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REDWING

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WT-1359

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REPORT OF THE COMMANDER, TASK GROUP 7.1

Los Alamos Scientific Laboratory
Los Alamos, New Mexico
August 1956

[redacted]

[redacted]

[redacted]

[redacted]one radius of an asymmetric crater about 270 ft (easterly along the island). In addition, [redacted] tower shot having a high kiloton yield, was surveyed for crater size. The results are not available at this time.

Jeeps were exposed on three events in an investigation of the response of drag-sensitive targets. Good results were obtained and will supplement the damage-prediction curves by including the blast conditions resulting from these particular types of shots.

Water-wave studies were made on the megaton-range devices. Instruments were placed to document the Bikini Lagoon waves, and at distant locations (Ailinginae and Eniwetok Atolls, and Wake and Johnston Islands) to record the long-period ocean waves. Microbarographs were operated at Wake and Johnston to investigate the possibility that these long-period waves are air-coupled. Considerable inundation photography was taken. Wave action from [redacted] in the Bikini Lagoon was less than expected, since the crater did not breach into the ocean or the deep channel and, apparently, there was unexpectedly great convergence and dissipation onto the near islands of the Eninman complex.

These results, based on preliminary analysis in the field, must be considered as tentative. Blast records will be re-examined and reanalyzed at the laboratories. Photographic analysis cannot be accomplished at the proving grounds and must await laboratory study.

However, a general statement of the accomplishment of this program can be made: With the exception of [redacted] in which the drop error affected the results of those projects participating, the objectives of the Program 1 projects were carried out. On all events a high percentage of instrumentation successfully operated at and through shot time, recording reliable data. Blast data have been obtained which will supplement existing information. These data will extend presently established curves, and will strengthen the knowledge of blast phenomena in areas heretofore only meagerly instrumented or not documented at all.

2.1.2 Program 2, Nuclear Radiation and Effects

Program 2 was concerned with the distribution of radioactivity in the cloud resulting from nuclear explosions and the subsequent fallout of material from the cloud and with various nuclear radiation effects.

Gamma ion chambers were fired into the cloud by high-speed rockets and the resulting gamma-rate data were telemetered to recording stations. Preliminary analysis indicates there is comparatively little activity in the stem region and that cloud activity is in the lower portion of the cloud.

Destroyer escorts and the M/V Horizon were used to delineate the fallout pattern over water and to study the nature of the transport and dilution of radioactive fallout material in the ocean and Bikini Lagoon. The difficult job of deep-mooring 14 to 17 skiffs in the open ocean to the north of Bikini Atoll was accomplished. The skiff stations were used for fallout collection.

Collecting stations were instrumented on islands of Bikini Atoll, two YFNB's and three rafts anchored in the lagoon, and on three manned ships. Samples collected and studied from early times with respect to gamma and beta activity were also analyzed for chemical and radiochemical composition, and determinations were made of certain of their physical properties, including distribution of particle size. It is certain that this effort will provide a basis for the improvement of theories describing the formation, dispersion, and over-all characteristics of fallout.

Four P2V-5 aircraft were used to survey gamma radiation from fallout-contaminated ocean areas. The data were used to direct survey vessels and for determining contours in producing land-equivalent fallout patterns.

Fallout samples collected from a number of land stations were subjected to radiophysical and radiochemical measurements to determine better the characteristics of in-close fallout material. A gamma-rate meter suspended from a helicopter was successfully used to measure dose-rate contours. A few stations were instrumented in an effort to evaluate the roll of the base surge in transport of radioactive material.

Five B-57B aircraft were used to collect data on radiation dose and aircraft contamination resulting from early penetrations into the clouds and stems of thermonuclear detonations. Twenty-seven penetrations of [redacted] radiation clouds from megaton-range detonations were made at time[redacted]ng from 20 to 78 min after detonation and at altitudes from 20,000 to 50,000 ft. The dose rate in the stem was found to be less than the dose rate in the cloud by a factor of 5 to 10. Important information for operational usage was obtained.

Sufficient data on gamma exposure as a function of distance from the point of detonation of various high-yield devices were obtained so that it will eventually be possible to conclude dosage contours and the validity of scaling laws.

A reasonable picture of the initial and the residual gamma intensities as a function of time after the detonation of high-yield devices should be obtained upon postoperational data analysis.

Several types of building surfaces were exposed at various orientations to fallout on the bows of two of the collection ships. Contamination on all events was so low that it was not possible to make good decontamination studies. Surfaces exposed to high fallout fields [redacted] (Tewa) ended with very little contamination; however, this in itself may give data for the radiological recovery of military installations constructed from such materials and subjected to fallout from this type of burst.

Results should be forthcoming on the neutron flux and energy spectrum as a function of distance and also as a function of angle from the axis of linear-type devices. Full evaluation of field data should advance the state of knowledge as to the type of protection, if any, required for bomb neutrons.

The experimental determination of the radioactivity from a thermonuclear detonation in various typical soil samples was attempted so that a basis could be obtained for predicting soil radioactivity for a nuclear explosion at any location. No data were obtained because of the bombing error on [redacted] (Cherokee).

Some data were obtained during ship-shielding studies on the relative radiation dose rates contributed by contamination of the air envelope, water envelope, and the ship's weather surfaces.

Phantoms for depth dose measurements, in conjunction with standard dosimeters worn externally, were exposed on two of the fallout ships. Data, primarily from [redacted] indicate inconsistencies in the dosimeter readings and the biologically significant depth dose.

Investigations on the relative effectiveness and cost of various proposed ship and personnel reclamation methods were made. These studies were primarily conducted in conjunction with the fallout-collection ships.

A proof-test decontamination procedure was conducted on the fallout-collection ships. The procedure consisted of firehosing, hand scrubbing with detergent, and a second firehosing.

Verification was attempted of Washdown Effectiveness as a Shipboard Radiological Countermeasure. The major fallout was encountered during [redacted] and the effectiveness of the washdown system on the contaminant from this shot is being studied.

2.1.3 Program 3, Structural Response

The primary objective of Program 3 and of the single, sizable Project 3.1 comprising the program was to obtain information regarding the effect of the positive-phase length of blast from nuclear weapons on the response of drag-type and semidrag-type structures. The secondary objective of Project 3.1 was to study further the general problem of drag loading and response of structures to blast forces.

This project on Operation Redwing was actually the second part of a two-part study. The first part was conducted during Operation Teapot and involved the response of four typical single-story, steel-frame, industrial buildings to a 22-kt burst, with a relatively short duration positive-phase air blast. The second part involved the response of identical industrial-building structures to an air burst of [redacted] Mt, with a relatively long duration positive-phase air blast.

Six steel-frame industrial buildings were tested in Operation Redwing: three drag-type structures, 30 ft in height, 40 ft in span, and 40 ft in length; and three semidrag-type structures, 30 ft in height, 40 ft in span, and 80 ft in length. These buildings were located on Yurochi and on three man-made islands along the shallow reef between Yurochi and Namu. The locations from GZ were selected at such range distances (20,500, 24,000, 29,000, and 36,000 ft) as to produce expected degrees of damage ranging from severe to moderate deformation.

Because of a gross bombing error for the airburst [redacted] all structures were subjected to pressures higher than expected and suffered complete collapse; therefore, the planned gradation of damage was not achieved.

However, a qualitative demonstration of the effectiveness of the long duration positive blast phase was achieved, since one drag structure collapsed at a lower overpressure than that which an identical structure on Operation Teapot received without collapse. This agrees with theoretical studies which have indicated that, for drag-type targets, as the length of the positive phase of the blast wave increases, the overpressure required to cause a given degree of damage decreases.

Analytical studies will be made of the test results obtained during Redwing and Teapot in an effort to determine the magnitude of the bonus effect of the long duration of the positive phase.

2.1.4 Program 4, Biomedical Effects

The only project in this program was Project 4.1, Chorioretinal Burns, by Air Force School of Aviation Medicine, Randolph Air Force Base, Texas. It was a sequel to a study in 1953 during Operation Upshot-Knothole. In the latter study, weapons of about 20 kt produced burns in the eyes of rabbits at distances of 2 to 42.5 statute miles from GZ. On all studies prior to Operation Redwing, rabbits were the only experimental animals used to evaluate ocular damage. Four cases of accidental human burns were produced at distances of 2 to 10 statute miles.

The present study was designed to furnish additional information on the requirements for protection against retinal burns, utilizing both rabbits and monkeys as experimental animals. The effectiveness of various parts of the power pulse was evaluated as to its ability to produce chorioretinal burns on rabbits and monkeys. This was accomplished by two series of time-fractionating shutters. The first group, open at time zero, closed at increasing intervals of time. The second series, closed at time zero, were open for preselected time increments during the flash. The feasibility of protection by fixed-density optical filters was explored. Two types of developmental protective electronic shutters were field-tested.

Results at yields o[redacted]demonstrated that the blink reflex does not protect against chorioretinal burns. The [redacted] caused retinal lesions at 8.1 statute miles. The device [redacted] produced burns at 7.6 statute miles but not as far as 14.4 miles. Burns were not obtained from devices of 3.5-Mt yield at distances of 12.9 and 21.6 miles. The lower effective range of burning at the PPG is attributed to higher atmospheric attenuation from excessive humidity and salt spray from the reefs. Note is made that additional information is needed in order to determine the limiting distance for retinal burns at [redacted] and, especially, higher yields. Both [redacted] devices produced retinal burns in two of the eight animals exposed to only the first pulse. Both detonations produced burns during the second pulse.

The optical filters tested at near-threshold distances prevented retinal burns. At intermediate distance, filters reduced the incidence and severity of the lesions. The results obtained on protective shutters were inconclusive but can guide future development.

2.1.5 Program 5, Aircraft Structures

Program 5 included nine projects primarily concerned with the determination of the capability to deliver nuclear weapons of six Air Force types of aircraft and one Navy aircraft. One project, sponsored by the AFCRC, provided thermal-measurement support, and another will provide data on the thermal lethality of a nuclear detonation to certain basic missile structures and materials. Secondary objectives of the aircraft projects were to (1) obtain data for basic research and design of future aircraft, and (2) verify or correct the present analytical methods for the prediction of weapon-effect inputs and the resultant responses by the aircraft structure.

A test of an Air Force B-47 successfully obtained data for wing-bending loads from 39 to 91 per cent of design limit and temperatures of up to 550°F on thin-skinned control surfaces by the use of high-absorptivity paints. Some measurements of the effects of side loads on the aircraft structure were also made. Correction of the Weapon Delivery Handbook for the B-47 will be made after data evaluation.

