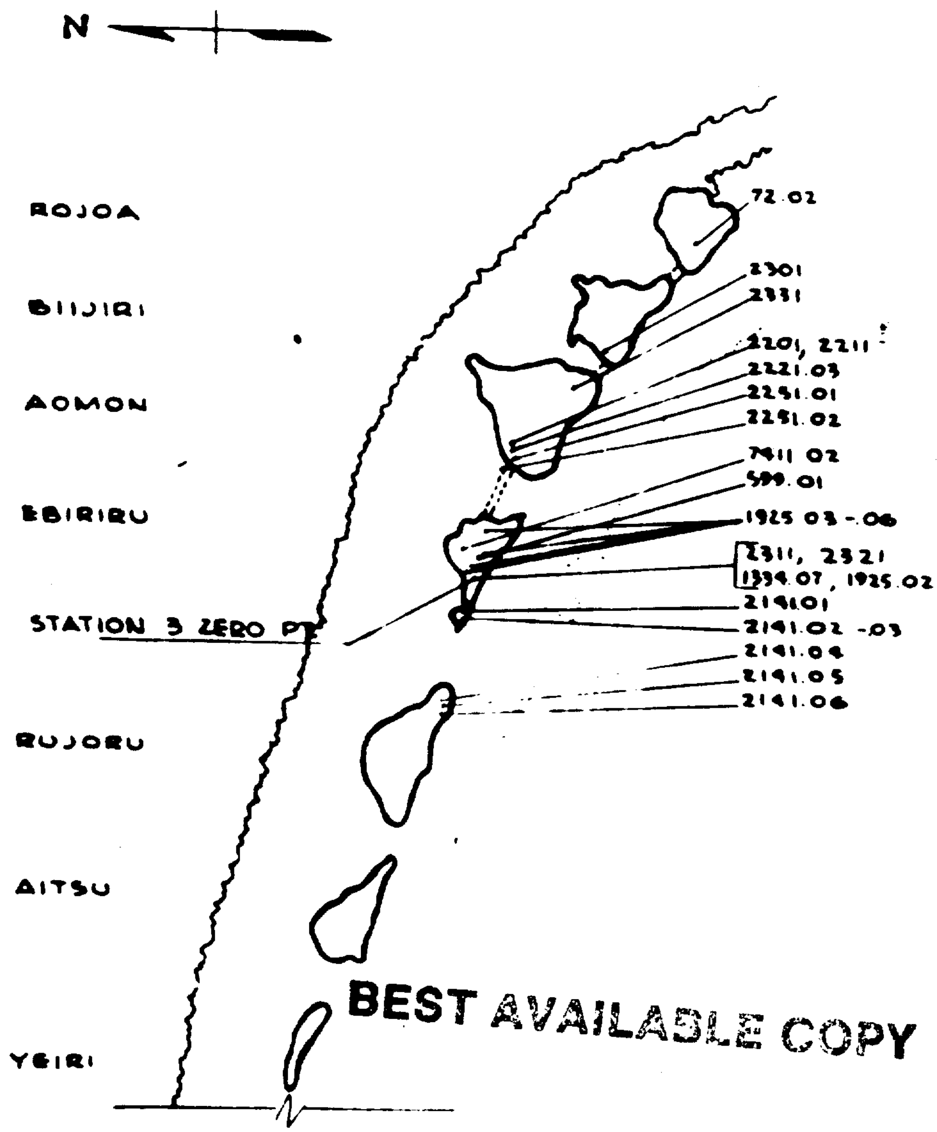

Fig. 0-2 - Scientific Stations and Zero Point

Fig. 6-3 - Pre-Shot Photo

Fig. 6-4 - Post-Shot Photo

[redacted]

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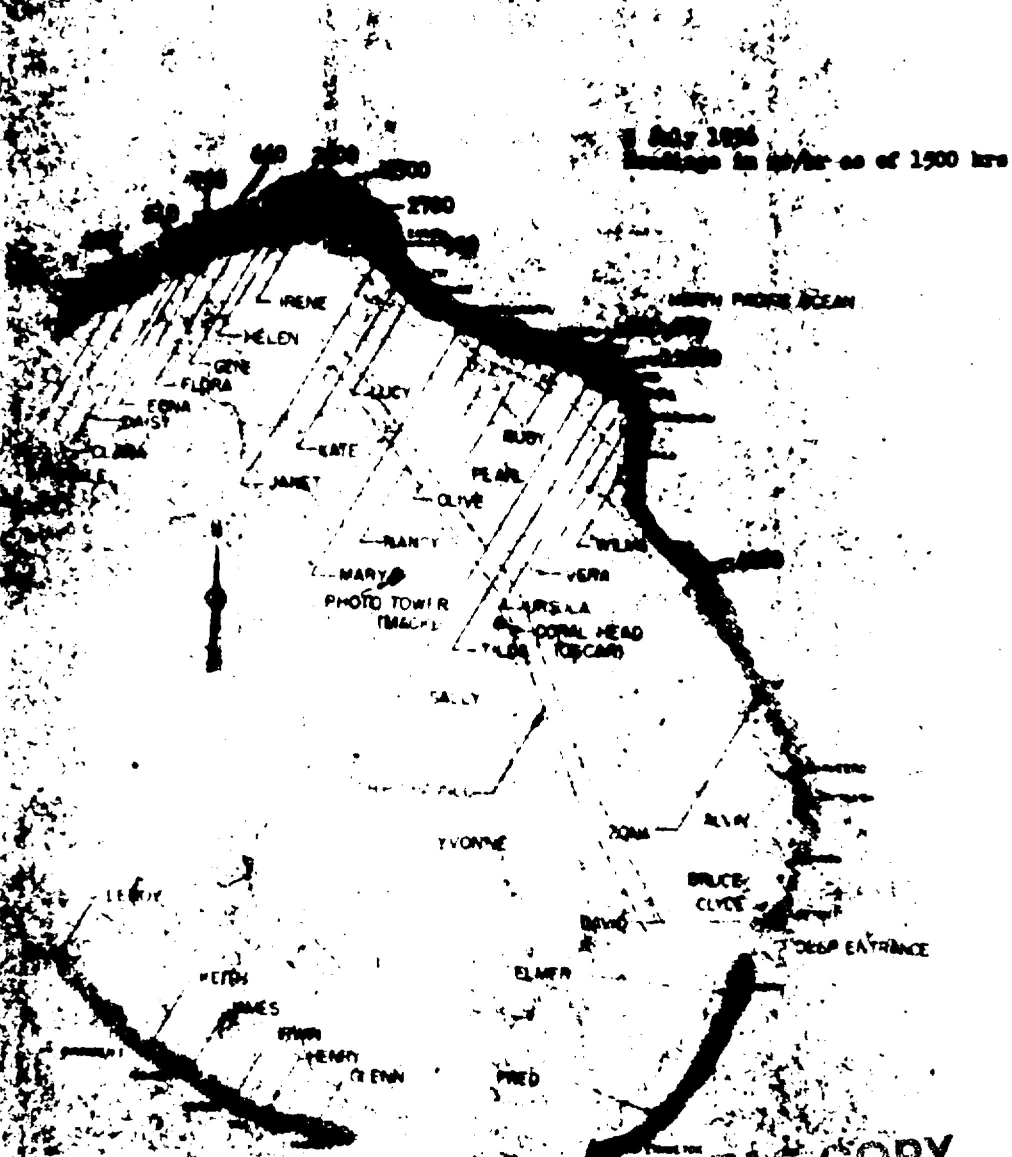

