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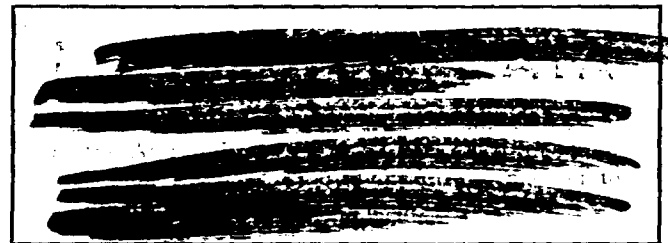
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OPERATION HARDTACK, PHASE I

MARCH - SEPTEMBER 1958
ENIWETOK PROVING GROUND

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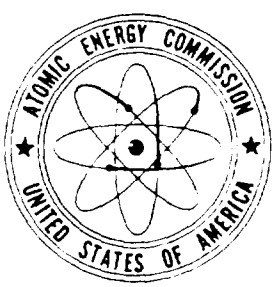
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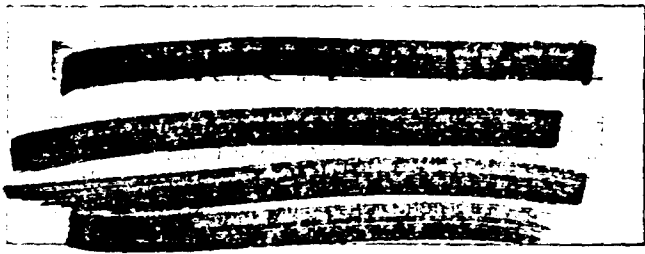
REPORT of the MANAGER



OPERATION HARDTACK, PHASE I

SEPTEMBER 1958

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FOREWORD

The primary purpose of this report is to present pertinent data from Operation HARDTACK, Phase I, conducted at the Eniwetok Proving Ground from March through September, 1958, that will provide useful information for the AEC-ALO in planning future testing operations.

Cognizance has been taken of the various official reports of the Commander, Joint Task Force Seven, to the Joint Chiefs of Staff, and of the Completion Report prepared for the U. S. Atomic Energy Commission by Holmes & Narver, Inc., Architect-Engineer-Construction-Management Contractor.

The report is confined to resumes of Task Group 7.5 responsibilities, the means utilized to accomplish objectives, and recommendations for attaining comparable aims in future operations. Highlights of general interest contained in other widely distributed reports of Operation HARDTACK, Phase I, are included for reference purposes.

Four principal sections comprise this report:

- PART I. "General Account" — contains general information about the operational sites, scope, schedule, organization and command relationships, and the functional responsibilities of TG 7.5.
- PART II. "Scientific Account" — contains a brief summary of general data contained in the TG 7.1 report, excluding any yield data or descriptions of specific devices.
- PART III. "Managerial Account" — covers the general administrative aspects of the Operation.
- PART IV. "Conclusions and Recommendations" — prepared by the Manager, Albuquerque Operations, with respect to activities which affect TG 7.5 functions.

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PART I
GENERAL ACCOUNT

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CHAPTER I OPERATIONAL SITES

1.1 The Atomic Energy Commission's Eniwetok Proving Ground (EPG) is comprised of the complex of islands in the Eniwetok and Bikini Atolls. During Operation HARDTACK, Phase I, Johnston Island was added to the complex of EPG to provide a firing site for two high altitude bursts (TEAK and ORANGE) which were originally scheduled for launching from Site How, Bikini Atoll. (See Fig. 1-5, Sphere of Operations).

1.2 Detailed geographical layouts and land areas of the Eniwetok and Bikini Atoll and Johnston Island are shown on Figs. 1-1, 1-2, 1-3, 1-4, 1-6, and 1-7. TG 7.5 provided construction and service activities to 33 islands in the Eniwetok Atoll and 20 islands in the Bikini Atoll.

1.3 On 5 April 1958, prior to the first nuclear detonation of the HARDTACK series, AEC officially established a danger area around EPG (See Figure 1-5) to avoid possible damage to transient aircraft, fishing craft, and surface shipping vessels. The danger area encompassed the Eniwetok Proving Ground and ocean areas bounded by 18°30'N, 156°00'E; 18°30'N, 170°00'E; 11°30'N, 170°00'E; 11°30'N, 166°16'E; 10°15'N, 166°16'E; and 10°15'N, 156°00'E, extending North to 18°30'N, 156°00'E. This area was declared safe on 8 September 1958, whereas the operational phase of Operation HARDTACK, Phase I, was terminated 15 September 1958.

1.4 Three separate danger areas were established for the Johnston Island area:

1.4.1 In its Newsreel Operations Order, JTF-Seven established a "Missile Danger Area" in which no aircraft would fly from H minus 3 minutes until H-hour. Arrangements were made for the JTF-Seven Missile Flight Safety Officer to take emergency flight termination action to prevent impacting of an erratic missile outside of this area. The missile danger area was described by JTF-Seven as "that surface area enclosed by a circle of 200 nautical miles radius and centered at the launching pad, excluding that part of the circle beyond a line perpendicular to the launching azimuth (180° true) and 40 nautical miles to the rear of the launching pad. The launching pad is located at 16°44'32"N, 169°30'53"W."

1.4.2 Aircraft were excluded from the "Air Closure Area" which was defined as a circle 520 nautical miles in radius, centered on Johnston Island. Arrangements for this area were made by representatives of JTF - Seven in conference with members of the 6th Regional Office, Civil Aeronautics Administration, and with the concurrence of the latter's headquarters. It became effective upon notice of an impending "live" shot by JTF - Seven. This information was then disseminated by the 6th Regional Office, CAA, to each of the Air Route Traffic Control Centers feeding traffic into this area. It was the responsibility of each Center to ensure that all air traffic was outside this circle at the planned H-hour and that in-bound traffic would not be cleared into that area until the detonation had taken place or a definite postponement had been received. This air closure area applied at all altitudes from 5000 feet, the the minimum over-water clearance altitude, and up.

1.4.3 Effective 25 July 1958, a "Surface Danger Area" was established for the Johnston Island area by JTF - Seven Operation Order (Hydropac 601.58ABCD) which designated the danger area as "a circle with a 400-mile radius centered at Latitude 16°45'N, Longitude 169°31'W." The danger area restriction was lifted 25 August 1958.

1.5 JTF - Seven was responsible for all Rad-Safe and weather information; however, TG 7.5, in its support capacity, performed varying degrees of construction and provided camp support operations and or maintenance to the various outlying stations listed below, as directed by JTF - Seven.

Utirik

Kusaie

Kapingamarangi

Nauru

Tarawa

Ponape - Operated by U. S. Weather Bureau

Truk - Operated by U. S. Weather Bureau

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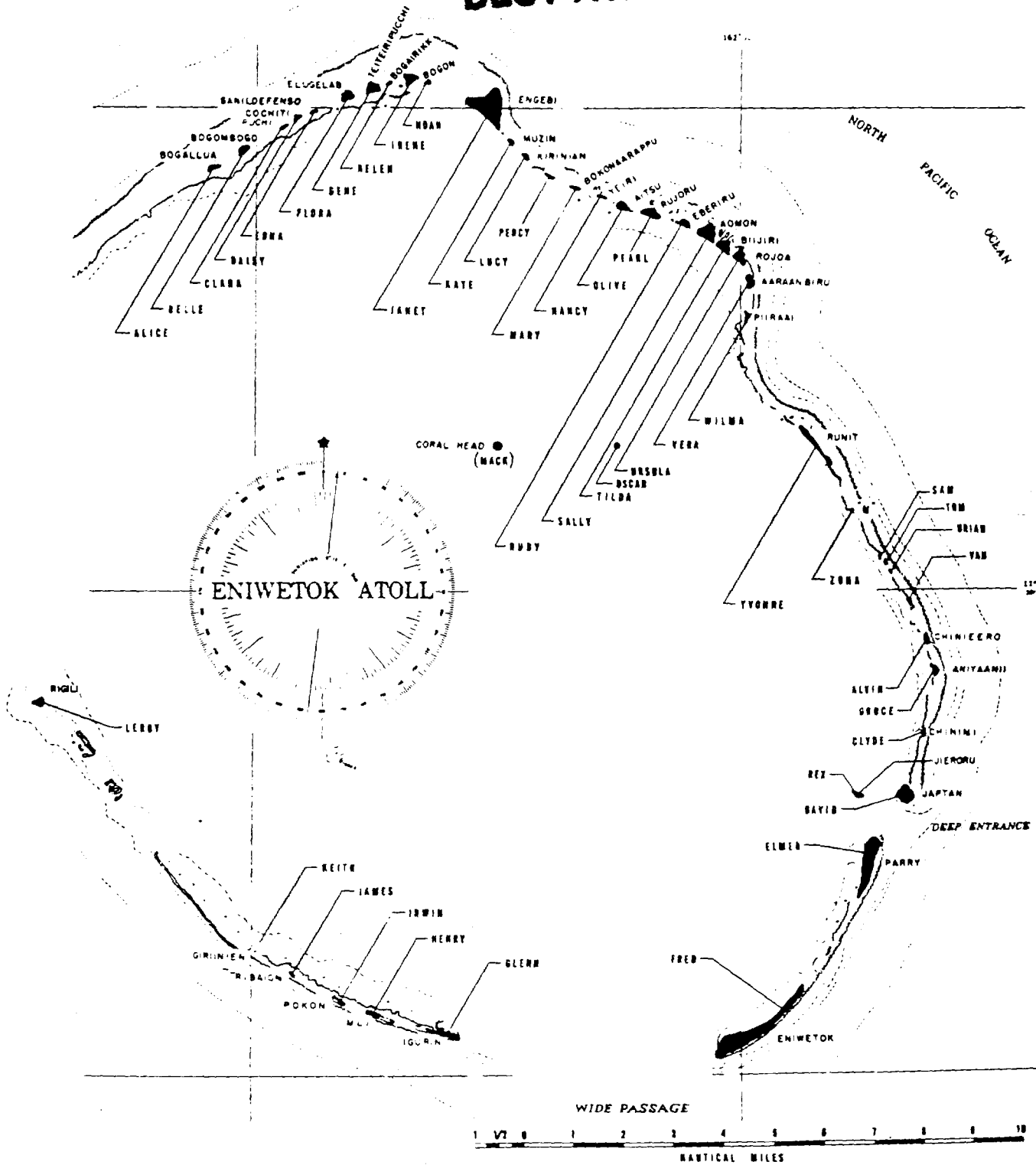


Figure 1-1. Eniwetok Atoll.

<u>SITE</u>	<u>SQ. FT.</u>	<u>ACRES</u>
FRED	14,019,200	321.84
JANET	12,657,600	290.58
ELMER	9,574,200	219.79
SALLY	4,323,600	99.26
YVONNE	4,071,600	93.47
DAVID	3,430,400	78.75
PEARL	2,358,000	54.13
TILDA	2,263,500	51.96
IRENE	1,989,000	45.66
URSULA	1,762,200	40.45
OLIVE	1,758,600	40.37
GLENN	1,758,600 (EST.)	40.37
HENRY	1,758,600	40.37
VERA	1,645,200	37.77
BELLE	1,328,400	30.50
IRWIN	1,328,400 (EST.)	30.50
BRUCE	1,108,000	25.44
KEITH	1,088,000 (EST.)	25.44
GENE	1,008,000	23.14
ALICE	974,700	22.38
DAISY	924,300	21.22
JAMES	885,712 (EST.)	20.34
LUCY	884,725	19.39
KATE	692,475	15.90
WILMA	630,000	15.83
HELEN	689,400	14.46
LEROY	590,475	13.56
MARY	505,625	11.61
NANCY	480,600	11.03
EDNA	429,300	9.86
RUBY	357,300	8.20
CLARA	298,800	6.86
VAN	285,825	6.56
REX	231,775	5.32
PERCY	209,400	4.81
URIAH	167,150	3.84
CLYDE	134,100	3.08
ALVIN	95,025	2.18
TOM	80,000	1.84
SAM	39,350	0.90
40 Sites	2.83 Sq. Miles	1,808.96

Figure 1-2. Land Areas — Eniwetok Atoll.

<u>SITE</u>	<u>SQ. FT.</u>	<u>ACRES</u>
HOW (SE)	12,684,932	291.21
HOW (NW)	11,106,666	254.97
NAN	12,972,603	297.81
UNCLE	9,444,444	216.81
CHARLIE	5,755,500	132.13
FOX	2,097,222	48.15
SUGAR	2,081,081	47.78
PETER	2,013,889	46.23
OBOE	2,000,000	45.91
ABLE	1,404,000	32.23
VICTOR	1,561,644	35.85
DOG	1,513,514	34.75
GEORGE	1,444,444	33.16
WILLIAM	1,287,671	29.56
TARE	1,087,000	25.00
KING LOVE	1,067,485	24.51
ROGER	702,703	16.13
EASY	619,718	14.23
ZEBRA	581,081	13.34
ALFA	310,811	7.14
JIG	310,811	7.14
BRAVO	270,270	6.20
MIKE	270,270	6.20
YOKE	180,556	4.14
<u>ITEM</u>	<u>155,406</u>	<u>3.57</u>
25 Sites	2.62 Sq. Miles	1,674.15 Acres

Figure 1-4. Land Areas — Bikini Atoll.

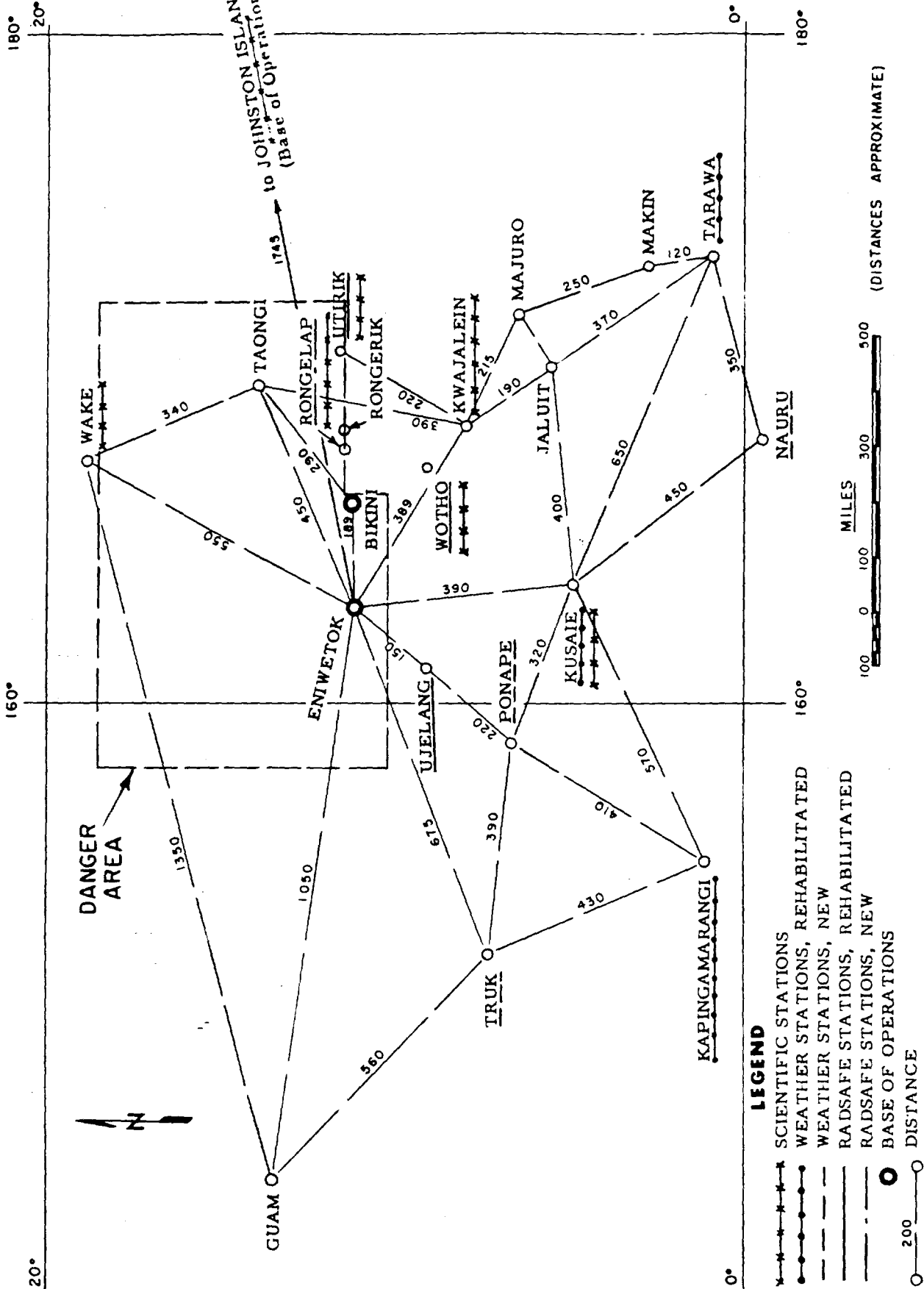


Figure 1-5. Sphere of Operations.

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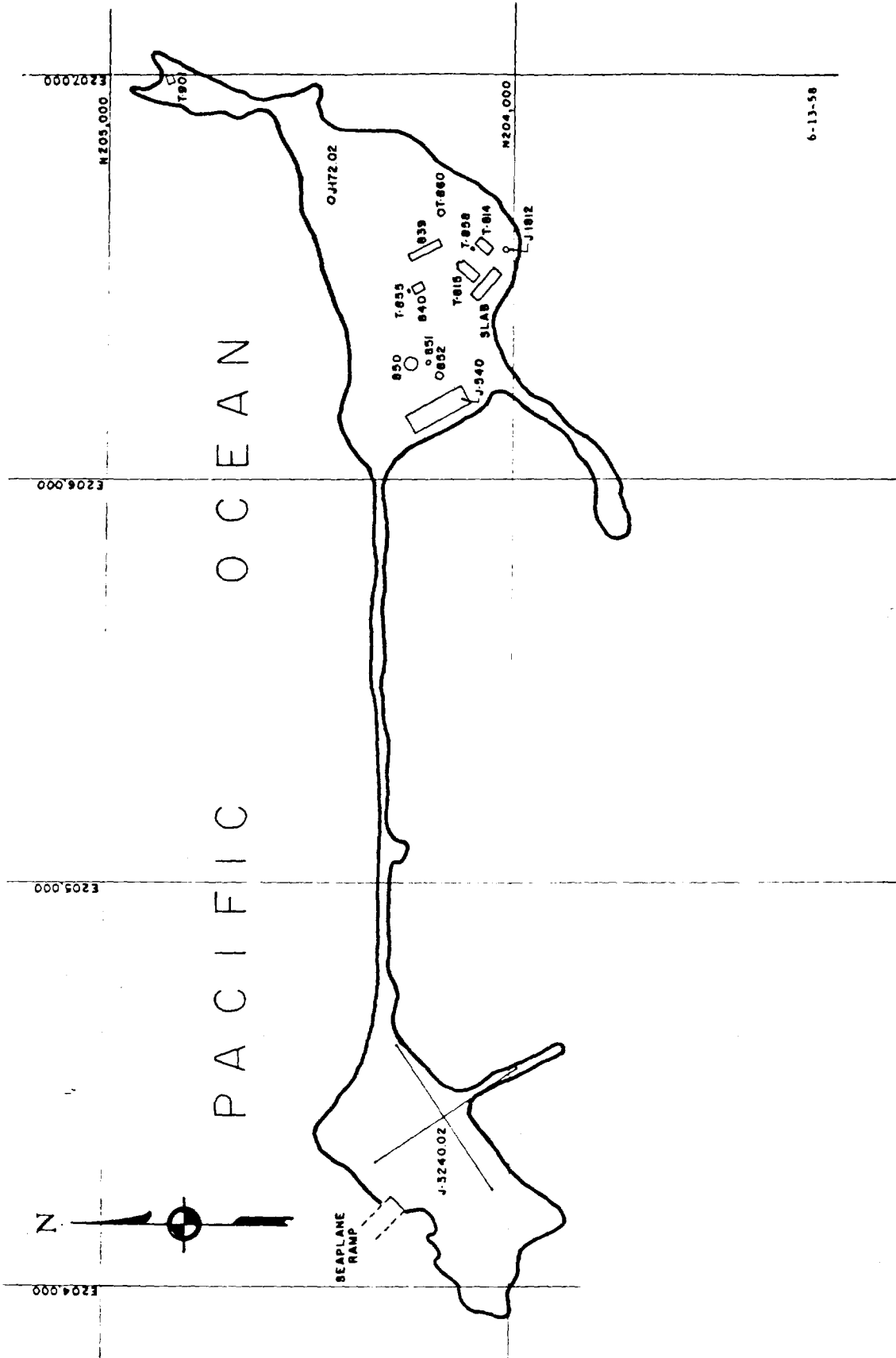


Figure 1-7. Sand Island.
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PART I, CHAPTERS 1 and 2

- *Rongelap
- *Wotho
- *Ujelang

*At these locations Rad-Safe information was provided by U. S. Public Health Service personnel, independent of the JTF-Seven Weather Service staff. All stations provided Rad-Safe service as a protection to the inhabitants.

H&N performed new construction on Truk, Rongelap, Ponape, and Nauru, 660, 280, 370, and 770 nautical miles respectively from Eniwetok Atoll. Rehabilitation and or new construction were also provided at the other off-atoll sites. The camps at Wotho, Ujelang, Utirik, and Rongelap were operated by H&N, whereas the other off-atoll locations were operated by JTF-Seven.

CHAPTER 2

MISSION — TASK GROUP 7.5

2.1 The principal tasks assigned by CJTF-Seven to TG 7.5 were detailed in the following JTF-Seven publications:

- a. Administrative Plan 1-58
- b. Operation Plan 1-58
- c. Operation Order 35-58 (HARDTACK-Johnston Island Phase)
- d. Operation Order 45-58 (Interim Phase Operation Order)

2.2 Based on the above documents, CTG 7.5 published the following:

- a. CTG 7.5 Operation Order 1-58
- b. Standard Operating Procedure Task Group 7.5
- c. Special instructions for each event

2.3 The following is a brief summary of the responsibilities of TG 7.5:

- a. Provide the necessary structures to meet diagnostic and military effects test requirements.
- b. Construct and operate camp or base facilities at Johnston Island, Bikini Atoll, and all islands of Eniwetok Atoll, except Sites Fred and David.
- c. Operate all utilities at Bikini Atoll, Eniwetok Atoll, and Johnston Island, except the POL farm on Site Fred.
- d. Construct camp and operating facilities at off-atoll Weather and Rad-Safe Stations.
- e. Operate and maintain communications centers to serve TG 7.1 and TG 7.5.
- f. Operate and maintain telephone systems required at Eniwetok and Bikini Atolls, except Site Fred.

g. Support TG 7.1 Rad-Safe organization by providing personnel, equipment, and facilities.

h. Operate pass and badge system for EPG.

i. Operate guard system for the protection of restricted areas.

j. Handle reception, custody, security, and movement of test devices, weapons, and classified materials within the EPG.

k. Operate and maintain TG 7.5 boat pools at Sites Elmer and Nan, and at Johnston Island.

l. Provide stevedoring and trucking operations.

m. Participate in Task Force pre-shot and emergency post-shot evacuation plans.

n. Provide Air Priorities Agents and cargo handling personnel to expedite and control the shipment of personnel and cargo between Eniwetok and Bikini Atolls and between Eniwetok Atoll and the Weather and Rad-Safe Stations.

2.4 Three major obstacles were encountered in accomplishing the mission of TG 7.5.

- (1) The late receipt of criteria from the Users and the advancement of the Operation starting date from 1 May to 15 March 1958 compressed the construction schedule into one that was approximately three months less than that of Operation REDWING. It should be noted that since the Laboratories did not have a firm delivery schedule for all devices to be tested in sufficient time to provide diagnostic requirements and criteria to H&N, con-

siderable hardship in meeting construction deadlines was experienced.

- (2) The dismantling of the completed VHA Scientific Stations on Site How and their movement and reconstruction on Johnston Island diverted considerable quantities of personnel, materials, equipment, and ships from Eniwetok and Bikini Atolls.
- (3) The size of Operation HARDTACK, Phase I, embracing 35 events as compared with 17 for Operation REDWING, required considerable additional construction, particularly shot-barges.

2.5 It was necessary to institute several emergency measures to perform the tasks of TG 7.5. Critical materials and equipment were procured at premium prices on a "crash" basis and transported to Jobsite by air. H&N was authorized by the CTG 7.5 to use essential

craftsmen, such as structural steel workers, welders, electricians, pile drivers, cable crews, plumbers, carpenters, and boat crews 12 hours per day, seven days a week. In emergency situations, such as laying 2,000,000 feet of cable which had been delayed in shipment, the Contractor was authorized to use supervisory personnel and others to meet the prescribed ready dates.

2.6 No attempt will be made to report in detail the accomplishment of each of the tasks assigned to TG 7.5. In brief, all assigned tasks were completed satisfactorily. It should be noted, however, that delays would have been experienced in meeting established scientific ready dates if both construction and scientific personnel had not worked long hours of overtime. "Crash" construction was generally attributable to late delivery of supplies and lack of approved construction drawings at critical times. One noteworthy improvement over Operation REDWING was in communications at Eniwetok Atoll and between Eniwetok and Bikini Atolls.

