EXTRACTED VERSION

18876

OPERATION CASTLE

Report of the Manager
Santa Fe Operations

Pacific Proving Ground
Spring of 1954

NOTICE

This is an extract of Operation CASTLE, Report of the Manager, which remains classified SECRET/RESTRICTED DATA as of this date.

Extract version prepared for:

Director
DEFENSE NUCLEAR AGENCY
Washington, D.C. 20305

1 November 1981

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle) Operation CASTLE - Report of the Manager - Santa Fe Operations - Pacific Proving Ground Spring of 1954	5. TYPE OF REPORT & PERIOD COVERED
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS AEC Santa Fe Operations Office	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE 1954
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; unlimited distribution.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

This report has had the classified information removed and has been republished in unclassified form for public release. This work was performed by Kaman Tempo under contract DNA001-79-C-0455 with the close cooperation of the Classification Management Division of the Defense Nuclear Agency.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Operation CASTLE
Santa Fe Operations

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

FOREWORD

This report has had classified material removed in order to make the information available on an unclassified, open publication basis, to any interested parties. This effort to declassify this report has been accomplished specifically to support the Department of Defense Nuclear Test Personnel Review (NTPR) Program. The objective is to facilitate studies of the low levels of radiation received by some individuals during the atmospheric nuclear test program by making as much information as possible available to all interested parties.

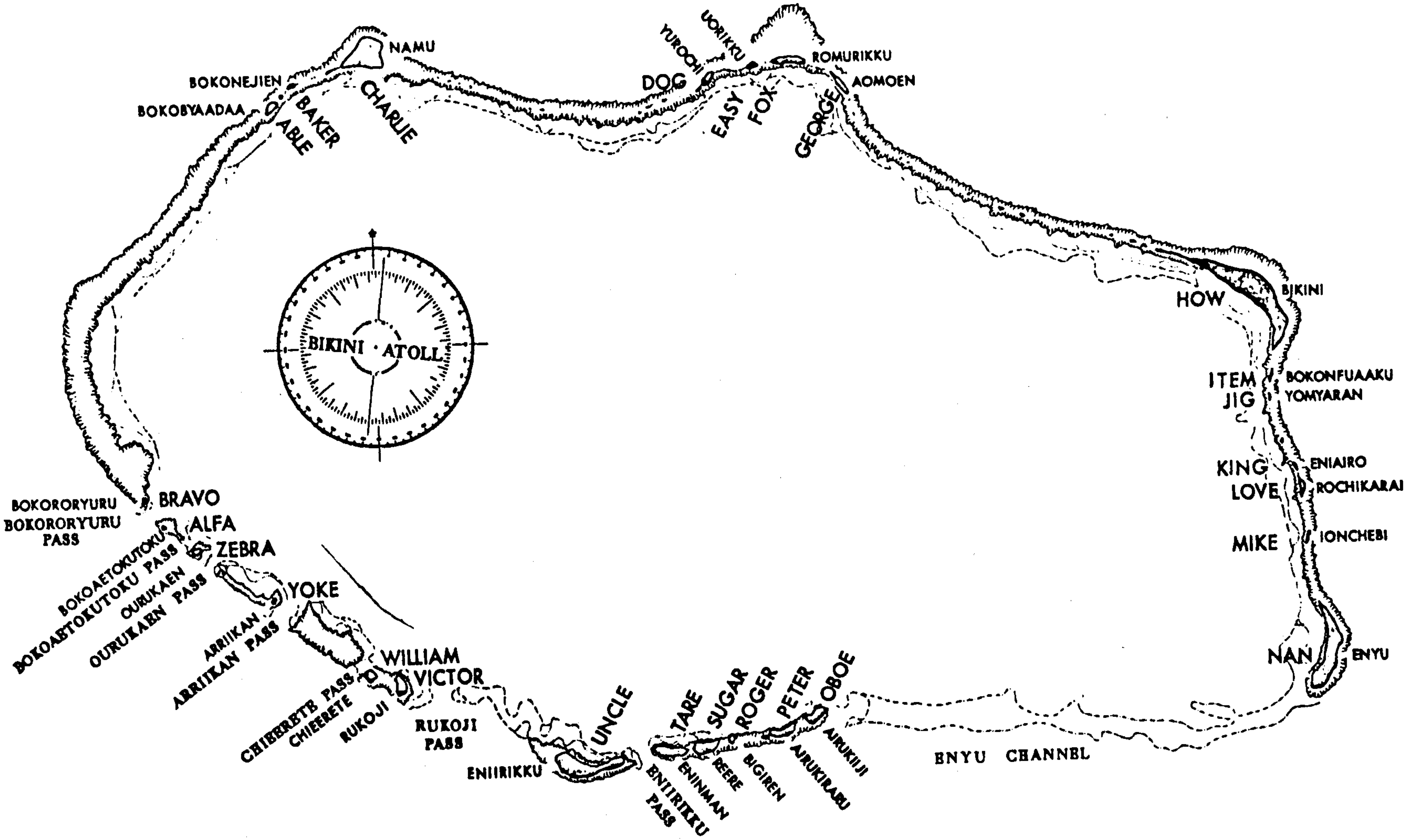
The material which has been deleted is all currently classified as Restricted Data or Formerly Restricted Data under the provision of the Atomic Energy Act of 1954, (as amended) or is National Security Information.

This report has been reproduced directly from available copies of the original material. The locations from which material has been deleted is generally obvious by the spacings and "holes" in the text. Thus the context of the material deleted is identified to assist the reader in the determination of whether the deleted information is germane to his study.

It is the belief of the individuals who have participated in preparing this report by deleting the classified material and of the Defense Nuclear Agency that the report accurately portrays the contents of the original and that the deleted material is of little or no significance to studies into the amounts or types of radiation received by any individuals during the atmospheric nuclear test program.

FOREWORD

In the preparation of this report, cognizance has been taken of the reports of the Commander, Joint Task Force SEVEN to the Joint Chiefs of Staff pertaining to Operation CASTLE. Although the JTF reports are comprehensive in scope, it is believed that their composition is, in general, directed toward military and scientific channels of thought. In addition, the JTF reports are thought to lack pertinent information on certain AEC activities and costs useful in evaluating various aspects of an operation and in planning for future operations. Therefore, in order to derive maximum benefit from experience gained during an operation, it has been concluded that a supplemental report, embodying only that amount of technical detail essential to an understanding of results and with certain data presented in a manner conducive to useful analyses of proving ground development, would prove decidedly beneficial. This report attempts to achieve these aims in a manner as brief and concise as clarity will permit.


BIKINI ATOLL
NAMU
BOKONEJIEN
BOKOBYAADAA
ABLE
BAKER
CHARLIE
YUROCHI
UORIKKU
DOG
EASY
FOX
ROMURIKKU
AOMOEN
GEORGE
HOW
BIKINI
ITEM
JIG
BOKONFUAAKU
YOMYARAN
KING
LOVE
ENIAIRO
ROCHIKARAI
MIKE
IONCHEBI
NAN
ENYU
ENYU CHANNEL
OBOE
PETER
ROGER
SUGAR
TARE
AIRUKIIJI
AIRUKIRARU
BIGIREN
REERE
ENINMAN
ENIIRIKKU PASS
UNCLE
ENIIRIKKU
RUKOJI PASS
WILLIAM
VICTOR
RUKOJI
CHIEERETE
CHIEERETE PASS
ARRIIKAN
ARRIIKAN PASS
YOKE
OURUKAEN
OURUKAEN PASS
ZEBRA
BOKOAETOKUTOKU
BOKOAETOKUTOKU PASS
ALFA
BRAVO
BOKORORYURU
BOKORORYURU PASS

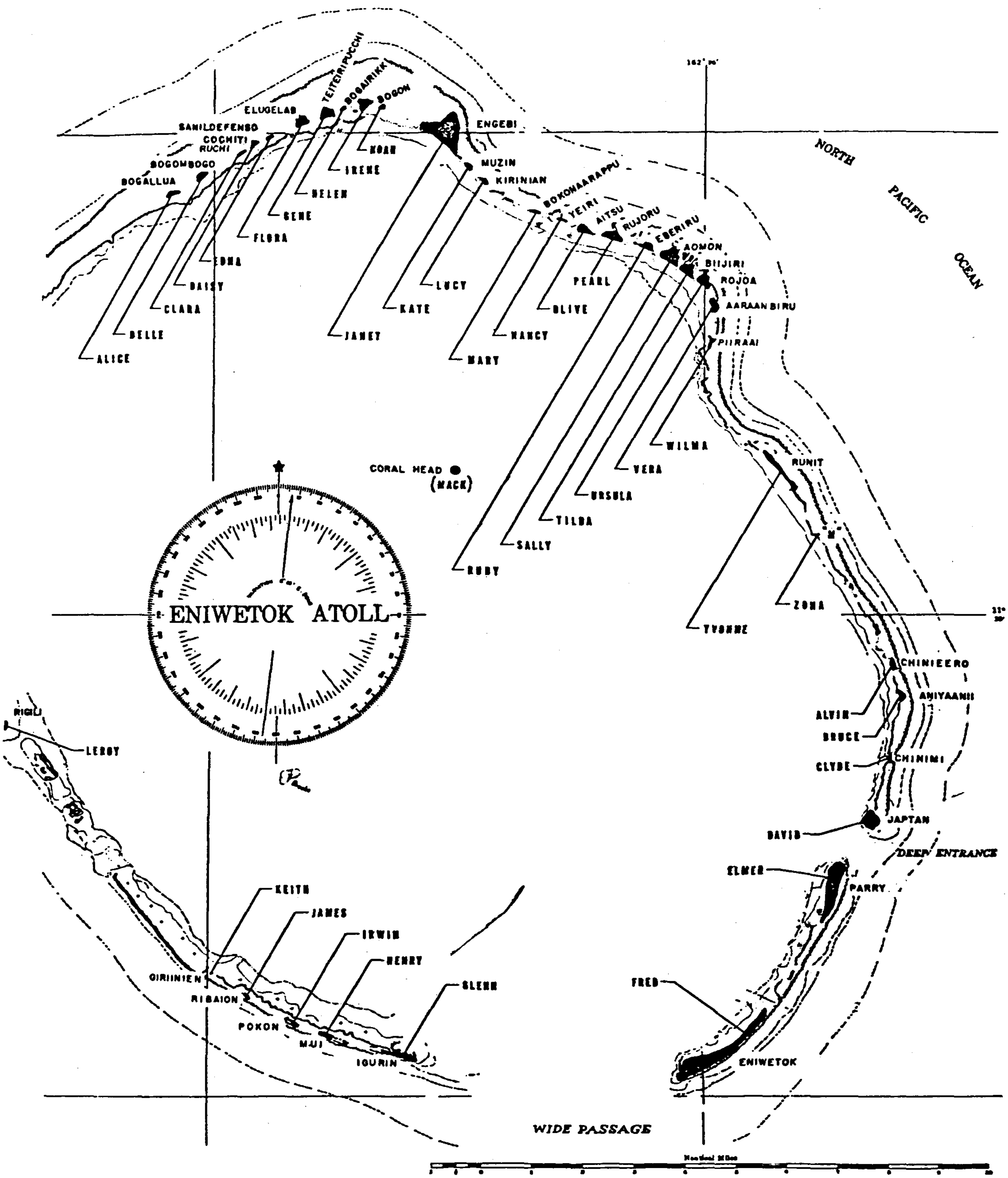

ENIWETOK ATOLL
NORTH PACIFIC OCEAN
ENGEBI
ELUGELAB
TEITEIRIPUCCHI
BOGAIRIKK
BOGON
SANILDEFENSO
COCHITI
RUCHI
BOGOMBOGO
BOGALLUA
NOAH
IRENE
HELEN
GENE
FLORA
EDNA
DAISY
CLARA
BELLE
ALICE
MUZIN
KIRINIAN
BOKONAARAPPU
YEIRI
AITSU
RUJORU
EBERIRU
AOMON
BIIJIRI
ROJOA
AARAANBIRU
PIIRAAI
LUCY
KATE
JANET
PEARL
OLIVE
NANCY
MARY
WILMA
VERA
URSULA
TILDA
SALLY
RUBY
CORAL HEAD
(MACK)
RUNIT
ZONA
YVONNE
CHINIEERO
ANIYAANII
ALVIN
BRUCE
CLYDE
CHINIMI
JAPTAN
DAVID
DEEP ENTRANCE
ELMER
PARRY
FRED
ENIWETOK
RIGILI
LEROY
KEITH
JAMES
IRWIN
HENRY
GLENN
GIRIINIEN
RIBAION
POKON
MUI
IGURIN
WIDE PASSAGE

TABLE OF CONTENTS

INTRODUCTION

It is the primary purpose of this report to interpret and make record of test operation data and experience which will be of greatest use to those responsible for the continued maintenance and development of the proving ground. More specifically, the report has been compiled with a view toward its reference value to the Atomic Energy Commission. Although this report is supplemental in nature to the more comprehensive reports prepared by the Commander, Joint Task Force SEVEN for the Joint Chiefs of Staff, it is intended to be complete to the extent required in the satisfactory attainment of its aims.