A test of an Air Force B-52 proved its capability to deliver high-yield nuclear weapons. Extensive thermal, overpressure, and gust measurements will result in fairly clear definition of the safe-delivery envelopes. It appears that 0.9 psi will be the limiting overpressure, instead of 0.8 psi as had been predicted prior to the test series. The ability to predict structural

5. As a result of the above data, it was decided that the [redacted] would perform satisfactorily without any design changes.

2.2.7.2 Electromagnetic Measurements

[redacted]

[redacted]

2.2.9 Program 19, Nuclear Vulnerability

a. Objective

To determine the damaging effects of neutron heating incurred when a nuclear weapon is exposed to the flux from a nuclear explosion.

b. Technique

[redacted] weapons with both real and dummy pits were placed at about 1000 ft and 1300 ft from [redacted] detonation and protected from blast by 3/4 in. thick steel shells. After detonation they were recovered and checked for thermal damage.

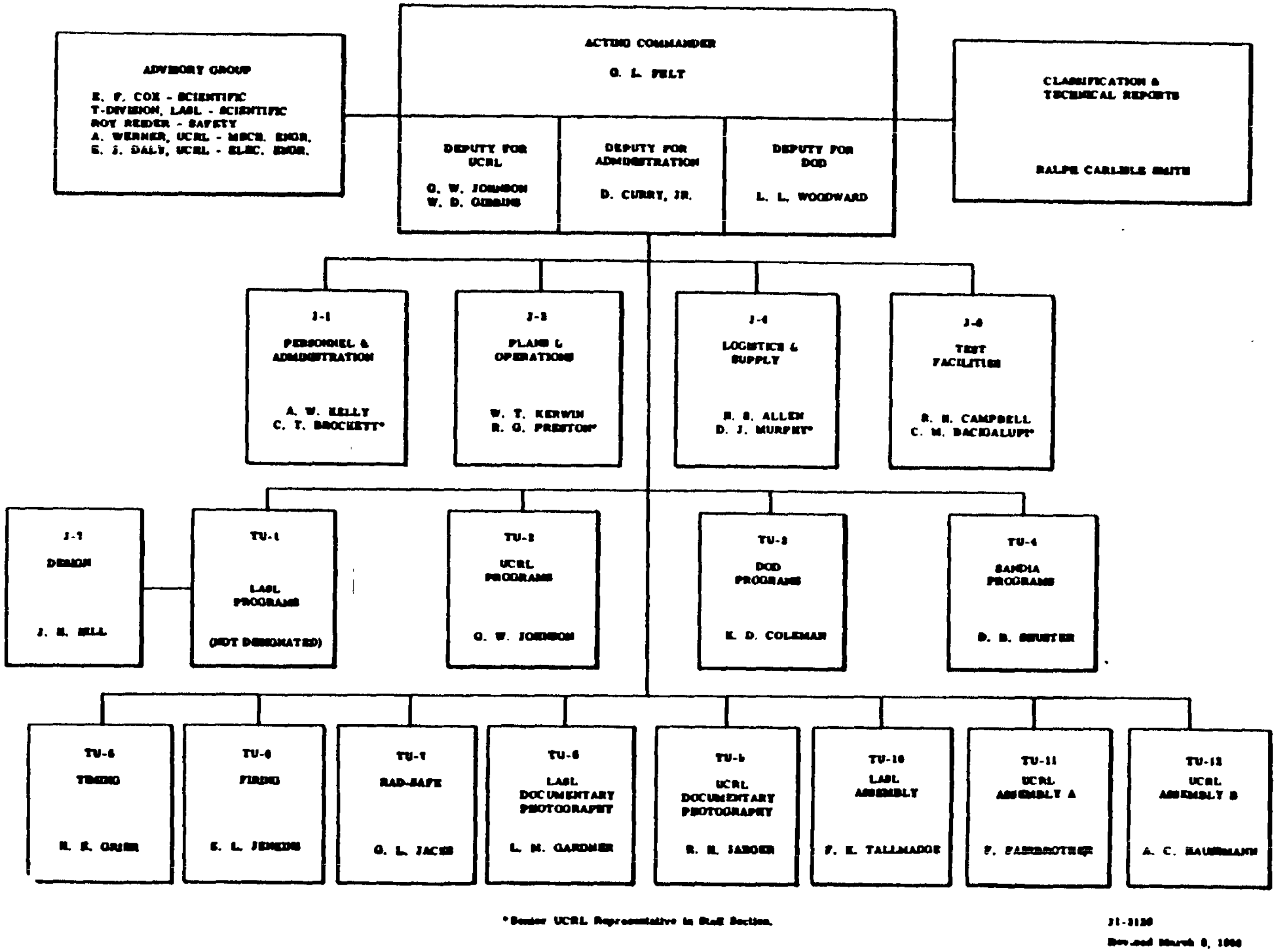

Fig. 3.1 Organization chart - Task Group 7.1.

*Senior UCRL Representative in Staff Section.

Revised March 8, 1956

Fig. 3.1 Organiza... chart - Task Group 7.1.

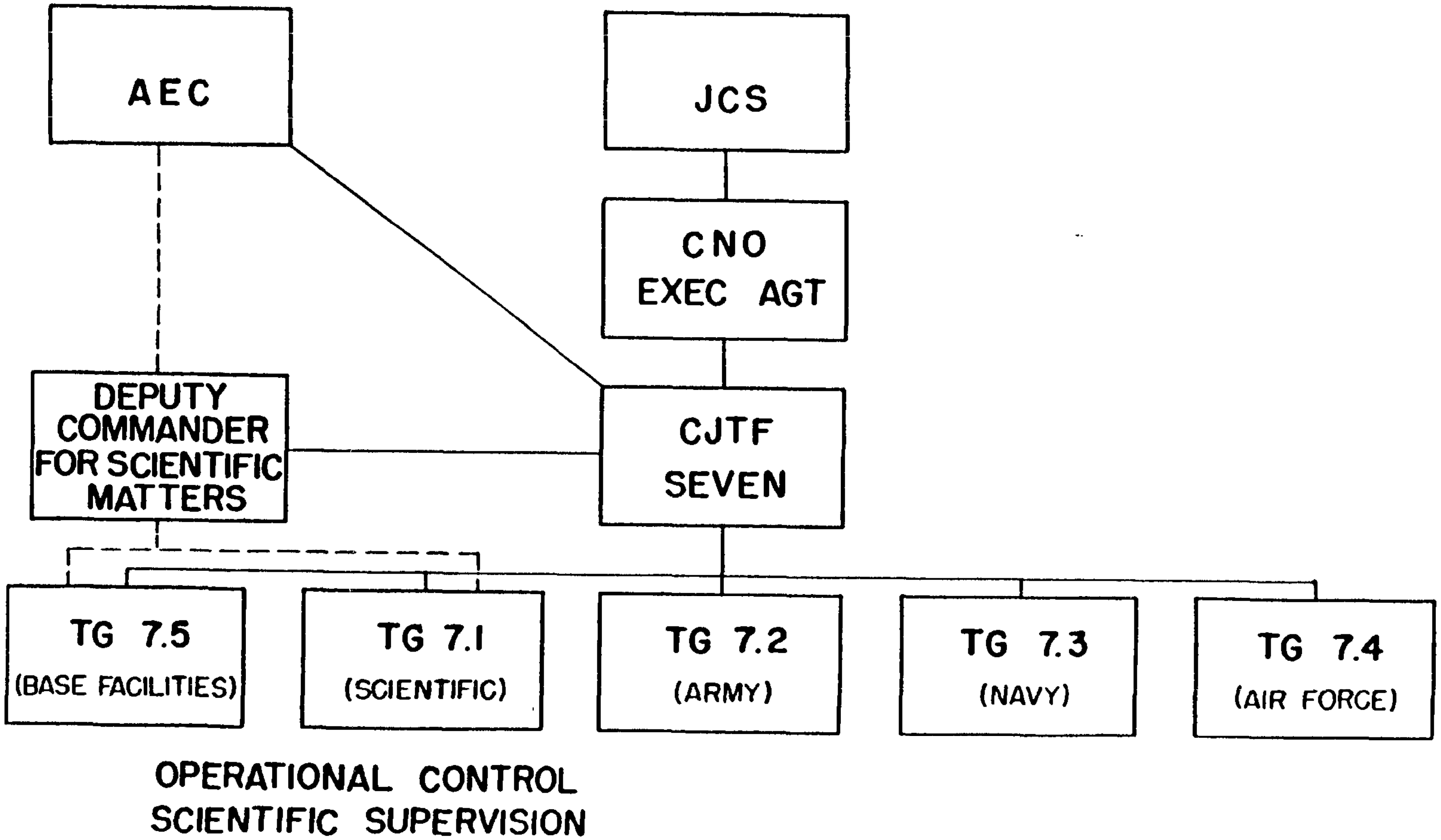

Fig. 3.2 CJTF 7 Organization for Redwing.

TABLE 3.1

KEY PERSONNEL OF TASK GROUP 7.1

Unit or Section	Name	Organization
Commander, Task Group 7.1	Gaelen L. Felt	LASL
Deputy for UCRL	Gerald W. Johnson	UCRL
	Duane C. Sewell	UCRL
	Walter D. Gibbins	UCRL
Deputy for Administration	Duncan Curry, Jr.	LASL
Deputy for DOD	Lester L. Woodward, Col., USAF	WETD
Advisory Group		
T-Division, LASL	J. Carson Mark	LASL
Scientific	Everett F. Cox	SC
UCRL Mechanical Engineering	Arthur Werner, Jr.	UCRL
UCRL Electrical Engineering	Elisha J. Daly	UCRL
Safety	Roy Reider	LASL
Radiological Safety	Leo G. Chelius	LASL
	Edwin A. Bemis, Jr.	LASL
	William R. Kennedy, Jr.	LASL
Classification, Security Liaison, and Technical Reports	Ralph Carlisle Smith	LASL
	John M. Harding	LASL
J-1 - Personnel and Administration	Armand W. Kelly	LASL
	Robert B. Cruise, Lt. Col., USA	LASL
	Samuel R. Whitaker	LASL
	Clarence T. Brockett	UCRL
J-3 - Plans and Operations	Walter T. Kerwin, Col., USA	LASL
	Emil A. Lucke, Col., USA	LASL
	Robert H. Gattis, Col., USAF	LASL
	Reuben N. Perley, Cdr., USN	LASL
	Roger G. Preston	UCRL
	John P. Flynn	UCRL
	John Tyson, Lt. Col., USAF	WETD
J-4 - Logistics and Supply	Harry S. Allen	LASL
	Robert J. Van Gemert	LASL
	John W. Lipp, Lt. Col., USA	LASL
	Daniel J. Murphy	UCRL
J-6 - Test Facilities	Robert H. Campbell	LASL
	Robert W. Newman	LASL
	Clifford M. Bacigalupi	UCRL
	Arthur P. Minwegen, Cdr., USN	WETD
	William A. Mowery, Lt. Col., USA	WETD