CHAPTER 3 AUTHORITY

3.1 DMA, by TWX-NR-S88, dated 20 February 1958, stated that the President had approved the HARDTACK program as submitted by the Commission and had also authorized the expenditure of the special nuclear materials required for the HARDTACK test devices.

3.2 The following is quoted from a memorandum from DMA to the Manager, ALOO, dated 7 March 1958, subject "Designation of Senior Atomic Energy Commission Representative for Operation HARDTACK."

"The Commission, with the concurrence of the Department of Defense, has designated Major General Alvin R. Luedecke, Commander, Joint Task Force Seven, as its senior representative at the Eniwetok Proving Ground, effective March 15 (Eniwetok time) 1958, with full authority to act for the Commission in all matters concerning the successful execution of Operation HARDTACK. The terminal date for this authority cannot now be set, but it should coincide with the end of the operational phase of HARDTACK. A copy of the Chairman's letter requesting General Luedecke to accept this authority is attached.

"You are hereby authorized to ship to the SSN materials accountability station at

EPG the amounts of special nuclear materials required for the sixteen LASL and DOD shots which were enumerated in my January 29, 1958, message, including materials for such spares as may be required. You are also directed to transfer custody of the nuclear devices involved in those sixteen shots, including the expendable and spare nuclear materials referred to above, to General Luedecke, Commander, Joint Task Force Seven, under his delegated authority as Senior Atomic Energy Commission Representative at the EPG. This transfer of custody will be made effective on March 15 (Eniwetok time) for those devices and components on hand in the EPG, on arrival at the EPG for those devices and components enroute on March 15 (Eniwetok time), and at the time subsequent to March 15 (Eniwetok time) and place in the continental United States that the devices and components are delivered plane-side for shipment to the forward area, and will terminate with the delivery of the unexpended devices and components to the authorized AEC courier in the continental United States on return from the forward area, or with the end of the operational period which will also terminate the delegation of authority to the Commander, Joint Task Force Seven, whichever is sooner.

PART I, CHAPTERS 3 and 4

"During the operational period, the Commander, Task Group 7.5 (Assistant Manager for Test Operations, ALOO) will have physical custody of and be accountable to the Senior AEC Representative for all nuclear devices and their components on hand or enroute at its start, as well as for those placed in his custody during the operational period. The Commander, Task Group 7.5, will also be responsible for the operation of the SSN materials accountability station for the EPG. At the end of the operational period the Assistant Manager for Test Operations, ALOO, will resume complete custody and be accountable to the Manager, ALOO, for the nuclear devices and their components still on hand as of that date.

"Our delegation of authority to the Commander, Joint Task Force Seven for both Operation HARDTACK and the EPG during the operational phase of HARDTACK is necessary for his successful conduct of that operation. It is recognized that we have thereby withdrawn from you, for the period involved, certain responsibilities which had been previously been delegated to you. Nevertheless, it is desired that you retain your long term responsibility for the EPG and by means of direct liaison with and reports from

Joint Task Force Seven, assure yourself that you will be able to resume your original position of responsibility with respect to the EPG upon the termination of General Luedecke's special authority.

"As to the fiscal aspects of the operation, agreements already in force between ALOO and the Joint Task Force will apply. In addition, you will support the operational needs of Joint Task Force Seven to the limit of the funds currently made available to you for that purpose, noting that General Luedecke has been instructed to consult with the Commission in case operational necessity should require the expenditure of AEC funds in excess of those available to you.

"The Commission is aware of the many temporary administrative adjustments and compromises required for the success of Operation HARDTACK. We believe, however, that cooperation between you and the Commander, Joint Task Force Seven, as in the past, will solve any difficulties that may arise."

3.3 In accordance with TWX-NR-1013, dated 24 September 1958 from DMA, the operational phase of Operation HARDTACK, Phase I, was terminated 15 September 1958.

**CHAPTER 4
ORGANIZATION**

4.1 During the interim, the planning, the build-up, and part of the roll-up periods relating to Operation HARDTACK, the maintenance and development of EPG were the responsibility of the Assistant Manager for the Office of Test Operations as delegated to him by the Manager, ALO. (See Figs. 1-8 and 1-9). During these periods, the CJTF-Seven exercised no direct jurisdiction over EPG activities. He was, however, responsible for performing operational planning and coordination.

4.2 The JTF-Seven organization became responsible for all facets of Operation HARDTACK on 15 March 1958, when the operational phase officially started. Command and functional relationships are depicted on Fig. 1-10. The CJTF-Seven was the senior AEC representative at EPG during the operational period.

4.3 For Operation HARDTACK, TG 7.5 was organized as shown in Fig. 1-11.

4.4 At the beginning of the operational period, the Assistant Manager for Test

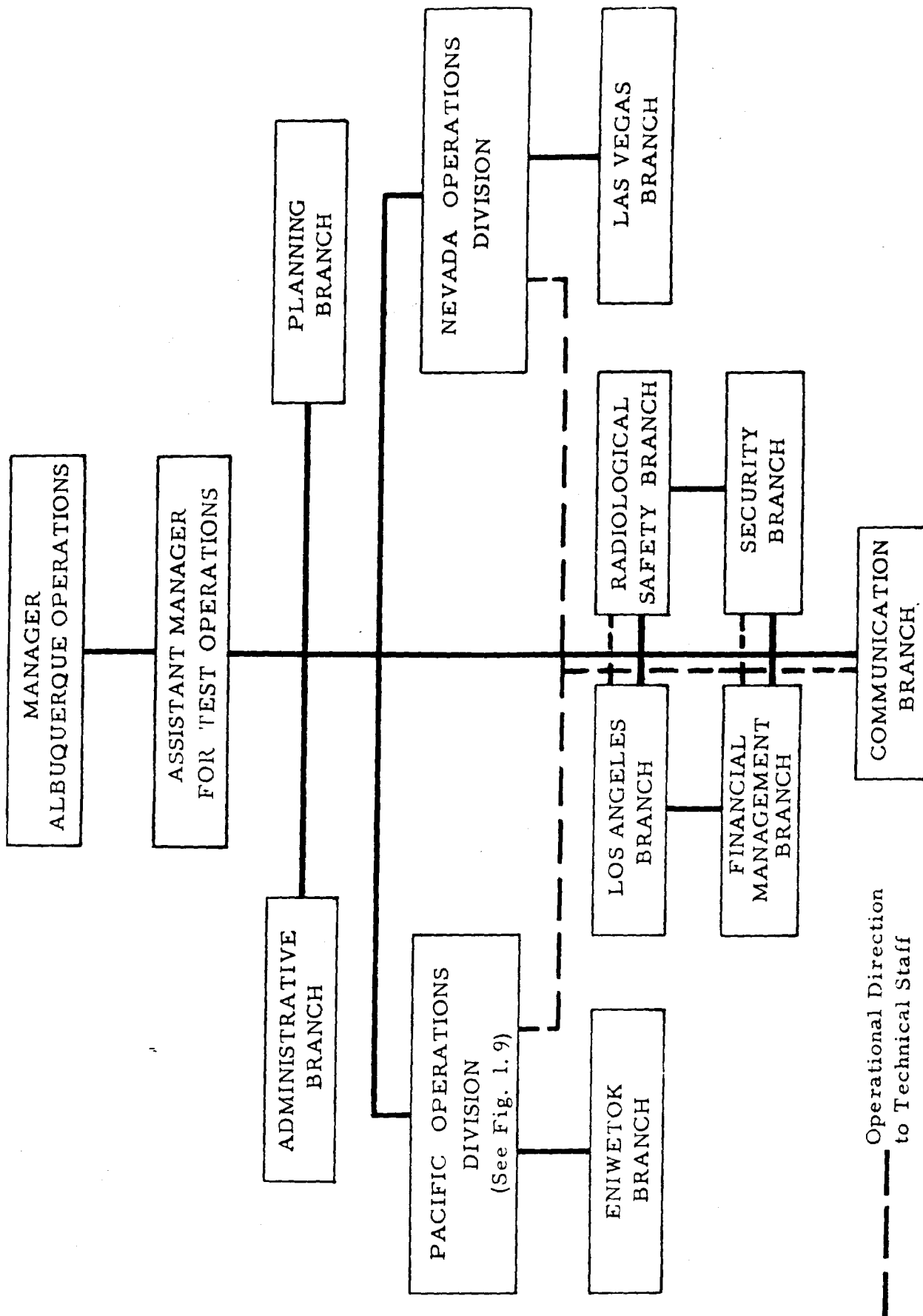
Operations, ALO, AEC, assumed the duties and responsibilities of the CTG 7.5. The Director, Pacific Operations Division, ALO, was the Deputy Commander, and the Chief, Eniwetok Branch, AEC, was the Chief of Staff. The personnel for the staff came from the Office of Test Operations, ALO; the Eniwetok Branch Office, AEC; the Las Vegas Branch Office, AEC; and H&N.

4.5 The various Task Units of TG 7.5 comprised the regular divisions of H&N's EPG organization, augmented by personnel for the build-up and operational periods.

4.6 Security officers for E-2 operations were obtained on a loan basis from ALO, SAN, and LASL.

4.7 With the advent of Johnston Island events, transfers from within TG 7.5 were made without augmentation of personnel or overhead.

4.8 Detailed duties and responsibilities of the Commander, Deputy Commander, Chief of Staff, Resident Manager, H&N, staff officers,



Operational Direction
to Technical Staff

Figure 1-8. Organization -- Office of Test Operations.

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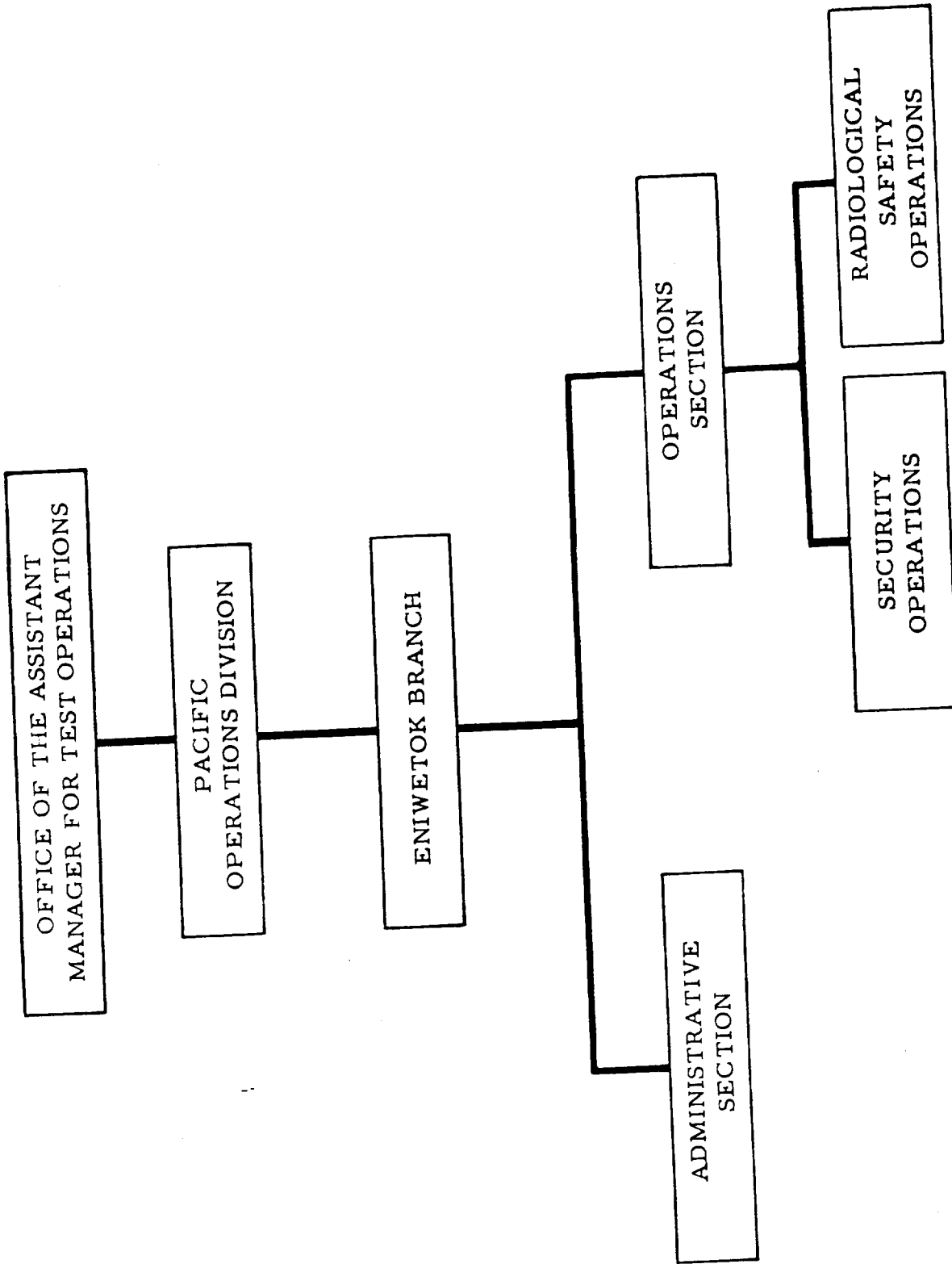


Figure 1-9. Organization — Pacific Operations Division.

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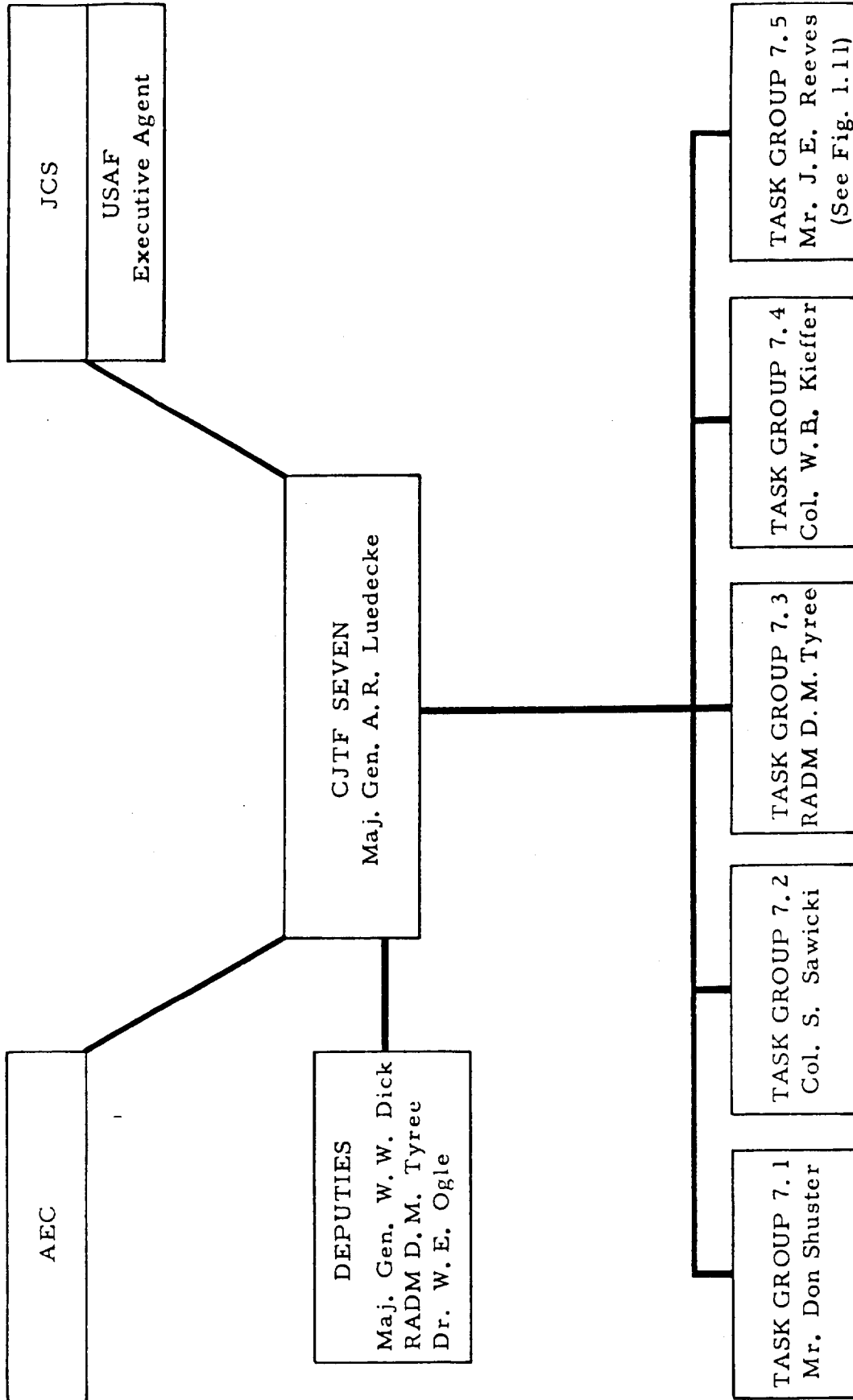


Figure 1-10. JTF-7 Organization for Operation HARDTACK.

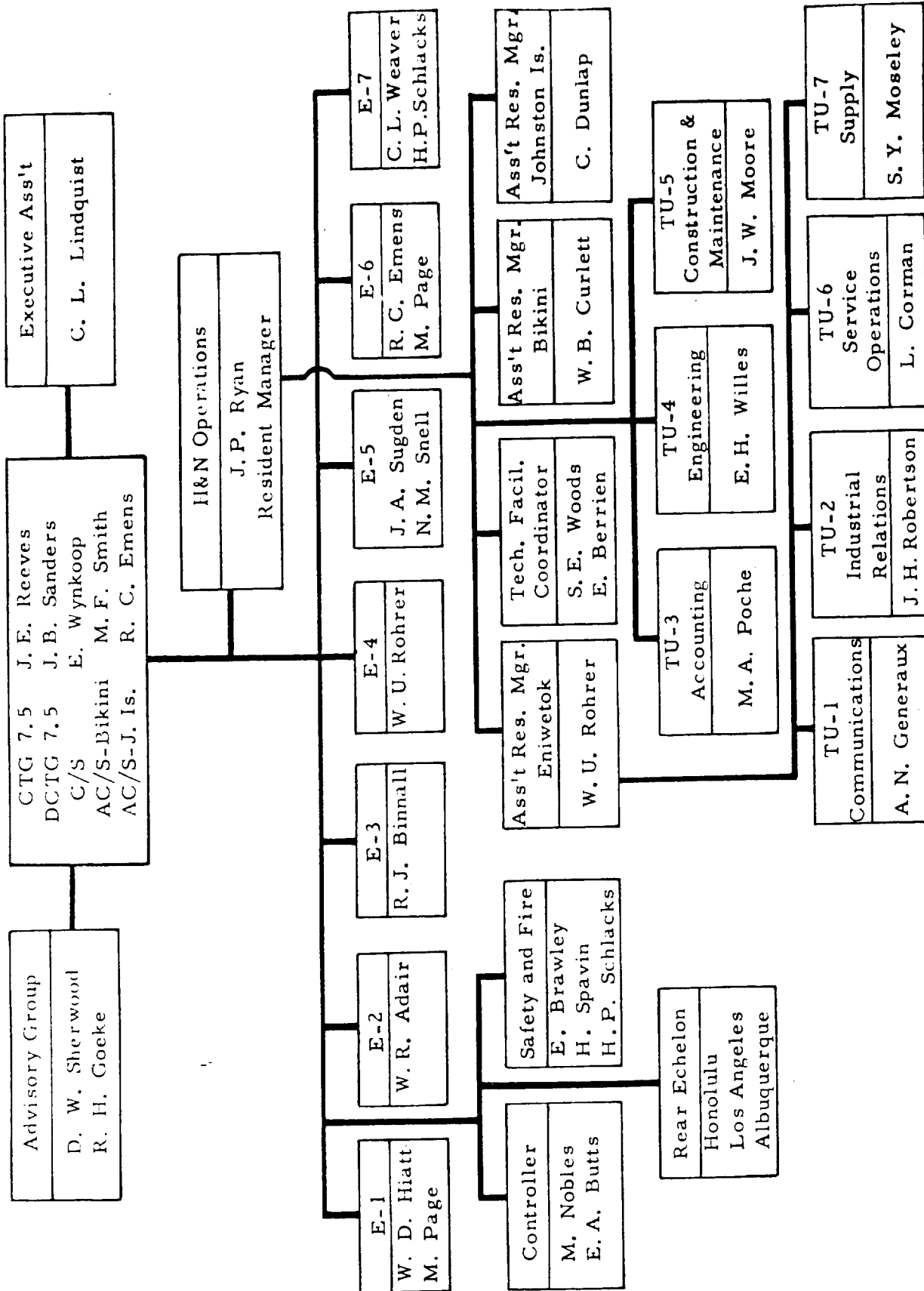


Figure 1-11. TG 7.5 Organization Chart.

controller, and safety and fire protection engineers were determined and published in Chapter 0102, Standard Operating Procedure, TG 7.5.

4.9 In September 1957, the Director, POD, ALO, authorized direct communications between the Users and H&N's Los Angeles Office to expedite the completion of design, procure-

ment of materials, and construction of scientific test structures. Copies of correspondence were transmitted to all offices concerned. In November 1957 liaison engineers from the H&N Los Angeles Office were placed on TDY at LASL and UCRL. This system materially assisted the Contractor in meeting construction ready dates.

CHAPTER 5
PARTICIPATING AGENCIES

USER

ABMA	Army Ballistic Missile Agency
AFCRC	Air Force Cambridge Research Center
AFSWC	Air Force Special Weapons Center
BRL	Ballistic Research Laboratories (Aberdeen Proving Ground, USA)
BuAer	Bureau of Aeronautics, U. S. Navy
CWL	Chemical Warfare Laboratory (USA)
DBM	Division of Biology and Medicine
DMA	Division of Military Application, AEC
DOD	Department of Defense
DOFL	Diamond Ordnance Fuze Laboratory
DTMB	David Taylor Model Basin, U. S. Navy
EG&G	Edgerton, Germeshausen and Grier, Inc.
H&N	Holmes & Narver, Inc.
LASL	Los Alamos Scientific Laboratory
MDL	Missile Development Laboratory
NASWF	Naval Air Special Weapons Facilities
NAVCEL	Naval Civil Engineering Laboratory
NEL	Naval Electronics Laboratory
NML	Naval Materiel Laboratory
NOL	Naval Ordnance Laboratory
NRDL	Naval Radiological Defense Laboratory
NRL	Naval Research Laboratory
ONR	Office of Naval Research
R. W	Ramo-Wooldridge Corporation
SC	Sandia Corporation
SCEL	Signal Corps Engineering Laboratory
SIO	Scripps Institution of Oceanography
SRI	Stanford Research Institute
UCRL	University of California Radiation Laboratory
WADC	Wright Air Development Center

CHAPTER 6 SIGNIFICANT EVENTS

JOHNSTON ISLAND

6.1 DMA, in a letter to LASL on 22 March 1958, first questioned the propriety of detonating two atomic devices over EPG for the ABMA program (sponsored by DOD). Innumerable conferences and voluminous correspondence among all elements of the HARDTACK organization preceded the decision in early April 1958 to abandon the Site How ABMA launching site (substantially completed on 6 April 1958) and to relocate the facilities on Johnston Island.

6.2 Following the official notification on 10 April 1958 that facilities would be moved from Site How to Johnston Island, numerous conferences were held among all participants in the ABMA program to determine the scope of activity. Since the Users were at EPG, H&N performed all engineering design at Site Elmer. It was determined that engineering design could be most efficiently expedited at EPG using engineering personnel who were cognizant of ABMA program problems experienced at the Site How installation.

6.3 An inspection of the utilities at Johnston Island disclosed that most of them were in need of repair; hence, extensive maintenance was performed prior to housing the full complement of personnel required for the two events scheduled there. Operation of all major facilities at Johnston Island was assumed by H&N prior to 13 May 1958.

6.4 The logistics problem was one of the major difficulties encountered during the construction build-up. The channel had to be cleared of coral heads to permit entry by LST's; a coastal tug was secured from the Navy and operated by an H&N crew, and a beaching ramp was constructed for LST's. In order to maintain the anticipated construction schedule, it was necessary to transship all existing equipment

and materials from Site How to Johnston Island. Procurement of additional scientific equipment and materials from Honolulu and the Mainland was also necessary, with shipments being made in most instances by MATS and commercial air freight to Honolulu for transshipment to Johnston Island. During the construction period, a total of 35,194 measurement tons (5580 long tons) were received at Johnston Island by surface craft and 2,193,955 pounds by air.

6.5 A 60-hour extended work-week was required during the construction phase to maintain the accelerated construction schedule. Scientific Station construction was initiated on 2 May 1958, and work continued at an accelerated pace until the completion of all Scientific Stations on 7 July 1958. Arrangements were made with the Navy to secure from Hawaii various items of heavy equipment required for the Johnston Island phase of Operation HARDTACK to avoid interference with progress at Eniwetok and Bikini Atolls.

6.6 The TEAK event, originally scheduled for firing from Site How on 23 April 1958, was detonated over Johnston Island on 31 July 1958. The ORANGE event, originally scheduled for firing from Site How on 7 May, was detonated over Johnston Island on 11 August.