July 1956
Readings in mr/hr as of 1500 hrs
NORTH PACIFIC OCEAN
2700
IRENE
HELEN
GENE
FLORA
EDNA
DAISY
LUCY
KATE
JANET
RUBY
PEARL
OLIVE
NANCY
MARY
PHOTO TOWER
WILMA
VERA
URSULA
CORAL HEAD
(OSCAR)
TILDA
SALLY
YVONNE
ALVIN
BRUCE
CLYDE
DAVID
DEEP ENTRANCE
ELMER
JAMES
HENRY
GLENN
FRED

[illegible] – [illegible], D-Day

[redacted]

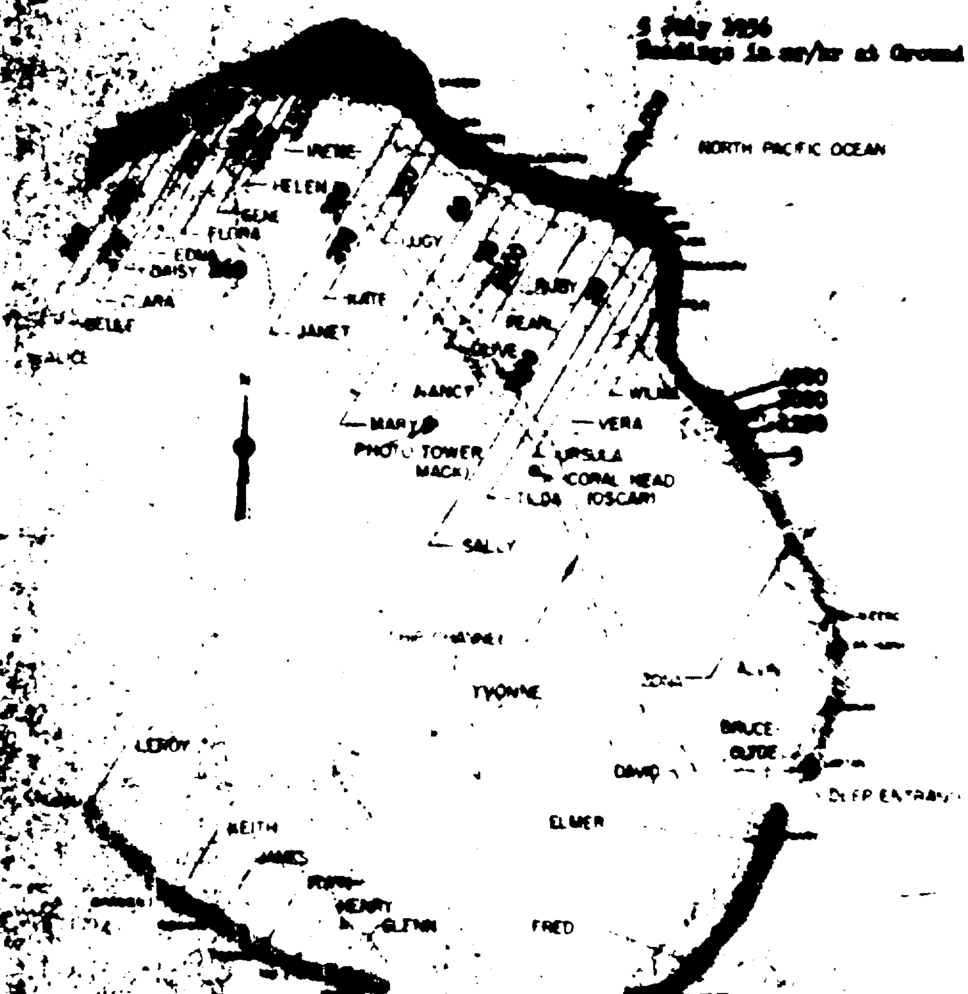
300 hrs

[illegible] Survey, D + 1

[redacted]

13

5 July 1956
Readings in mr/hr at Ground



[illegible] Survey, D + 2

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

[redacted]

[redacted] (MOHAWK)

Project 1.3 - Shock Photography - J. Petes

OBJECTIVES

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

INSTRUMENTATION

High speed photography was accomplished from the Mack photo tower.

RESULTS

The photography was successful, and enough information will be obtained to satisfy the objectives of this shot. The processed film has been returned to NOL for analysis.

[redacted]

[redacted]

[redacted] (NOMAMT)

DELE

Project 1.8 - Crater Measurements - F. E. Deeds

OBJECTIVES

To measure the physical characteristics of the crater produced by the low scaled height of burst on this shot, and to correlate this information with past crater results.

INSTRUMENTATION

Stereoptic aerial photography was used to obtain crater data.

RESULTS

The H + 2 photo-run film was fogged by radiation. Later runs were successful. The film has been transmitted to ERDL for analysis.

[redacted]

[redacted]

[redacted] (MOHAWK)

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

OBJECTIVES AND INSTRUMENTATION

Studies of water wave action generated by the detonation of large yield [redacted] nuclear devices are made at relatively close ranges and at several distant island stations by Project 1.9. Four shore recording wave measuring stations (of the Mark VIII type) were active in Bikini Lagoon for the [redacted] (Mohawk) shot. In addition, Project 1.9 constructed and installed four new type long period wave recorders on Eniwetok, Ailinginae, Wake, and Johnston Islands. These recorders are designed to document long period, low amplitude deep ocean waves of the tsunami type. The recorders operate continuously but only receive significant signals from the large shots. In addition to the above instrumentation, a tide gage was active at Ailinginae Atoll, and Sandia Corporation microbarographic stations were operated by Project 1.9 at Wake and Johnston.

RESULTS

The lagoon and deep water long period recorders did not detect water wave action from [redacted] (Mohawk).

[redacted]

18

[redacted]

[redacted] (MOHAWK)

Project 2.64 - Fallout Location and Delineation by Aerial Survey -

R. Graveson

OBJECTIVES

Participation in this shot was scheduled to obtain data which could be used to validate altitude absorption calculations. These air absorption factors are used to compensate aircraft dose rate readings to an equivalent surface reading.

OPERATION PLAN

This additional project participation was requested and approved in June 1956, and was based on non-interference with the major [redacted](Navajo) operations scheduled soon after this shot.

D+1: One project aircraft was requested for 0900 arrival at Eniwetok. After installation of the project equipment an aerial survey was scheduled (to include one pass over the islands in the atoll, three passes over the lagoon, and an area search over the open sea out to 100 miles).

D+2: The aircraft was scheduled to rendezvous at Eniwetok and repeat the open sea survey if warranted by the results on the previous day.