Unit or Section	Name	Organization
TU-1 - LASL Programs	Keith Boyer	LASL
	A. T. Peaslee, Jr.	LASL
	David A. Liberman	LASL
J-7 - Design	James H. Hill	LASL
Program 10	Herman Hoerlin	LASL
	Joseph F. Mullaney	LASL
	Leroy N. Blumberg	LASL
Program 11	George A. Cowan	LASL
	Harold F. Plank	LASL
	Phillip F. Moore	LASL
	Jere D. Knight	LASL
Program 12	Rodney L. Aamodt	LASL
	Wendell A. Biggers	LASL
	Donald D. Phillips, Sr.	LASL
Program 13		
Project 13.1	John S. Malik	LASL
	Robert B. Patten	EG&G
	William A. Ward	EG&G
	Richard E. Knappenberger	EG&G
	Bruce M. Carder	EG&G
Project 13.2	Roger Ray	LASL
	Leland K. Neher	LASL
	Douglas O. Cochrane	EG&G
Project 13.3	Carroll B. McCampbell	SC
	David E. Henry	SC
	Jesse C. Rehberg	SC
Program 15	Gaelen L. Felt	LASL
	Arthur N. Cox	LASL
	Robert S. Fitzhugh	LASL
	Avery L. Bond	LASL
Program 16	Bob E. Watt	LASL
	Ralph E. Partridge, Jr.	LASL
Program 18	Herman Hoerlin	LASL
Project 18.1	Harold S. Stewart	NRL
	Walter F. Weedman	NRL
	George F. Wall	NRL
Project 18.1 & 18.3	Gordon G. Milne	U. of Rochester
	Francis D. Harrington	NRL
Project 18.2	Dennison Bancroft	LASL
	Joseph E. Perry, Jr.	LASL
Project 18.2 & 18.4	Robert B. Day	LASL
Project 18.3	Donald F. Hansen	NRL
Project 18.4	Donald R. Westervelt	LASL
	Elbert W. Bennett	LASL
Program 19	Lew Allen, Jr., Capt., USAF	LASL

Unit or Section	Name	Organization
TU-2 - UCRL Programs	Gerald W. Johnson	UCRL
	Duane C. Sewell	UCRL
Program 21	Robert H. Goeckermann	UCRL
	Roger E. Batzel	UCRL
	Floyd F. Momyer, Jr.	UCRL
	Norman A. Bonner	UCRL
Program 22	Louis F. Wouters	UCRL
	Clarence E. Ingersoll	SC
Program 23	Harry B. Keller, III	UCRL
UCRL Weapon Physicists	Harold D. Brown	UCRL
	John S. Foster, Jr.	UCRL
TU-3 - DOD Programs	Kenneth D. Coleman, Col., USAF	WETD
	David T. Griffin, Col., USA	WETD
	Wade H. Hitt, Lt. Col., USMC	WETD
Program 1	Henry T. Bingham, Maj., USA	WETD
Project 1.1	Julius J. Meszaros	BRL
Project 1.2	Arnold D. Thornbrough	SC
Project 1.3	Joseph Petes	NOL
Project 1.4	James A. Fava, Lt. Col., USAF	AFCRC
Project 1.5	Julius J. Meszaros	BRL
Project 1.6	Joseph Petes	NOL
Project 1.8	Frank E. Deeds, Capt., USA	ERDL
Project 1.9	William G. Van Dorn	SIO
Project 1.10	Arnold D. Thornbrough	SC
Program 2	Donald C. Campbell, Cdr., USN	WETD
Project 2.1	Peter Brown	ESL
Project 2.2	Peter Brown	ESL
Project 2.4	Joseph C. Maloney	CRL
Project 2.51	Benjamin Barnett	CRL
Project 2.52	Trevor C. Looney	SC
Project 2.61	Richard R. Soule	NRDL
Project 2.62	Feenan D. Jennings	SIO
Project 2.63	Terry Triffet	NRDL
Project 2.64	Robert T. Graveson	NYOO
Project 2.65	Manfred Morgenthau	CRL
Project 2.66	Ernest A. Pinson, Col., USAF	AFSWP
Project 2.71	Heinz R. Rinnert	NRDL
Project 2.72	Samuel C. Rainey	BuShips
Project 2.8	Raymond R. Heiskell	NRDL
Project 2.9	Frank S. Vine	BuShips
Project 2.10	Michael M. Bigger	BuShips
Program 3	Henry T. Bingham, Maj., USA	WETD
Project 3.1	Robert E. Grubaugh, Capt., USAF	WADC
Project 3.10	Julius J. Meszaros	BRL
Program 4	Clyde W. Bankes, Lt. Col., USA	WETD
Project 4.1	David V. L. Brown, Capt., USAF	AFSAM

Unit or Section	Name	Organization
Program 5	Milton R. Dahl, Cdr., USN	WETD
Project 5.1	Clarence W. Luchsinger	WADC
Project 5.2	Francis L. Williams, 1st Lt., USAF	WADC
Project 5.3	Richard W. Bachman	WADC
Project 5.4	Harold M. Wells, Jr., 1st Lt., USAF	WADC
Project 5.5	Robert F. Mitchell, 1st Lt., USAF	WADC
Project 5.7	Richard L. Dresser, Capt., USAF	AFCRC
Project 5.8	Philip S. Harward, Lcdr., USN	BuAer
Project 5.9	Charles J. Cosenza, 2nd Lt., USAF	WADC
Program 6	Clyde W. Bankes, Lt. Col., USA	WETD
Project 6.1	Edward A. Lewis	AFCRC
Project 6.3	Arthur K. Harris	ESL
Project 6.4	Alan J. Waters	ARDC
Project 6.5	Charles J. Ong, 2nd Lt., USA	ESL
Program 8	Alfred H. Higgs, Cdr., USN	WETD
	William C. Linton, Jr., Maj., USA	WETD
Project 8.1	William B. Plum	NRDL
Project 8.2	Wallace L. Fons	CFRES
Project 8.3	Jerry J. Mahoney	CRL
Project 8.4	Alexander Julian, Lcdr., USN	BUAER
Project 8.5	Ralph Zirkind	BUAER
Program 9	Jack G. James, Lt. Col., USAF	WETD
TU-4 - Sandia Programs	Don B. Shuster	SC
	Robert E. Hepplewhite	SC
	Edwin L. Jenkins, Jr.	SC
Program 30	Charles G. Scott	SC
	Francis E. Thompson	SC
	Hans E. Hansen	SC
Program 31	Don B. Shuster	SC
	Willard A. Gustafson	SC
	Billy M. Ray	SC
Program 35*	Lauren Donaldson	UWFL
	Edward E. Held	UWFL
	Arthur D. Welander	UWFL
	Allyn H. Seymour	UWFL
	Ralph E. Palumbo	UWFL
	Frank G. Lowman	UWFL
TU-5 - Timing	Herbert E. Grier	EG&G
	Bernard J. O'Keefe	EG&G
	Lewis Fussell, Jr.	EG&G
TU-6 - Firing	Edwin L. Jenkins, Jr.	SC
	Robert J. Burton	SC

*Sponsored by DBM, AEC; carried out by Applied Fisheries Laboratory, University of Washington.

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EG&G
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EG&G
SC
SC
University of

Unit or Section	Name	Organization
TU-7 - Radiological Safety	Gordon L. Jacks, Maj., USA	LASL
	Charles L. Weaver, Maj., USA	1st RSSU
	Benjamin H. Purcell, Capt., USA	1st RSSU
	Rex Gygax, Lt., USN	LASL
TU-8 - LASL Documentary Photography	Loris M. Gardner	LASL
	Robert C. Crook	LASL
	Gustaf N. Lindblom	LASL
TU-9 - UCRL Documentary Photography	Raymond H. Jaeger	UCRL
TU-10 - LASL Assembly	Francis K. Tallmadge	LASL
	David R. Smith	LASL
	John H. McQueen	LASL
	Andrew M. Koonce	LASL
	Douglas F. Evans	LASL
	Edwin L. Kemp	LASL
	Jay E. Hammel	LASL
TU-11 - UCRL Assembly A	Forrest Fairbrother, Jr.	UCRL
TU-12 - UCRL Assembly B	Alfred C. Haussmann, Jr.	UCRL
	Joseph A. Lovington, Cdr., USN	UCRL

TABLE :

REDWING SHOT SCHEDULE

(L = LASL, U = UCRL, E = Eniwetok, B = Bikini)

Model and Laboratory	Shot Name	Probable Yie[redacted]ts[2]	Location	Date Fired	Actual Ready Date	Listed in Concept[3]	Revision[4] (10/11/55)	Op Plan Date[5]	Actual Shot Time[6]
[redacted]	Lacrosse	[redacted]	Runit (E) ground	5/5	4/29	No	5/1	5/1	0625:05
	Cherokee		Namu (B) 5000 ft air burst	5/21	5/9	Yes	5/1	5/1*	0551
	Zuni		Eninman (B) ground	5/28	5/28	Yes	5/15	5/8	0556
	Yuma		Aomon (E) 200 ft tower	5/28	5/28	Yes	5/8	6/1	0756
	Erie		Runit (E) 200 ft tower	5/31	5/31	No	5/23	5/23	0615:05
	Seminole		Bogon (E) ground	6/6	6/5	No	5/26	5/28	1255:05
	Flathead		South of Yurochi (B) barge	6/12	6/10	Yes	5/30	6/2	0626
	Blackfoot		Runit (E) 200 ft tower	6/12	6/12	Yes	6/7	6/7	0626
	Kickapoo		Aomon (E) 300 ft tower	6/14	6/14	Yes	5/18	6/18	1126
	Osage		Runit (E) 700 ft air burst	6/16	6/16	Yes	6/7	6/14	1314
	Inca		Rujoru (E) 200 ft tower	6/22	6/22	No	5/1	6/8	0956
	Dakota		South of Yurochi (B) barge	6/26	6/22	No	---	6/13	0606
	Mohawk		Eberiru (E) 300 ft tower	7/3	7/3	Yes	6/8	7/1	0606
	Apache[1]		Mike crater, west of Teiteiripucchi (E) barge	7/9	7/8	Yes	7/1	6/20	0606
	Navajo		South of Yurochi (B) barge	7/11	7/9	Yes	6/18	6/8	0556
	Tewa		Halfway between Yurochi & Namu (B) barge	7/21	7/18	No	---	7/7	0546
	Huron		Mike crater (E) barge	7/22	7/2, 7/20[7]	No	6/11	6/12	0616
			[redacted]oposed Shots, Eventually Deleted from Schedule						
	Pawnee		Engebi (E) ground	---	---	No	Unspecified	Unspecified	
	Pueblo		Bogairikk (E) ground	---	---	Yes	---	---	
	Hopi		Runit (E) 100 ft tower	---	---	Yes	---	---	
	Shawnee		Runit (E) 100 ft tower	---	---	Yes	---	---	
	Shawnee 2		Engebi (E) ground	---	---	No	---	---	
	Shawnee 3		Engebi (E) ground	---	---	No	---	---	

Notes

(1) [redacted] (Apache) was originally planned as a LASL model. Later, by agreement between LASL and UCRL, it became a UCRL model.