REPATRIATION OF RONGELAP NATIVES

6.7 Between Operations REDWING and HARDTACK, 250 Rongelap natives were transported from their temporary home at Ejit Island, Majuro Atoll, and returned to newly constructed homes on Rongelap Atoll. Details of the repatriation were published by H&N for the AEC in a report entitled "Report of Repatriation of the Rongelap People," dated November 1957, and distributed to all offices concerned.

CHAPTER 7
REFERENCES

7.1 The Report of the Manager, ALO, is limited to those functions which are the responsibility of TG 7.5; hence, the reader requiring further information relating to Operation HARDTACK is referred to the following listed reports:

TITLE	AUTHOR
✓ 1. Final Report of the Commander, TG 7.1 (Scientific)	TG 7.1
2. Final Report of the Commander, TG 7.2 (Army)	TG 7.2
3. Final Report of the Commander, TG 7.3 (Navy)	TG 7.3
4. Final Report of the Commander, TG 7.4 (Air Force)	TG 7.4
✓ 5. Final Report of the Commander, JTF-Seven	CJTF-Seven
6. Report on "Study of the Safety Aspects of UHA and VHA for Operation HARDTACK" by Safety Working Group (21 Oct. 1957)	AFSWP
7. Final Report — "Operation HARDTACK Communications-Electronics"	JTF-Seven
8. Completion Report, Operation HARDTACK, Phase I	H&N
9. Monthly Narrative Reports (January 1957 - October 1958)	H&N
10. "TG 7.5 On-Site Rad-Safe Report"	H&N, and OTO, ALO
11. Long Range Improvement Planning at EPG, 1959 through 1962. (June 1958) - Volumes I and II	H&N
12. Meteorological Report on Operation HARDTACK (6 volumes)	JTF-Seven
13. Status of WT Reports.	AEC Technical Information Service Extension, Oak Ridge, Tennessee

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PART II
SCIENTIFIC ACCOUNT

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**CHAPTER 1
GENERAL OBJECTIVES**

1.1 The HARDTACK test series at EPG was designed to achieve the following objectives which are vital to the continued progress in research and development of atomic weapons and in the improvement of atomic defense:

- a. To test-proof certain weapons in stockpile or to be stockpiled in the

near future;

- b. To continue developmental research on promising weapons;
- c. To continue long-range weapons research of new techniques, ideas, and designs; and
- d. To conduct a weapons effects program required by DOD.

**CHAPTER 2
TEST EVENTS**

ORIGINAL CONCEPT

2.1 AEC Staff Paper 952 19 (Test Activities for Calendar Year 1958) secured formal approval for Operation HARDTACK, which included the following atomic detonations:

FIRM LABORATORY SHOTS

- 8 sponsored by LASL — 7 on barges; 1 on surface
- 9 sponsored by UCRL — all on barges

CONTINGENCY LABORATORY SHOTS

- 3 sponsored by LASL — 2 on barges; 1 in shallow water or in a barge

DEMONSTRATION SHOT (UN OBSERVERS)

- 1 shot on a barge sponsored by AEC

DOD EFFECTS SHOTS

- 3 shots at high altitude
- 2 shots underwater

These 26 shots were contemplated as of

1 May 1957.

SHOT EXPERIENCE

2.2 The following is a summary of shots actually detonated at EPG during Operation HARDTACK (Operational phase 15 March 1958 — 15 September 1958):

LABORATORY DIAGNOSTIC SHOTS

LASL sponsored 13 barge shots, of which one was a one-point safety shot.

LASL sponsored 2 ground shots.

UCRL sponsored 13 barge shots.

UCRL sponsored 2 ground shots, of which 1 was a "zero" shot.

DOD sponsored 2 underwater shots.

DOD sponsored 3 high altitude shots.

Total — 35

2.3 Figs. 2-1A and 2-1B, entitled "Shot Delay Chart," include all of the events of Operation HARDTACK, Phase I, with an indication of the various types of delays preliminary to the actual detonation.

**CHAPTER 3
SUMMARY OF RESULTS**

Details of the original scientific concept of the Operation, complete descriptions of test devices, device yield, and performance data are omitted from this report, since details of this information have been included in the Final Op-

eration HARDTACK Report of CTG 7.1 to CJTF-Seven. This information is available from CTG 7.1 of JTF-Seven on a "need-to-know" basis.

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PART II, CHAPTER 3

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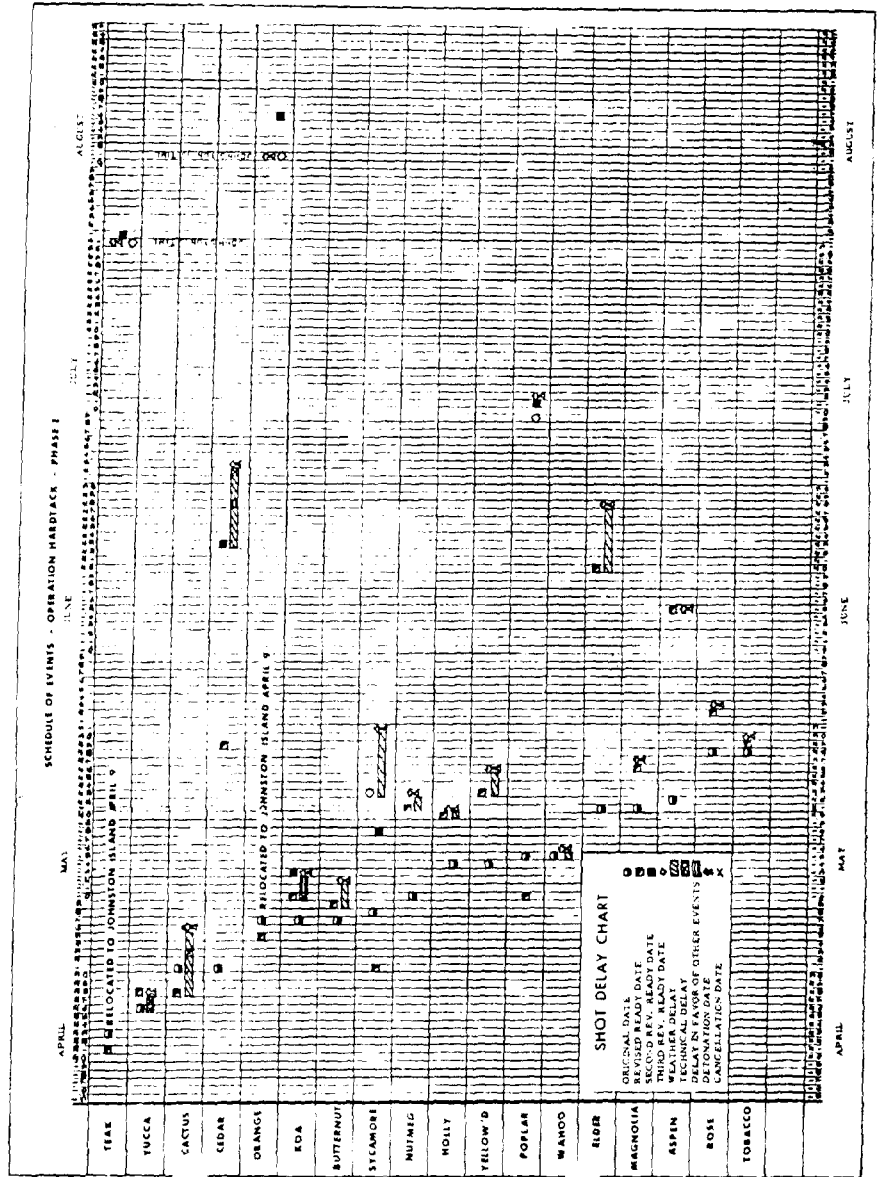


Figure 2-1A. Shot Delay Chart (Sheet 1 of 2).

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PART III
MANAGERIAL ACCOUNT

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CHAPTER 1

PLANNING

1.1 Plans for the improvement of EPG base facilities (PAC construction) were drawn up and submitted to ALOO by the Contractor in March 1957 for inclusion in the FY 1958 budget.

1.2 Formal planning for expendable test facilities for the HARDTACK Operation, scheduled for Spring 1958 at EPG, began late in 1956, several months after the successful conclusion of Operation REDWING (last detonation of this series was 22 July 1956). Criteria for test facilities began to be developed in late Spring 1957.

1.3 Plans for advance procurement and shipment of construction materials and equipment began at the Contractor's Los Angeles Office and at Jobsite in January, 1957.

1.4 Planning for all facets of TG 7.5 operational responsibilities for Operation HARDTACK at EPG began in earnest in January, 1957, with the preparation of the budget for FY 1958. The scheduled PAC construction assumed that Operation HARDTACK would be approximately the same size as Operation REDWING.

1.5 As early as July, 1958, it became apparent, based on a study of TG 7.1's general concept, that Operation HARDTACK would be at least 60% larger than Operation REDWING; hence, a revised estimate of required funds was submitted to DMA. Authority for additional advance procurement was also requested.

1.6 Coordination of all planning was effected by AEC ALO direct communications with the various Scientific Users; conferences sponsored by CJTF-Seven; EPG Planning Board meetings; Project Officers' conference at Sandia Base; engineering and construction conferences with H&N; and inspection trips to EPG.

1.7 In October, 1957, after receipt and study of the JTF-Seven Operation Plan, the Pacific Operations Division, ALO, began the preparation of TG 7.5 directives. The Director, POD, made a decision to simplify the TG 7.5 Operation Plan through the use of a Standard Operating Procedure. The bulk of routine instructions plus new instructions on items, such as the check-cashing service, that were not classified were included in the SOP and distributed to JTF-Seven; all Task Groups; all AEC offices directly concerned; Field Command, AFSWP;

AFSWC; LASL; UCRL; Sandia Corporation; and all other agencies that participate regularly in EPG operations.

1.8 The TG 7.5 Operation Plan 1-58 was issued on 14 February 1958 and included only essential classified information and instructions that could not be issued in the unclassified SOP. Distribution was limited to offices which required this information.

1.9 The Chiefs, Financial Management, Security, and Communications Branches of OTO, ALO, made detailed advance plans for their respective operations at EPG. The Financial Management Branch issued a classified Chart of Accounts and detailed instructions on the preparation of improved Cost Reports. Details on Security and Communications plans are covered in Chapters VII and VIII.

1.10 E-3, TG 7.5, was assigned the responsibility for TG 7.5 operational plans, including evacuation plans. E-3 prepared, issued and supervised the execution of detailed plans for the evacuation of TG 7.5 personnel for each event and coordinated the plans with JTF-Seven and other Task Groups.

1.11 Similarly, E-4, TG 7.5, was responsible for the preparation and execution of plans for TG 7.5 supply and transportation operations. Plans for over-all requirements of supplies, materials, and equipment were prepared at Jobsite and transmitted to the Los Angeles Office for procurement and shipment to the EPG. Individual plans were made for the over-all supply requirements for Bikini Atoll and later for Johnston Island. Changes and additions to the shot schedule required an alteration of the supply and transportation plans. Transportation plans for supplies, materials, equipment, and personnel by land, sea, and air were also continuous and comprehensive. Brief reports on the transportation and supply operations of TG 7.5 are included in Chapters IX and X.

1.12 Another major field in which planning played an important part was in the engineering, construction, operation, and maintenance of base facilities and scientific test facilities. Detailed plans and cost estimates were prepared, both at the Los Angeles Office and at Jobsite. The Chief, Los Angeles Branch, AEC, supervised the work and approved plans for construction at the Los Angeles Office. E-6, TG 7.5, performed the same functions at Jobsite. For

information on these operations, refer to Chapters III and IV.

1.13 Plans for JTF-Seven Weather Rad-Safe Stations called for the re-activation of stations at Rongerik, Kusaie, Ujelang, Rongelap, Wotho, Kapingamarangi, and Tarawa and the construction of new facilities at Utirik, Nauru, Ponape, and Truk. The Chief, Eniwetok Branch, AEC, handled the negotiations for sites and clearances directly with the U. S. High Commissioner, Trust Territories, Pacific; the British Resident Commissioner, Tarawa; and the Australian Administrator, Nauru, Central Pacific Islands. For entry to Nauru, it was necessary to obtain permission from the Australian Government, through the U. S. State Department, Washington, D. C. After considerable delay, permission was granted and a lease agreement was concluded in time to permit completion of construction prior to the beginning of the Operation.

1.14 Detailed plans were made by H&N for the recruitment of personnel, operation and management of camp and support facilities, off-atoll operations, hostile action alerts, natural disaster defense, and for the radiological safety of its own personnel.

1.15 E-7, TG 7.5, assisted by the OTO Rad-Safe Adviser and the AEC Rad-Safe Officer, made detailed plans for TG 7.5 Rad-Safe operations and supervised their execution. This planning included the use of IBM equip-

ment to prepare accurate and rapid Rad-Safe records. Refer to Chapter XI for details on TG 7.5 Rad-Safe operations.

1.16 TG 7.5 natural disaster defense and hostile action alert plans were prepared and included in the TG 7.5 SOP.

1.17 Plans were also made for the roll-up of the EPG and off-atoll Weather Rad-Safe Stations after the completion of Operation HARDTACK. The roll-up of Bikini Atoll began after the JUNIPER event and was completed on 19 August. The roll-up of the off-atoll Weather Stations began on 26 July with the departure of the LST-618 for Nauru, and Weather Station roll-up was completed on 16 September 1958. The roll-up of Johnston Island began on 14 August and was completed by 19 September 1958. Eniwetok Atoll roll-up was essentially complete by 1 October 1958.

1.18 A revised long-range plan for PAC improvements to EPG was submitted in June 1958 in two volumes entitled LONG-RANGE IMPROVEMENT PLANNING—1959 THROUGH 1962 — ENIWETOK PROVING GROUND. Volume I covers Site Elmer; Volume II covers Sites Fred and Rex. Some of the projects described in the June 1956 publication of the same general title were completed during FY's 1957 and 1958. The remainder of the construction as then planned, together with additional requirements, forms the basis of the new report which augments long-range planning through FY 1962.

CHAPTER 2

PERSONNEL PHASING

2.1 TG 7.5 manpower was phased with construction and support requirements. Construction personnel recruitment fell below estimated rates in 1957. (See Fig. 3-1). This reduced manpower requirement was caused by rescheduling the construction program.

2.2 Due to recruitment difficulties, it became necessary to work engineering and critical craft personnel up to 84 hours per week during peak activity periods. This factor, together with the extended build-up period, held the TG 7.5 population below the estimated peaks. TG 7.5 population fell off sharply during the latter part of April but remained higher than originally planned due to an increase in the number of events scheduled and additional construction requirements. Another factor affecting the TG 7.5 population level was the transfer of the VHA events from Bikini to Johnston Island. TG 7.5 peak population at Johnston Island was 380 on 12 July 1958.

2.3 Personnel of Task Groups supported by TG 7.5 exceeded scheduled numbers by approximately 150 and reached a peak of 2330 on 14 May 1958. The personnel build-up of Task Groups supported by TG 7.5 was slightly in advance of original predictions but reached the peak as scheduled. The reduction of personnel of the various Task Groups was gradual, until after the cancellation of the UN event when numbers were reduced sharply.

2.4 With the completion of the HARDTACK, Phase I, series, TG 7.5 began the roll-up program and subsequently reduced personnel strength. It was planned that TG 7.5 strength would be reduced to approximately 1200 by 1 October 1958. Plans also indicated that TG 7.5 interim strength would not fall below 900, assuming a normal 18-month interim period.

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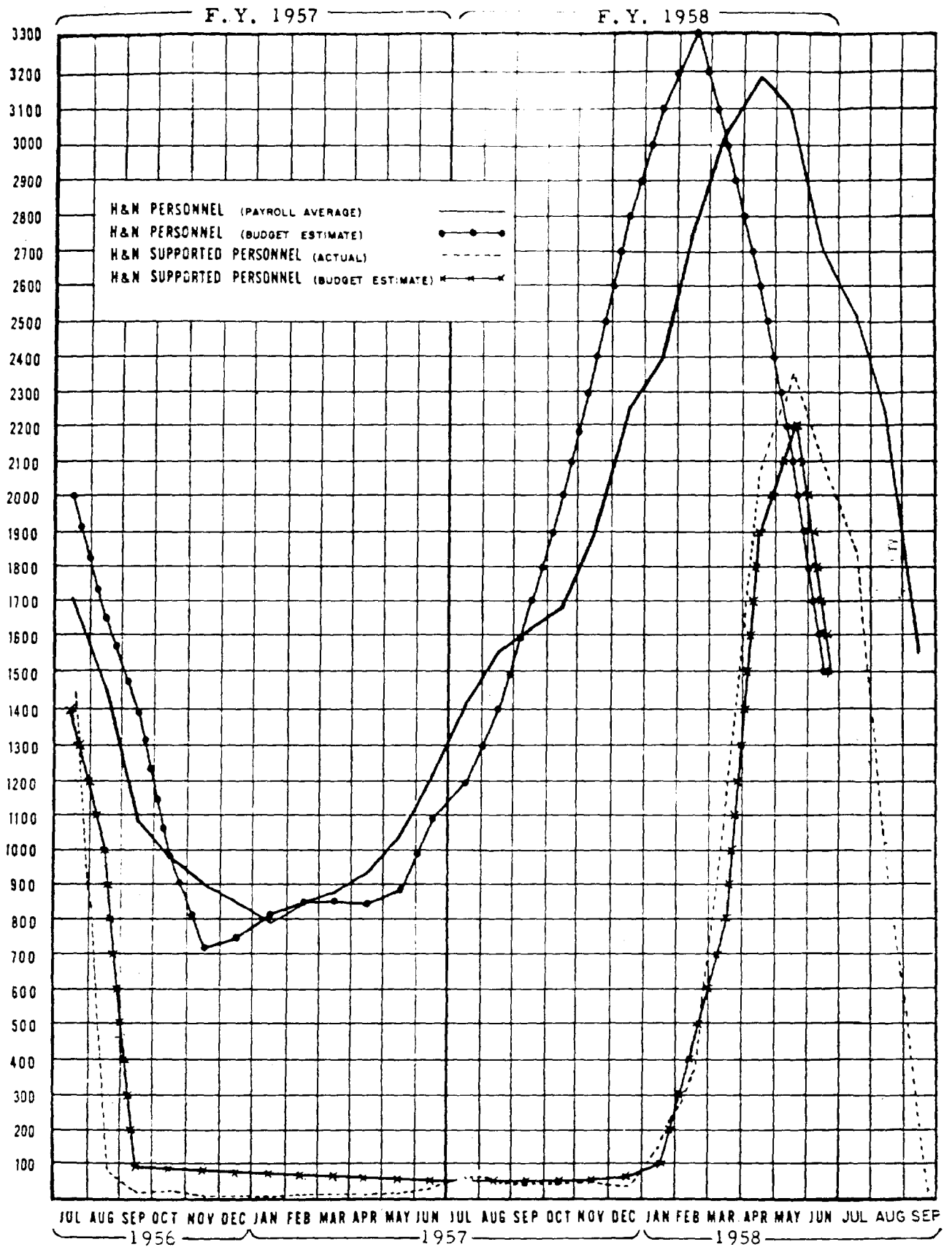


Figure 3-1. Jobsite Personnel Chart.

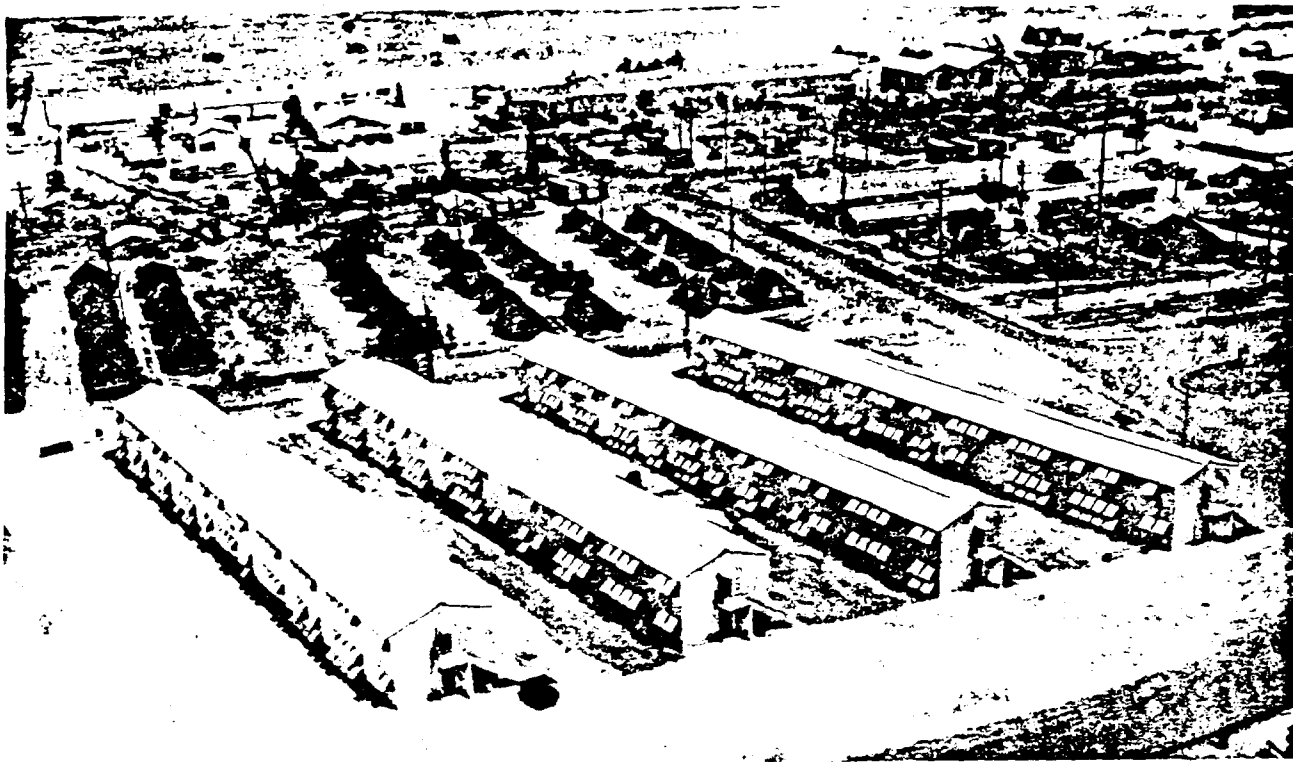


Figure 3-2. Four 2-story Barracks, Site Elmer.

(W.V-296-2)

CHAPTER 3

ENGINEERING, CONSTRUCTION, AND MAINTENANCE OF BASE FACILITIES

GENERAL

3.1 Late receipt of FY 1958 PAC and miscellaneous construction funds resulted in the postponement of 43 of the 130 authorized construction projects until after the completion of Operation HARDTACK. Critical facilities required to support the test program were completed prior to the start of the operational period. These included the erection of additional barracks facilities on Site Elmer (see Fig. 3-2), extensions of the Site Fred runway (see Figs. 3-3 and 3-4), and additional aircraft parking aprons, and the augmentation of the base power facilities by use of portable generators borrowed from the U. S. Navy. To conserve real estate, four 2-story barracks were constructed of concrete and prefabricated aluminum, each capable of billeting 128 men. To improve efficiency in communications, a 600-line dial telephone system was installed on Site Elmer and a smaller automatic dial system was installed on Site Fred. Additions to the salt water fire protection system were made to provide adequate fire protection to the facilities at Sites Elmer and Fred. Despite the increased plant,

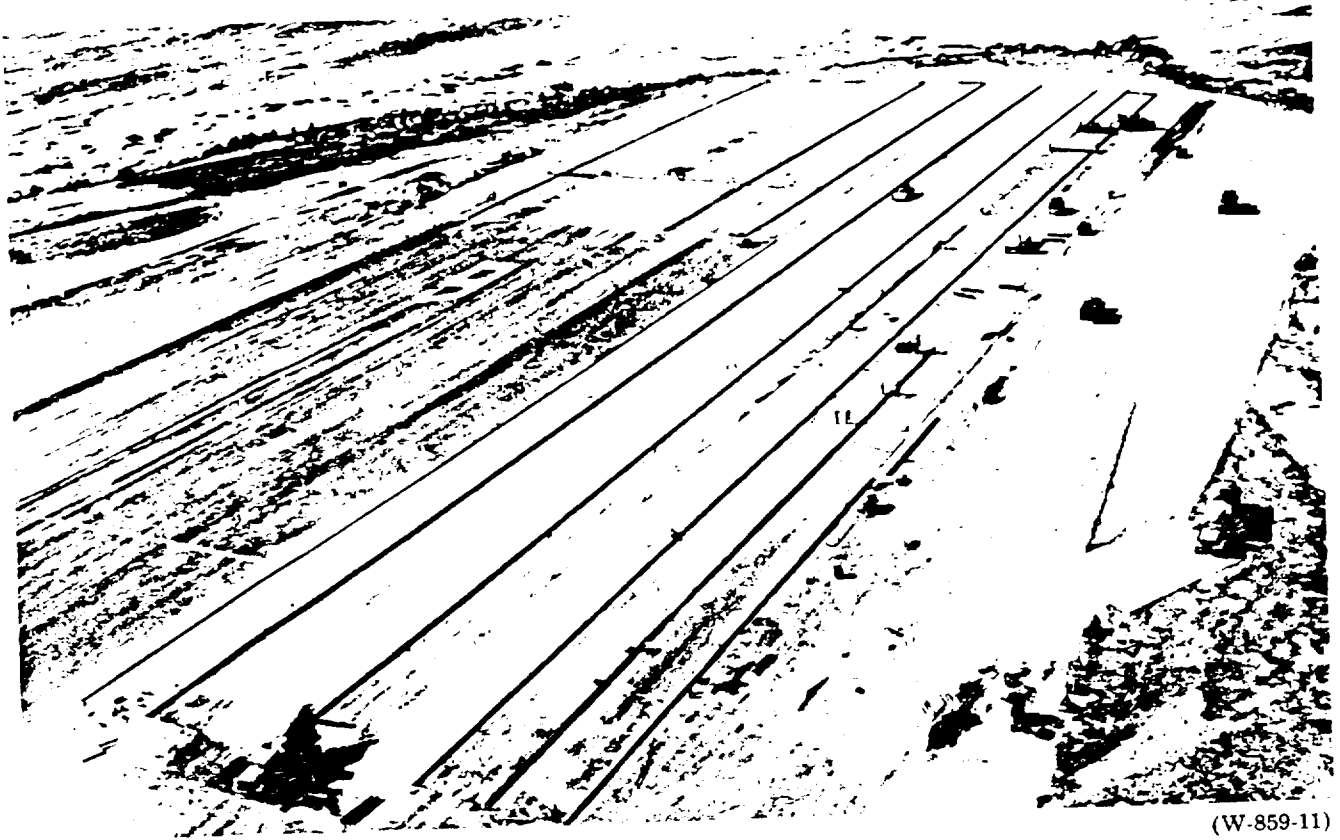
the utility systems and housing and feeding facilities were taxed to capacity throughout the EPG. Additional billeting space was provided by use of eight-man tents at Site Elmer, and tents were utilized for housing at all off-island camps.