The entire report is comprised of three principal parts. Part I presents a general over-all concept of the Operation from the AEC Santa Fe Operations point of view and includes recommendations for future operations; Part II is the scientific version of the Operation's aims and accomplishments as presented by the Los Alamos Scientific Laboratory (LASL) and the University of California Radiation Laboratory (UCRL); Part III presents the managerial or administrative aspects of the Operation. For a more comprehensive account of the LASL participation in the Operation, reference is made to the Report of the Commander, Task Group 7.1 for Operation CASTLE. Detailed coverage of the Contractor's activities may be found in the Completion Report for Operation CASTLE as prepared by Holmes & Narver, Inc.

PART I GENERAL ACCOUNT

CHAPTER 1. SUMMARY

1.1 OPERATION SITE

The Atomic Energy Commission's Pacific Proving Ground (PPG) comprises Eniwetok and Bikini Atolls in the Marshall Islands. Prior to the first CASTLE shot the water area surrounding these atolls and bounded by Lat. 12° 45' N on the North, Long. 166° 16' E on the East, Lat. 10° 15' N on the South, and Long. 160° 35' E on the West was established as a danger area, and unauthorized entrance by water or air was prohibited. The far-reaching fall-out effects occasioned by the first CASTLE shot prompted an immediate enlargement of the danger area for the balance of the Operation. The modified danger area is described as a circular segment centered at Lat. 12° N, Long. 164° E, with a radius of 450 nautical miles, and arc lengths extending from true bearings 240° to 95° in a clockwise direction. Figure 1 shows the proving ground and danger areas.

1.2 OPERATION SCOPE AND SCHEDULE

Operation CASTLE was a full-scale test operation developed by the Atomic Energy Commission (AEC) for testing nuclear devices and experimental

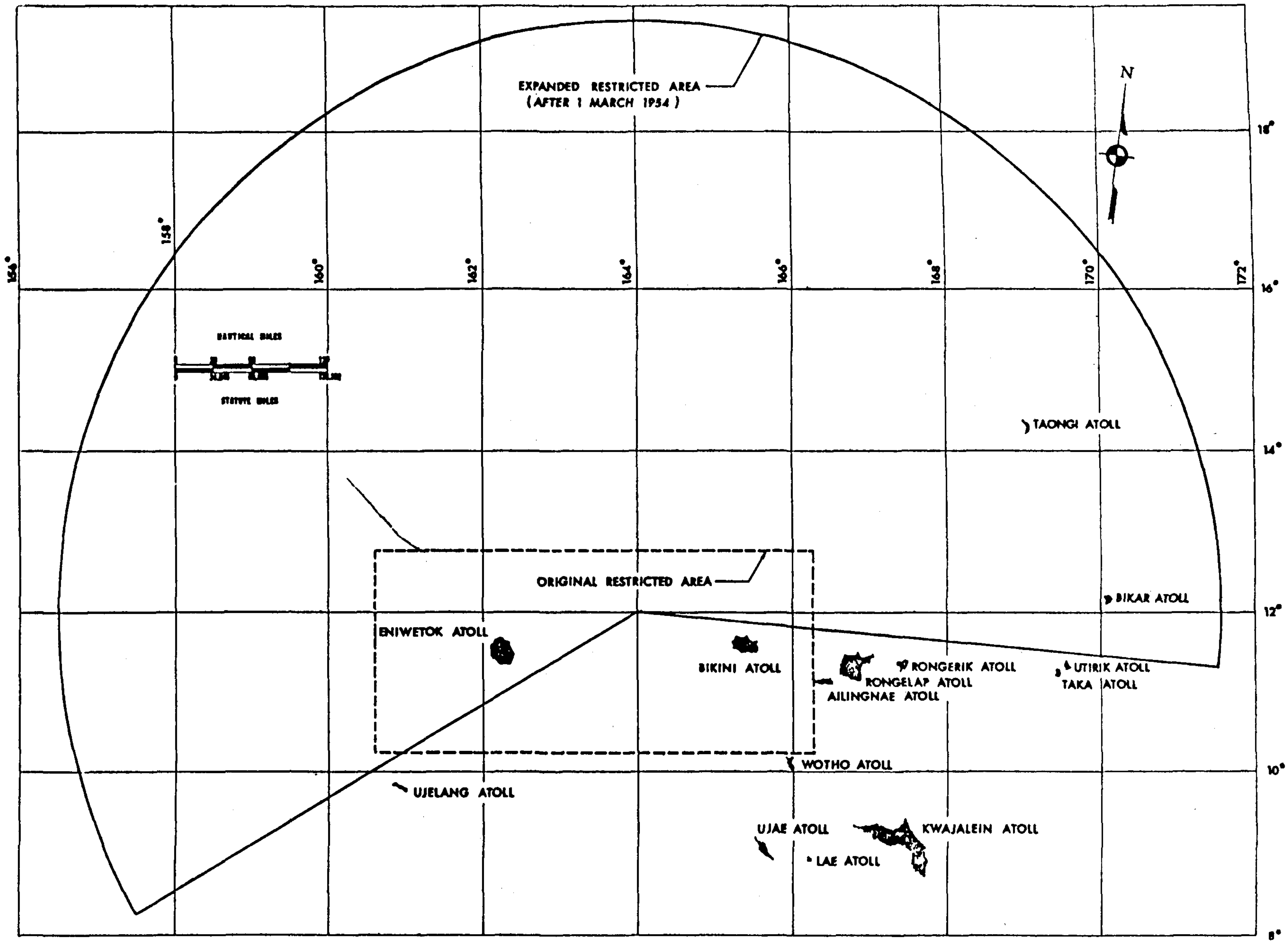


Figure 1. Restricted Area Chart

weapons evolved in the Los Alamos Scientific Laboratory (LASL) and the University of California Radiation Laboratory (UCRL). In addition to extensive diagnostic experiment programs conducted by these laboratories, there was also included a program of weapons effects experiments sponsored by the Department of Defense (DOD). The final approved shot schedule is shown in Table 1. The number and sequence of shots as they actually occurred are shown in Table 2.

1.3 ORGANIZATION AND COMMAND RELATIONS

Ownership of all fixed installations at the PPG, except for several on Eniwetok Island, is in the AEC by purchase. Responsibility for the normal operation and maintenance of the proving ground rests with the Manager, Santa Fe Operations. This responsibility is delegated by the Manager, SFO, to the Field Manager, Eniwetok Field Office. The Field Office accomplishes the functions of engineering, design, construction, camp operation and maintenance through a single contractor, Holmes & Narver, Inc. In turn, these responsibilities are temporarily assumed by the Commander, TG 7.5 during active periods of that group.

Subsequent to Operation SANDSTONE, the AEC recommended to the DOD the establishment of a permanent test organization to conduct tests outside the United States. Initially, the Joint Chiefs of Staff (JCS) decided that successive Joint Task Forces for the conduct of overseas operations would be established as required. Due to the method of implementation, this directive essentially satisfied the AEC requirement for a continuing organization since it developed that succeeding Task Forces were activated prior to the deactivation of their predecessors. With the establishment of JTF 7 for Operation CASTLE, however, the concept of designating a new Task Force for each pending overseas operation was abandoned in favor of a permanent Joint Task Force.

Under agreement between the AEC and the DOD, Operation CASTLE was conducted by Joint Task Force SEVEN (JTF 7). By direction of the Joint Chiefs of Staff (JCS), the Task Force was placed under the Command of Major General P. W. Clarkson, U.S.A.

The Task Force was comprised of the Commander and his staff and five Task Groups:

Task Group 7.1 - Scientific
Task Group 7.2 - Army
Task Group 7.3 - Navy
Task Group 7.4 - Air Force
Task Group 7.5 - AEC (Base Facilities)

In approving the establishment of a permanent Joint Task Force organization for support and execution of AEC full-scale tests at the PPG, the JCS

TABLE 1. FINAL APPROVED SHOT SCHEDULE

Shot No.	Code	Model	Date	Site	Megaton Yield (Presumed Range)	Remarks
1	BRAVO		1 Mar	Bikini. On reef 2950' bearing 250° true from SW tip of Namu.	6 (4-8)	(LASL) Fired from bunker on Enyu.
2	UNION		11 Mar	Bikini. Intersection of arcs with radii of 6900' from Yurochi & 3 nautical miles from Aomeon. Barge.	3-4 (1-6)	(LASL) Fired from bunker on Enyu.
3	YANKEE		22 Mar	Bikini. [redacted] crater. Barge.	8 (6-10)	(LASL) system. Fired from bunker on Enyu.
4	ECHO		29 Mar	Eniwetok. Eberiru.	125 KT (65-275 KT)	(UCRL) system. Fired from station on Parry.
5	NECTAR		5 Apr	Bikini. [redacted] crater.	1.8 (1-2.5)	(LASL) Fired from bunker on Enyu.
6	ROMEO		15 Apr	Bikini. [redacted] crater.	4 (1.5-7)	(LASL) Fired from bunker on Enyu.
7	KOON		22 Apr	Bikini. Eninman.	1 (0.33-2.5)	(UCRL) Fired from bunker on Enyu.

TABLE 2. ACTUAL SHOT SCHEDULE

Shot No.	Code	Model	Date	Site	Megaton Yield [1] (Presumed Range)	Remarks
1	BRAVO		1 Mar	Bikini. On reef 2950' bearing 250° true from SW tip of Namu.	6 (4-8)	(LASL) Fired from bunker on Enyu.
2	ROMEO		27 Mar	Bikini. crater. Barge.	8 (1.5-15)	(LASL) Fired by radio aboard USS Estes.
3	KOON		7 Apr	Bikini. Eninman.	1.5 (0.33-4)	(UCRL) Fired by radio aboard USS Estes.
4	UNION		26 Apr	Bikini. Intersection of arcs with radii of 6900' from Yurochi and 3 nautical miles from Aomoen. Barge.	5-10 (1-18)	(LASL) Fired by radio aboard USS Estes.
5	YANKEE		5 May	Bikini. crater. Barge.	9.5 (7.5-15)	(LASL) Fired by radio aboard USS Estes.
6	NECTAR		14 May	Eniwetok. MIKE[2] crater. Barge.	2-3 (1-5)	(LASL) Fired from station on Parry.

1. Latest revised estimates of yield prior to actual detonation.

2. Operation IVY thermonuclear shot.

specifically charged the Commander with:

1. Technical responsibility for all phases of the Operation.

2. The safety of personnel and units assigned to the JTF.

3. Advising the appropriate Commanders under the JCS of the special hazards and danger areas involved in tests and appropriate precautions to insure the safety of units other than the JTF.

4. Acting as agent for the AEC for the exercise of such functions on behalf of the Commission as the latter may deem necessary.

On 15 December 1953, the AEC withdrew from the Manager, Santa Fe Operations Office (SFOO) and assigned to the CJTF 7 full authority to act for the Commission in all matters which concerned the successful execution of the Task Force Operation Plan. It should be noted, however, that the CASTLE construction program was about 85% complete at this time. The 15 December date also marked the beginning of the CASTLE operational period which continued until 2 June 1954, at which time all AEC vested authority was relinquished by the CJTF 7. During periods between operations the authority of the CJTF, insofar as AEC functions are concerned, is limited to operational planning and coordination. Organizational and command relations in effect both prior to and during the operational period are depicted on Figure 2 and Figure 3 respectively.

1.4 GENERAL ACTIVITIES OF TASK GROUP 7.5

In off-continent test operations prior to CASTLE, the AEC functions of engineering design, construction, operations and support have been performed by a Task Unit within the organizational structure of the Scientific Task Group. In order that the responsibilities for AEC functions might be more clearly identified and the position of the AEC in the Task Force organization more postively established, it was recommended that the AEC component of the Task Force be given Task Group status. On 26 February 1953, the Director, Division of Military Application (DMA), AEC, formally requested the CJTF 7 to organize the AEC Base Facilities Task Group. In making this request, the DMA accepted certain conditions, among which was the requirement that the CJTF, in accomplishment of his scientific mission, would control and direct the activities of the Scientific and Base Facilities Task Groups through his Scientific Deputy. Task Group 7.5 was formally activated on 4 March 1953.

The mission of Task Group 7.5 is to:

1. Provide all base facilities at the Pacific Proving Ground necessary to the Task Force and AEC and its contractors in the conduct of test operations.

2. Provide all structures and related facilities required by the Scientific Task Group for the successful execution of the scientific experiments.

3. Provide personnel, equipment and materials to support the Scientific Task Group in its on-site operational activities.

4. Maintain all base facilities at the Pacific Proving Ground except for the military communications facilities at Eniwetok Island and Bikini Atoll.