(2) Probable yield limits, estimated before the shot, for construction, instrumentation, evacuation, aircraft positioning, fallout prediction and other purposes.

(3) CTG 7.1 General Concept No. 1-55 (dated 4/12/55). First shot at each atoll was to be ready 4/15/56 but no shot dates or orders were given.

(4) Ready dates in Revision No. 4 (dated 10/11/55) to CTG 7.1 General Concept No. 1-55.

(5) CTG 7.1 Operation Plan No. 1-56 (dated 1/25/56). Later dates of UCRL small shots caused by December 1955 estimate of UCRL that this program was a month behind schedule. Dates listed are from Revision No. 2 to Op Plan (dated 2/4/56).

(6) Eniwetok (Zone-12) dates and times are used in this table

(7) [redacted] postponed at H-3 min, 7/2/56. [redacted]

TABLE 3.3

MAJOR ITEMS OF MILITARY SUPPORT

Ships or Aircraft and Purpose	Dec. 1954[1]	April 1955[2]	Aug. 1955[3]	Actual	Remarks
AGC (Estes) - Command		1	1	1	Provided Program 2 Control Center
AV-4 (Curtiss) - TG 7.1 Command and Weapons	1	1	1	1	Transport of devices, housing, shops and offices
CVE - Helicopter base, early recovery and re-entry base	1	1	1	1	Master Raydist Station Base
LSD - Barge lift and boat pool support	1	1	1	1	Project 1.4 Telemetering Station
LST - Weather Island support	1	1	1	1	
LST - Interatoll	1	1	1	1	
ATF - Towing	3	4	4	4	One with echo sounding equipment; one with skiff handling equipment installed
APD - Personnel transport and fast freight[4]	2	2	2	1	Project 2.61 Telemetering Station
TAP - Afloat housing at Bikini	1	1	1	1	
DD/DE - Security		as req'd	4	4	Two DD's used for Security; two DE's used for Security and by Program 2
LST-611 - Program 2		1	1	1	
YAG-39 and 40 - Program 2		2	2	2	
Navy Boat Pool	1	1	1	1[5]	
AVR - Firing Party	1				Actual, used helicopters and LCM's as required
ARSD - For possible buoy project	1				No buoy project authorized
YC - Sample packing - Program 2	1	1	1	1[4]	
YCV - Copter barge	1	1	1	1	
Sectional Pontoon - Program 2			3	2	Instrument platform, Bikini Lagoon
YFNB - Program 2				2	
Submarine - Program 2 - Fallout		1 or more			None authorized

YFNB - Program 2	1 or more	None authorized
Submarine - Program 2 - Fallout		

Ships or Aircraft and Purposes	Dec. 1954	April 1955	Aug. 1955	Actual	Remarks
SA-16 - Off-atoll and SAR		7	9	7[7]	
C-47 - Interatoll airlift	4	4	4	4	
L-20 - Interisland airlift	6	6	6	8	
P2V - Security		as req'd	10	10	
Copter Squadron - Bikini - Carrier Based	1[6]	1	1	1	15 copters in squadron
H-19B - Copters, Eniwetok	9	9	9	10	
		Sampling			
B-57B - Sampling aircraft		6	6	6	Three B-57D also requested in April; not authorized
F-84G - Sampling aircraft		8	10	10	
		Effects			
B-36 - Cannister drop (Project 1.4)		2 B-29	1	1 B-36	
B-57 - Cloud penetration (Project 2.66)		6	6	5 B-57	Three B-57 and three B-47 requested in April
P2V5 - Early Fallout (Project 2.64)			3	3	
B-47 - Effects (Project 5.1)		1	1	1	
B-52 - Effects (Project 5.2)		1	1	1	
B-66 - Effects (Project 5.3)		1	1	1	
B-57B - Effects (Project 5.4)		1	1	1	
F-84F - Effects (Project 5.5)		2	2	2	
F-101A - Effects (Project 5.6)		1	1	1	
A3D1 - Effects (Project 5.8)		1	1	1	
F-89D - Effects (Project 5.11)			1		Project cancelled
C-97 - Project 6.3		2	1	1	
P2V5 - Effects (Project 8.5)		1		1	
RB-50E - Photography		3 R7V's	3	3	Support for Program 9 and Project 1.8

Others

Ships or Aircraft and Purposes	Dec. 1954	April 1955	Aug. 1955	Actual	Remarks
Drop aircraft		2 FB-36 or 2 B-47	2	3	Actual: Two B-52 and one B-36
B-47 - IBDA		2	3	3	

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(1) Reference, CTG 7.1, Secret letter, J3-26, subject: Major Military Support Requirements for Redwing, dated December 20, 1954.

(2) Reference, JTF-7, Secret letter, J-3/SRD-221-55W, subject: Resumé of Conference on Military Support Requirements, dated April 29, 1955. Date of conference was April 21, 1955.

(3) Reference, JTF-7, Secret letter, J-3/S-483-55W, subject: Record of Conference Held at CJTF7 Headquarters to Discuss Military Support Requirements for Operation Redwing, dated September 7, 1955. Conference was held August 23, 1955.

(4) To be used in event of full shipboard operation.

(5) 5 LCU's, 19 LCM, 2 LCPR, 1 LCPL, 1 MWB and 1 YFN.

(6) 16 to 20 helicopters.

(7) Amphibian or seaplane support would have been required at Bikini if airstrip had become unusable.

The Curtiss transported a number of devices to the FA and MSTS continued to provide regularly scheduled surface lift from the West Coast to the PPG. As the operational period approached, MSTS increased the frequency of sailings and provided a special ship to expedite the shipment of large numbers of scientific trailers, a necessary feature of the late build-up phase of overseas tests.

Alteration of a number of naval and MSTS ships and craft was required for their support and scientific functions and was accomplished by the Navy.

As shown in Table 3.3, the Air Force provided drop and sampler aircraft; effects, photographic, and other scientific project aircraft; helicopters at Bikini and Eniwetok; liaison planes, interatoll aircraft and offatoll support. The extensive and detailed meteorological information required by various scientific projects was provided by the Air Force, as was the weather information on which the decisions as to whether or not to fire were made.

MATS provided airlift of the great majority of TG 7.1 personnel and many tons of urgent freight, furnished all of the sample return services, and lifted a number of the devices from Travis AFB to Eniwetok.

Details and statistics of a number of the items of support provided by the AEC and the DOD are covered elsewhere in this report.

Determination of all these support requirements represented many months of study, discussion, negotiation, and compilation of information. The phasing overseas of major elements of military support was determined in December 1955 and January 1956. Subsequent changes were of a minor nature.

3.4.3 Training and Rehearsals

Details of training are covered as appropriate in the reports of the various programs, projects, and task units. Extensive training of personnel and testing of equipment began at the various laboratories in the U. S. and continued overseas.

In order to make the maximum use of project Rad-Safe monitors, about 125 of them were trained at Fort McClellan, Alabama, during the week of January 9, 1956. During the operation several courses were conducted by TU-7 at the PPG to provide additional project monitors. Five chemical laboratory technicians were trained in basic radiochemistry techniques at LASL, and four members of TU-7 were trained in alpha monitoring at LASL and Mercury, Nevada. NRDL trained 30 individuals from various naval shipyards throughout the U. S. to act as TU-7 monitors for Program 2. Six men were trained in radiac instrument repair at Treasure Island and Los Alamos.

In preparation for each shot, TG 7.1 conducted several dry runs of the timing and firing systems, including at least one full power dry run before each shot. These runs were normally conducted twice a day until satisfactory, and then once a day until the shot or weather postponement. During prolonged states of readiness on a −1 basis, they were held every other day, or more often as necessary. Operations for which timing was important, such as recovery operations and key operations affecting the D−1 day schedule, were rehearsed as often as necessary to determine the actual time required and to decrease it as practical.

A fairly complete Task Force rehearsal for Cherokee was conducted at Bikini beginning 0500 April 23 and ending at 1200 April 24. H-hour was as scheduled for Cherokee. Neither the TG 7.1 command ship, the USS Curtiss, nor the USNS Ainsworth was available for this rehearsal. A very small token number of TG 7.1 personnel completed evacuation and re-entry. Nearly all of the vessels present proceeded to their shot-time positions at sea. Effects and other planes participated on a large scale. A voice count-down was provided, messages were sent to offatoll stations for time studies, and the communication rehearsal was as complete as possible in order to test communications and detect frequency conflicts. The rehearsal was satisfactory.

A number of other communication rehearsals were conducted during April at both Eniwetok and Bikini. Several of them were for the purpose of positioning aircraft as well as for testing communications and for determining interference caused by electronic equipment. Task Group 7.4 conducted a number of bombing rehearsals in which TG 7.1 participated to a limited extent.

3.5 MOVEMENT TO THE FORWARD AREA AND ASSEMBLY OF SUBORDINATE UNITS

3.5.1 Personnel

Information regarding the expected number of personnel to be present in the FA during Operation Redwing was obtained from the monthly status reports submitted prior to forward movement by the various units of the Task Group. These population figures were subdivided by location into the following general categories: sites at Bikini Atoll; sites at Eniwetok Atoll; and shipboard space. Detailed compilations were prepared showing the estimated weekly population at any location in the PPG. These population estimates were useful in determining such things as camp locations, camp size, MATS transportation required, and over-all camp support required of with the LASL group serving as the final clearing house for all three agencies in transmitting the requirements of TG 7.1 to TG 7.5. During the planning phase the four UCRL representatives functioned from their own laboratory while the DOD representative established residence at Los Alamos. During the instrumentation and shot periods these three groups combined in the Forward Area and representatives of this combined group were stationed at various sites throughout the PPG where major activities concentrated. Under this method of operation in the field, individual members of the group were not restricted to problems of their parent agency and frequently assisted other agencies in accomplishing the over-all mission of the Task Group.

During the spring and summer of 1955, devices or weapons and experiments were added or deleted from the operation with a frequency that produced a continual revision of the test facilities required by the resulting scientific programs. However, at the end of September 1955 it was estimated that the basic criteria necessary for the design of 95 per cent of the scientific structures had been transmitted to the AEC Field Manager, Eniwetok Field Office. The technique employed during this period was to delineate items which would be required in the operation regardless of the concept of the day. This included items such as submarine cable systems, gas storage building, HE magazines, standardized shot barges, and the basic major scientific stations. This approach was necessary because the time involved in design, procurement, and construction precluded waiting until participation was firm and locations selected before gathering the test facility criteria.