ENGINEERING

3.2 H&N, the AEC's A-E-C-M Contractor, performed all design and engineering of the facilities and structures added to the permanent base during FY's 57 and 58 at its Los Angeles Office. The Chief, Los Angeles Branch, AEC, approved finalized drawings and specifications. Field revisions and engineering changes were made at EPG and approved by the AEC Eniwetok Branch engineering staff.

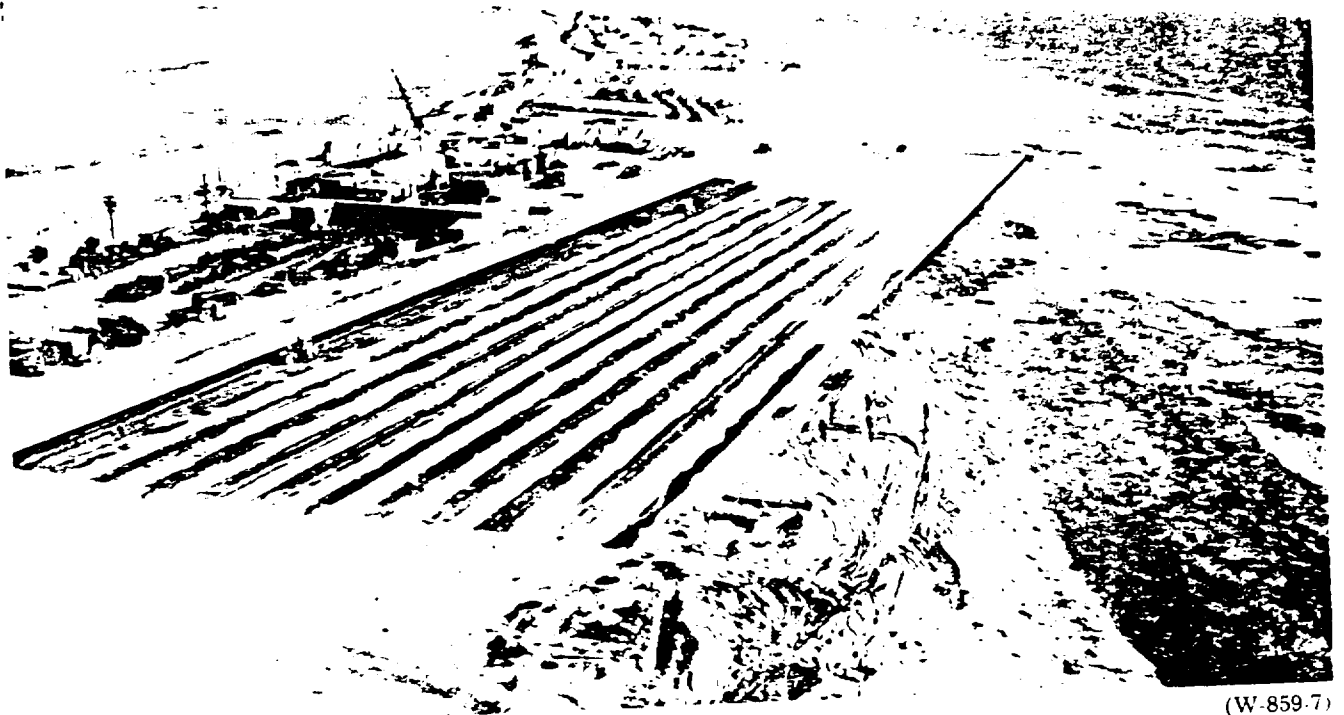
CONSTRUCTION

3.3 New PAC construction generally was hampered by a shortage of materials, mostly metal products which normally require a long lead-time, and skilled labor which was utilized for scientific construction. An interesting addition to the base facilities on Site Elmer was the con-



(W-859-11)

Figure 3-3. Addition to Southwest End of Site Fred Airstrip.



(W-859-7)

Figure 3-4. Addition to Northeast End of Site Fred Airstrip.

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struction of a poured concrete IBM building with suspended acoustical ceiling, removable floor panels supported on stringers, and a major utilities plant to provide air conditioning both overhead and under the floor. Two guest houses were erected on Site Elmer to accommodate visiting dignitaries. The base facility construction program also included a Butler-type administration building to house the Contractor's offices, concrete and prefabricated aluminum barracks, warehouses, community service buildings, and several laboratory buildings. The Administration Compound was enlarged and provided with aluminum chain link fencing. A large volume of modifications to existing structures and additional construction was accomplished to provide some measure of comfort to Task Force personnel. For example, eight barracks were modified to provide day rooms, and newly constructed barracks included day rooms.

Building construction on Site Fred was predominantly Pasco-type structures for warehousing. Ten major concrete projects on Site Fred included the airfield extension, a 200,000-gallon water storage reservoir, an explosive storage building, two pumphouses, three concrete ramps, a double tennis court, and a decontamination storage building.

Additional recreational facilities, such as volleyball and basketball courts, were constructed on Sites Fred, Elmer, and Nan.

MAINTENANCE

3.4 H&N was responsible for the maintenance of all buildings, grounds, utilities, and all

AEC-owned equipment. Although somewhat curtailed by the construction effort, the maintenance program was continuous throughout Operation HARDTACK, Phase I, and was predicated on preventive maintenance, normal wear and tear, and non-scheduled repairs. Due to the critical requirement for continuous operation, reefers, generators, and pumps were checked daily, and any breakdowns were cause for immediate repair, day or night. All construction equipment was rigidly scheduled for lubrication and inspection, and breakdowns were often forestalled by timely replacement or overhaul of parts. Preventive maintenance with respect to buildings and structures included securing all doors and shutters in an open position to prevent shock-wave damage during test events.

During the operational phase, H&N was also responsible for the preventive maintenance and minor repair of all Military-owned vehicles, except those located at Site Fred.

The maintenance and repairs to marine craft was confined to engines, bottom and hull plating, replacement of stringers and stiffeners, and the replacement and repairs of propellers and shafts. These repairs were accomplished by either beaching the craft by use of a "Gilhoist" or placing the craft in a floating dry dock.

The maintenance of utilities increased proportionally with the increase in population during the build-up period, when additional facilities were put into use.

CHAPTER 4

ENGINEERING, CONSTRUCTION, AND MAINTENANCE OF TEST FACILITIES

GENERAL

4.1 The increased scope of Operation HARDTACK, Phase I, nearly twice the magnitude of Operation REDWING, required a heavy expendable test construction program for both Bikini and Eniwetok Atolls. Criteria for scientific structures were not completely released by the Laboratories until the middle of January, 1958. The procurement of men and materials and the task of transporting them to the EPG created multitudinous problems for the AEC Contractor. Material storage, fabrication, construction, and inspection, as well as the housing and feeding of construction personnel, are but a few of the many efforts that result in a completed structure. Despite the many obstacles and the rigid construction schedules, the job was effectively accomplished by H&N.

4.2 To maintain a dual-shot capability, UCRL test facilities were constructed at Bikini Atoll and LASL test facilities at Eniwetok Atoll. However, adverse weather conditions in the Bikini Atoll area resulted in the transfer of five shots to Eniwetok Atoll. Twenty-four barge zero stations and five LCU hull zero stations were fabricated for Operation HARDTACK, Phase I, using cargo-type barges and obsolete LCU hulls procured from Navy and Army sources. Subsequent to construction completion, one of the barge zero stations was damaged beyond repair while in tow from Eniwetok to Bikini Atoll, and two were cancelled as a result of a program change. Barge station construction required the addition of a second floating dry dock (AFDL) at Eniwetok Atoll and the construction of a three-fingered barge slip at Site Nan. Of the shots scheduled for Operation

HARDTACK, Phase I, 2 were high altitude, 4 were surface ground shots, 1 was a balloon shot, 2 were underwater or sub-surface, and 26 were detonated on floating zero stations.

4.3 The high altitude events required an entirely new test facility at Site How in Bikini Atoll for the Army Ballistics Missile Agency. This new facility included the construction of 62 scientific stations, and was rushed to completion in time for beneficial occupancy only through a "crash" program involving emergency procurement and premium overtime payments. At the end of March, 1958, when the facility was substantially complete, it became apparent that the entire ABMA program should be moved to Johnston Island for reasons of safety that developed only as the program advanced. Once the acquisition of Johnston Island from the Pacific Air Force Command was achieved by CJTF-Seven on 10 April 1958, the gigantic task of moving the entire ABMA facility from Site How to its new location began. Construction crews removed the ABMA facility and re-erected it at Johnston Island in record time. Construction at Johnston Island was completed on 15 July, two weeks ahead of schedule.

ENGINEERING

4.4 The engineering of test structures for Operation HARDTACK involved the design and construction of more than 350 scientific structures at various locations within the EPG. UCRL requirements and criteria were in the hands of the AEC Contractor by the end of December, 1957, and those of LASL by the middle of January, 1958. To expedite the necessary engineering design and planning requirements of the scientific program from initial criteria to the release of approved plans for construction, H&N assigned Project Engineers from its Los Angeles Office to provide liaison with each of the major Scientific Users. At Jobsite, the AEC Contractor created the position of Technical Facilities Coordinator to execute new and revised engineering design requirements and to provide on-the-spot liaison between the Users and the Contractor's Jobsite Engineering Division. Headed by the Contractor's Assistant Engineering Manager and staffed with Project Engineers, Design Engineers, and Design and Senior Draftsmen from H&N's Los Angeles Office, this group stayed in force at EPG from January until late April, 1958, at which time the position of Technical Facilities Coordinator was sustained by a Project Engineer until early June. The Technical Facilities Group proved very effective in the expeditious processing of User requirements and changes initiated at EPG and aided immeasurably in the over-all construction effort. Drawings for Jobsite-designed test facilities were approved by the Eniwetok Branch engineering staff.

CONSTRUCTION

4.5 Expansion of the off-site Rad-Safe Weather Station network called for the construction or rehabilitation of facilities at four other atolls in the Marshall Islands, Rongelap, Ujelang, Utirik, and Wotho and at Kapingamarangi and Kusaie Atolls in the Carolines; and at Tarawa in the United Kingdom Trust Territory of the Pacific, as well as at Nauru in the Australian Trust Territory. Weather Stations were also constructed at Truk and Ponape. In most cases, materials were precut at Site Elmer for assembly at the pertinent location.

4.6 The major scientific facilities at Eniwetok Atoll were constructed at Sites Yvonne and Janet and on the Gene-Helen-Irene complex. These facilities were utilized in the detonation of 18 LASL and 5 UCRL shots. Among the major scientific structures were Station 91, a 300-foot photo tower on Site Elmer; Stations 1130, 1611, and 1612 on Site Yvonne, and Stations 1212.01 and 1212.02 on the Gene-Helen-Irene complex.

Station 1312, constructed for LASL and EG&G, was the largest scientific structure built for the Operation (see Fig. 3-5). It was designed as a Recording Station for participation in the DOGWOOD, PINE, OLIVE, OAK, ELDER, YELLOWWOOD, TOBACCO, and WALNUT events. For this station alone, a total structural concrete pour of 3673 cubic yards was required. The floor plan provided for five utility rooms, connecting passageways, and an escape hatch compartment to the outside and through the roof.

Station 21, the GZ Station constructed for LASL for the KOA event, consisted of two steel tanks, one inside the other, and three sand-filled boxes (see Fig. 3-6). The inner tank was 10 feet in diameter and 11 feet high; the outer tank was 30 feet in diameter and more than 22 feet high to maintain 10 feet of water above the inner tank. Power was supplied by two 30-kw. 120 208-volt motor generators.

4.7 Major scientific station construction at Bikini Atoll was required on the Oboe-Peter-Tare complex and at Site How. Station 2200, Site Sugar, was modified to add a generator room, and a 150-foot diagnostic tower was constructed on top of the bunker and was designated as Station 2250. In conjunction with the ABMA program, Stations 6001, a rocket firing-pad and service tower, and 6002, a control bunker, were constructed at Site How. In addition to the two major facilities at Site How, there were 60 stations constructed for participation in the two high altitude shots. When it was determined that the ABMA facilities would be reconstructed at Johnston Island, all but 7 of the scientific stations originally located on Bikini Atoll were

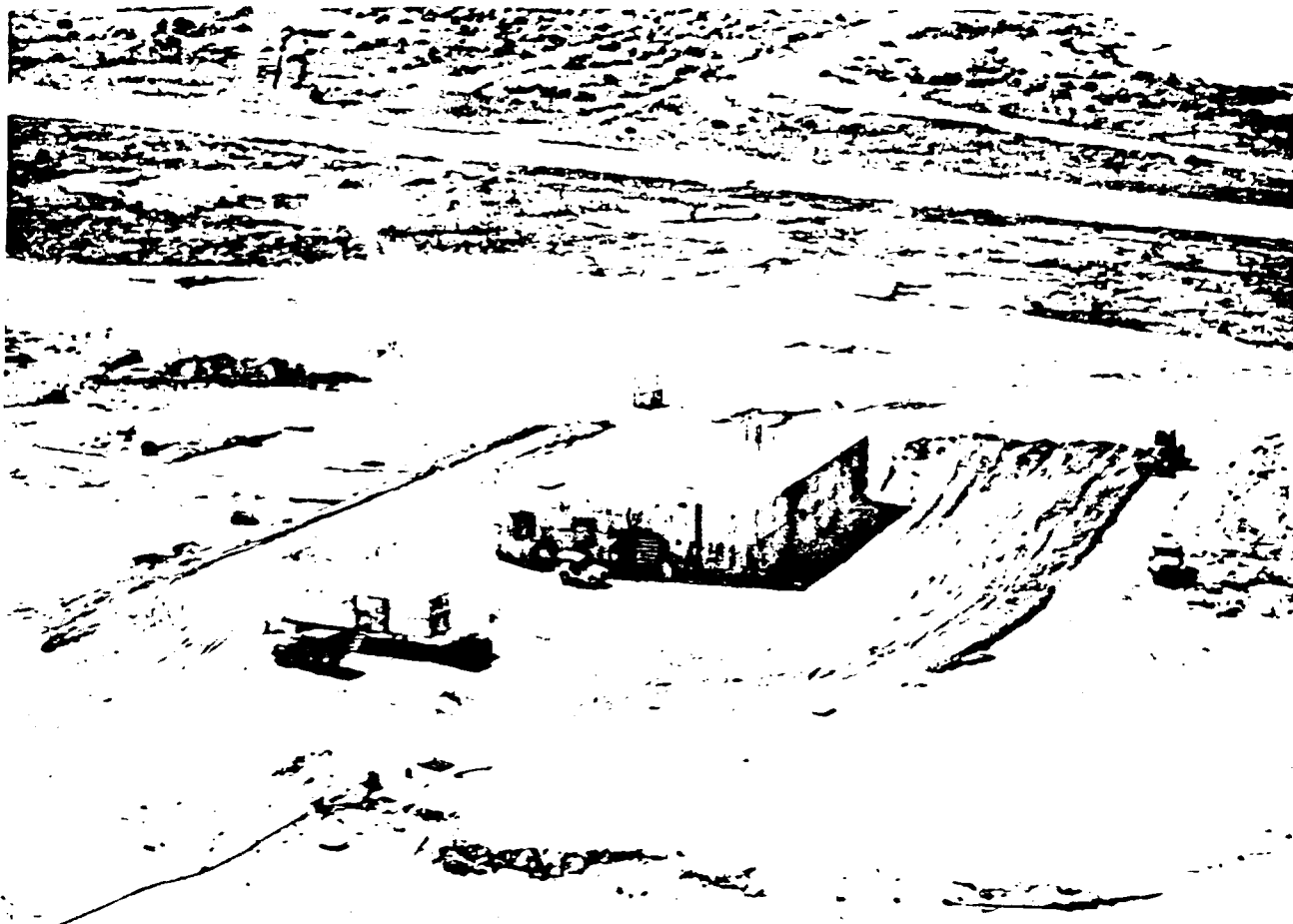


Figure 3-5. Station 1312, Site Janet.

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rebuilt at the new location. On Site Nan, the base camp for Bikini Atoll, the major facilities constructed included a TG 7.1 Administration Building; Building 204-Communications; a three-fingered barge slip and assembly area; and Assembly Building 279. The rehabilitation and modification of Stations 70 and 500 also required considerable construction effort.

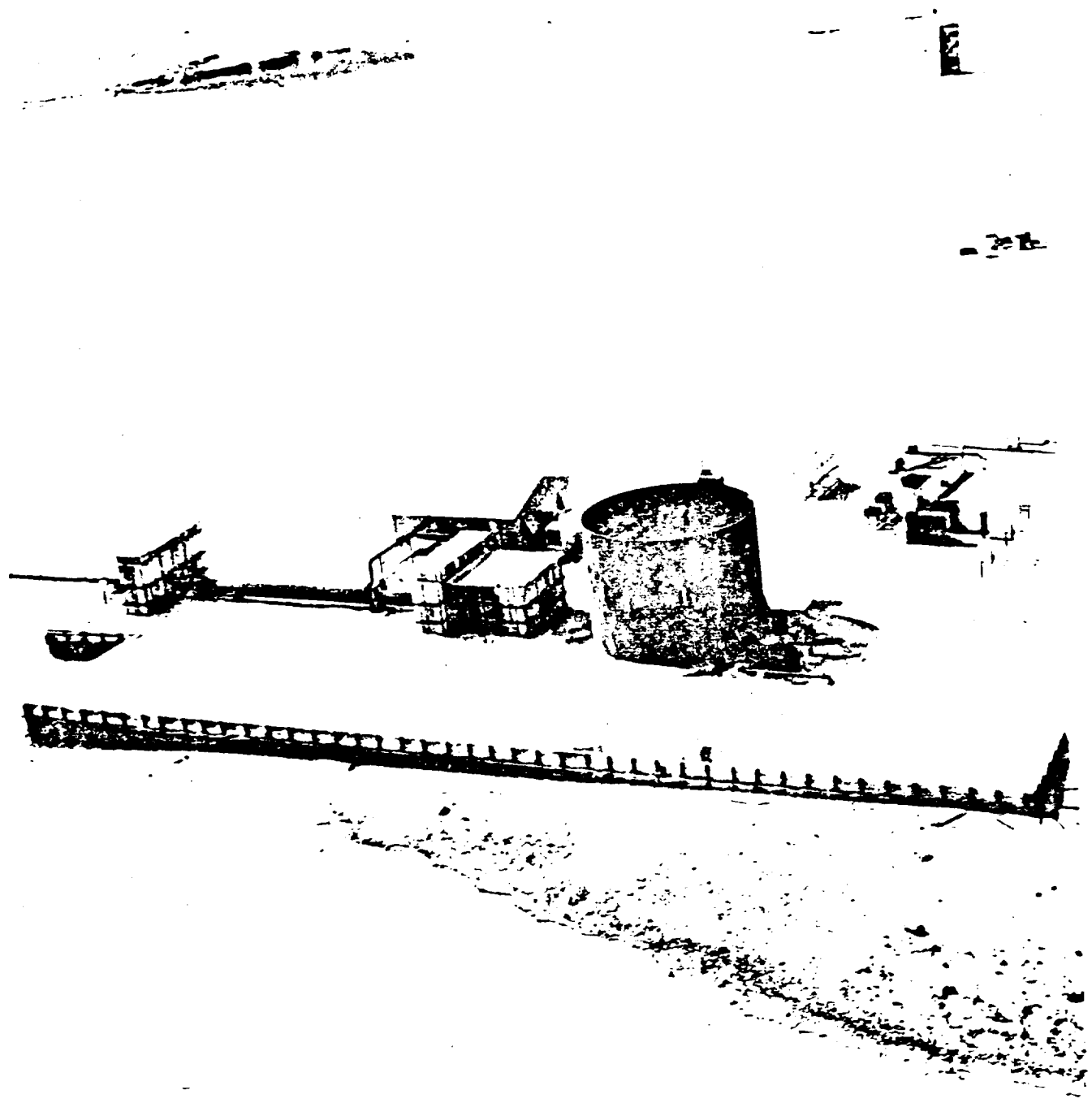
4.8 In addition to the many scientific structures, complex submarine cable and electrical distribution systems were installed at Eniwetok and Bikini Atolls to service the various major installations. Several existing stations at both atolls were modified to meet the requirements of Operation HARDTACK, Phase I.

4.9 The late submission of criteria to the Contractor resulted in a "crash" construction program to meet target dates for scheduled events. Use of shot barges for the majority of events provided a flexibility of location and at the same time allowed maximum utilization of the scientific complexes. Construction forces were working on a 72-hour extended work-week from March through July in order to complete

test facilities on schedule. Additional events were scheduled early in June and absorbed into the construction program. The problems of emergency procurement were met by "crash" buying in the United States and in the Hawaiian Islands, and by the expediting of items by air to Jobsite. Construction starting and completion dates for scientific stations are shown in Fig. 3-7.

MAINTENANCE

4.10 Prior to the build-up phase of Operation HARDTACK, maintenance on scientific structures was continuous, with records kept reflecting the maintenance checks for each of the stations. Maintenance Work Orders were issued for the rehabilitation of certain of these stations during the build-up period. The interiors of such stations were cleaned or sandblasted and painted and, in some cases, the blast doors required extensive repair work. Following Operation HARDTACK, the majority of mechanical equipment installed in stations remained in place, with the provision that the equipment be operated every two weeks for maintenance purposes.



(W-881-1)

Figure 3-7. Station 21, Site Gene.

SCIENTIFIC STATION COMPLETION LIST

<u>STATION</u>	<u>DATE STARTED</u>	<u>DATE COMPLETED</u>	<u>STATION</u>	<u>DATE STARTED</u>	<u>DATE COMPLETED</u>
1	8-7-58	8-18-58	50.14-.15	4-1-58	4-18-58
2	6-16-58	7-5-58	70	3-6-58	4-19-58
3	1-20-58	7-3-58	J70	6-5-58	6-12-58
4	1-20-58	7-12-58	71	2-5-58	7-10-58
5	1-20-58	5-16-58	72.02	2-14-58	4-20-58
6	1-28-58	4-21-58	73.01	3-3-58	4-17-58
7	11-25-57	6-14-58	74.01	2-17-58	5-29-58
8	11-25-57	6-9-58	74.02	3-31-58	4-5-58
9	1-20-58	6-27-58	75.02	3-17-58	4-4-58
10	5-6-58	7-26-58	76	11-23-57	5-8-58
11	1-25-58	5-9-58	77.01	2-26-58	4-11-58
12	1-11-58	6-28-58	77.02	12-24-57	5-16-58
13	1-11-58	7-22-58	78.01	11-11-57	4-18-58
15	7-7-58	8-6-58	80.01	3-5-58	4-19-58
16	6-8-58	7-22-58	82.01	3-3-58	4-19-58
17	6-16-58	7-25-58	82.02	2-24-58	4-10-58
20	1-4-58	4-25-58	84.01	3-7-58	4-19-58
21	12-31-57	4-17-58	90	4-1-58	7-25-58
22	6-6-58	7-18-58	91	10-2-57	8-16-58
23	3-21-58	6-5-58	92.01-.02	1-22-58	4-20-58
24	5-24-58	6-28-58	92.03	12-2-57	4-17-58
25	5-30-58	6-28-58	92.04	12-2-57	4-19-58
27	12-26-57	5-14-58	105	3-3-58	4-19-58
28	12-27-57	5-14-58	110.01-.02	3-23-58	5-5-58
29	1-30-58	5-27-58	110.05	3-23-58	5-5-58
30	1-8-58	5-27-58	111.01-.08	3-4-58	4-19-58
32	2-20-58	4-18-58	121.02	2-19-58	4-26-58
33	1-28-58	5-10-58	125.01-.06	4-21-58	4-24-58
34	1-15-58	5-12-58	125.07-.09	4-17-58	4-17-58
37	2-23-58	6-14-58	131.01	4-8-58	4-12-58
38	5-12-58	Cancelled	131.02	4-12-58	4-14-58
39	5-20-58	Cancelled	131.03-.04	4-8-58	4-12-58
50.01-.06	3-25-58	4-18-58	160.01	4-8-58	4-26-58
50.07-.10	4-1-58	4-18-58	160.02	4-8-58	5-3-58
50.11-.13	4-1-58	7-12-58	160.03	4-8-58	4-26-58

Figure 3-7A. Scientific Station Completion List (Sheet 1 of 4).