All plotting and flight planning was to be done in the aircraft by two project passengers. The flight plotting, rather than a central plot control was possible since close correlation between more than one aircraft and also between aircraft and ship elements was not required.

A helicopter was scheduled for D+2 to perform surveys over two islands and open water at varying flight altitudes between 25 and 1,000 feet. A gamma spectrum analyser and special survey meters were to be installed for these measurements of altitude absorption coefficients.

[redacted]

PROCEDURE

The flight altitude and operational plans were coordinated with the AOC (TG 7.4) and this organization assumed primary guard and SAR responsibility for the mission. The atoll and lagoon (Phase A and B) were surveyed immediately after take-off (1130 to 1230) and concluded with altitude correlation passes over Engebi at 100, 200, 300 and 500 feet. The area out to sea was surveyed from 1239 to 1500, and the mission terminated at Eniwetok. Based on the survey results, the aircraft was released for return to PATRON ONE at Kwajalein and the D+2 survey cancelled.

The project equipment was installed, checked, and calibrated in the helicopter from 1015 through 1230 on D+2. The mission then left Parry and proceeded to Aomon. Altitude runs were made across the bunker. The helicopter was hovered for one minute at 500 and 800 feet altitudes to obtain gamma spectral data. The pilot could not hover at less than 500 feet, so that lower altitude data was not obtained.

Rojoa was selected to provide intensity data over an area with a lower density of contamination. Altitude passes were run over the air strip from 50 to 500 feet. The open water runs were cancelled due to the extremely low levels of water contamination available.

TEST RESULTS

The aerial survey over the islands of the Eniwetok Atoll have been correlated to surface intensities. Examination of this data shows little or no fallout except the northeastern islands. Parry and Eniwetok were not surveyed, however, fallout intensity measured at the surface reached a peak of 20 mr/hr on D+1.

No contamination could be detected in the lagoon or at sea, around the atoll.

[redacted]

[redacted]

The altitude data is being correlated to the theoretical calculations. However, no early conclusions are available. The calculations have been based on an effective gamma energy of 0.5 mev on the basis of the gamma spectrometer runs at 500 and 800 feet. This figure appears to be a reasonable estimate.

[redacted]

[redacted] (MOHAWK)

Project 2.65 - Analysis of Fallout and Base Surge - M. Morgenthau

OBJECTIVE

To survey the close-in residual contamination field resulting from the [redacted] (Mohawk) shot.

DESCRIPTION AND EXPERIMENTAL PROCEDURES

For this event the project had only limited participation, consisting of an aerial survey on M, M+1, and M+2 days. The survey was made of the portion of Eniwetok Atoll contaminated to a significant amount by this event. This included the islands between Engebi and Aomon. Particular attention was paid to the residual contamination on Rojoru, Eberiru, and Aomon. The measurements were taken by means of a probe on a long cable suspended below a hovering helicopter. The position of the probe was determined by reference to charts and aerial photographs.

RESULTS

Aerial survey readings taken on three successive days were corrected for meter calibration and corrected to H+1 hour values as shown in Table 2.65-1 by using the decay exponent of -1.10. This decay exponent was determined from a plot of field dose rate readings vs time for three of the islands surveyed as shown in Fig. 2.65-1. These particular islands were chosen for this plot because of their low background prior to the shot. H+1 hour extrapolated readings for Eberiru Island are shown in Fig. 2.65-2.

[redacted]

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[redacted] (MOHAWK)

TABLE 2.65-1

CORRECTED AERIAL SURVEY READINGS
(Field Gamma Decay Factor: -1.10)

Island	Survey Point	Time After Shot (hrs)	Corrected Reading (mr/hr)	r/hr at H+1 hr	Avg H+1 hr Dose Rate (r/hr)
Engebi	1	9.43	985	11.6	
	2	31.5	285	13.4	12.0
	3	55.6	135	11.1	
Musinbaarikku	1	9.48	985	11.7	
	2	31.6	275	13.0	11.9
	3	55.7	135	11.1	
Kirinian	1	9.53	935	11.1	
	2	31.6	335	15.0	12.7
	3	55.7	145	12.0	
Bokonaarappu	1	9.58	135	1.60	
	2	9.88	125	1.74	
	3	31.7	45	2.02	1.70
	4	55.8	15	1.25	
Aitsu (North)	1	9.92	35	0.42	
	2	9.63	35	0.42	
	3	31.7	15	0.67	0.50
	4	55.8	5	0.41	
Aitsu (South)	1	9.95	110	1.38	
	2	31.8	50	2.24	2.71
	3	55.9	55	4.50	
Rujoru (North)	1	9.97	1700	These readings were not extrapolated to H+1 hr due to uncertainty of residual contamination from Inca shot.	
	2	31.8	2700		
	3	55.9	3000		
Rujoru (Center)	1	9.97	1200	15.1	
	2	31.8	600	27.0	18.2
	3	56.0	190	12.6	
Rujoru (South)	1	10.0	50000	627	
	2	10.0	48000	603	
	3	31.8	22000	990	773
	4	56.0	9500	798	
Aomon (Center)	1	9.27	350	4.0	
	2	32.4	4300	198	248*
	3	56.4	3500	298	

*The 4.0 r/hr reading was not considered in the average due to its obvious complete lack of agreement with the other data.

[redacted]

TABLE 2.65-1 (CONTINUED)

Island	Survey Point	Time After Shot (hrs)	Corrected Reading (mr/hr)	r/hr at H+1 hr	Avg H+1 hr Dose Rate (r/hr)
Aomon	1	9.33	41000	478	
(north)	2	32.4	12000	550	473
	3	56.4	4600	391	
Eberiru	1	31.8	34000	1560	
	2	31.9	50000	2250	
	3	32.2	180000	8290	
	4	31.9	200000	8990	
	5	32.2	250000	11500	
	6	32.3	230000	10600	
	7	32.3	215000	9900	
	8	32.3	84000	3870	
	9	32.3	285000	13100	
	10	32.4	285000	13200	
	11	56.1	78000	6550	
	12	56.1	110000	9230	
	13	56.1	105000	8810	
	14	56.2	130000	10900	
	15	56.2	100000	8400	
	16	56.3	150000	12600	
	17	56.3	130000	10900	

[redacted]

[redacted]