By mid-September construction necessitated opening the J-6 Office in the FA to maintain close coordination with the construction forces.

The field revisions in the shooting sequence and locations had little effect upon the facilities required beyond the expansion of the existing capability of firing a barge shot in the Mike crater at Eniwetok Atoll.

In the course of the operation, approximately 735 scientific stations were constructed, nearly 1300 work orders prepared, and 20 man-months of machinist time were expended in the J-6 Shop in support of the mission of TG 7.1.

1.7.3 Intra-atoll Airlift

Airlift support to the islands of Eniwetok Atoll was provided by TG 7.4 using eight L-20 aircraft and ten H-19B helicopters. The full complement of L-20 aircraft was not in place until after the arrival of the USS Badoeng Strait on March 16, 1956. In addition, one L-20 was in place at Enyu to support special missions at Bikini Atoll during the build-up phase.

The airlift support of Bikini Atoll was provided by HMR-363, a Marine Helicopter Squadron with a complement of 15 HRS-1 (H-19A) aircraft. The squadron initially provided eight aircraft with the remainder arriving on the USS Badoeng Strait. Additional support by one Air Force L-20 was available during early phases of the operation; this was increased to a total of two, immediately preceding [redacted] (Zuni) to support the Tare complex. Following Zuni, the L-20's were no longer required.

On March 27, the Marine Squadron at Bikini lost a helicopter owing to engine failure. With the cause undetermined and with a history of similar trouble, all helicopters were grounded. Subsequently, limited numbers were made available but were used for freight only following the decision of CTG 7.1 that personnel would not be airlifted by Marine helicopter until the engine deficiency was corrected or replacement aircraft were available. A decision was made to use the Air Force helicopters from Eniwetok until later-model replacements were made available. This was considered essential due to critical requirements at Bikini. On March 29, the Air Force was flying necessary support. On April 25, HRS-3's (H-19B's) were available at Bikini as replacement aircraft for grounded aircraft and took over responsibility for Bikini airlift.

Helicopter support at Eniwetok Atoll was curtailed effective March 27 with the movement of the AF H-19's to Bikini to support airlift requirements there. The AF helicopters were returned to Eniwetok on April 26 after the arrival of the new Marine helicopters.

The Eniwetok islands were supported by air as follows:

Runit - L-20 and H-19
Rojoa complex - L-20's primarily
Teiteiripucchi complex - L-20 and H-19

The Bikini islands were supported as follows:

Romurikku complex and north islands of atoll - helicopter.
Eninman complex and south islands - helicopters and L-20.

Procedures were established at both atolls for providing airlift for TG 7.1 personnel. For published scheduled flights, it was normal for individuals to request space by direct contact with the appropriate TCA dispatcher. For all special flights which regular scheduled service could not accomodate, requests were submitted to J-3 for approval and booking.

The short airstrip at Runit necessitated using H-19's for airlift any time the wind velocity dropped to less than 10 mph or became a cross wind.

With the temporary movement of the AF helicopters to Bikini, support to the Teiteiripucchi complex was accomplished by landing L-20 aircraft at Engebi and using surface transportation to Teiteiripucchi. The decision was made at this time to complete construction of the Teiteiripucchi airstrip which eliminated the need for using Engebi and surface transportation.

For periods of three to four days after some of the shots, certain of the airstrips were out of commission for L-20 traffic owing to radiation. H-19's were used to move priority personnel to those complexes, supplemented by water taxis for low priority traffic.

After [redacted] (Erie), the Runit airstrip was completely out of commission. Preparation [redacted] (Blackfoot) [redacted] (Osage) at Runit was supported entirely by H-19's and surface transportation.

L-20 aircraft were used to support [redacted] (Seminole) preparation as soon as radiation levels permitted use of the Teiteiripucchi strip; however, H-19's primarily supported Seminole preparatory work.

During a representative week of the build-up phase (April 1-7), the interisland airline had the following traffic load:

	Bikini	
H-19B	844 flights	1900 passengers (382 - TG 7.1)
	Eniwetok	
H-19B	47 flights	84 passengers (62 - TG 7.1)
L-20	223 flights	717 passengers (548 - TG 7.1)

During a representative week of the operational phase (May 6-12), the interisland airline had the following traffic load:

	Bikini	
HRS-3 (H-19B)	589 flights	1563 passengers (1250 - TG 7.1)
	Eniwetok	
H-19B	91 flights	313 passengers (191 - TG 7.1)
L-20	279 flights	742 passengers (400 - TG 7.1)

The L-20 liaison-type aircraft was the answer to many of the demands for rapid transportation of personnel and its performance and "in operation" rate were very high. The HRS-1's (H-19A), with which the HMR-363 was first equipped, did not prove adequate in performance or in the availability of replacement parts for an operation of this sort. Such was not true of the HRS-3's with which the Marine Squadron at Bikini was later equipped (after

CTG 7.1 had stopped using the HRS-1's for passengers, and recommended to CJTF 7 that they be replaced) or the H-19B's at Eniwetok. This latter model of helicopter performed well and was adequate performance-wise for the operation. Numbers available for TG 7.1 and 7.5 missions were often inadequate because of SAR, Task Force, other task group, VIP, and maintenance requirements.

3.7.4 Interatoll Airlift

Initial plans for the routine airlift of personnel and air cargo between Eniwetok and Bikini generated a requirement for four scheduled flights to and from Bikini each day. During the build-up phase of the operation, two round trip flights each day were flown on a scheduled basis, one departing Eniwetok at 0800 and one at 1300. As the traffic load between atolls increased, it was found to be more efficient to contimue using these same two scheduled departure times but with additional sections as required. Task Group 7.4 had four C-47 aircraft which were assigned primarily for interatoll airlift. When required and as available, C-54 aircraft were used to supplement the C-47 airlift.

Task Group 7.1 personnel desiring airlift placed space requirements directly with the J-3 Airlift Booking Section. J-3 forwarded these requirements to TG 7.5 Personnel Section who in turn manifested combined requirements with TG 7.4. Since TG 7.1 and TG 7.5 (H&N) were primary users of the interatoll airlift, the consolidation of passenger bookings by the TCA permitted improved coordination and eliminated much unnecessary duplication. Surface transportation to and from Eniwetok Island for TG 7.1 passengers departing or arriving on interatoll flights was provided by TG 7.5 on a routine scheduled basis in conjunction with the movement of their personnel. In addition TG 7.1 passengers were placed on TG 7.5 Movement Orders which served as an aid in accounting for personnel movement between atolls during muster periods.

The following is a summary of the passenger and cargo load during a representative week in April (1-7 inclusive) while in the build-up phase of the operation:

Number of flights	28 (14 round trips)
Total passengers	366 (166 TG 7.1 personnel)
Total cargo	44,596 lb

The following is a summary of the passenger and cargo load during a representative week in May (6-12 inclusive) at the beginning of the operational phase:

Number of flights	34 (17 round trips)
Total passengers	422 (246 TG 7.1 personnel)
Total cargo	32,128 lb

*Last minute urgent requirements created numerous difficulties in coordination. In addition the actual handling of all airlift requirements would have been much improved if TG 7.4 had an Operations Section to receive and coordinate all airlift requirements. J-4 Section of JTF 7 attempted to fill this requirement on D-1 and shot days for Bikini Atoll shots. Unfortunately, this tended to increase the confusion by interposing an additional agency on a temporary basis, and on some occasions resulted in unwarranted delays in the emergency movement of key personnel between atolls. The system never proved able to provide this group with the timely and rapid transportation required.

*Although most requirements for interatoll airlift were satisfied, it was concluded that during the period of peak activity one or more additional aircraft would have materially increased the efficiency, safety, and general support capability. Of the four C-47 aircraft on hand, TG 7.4 was reluctant to guarantee the availability of more than two on any given day. The three C-54 aircraft assigned to Test Services Unit were not consistently available when requested, and could not be counted on. In addition, the lack of any central operations section in TG 7.4, in combination with what appeared to be a lack of coordination between Base Operations and TSU Operations, caused a certain amount of confusion and inefficiency when these aircraft were used for interatoll airlift. Because of the extremely willing attitude of most of the personnel providing the support required, the effects of these deficiencies were minimized.

3.7.5 Motor Vehicle Transportation

Motor vehicle requirements for TG 7.1 were developed after analysis of the final status reports from the various projects. Two main motor pools were operated, one on Parry Island and one on Enyu Island. The vehicle density of these motor pools was also based on the project final reports. Although the reports provided a fairly sound basic figure for establishing vehicle strength, in many instances the information was not adequate.

*It became evident during the first month of operation that the notion of providing only one vehicle for a project working alternately on both atolls

*In order to emphasize operational conclusions and recommendations, sections or paragraphs where they appear have been marked with an asterisk.

TABLE 3.4

BIKINI EVACUATION

Vessel	Cherokee (May 20) Cabin Class	Cherokee (May 20) Troop Class	Cherokee (May 20) Total	Zuni (May 27) Cabin Class	Zuni (May 27) Troop Class	Zuni (May 27) Total	Flathead (June 11) Cabin Class	Flathead (June 11) Troop Class	Flathead (June 11) Total
USS CURTISS	53	22	75	72	24	96	58	19	77
USNS AINSWORTH	169	56	225	117	56	173	97	48	145
USS BADOENG STRAIT	56	17	73	68	14	82	37	11	48
USS ESTES	18	3	21	16	3	19	15	3	18
USS McGINTY	3	0	3	3	0	3	3	0	3
USS CATAMOUNT	12	9	21	1	4	5	3	4	7
M. V HORIZON	26	0	26	26	0	26	26	0	26
USS SIOUX	3	0	3	4	2	6	3	0	3
USS KNUDSON	6	0	6	10	2	12	0	0	0
USS McKINLEY	3	0	3	0	0	0	0	0	0
YAG 39	8	2	10	9	2	11	8	3	11
YAG 40	13	2	15	14	2	16	15	2	17
LST 611	1	3	4	4	2	6	3	2	5
USS SILVERSTEIN	3	0	3	3	0	3	2	0	2
TOTAL	374	114	488	347	111	458	270	92	362