SCIENTIFIC STATION COMPLETION LIST (Continued)

<u>STATION</u>	<u>DATE STARTED</u>	<u>DATE COMPLETED</u>	<u>STATION</u>	<u>DATE STARTED</u>	<u>DATE COMPLETED</u>
163.01	4-10-58	4-26-58	322.03	1-22-58	4-10-58
163.03	4-10-58	4-26-58	322.04	1-22-58	4-5-58
163.04	4-10-58	4-12-58	360.01-.02	2-5-58	4-24-58
163.06	4-10-58	4-26-58	500	1-20-58	7-7-58
170.01-.03	3-10-58	4-26-58	540.01-.02	4-28-58	4-28-58
170.04-.06	4-2-58	4-20-58	J540	5-8-58	5-15-58
171.01	3-11-58	4-19-58	541.01	4-7-58	4-7-58
171.04	4-2-58	4-20-58	541.02	3-22-48	4-10-58
J172.01	6-2-58	6-8-58	541.03	4-5-58	4-9-58
J172.02	6-11-58	6-20-58	J600	6-13-58	6-13-58
178.01-.36	7-7-58	8-2-58	J611.01	5-15-58	6-2-58
180.1	2-7-58	4-24-58	J612	5-12-58	5-29-58
180.02	2-15-58	4-24-58	J613	5-1-58	7-7-58
180.03	2-19-58	4-24-58	630.01-.03	3-10-58	4-26-58
181.01-.03	3-11-58	4-20-58	630.04	3-21-58	4-18-58
182.01	3-20-58	4-11-58	630.05	3-22-58	4-18-58
182.02	3-3-58	4-18-58	J660.03	5-9-58	7-7-58
190.01	2-7-58	4-17-58	681.01	3-31-58	4-4-58
190.02	2-13-58	4-20-58	681.02	3-31-58	4-12-58
201	7-20-58	7-27-58	681.03	3-31-58	5-17-58
203.01-.02	7-19-58	8-6-58	810.01-.02	3-3-58	5-20-58
204.01-.50	7-19-58	8-6-58	810.03	2-24-58	5-23-58
210.01-.12	7-19-58	7-24-58	J831	6-2-58	6-21-58
211.01-.36	7-24-58	7-24-58	860	3-31-58	4-5-58
231	4-8-58	4-26-58	861	4-17-58	4-26-58
240.01	2-25-58	5-24-58	870.01-.02	7-21-58	7-27-58
240.02	2-25-58	6-20-58	871.01-.02	7-22-58	7-22-58
241.01-.10	7-23-58	8-2-58	872.01-.08	7-18-58	7-22-58
242.01-.06	7-24-58	8-2-58	J910	5-12-58	5-29-58
260	4-24-58	7-7-58	J930.01-.03	6-1-58	6-5-58
261	4-28-58	6-27-58	940	2-17-58	4-26-58
290.01-.04	7-20-58	7-23-58	941	4-18-58	5-3-58
291.01-.36	7-18-58	7-24-58	942	5-1-58	5-7-58
322.01	1-27-58	4-24-58	945	2-24-58	5-14-58
322.02	1-22-58	4-1-58	946.01	4-12-58	4-19-58

Figure 3-7B. Scientific Station Completion List (Sheet 2 of 4).

SCIENTIFIC STATION COMPLETION LIST (Continued)

<u>STATION</u>	<u>DATE STARTED</u>	<u>DATE COMPLETED</u>	<u>STATION</u>	<u>DATE STARTED</u>	<u>DATE COMPLETED</u>
946.02	4-12-58	6-14-58	1526	1-8-58	4-16-58
1021	2-25-58	4-19-58	1527	2-27-58	4-20-58
J1030	5-8-58	7-7-58	1528.01-.02	3-22-58	4-10-58
1130	1-11-58	4-20-58	1610	2-10-58	4-20-58
1131	2-13-58	4-11-58	1611	2-15-58	4-28-58
1210.01	2-3-58	4-17-58	1612	2-15-58	4-23-58
1210.02	1-6-58	4-20-58	1616	3-22-58	4-20-58
1211	1-29-58	4-26-58	1617	3-22-58	4-20-58
1212.01-.02	1-14-58	4-12-58	1710	3-8-58	4-19-58
1213	2-13-58	4-18-58	J1711	5-2-58	7-7-58
1216	1-7-58	4-20-58	J1810	5-8-58	7-25-58
1217	2-17-58	4-11-58	J1811	5-11-58	5-30-58
1218	1-24-58	4-20-58	J1812	6-13-58	7-7-58
1220.01-.02	3-27-58	4-24-58	2130	2-10-58	2-27-58
1310	11-12-57	4-23-58	2131.01	2-14-58	4-18-58
1311	1-23-58	4-17-58	2130.02	3-21-58	4-20-58
1312	9-20-57	4-25-58	2130.03	2-6-58	4-20-58
1314	3-5-58	4-17-58	2130.04	1-28-58	4-20-58
1315	2-7-58	4-20-58	2130.05	2-6-58	4-20-58
1316.01	2-17-58	4-20-58	2132	1-7-58	3-8-58
1317.01-.02	4-4-58	4-21-58	2150.01-.04	3-31-58	6-23-58
1320	4-8-58	4-10-58	2151.01-.03	3-11-58	6-10-58
1330	2-22-58	8-16-58	2200	11-14-57	8-1-58
1410	1-29-58	4-26-58	2210	1-29-58	6-7-58
1510	4-1-58	7-25-58	2230.01-.02	2-6-58	6-7-58
1511	1-11-58	5-31-58	2240	3-3-58	4-19-58
1512	2-13-58	4-4-58	2250	1-29-58	4-26-58
1513.01	2-26-58	4-11-58	2251	3-24-58	4-19-58
1513.02	12-24-57	5-24-58	2253	4-7-58	4-18-58
1515	3-3-58	3-8-58	2260	4-7-58	4-26-58
1520	12-2-57	4-20-58	2270	2-6-58	4-26-58
1522	2-19-58	4-20-58	2300	11-15-57	4-26-58
1523.01-.04	2-15-58	4-20-58	2410.01-.03	3-9-58	4-18-58
1524	1-8-58	4-25-58	2420.01-.02	3-9-58	5-17-58
1525	1-22-58	4-15-58	2430.01-.02	6-6-58	6-6-58

Figure 3-7C. Scientific Station Completion List (Sheet 3 of 4).

SCIENTIFIC STATION COMPLETION LIST (Continued)

<u>STATION</u>	<u>DATE STARTED</u>	<u>DATE COMPLETED</u>	<u>STATION</u>	<u>DATE STARTED</u>	<u>DATE COMPLETED</u>
J3230.01	5-1-58	7-7-58	3440.07	3-22-58	3-25-58
J3231.01-.06	5-3-58	6-20-58	3480.01	7-20-58	8-2-58
J3231.07-.08	6-2-58	6-20-58	3481	7-20-58	7-26-58
J3240.01-.02	5-26-58	7-7-58	3482.01-.92	7-24-58	8-4-58
J3241.01	5-1-58	7-1-58	3483.01-.42	7-21-58	7-24-58
J3260.01	5-19-58	6-9-58	3484.01-.08	7-21-58	7-25-58
J3260.02-.05	5-22-58	6-9-58	3485.01-.14	7-20-58	7-30-58
J3260.06	5-19-58	6-9-58	3486.01-.15	7-21-58	7-30-58
J3261.01-.02	5-19-58	6-4-58	3487.01-.61	7-19-58	7-31-58
J3262	5-1-58	7-7-58	3488.01-.05	7-20-58	7-31-58
3401	7-24-58	7-24-58	3489	7-20-58	8-2-58
3402	7-24-58	8-2-58	J6001	4-24-58	7-7-58
3440.01	3-8-58	3-24-58	J6002	4-24-58	7-7-58
J3440.01	5-1-58	7-7-58	J6003.01-.03	4-24-58	6-5-58
3440.02	3-7-58	3-20-58	J6004	5-15-58	6-2-58
3440.03	2-18-58	3-18-58	J6006.01-.02	6-12-58	7-7-58
3440.04	3-7-58	3-26-58	J6007.01-.02	5-24-58	6-26-58
3440.05	3-8-58	4-23-58	J7410	5-5-58	7-7-58
J3440.05A	6-19-58	6-20-58	7420	3-22-58	4-19-58
3440.06	4-7-58	4-12-58	7421	6-5-58	7-14-58

Figure 3-7D. Scientific Station Completion List (Sheet 4 of 4).

CHAPTER 5 OPERATION AND MANAGEMENT OF CAMP AND SUPPORT FACILITIES

5.1 Camp management and operations were provided by H&N for the AEC at all EPG camp sites, except Sites Fred and David, which were operated by CTG 7.2. Operation and management included:

- a. All camp services including subsistence, quarters, laundry, mail, camp stores, barber shops, refreshment bars, medical and dental facilities, insect and rodent control, and recreation.
- b. Utilities operation including salt and fresh water services, electric power, sewage disposal, telephone, radio-telephone and teletype.
- c. Warehousing and property accounting for all materials and equipment shipped for CTG 7.5 and, in some cases, for other Task Groups.
- d. Stevedoring and cargo handling, except on-shore at Sites Fred and David.

5.2 Temporary camps were operated at Sites Janet, Yvonne, How, George, Nan, and Ohoe. The permanent camp at Site Elmer was expanded with the construction of 4 two-story barracks, 3 single-story barracks, and 2 guest houses. Each off-island camp provided services identical to those supplied at the permanent camp, although in reduced scope. A completely

outfitted laundry was operated at Sites Elmer and Nan; however, ironing service was not provided at Site Nan. Home-type washing machines were supplied at all temporary camps. Limited camp services were provided by the Contractor in support of all scientific personnel at Ujelang, Wotho, Utirik and Rongelap. Camp store items were available at all sites including off-atoll Weather and Rad-Safe Stations. In general, only necessities were stocked; however, limited recreational gear, such as fishing equipment and a few non-essentials, were provided.

5.3 Stevedoring operations at EPG were provided as specified in the agreement between the AEC and CJTF-Seven dated 1 June 1955, until modified and revised on 1 July 1958. Under the former agreement, CJTF-Seven, through the facilities of the ATCOM, CTG 7.2, was responsible for all port operations. Under the new agreement, CTG 7.2 was relieved of the documentation responsibilities, including Custom Declarations, Landing Certificates, and documents of a similar nature, and they were assumed by H&N. However, preparation, inspection, and performance of all security regulations remained under the ATCOM's control. Cargo handling was also the responsibility of H&N during Operation HARDTACK. As an indication of the volume of TG 7.5 cargo handled, a total of 10,374 long tons (23,907 measurement tons) were offloaded and backloaded during January, 1958, a peak month for stevedoring activities.

CHAPTER 6 OFF-ATOLL OPERATIONS

6.1 All Weather and Rad-Safe Stations, including new construction at Nauru, Ponape, and Truk, were completed prior to 15 March, the operational date of HARDTACK, Phase I. H&N operated all facilities at Wotho, Utirik, Ujelang, and Rongelap, and provided trained personnel for the maintenance and operation of equipment. Maintenance at stations operated by military personnel--Tarawa, Kapingamarangi, Nauru, and Kusaie--became an increasingly difficult problem as the Operation progressed. Although a training program for military personnel responsible for the opera-

tion of distillation and power equipment was instituted prior to the activation of these camps, the time devoted to such training was insufficient to provide qualified personnel. Many costly maintenance support missions by H&N were required as a result of excessive breakdowns of distillation and power equipment.

6.2 Cargo-carrying capabilities of support aircraft severely limited the Contractor in his efforts to provide repair and maintenance of the equipment necessary for the operation of off-atoll sites; support by ship was impractical during the operational phase of the test series.

CHAPTER 7
SECURITY, CLASSIFICATION, AND
PUBLIC INFORMATION

PLANNING

7.1 A series of conferences and the interchange of correspondence between Headquarters, JTF-Seven, and TG 7.5 contributed to the establishment or reaffirmation of basic security policies for Operation HARDTACK. Among these policies were controls for access to EPG; minimum security clearances for military and civilian participants; designation of security areas; strength and deployment of military guards; security badge system; security briefing media; control of photography; use of couriers; and shipment of test devices and other classified materials and documents between the Mainland and EPG. These subjects, with the exception of the latter one, were formalized in the JTF-Seven SOP series. The shipping instructions are contained in Appendix 1 to Annex C, JTF-Seven Administrative Plan 1-58.

7.2 The minimum clearances for HARDTACK participants at EPG were established as "Confidential" for military personnel and "L" for AEC Contractor personnel, as of the 1 March 1958 "cut-off" date. This date was later extended to 15 March 1958.

7.3 At the request of AEC, CJTF-Seven made the arrangements necessary to obtain Military Police from units having had previous experience in guarding nuclear weapons storage areas. Due to economic limitations and the inability of the Department of the Army to provide such experienced guard personnel in quantities equivalent to those during Operation REDWING, it was necessary to reduce the number of Military Guards for Operation HARDTACK. The REDWING total of 260 Military Police (252 enlisted men and 8 officers) was reduced to 141 "Top Secret"-cleared MP's (133 enlisted men and 8 officers) for HARDTACK. This decrease in force necessitated the elimination of certain "travel control" points and the reduction of the ratio of guards for contingency use. A joint JTF-Seven and AEC training session was held for several weeks in January, 1958, at Sandia Base to train the Military Police in the fundamentals of the AEC physical security procedures and in the HARDTACK security badge system.

7.4 A detachment of "Top Secret"-cleared Marines was assigned to TG 7.3, based on the USS BOXER, and detailed to guard shot barges at Bikini Atoll and to provide a military guard for inter-atoll water shipments of test devices.

7.5 The normal complement of AEC security personnel assigned to the Pacific Operations Division of the Office of Test Operations, ALO, was increased to handle the anticipated operational work load. This was accomplished by obtaining personnel from other ALO offices and from the San Francisco Operations Office. For the most part, such personnel were inexperienced in test security problems; and, as they were assigned to the EPG for varying periods of TDY, considerable on-the-job training was required.

7.6 Test devices for the DOD-sponsored underwater and high altitude shots were transported to the EPG via the USS BOXER. By agreement with CJTF-Seven, the Commanding Officer of the USS BOXER was designated an AEC Military Courier by the Manager, ALO, to provide security protection to the nuclear materials enroute to the EPG and to certain items remaining aboard after arrival. Custody of the materials off-loaded from the USS BOXER at EPG was assumed by the AEC SS Materials Accountability Representative (AC/S, E-2, TG 7.5). Accountability for all HARDTACK SS materials was the delegated responsibility of the AEC SS Materials Accountability Representative.

7.7 Arrangements were made with the US Bureau of Customs to identify official bulk mail of TG 7.1 to eliminate customs interception and examination, which were encountered during Operation REDWING.

OPERATIONAL PHASE

7.8 In addition to the Category 1 materials brought to the EPG via the USS BOXER, there was a total of 52 special flights used to transport the bulk of such materials to the test site. Whenever possible, classified spare test device components were brought back to the Mainland on "sample return" aircraft, using armed officer couriers operating under the provisions of SOP 205-4. Nine special flights were required to return test devices or components, which, for various reasons, could not be sent on "sample return" aircraft. From a security standpoint, there were no incidents to cause concern. In the early phases of the Operation, some couriers of classified nuclear materials of subordinate exigency were not receiving complete instructions on the Mainland regarding where and to whom to surrender the nuclear materials upon arrival at EPG. That condition was quickly corrected by Headquarters JTF-

PART III, CHAPTER 7

Seven. Upon arrival at the EPG, custody of these materials was assumed by the CTG 7.5. Military Guards were utilized to safeguard movements of such materials outside guarded security areas. AEC couriers accompanied all intra-atoll movements and inter-atoll air shipments of Category I materials. Inter-atoll surface shipments were in the custody of CTG 7.3. Certain scientific, technical, and operational personnel of TG 7.1 were authorized in writing to transport intra-atoll, in their personal custody, Categories II and III materials.

7.9 Due to the delay in the acquisition of PAC funds and the shortage of stock-piled construction materials, required physical security installations, such as replacement perimeter fences for the Administration Compound and the CMR area, Site Elmer; guard shacks; and pertinent communications, were completed at a critically late date. In some instances, emergency measures had to be adopted to provide suitable protection for classified materials and documents which arrived at EPG prior to the completion of the physical security plant.

7.10 The number of "travel control" points was reduced during this Operation. Therefore, numerous signs pointing out security areas and badge requirements were posted. Military and H&N guard patrols were utilized to enforce access to such areas; these guards also made periodic checks to see that required badges were worn.

7.11 The HARDTACK security badge system became operational on 15 March 1958. During the Operation, a total of 20,995 badges was issued to all participants. This figure included regular, special, and exchange badges and replacements for broken or lost badges. The badge system, as described in SOP 205-6, required minor modifications to change the design of the Official Observer badge and to provide several new badge types to identify observers from the United Kingdom, NATO, and the United Nations. Color layouts depicting the security badge system were made available to Headquarters, JTF-Seven, and all Task Groups for orientation and information purposes.

7.12 A total of 185 HARDTACK security badges were reported as lost and not recovered, constituting a loss percentage of 0.009. Persons reporting their badge as lost were required to execute a "Lost Security Badge Statement."

7.13 Exchange badges were used to ensure maximum security controls for access to exclusion areas, such as the assembly areas and barge slips at Sites Elmer and Nan and the CMR area at Site Elmer. Comparison cards containing photos were utilized to control access to storage bunkers for test devices and components

and to the zero points, both ashore and afloat. There were no security infractions associated with controlling access to these areas; however, in several instances the mechanics of control were seriously in danger of compromise as a result of the failure of some scientific personnel at zero locations to cooperate with the access controls. This situation was intensified by a lack of adequate numbers of experienced security personnel to provide frequent field reconnaissance. Agreements reached between TG's 7.1 and 7.5 later corrected this situation.

7.14 A record of security infractions incurred by personnel of TG's 7.1 and 7.5 was maintained. In each case, the individual responsible was properly cautioned, and steps were taken to prevent recurrences. A total of 44 security infractions were committed by personnel of TG 7.1. Thirteen of the 44 security infractions were committed by military personnel assigned to TG 7.1. Twenty-four infractions were committed by personnel of TG 7.5, of which 23 were by H&N personnel and 1 by AEC. There were no security violations committed by personnel of TG 7.1 or 7.5, as defined by AEC regulations.

7.15 An extensive locally-designed security poster program was initiated by the H&N security organization. These posters, suitable for indoor or outdoor use, were placed at strategic locations and were relocated at frequent intervals on a firm schedule. Color slides of some of these posters were also shown periodically at the movies operated by H&N.

7.16 Emergency burn-barrels and burn-boxes were fabricated and supplied for use as required by Headquarters, JTF-Seven, for elements of TG's 7.1 and 7.5. New incinerators of advance design were provided in the administration compounds on Sites Elmer and Nan for routine destruction of classified waste and documents.

7.17 The H&N security organization, in conjunction with TG 7.1 and the AEC offices, compiled and coordinated with the Military Police a location list of all safe files utilized by TG 7.1 and the AEC offices for the storage of classified documents and materials. During non-working and lunch periods, the MP's made security checks of the repositories and adjacent unattended office areas. Records were also kept of H&N classified repositories which were similarly checked by H&N guards.

7.18 The only AEC "Top Secret" documents at the EPG were several from LASL, maintained in the custody of Dr. W. E. Ogle, Scientific Deputy, JTF-Seven. Several "Top Secret" teletypes were sent from DMA, AEC, Washington, to General Luedecke, the senior AEC representative; however, they were subsequently downgraded to "Secret."

7.19 AEC and H&N security personnel were assigned to Johnston Island in June, 1958, and TG 7.5 Pass and Badge Office was established on 16 June 1958. All cleared JTF-Seven personnel at Johnston Island wore green badges, and all others were required to wear red badges. Special "No Clearance" badges from the EPG interim badge system were used to denote uncleared H&N personnel working there as "Good Security Risks."

7.20 The controls on photography at EPG, as set forth in SOP 205-5, were followed by both TG's 7.1 and 7.5. At the request of this Headquarters, CIC personnel of Headquarters, JTF-Seven, conducted a survey of all TG 7.1 photographic processing and issuance points. Compliance with control regulations was generally satisfactory; however, certain deficiencies were brought to the attention of the CTG 7.1 and later corrected. TG 7.5 photo processing points were checked by AEC security personnel and were found to comply with the prescribed regulations.

7.21 A security survey of AEC interests at the EPG was conducted by inspectors of the Office of Security, ALO, during the period 25 May to 1 June 1958, and it was found that, in general, the EPG security program was functioning satisfactorily.

ROLL-UP

7.22 The last test detonation at Bikini occurred on 22 July 1958. All classified information was removed from that atoll, and the Military Police departed on 1 August. The Marine guards of TG 7.3 were relieved from further guard responsibilities at EPG on 22 July.

7.23 The last test detonation at Johnston Island occurred on 11 August 1958. All classified activities of TG's 7.1 and 7.5 ceased on 18 August, at which time the military security guards were no longer required.

7.24 The last shot at Eniwetok Atoll occurred on 18 August 1958. The operational phase was concluded on 15 September 1958. Responsibility for the custody, security, and accountability for unexpended test materials (SS materials at the EPG reverted to the Manager, ALO, on the latter date. All SS materials left the EPG for return to the Mainland by 20 August 1958. Classified documents and other materials, other than those to be maintained at the EPG by the AEC and its Contractors, were removed by the same date.

7.25 The Military Police closed their last guard post at the EPG on 20 August 1958, and departed for the States. The HARDTACK badge system was deactivated on 9 September 1958, and was replaced by the EPG interim

badge system which had been suspended during the HARDTACK, Phase I, operational period.

PUBLIC INFORMATION PROGRAM

7.26 Responsibility for issuing all public information materials concerning Operation HARDTACK, Phase I, rested with the Joint Office of Test Information in Washington, D. C. The staff of JOTI was made up of AEC and DOD public information personnel, with a representative of AEC's Division of Information Services as Director.

7.27 In addition, a military public information officer was assigned to the staff of the Commander, JTF-Seven.

7.28 Public announcements of individual detonations were generally confined to those for which the yield was more than 200 kilotons. During the series, a total of 16 detonations were announced.

7.29 The Director of ALO's Office of Information was assigned as a Liaison Officer to the Joint Task Force on the staff of JOTI for the PINON (open shot) event of Operation HARDTACK, Phase I; however, the event was cancelled during the latter part of the program.

CLASSIFICATION

7.30 Prior to Operation HARDTACK, Phase I, representatives of the Classification Offices of ALO, SAN, FC/AFSWP, LASL, UCRL, and Sandia Corporation met to revise and rewrite the Classification Guide for the Pacific Test Operations. The revision agreed upon was submitted to AEC, Washington, and AFSWP, and after their approval it was forwarded to JTF-Seven where it was approved for use in Operation HARDTACK, Phase I.

7.31 The Chief of the Classification Branch of the Classification Division, AEC, Washington, was designated as Chief Classification Officers for JTF-Seven. His alternate was the Chief of the Declassification Branch of the Classification Division, AEC, Washington.

7.32 Direct participation of the ALO Classification Division in the Marshall Islands phase of the Operation was rather limited and, in the main, was handled by communication with Albuquerque. A representative of the ALO Classification Office was in residence at Eniwetok and Bikini Atolls as the Classification Officer for TG 7.5 for a period of three weeks. Since most classification problems arose within TG 7.1, which had its own classification representatives, there was relatively little demand for a resident classification representative for TG 7.5 affairs.

7.33 Major involvement of the ALO Classification Division started with the Johnston Island phase of Operation HARDTACK

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with attempts to resolve classification problems arising from the unexpected rapid establishment of Johnston Island facilities. ALO Classification Division afforded the Contractor classification advice and assistance within the limits of its authority. Subsequent to the establishment of the Johnston Island facilities, a representative

of the ALO Classification Division was loaned to LASL and designated as Classification Officer for TG 7.1 throughout the Johnston Island phase. Inasmuch as other Task Groups operating at Johnston Island did not have resident classification representatives, these groups were serviced as required.

CHAPTER 8
COMMUNICATIONS — ELECTRONICS

GENERAL

8.1 TG 7.5 provided communications services in accordance with EPG SOP Manual, Chapter 0270. This report summarizes briefly the services provided and documents the required service improvements. A detailed technical report is included in the Contractor's COMPLETION REPORT, OPERATION HARDTACK, PHASE I.