5. Provide camp and support facilities at the proving ground, including housing, feeding, laundry, medical, recreational and other camp services on all islands except Eniwetok; land transportation and motor pool operation; boat pool operation; utilities operations except military communication facilities on Eniwetok Island and Bikini Atoll and the POL farm on Eniwetok Island; and warehousing and property accounting for Task Groups 7.5 and 7.1, as requested.

6. Provide for radiological safety of TG 7.1 and 7.5 personnel in periods between operations.

7. Formulate and operate a comprehensive security program to cover AEC interest during non-operational periods, and during operations to provide at the proving ground security servicing for AEC, AEC contractor components, and TG 7.1, in coordination with the staff of JTF SEVEN and AEC, Washington.

The Task Group 7.5 headquarters organization was comprised of personnel assigned from various offices and divisions of the SFOO and certain key men of Holmes & Narver, Inc. For Operation CASTLE, Task Group 7.5 was organized along military lines. Staff positions were filled by AEC personnel, and the line organization closely followed the normal organizational pattern of the Contractor and was completely manned by Holmes & Narver employees. Coincident with the transfer of AEC authority to the CJTF 7, TG 7.5 became operational and the regular duties of its personnel were adapted to Task Group functions. Upon termination of the operational period these people reverted to their normal duties, and concluding operational activities of the Task Group were handled through AEC channels. For Operation CASTLE, the Commander, TG 7.5, was the Director, Office of Test Operations, SFO, and his deputy was the Field Manager, Eniwetok Field Office, SFO. A chart of TG 7.5 organization for CASTLE is depicted on Figure 4.

A statement of functions assigned to TG 7.5 is attached as Appendix A.

ORGANIZATION FOR CASTLE

PRE-OPERATIONAL PHASE

ATOMIC ENERGY COMMISSION - JOINT TASK FORCE SEVEN

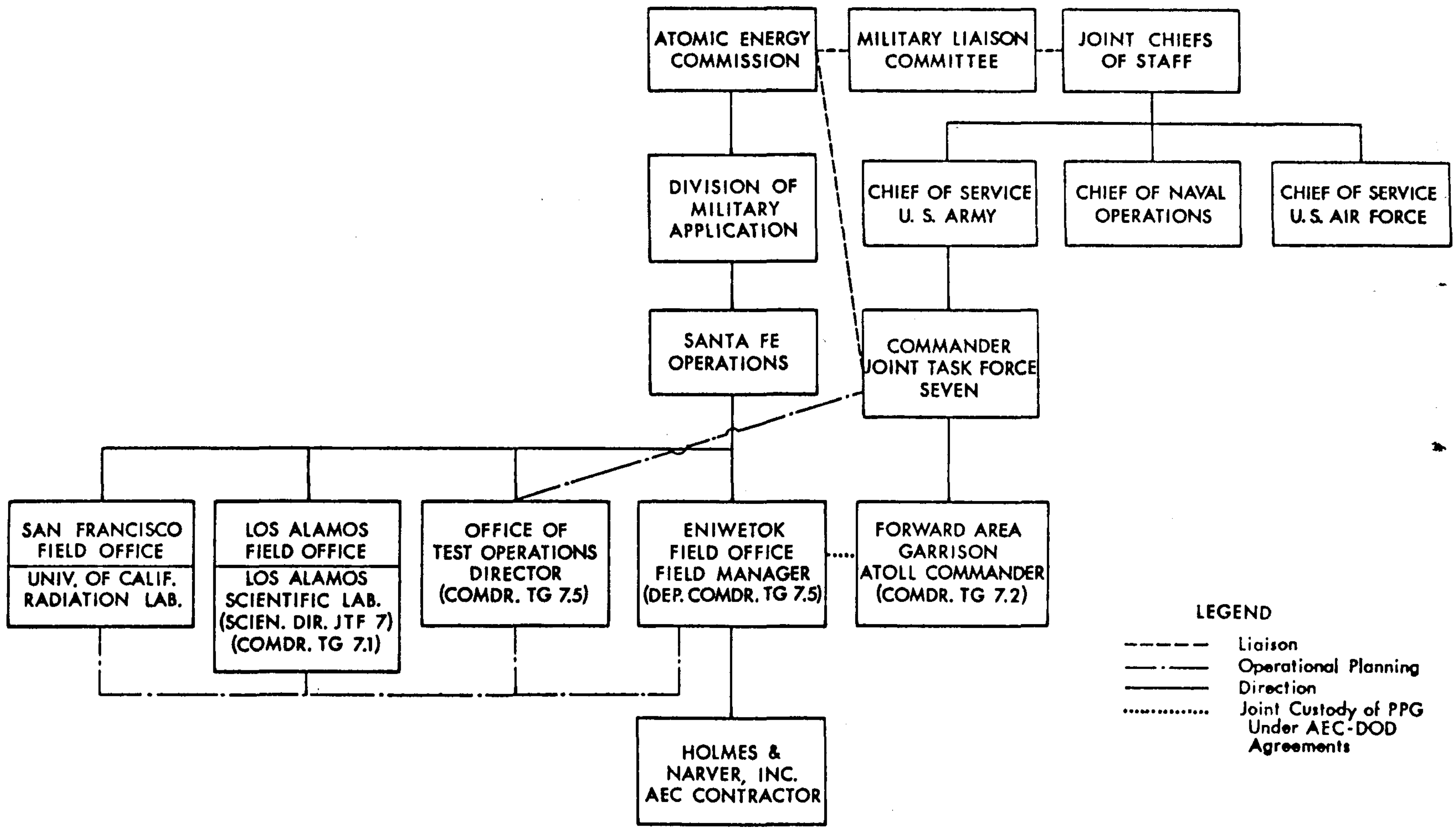


Figure 2

ORGANIZATION FOR CASTLE

OPERATIONAL PHASE

ATOMIC ENERGY COMMISSION - JOINT TASK FORCE SEVEN

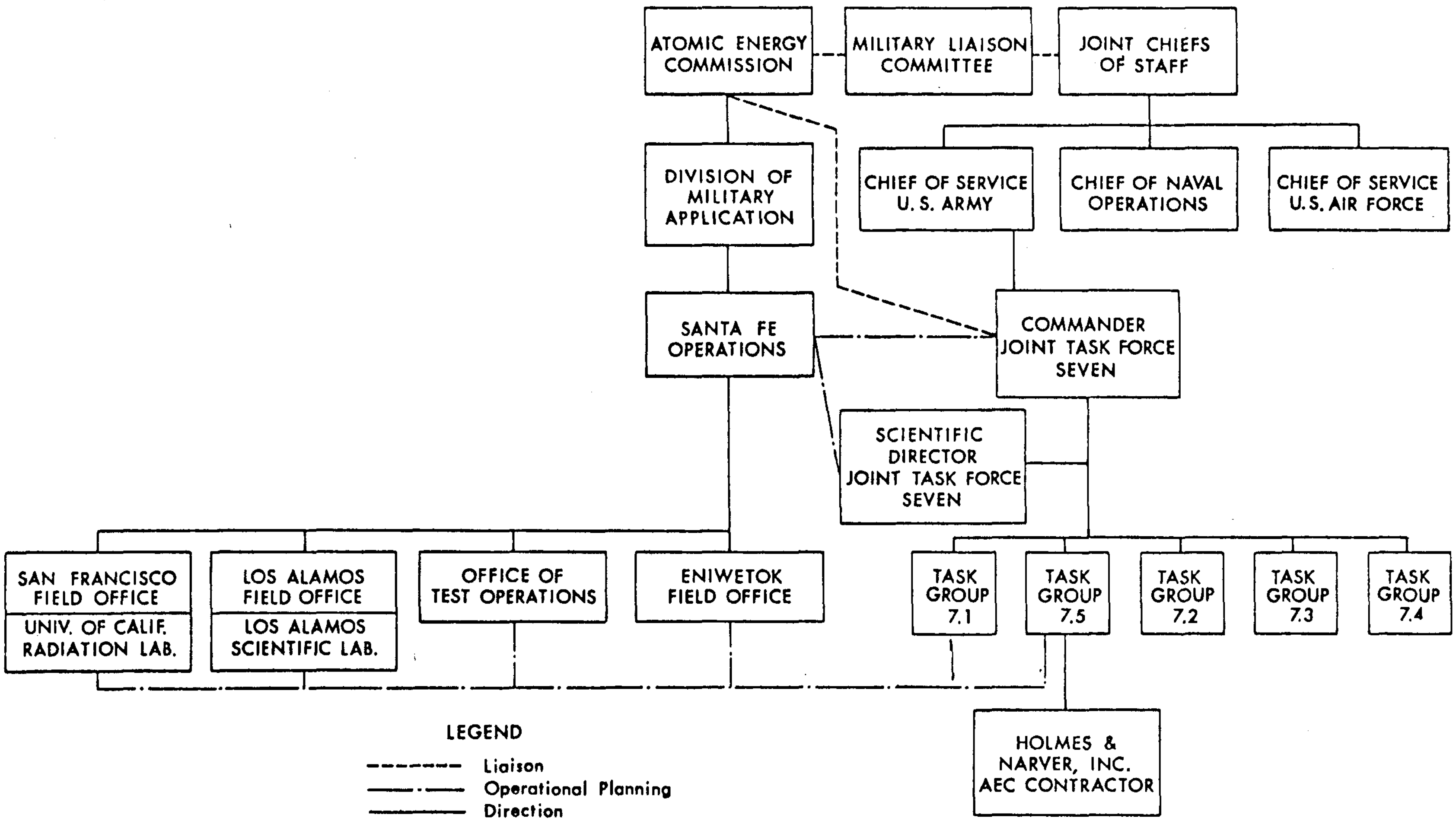


Figure 3

1.5 PARTICIPATING AGENCIES

Agencies which were allocated scientific stations are as follows:

1.	AF	Air Force Office of Atomic Energy
2.	BRL	Ballistics Research Laboratory
3.	CRL	Chemical and Radiological Laboratory
4.	DIRX	Director Office Special Assignment
5.	EG&G	Edgerton, Germeshausen and Grier, Inc.
6.	ESL	Evans Signal Laboratory
7.	LASL	Los Alamos Scientific Laboratory
8.	NRDL	Naval Radiological Defense Laboratory
9.	NRL	Naval Research Laboratory
10.	NRLS	Naval Research Laboratory - Stewart
11.	NOL	Naval Ordnance Laboratory
12.	ONR	Office of Naval Research
13.	SANDIA	Sandia Corporation
14.	SRI	Stanford Research Institute
15.	UCRL	University of California Radiation Laboratory
16.	USFS	United States Forest Service
17.	WADC	Wright Air Development Center

In addition, there were several agencies that participated in or contributed to the various programs, and which were given support services; these are listed below:

18.	ACC	Army Chemical Corps
19.	ACF	American Car Foundry
20.	AFL	Applied Fisheries Laboratory, University of Washington
21.	AFSWP	Armed Forces Special Weapons Project
22.	ARDC	Air Research and Development Center
23.	CAMCO	Cambridge Corporation
24.	DBM	Division of Biology and Medicine, AEC
25.	DOD	Department of Defense
26.	DTMB	David Taylor Model Basin
27.	HLJ	Herrick L. Johnston
28.	LML	Lookout Mountain Laboratory
29.	NEL	Naval Electronics Laboratory
30.	SAC	Strategic Air Command
31.	SCRIPPS	Scripps Institute of Oceanography
32.	USCGS	United States Coast and Geodetic Survey
33.	WPD	Weapons Performance Division