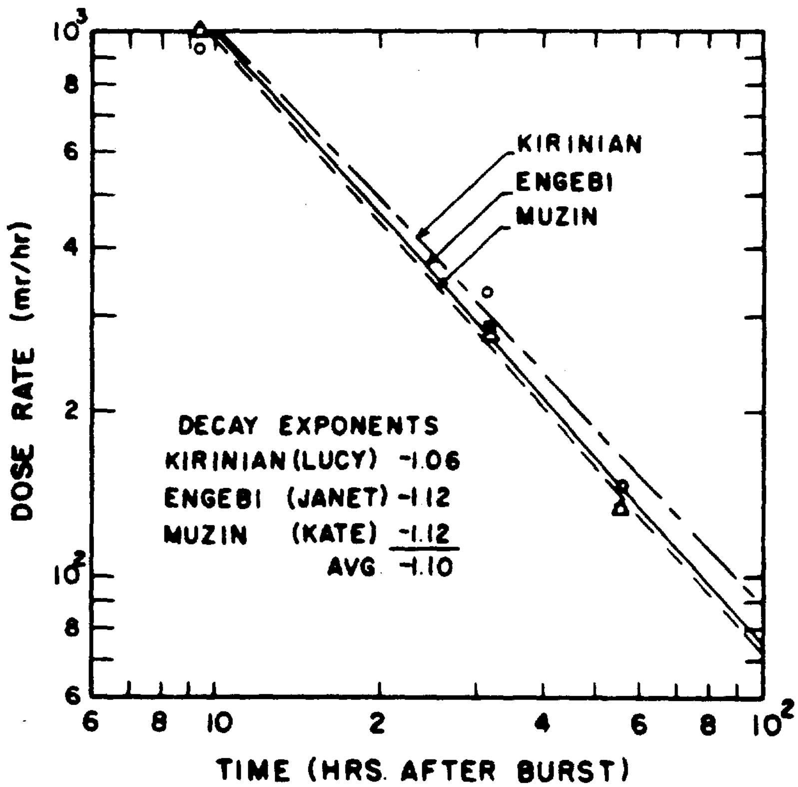

Fig. 2.65-1 - Aerial Survey Readings at 3 Ft. Level Taken on Three Successive Days (Corrected Readings), [redacted] (Mohawk)

[redacted]

[redacted]

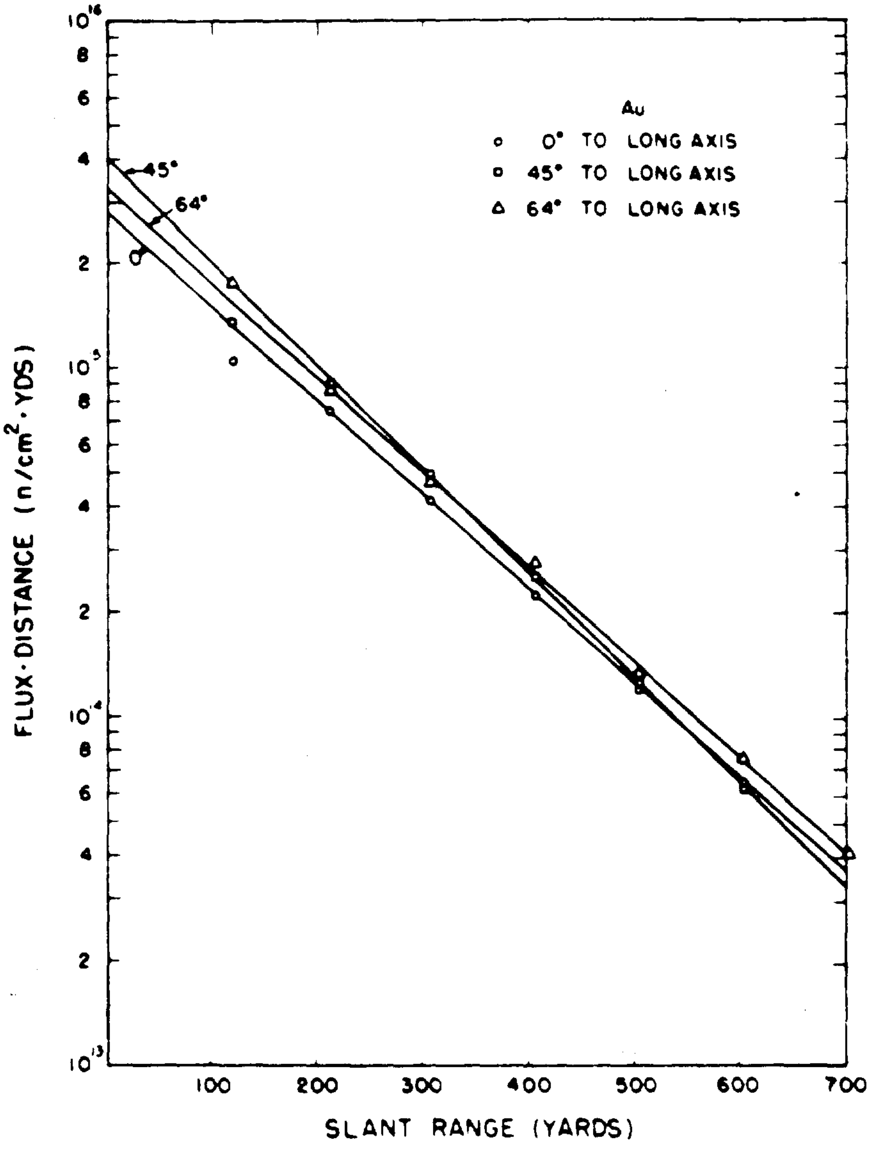

Fig. 2.65-2 - Extrapolated Readings for H + 1 Hour from Aerial Surveys

[redacted]

Project 4.1 - Flash Blindness - Chorioretinal Burns - Col. R.S. Pixott

OBJECTIVES

The primary objective of this project is to obtain information on the requirements for protection of the eyes against chorioretinal burns from atomic detonations of various yields; in this case, a weapon of [redacted]

Corollary technical objectives at the same yield are to:

Determine whether blink reflexes will prevent chorioretinal burns.

Ascertain which portions of the time-intensity pulse can produce thermal injury to the retina and choroid of the eye.

Determine the time required for blink reflex (BRT) in rabbits and monkeys exposed to the extreme light intensity of the atomic detonation.

Explore the feasibility of ocular protection by means of fixed density optical filters and/or combinations of filters.

Test, under field conditions, protective shutter devices which are in the developmental stage and which are designed to close much more rapidly than the BRT.

INSTRUMENTATION

The basic instrumentation for this shot was identical to that used for previous shots. In addition instrumentation on loan from Project 2.65 (Army Chemical Center) was employed for measuring the thermal radiation dosage received at exposure sites on Japtan (David) and Runit (Yvonne). This instrument gives no information on pulse shape.

RESULTS

General Observations

Chorioretinal burns were produced in 19 of 92 rabbits and 8 of 8 monkeys participating in this shot. All of the burns were produced at the Runit site.

[redacted]

Failure to produce burns at Japtan sustained the decision to move the main exposure facility from its former location to Runit.

<u>Thermal Measurements</u>

A thermal yield of [redacted] was measured on Runit. This is in agreement with the range of [redacted] calculated from the parameters of [redacted] transmission of 90 percent of the energy per statute mile for 7.6 miles from the target zero. A thermal dosage of about [redacted] was measured at Japtan as opposed to a dose of [redacted] forecast for the same yield and transmission but at a distance of 14.4 miles. The disparity between the measured and predicted or calculated dosage at this location is attributed to instrumentation operating at its lower limit of resolution.