ORGANIZATION

8.2 It was apparent during Operation REDWING that the TG 7.5 organization to support the communications mission was ineffective because the communications functions were divided within the Contractor's organization. This led to confusion, misinterpretation of instructions, and duplication of effort. Prior to the build-up for HARDTACK, Phase I, a Communications Division was established within H&N's Eniwetok organization which resulted in the successful accomplishment of the communications mission. The scope of communications work for HARDTACK was several times that of REDWING but was performed with only a 22% increase in communications personnel. A reduction in AEC communications staff was also realized by shifting a larger portion of the communications program supervision to the Contractor. The organizational status of H&N's Communications Division at Jobsite will be continued, and it is planned that the cable installation and splicing functions will be transferred to the Communications Division to provide improved coordination of User requirements and professional supervision of the cable program.

DESCRIPTION OF FACILITIES

8.3 TG 7.5 provided telephone service on all islands, except Site Fred. At the conclusion of REDWING, it was apparent the Site Elmer telephone facility was inadequate, and engineering was initiated to replace the existing manual-type system before Operation HARDTACK.

8.4 On 1 February 1958, a 700-line dial system with three-attendant cabinets was placed in service with dial tie-lines to the TG 7.2-

furnished unattended dial system on Site Fred. This system provided adequate service and no further expansion is indicated, unless the population figures greatly exceed those of HARDTACK. Of the 686 lines available, a maximum of 582 were installed, and it is felt that this number of lines could be reduced without affecting the grade of service.

8.5 Three 70-line PABX dial systems were procured to extend dial service to three Eniwetok Atoll camps; however, installations were made only at Sites Yvonne and Janet. The third PABX was placed in stock after the Site Ursula camp was cancelled and is available to equip a third camp at Eniwetok Atoll or it may be utilized in Bikini Atoll after the conversion of that atoll to dial service. The Sites Yvonne and Janet exchanges were connected to the Elmer exchange by dial tie-lines; thus, all subscribers within Eniwetok Atoll could be reached by direct dialing.

8.6 During the planning for Operation HARDTACK, TG 7.1 could not be assured that the off-island PABX exchanges would withstand the blast effects; therefore, parallel services were provided from the Elmer exchange to a number of off-island locations by direct lines. The PABX off-island installations withstood the blast effects, however, and functioned properly throughout the shot series.

8.7 The telephone service for Bikini Atoll was provided on a manual basis. It was found that the increased requirements due to dividing the two laboratory activities, placing UCRL shots at Bikini Atoll and LASL shots at Eniwetok Atoll, overcrowded the system, rendering it incapable of handling the traffic load on Site Nan. Manual exchanges were installed and operated on Sites Nan, Oboe, and How. TG 7.5 is currently planning to replace the Bikini Atoll manual system with a dial system before the next full-scale test operation.

8.8 TG 7.5 funded the reinstallation of a 35-line dial system and radio equipment aboard the USNS AINSWORTH at a cost of approximately \$65,000. This communications equipment had been previously installed for RED-

WING but was removed after that Operation. When it was determined that the USNS AINSWORTH would again be used for Operation HARDTACK, TG 7.1 requested communications services be provided to support the evacuations of Bikini Atoll. After the equipment was reinstalled, it was requested that it remain installed for possible future use. H&N maintained the radio equipment aboard and operated the telephone exchange. Personnel required to man the TG 7.5 Com Center during evacuations were assigned from the Nan Com Center.

INTER-ATOLL SERVICE

8.9 A 12-channel tropospheric scatter radio system was developed during REDWING to provide inter-atoll communications services. Requirements for HARDTACK greatly exceeded those for REDWING, and action was taken to obtain a system with suitable band width to accommodate the added requirements. A 72-channel tropospheric scatter system, located within a U. S. Air Force Base and determined to be excess to needs, was loaned to the EPG indefinitely. This system was moved from Stewart AFB, New York, and installed at EPG. Sixteen channels were utilized to provide private line subscriber-to-subscriber type service. A 24-channels of encrypted voice (ciphony) service and two channels of teletype service. Also, a channel was allocated to TG 7.1 for use in passing Bikini voice "count-down" to selected Site Elmer subscribers, and a channel was allocated to TG 7.4 for the coordination of air traffic between the Eniwetok and Bikini control towers.

8.10 A total of 51 voice equivalent channels was utilized during Operation HARDTACK. The subscriber-to-subscriber-type private-line channels were eliminated. However, the Bikini Atoll dial system, the additional 2-way dial tie-lines between Eniwetok and Bikini Atolls, and the improvements in ciphony equipment to permit good quality voice service within the designed 50-kc band width (12-channel equivalent) will ensure an adequate number of channels for future operations.

SHIP-SHORE SERVICE

8.11 The AN TRC-24-type radio equipment obtained on loan from military sources was installed at Sites Nan and Elmer to provide radiotelephone and radioteletype service to the USS BOXER and the USNS AINSWORTH. This equipment was also utilized to extend ciphony service to the USS BOXER. Radiotelephone channels were connected to Sites Elmer and Nan switchboards, and adequate service was obtained. The increased power of this type transmitter and the use of higher gain directional antenna ashore improved coverage and extended reliable service from as far as 40 to 45 miles from Site Nan.

8.12 A high frequency circuit utilizing frequencies and equipment formerly allocated to inter-atoll service was activated to provide a ship-shore service with the MV ALOTO and to provide communications with H&N forces engaged in constructing off-atoll Weather and Rad-Safe Stations. Voice service was considered marginal and procurement action has been initiated to obtain single side-band-type transmitters and receivers to improve voice quality, thereby reducing the volume of CW message traffic.

COM CENTER AND CRYPTOGRAPHIC SERVICES

8.13 TG 7.5 provided and operated Com Centers on Sites Elmer, Nan, How, and during evacuation periods, aboard the USNS AINSWORTH. The Com Center on Site How was deactivated when ABMA facilities were relocated to Johnston Island. The principal Com Center was located in Building 208, Site Elmer, and was equipped with on-line crypto circuits to Los Alamos, and to the Sites Nan and Fred crypto. In addition, circuits capable of handling unclassified messages and messages encrypted in off-line crypto systems were installed, connecting the Site Elmer Com Center to Weather Central, Fred relay, and the back-up circuit to the USS BOXER. The average in-station handling time for message of all precedences was considerably higher than during the REDWING Operation. This was due to a 33% increase in traffic with no increase in operating work space. Crowded conditions led to lower operating efficiency and an increased number of security violations. The space situation became so acute that it was necessary to establish a Com Center Annex in the TG 7.1 teleconference facility. This allowed more space for operators to handle the traffic load, but it was not the solution to the space problem. Separating the Com Center function increased supervision problems and the opportunities for committing security violations since it entailed carrying classified messages to and from the Annex. Action is being taken to construct an addition to Communications Building 224 to accommodate a TG 7.5 Com Center facility.

8.14 TG 7.5 was delegated installation and operating supervision for the Com Center created to process news agency traffic resulting from the PINON event. The installation was made in Building 224, with 8 teletypes machines and 1 facsimile machine to handle the traffic originated by news media representatives. The circuits were connected through military transmitting facilities from Eniwetok to Hawaii and were terminated in Honolulu commercial services. After the PINON shot was cancelled, equipment was removed and operating personnel were released.

SUBMARINE CABLE SERVICES

8.15 The submarine cable program cost approximately \$2 million for Operation HARDTACK. Two new 26-pair cables were installed around both atolls to provide required pairs for the TG 7.1 timing and firing mission. Additions were made to the telephone cable plant to provide a minimum of 16 pairs at most off-island locations. Studies indicate that it costs from \$1/2 to \$3/4 million to maintain the submarine cable system for each operation. TG 7.5 is considering microwave to back up and eventually replace major submarine cable runs utilized to provide communications services. TG 7.5 has also recommended that TU-5, TG 7.1, conduct tests to determine the feasibility of eventually replacing the cable timing and firing system with microwave. Microwave has proved dependable in telephone company communications and television applications and is portable to meet the changing requirements of test programs.

8.16 Augmentation of the Sites Elmer-Fred cable plant was accomplished by installing JTF-Seven-furnished telegraph carrier equipment to derive additional teletype quality channels. Installation of JTF-Seven microwave provided the required additional telephone channels, and back-up to the submarine cable plant. Both of these facilities functioned as designed, providing a high grade of communications service.

MOBILE RADIO SERVICE

8.17 TG 7.1 was provided the following commercial VHF mobile type communications networks at a cost of approximately \$200,000:

- Command Net.....Both Atolls
- TU-4 (Sandia) Net...Both Atolls
- Rad-Safe Net.....Both Atolls
- TU-1 (LASL) Net...Eniwetok Atoll
- TU-2 (UCRL) Net...Bikini Atoll
- Administrative Net...Bikini Atoll

8.18 In many cases, these radios paralleled dial telephone service at Eniwetok Atoll, and in other cases radios on several different nets were installed in an office to supplement telephone service. The number of mobile-type installations was limited. Traffic studies taken under varying operational conditions revealed that only a small percentage of the system capacity was utilized.

8.19 VHF-FM tactical-type military radio equipment (AN/VRC series), on loan from military sources, was installed in TG 7.5 Boat Pools, TG 7.5 Air Dispatcher nets, and TU-3, TG 7.1 nets. Approximately 200 units were installed, mostly afloat. These units provided a flexible means of communications, be-

cause they could be pretuned to operate on several different nets. All nets were considered adequate.

INTERFERENCE DETECTION SERVICE

8.20 Since a considerable portion of the scientific diagnostic data was obtained through the use of microwave telemetry, it was of prime importance that these channels be protected from interference by radar and other radio signals. At Site Elmer, a military-furnished interference measuring and locating set was installed in REDWING Station 1518. This installation protected the telemetry circuits located on the adjacent 300-foot tower. A similar installation, made in Building 204, Nan, was transferred to Johnston Island during June. Portable units covering 0-300 megacycles were operated at both atolls, as required. This equipment was utilized to locate radio interference to any authorized radio facility. The interference detection team identified the offending signal, pinpointed its location, and advised JTF-Seven for regulatory action.

8.21 Considerable difficulty was experienced in bringing the older type of equipment up to satisfactory operating standards. The equipment furnished to protect the microwave telemetry lacked the sensitivity and operating efficiency of later model equipment. TG 7.5 is investigating the availability of commercial-type interference-detection equipment; it is planned that such a system mounted in a trailer will be procured for use in future Nevada and Eniwetok programs.

NEWSREEL OPERATION

8.22 Although the original delineation of TG 7.5 communications responsibilities with respect to the transfer of the TEAK and ORANGE events to Johnston Island was very minor, requirements increased as program planning developed. A telegraph circuit was established between Johnston Island and Site Elmer to handle traffic during the initial entry until the projected military voice circuits were established in May. A harbor control station, using HF and VHF radio equipment, was established to handle marine traffic.

8.23 Approximately 25 VHF-FM-VRC-18 type radio units were installed and maintained to support TG 7.1. Ship-shore radiotelephone service was provided the USS BOXER by installing AN/TRC-24-type equipment and telephone carrier to provide four voice channels. In mid-June, a requirement was received to provide and install single side-band HF transmitters and receivers for a count-down circuit covering a 90-degree sector between Johnston Island and the Hawaiian Islands. Emergency procurement action was initiated by the Contractor's Los Angeles Office, and the equipment was purchased,

inspected, airshipped to Johnston Island, and placed in operation 10 days prior to the User's deadline.

MOTION PICTURE SERVICES

8.24 Coincident with camp activation, TG 7.5 operated six open-air theaters during the build-up and operational phases of HARDTACK. Theaters at Sites Elmer and Nan were equipped with arc projectors, and those at the smaller camps and aboard scientific houseboats were equipped with lamp-type projectors. Films were rented from the Armed Forces Motion Picture Service to provide a free showing of regular or cinemascope feature movies seven nights a week. The theater at Site Elmer was extremely overcrowded and interfered with night softball, tennis, and handball activities. Plans have been made to relocate the present theater and to con-

struct an additional theater before another operation. Also, arc-type projection equipment has been obtained to replace all lamp-type projection equipment.

TELEVISION STATION

8.25 WXLE-TV operates as an Armed Forces Television Station and is operated and maintained by TG 7.5. The facility consists of a combined studio and transmitter station in Building 488, Site Elmer. The station operates from 1730 to 2255 hours daily and from 1330 to 2255 hours on Sundays and holidays. Coverage of the Sites Fred-Elmer-David area is excellent. This station, as presently located, interferes with official communications services, and plans are being made to construct new studios at the south end of Site Elmer to accommodate the television as well as the amateur radio station.

CHAPTER 9
TRANSPORTATION

9.1 All water transportation within the EPG was provided by TG 7.5, with the support of TG 7.3. LSD's under the control of CTG 7.3 were used extensively during the Operation. Two LST's and MV ALOTO provided shuttle service between Bikini and Eniwetok Atolls, while intra-atoll water transportation was accomplished by means of LCU's, LCM's, and DUKW's.

9.2 The addition of Johnston Island required a major effort from both Eniwetok and Honolulu for the movement of construction equipment and materials. The major part of the freight movement from Honolulu was accomplished by barge. Ships larger than an LST could not enter Johnston Harbor; therefore, all direct-lift cargo from the Mainland was stevedored outside the lagoon and brought in by barge. It was possible to beach LST's after the removal of coral heads in the channel and the construction of an LST landing ramp. A major increase in the support provided other Task Groups was made possible by the addition of the MV ALOTO to the permanent craft at Eniwetok. Its presence in the EPG allowed continuous construction support by both LST's at widely separated areas, such as Wotho and Nauru Atolls. If it were not for the support provided between Eniwetok and Bikini Atolls by the MV ALOTO, construction at such distant locations as Nauru Atoll might well have fallen behind schedule because of a lack of surface craft. Inclement weather and other factors frequently delayed construction at the off-atoll sites, and this delay might have adversely affect-

ed the scientific program at Eniwetok and Bikini Atolls had the ALOTO not been available.

9.3 In an attempt to solve the complicated requirements for air support of all Task Groups, an Air Priorities Agent, based at Site Fred, was established under a JTF-Seven Operations order, to control and coordinate with TG 7.4 all aircraft dispatching within the EPG. Each Task Group provided a Transportation Control Agent for coordination with the APA. All aircraft were scheduled from Site Fred, with the exception of liaison aircraft on D-1 and on shot days. Due to the greatly increased volume of traffic from Site Elmer on these days, it was agreed that traffic control would be handled from that site.

9.4 The unanticipated extension of the HARDTACK program posed major problems in the maintenance of ships at the EPG. It was necessary to release one of the LST's to Pearl Harbor for repairs during the most critical part of the move to Johnston Island. Repairs required 10 days and resulted in the absence of the LST from the EPG for more than 30 days. An LSD was also absent for an extended period for repairs at Pearl Harbor.

9.5 Inter- and intra-atoll shipping was under the control of CTG 7.5. Jobsite procedures to prevent duplication of shipment and to account for all materials shipped from one island to another were revised to include the experience gained during Operation REDWING. CTG 7.5 and CTG 7.1 observed the methods provided by H&N Jobsite Procedure

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D-14 (Inter- and Intra-Atoll Shipping), dated 20 November 1956. A representative of TG 7.5 stationed at each camp was responsible for the receipt and shipment of all supplies and the allocation of space aboard surface craft and aircraft. Each Task Group Commander provided TG 7.5 with the names of persons authorized to make requests for shipments; requests of authorized persons only were honored.

The volume of cargo originating at Site Elmer during HARDTACK far exceeded that of any previous operation:

- Air freight to all Weather and Rad-Safe sites 96,402 lbs.
- Air freight to Johnston Island 1,048,304 lbs.
- Air freight to Bikini Atoll 389,048 lbs.
- Air freight to Mainland 369,999 lbs.
- Surface freight to all Weather Rad-Safe sites 8,198.8 LT

- Surface freight to Johnston Island 4,052.9 LT
- Surface freight to Bikini Atoll 28,130.2 LT
- Intra-atoll freight shipments 92,149.5 LT

9.6 A joint motor pool system of dispatching vehicles for all Task Groups was not established, except at Johnston Island. At Eniwetok and Bikini Atolls each Task Group maintained dispatch controls of their assigned vehicles. Bus service was provided at Sites Elmer, Nan, and Johnston Island, with routes and schedules established jointly by CTG 7.1, 7.5, and CJTF-Seven.

9.7 Surface and air-lift support by TG's 7.3 and 7.4 from the Mainland to the EPG and within the EPG was excellent, particularly in relation to the move to Johnston Island.

**CHAPTER 10
SUPPLY**

10.1 Supply requirements for Operation HARDTACK were increased in magnitude over any previous operation. In anticipation of a program equal to REDWING, procurement of inventory supplies was initiated as far in advance as procedures, regulations, and availability of funds permitted. The addition of a number of events early in June led to a program of "crash" buying; however, requirements were met, and no delay in the program resulted from a lack of materials. In general, basic materials were already on hand and preliminary work could proceed while awaiting delivery of more critical items. Advance procurement before construction plans were firm resulted in some expenditures for certain facilities at Truk and Ponape which were later deleted from the program. However, the existence at Jobsite of material procured for these stations allowed increased flexibility later in the program in accommodating additional scientific construction which could not be foreseen. A proposal to increase the basic inventory by several million dollars in anticipation of future programs has been submitted. A larger basic inventory will permit greater leeway in design and construction during an actual test period, and will reduce the necessity for "crash" buying and a tremendous amount of air freight. Orderly procurement in

accordance with Government policies for proper documentation, expediting, and traffic control will greatly reduce costs.

10.2 During the interim period, additional warehouse space totaling 12,800 square feet was provided with the erection of a paint warehouse, a general stores warehouse, and a bulk storage warehouse. A considerable amount of stabilized storage area was given up to other activities, and new areas as yet have not been completely integrated. However, a more compact and efficient operation can be expected for future test series. Warehouse facilities provided for 80,069 square feet of inside storage, 49,524 square feet of refrigerated storage, and 547,750 square feet of outside storage. Limited personnel and equipment support from the J-4 Section, TG 7.1, was provided at Eniwetok and Bikini Atolls.

10.3 Roll-up of all off-atoll operations was completed on 18 August 1958, with the exception of Johnston Island which was completed on 19 September 1958. Equipment necessary for the operation of these sites has been returned to inventory at Site Elmer. DOD equipment and facilities for all Weather and Rad-Safe Stations have been turned over to the AEC and will become AEC property.

CHAPTER 11 RADIOLOGICAL SAFETY

GENERAL

11.1 On 15 March 1958, the beginning of Operation HARDTACK, CJTF-Seven assumed responsibility for the radiological safety of all JTF-Seven personnel. Each Task Group Commander was delegated the responsibility for radiological safety for the personnel within his particular Task Group.

11.2 On 1 April 1958, CTG 7.5 relinquished to CTG 7.1 the operational control of the Rad-Safe facilities operated during the non-test period by H&N. This control was returned to CTG 7.5 on 3 September 1958, 15 days after the last detonation.

11.3 The Rad-Safe personnel of AEC and its Contractor functioned as an independent Rad-Safe organization for TG 7.5. TU-6, the Rad-Safe organization for TG 7.1, acted as the Rad-Safe organization during the operational period; however, to keep radiation exposure to a minimum, TG 7.5 maintained control over services and operations as they affected TG 7.5 personnel. Close liaison was maintained between CTG 7.5 and CTG 7.1 on all Rad-Safe matters of mutual interest. Facilities were shared, and work on common problems, such as dosimetry, decontamination, and equipment repair, was accomplished by agreement between the two TG Commanders.

11.4 The Commander of TG 7.5 held Rad-Safe responsibility for the personnel of TG 7.5. The CTG 7.5's Rad-Safe Adviser was responsible for staff direction on all TG 7.5 Rad-Safe policies. The AEC Rad-Safe Officer was designated the Assistant Chief of Staff, E-7, with responsibility to the TG 7.5 Deputy Commander for supervising the Rad-Safe operations and recommending protection measures. The Contractor's Rad-Safe Officer functioned as the Operations Officer and provided necessary support. During periods when neither the Rad-Safe Adviser nor the Assistant Chief of Staff, E-7, was at EPG, the AEC Rad-Safe Assistant acted as Assistant Chief of Staff, E-7. This organizational arrangement was most satisfactory, and demonstrated that H&N could adequately supply radiological safety services for TG 7.5. In previous test series, Rad-Safe personnel were integrated into TU-6, TG 7.1, and the CTU-6 became the Rad-Safe Officer for TG 7.5.

11.5 The operational chart of the TG 7.5 Rad-Safe organization is shown in Figure 3-8.

RADIATION EXPOSURE OPERATIONAL GUIDES

11.6 The total cumulative exposure to JTF-Seven personnel authorized by CJTF-Seven directive was:

- a. Gamma--a maximum of 3.75 roentgens (r) for any consecutive 13-week period, with a maximum of 5.0 r within the period of the Operation.
- b. Any exception to this guide was to be on an individual basis and had to be approved by CTG 7.5 and the CJTF-Seven.

The gamma criteria for TG 7.5 personnel was further restricted to 5.0 r for the calendar year.

11.7 A contaminated area, defined as a radiological exclusion area (RADEX), was as follows:

FULL RADEX--an area in which the gamma radiation contamination was greater than 100 mr hr gamma, or greater than 10,000 counts per minute (cpm) alpha using a portable survey meter with a probe area of 55 square centimeters.

LIMITED RADEX--A radiation contaminated area with an intensity between 10 and 100 mr hr gamma, or between 1000 and 10,000 cpm alpha, with a probe area of 55 square centimeters.

11.8 Entry of all personnel into contaminated areas was controlled by CTG 7.1, TU-6. Personnel were not permitted beyond the Rad-Safe check point without a proper access pass issued by the TU-6 Plotting and Briefing Officer which stated the purpose and the precise location of the entry. H&N operated Rad-Safe check points only when it was necessary for the control of TG 7.5 personnel or when required to supplement TU-6 personnel.

11.9 All parties entering FULL RADEX areas were accompanied by certified monitors. Work-party monitors were furnished by H&N. All persons were required to wear anti-contamination clothing in FULL RADEX areas. TU-6, TG 7.1, determined the kind of clothing to be worn in a LIMITED RADEX area as the particular mission demanded. However, for TG 7.5 personnel, concurrence was obtained from the Contractor's Rad-Safe Officer.

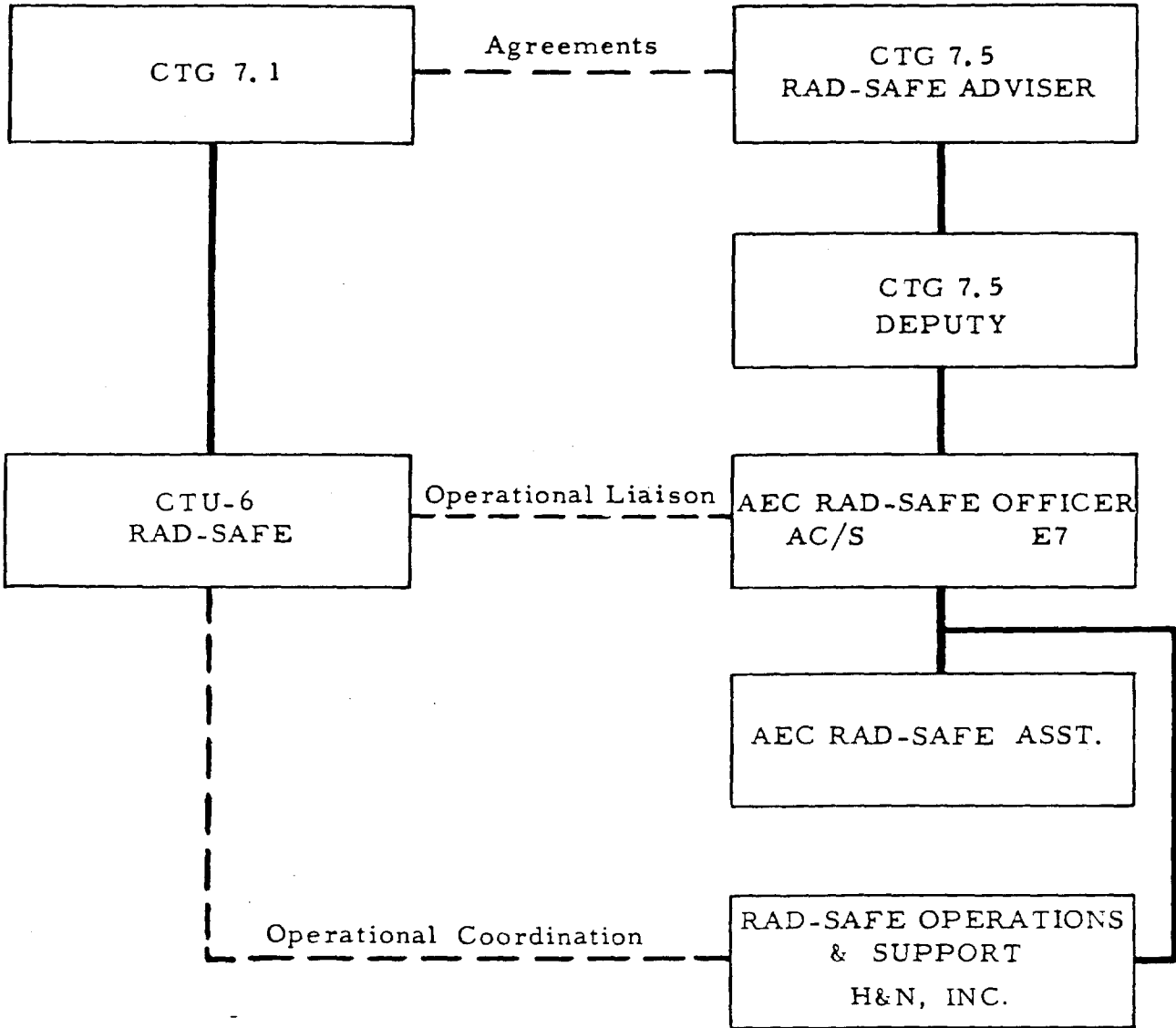


Figure 3-8. TG 7.5 Radiological Safety Organization.