ORGANIZATION CHART, TASK GROUP - 7.5

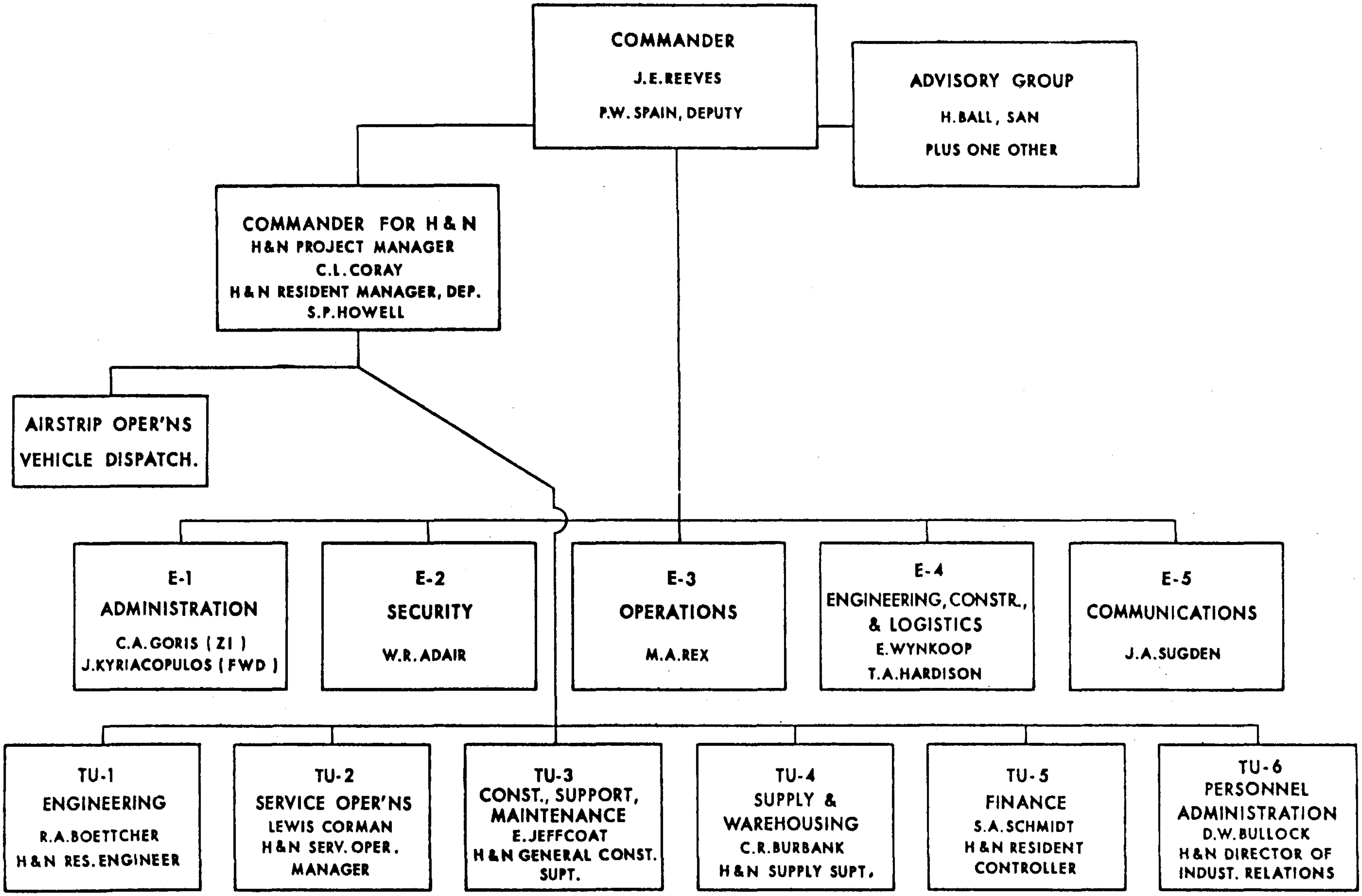


Figure 4

1.6 SIGNIFICANT EVENTS

Several times in the past, criticism has been directed at what was considered to be an unnecessary lag in the reduction of the labor force as an operational period advanced. Such criticism can usually be traced to sources only distantly familiar with the peculiar demands of a test operation. To substantiate this view, a summary description of the BRAVO fall-out effects and their impact upon the Contractor's organization has been included in this report. For a more comprehensive coverage of the incident, reference is made to the report of Holmes & Narver, Inc. for Operation CASTLE.

On 1 March 1954, at 0645 hours, BRAVO was fired upon an artificial island between Namu and Bokonejien Islands at Bikini Atoll. The decision to fire was based on a predicted surface radex that showed no fall-out on inhabited islands that was significant from a health hazard standpoint. Therefore, on the basis of information available immediately prior to BRAVO, no significant fall-out was expected on inhabited areas and, consequently, it was not considered necessary to evacuate natives from neighboring atolls. However, an emergency plan for such an evacuation was prepared prior to the detonation and put into effect after the detonation.

At Rongerik Atoll a detachment of 28 USAF weather personnel were evacuated by aircraft. Evacuation was completed by 1800 hours on 2 March. The highest dosage received was one film badge at 98 roentgens (R) which represented three people living in a tent. Four badges representing the remainder of personnel living in metal barracks read 40 R, 40 R, 44 R and 52 R. The ground station at Rongerik began reading about 100 milliroentgens (MR) at 1400 hours on 1 March.

At Rongelap Atoll, 65 natives were evacuated by ship. Evacuation was completed by 1000 hours on 3 March. The average total dose was computed to have been approximately 100 R. The surface readings at Rongelap at 1830 hours on 2 March were reported as 1.4 R per hour average. An additional 17 natives visiting the neighboring Alinginae Atoll were also evacuated at this time. Their dosage was computed to have been approximately 74 R.

At Utirik Atoll, 154 natives were evacuated by ship. Evacuation was completed by 1245 hours on 4 March. The average total dose was computed to have been approximately 17 R. The surface readings at Utirik at 1345 hours on 3 March were reported as 160 MR per hour.

Evacuation proceedings were completed within 78 hours after the BRAVO detonation and all of the native evacuees were taken to Kwajalein and placed under the care and supervision of COMNAVSTAKWAJALEIN. The Rongelap natives were subsequently transferred to Majuro Atoll where it is anticipated they will remain for approximately one year before returning to Rongelap. Temporary living facilities, costing about $ 50,000., were constructed at Majuro Atoll by Holmes & Narver forces for the accommodation of the displaced natives as shown in Figures 5, 6 and 7. Return of the Utirik natives

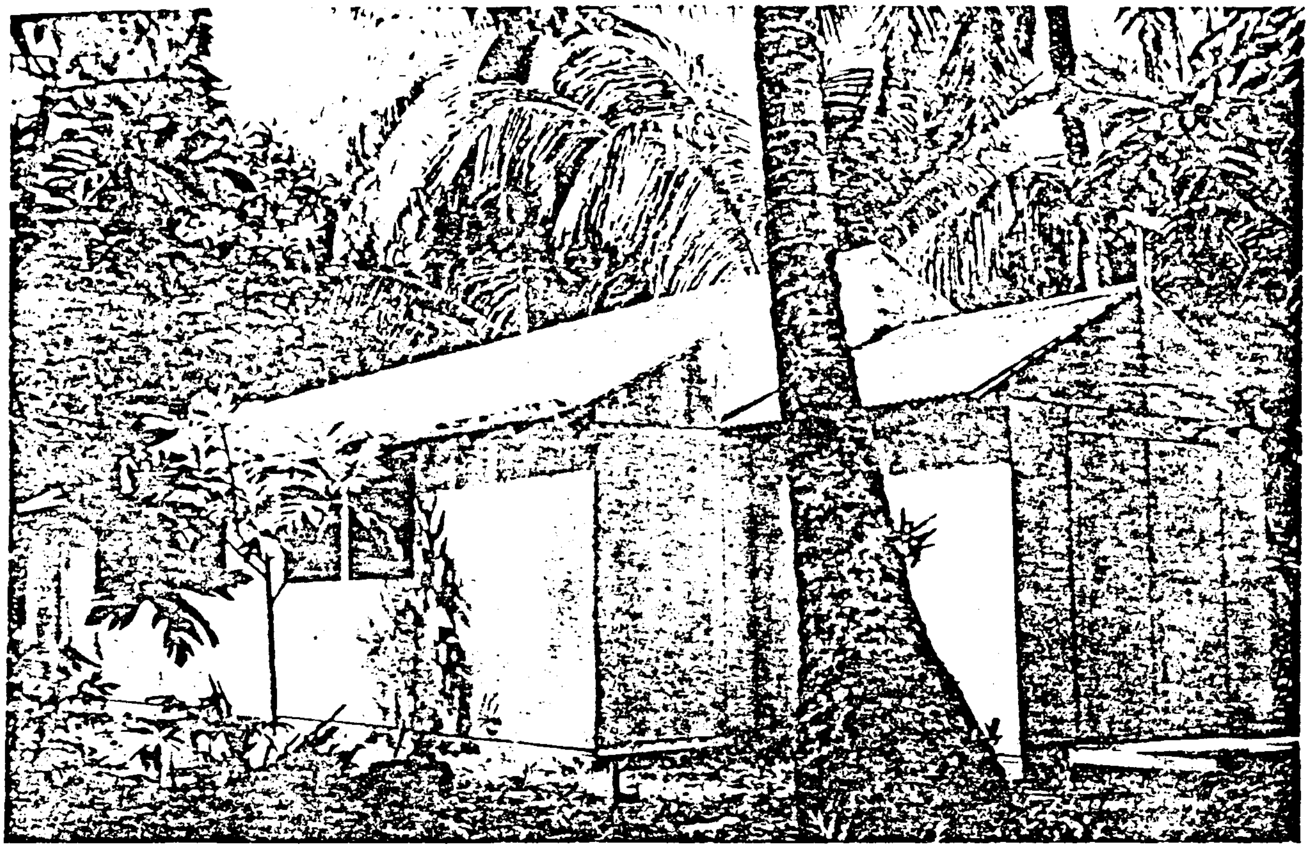
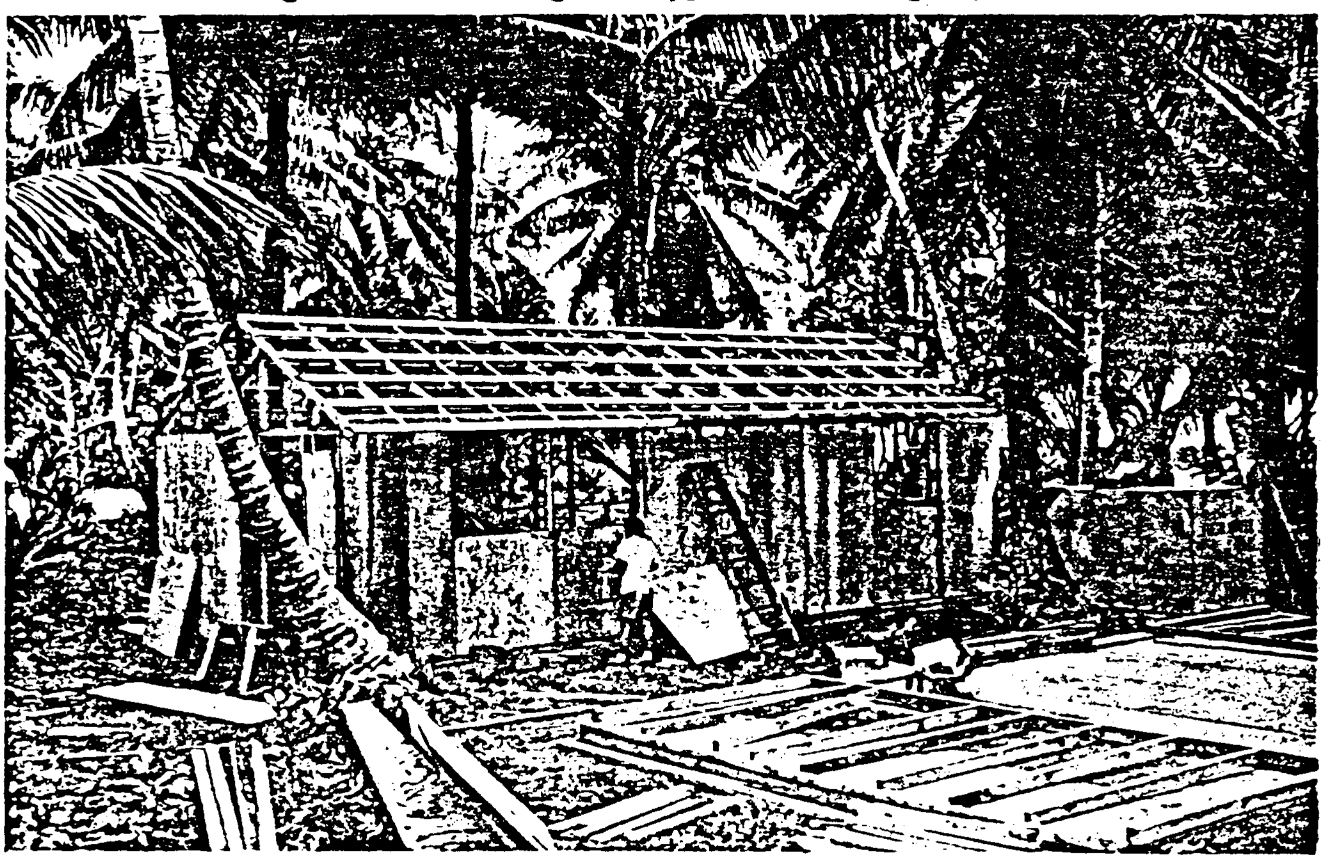