<u>Blink Reflex Studies</u>

Animals were allowed to view the flash ad libitum without any protection. Blink reflex times will be determined at the ZI by evaluation of high speed photography accomplished during the flash interval. This exposure series produced chorioretinal burns in 6 of 8 rabbits and 8 of 8 monkeys at Runit. Among the rabbits the burns were moderate to severe and all were about 1 human optical disk in diameter (d.d.) in size. Minor hemorrhaging was observed in only one instance. It is calculated that equivalent lesions would have been produced in man at a distance of about [redacted]

Among the monkeys both eyes received burns. In one case minor hemorrhaging in one eye and in another instance central hemorrhaging of both eyes was observed. The two remaining animals had lesions the size of 1/8th and 1/2 d.d., respectively. The burns in the BRT series appeared comparable to those which were encountered at 3 to 5 miles distance from the [redacted] (Erie) shot.

A note of special interest is that some indication of the fireball size as a function of yield is found in a comparison of the ERT data of the present shot with that of [redacted] Large burns of 1 d.d. were produced by exposure to [redacted] at Runit [redacted] from [redacted] yield at transmission of 90 percent per mile.) At essentially the same distance, much smaller lesions averaging only 1/4 d.d. were produced at Japtan by the near [redacted] from [redacted] at the same transmission). At this distance the small difference of 1/2 mile has a negligible effect upon the size of the image of the fireball upon the retina.

__Staggered Shutters__

These shutters were open at zero time and closed in pairs at intervals increasing by 10 msec through 100 msec. The remainder of this series, also open at zero time, closed in pairs at 120, 250, and 1000 msec. The exact time of closing will be determined at a later date from evaluation of the high speed photography accomplished during the flash interval. The time for the minimum following the first pulse is calculated at [redacted] It is of interest that 4 of 15 rabbits received burns during this period. In fact, 2 animals appear to have sustained retinal damage as early as the first 10 msec of the flash. At comparable distances the incidence of burning during the first pulse alone [redacted] is about 25 percent for both shots.

All of the lesions from the first wave of the power pulse were mild and small, ranging from pin-point to about 1/3 d.d. in size. No burns were produced behind shutters open in the range between 0 to 60 and 0 to 250 msec except in one case at the latter limit where a small double burn occurred. This apparent inconsistency in the data is unexplained at the moment.

Delayed Shutters

These shutters were closed at zero time but subsequently were opened for a pre-selected time interval during the power pulse. Four of 16 rabbits sustained burns in this series. The interval of 10 to 250 msec produced a lesion in 1 of 2 animals exposed. In 2 of 2 rabbits the increment of 10 to 1000 msec produced burns essentially the same size and severity as those observed in the BRT study. The interval of 500 to 600 msec caused a small mild burn in 1 of 2 animals. Although this animal was exposed only about one-third of his blink reflex time, the dose rate was near the maximum for this shot. The time of the maximum is calculated at about [redacted] No burns were produced after the first second of the flash.

Protective Electronic Shutters

No burns were sustained by the 2 rabbits exposed behind these shutters. Unfortunately the electronic recording system for these devices was inoperative at the time of the shot. The results of this portion of the study are inconclusive.

Protective Filters

Only 2 burns were produced in 27 exposures behind the fixed density optical filters. These lesions were both 1/2 d.d. in size and were of moderate severity. Unexplainably, neither burn was produced behind the least protective filters.

CONCLUSIONS

The blink reflex time for man and animals is not fast enough to protect against the flash from an atomic detonation on the order of [redacted] yield. An air burst of this size on a clear day (90 percent transmission/mile) is sufficient to cause large chorioretinal burns in rabbits and monkeys at [redacted] and in man at [redacted] Additional data are needed in order to establish the limiting distance for burns at [redacted]

[redacted]

and other yields. The results of the test indicate that burns could be encountered by man at distances greater than [redacted] but not as far as [redacted] except where atmospheric transmission is greater than 90 percent per mile. Note is made that this condition is met at high altitudes and in geographical areas such as the Nevada Test Site.

S[redacted]

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 and seventy-three data channels were available on this shot including seventeen new channels at station 1044.0 of the fuselage to measure bending, shear and torsion from side loads. The remaining channels recorded 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% of these channels were operating satisfactorily.

AIRCRAFT POSITION IN SPACE

The B-47 aircraft was positioned for side-loads effects in this event. The aircraft was flying at an absolute altitude of 37,000 feet, an offset of 40,000 feet, a speed of Mach 0.75 and on a heading of 021° at both T_0 and shock arrival. At T_0 the shot was ahead and to the left of the aircraft such that the horizontal range was 32,000 feet short of a point directly abeam of ground zero. At shock arrival the aircraft was directly abeam of ground zero and exactly tangential to the impinging shock wave.

RESULTS

Thermal: The temperature rise was insignificant due to the limiting side loads position and very small thermal inputs that were received.

Gust: At time of shock arrival the gust load was 48% of limit wing bending at station 493.0, 45% at station 615.0 and 42% at station 144.0. Since the fuselage bending, shear and torsion gages were added only recently, they have not been calibrated, and results from recorded inputs cannot be compared to limiting criteria at this time. However, it is believed that the recorded fuselage inputs for this event were small.

Overpressure: Peak overpressure measured was [redacted] at H + 44.06 seconds.

DISCUSSION

The calibration of the side loads gages in the fuselage will not be accomplished until return to the ZI. Therefore the percent bending in the fuselage will not be known until the calibration is completed and the data reduced.

[redacted]

[redacted] (MOHAWK)

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 the [redacted] (Mohawk) shot consisted of 310 oscillograph channels which recorded measurements from strain-gage bridges, accelerometers, roll and pitch gyros, radiometers, and control position transducers. In addition, 15 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 time zero and time of shock arrival:

	Altitude (abs. ft)	Offset (ft)	Heading (true-deg)	Slant Distance (ft)	Velocity TAS	(fps) Ground
Conditions at Time Zero	25000	0	136	26300	782	775
Conditions at Shock Arrival	25000	0	135	41700	794	788

RESULTS

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

Maximum Temperature: 330°F measured on a black 0.032 magnesium lower fuselage panel at BS 1141. The absorptivity of the panel was 0.92.

Gust: 59% wing bending at LHWS 444

54% tail bending at SS 300

[redacted]

<u>Overpressure</u>: [redacted] measured on the left fuselage side at BS 340.

<u>Instrumentation Failures</u>: Nine oscillograph channels, one photo-recorder channel (OAT), and one camera failed during the [redacted] (Mohawk) mission. Approximately 96.8% of the total instrumentation was operative.

[redacted]

[redacted]

[redacted] (MOHAWK)

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 and high Q field effects of [redacted] weapon on a B-66B aircraft in low altitude flight.

INSTRUMENTATION

Instrumentation on the B-66B for this 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; 24 T.C. at 9 stations on the fuselage; 26 channels of engine information; 3 pressure pickups on the wing; 3 pressure pickups on the empennage; and 9 pressure pickups on the fuselage; 17 accelerometers on the fuselage, empennage and nacelle; 16 calorimeters and 2 radiometers in the tail; 3 calorimeters in the fuselage belly; wing and tail deflection cameras; 32 basic aircraft flight instruments on a photo recorder panel; and 8 channels of correlation data.