- 11.10 Vehicles leaving contaminated areas were monitored and decontaminated when the radiation levels were greater than 7 mr hr gamma only, or 500 cpm alpha on the outside, or 7 mr hr gamma plus beta, or 500 cpm alpha on the inside.
- 11.11 Personnel leaving contaminated areas were monitored and decontaminated when levels were greater than 7 mr hr gamma plus beta, or 55 cpm alpha for outer clothing, or greater than 1 mr hr or 100 cpm on the skin or underclothing.
- 11.12 Construction activities in RADEX areas were accomplished at the discretion of CTG 7.5 and the AC, S, E-7.

OBJECTIVES

- 11.13 The objective and mission of Rad-Safe operations and support services were as follows:
 - a. To turn over to TU-6, TG 7.1, the responsibility of Rad-Safe operations for the duration of the Operation;
 - b. To comply with all JTF-Seven directives and requirements relative to radiation safety;
 - c. To provide buildings and equipment for the Rad-Safe Centers;
 - d. To provide laundry facilities for decontaminating clothing;
 - e. To provide the facilities for decontaminating personnel, vehicles, and equipment;
 - f. To conduct training courses to qualify Rad-Safe monitors for TG 7.5 operations;
 - g. To provide a pool of qualified monitors to support Contractor operations;
 - h. To maintain the records of radiation exposure for all TG 7.5 personnel; and
 - i. To assume the responsibility for Rad-Safe services at the completion of the Operation.

FILM BADGE PROCEDURES

11.14 All personnel within EPG were provided with an addressograph identification plate and a film badge. These badges were attached to and worn with the security badge at all times. The badges were exchanged bimonthly or upon return from a mission into a contaminated area. The AEC Contractor was responsible for the issuance of identification plates and for

the exchange of film badges for all TG 7.5 personnel.
11.15 IBM cards corresponding to numbered film badges were stamped using the individual identification plates at the time the film badge was issued. Using the IBM cards, H&N maintained the records and tabulated the individual dosage of all TG 7.5 personnel and prepared the following reports:

- Daily Dosage Report
- Daily over 2r Report
- Daily over 4r Report
- Bimonthly Summary Report
- Monthly Report of History of all Film Badges Issued
- Quarterly Summary Report

The summary report at the end of the Operation listed accumulated gamma exposures for 3464 TG 7.5 personnel.

GAMMA EXPOSURES

11.16 Following an unexpected fallout over Sites Elmer and Fred resulting from the FIR and KOA detonations on 12 and 13 May, it became necessary to request that the guide of 3.75r for a 13-week period be increased and the 5.0r for the Operation be raised to 10.0r for 35 key H&N personnel whose absence from EPG would have seriously handicapped the Operation. This fallout produced an additional radiation dose to the end of the Operation ranging from 100 to 1500 mr, depending upon the length of time a person remained at those sites. The request for increasing the guide limit for these individuals was approved by CJTF-Seven.

11.17 Of the total of 3464 TG 7.5 personnel listed on the summary report for Operation HARDTACK, the exposures can be broken down as follows:

DOSAGE	NUMBER OF PERSONS	PERCENT IN DOSAGE RANGE
No Dosage	676	19.5
0 - 499 mr	493	14.2
500 - 999 mr	378	10.9
1000 - 1999 mr	1330	38.4
2000 - 2999 mr	472	13.6
3000 - 3750 mr	78	2.3
3751 - 5000 mr	37	1.1
Over 5000 mr	0	0
Total	3464	100.0

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11.18 Four persons exceeded the 3.75r for a 13-week-period guide; however, none exceeded the 5r limit for the Operation. The highest exposure was 4805 mr. One person, however, did exceed the 5r for the period from 1 January to 1 August 1958, receiving a total of 5036 mr. All five of these persons were on the list authorizing over 3.75r dosage for 13 weeks and up to 10 r for the Operation. The one individual who received 5036 mr for the calendar year was returned to the Mainland on 10 August and hence received no further exposure during the calendar year.

RADIOLOGICAL SAFETY OPERATIONS

11.19 The Rad-Safe Department of H&N employed 14 persons during Operation HARDTACK. Of these, six were located at Site Nan, Bikini Atoll, and the remaining eight at Site Elmer, Eniwetok Atoll.

11.20 One electronics technician was stationed at Site Nan and one at Site Elmer for radiation instrument repair. These persons worked with TU-6 technicians on all radiation measuring equipment used at the two sites.

11.21 During certain periods, H&N maintained check-point monitors at the marine ramps on Sites Elmer, Yvonne, and Tare. These were special check-points established for the control of TG 7.5 personnel only.

11.22 H&N organized and trained a four-man underwater monitoring team that performed underwater monitoring prior to authorizing entry of personnel, such as divers and cable crews, into the area.

11.23 A limited environmental sampling program was conducted as a joint function with TU-6, TG 7.1. Rad-Chem trailers at Sites Elmer and Nan provided the laboratory facilities for this work. The majority of the samples were counted for gross beta activity; the remainder were counted for alpha activity. The following is a summary of the samples counted during Operation HARDTACK:

Sea Water	463
Rain Water	29
Fresh Water	2
Alpha Swipes	60
Nose	200
Food	15
Soil	13
Urine (tritium)	20
Marine Specimens	6
Plant Specimens	3

11.24 Area decontamination was necessitated in two instances. On Site Tare, Bikini Atoll, backfilling with uncontaminated coral sand minimized the radiation dose H&N personnel received while replacing a sea wall. On Site Yvonne, Eniwetok Atoll, decontamination of the QUINCE GZ allowed personnel to work in the area in preparation for the FIG shot. Decontamination was by removal of the top layer of sand.

11.25 At the request of Headquarters, JTF-Seven, the Rad-Safe Adviser served on the medical and technical team sent to Rabaul, New Guinea, to report on the medical and radiological situation aboard two Japanese IGY ships that had been exposed to an indeterminate amount of radiation during a short rain-out.

11.26 The Rad-Safe Adviser, TG 7.5, was requested by CTU-6, TG 7.1, through Headquarters, JTF-Seven, to act as Officer-in-Charge of the Eniwetok TU-6 Detachment for a 10-day period. However, due to a change in circumstances, this order was never executed.

11.27 TG 7.5 Rad-Safe support was not furnished for the detonations at Johnston Island; however, an emergency team of four persons and the necessary equipment were on stand-by, if the need arose.

TRAINING

11.28 Prior to Operation HARDTACK, Rad-Safe monitor training courses for H&N personnel were conducted at Sites Elmer and Nan. A basic mathematics test was given to applicants for the course to eliminate personnel without the proper background. The course consisted of 20 hours of classroom and field training. Fifty-three persons successfully completed the course.

11.29 In addition to the monitor training course, a two-hour indoctrination lecture was presented to all H&N supervisory personnel. Approximately 230 foremen and supervisors were acquainted with the principles of radiological safety and with their responsibilities as work-party leaders when in contaminated areas.

OPERATIONS OF TU-6, TG 7.1

11.30 The responsibility for all Rad-Safe operations rested with TU-6 of TG 7.1 for conducting all surveys to document the radiological situation, providing a plotting and briefing service, furnishing monitoring assistance to other Task Units, maintaining the registry of radioactive sources at EPG, advising about the preparation of radioactive material for shipment from the site, conducting personnel decontamination, and providing the necessary anti-contamination clothing and equipment. Vehicle decontamination, dosimetry and records, instrument repair, and Rad-Chem laboratory facilities were shared jointly by TU-6, TG 7.1, and H&N.

CHAPTER 12

EMERGENCY PLANS

NATURAL DISASTER DEFENSE

12.1 Procedures to be followed by TG 7.5 in the event of a natural disaster at the EPG, such as a typhoon or a seismic wave, were prescribed in Chapter 0504, TG 7.5 SOP. Plans were made for sounding emergency signals, location of command posts, recall of small boats and construction personnel from shot islands, emergency operation of utilities, alerting medical facilities, securing construction projects in progress, securing base facilities, and for the evacuation of personnel to ship in the event such action should be required.

12.2 Only one early warning of a possible tidal wave was received during Operation HARDTACK. The wave dissipated long before it reached the EPG, and it was not necessary to execute any precautionary measures.

HOSTILE ACTION ALERT

12.3 Plans for TG 7.5 activities in the event of enemy action at the EPG were coordinated by E-3, TG 7.5, with Headquarters, JTF-Seven, and with TG 7.2 on Site Fred. It was agreed that upon the announcement of either a red or white alert by CJTF-Seven, TG 7.5 would proceed as follows:

- a. Sound general emergency
- b. Assemble TG 7.5 staff at Sites Elmer and Nan
- c. Man all marine craft and be prepared to evacuate men and equipment to ships
- d. Assist other Task Groups in emergency loading of ships
- e. Provide equipment and personnel to assist TG 7.1 in evacuating weapons, device components, and critical equipment to ships, if so ordered
- f. Man all TG 7.5 radio and telephone circuits continuously
- g. Man all fire-fighting equipment with augmented crews continuously
- h. Be prepared to destroy all classified documents and equipment on orders of CTG 7.5.

However, no enemy action alert occurred at EPG during Operation HARDTACK, Phase I.

EVACUATION AND RE-ENTRY OPERATIONS

12.4 During Operation HARTACK, personnel were evacuated to sea for the SYCAMORE and POPLAR events at Bikini Atoll. For the FIR and NUTMEG events, personnel on Site Oboe were evacuated to the AINSWORTH. Subsequent to the NUTMEG event, CTJF-Seven authorized Site Oboe personnel to remain on Oboe during shots fired at the northern part of the Bikini Atoll. For shots fired at the end of Site Tare, Oboe personnel were evacuated to Site Nan. Fig. 3-9 shows the evacuations held at Bikini Atoll.

12.5 Personnel at Eniwetok Atoll were evacuated from the northern islands to Sites David, Elmer, and Fred for each shot, except a limited number of TG 7.1 personnel who were authorized to remain at stations on Site Bruce.

12.6 At Johnston Island all personnel, except a few operational people, were evacuated by helicopter and LCU's to the USS BOXER for the TEAK and ORANGE events. Contractor ingenuity and the skill of a sailor hoist operator combined to overcome the problem of transporting personnel from LCU's to the USS BOXER. A cage, approximately 12x12x7 feet, was fabricated of channel iron, angle iron, chain, and heavy metal screening. This cage was filled with approximately 25 people and was lifted from the LCU to the USS BOXER hangar deck by a high-speed crane located aboard the USS BOXER.

12.7 All personnel evacuations and re-entry operations were executed as prescribed in Chapter 0505, TG 7.5, SOP. E-3, TG 7.5, published and distributed detailed safety and evacuation instructions for each shot.

12.8 All personnel evacuation and re-entry operations were conducted without a serious incident or injury to personnel. Similarly, the evacuation and roll-up of shot-island camps at Sites Janet, Yvonne, George, How, and Oboe were accomplished successfully by H&N. E-3, TG 7.5, prepared detailed plans for the roll-up of each of these shot-island camps and supervised their execution.

DATE	EVENT	TO "AINSWORTH" FROM			TO "BOXER"	TO LSD	TOTAL 7.5 EVACUATION
		OBOE	NAN	HOW	FROM NAN	FROM NAN	
April 24	FIR	117		112			229
April 25	FIR	117		115			232
April 26	FIR	112					112
April 27	FIR	112					112
April 28	FIR	112					112
April 29	FIR	110					110
May 2	FIR	107					107
May 3	FIR	105					105
May 4	FIR	105					105
May 5	FIR	105					105
May 6	FIR	105					105
May 7	FIR	105					105
May 9	FIR	106					106
May 10	FIR	50					50
May 11	FIR	103					103
May 12	FIR	103					103
May 20	NUTMEG	94					94
May 21	NUTMEG	94					94
May 22	NUTMEG	94					94
May 22	SYCAMORE	94	473		21		588
May 23	SYCAMORE	94					94
May 24	SYCAMORE	94					94
May 25	SYCAMORE	70					70
May 26	SYCAMORE	93					93
May 27	SYCAMORE	70					70
May 28	SYCAMORE	91					91
May 29	SYCAMORE	91	466		21		578
May 30	SYCAMORE	91	464		23		578
May 31	SYCAMORE	91	464		23		578
July 11	POPLAR	94	393			13	500

Figure 3-9. TG 7.5 Personnel Evacuations — Bikini Atoll.

CHAPTER 13
FUNDING AND ACCOUNTING

13.1 The major financial problems encountered during Operation HARDTACK were:

- a. The receipt of Plant Acquisition and Construction funds was in conflict with the operational period. The bulk of major additional and replacement permanent construction had to be accomplished concurrently with the scientific test facilities. This contributed to excessive peaking manpower requirements and the diversion of much needed construction stores to permanent plant instead of to scientific construction.
- b. Current-use stores inventory levels were too low preceding the start of Operation HARDTACK. The Contractor's cost ceiling limitations on inventory levels made it impossible to stockpile sufficient long lead-time and scarce materials. This contributed to "crash" procurement, expensive airlift, and the disruption of construction planning schedules pending receipt of key materials.
- c. Discrepancy in the Contractor's cost of installed equipment was noted early in the Operation, but it was too late to effect a correction during the Operation. Equipment procured for a particular structure or facility was charged to that structure or facility, despite the fact that subsequent planning may have deleted the requirement for the installation of the equipment. The equipment that had been charged but not installed was then available for installation in a different facility at no charge to that project (considered as Government Furnished Equipment). Obviously, this created gross overstatement of costs in the first instance and equally gross understatement of costs in the latter instance. This problem was subsequently corrected by establishing an inventory of equipment, normally considered as installed, which will be charged with the cost of all the equipment on hand (not physically installed) and subsequently procured. The inventory will be credited with the value of the equipment withdrawn for installation in a specific

structure, and that specific structure will be charged with the cost of all such items.

13.2 For Operation HARDTACK, considerable progress was made in expediting the publication and circulation of timely test construction Cost and Estimate Reports. For previous operations, this report had been compiled by the Los Angeles Office of the Contractor. By moving the responsibility for compiling and issuing this report to Jobsite through the critical construction stage, information was available to participants as much as three weeks earlier than during previous operations. Also, as shown in Figs. 3-11A-C, a new report, entitled Cost and Estimate Report — Expendable Test Construction and Test Site Operations, was instituted. The principal purpose of this report was to associate cost with the scientific participant responsible for the cost. To this end the report has proved successful, particularly in disclosing to the Users the varying costs of providing temporary camps and auxiliary facilities, including operation and maintenance.

13.3 Based on data furnished the Manager. ALO, by the participating organizations, a report has been compiled covering the ALO cost for test construction and test site operations in connection with AEC participation in Operation HARDTACK, Phase I. This report is presented herewith as Fig. 3-10, Summary by Cost Budget Category, and is supported by Figs. 3-11A-C, Expendable Test Construction and Test Site Operations.

13.4 Fig. 3-10 reflects the ALO 3000 Program full-scale activity and related reimbursable work costs by organization and by the following major cost categories:

- 3831 Expendable Test Construction
- 3832 Test Site Operations

13.5 Costs supporting Fig. 3-10 reflect further breakdowns of cost as follows:

- Fig. 3-11A — Expendable Test Construction detailed by major items or types and by Users
- Figs. 3-11B & C — Test Site Operations detailed by subfunctions and by Users

13.6 Also included are two charts which present graphically the relation of certain cost factors to population factors. The data used

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in preparing these charts were furnished by participating organizations.

- a. Fig. 3-12 shows the relation of the cost of support services performed for test organizations to the number of scientific personnel at EPG. This chart reflects an increase in support requirements with an increase in scientific personnel as the test period is approached, and a corresponding decrease in support requirements and scientific personnel subsequent to the test period.
- b. Fig. 3-13 shows the trend of costs for maintenance and operation in relation to the total population trend, as the test period is approached and passed.

13.7 Test Planning and Evaluation, shown as Category 3810 on the cost reports of REDWING and previous operations, has been discontinued as a budget and accounting category for Scientific Contractors and is not included in Fig. 3-10. Costs of this activity, totaling \$14,040,469, (incurred costs plus the estimated costs to complete) are shown detailed by scientific program and project in the Consolidated AEC Test Cost Report — Operation HARDTACK as of 31 July 1958, in accordance with JTF-Seven cost reporting procedures.

13.8 The total cost reflected on Fig. 3-10 includes actual cost with estimates to complete as of the dates and during the periods shown in the footnote.

DEFINITIONS

13.9 Definitions of the major cost categories are as follows:

EXPENDABLE TEST CONSTRUCTION includes all costs of towers, scientific stations, and other facilities, including temporary camps, constructed in test areas subject to damage or destruction during operations, and those scientific structures in non-test areas that are constructed for a particular operation.

TEST SITE OPERATIONS include all costs incurred in the maintenance and operation of the test site, such as maintenance, operation of facilities, and support services provided to participating test organizations on a Special Work Order basis.

TECHNICAL SUPPORT SERVICES (shown as a line item under Test Site Operations) include all costs incurred by organizations, other than scientific participants sponsoring tests, in technical support of full-scale tests. Such costs cover but are not limited to timing and firing; fireball and cloud formation photography; yield determinations; measurement of reaction history; radiological services; meteorological services; and microbarograph studies.

BREAKDOWN OF FINAL COSTS

13.10 Breakdown of final costs of Operation HARDTACK, Phase I, on a percentage basis as shown below, reflects the distribution of the ALO full-scale test dollar:

OPERATION HARDTACK, PHASE I

<u>Expendable Test Facilities Test Site Operation - (15 months)</u>	<u>Gross Cost Including Reimbursable Work</u>	<u>Per- cent</u>	<u>Gross Cost Excluding Reimbursable Work</u>	<u>Per- cent</u>
	\$25,344,100	41.4	\$22,027,950	39.2
	<u>35,884,819</u>	<u>58.6</u>	<u>34,142,844</u>	<u>60.8</u>
Total	<u><u>\$61,228,919</u></u>	<u><u>100.0</u></u>	<u><u>\$56,170,794</u></u>	<u><u>100.0</u></u>

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OPERATION HARDTACK, PHASE II
ALO FULL SCALE TEST ACTIVITY
SUMMARY BY COST-BUDGET CATEGORY

COST-BUDGET CATEGORY

3832 EXPENDABLE TEST CONSTRUCTION (Fig. 3-11A)

Scientific Facilities	\$15,517,098		
Transportation	7,267,858		
Construction, Camps & Auxiliary Facilities	1,837,238		
Construction, Equipment Procurement	\$25,122,724		
Gross Cost	\$49,744,918		
Less: Reimbursable Work - DOD	\$21,860,714		
Net Costs Incurred by ALO to September 30, 1958	\$27,884,204		
Add: Estimated Net Cost to Complete	251,876		
Net Costs Incurred and Estimated - ALO	\$28,136,080		

3832 TEST SITE OPERATIONS (Figs. 3-11B & C)

Base Camp Facilities - Maintenance	\$ 5,247,297		
Base Camp Facilities - Operation	10,676,741		
Research and Scientific Facilities	7,148,819		
Inter Island Marine Transportation - Maintenance	2,377,886		
Inter Island Marine Transportation - Operations	3,180,913		
Special Order Work for Test Organizations	2,127,458		
Technical Support Services	4,626,807		
Gross Cost	\$33,385,931		
Less: Cash Revenue from Operation of Test Site Facilities	(3,743,967)		
Reimbursable Work - DOD	(1,201,920)		
Net Costs Incurred by ALO to September 30, 1958	\$28,440,044		
Add: Estimated Net Cost to Complete	314,200		
Net Costs Incurred and Estimated - Test Site Operations - ALO	\$28,754,244		

COST SUMMARY

Total Gross Cost Incurred	\$60,922,843		
Less: Cash Revenue from Operation of Test Site Facilities	(3,743,967)		
Reimbursable Work for Other Government Agencies	(15,028,125)		
Net Total ALO Costs Incurred	\$42,150,751		
Add: Total Estimated ALO Cost to Complete	566,076		
Net Total ALO Costs Incurred and Estimated (Fig. 13-3)	\$42,716,827		

Technical Support Services costs (Edgerton, Gernsbausen & Greer, Inc) are based on Contractor's reports as of July 31, 1958, Holmes & Narver, Inc, ALO, and other Government agencies as of September 30, 1958. Expendable Test Construction includes costs incurred in connection with Operation HARDTACK from inception. Test Site Operations costs (except Technical Support costs) cover period beginning with July 1, 1957. Note: Net total cost includes Reimbursable Work performed for AEC by other Federal agencies but does not include:

- a. Weapons cost
- b. Any capital cost or depreciation of capital assets
- c. Any cost of AEC administrative costs
- d. Non-reimbursable services and materials furnished by other Federal agencies.

ALO AND OTHER
GOVERNMENT
AGENCIES

HOLMES &
NARVER, INC

EDGERTON,
GERNSBAUSEN,
& GREER, INC

TOTAL

	\$15,517,098			
	7,267,858			
	1,837,238			
	\$25,122,724			
	(3,316,100)			
	\$21,806,624			
	251,876			
	\$22,058,500			
	\$ 5,247,297			
	10,676,741			
	7,148,819			
	2,377,886			
	3,180,913			
	1,619,636			
	286,339			
	\$ 3,958,355			
	\$ 3,958,355			
	(1,201,920)			
	\$ 2,756,435			
	314,200			
	\$ 3,070,635			
	\$56,611,955			
	(3,743,967)			
	(13,526,205)			
	\$ 39,341,783			
	566,076			
	\$ 39,907,859			
	\$ 3,958,355			
	(1,201,920)			
	\$ 2,756,435			
	314,200			
	\$ 3,070,635			
	\$ 899,293			
	\$ 899,293			
	\$ 240,000			
	\$ 1,139,293			

Figure 3-10 Cost Report - Summary by Cost Budget Category

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OPERATION HAROTACK, PHASE I
ALO FULL SCALE TEST ACTIVITY
EXPENDABLE TEST CONSTRUCTION AND TEST SITE OPERATIONS

051 SCIENTIFIC FACILITIES ZERO STATIONS	TOTAL COSTS INCURRED & ESTIMATED	ESTIMATED COMPLETE	TOTAL COST /	COST DISTRIBUTION BY USER /				DOD
				UCRL	LASL	SANDIA CORP.	AEC	
Barges	\$ 4,093,938		\$ 4,093,938	\$ 2,334,637	\$ 1,759,301			
Ground	233,549		233,549	20,911	214,638			
Other	279,889		279,889	20,911	258,978			
Total Zero Stations	\$ 4,609,306		\$ 4,609,306	\$ 2,334,637	\$ 1,972,917			
60-99 Group	\$ 400,797		\$ 400,797	\$ 49,211	\$ 351,586	\$ 21,694		\$ 330,214
100-999 DOD Scientific	330,214		330,214					
1000-9999 LASL Scientific	2,156,700		2,156,700					
2000-9999 ERL Scientific	1,201,927		1,201,927					
6000-9999 Sandia Corp. Scientific	124,026		124,026			124,026		
6000-9999 AF Scientific	1,016,000		1,016,000					1,195,000
7000-9999 AF Scientific	20,061		20,061					20,631
Total Number of Stations	\$ 5,214,903		\$ 5,214,903	\$ 2,334,637	\$ 2,880,266	\$ 315,720		\$ 1,543,925
OTHER THAN NUMBERED STATIONS	\$ 1,425,125		\$ 1,425,125	\$ 1,222,492	\$ 202,633			\$ 202,633
Rehabilitation	145,800		145,800					
Miscellaneous	138,100		138,100					
Communications and Support Construction	91,200		91,200			86,890		
Communications - Scientific Projects	191,563		191,563					45,263
Telephone System	341,523		341,523					
Other Communications	939,441		939,441					463,006
Electrical Distribution - Scientific Projects	\$ 5,475,037		\$ 5,475,037	\$ 2,822,062	\$ 1,861,877	\$ 124,461		\$ 657,107
Total Other than Numbered Stations	\$ 13,317,097		\$ 13,317,097	\$ 6,428,751	\$ 6,611,916	\$ 270,234		\$ 2,203,117
052 TEMPORARY CAMPS & AUXILIARY FACILITIES								
Airstrips & Facilities	\$ 114,230		\$ 114,230	\$ 5,156	\$ 32,732			\$ 16,885
Causeways, Bulkheads, and Off Shore Islands	107,403		107,403	81,934	21,469			
Camp, Temporary Facilities	259,200		259,200				302,405	
Communications - Temporary Camps	303,646		303,646		199,977		303,871	226,798
Communications - Basic System	72,455		72,455	5,972	44,297			17,044
Telephone System	483,441		483,441					13,704
Other Communications	759,377		759,377					70,489
Water Distribution - Basic System	366,268		366,268		236,167			41,581
Electrical Distribution - Basic System	173,633		173,633		74,065			5,733
Ramps, Channels, & Piers	35,111		35,111		43,518			124,402
Tent Shops & Trailer Area	917,416		917,416		191			1,489
Warehouses & Support Construction	1,937,288		1,937,288		45,617			81,347
Temporary Camps	1,910,400		1,910,400	374,705	214,915			458,982
Other	1,929,064		1,929,064	39,927	67,662			367,678
TOTAL COST - TEMPORARY CAMPS & AUXILIARY FACILITIES	\$ 7,959,064		\$ 7,959,064	\$ 790,116	\$ 977,490	\$ 7,097	\$ 1,650,502	\$ 2,031,149
053 CONSTRUCTION EQUIPMENT PROCUREMENT								
Replacement & Additions	\$ 1,837,236		\$ 1,837,236					\$ 1,837,236
TOTAL COST - EXPENDABLE TEST CONSTRUCTION	\$ 25,344,109		\$ 25,344,109	\$ 7,224,870	\$ 7,592,436	\$ 277,376	\$ 5,999,274	\$ 4,234,266
LESS REIMBURSABLE WORK	3,316,150		3,316,150					3,316,150
NET COST - INCURRED & ESTIMATED - EXPENDABLE TEST CONSTRUCTION, ALO	\$ 22,027,959		\$ 22,027,959	\$ 7,224,870	\$ 7,592,436	\$ 277,376	\$ 5,999,274	\$ 918,116

Figure 3-11A. Cost and Estimate Report - Expendable Test Construction (As of 30 September 1958) (Sheet 1 of 3).