Figure 5. Combination Church and School Building, Ejit Island

Figure 6. Framing for Typical Dwelling, Ejit Island



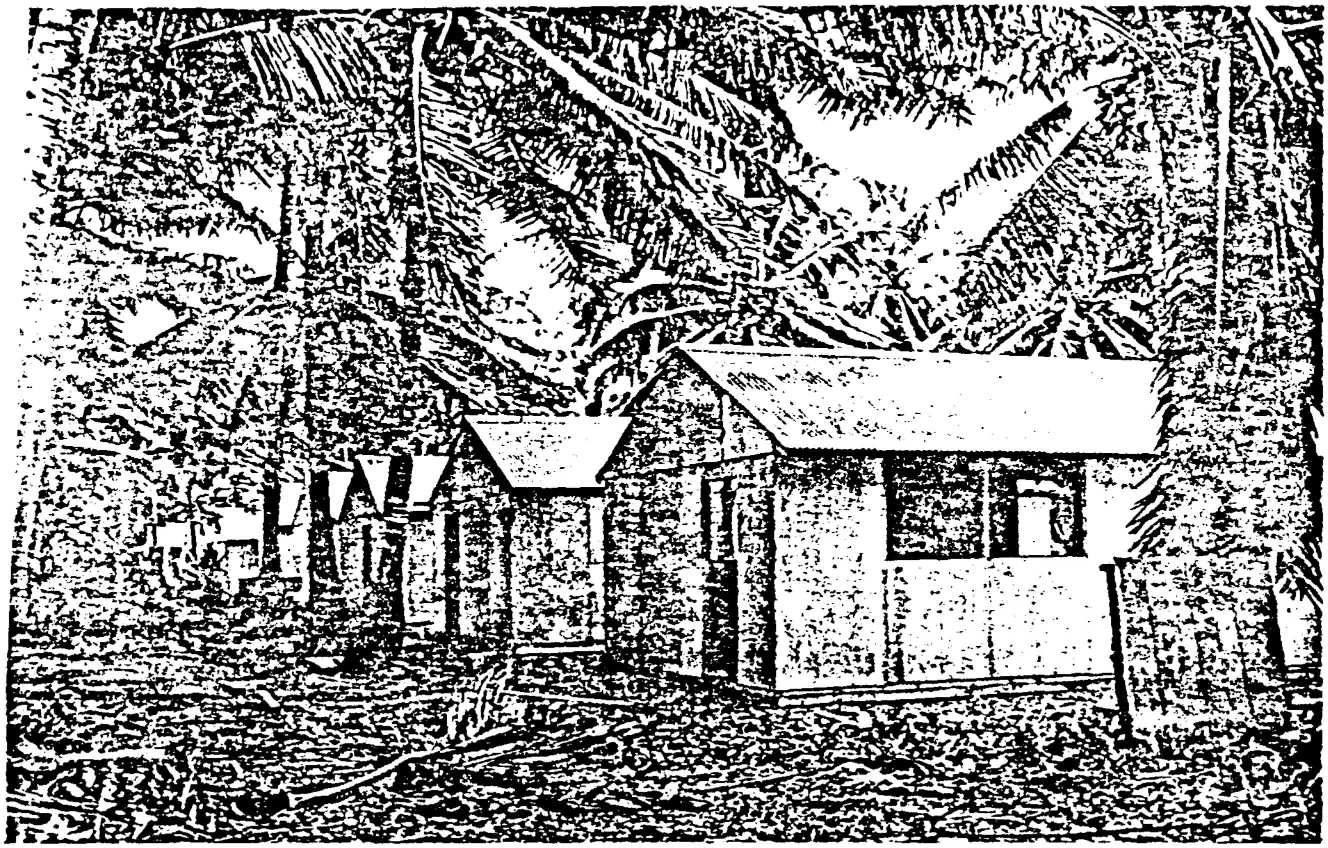


Figure 7. Row of Dwellings - Complete except for Windows, Ejit Island

to their atoll was completed on 5 June. As a result of the BRAVO fall-out incident, a joint AEC-DOD Project 4.1 was established to study the physiological symptoms of evacuated natives.

Subsequent to the BRAVO shot, many pre-test plans were either abandoned or greatly modified due to the widespread destruction of facilities on several of the sites and radioactive contamination over much of Bikini Atoll. The changes in shot sequence necessitated the following scientific station substitutions: Station 90 for Station 30 (second shot); Station 50 for Station 40 (third shot); Station 1581 (Japtan) for Station 1580.01 (Enyu); Station 712 (Runit) for Station 710 (Enyu). Station 10 was relocated from the Bikini Lagoon to the Elugelab crater at Eniwetok Atoll. Radioactive contamination necessitated a new barge Station 1840.01 at Bikini in lieu of Station 1820.02. Support services, furnished by Contractor personnel of TG 7.5 to various participating agencies, were also severely taxes by the numerous program changes. Extra demands for a wide range of skilled labor, tools and equipment needed in the handling, unpacking, moving and installing of scientific equipment had to be met. The original plan for re-occupation of Enyu and Eninman camps were, of necessity, abandoned, thus requiring the evacuation of 1330 men from Bikini Atoll to Eniwetok Atoll. Of this number, 200 were TG 7.2 and TG 7.4 personnel who were quartered on Eniwetok Island; the balance of 1130 men were TG 7.1 and TG 7.5 personnel who were quartered on Parry Island. TG 7.3 personnel remained afloat. A considerable amount of effort was required of the Contractor in order to properly feed, clothe, and house this sudden population influx at Parry. Recreation centers and beach buildings were converted into emergency housing; mess hall schedules were changed and Post Exchange operations enlarged to permit replenishment of lost or abandoned personal articles. It is the opinion of the SFOO that in successfully overcoming the many unforseen demands placed upon his organization, the Contractor exercised a commendable degree of foresight, ability and good judgement. The geographical relation of evacuated atolls with Bikini and Kwajalein is depicted in Figure 1.

CHAPTER 2. COMMENTS AND RECOMMENDATIONS

2.1 COMMENTARY

As previously indicated in paragraph 1.4, the managerial functions for off-continent test operations prior to Operation CASTLE were performed by the AEC in the capacity of a Task Unit within the Scientific Task Group of the Task Force organization. As may be surmised, it was not possible from such a subordinate level for the AEC to exercise the prerogatives to which it was entitled as the employer of the LASL and principal financial contributor to the cost of test operations. Being firmly convinced that broader AEC participation in the actual conduct of overseas test operations would aid materially in the planning and execution of support activities, the Santa Fe Operations Office recommended that the Task Force be augmented by a Base Facilities Task Group for Operation CASTLE. The recommendation was approved and, based on CASTLE experience, it is the opinion of the SFOO that this arrangement was superior to the previous organization.

The long-range communication facilities at Eniwetok Island were seriously hampered by overcrowding, resulting in interference from motors, arc welders, aircraft operation, and interference between transmit and receive signals due to lack of physical separation of the equipment. Present plans for improving communications includes separation of the transmit and receive facilities by moving the transmitters to some other island within the atoll, moving of receivers to the present transmitter site, and installation of microwave or an equal to interconnect transmitters and receivers. If the separate island concept is adopted, it is planned to allow for transmissions from Eniwetok Island during interim periods and activation of the principal transmitter site during operational phases only. This plan is both feasible and desirable due to the limited number of operating circuits during interim periods and the substantial reduction in support requirements which would result therefrom as compared to operating a transmitter on a separate island on a year-around basis. Improved communications between Eniwetok and Bikini Atolls during afloat operations is highly important. The USS ESTES was extremely overcrowded from a communications standpoint and interference was the rule rather than the exception.

There were two principal types of visitors to the proving ground during Operation CASTLE, the first being the Official Visitor Group, which consisted of approximately 20 people, ten each selected by the AEC and the DOD. Ostensibly, the requirements for participation in this group were: (1) A high-level individual, either civilian or military, engaged in some phase of the Atomic Weapon Program, (2) The individual had a definite need to know the over-all program, (3) The individual was Queen cleared. The second group, Participant Observers, was established primarily to satisfy the needs of SWC (Special Weapons Command) and SAC (Strategic Air Command) in allowing certain of their key personnel to witness a shot. In addition there were visits by representatives of SFOO and AEC Washington in a semi-work status. Many of these visitors (all categories) arrived at the proving ground aboard Special Air Mission flights but did not return with the same flight. Others arrived aboard regular MATS flights. In the handling of these visitors, TG 7.5 was made responsible for all AEC people (except VIP's) who did not come and go via the same SAM flight. Since the number of visitors of this kind and their plans were not known in advance of their actual arrival, TG 7.5 found itself somewhat handicapped in arranging the necessary accommodations and catering to their wishes. It was noted, too, that the standing of official visitors during CASTLE was, in many instances, below the standard contemplated when the visitor program was established. Since the on-site briefings approached a Top Secret classification, the conclusion is that many people received information as members of a visitor group which was far above a level which could be justified on a need-to-know basis.

2.2 RECCOMMENDATIONS

In connection with Task Force organization, it should be noted that, although the operational phase was changed completely immediately after the first detonation, the rapid solution of the resulting problems indicated that the organization was quite satisfactory in its flexibility. It is thought, however, that TG 7.5 should provide more extensive assistance to TG 7.1 in the fields of administration, planning and support. By relieving both the LASL and the UCRL of a maximum amount of non-scientific functions, it is believed that these tasks could be combined in such a way as to effect some economy in personnel strength and minimize opportunities for conflicting procedures. It is contemplated, therefore, that the SFOO will, with the assistence of Holmes & Narver and appropriate Laboratory elements, undertake further study of administration, planning, and support functions for TG 7.1 and TG 7.5 prior to the next off-continent test operation.

In connection with overcrowding of long-range communication facilities, both ashore and afloat, it is recommended that appropriate Task Force and Task Group elements and SFOO communications personnel make a joint study of existing conditions with a view toward submitting their recommendations for improvement thereto well in advance of the next operational period at the PPG.

In line with the comments made on the visitor problem, it is recommended that appropriate JTF personnel attempt to devise a method of advance notice whereby TG 7.5 can be better prepared to handle this requirement. In conjunction, it is also recommended that the Commission review the matter of official visitors being present without a need-to-know justification.

It is believed that Operation CASTLE has clearly indicated the desirability of establishing a Rad-Safe unit within TG 7.5 which would be readily susceptible to integration with the Rad-Safe organization of the Scientific Task Group during operation periods but which would still retain responsibility for the actions of TG 7.5 personnel. Therefore, the Field Manager, EFO, will explore with the appropriate JTF element the possibility of maintaining the Field Manager's Rad-Safe group as a unit within the Task Force Rad-Safe organization; this unit will continue in future test operations with the responsibility of TG 7.5 Rad-Safe activities, including the maintenance of records. In this connection it is intended that field supervisory personnel of the Contractor would be trained to do their own monitoring and "policing" of Contractor's personnel so that special monitors would not be required by TG 7.5 working parties.

It is the opinion of the SFOO that public acceptance of the Operation was again handicapped by an unrealistic public relations policy. Accordingly, it is recommended that public relations aspects of full-scale tests be reviewed and that JTF elements, along with interested offices of the AEC, develop for consideration by the DOD and the AEC a revised concept of public information practices based upon known realities.

Page 18 not in original.

PART II SCIENTIFIC ACCOUNT

CHAPTER 1. GENERAL OBJECTIVES AND TECHNICAL CONCLUSIONS

1.1 GENERAL OBJECTIVES

The objectives of Operation CASTLE were threefold: first, to fire six or seven experimental devices (the firing of [redacted] was contingent upon the results of [redacted] - six of which were to be in the megaton range and three of which were to be proof tests of emergency capability weapons; second, to obtain the diagnostic information on these devices necessary to evaluate properly their performance in case of either success or failure; and third, to obtain effects information on devices in the megaton region. At the beginning of CASTLE, three devices had been given an emergency capability status, meaning that they had been designed as potential deliverable weapons. They were [redacted] From the results of CASTLE the scope of the emergency capability program would be largely determined.

At the beginning of the Operation, the following seven devices were scheduled: [redacted] (refer to Table 1). The first five of these were designed by the Los Alamos Scientific Laboratory, the last two by the University of California Radiation Laboratory at Livermore. During the Operation, observations were made which allowed changes in the devices and even removed some from the schedule (refer to Table 2). The first two fired, [redacted] gave yields considerably above those expected and led to a conclusion that a [redacted] was practical for stockpiling purposes. Since this type device is appreciably simpler to use than a [redacted] the Los Alamos shot, [redacted] was removed from the schedule and a second, somewhat revised, [redacted] inserted in its place. The success of the [redacted] shot also indicated [redacted]

The surprisingly low yield of [redacted] the third shot fired, combined with the success of the diagnostic measurements associated with that shot, led to a belief that the [redacted] shot would not be profitable and therefore that shot was cancelled. Thus the Operation concluded with the firing of six shots: [redacted] in that order.

1.2 TECHNICAL CONCLUSIONS

The technique of using vacuum pipes, as shown on Figure 18, in order to allow detailed studies of reaction characteristics is eminently satisfactory.