AIRCRAFT POSITION IN SPACE

Using the K-5 radar system, the B-66B was positioned at an altitude of 6,000 feet, on a heading of 050 degrees, and a horizontal range of 12,700 feet at time zero. At time of shock arrival, the horizontal range was 28,400 feet, with the aircraft on the same heading and at the same altitude as before.

[redacted]

RESULTS

The aircraft took off at the scheduled time and climbed to shot altitude. A normal mission profile was flown and after shock arrival returned to base, landing at the scheduled time. A post flight inspection revealed that the "Oscillograph ON" switch and the "Photo Recorder ON" switch, were accidently turned off prior to take off and remained off during the entire flight. No data were recorded even though the aircraft position was good.

[redacted]

U[redacted]

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

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

The aircraft aborted following a failure of the MSQ positioning system.

[redacted]

Project 5.5 - In-Flight Participation of an 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.

Earley (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. Out of these channels there were four channels that failed.

Earley - Out of the 100 channels available to record essentially the same information as above, there were no channel failures.

AIRCRAFT POSITION IN SPACE

Waiter - At time zero, the aircraft was flying at an altitude of 19,920 feet on an inbound heading of 070.8°. The horizontal range was 3,729 feet and 52 feet offset. The shock arrival position was 20,129 feet altitude, 19,532 feet horizontal range and 2,566 feet offset to the right.

Earley - At time zero, the aircraft was flying at an altitude of 23,318 feet on an inbound heading of 060.4°. The horizontal range and offset were 16,653 feet and 22,237 feet respectively. At shock arrival, the aircraft was at 23,075 feet altitude, 22,443 feet offset, and 3,757 feet horizontal range.

RESULTS

Waiter

Thermal - 250° temperature rise in aluminum skin of flap.

Gust - Not available at this time.

Overpressure - [redacted]

Radiant Energy - [redacted]

Barley

Thermal - Negligible.

Gust - 49% limit load in side fuselage bending.

Overpressure - [redacted]

SPECIAL

Waiter - Minor thermal damage.

APX-6 antenna cover showed definite signs of charring.

Vertical fin antenna had minor bubbles on top edges.

Black radio deck cover had minor blisters.

The thermal curtain started to char and blister in several places.

Black tape around Raydist indicator and on wires behind instrument panel was charred and burned.

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

OBJECTIVE

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

INSTRUMENTATION

The aircraft was instrumented with radiometers, calorimeters and pressure transducers to measure the thermal and blast inputs and with strain gages, thermocouples and various other instruments to measure the aircraft response to the inputs. For this shot, the aircraft was positioned to theoretically receive a ΔT of 350°F on the 0.020" skin covered honeycomb surfaces based on the positioning yield and the on-time position. The aircraft was to be flown at supersonic speed. It was expected that it would out run the shock, thus gathering no gust data.

AIRCRAFT POSITION IN SPACE

The aircraft was to fly at 21,500 feet absolute altitude on an inbound heading of 040° at a ground speed of 1170 fps. It was planned that the aircraft would be beyond ground zero at a distance of 8500 feet at time zero. Actual shot position was 470 feet short and 280 feet to the right of the planned position. The aircraft out ran the shock.

RESULTS

Damage

Raydome Sample: The black rain erosion coating was scorched and peeled. The thermal input scorched it and it is felt that the rain and air stream caused the peeling.

Pitot Mast: The aluminum painted under surface was blistered but not quite as badly as in TX-28C (Dakota).

Free Air Temperature Probe: Same as the pitot mast.

Right Nose Gear Door: The aluminum paint was blistered and scorched. Thermally caused buckles measured 1/32" to 1/16" in depth from crest to valley. The damage was similar to that sustained in [redacted] (Dakota), but not as extensive.

Engine Access Doors: The primer on the inside of the doors was mildly scorched behind the insignia numerals painted on the outside of the doors. There was no blistering of the numerals. An oil soaked area (oil from the hydraulic drain) on the inside of the right door was also scorched.

Turbine Warning Stripe: The red paint was mildly blistered and scorched.

Wing Insignia Paint: The blue paint was mildly blistered and scorched under both wings. The left wing was worse than the right wing as in the [redacted] (Dakota). This would be expected since the aircraft was offset to the right. However in [redacted] (Dakota) the same effect was evident although the aircraft was offset to the left. This can be explained as specifications call for two different types of paint to be used on the insignia; on the right wing "Insignia Blue" is used while on the left wing "Strato Blue" is used. The "Strato Blue" apparently has a lower threshold of damage.

[redacted]

Plastic Wing Tips: The paint was blistered and peeled on the top and bottom of both wing tips. Again, in this case, it is difficult to separate thermal from rain damage. The plastic itself did not appear damaged but only the aluminum paint.

Stabilator Plastic Tips: About the same as the wing tips but to a lesser degree.

Stabilator: The aluminum paint on the underside was blistered and peeled in some cases.

Parabrake Compartment: The white silicone rubber seal on the bottom edge of the door was cracked diagonally across and two lock tabs were broken off. This damage can be attributed to wear and tear from overheat caused by use of afterburners and normal usage of opening and closing the door.

Upper Wing Surface: The blue insignia paint on the upper left wing was mildly blistered near the aileron hinge attachment.

Instrumentation: There was no apparent damage to the instrumentation. Of the 50 oscillograph recorded parameters, 47 produced usable data. One calorimeter malfunctioned. Two thermocouples failed to produce usable data; one became unopened and the other gave unreliable readings. Of the 26 parameters recorded on the photopanel, 24 produced usable data. The ambient air temperature probe malfunctioned and the A/B fuel flow produced unreliable data.

Gust Data: No gust data was received since the aircraft out ran the shock.

Thermal Data: A ΔT of about 160°F was experienced on the unpainted honeycomb of the wing. The stabilator honeycomb experienced a ΔT of

[redacted]

about 290°F. Evidence of heat on the upper surface of the aircraft was shown by blistered paint on the wing and stabilator tips. This was caused by reflection from the cloud cover.

Nuclear Radiation: No indication of nuclear radiation was recorded on the pilot's film badge.

General: The participation was considered successful by this project. This was the first time an aircraft has flown supersonically through a thermonuclear explosion.

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] (MOHAWK)

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 province of Project 5.7 which was installed in the B-47 included 19 MRDL calorimeters and two MRDL radiometers for measuring the direct and surface reflected thermal radiation. Six additional calorimeters were utilized to measure thermal radiation which was back-scattered toward the cockpit. Seven OSAP M-9 cameras were utilized to obtain photographic coverage of the fireball, the earth's surface, and of clouds beneath the aircraft, and also of any reflecting surface such as a cloud which could contribute to the back-scattered radiation.

Project 5.7 instrumentation on the B-52 included the 21 basic instruments for thermal radiation measurements, but only an additional two instruments were utilized for back-scatter measurements. Eight OSAP cameras were utilized for photographic coverage.

Project 5.7 instrumentation on the B-57 consisted of the basic 21 instruments and six cameras.