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OPERATION, HANDOFF, PHASE I
 ALSO FULL-SCALE TEST ACTIVITY
 EXPENDABLE TEST CONSTRUCTION AND TEST SUI OPERATIONS

362 TEST SITE OPERATIONS - 1. BASE CAMP FACILITIES OPERATION	TOTAL COSTS INCURRED & ESTIMATED	ESTIMATED COST TO COMPLETE	COST DISTRIBUTION BY USER /					
			TOTAL COST /	UCRL	LASL	SANDIA CORP.	AEC	DOD
Utilities	\$ 1,852,124		\$ 1,627,123				\$ 1,216,531	\$ 635,594
Land and Air Transportation	275,507		275,507				221,843	53,664
Messing & Housing	4,376,531		4,376,531				4,362,979	234,552
Laundry & Post Exchange	1,276,531		1,276,531				1,276,531	
Fire & Safety, Health & Sanitation	915,000		915,000				1,839,862	
Other Facilities	416,110		416,110				748,260	167,475
Security	218,250		218,250				411,947	44,472
Miscellaneous	310,650		310,650				528,794	9,556
Total Operation - Base Camp Facilities	\$ 3,636,331		\$ 3,636,331				\$ 9,537,596	\$ 1,098,651
MAINTENANCE								
Utilities	\$ 2,150,340		\$ 2,150,340				\$ 1,613,256	\$ 537,083
Land & Air Transportation	166,620		166,620				141,976	24,643
Messing & Housing	740,600		740,600				416,109	324,491
Laundry & Post Exchange	38,650		38,650				64,871	32,925
Fire & Safety, Health & Sanitation	182,000		182,000				36,482	12,195
Other Facilities	1,848		1,848				136,694	50,176
Security	1,532,465		1,532,465				1,220,580	311,884
Miscellaneous	26,261		26,261				1,220,580	67,410
Total Maintenance - Base Camp Facilities	\$ 5,247,299		\$ 5,247,299				\$ 3,631,300	\$ 1,615,583
TOTAL OPERATION & MAINTENANCE - BASE CAMP FACILITIES	\$ 13,901,035		\$ 13,901,035				\$ 13,168,896	\$ 2,732,639
2. TEMPORARY & SCIENTIFIC FACILITIES OPERATION								
Temporary Camps								
Utilities	\$ 533,355		\$ 533,355				\$ 438,670	\$ 178,637
Land & Air Transportation	192,232		192,232				24,045	47,134
Messing & Housing	2,016,641		2,016,641				1,589,147	797,708
Laundry & Post Exchange	541,724		541,724				470,445	272,396
Fire & Safety, Health & Sanitation	137,284		137,284				318,542	139,333
Other Facilities	165,170		165,170				9,614	30,953
Security	26,261		26,261				18,270	31,082
Miscellaneous	26,261		26,261				18,270	31,082
Total Operation - Temporary Camps	\$ 3,616,295		\$ 3,616,295				\$ 3,082,967	\$ 1,464,798
TOTAL OPERATION - TEMPORARY CAMPS & SCIENTIFIC FACILITIES	\$ 3,616,295		\$ 3,616,295				\$ 3,082,967	\$ 1,464,798
MAINTENANCE								
Temporary Camps								
Utilities	\$ 658,951		\$ 658,951				\$ 31,671	\$ 63,177
Land & Air Transportation	240,000		240,000				20,843	3,817
Messing & Housing	2,016,641		2,016,641				1,622,154	29,697
Laundry & Post Exchange	541,724		541,724				11,156	3,488
Fire & Safety, Health & Sanitation	137,284		137,284				10,341	829
Other Facilities	165,170		165,170				2,004	6,829
Security	26,261		26,261				237,188	58,000
Miscellaneous	26,261		26,261				237,188	58,000
Total Maintenance - Temporary Camps	\$ 1,322,476		\$ 1,322,476				\$ 951,628	\$ 161,391
TOTAL OPERATION & MAINTENANCE - TEMPORARY CAMPS & SCIENTIFIC FACILITIES	\$ 4,938,771		\$ 4,938,771				\$ 4,034,595	\$ 1,626,189

Figure 3-11B Cost and Estimate Report - Test Site Operations (As of September 1958) (Sheet 2 of 3)

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OPERATION HARDTACK, PHASE 1
 ALSO FULL SCALE TEST ACTIVITY
 EXPENDABLE TEST CONSTRUCTION AND TEST SITE OPERATIONS

	TOTAL COSTS INCURRED & ESTIMATED	ESTIMATE D COSTS YR COMPLETED	COST DISTRIBUTION BY USER 1/					DOD
			TOTAL COST 1/	UCRL	LASL	SANDIA CORP.	AEC	
3832 TEST SITE OPERATIONS (CONTD)								
3 INTER-ISLAND MARINE TRANSPORTATION								
Operation	\$ 3,180,913		\$ 3,180,913				\$ 3,180,913	\$ 3,559
Maintenance	2,372,986		2,372,986				2,369,427	
	\$ 5,553,899		\$ 5,553,899				\$ 5,550,340	\$ 3,559
4 SPECIAL ORDER WORK FOR TEST ORGANIZATIONS								
TOTAL OPERATION & MAINTENANCE, INTER-ISLAND MARINE TRANSPORTATION	\$ 1,619,636		\$ 1,619,636	\$ 300,952	\$ 206,256	\$ 63,215	\$ 573,696	\$ 475,537
Operation	500,000		500,000	250,000	250,000		7,600	
Maintenance	7,600		7,600					
	\$ 2,127,236		\$ 2,127,236	\$ 550,952	\$ 456,256	\$ 63,215	\$ 581,296	\$ 475,537
5 TECHNICAL SUPPORT SERVICES								
Tuning & Firing	\$ 1,406,502	\$ 31,964	\$ 1,374,538		\$ 863,801		\$ 729,386	\$ 67,152
Fireball & Cloud Photography	1,098,530	115,910	982,620					56,839
Yield Determination	234,792	346,326	234,792	\$ 1,215	1,230,380		178,074	231,792
Radiological Services	1,842,616		1,496,290				391,694	66,671
Other Technical Support	565,317		568,347				1,299,104	1,666.9
	\$ 5,150,807	\$ 514,200	\$ 4,636,607	\$ 1,215	\$ 2,134,141		\$ 1,299,104	\$ 1,707,107
TOTAL TECHNICAL SUPPORT SERVICE	\$ 35,884,819	\$ 314,200	\$ 35,570,619	\$ 1,147,204	\$ 3,476,971	\$ 63,215	\$ 24,661,104	\$ 6,073,922
GROSS COST — TEST SITE OPERATIONS								
9 CASH REVENUE								
Operation of Base Camp	\$ (2,483,348)		\$ (2,483,348)		\$ (131,432)		\$ (1,197,311)	\$ (1,287)
Operation of Temporary Camp	(1,251,930)		(1,251,930)				(676,292)	(67,316)
Other	(8,669)		(8,669)				(5,068)	(5,068)
	\$ (3,743,947)		\$ (3,743,947)		\$ (131,432)		\$ (1,878,671)	\$ (1,950)
TOTAL CASH REVENUE	\$ (3,743,947)		\$ (3,743,947)		\$ (131,432)		\$ (1,878,671)	\$ (1,950)
NET COST — TEST SITE OPERATIONS	\$ 32,140,872	\$ 514,200	\$ 31,626,672	\$ 1,069,934	\$ 3,347,539	\$ 63,215	\$ 22,782,433	\$ 4,071,972
LESS REIMBURSABLE WORK	1,741,975		1,741,975				21,567,221	1,741,975
NET COSTS — INCURRED & ESTIMATED — TEST SITE OPERATION, ALSO	\$ 30,398,897	\$ 514,200	\$ 29,884,697	\$ 1,069,934	\$ 3,347,539	\$ 63,215	\$ 21,567,221	\$ 2,813,947
TOTAL NET COSTS — ALSO EXPENDABLE TEST CONSTRUCTION AND TEST SITE OPERATIONS	\$ 52,426,927	\$ 736,076	\$ 51,690,851	\$ 8,586,804	\$ 10,939,926	\$ 340,493	\$ 27,386,797	\$ 4,734,902

1/ Cost Distribution by User does not include Estimate to Complete, as estimates were not made at this level.

Figure 3-11C. Cost and Estimate Report — Test Site Operations as of 30 September 1955 (Sheet 3 of 3)

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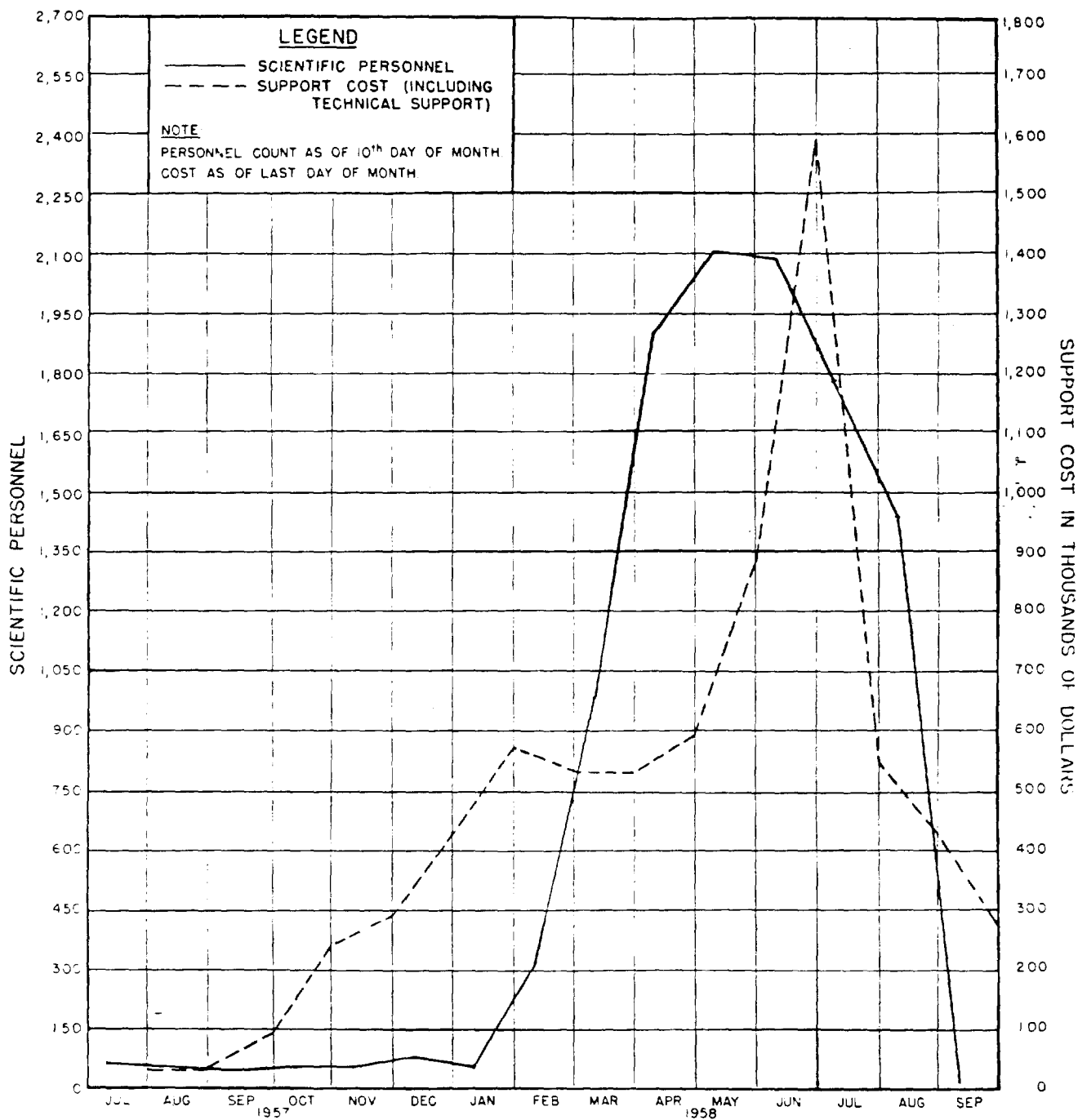


Figure 3-12. Relation of Support Costs to Number of Scientific Personnel at EPG.

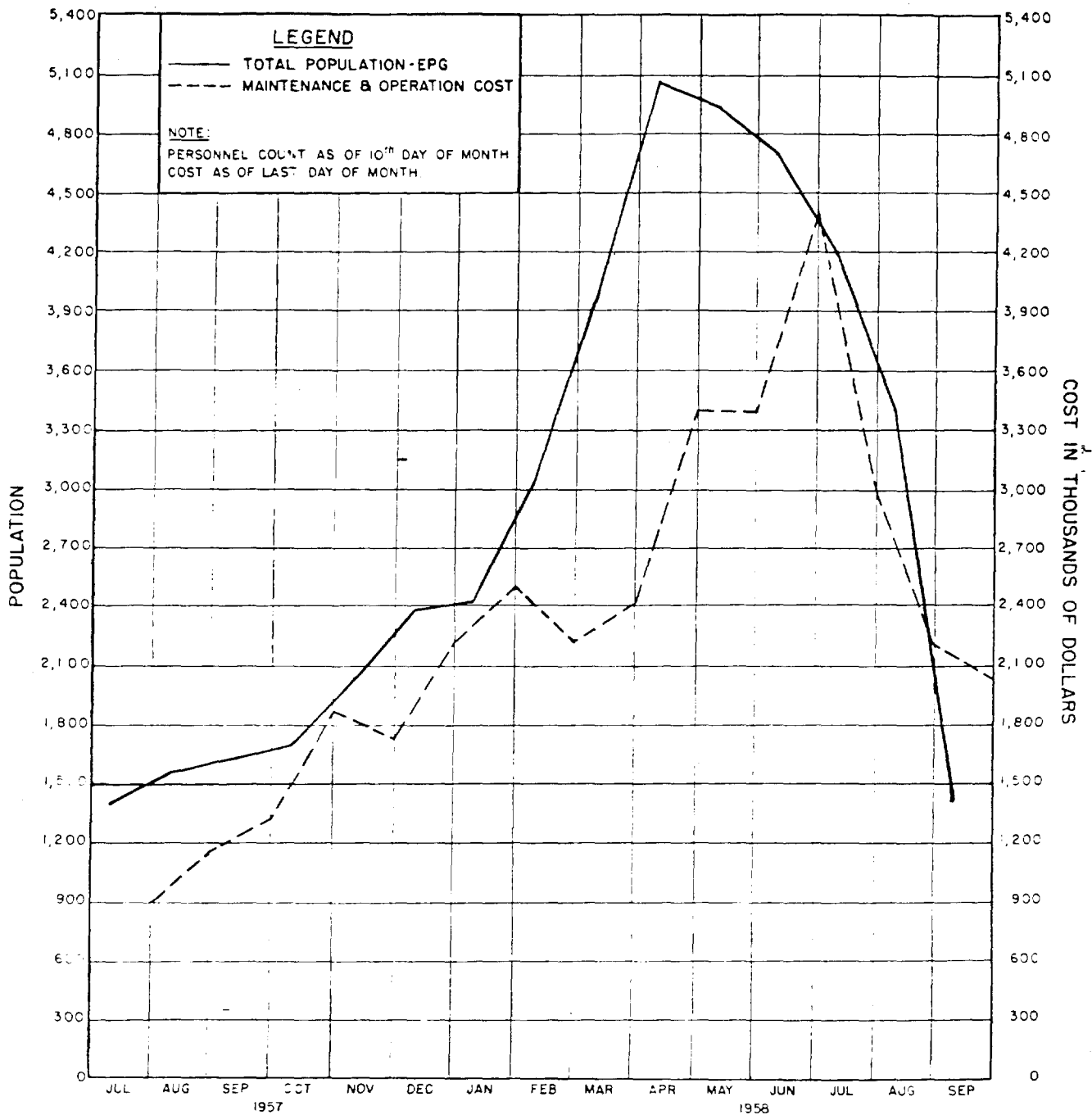


Figure 3-13. Relation of Maintenance and Operation Costs to Total Population at EPG.

13.11 For purposes of comparison, final costs for Operations REDWING, CASTLE, and IVY, on the same basis as Operation HARD-TACK, Phase I, (par. 13.8), are shown below:

<u>OPERATION REDWING</u>				
<u>Expendable Test Facilities Test Site Operation (14 months)</u>	<u>Gross Cost Including Reimbursable Work</u>	<u>Per- cent</u>	<u>Gross Cost Excluding Reimbursable Work</u>	<u>Per- cent</u>
	\$21,521,423	50.1	\$18,742,050	50.6
	<u>21,399,803</u>	<u>49.9</u>	<u>18,301,875</u>	<u>49.4</u>
Total	<u>\$42,921,226</u>	<u>100.0</u>	<u>\$37,043,925</u>	<u>100.0</u>
<u>OPERATION CASTLE</u>				
Expendable Test Facilities Test Site Operations (18 months)	\$17,769,481	46.3	\$16,624,764	45.2
	<u>20,587,384</u>	<u>53.7</u>	<u>20,184,657</u>	<u>54.8</u>
Total	<u>\$38,356,865</u>	<u>100.0</u>	<u>\$36,809,421</u>	<u>100.0</u>
<u>OPERATION IVY</u>				
Expendable Test Facilities Test Site Operations (12 months)	\$ 8,287,535	47.3	\$ 6,442,846	41.8
	<u>9,227,284</u>	<u>52.7</u>	<u>8,983,446</u>	<u>58.2</u>
Total	<u>\$17,514,819</u>	<u>100.0</u>	<u>\$15,426,292</u>	<u>100.0</u>

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PART IV
CONCLUSIONS AND RECOMMENDATIONS

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CHAPTER 1 CONCLUSIONS

- 1.1 EPG logistics and the associated problems of funding, advance procurement of long-lead-time items, and delay in the preparation of the definitive plans of construction resulted in the performance of work on a "crash" basis and a marked increase in the total cost of the program.
- 1.2 The expanded scope of the operation to include Johnston Island contributed to a serious shortage of experienced security personnel within TG 7.5.
- 1.3 The retention of responsibility for TG 7.5 radiological safety within TG 7.5 proved successful in protecting the interests of the AEC and should be continued during any future operation.
- 1.4 In view of the magnitude and successful completion of Operation HARDTACK, Phase I, it is concluded that all staff sections of TG 7.5 and H&N accomplished an outstanding job in the planning and execution of TG 7.5 operations.

CHAPTER 2 RECOMMENDATIONS

The following recommendations are based on the concept that future operations at EPG will be comparable in scope to Operation REDWING and HARDTACK, Phase I:

- 2.1 The concept of testing in the Pacific has changed gradually over the past several years, and it appears that even greater changes may well be in prospect. Preliminary studies indicate that an appreciable reduction could be made in the personnel strength required to conduct an operation the magnitude of HARDTACK, Phase I, under the revised concept of organization. Any appreciable reduction in personnel will release drastically needed facilities, including barracks, warehousing, etc. It is recommended that a joint AEC-DOD review be made of the test organization structure and of the AEC-DOD agreement, with particular regard to distribution of support services between the two agencies.
- 2.2 Phasing of the use of EPG to one primary User (LASL, UCRL, or DOD) at any one time would tend to reduce further the total manpower requirements and would result in stabilization of the Contractors' work force to a lower level. It is obvious that such a policy would not only reduce scientific personnel strength but would likewise reduce the strength of all supporting Task Groups.
- 2.3 TG 7.5 should be assigned complete responsibility for all radiological safety support services at EPG during interim and operational periods.
- 2.4 Funds for PAC construction should be authorized on the basis of an APPROVED projected 5-year long-range program, with individual projects approved by competent authority cognizant of the current MODUS OPERANDI and based on probable future scopes of activity. Definitive plans would be reviewed in a more orderly and realistic manner preliminary to an authorization for construction on a normal-time basis.
- 2.5 Future budget planning should provide for the bulk of permanent construction in the fiscal year preceding the operational period. This will result in a more economical and orderly construction program.
- 2.6 Funds should be advanced for preliminary and final engineering of expendable test facilities as soon as the basic needs become known, even if a test series is not immediately foreseeable. Construction would be authorized only after Scientific Users have demonstrated to AEC higher authority that a specific device requires testing in the manner proposed. Many preliminary and final plans probably would be wasted; however, the savings realized in "non-crash" construction programs would more than offset added engineering costs due to discarded plans.
- 2.7 A substantial increase in investment in the Contractor's current-use stores inventory should be authorized, in view of the fact that advance procurement of long-lead-time items is highly important to the orderly and economical consummation of a test program. Emphasis should be placed on building up the inventory of such items as coaxial cable, submarine cable, dehumidification units, generators, PI&S building sections, etc.

PART IV, CHAPTER 2

2.8 The Contractor should standardize the sizes and types of items required in order to limit the categories and sizes of items used at EPG. A study on this subject is scheduled for completion in early 1959. For example, requirements for various items of equipment must be analyzed to ascertain the possibility of using one or more standard sizes and types of equipment, multiples of which will satisfy the requirements for many facilities. Thus, specialized requirements which cannot be fulfilled from stocked items will be discouraged.

2.9 Fallout shelters should be provided at Sites Elmer, Fred, and Nan to eliminate the requirement for an MSTs transport standing by during operational periods (about four months), at a cost of \$6,600 per day to maintain the capability for evacuation of all personnel from the EPG during operations. A feasibility study was initially authorized by OTO-ALO on 13 August 1958. A preliminary report was submitted by H&N on 21 August 1957 and a final report is now scheduled for the Spring of 1959, at which time DMA will be furnished all recommendations.

2.10 An AEC security force of sufficient size should be available in future operations to provide daily contact with all shot zero sites.

2.11 TG 7.1 test-briefing personnel should be informed regarding the levels of classified information to which Official Observers have access.

2.12 Extensive security construction, such as perimeter fences and lighting facilities, should be accomplished *BEFORE* the start of the scientific construction phase of the Operation.

2.13 The planning for the number of Military Guards in future operations should be based on a greater contingency factor than that used for HARDTACK, Phase I.

2.14 A greater effort should be made for the exchange of information between the AEC and the scientific and military elements of JTF-Seven. This might be accomplished if the respective classification representatives are kept informed of developments and plans by the use of circulating files and by attendance at briefing sessions.

2.15 The provision of direct line telephone services paralleling PABX exchange services

from Site Elmer to off-island locations should be discontinued.

2.16 Future communications requirements should be scrutinized to provide radios only for barges or other mobile facilities which cannot be afforded full-time telephone service, and consideration should be given to integrating mobile radio units into the dial telephone system, thereby eliminating the duplication of telephones and radios in administrative offices.

2.17 The three communication channels between Eniwetok Atoll and Honolulu should be increased to four channels to include two voice, one teletype, and one order wire.

2.18 A 300-foot tower should be erected adjacent to Building 488 on Site Elmer to provide a service range comparable to the excellent Bikini VHF system.

2.19 Marine channels should be cleared into all islands containing major scientific installations.

2.20 An additional 1000-man mess hall should be constructed on Site Elmer.

2.21 More realistic billet and personnel forecasts should be made by each element of the Task Force at least four months in advance of actual need.

2.22 The responsibility for all camp operations on Site Fred should be assigned to the Contractor under the direction of TG 7.5 in order to reduce the total number of personnel at EPG.

2.23 A snack bar should be installed at Site Nan.

2.24 The support of all off-atoll Weather and Rad-Safe Stations should be made the responsibility of the Contractor, particularly the power generation and distillation plant operations.

2.25 Personnel should be employed and administered by the organization under whose supervision they work, or the personnel required to fulfill User requirements should be furnished by the Contractor and supervised by him on the basis of a definitive scope of work. This policy will eliminate the friction and misunderstanding resulting from differences in policies and procedures followed by the various organizations of the Task Force.