The technique of using barges as zero positions, from which to detonate the devices, was practical and essential to the CASTLE Operation. It allowed great flexibility in the Operation. For instance, the [redacted] was fired some ten miles from the planned position, and the [redacted] was fired at Eniwetok instead of at Bikini. Neither change would have been possible with fixed land zero points. However, no attempt should be made to fire from a barge in the open ocean unless the problems of phenomenal waves produced by submarine earth movement (tsunami) are settled and the other operational problems are carefully studied.

It can be concluded that CASTLE achieved the following:

1. Established adequacy for emergency capability on two weapons [redacted]
2. Demonstrated the practicability of using [redacted]
3. Provided experimental evaluation [redacted]
4. Gave valuable experimental information which can be employed in the design of lighter thermonuclear weapons.

5. Gave highly significant effects information on high yield explosions.
6. Significantly reduced the requirement for tritium production.

CHAPTER 2. OPERATIONAL CONCEPTS

2.1 INITIAL CONCEPT

The intiial concept of the LASL participation in Operation CASTLE is presented in a classified document (TS) from the Director, Los Alamos Scientific Laboratory to the Director, Division of Military Application, AEC, dated 28 November 1952. The following is an excerpt in substantially the same form as contained in the reference:

2.2 FINAL CONCEPT

During the intervening year between the initial and final concepts of Operation CASTLE, numerous changes were made in scope, shot sequence, and shot locations. For a complete account of the CASTLE firing schedules, reference is made to "Report of the Commander, Task Group 7.1", dated June 1954. The final approved shot schedule as presented in Task Group 7.1 Operation Plan No. 1-53, dated 8 December 1953, is shown in Table 1. A ready comparison with actual events may be had by comparing Table 1 with Table 2.

CHAPTER 3. DEVICES

Only a general description of the devices involved in Operation CASTLE will be given in this report. Detailed information may be found in publications of the LASL and the UCRL.

Pages 23 & 34 Deleted.

PART III MANAGERIAL ACCOUNT

CHAPTER 1. POPULATION RECORD

1.1 COMMENTS

Basic planning for camp operation underwent several revisions due to increases in population estimates which gradually developed for all Task Force Groups. The initial planning contemplated having two temporary camps, one each at Bikini and Eniwetok Atolls. The development of Bikini Atoll for Operation CASTLE is described in limited detail in Chapter 2, which follows. Suffice it to say, the original concept in the Fall of 1952 of a 500-man "shot island" camp had, by the end of 1953, evolved into an operational task involving temporary camp facilities on four different islands of the atoll with a total capacity of approximately 1900 people. At Eniwetok Atoll, a camp site previously established on Rojoa Island for Operation IVY was re-activated and constituted the only temporary camp operated at this atoll for CASTLE.

Concurrent with the expanding scope of the Operation, the participating agencies submitted revisions to their personnel accommodation requirements. Accordingly, suitable adjustments in population densities at the various camp sites were made from time to time, and it is believed that the final preparations for personnel accommodations were realistic in every way. As previously indicated, however, the immediate aftereffects of the SHRIMP shot had an adverse effect upon the camp preparations at Bikini. Action for handling this emergency was largely guided by decisions arrived at in frequent meetings of key TG 7.5 and TG 7.1 personnel on the USS ESTES, where they were quartered at Bikini, and at Parry Island when Eniwetok action was involved. Other Task Groups and the Task Force were represented or consulted as appropriate. Considering the emergency nature of the situation, it is thought that the actions taken by all concerned were commendable. It is believed, however, that if future planning properly anticipates loss of camp facilities, such as occurred in this Operation, some improvement in the necessary readjustments can be realized.

1.2 RECOMMENDATION

In view of the experience referred to above and other adversities of lesser consequence, it is recommended that a joint effort be made by TG 7.5 and TG 7.1 to include in the camp planning for future operations procedures to be followed in the event of unanticipated camp abandonment.

1.3 POPULATION ANALYSIS

In an effort to present CASTLE population trends at the PPG in a manner most useful to planning for future operations, it was deemed most practical to employ time-rate of growth and decline graphs. Accordingly, curve graphs have been prepared for the following segments of proving ground population:

Figure 8. Eniwetok Island, TG 7.5 Personnel
Figure 9. Parry Island, Task Group Personnel
Figure 10. Rojoa Island, Task Group Personnel
Figure 11. Eniwetok Atoll, TG 7.1 and TG 7.5 Personnel
Figure 12. Bikini Atoll, All Task Groups' Personnel Based Ashore.
Figure 13. Jobsite Personnel for Both Atolls by Months from 15 October 1952 (IVY) through 15 June 1954.

The camp facilities and services provided were adequate with one exception: On 1 March 1954 the initial experiment (BRAVO) was executed and the original plans were to re-occupy sites Enyu and Eninman on the day of the first shot. However, due to the widespread destruction of facilities on these two sites and to the high degree of radioactivity that prevailed immediately following this test, it was deemed advisable to return all personnel to Eniwetok Atoll. The disposition of Task Group evacuees is outlined in Part I, 1.6 Significant Events. All personnel were clothed, fed and sheltered, but the existing billeting facilities were increased 33 percent above the maximum capacity, resulting in some inconveniences. (Task Group 7.3 personnel remained afloat.) These conditions existed for a few days only; personnel were later returned to Bikini where future tests were conducted from aboard ship. Some H&N personnel were returned to the States because major construction work had been completed.

CHAPTER 2. CONSTRUCTION ACTIVITIES

2.1 COMMENTS

Prior to Operation IVY, there was growing concern over the limitations of Eniwetok Atoll for detonation of very high yield thermonuclear devices. As early as May 1952 the Task Force command, the staff of the Los Alamos Scientific Laboratory, and AEC test personnel were investigating the pros and cons of firing very high yield test units at locations other than Eniwetok, and the possibility of reactivating Bikini was being discussed. Practicability of utilizing one of several uninhabited islands in the Marshall, Caroline and Mariana Island groups was investigated and a survey of the Bikini Atoll as to its suitability for executing a very high yield detonation was conducted. The conclusion was reached that utilization of Bikini Atoll was most desirable from the standpoint of available land, isolated location, operational efficiency and economy. On 11 September 1952, concurrent with appropriate action with representatives of the Department of Interior and the State Department, the Atomic Energy Commission approved use of Bikini for CASTLE. The Commission stipulated that there must be no permanent construction at Bikini and that maximum possible economy and use of temporary and portable equipment must be the rule. Beachhead operations at Bikini on 1 October 1952, as proposed, were authorized at the same time.