Project 5.7 instrumentation on the B-66 consisted of the basic 21 instruments and 12 cameras.

Neither tactical bomber (B-66, B-57) was instrumented for measuring back-scattered thermal radiation. The 21 basic thermal instruments possessed

[redacted]

[redacted]

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-47

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: Unfortunately the B-47 was positioned for side loads on this event. Because of the extensive overcast the back-scatter information would have been particularly interesting had the aircraft been positioned for thermal. However, the back-scatter inputs measured were greater than expected on the basis of predicted direct thermal energy. These preliminary, uncorrected values are on the order of from 40 to 50 millicalories.

Photographic Data: A total of 31 cameras were operated by Project 5.7 on this event. Because the B-47 was positioned for side loads none of the tail position cameras would have been effective so they were not operated.

[redacted]

Of the 31 cameras, 29 were airborne in four aircraft. The two cameras operated at the EG&G Parry photo tower produced spectra which are suitable for analysis. Six of the airborne cameras were on the B-57 which aborted. This film was not run and was subsequently destroyed. Of the remaining 23 cameras, two suffered mechanical failure and failed to transport film. Analysis of the remaining 21 records, two were found to be so poor as to be valueless for subsequent analysis and were destroyed. To summarize briefly, of the total of 31 cameras operated, 21 produced films of sufficient quality for subsequent analysis.

[redacted]

[redacted]

[redacted] (MOHAWK)

Project 5.9 - Weapon Effects on Missile Structures and Materials -

1st Lt C. J. Cosenza

OBJECTIVE

The primary purpose of this exposure was to compare the effectiveness of lower temperature and longer time thermal inputs from a high yield shot with those from a lesser yield shot.

INSTRUMENTATION

A light weight 150 foot tower was erected at a range of 525 feet from ground zero for the purpose of exposing nine spherical specimens. Two 10 inch steel spheres were suspended from a beam at the 70 foot level. At the top of the tower was mounted an array consisting of two 10 inch and two 8 inch steel spheres, one 10 inch aluminum sphere and two 9 inch steel spheres containing several inserts of various materials.

RESULTS

No results are available at this time. The radiation level of the recovery area is so high that no specimens have been retrieved. Aerial photographs have been taken to preserve, for future use on recovery, any evidence of the penetration of the specimens into the ground.

[redacted]

Project 6.1 - Accurate Location of 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 was made by use of inverse Loran principle. The exact time the bomb pulse is received at various stations was recorded. The exact time difference in receipt of the electromagnetic pulse between two stations was used to determine a hyperbolic curve which runs through ground zero. The point of intersection of two or more curves determines ground zero.

There were two systems. One of the systems was known as the long base line system and the other, the short base line system. Each system had two sets of stations. The long base line had 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 had 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 Marysville).

RESULTS

Short Base Line

Hawaii - All stations in the Kona net successfully received and recorded the wave form of the electromagnetic pulse emanating from the bomb

[redacted]

[redacted]

detonation. Maximum field strength -[redacted] Line of position error 4.7 nautical miles.

California - Woodland net operated successfully. Maximum field strength was [redacted] Line of position error 8.5 nautical miles.

<u>Long Base Line</u>

Hawaii - All stations in the Lahaina net received and recorded the wave form of the electromagnetic pulse emanating from bomb detonation.

Stateside - Harlingen net operated successfully.

Griffiss AFB equipment operated satisfactorily.

[redacted]

[redacted]

[redacted] (MOHAWK)

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 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 the direction of maximum intensity of radiation will be at the desired vertical angle over all of the operating frequency range from 1 to 23 megacycles.

[redacted]

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 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

Routine operation until H-15 minutes; thence continuous until H+1 hour; thence once per minute until H+2 hours; thence routine.

RESULTS

All stations operated successfully during this shot.

Kusaie: At H+31 minutes a pronounced disturbance, similar to that observed during the [redacted] (Cherokee) and [redacted] (Zuni), was observed in the F region of the ionosphere. This disturbance effected the F-2 layer above Kusaie for about 6 minutes. The data shows a continual disturbance, in the F region, until approximately H+1 hour.

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

C-97 Airborne Station: On this shot the virtual height of the F layer seemed to rise about 5 to 10 percent above normal. There was a slight increase in absorption. No abnormal E layer traces were observed, except for a little sporadic E which lasted only a few minutes. In general effects were relatively small.

[redacted]

[redacted] (MOHAWK)

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 62 miles.

RESULTS

Signals were received on both antennas. However, because of improper scope settings, excessive hash was photographed along with signal on one

[redacted]

scope. Excess of hash completely buried the signal. The other scope picture was satisfactory.

Photohead data was received on one channel, a miscalibration of galvanometer in the recorder prevented recording of the other channel.

DELETED [redacted] (MOHAWK)

Project 6.5 - Analysis of the Electromagnetic Pulse Produced by a 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.

RESULTS

Station A - Parry Island

Data was recorded on two oscilloscopes. The camera shutter on the third oscilloscope did not open and the data was not recorded.

The predicted field strength was [redacted] and the measured field strength was [redacted]

The wave form results were not good due to setting the intensities of the trace too high.

Station B - Kwajalein

Data was recorded on all oscilloscopes.

The predicted field strength was [redacted] and the measured field strength was [redacted]

The quality of the waveforms were good and should provide easy analysis.

[redacted]

[redacted] (MOHAWK)

Project 9.1 - Technical Photography - Lt Col J. C. James

Three RB-50 aircraft of Project 9.1 participated on this event. Carter 1 and 2 in east and south quadrants respectively attempted cloud photography at 25,000 feet but natural cloud obscuration plus heavy icing conditions prevented satisfactory photographic runs. Mission for both aircraft was aborted at H + 15 minutes. Carter 3 at 20,000 feet 50 nautical miles west from ground zero, experienced fair photographic conditions until H + 7 minutes. Mission was aborted at that time due to unfavorable weather conditions.

Carter 1 conducted a crater survey and damage survey on D + 1. Photography on this mission is excellent.

[redacted]

PART III

TASK UNIT 1

LASL PROGRAMS

Keith Boyer
Advisory Group

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

[redacted]

[redacted] (MOHAWK)

Project 16.3 - Electromagnetic Investigations - R. Partridge

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

The [redacted] Mohawk) gave good traces on all channels. The time interval measured was [redacted] This margin of error is relatively large because this device radiated a somewhat unusual signal.

Radio interference again limited the sensitivity which could be used for the alpha measurement. A greater surprise, however, was that the early signal polarity was opposite to that expected. As a result, the early part of the alpha signal was obscured and reading will be difficult.

[redacted]

[redacted]

PART IV

TASK UNIT II

UCRL PROGRAMS

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. B. Keller**

[redacted]

[redacted]

[redacted] (MOHAWK)

Project 21.1 - Radiochemical Analysis - R. Goeckermann

Fission yield

DELETED

[redacted]

[redacted]

[redacted] (MOHAWK)

Project 21.2 - Sampling - R. Batzel

The Air Force Special Weapons Center supplied five B-57, one of which acted as control plane. B-57 aircraft were used instead of F-84Gs due to the operating altitude.