Vessel	Dakota (June 25) Cabin Class	Dakota (June 25) Troop Class	Dakota (June 25) Total	Navajo (July 10) Cabin Class	Navajo (July 10) Troop Class	Navajo (July 10) Total	Tewa (July 19) Cabin Class	Tewa (July 19) Troop Class	Tewa (July 19) Total
USS CURTISS	55	17	72	62	18	80	42	18	60
USNS AINSWORTH	83	51	134	60	44	104	58	45	103
USS BADOENG STRAIT	23	7	30	35	11	46	27	9	36
USS ESTES	2	2	4	13	3	16	15	3	18
USS McGINTY	0	0	0	3	0	3	3	0	3
USS CATAMOUNT	3	6	9	1	4	5	1	4	5
M. V HORIZON	0	0	0	24	0	24	24	0	24
USS SIOUX	0	0	0	2	1	3	3	0	3
USS KNUDSON	0	0	0	6	0	6	6	0	6
USS McKINLEY	0	0	0	0	0	0	0	0	0
YAG 39	0	0	0	7	3	10	7	3	10
YAG 40	0	0	0	12	2	14	14	2	16
LST 611	0	0	0	2	3	5	2	3	5
USS SILVERSTEIN	0	0	0	4	0	4	3	0	3
TOTAL	166	83	249	231	89	320	205	87	292

3.18.3 Property Roll-up

Property roll-up consisted of two stages, preliminary and final. Pre-liminary roll-up consisted of the return of equipment as it became surplus and project property from completed operations. It started after the first shot, Lacrosse, and continued until Tewa. Final roll-up can be considered the period after Huron, the last shot. Preliminary roll-up cargo was re-turned to the ZI on the cargo vessel USNS Sergeant Archer T. Gammon in June and on the USNS Private Joe E. Mann in July. Cargo breakdown was as follows:

USNS Sergeant Archer T. Gammon	850.7 M/T Special Cargo
	152.3 M/T General Cargo
USNS Private Joe E. Mann	1164.5 M/T Special Cargo
	821.9 M/T General Cargo

Inasmuch as at the time of writing of this report the final phase is just starting, planned shipping will be listed.

The bulk of TG 7.1 property will be returned to the U. S. on the USNS Brostrom which is scheduled to be on berth August 10, 1956, and should consist of the following:

7318.6 M/T Special Cargo
2168.0 M/T General Cargo

USNS Sergeant Archer T. Gammon will return about August 15 to pick up the last of the cargo which is estimated as follows:

892.0 M/T Special Cargo
125.1 M/T General Cargo

Bikini cargo was moved to Eniwetok by LST for processing and docu-mentation, and then consolidated with Eniwetok cargo for movement to the U. S.

Owing to high radioactivity at certain stations, and to remoteness in the case of weather stations, some equipment cannot be recovered by proj-ect people prior to their departure. Arrangements have been made with H&N to recover this equipment when conditions permit. Necessary work orders have been prepared to cover these requirements.

Cryogenic Plant. One of the two nitrogen generators was removed during roll-up and shipped to LASL. The balance of the cryogenic plant was moth-balled.

Property drawn on memorandum receipt from TG 7.2 and 7.5 has been cleared.

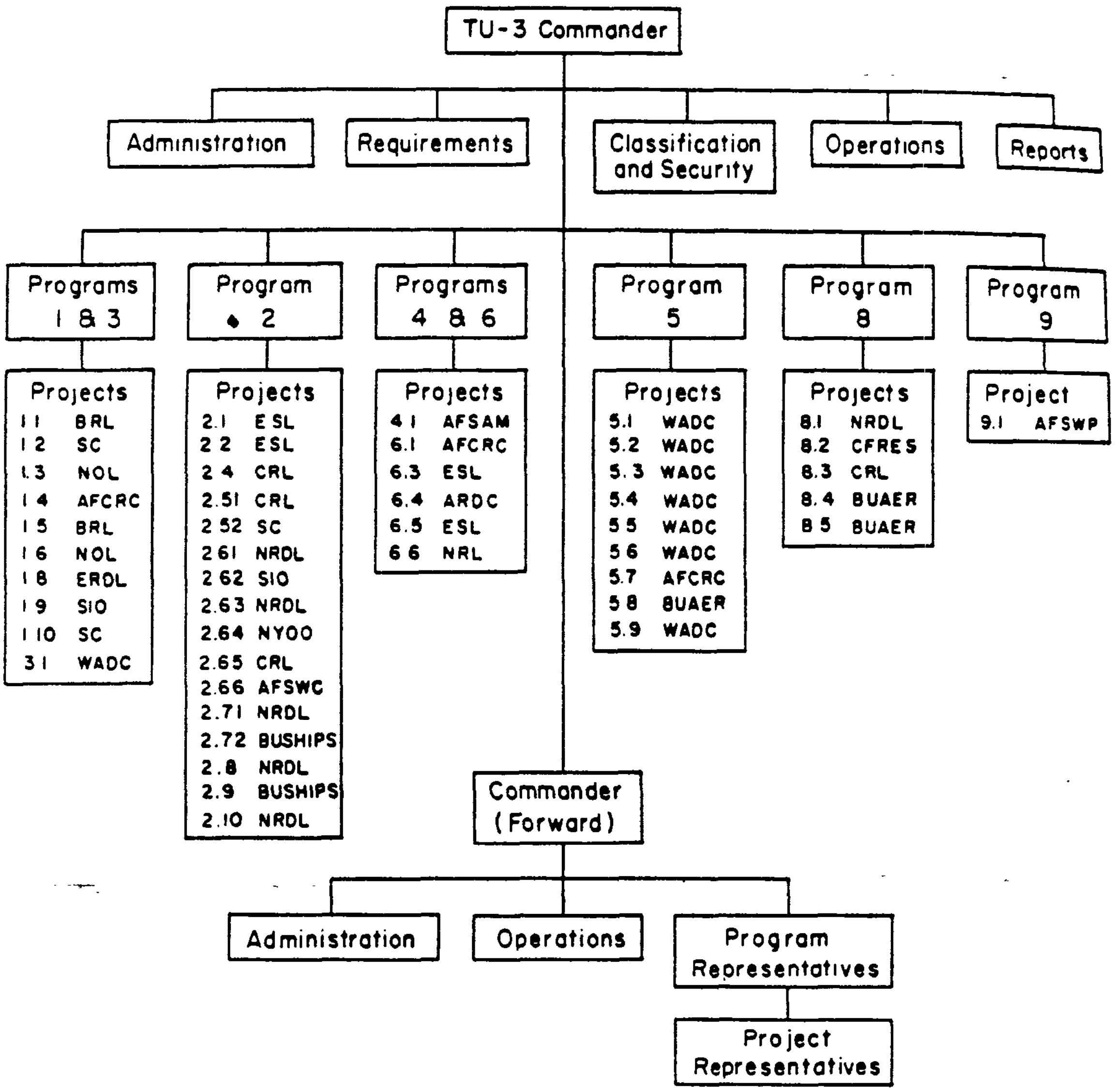

Fig. 4.1 Organization chart, TU-3.

augmented by staff and program personnel from Eniwetok as test activities required. This arrangement provided efficient control of activities at both atolls with a minimum of overhead, and proved to be quite satisfactory for this type of operation involving experiments at both atolls.

At Eniwetok the Commander, TU-3, supported by a small staff, supervised the activities of the directors of the eight technical programs. There were 47 projects grouped under the eight programs (see the organization chart, Fig. 4.1). During the course of the operation approximately 50 TU-headquarters personnel and 900 project personnel were present in the PPG. The peak strength was 710 on May 6, 1956. Headquarters personnel were furnished by Field Command, AFSWP. Project agencies are indicated on the organization chart.

The programs were the most extensive yet undertaken for an overseas test. Although the experimental objectives were numerous, the major overall objectives were to define or document (1) the weapon-delivery capabilities of late-model aircraft; (2) the radioactive fallout from high-yield devices, including the initial and final distribution of activity, the time history of accumulation locally and at sea, and the physical and chemical nature of the radioactive material; and (3) the basic effects of a high-yield air burst. In general, it appears that the program objectives were met, except for a considerable loss of data on the high-yield air burst [redacted] (Cherokee) due to a bombing error. Individual program results are covered in Chapter 2, Section 2.1.

*The TU-3 mission was accomplished without major operational problems. The large number of scientific stations involved in the weapon effects tests were widely scattered throughout the PPG and made the task unit dependent upon logistic-support agencies. Close liaison was maintained with TG 7.1's J-1, J-3, J-4, and J-6 staff sections, and all essential requirements were met in an excellent manner.

*Special problems were posed by the projects operating outside the PPG. Excellent cooperation on the part of staff sections, support agencies, and communications personnel led to satisfactory solutions.

4.4 TASK UNIT 4, SC PROGRAMS

4.4.1 Mission of Task Unit 4

In addition to technical and adminstrative responsibilities for Sandia Programs, TU-4 was assigned administrative support and technical monitor responsibilities for service projects being performed by Sandia Corporation for DOD, LASL and UCRL. These service projects included the following:

safe time interval after the weapon or device had been armed to allow complete evacuation of the atoll when necessary, and to permit the Firing Team to retire to the Control Room. When a shot was canceled within 2 hr of zero time, the Disarming Team entered the zero area after the timer opened the arm line. On some of the smaller shots at Eniwetok where the diagnostic measurements were not restricted to a certain early time period, the safe separation timer was set to open the arm line up to 8 hr after zero time. This provided several hours in which zero time could be rescheduled when the weather was uncertain. When possible the arming operations were conducted during the daylight hours, but on several occasions it was necessary to arm after dark. Transportation for the Arming Team was provided by plane, helicopter, or watercraft, according to the type best suited for the particular zero location.

Firing was accomplished from a Control Room by starting, 15 min before zero, a motor-driven timer which automatically provided the timing signals. There was a Control Room at Parry, Eniwetok, and Enyu, Bikini. The Control Room at Enyu could be remotely controlled by radio from the USS Curtiss. [redacted] was the only test where the remote station aboard the USS Curtiss was used.

Several disarming operations were conducted at both atolls because of postponements due to unfavorable weather conditions. Only one disarming was conducted under an emergency situation. This was [redacted] after the shot had been canceled with 3 min of zero time [redacted]

TU-6 did not have responsibility for the two airdrops during the operation. However, through visual observance it was noted that the airdrops were handled in accordance with Sandia approved field procedures. The fuze and firing circuits of the weapons operated well within the specified tolerances.

All weapons and devices were detonated at the proper time and no misfires occurred during the operation.

4.7 TASK UNIT 7, RADIOLOGICAL SAFETY

4.7.1 Mission

The mission of TU-7 was as follows:

1. Perform all ground and aerial monitoring services associated with the scientific mission except those in conjunction with aircraft and airborne collection of scientific data; assume responsibility for rad-safe for TG 7.5 during the operational phase.