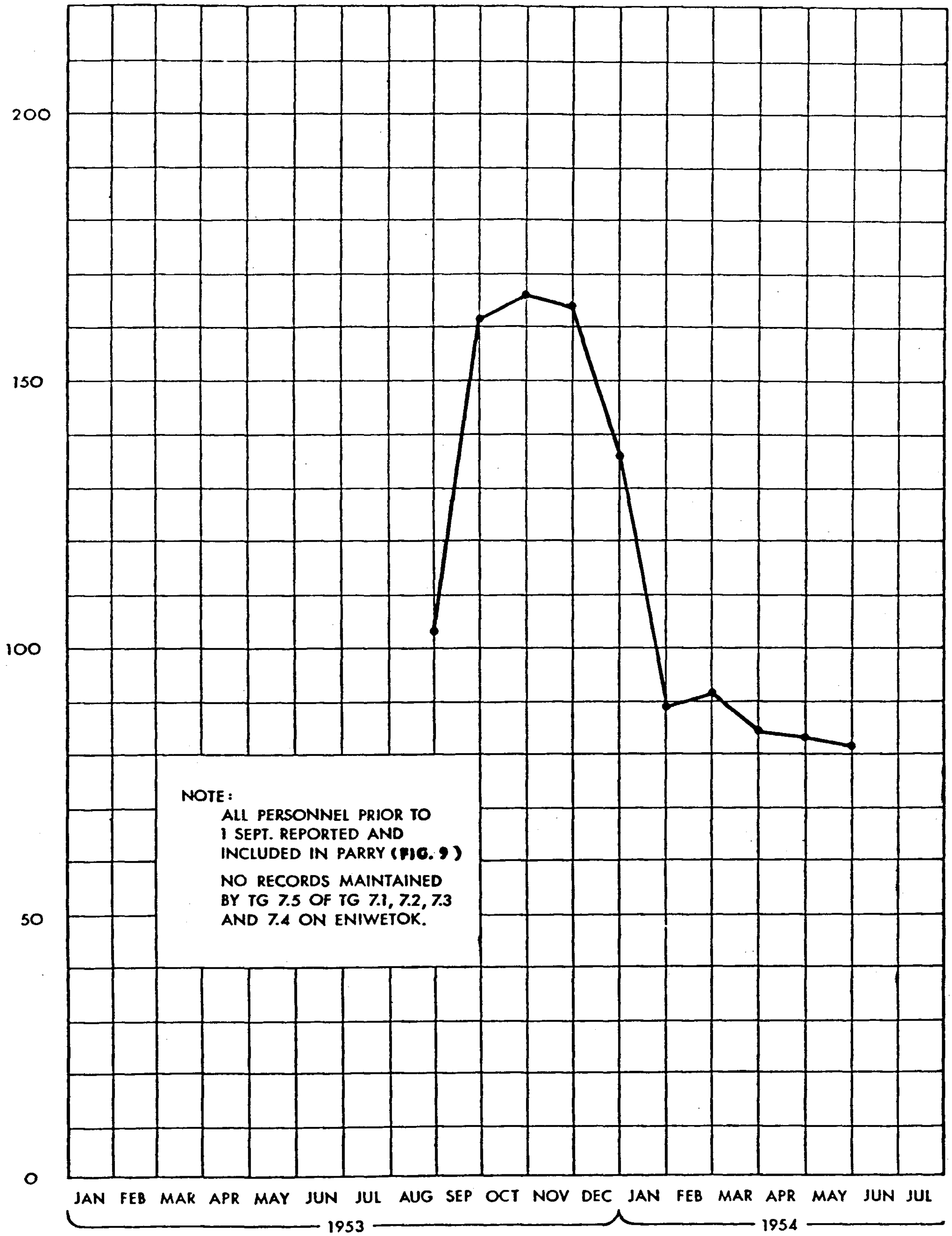


Figure 8. Eniwetok Island TG 7.5 Personel

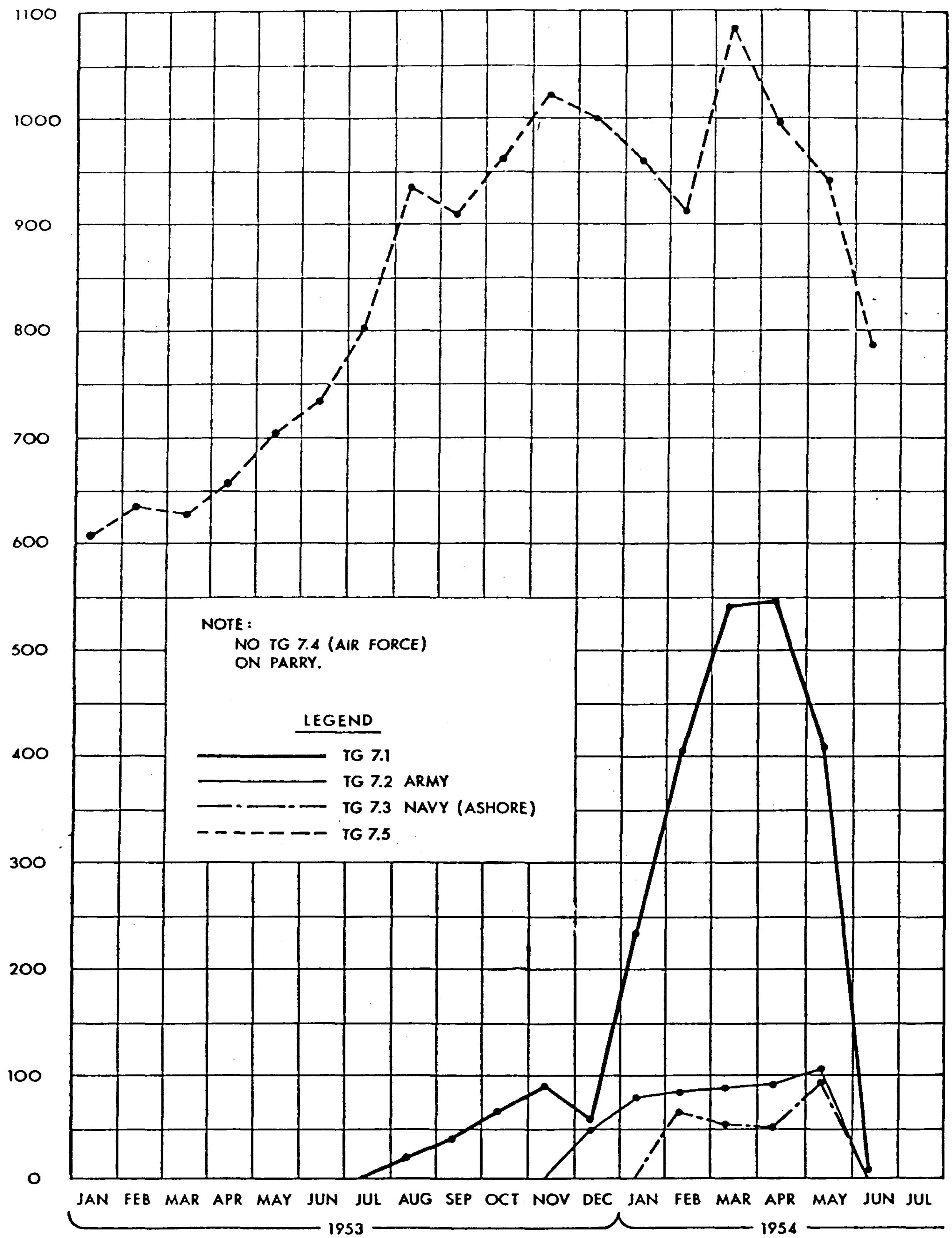


Figure 9. Parry Island Task Group Personnel

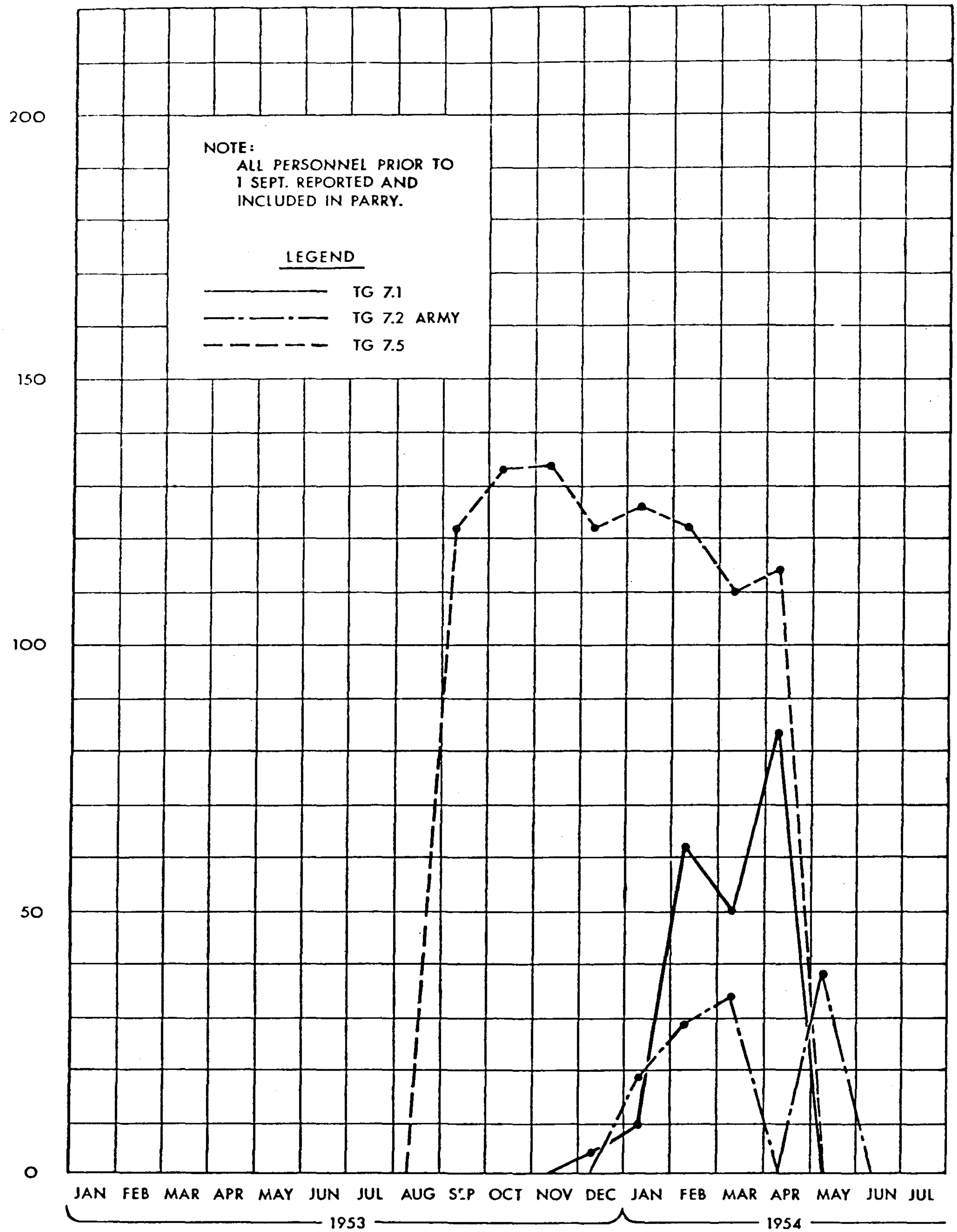


Figure 10. Rojoa Island Task Group Personnel

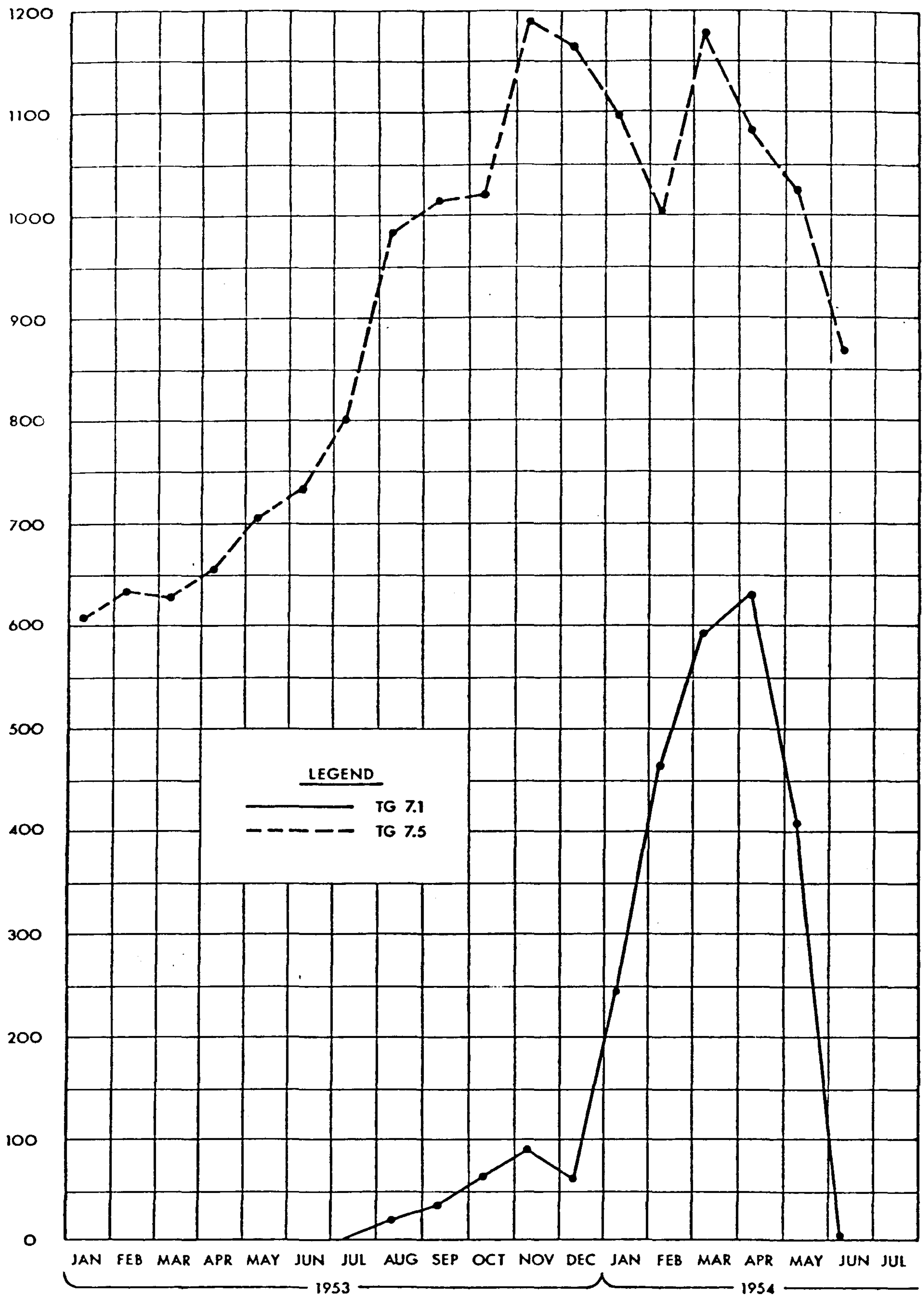


Figure 11. Eniwetok Atoll Task Groups 7.1 and 7.5 Personnel

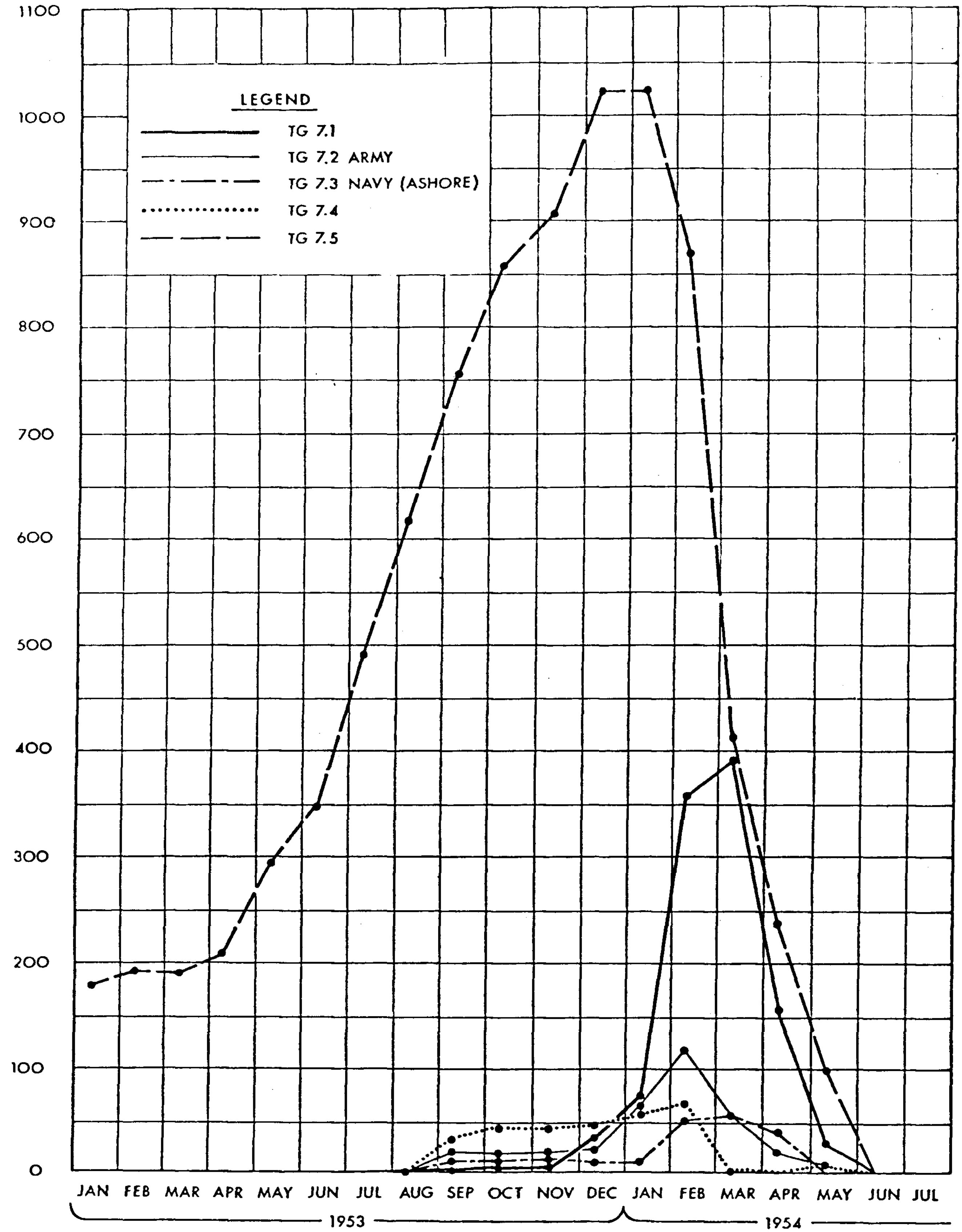


Figure 12. Bikini Atoll All Task Group Personnel Ashore

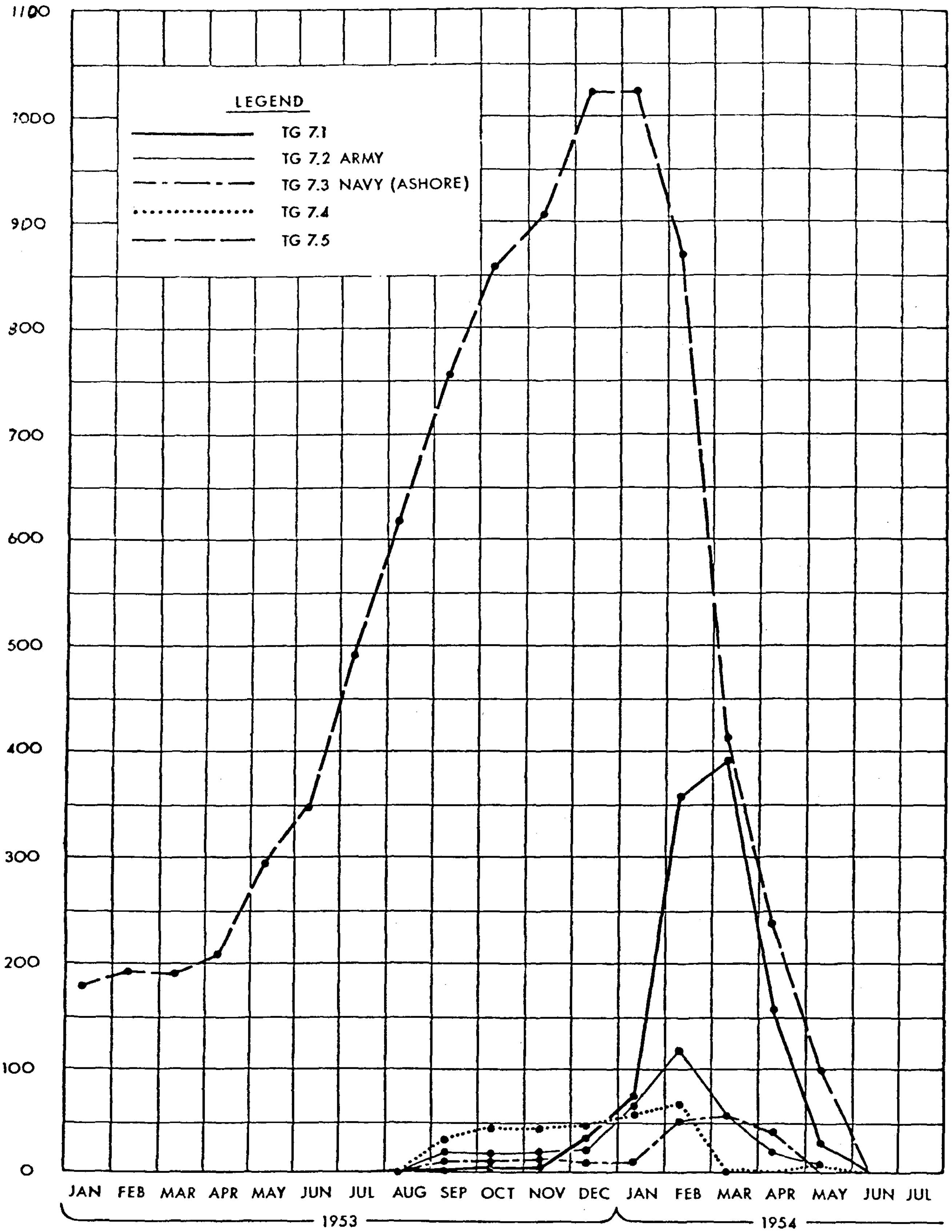


Figure 12. Bikini Atoll All Task Group Personnel Ashore

The original concept for the Bikini Atoll was of a 500-man "shot island" camp with an airstrip suitable for use by C-47 aircraft and test facilities adequate for detonation of one device. This relatively simple concept evolved into a complex operation involving temporary camp facilities on four different islands of the atoll, with a total capacity of approximately 1900 people, facilities for interatoll and intra-atoll air and water transportation, extensive radio and telephone communication systems, and scientific structures, control station and timing and firing circuitry adequate for detonation of six test units all in the greater than one megaton range.

Aside from the construction and operation of base facilities to accommodate the operational Task Force at the various locations, the major effort of TG 7.5 was directed toward construction of the numerous scientific stations and their many inter-related facilities. Extensive changes in plans of the Scientific Task Group as to devices to be tested, location of tests, and whether or not they were to be centered on barge or ashore introduced delays in planning and executing the scientific construction program. Late receipt of structural criteria on numerous structures complicated an already strenuous schedule for design, procurement of materials and equipment, shipment to the Jobsite, and construction. In September 1953, an evaluation of construction progress and scientific program development resulted in a decision to defer the date of the first detonation of the series from approximately 15 February to about 1 March 1954. There was no postponement or delay of any test in the series due to nonavailability on schedule of structures or support services. A large majority of the minor scientific stations were completed and occupied by the Using Agency in advance of construction schedules. Beneficial occupancy of major scientific stations by the Users was obtained by the desired date.

Since the receipt of design criteria was the starting point from which TG 7.5 construction activities began, it can be appreciated that a schedule for the receipt of this information was of paramount importance, and the Manager, SFO, set a deadline of 1 May 1953 for the submission of criteria. This deadline was ten months prior to the first test event, and the majority of the criteria was received by the deadline date. However, much of this information was only sufficient to establish a requirement and lacked the detail necessary for the preparation of preliminary working drawings. In many cases the supplemental details were not forthcoming for 30 to 60 days; in other cases, where criteria had been hastily assembled, changes were still being received several months later. It should be appreciated, however, that the 1 May deadline occurred during Operation UPSHOT/KNOTHOLE, the results of which affected much of the scientific planning for CASTLE.

To allow additional time for the submission of final criteria and still meet construction schedules, certain time-saving arrangements were made such as the use of air freight in lieu of land and water freight, bills of materials were prepared from preliminary drawings, and procurement was accomplished without competitive bidding. While such expediting saved valuable time, a number of undesirable effects resulted, which included: higher a number of undesirable effects resulted, which included: higher costs, higher cancellation charges, and excessive warehouse inventories of materials not immediately useful.

2.2 RECOMMENDATIONS

It is apparent from the foregoing comments that ways and means for expediting receipt of design criteria by the Contractor should be carefully explored. Toward this end it is directed that:

1. The Field Manager, EFO, afford the Contractor greater assistance in obtaining design criteria from participating agencies than has been the case heretofore. Lateness in arrival and incompleteness upon arrival are the two principal deficiencies to be overcome. Where the furnishing of criteria by a deadline date is impractical, the appropriate agency should be required to furnish a schedule showing when the criteria will be available.
2. Similarly, the Contractor will be assisted in acquiring Military Task Group requirements for additional base facilities. This criteria should be made available to the Contractor by approximately the same date established for receipt of criteria for scientific facilities.

2.3 PERMANENT BASE FACILITIES