Aircraft	Time after shot Hours	Alt. Collected Thousand Feet	Fission One Wing	Pilot Radiation *
502	1.45 - 2.30	45 - 46.8	11.2×10^{15}	
500	1.45 - 1.55	49.7	9.7×10^{15}	
495	2.40 - 3.15	52 - 53	14.5×10^{15}	
496	3.00 - 3.50	49 - 50.5	12.6×10^{15}	
504	2.50 - 3.30	48 - 49.5	13.8×10^{15}	

The cloud on [redacted] (Mohawk) topped at 65,000 feet. The base of the cloud was obscured by lower cloud cover.

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

[redacted]

[redacted]

[redacted] (MOHAWK)

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

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 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]D (MOHAWK)

TABLE 21.3-1

FISSION BOTTLE DATA

TIME - 0606 7/3/56

Bottle	RW-Mo - BP-116	RW-Mo - BP-112	RW-Mo - BP-32	RW-Mo - BP-120
Flt	Hot Shot 4	Hot Shot 1	Hot Shot 1	Hot Shot 3
Alt	47,500	40,000	44,000	50,500
Coll Time*	+184 - 234	+107 - 164	+107 - 164	+161 - 202
Net Sample Wt	12 oz	11 oz	10.5 oz	6 oz
PSI**	750	1075	1000	650

DELETED

* Time of collection after shot time (minutes)

** Final pressure of gas collected (PSI)

*** No Probe washes included

[redacted]

[redacted]

[redacted] (MOHAWK)

Project 21.4 - External Neutron Flux Measurements - N. Bonner

Three sets of external detectors were placed on the northwest tip of Eberiru and at 1300 feet from [redacted] (Mohawk). Each set of detectors were spaced 150 feet apart. Another three sets of detectors were placed on the southeast tip of Rojoru at a distance of 2,500 feet from [redacted] (Mohawk). This set of detectors also were spaced 150 feet apart. The detectors were a sample of arsenic and a zirconium sample sealed in a boron 10 shield. It was hoped that one could determine the number of fast neutrons by observing the (n,2n) reaction on these samples.

The set of samples placed on Rojoru were recovered on July 8, and were sent back to Livermore on July 10 for counting. The set of samples on the northwest tip of Eberiru could not be recovered at this time since the cable had been broken. The set of samples on Eberiru were recovered on July 17 and sent back to Livermore on Flyaway 1 of [redacted] (Tewa).

The flux at 1 meter from the device axis resulting from neutrons emitted normal to the axis was calculated using an air mean free path of 190 yards for the Zr and 195 yards for the arsenic. Preliminary results are:

DELETED

[redacted]

394

[redacted]

[redacted](MOHAWK)

Project 22.1 - Reaction History - L. F. Wouters

E. C. Woodward

DESCRIPTION OF THE EXPERIMENT

The gamma rays produced by the nuclear reactions were detected by flour - photocell detectors located in a lead lined detector pit located near the recording station some 2750 feet from the device. Collimation was provided by a 10 foot high by 12 foot wide wall in the cab consisting of 6 inches of lead and 12 inches of paraffin with appropriately shaped holes for the primary and secondary radiation to pass to the detectors, two collimating disks on short towers between the device and the detector pit, and a 27 foot lead pipe attached to the detector pit. The disks and pipe restricted the view of the detectors to the wall and the portions of the device observable through the two holes in the wall. The primary hole was covered with 3.2 inches of lead in order to extend the possible range of coverage of the secondary. Four fluors were positioned in tandem along the collimated gamma path and were observed by a total of three photodiodes and four photomultiplier units. Appropriate combinations of gamma attenuators between fluors and optical attenuators between different detector units on the same fluor made possible the complete coverage of a dynamic range of 10^{10}. The detector outputs were transmitted by cable to some 35 oscillographs located in the recording station where cameras provided a permanent film record of the signals.

EXPERIMENTAL RESULTS

High Explosive Transit Time - The high explosive transit time was measured to be [redacted] from the beginning of the X-unit load ring pulse to the time of the 50th generation level of the primary fission reaction.

[redacted]

DELETED

It should be emphasised that these are preliminary results, and that in particular the boost signal data have not been corrected for detector system response characteristics.

DELETED

Fig. 22.1-1 - Mohawk Primary Reaction History

DELETED

Fig. 22.1-2 - Mohawk Primary - Alpha vs Time

[redacted] (MOHAWK)

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] (Mohawk) 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-unit = [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 S-unit load ring pulse to breakaway of gamma pulse rise = [redacted]

[redacted]

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

α between gamma rise and equipment cutoff = [redacted]

[redacted]

[redacted] (MOHAWK)

Project 23.1 - Fireball and Bhangmeter - H. Grier

D. J. Barnes

FIREBALL

Preliminary fireball yields have been obtained from four high speed Eastman cameras with the following results:

Parry ♦:

Parry ♦:

Piiraai ♦:

Mack ♦:

DELETED

An ambient air density of 1.14 has been assumed in these raw data calculations. The preliminary fireball yield is therefore [redacted]

BHANGMETER

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

A tremendous jet is produced on the side of the fireball, presumably because of massive lead shielding in the cab. At the time of minimum fireball brightness [redacted] on the fireball film) the jet is very brilliant; this may be the cause of the discrepancy between the Bhangmeter and fireball yields.

[redacted]

[redacted]

DELETED

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[redacted]

[redacted]

DELETED

Fig. 22.1-2

[redacted]

[redacted]

DELETED

Fig. [illegible].1-3

[redacted]

DELETED

FIG. [illegible]-4

75

DELETED [redacted] (MOHAWK)

Project 23.3 and 23.4 - Time Interval and Time and Pressure Measurements -

H. B. Keller

OBJECTIVES

There were three different experiments conducted by Diagnostic Photography on the [redacted] (Mohawk) device. Radiation flow transit time measurements by means of hot-spots, measurement of interstage time and fireball growth by the Christmas tree experiment, and a fluor experiment to evaluate the reaction of fluors subjected to very high gamma and neutron fluxes.

Pre-operational calculations showed the following estimates:

Stage	Yield	Time of Explosion

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THE EXPERIMENT

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[redacted]

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DELETED The vacuum pipes were fifty feet long with turning mirrors to direct light toward Station 2301.

Fluors: Five fluors were used in the experiment, placed at intervals down along one tower leg. These fluors responded at a lower gamma flux level than did air (primary Teller light). Recovery and the later expected response to the gamma flux from the secondary was absent and is probably due to the saturation of the fluors because of their close proximity to the device.

INSTRUMENTATION

All equipment functioned satisfactorily. The transmissometers indicated good visibility, approximately 72% transmission at shot time. The Pirani gauges on the three vacuum pipes all indicated better than ten microns pressure, which is well below the upper limit of fifty microns.

RESULTS

All measurements by optical comparator:

Times - Primary zero times are recorded by fluors

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[redacted]

Transit and interstage times

DELETED

[redacted]

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