2. Provide laboratory and technical assistance to all task groups.
3. Provide all official dosimetry services for JTF 7.

4.7.2 Organization

The necessity of maintaining a capability for firing at both Bikini and Eniwetok Atolls at the same time required that TU-7 provide two complete and independent rad-safe organizations. Over-all control over the two organizations was maintained by CTU-7. Each organization contained the following sections:

1. Monitoring section for providing all monitoring services and manning check points.
2. Plotting and briefing section for conducting all aerial surveys and briefing all personnel going into radex areas.
3. Supply section for maintenance of rad-safe supplies, including laundry (facilities furnished by TG 7.5).
4. Instrument repair section for maintenance of rad-safe instruments.
5. Laboratory section for determining the amount of activity contained in soil and water samples.
6. Decontamination section for operating facilities for personnel and equipment decontamination.

Control over the official dosimetry and records section was maintained directly by CTU-7. This was necessitated by the double badge system (permanent and mission film badges) that was used during the operation. A small photodosimetry section was maintained at Bikini for processing mission film badges used at that atoll. All permanent badges were processed by the Eniwetok photodosimetry section. The master record file for all personnel in JTF 7 was maintained at Eniwetok.

Personnel for manning TU-7 were obtained from the Army, Navy, and Air Force. The majority of the personnel were obtained from the Army's 1st Radiological Safety Support Unit, a Chemical Corps unit stationed at Ft. McClellan, Alabama. The Army provided 102 officers and enlisted men; the Navy 8 officers and enlisted men, and 30 civilians; and the Air Force 12 officers and enlisted men. Los Alamos Scientific Laboratory provided four personnel in an advisory capacity.

Scientific projects in TG 7.1 and contractor personnel in TG 7.5 were required to provide their own monitors for recovery and construction missions. The majority of these personnel were trained by members of TU-7 at either Ft. McClellan, Alabama, or the PPG.

4.7.3 Operations

In support of TG 7.1 and 7.5 at both Bikini and Eniwetok, check points were established as required. Main check points utilized at all times at both atolls were located at the air dispatcher's office and the marine landing. All personnel entering or returning from a radex area were processed through the check points. An area was considered as a radex area if the contamination exceeded 100 mr/hr. Full protective clothing was required for entry into a radex area. Limited radex areas were established when the contamination level was above 10 mr/hr, but less than 100 mr/hr. Clothing requirements varied with the situation in the limited radex areas. An area contaminated to a level less than 10 mr/hr was considered non-radex. The following is a summary of rad-safe processing:

1. A total of 1560 parties, containing from 1 to 50 men per party, were processed through the Eniwetok check points from May 5, 1956, to July 20, 1956. Approximately 9500 personnel were processed through Bikini check points during the same period. The personnel decontamination station at Eniwetok handled a total of 1558 individuals, while the facility at Bikini processed 3350.

2. At the equipment decontamination facility at Eniwetok a total of 225 vehicles, ranging from jeeps and trailers to large mobile cranes, were processed. In addition, all equipment from three camps was decontaminated. Six helicopters, contaminated on aerial surveys, were also decontaminated. At Bikini, approximately 100 vehicles were processed.

The majority of the rad-safe surveys of radex areas at both atolls were conducted by helicopter. Normal operations included a pre-entry survey with CTG 7.1 at H + 1 to 3 hr, a detailed survey at H + 6 to 8 hr, and detailed surveys on the morning of D + 1 and 2 days. Additional surveys were made as required. Instruments used in the surveys included special Jordan ionization chambers and standard AN/PDR-39's converted to read to 500 r/hr. Ground surveys of islands in the atolls were conducted when required.

During the entire Eniwetok operational phase, the contamination from any one shot did not materially interfere with preparations for the next event. In all events local contamination was quite high, with the exception [redacted]. Contamination resulting from [redacted] required that the camps on Rojoa and Teiteiripucchi be closed up. [redacted] shots gave significant amounts of alpha (plutonium) contamination on Aomon.

Contamination from Bikini shots was such that Enyu could be used as a base of operations during the entire period. No significant delay in preparations for any shot resulted from contamination found in the atoll area.

No critical recoveries were delayed more than 24 hours. Roll-up operations in the Yurochi-Aomoen chain were curtailed by the contamination resulting from [redacted]

The only significant fallout observed at Eniwetok Atoll (on Parry and Eniwetok) during the operation resulted from [redacted] Fallout started at approximately 1500, July 21, and ended approximately 0800, July 22. Peak intensity measured on Parry reached 100 to 120 mr/hr depending upon the location. Early decay was rapid, but after 48 hours the decay of the active material followed the fission product decay curve. The impact of this dose rate on the Eniwetok roll-up was such that a 7 r total dose limit was established by CJTF 7 for 7.1 and 7.5 personnel.

Fallout was observed at Bikini (Enyu) one day afte[redacted] Maximum level observed was 12 mr/hr. Th[redacted]also caused minor fallout on Enyu; maximum level observed [redacted] case was 10 mr/hr.

A total of approximately 500 water and soil samples were handled at both atolls by laboratory personnel. Swimming areas at both atolls were declared off limits for several days following certain of the shots that significantly increased the lagoon contamination levels. An arbitrary limit of 50,000 disintegrations per minute per liter of water was established as the tolerance level for swimming.

4.7.4 Official Dosimetry

The permanent badge program was designed to provide a dosage-indicating device to all personnel in the Task Force. Issue of the first permanent badges was made on April 15, 1956, with exchange scheduled approximately each six weeks. As the operational phase progressed, it was found that permanent badges in use in excess of four weeks were badly watermarked and difficult to read. As a result, the exchange period for TG 7.1 and TG 7.5 was shortened to three weeks. During the operation approximately 40,000 permanent badges were issued, processed, and recorded.

The mission badge program was designed to provide a rapid determination of the dosage an individual had received while participating in recovery or construction missions in radex areas. Only those personnel entering a radex area were provided with mission badges. No deficiencies were noted in these badges as the usual period of wear was approximately 12 hours. A total of 30,000 mission badges were processed at Eniwetok, and approximately 20,000 at Bikini.

All film processing and record posting were done manually. As a result, approximately 40 individuals out of the entire Task Unit strength were assigned to the dosimetry and records sections.

Prior to the fallout at Eniwetok resulting from [redacted] approximately 50 individuals had received technical over-exposures in excess of 3.9 r. The dosage received from fallout at Eniwetok increased this number to approximately 600.

*4.7.5 Conclusions

1. The project monitor program was successful and significantly reduced the personnel strength of TU-7.
2. The permanent and mission film badge programs were successful in providing the necessary dosage information for all personnel in the Task Force. It is believed that the total number of personnel engaged in official dosimetry work should be reduced. Difficulties encountered with the permanent film badge can be remedied.
3. Maximum permissible levels and exposures were not established to cover all important cases. A need for flexibility in a few specific cases is apparent.
4. The Task Unit organization was adequate and satisfactorily met all requirements.

*4.7.6 Recommendations

1. The project monitor program should be continued in future operations.
2. A development program aimed at improving the permanent film badge package and providing a certain amount of automation to the film processing and recording procedures should be established.
3. Maximum permissible levels and exposures should be restudied and rewritten in the light of current thinking and past experience.

4.8 TASK UNIT 8, LASL DOCUMENTARY PHOTOGRAPHY

The following were the assigned responsibilities of TU-8 during operation Redwing:

1. To make all negatives necessary to provide full report coverage for TG 7.1, and for TU-1 and TU-3 programs, in black and white and color, still and motion pictures.
2. To provide construction, accident, and general record coverage. This included a limited number of pictures of the public relations type.
3. To make technical documentary records in still and motion picture of each operation.

SECTION VI - D

SHIP AND BOAT REQUIREMENTS, PROJECT 2.63

Event	Station Location	TIME Begin	TIME Duration	No. of Proj. Personnel	Wt & Cu of Proj Equipment	Remarks (including no. & type ship or boat)
CHEROKEE ZUNI FLATHEAD NAVAJO TEWA	Out to 30 mi from GZ in fall-out area	10 Apr	Continuous use	Skiffs unmanned.	150 lbs 10 cu ft in each skiff	16 skiffs and 2 spares will be furnished by Proj 2.63 and will be deep sea moored prior to CHEROKEE. Data will be collected between shots and equipment reset.
do	Skiff stations	10 Apr	Continuous	Crew - 8 Proj 2.62 -4 Proj 2.63 -4	n/a	SIOUX assigned to this project for skiff mooring and servicing. Full time use of this vessel will be required.
do	Bikini Lagoon	10 Apr		Barges unmanned	Proj 2.63 equipment.	YFNB barges 13 and 29 are assigned as collection platforms for Proj 2.63. To be towed into position, repositioned between shots, and anchored by TG 7.3.
do	Bikini Lagoon	10 Apr	Continuous	Rafts unmanned	do	3 pontoon rafts to be towed into position and anchored by TG 7.3.
do	Bikini Lagoon	Occasional use		n/a	n/a	Towing service to accomplish repositioning of barges.
do	Bikini Lagoon	Occasional use		n/a	n/a	LSU with crane, rigging and operating crew for occasional use.
do	Anchored off NAN	After shot		Proj 2.63,-5 to 15 Proj 2.65 -2		YC barge to be used as packaging station for Proj 2.63 and 2.65 in case NAN is contaminated.

SECTION VI - D

SHIP AND BOAT REQUIREMENTS, PROJECT 2.63 (cont'd)

Event	Station Location	TIME		No. of Proj. Personnel	Wt & Cu of Proj Equipment	Remarks (Including no. & type ship or boat)
		Begin	Duration			
CHEROKEE ZUNI FLATHEAD NAVAJO TEWA	YFNB's in Bikini Lagoon & HOW Is.	H-22	4 hrs	10 ea	250 lbs 50 cu ft each	2 LCM's (see Note 3) for final instrumentation.
do	Raft #1	H+8	½ hr	5	150 lbs 50 cu ft	2 LCM's for recovery of samples not included in earlier copter trip. Samples to be delivered to NAN for flight to ELMER.
	Raft #2	H+9½	½ hr	5		
	Barge #2	H+10	½ hr	5		
	Raft #3	H+11	½ hr	5		
	LOVE	H+11½	½ hr	5		
	Other Atoll islands	D 1		5		
do	Eniwetok Atoll					See Note 4.
	Eniwetok Atoll	1 Apr	2 wks			LCU support vessel for instrumentation work.

SECTION VI - D

SHIP AND BOAT REQUIREMENTS PROJECT 2.65 (Cont'd)

Event	Location	TIME Begin	TIME Duration	No. of Proj. Personnel	Wt & Cu of Proj Equipment	Remarks (including No.& type ship or boat)
CHEROKEE ZUNI FLATHEAD NAVAJO TEWA	Bikini Atoll	Intermittent during tests from 5 April to 1 July.				One DUKW with monorail hoist for installation & recovery of equipment plus 2 LCM's.
LACROSSE	Eniwetok Atoll	Intermittent during period 15 April to 7 May				One LCM for installation and recovery of equipment.
CHEROKEE ZUNI NAVAJO TEWA	Bikini Atoll	H+6	4 hrs	n/a	n/a	Radar tracking of Proj. 2.65 survey helicopters from USS CURTISS.

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SECTION VI - D

SHIP AND BOAT REQUIREMENTS PROJECT 2.10

Event	Location	Time		No. of Proj Personnel	Wt & Cu of Proj Equipment	Remarks (including No & type ship or boat)
		Begin	Duration			
CHEROKEE ZUNI FLATHEAD NAVAJO TEWA	Fall-out Zone - About 50 mi from GZ.	Leave Bikini	Est. 4 hrs	N/A	N/A	YAG-40 maneuvered into fall-out area. Manned during fall-out from shielded room. See Proj. 2.10 Operations for details.
do	Fall-out Zone - about 75 mi from GZ.	Leave Bikini est. H-12	Est. 6 hrs	N/A	N/A	YAG-39 maneuvered into fall-out area. Manned during fall-out from shielded room. See Proj. 2.10 Operations for details.
do	Fall-out Zone - about 175 mi from GZ	Leave Bikini Est. H-16	Est. 17 hrs	N/A	N/A	LST-611 maneuvered into fall-out area. Manned during fall-out from shielded room. See Proj. 2.10 Operations for details.
do	YAG-39 YAG-40 LST-611	When ships are moored off ELMER.				See Note 4.
do	Off ELMER Personnel Pier.	During operation.				Desire exclusive use of small aluminum row boat for use in mooring YAG small boats off pier. Proj. 2.10 will furnish this row boat.

SECTION VI - E

RADIO REQUIREMENTS BY PROJECTS

Project	Instrument Location	Type of Service or Equipment	Frequency	Traffic Load	Remarks
2.1	2 DUKW's	DOD Net 4	53.6 MC	Light throughout operation.	See Notes 1 & 3.
2.2	2 DUKW's	DOD Net 4	53.6 MC	do	do
2.4	None				
2.51	None				
2.52	None				
2.61	HOW rocket launcher. NAN Bldg 70, USS KNUDSON.	BC-610 (E or H) transmitter. R-390/URR receiver	3000 KC	H to H+20 min on CHEROKEE, ZUNI, FLATHEAD, HURON, NAVAJO, TEWA	
2.62	SIO buoy boat, SIO asgd LCU, SIO LCM, DE 534, DE 365, SIOUX, M/V HORIZON, Prog 2 Control Center, work skiff off SIOUX.	DOD Net 4. VRC - 18 Rx and Tx Channel F	53.6 MC	25 Mar to final event CHEROKEE, ZUNI, FLATHEAD, NAVAJO, APACHE, TEWA. Prior to H-24 of CHEROKEE, intermittent heavy. H-24 to H+36 all events, none or slight. H-36 to H-24, intermittent heavy.	See Notes 2 & 3.
	M/V HORIZON, DE 534, DE 365, Prog 2 Control Center	Surface communications net. Channel D	2-18 MC	1 Apr to final event. CHEROKEE, ZUNI, FLATHEAD, NAVAJO, APACHE, TEWA, H-24 to H+3, slight to moderate. H+3 to D+5, moderate to heavy.	
	M/V HORIZON, DE 534, DE 365	TED/URR-13, UHF ship to air circuit, channel E	225-400 MC	Same events. H+6 to end of Proj. 2.64 aerial survey, intermittent heavy.	

SECTION VI - E

RADIO REQUIREMENTS BY PROJECTS (Cont'd)

Project	Instrument Location	Type of Service or Equipment	Frequency	Traffic Load	Remarks
2.62 cont'd	M/V HORIZON	Facsimile receiver. Weather & fall-out predictions.	2096, 3160, 5255.5, and 5306 KC	15 Apr to final event.	Receiver to be furnished and installed by SIO.
	M/V HORIZON	Drogue to ship Radar AN/SSQ-2B(sonar buoys)	4412.5 KC 9036.4 MC 170.5 MC	1 Apr to final event-moderate	Equipment furnished by SIO
2.63	YAG-39 YAG-40 LST-611 Program 2 Control Center	Surface communications net. Channel D	2-18 MC	CHEROKEE, ZUNI, FLATHEAD, NAVAJO, & TEWA, H-6 to H-1 heavy, H to H+8 heavy. Other times light. D-2 first shot to end.	
	YAG-39 YAG-40 LST-611	AN/URR-13 UHF ship to air circuit, Channel E	225-400 MC	During test, intermittent. H-4 to H+2, none.	
	Proj Off. - ELMER Tent #4 - NAN YFNB 13 YFNB 29 YC barge ATF SIOUX	DOD Net 4 VRC-18 Rx and Tx Channel F	53.6 MC	1 Apr to final event	See Notes 1, 2, and 3.
2.64	4 P2V5 aircraft, Bldg 218	AN/URR-13 UHF ship to air circuit, Channel E	225-400 MC	During test series, intermittent; H-4 to H+2, none.	

(Continued)

SECTION VI - E

RADIO REQUIREMENTS BY PROJECTS (Cont'd)

Project	Instrument Location	Type of Service or Equipment	Frequency	Traffic Load	Remarks
2.64 (cont'd)	4 P2V5 aircraft. Program 2 Control Center	0.1A1/6A3 communications, Channel C	3088 KC and 6745.5 KC	CHEROKEE, ZUNI, FLATHEAD, NAVAJO, APACHE, TEWA, H+2 to D+6 continuous during day.	See Note 4.
2.65	None				
2.66	Project aircraft	air to air direction	305.4 MC		Assigned by CTG 7.4.
2.7	Use Project 2.63 facilities.				
2.8	Use Project 2.63 facilities.				
2.9	Use Project 2.63 facilities.				
2.10	YAG-39 YAG-40 LST-611 Bldg223 ELMER Tent 23 ELMER pier	DOD Net 4, Channel F	53.6 MC	Throughout tests, intermittent.	See Notes 1, 2, and 3.
	YAG-39 YAG-40	Remote control	30.133 MC 32.089 MC	Emergency use only.	For remote control of one YAG by other. Must be between 30-42 MC if these 2 cannot be approved.
	Use Project 2.63 facilities.				

SECTION VI - E

RADIO REQUIREMENTS BY CHANNELS

Channel Designation: Program 2 Control Center	Channel Designation: CTG 7.3	Frequencies	Type of Service	Instrument Location	15Feb → Status P-Pending A-Approve
A	14	3[redacted] nights 6693KC days	Telemeter	P2V5&s, #1 and #3, Control Center, Bldg 218 on ELMER.	P
B	15	315[redacted]ghts 6708KC days	Telemeter	P2V5's, #2 and #4, Control Center, Bldg 218 on ELMER.	P
C	12	3088 KC and 6745.5 KC	CW, Voice	4 P2V5's, Control Center, and AOC.	A
	5	TG 7.3 Voice Common	Backup, Voice		
	4C	TG 7.3 Voice Common	Backup, CW		
D	11	2-18 MC	Communications	YAG-39, YAG-40, LST-611, M/V HORIZON, DE-534, DE-365, Control Center.	P
E	13	225-400 MC	Air to ship communications	4 P2V5's, YAG-39, YAG-40, LST 611, M/V HORIZON, DE-534, DE-365, Bldg 218 on ELMER.	P
F		53.6 MC	DOD Nev #4 (See Note 3)	SIO vessels (PB, LCU, LCM, M/V HORIZON), SIOUX, Control Center, DE-534, DE-365, YAG-39, YAG-40, LST-611, YFNB-13, YFNB-29, YC, 1 skiff, Bldg 223-Rm 7 on ELMER (2.10) Proj 2.63 Office on ELMER, Tent #4 on NAN(2.63), Tent #23 on ELMER pier(2.10), Portable sets from radio pool installed in DUKW's and LCM's.	A
		223-229MC	Telemeter	Transmitter in Proj 2.61 rockets. Receivers at Bldg 70 on NAN, and USS KNUDSON.	A

SECTION VI - E

RADIO REQUIREMENTS BY CHANNELS (Cont'd)

Channel Designation		Frequencies	Type of Service	Instrument Location	Status P-Pending A-Approved
Program 2 Control Center	CTG 7.3				
		3000 KC	BC-610 Transmitter, R-390/URR Receiver.	Transmitter in Proj 2.61 rockets. Receivers at Bldg 70, NAN, and USS KNUDSON.	A
		305.4MC	Air to Air Comm.	Proj 2.66 aircraft (to be assigned by CTG 7.4).	A
		4412.5 KC	Drogue to ship.	Transmitters on Proj 2.62 drogues, receiver on M/V HORIZON.	P
		170.5 MC	Drogue to ship.	Proj 2.62 sonar buoys and M/V HORIZON.	P
		2096, 3160, 5255.5, 5306 KC	Facsimile Receiver.	Receiver on M/V HORIZON.	N/A
		9036.4 MC	Radar	M/V HORIZON	P
		30.133 MC 32.089 MC	Remote control	In YAG's 39 and 40. For emergency use only, for remote control of one YAG by the other. Must be between 30 and 42 MC if these two cannot be approved	I

NOTE: All transmissions to ZI and distant points will be through CJTF 7 circuits.

SECTION VI - F

TELEMETER REQUIREMENTS

PROJECT	FREQUENCY	LOCATION		EVENT	TIME
		TRANSMITTER	RECEIVER		
2.1	NONE				
2.2	NONE				
2.4	NONE				
2.51	NONE				
2.52	NONE				
2.61	223 MC 224 MC 225 MC 226 MC 227 MC 228 MC 229 MC	Head of atmospheric sounding vehicles	a. USS KNUDSON about 35 mi from GZ. b. NAN, Bldg 70. (Note: 2 pr hard wire required from launching revetment on HOW to Bldg 70 on NAN)	CHEROKEE ZUNI FLATHEAD HURON NAVAJO TEWA	H+5 min to H+25 min.
2.62	NONE				
2.63	NONE				
2.64	HF Voice Channel A	P2V acft #1 and #3	Program 2 Control Center.	CHEROKEE ZUNI FLATHEAD NAVAJO APACHE	H+2 to D+6 continuous during daylight hours.
	HF Voice Channel B	P2V acft #2 and #4	Program 2 Control Center	do	do
	HF Voice Channel A and B	None - Transmit from acft during calibration	Bldg 218 - ELMER	Calibration and test prior to and during above events.	Continuous during calibration. Intermittent throughout operation. No transmission H-4 to H+2
	do	Bldg 218 - ELMER	None - To acft during calibration	do	do
2.65 to 2.10 have no Telemeter Requirements					