Permanent Base Facilities (construction) is listed in the over-all program under Budget Projects 3028 (FY 1953) and 4015 (FY 1954). This work is generally scheduled to provide the Contractor with a practical minimum of work during interim periods. That portion of the work remaining to be done during an operational phase is scheduled so as to take up slack periods occurring in the scientific construction program. At the commencement of Operation CASTLE, Project 3028 was about 79 percent complete. Completion dates for the various items of Project 3028 are shown in Figure 14. At the cutoff date for CASTLE, Project 4015 was about 87 percent complete as indicated in Figure 15.

A large percentage of this permanent construction was required due to increases in operational population at both Eniwetok and Parry Islands, Eniwetok Atoll. Figures 16 through 19 are plan views of Parry and Eniwetok Island camps. Additional barracks, mess hall additions, laundry additions, additional sewers, water facilities, electrical facilities, and communications facilities were included. Additional warehouses, shop facilities, and 53 miscellaneous permanent construction items were likewise required. The majority of this work was accomplished concurrently with the scientific construction program.

Maximum use was made of prefabricated aluminum buildings for such structures as the barracks, mess halls, laundry, etc. This type of construction had a proven capability for withstanding the highly corrosive conditions and the high winds encountered at the PPG.

ITEM	DESCRIPTION	1953 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1954 JAN	FEB	MAR	APR	MAY	JUN	REMARKS
A-5-A	BLDG. 342 - ELMER	100.00																		
		100.00																		
A-13-A	PROTECTIVE FENCING & LIGHTING - ELMER	100.00																		
		100.00																		
A-14-A	UTILITY CONNECTIONS & EXTENSIONS - ELMER	100.00																		
		100.00																		
A-30-C	OPERATIONAL EQUIPMENT																			PROCUREMENT ONLY
A-33-C	MISCELLANEOUS CONST. - ALL SITES	12.50	25.00	37.50	50.00	62.50	75.00	80.00	83.00	87.82	90.23	90.45	100.00							ALL WORK AUTH. PRIOR 1 JULY 1953
		12.50	25.00	37.50	50.00	62.50	75.00	80.00	83.00	87.82	90.23	90.45	90.79	93.66	97.06	97.97	98.52	100.00		
A-34-A	BLDG. 194 - ELMER	100.00																		
		100.00																		
A-35-A	CONST. CHANGE ORDERS - ALL SITES	100.00																		
		100.00																		
A-37-C	ELEC. INTER-CONN. - ELMER/FRED																			PROCUREMENT ONLY
A-38-A	WAREHOUSES - ELMER - 3 BLDGS.	100.00																		
		100.00																		
A-42-C	CARGO PIER - FRED					12.50	50.00	62.50	87.50	100.00										
						4.20	49.93	63.00	86.00	96.00	100.00									
A-45-C	SALT WATER PUMP HOUSE - FRED					25.00	50.00	75.00	80.00	85.00	90.00	98.00	100.00							
						18.50	58.06	62.00	62.00	73.00	98.00	98.00	99.00	100.00						
A-46-C	ROAD CONSTRUCTION - FRED					15.00	75.00	90.00	100.00											
						15.00	74.22	97.00	97.00	99.00	100.00									
A-47-C	SEA WALL - FRED				33.33	98.00	100.00													
					33.33	99.03	100.00													
A-48-C	WATER LINES - FRED				25.00	60.00	95.00	100.00												
					25.00	65.00	98.64	100.00												
A-41-C A-49-C	WAREHOUSES - ELMER & FRED																			PROCUREMENT ONLY
	SUMMARY OF PROJECT 3028	79.08	79.45	79.86	81.12	85.32	92.15	94.84	97.59	97.59	98.45	98.67	100.00							
		79.08	79.45	79.86	80.24	84.36	92.32	94.77	97.59	97.41	98.45	98.67	98.73	99.15	99.60	99.73	99.80	100.00		

LEGEND

CONSTRUCTION SCHEDULE ESTIMATED PERCENT

CONSTRUCTION IN PLACE PERCENT COMPLETED

Figure 14 Construction Progress of Permanent Construction, Project 3028.

		1953												1954						
ITEM	DESCRIPTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	REMARKS
A-37-C	ELEC. INTER-CONN. ELMER / FRED							10.00	30.00	32.00	34.00	35.41	91.01	100.00						AWAITS MINOR CONSTRUCTION
								0.53	4.90	9.27	13.64	35.41	77.93	85.43	98.17	99.44	99.44	99.82	99.82	
A-41-C	WAREHOUSES - FRED									5.00	75.00	85.03	100.00							COMPLETION DATE CORRELATED WITH TG 7.2 IN FIELD
										4.00	48.00	85.03	92.91	95.02	100.00					
A-43-C	SPECIAL SERVICES BLDG. - FRED							10.00	30.00	60.00	80.00	86.00	100.00							
								10.00	13.00	31.00	77.00	86.00	97.00	98.00	100.00					
A-49-C	WAREHOUSES - ELMER										0.00	75.00	100.00	*		**	6.62	75.00	100.00	* BLDG. 511, 512 ** BLDGS. 504 THRU 510
											14.00	75.00	99.00	100.00			6.62	34.57	59.05	
A-50-C	BARRACKS - ELMER											23.37	77.85	100.00						
												23.37	93.57	100.00						
A-51-C	ADD. TO SHEET METAL SHOP - ELMER							25.00	75.00	100.00										
								6.00	100.00											
A-52-C	MESS HALL ADDITIONS - ELMER									5.00	15.00	97.00	100.00							
											15.00	97.00	99.00	100.00						
A-53-C	LAUNDRY ADDITION - ELMER									5.00	10.00	13.00	100.00							
										1.00	2.00	13.00	46.00	93.00	97.00	100.00				
A-54-C	ADMIN. BLDG. ADDITION - ELMER							25.00	50.00	75.00	99.00	99.00	100.00							
								25.00	55.00	98.00	99.00	99.00	99.00	100.00						
A-55-C	REPLACE P.O.L TANKS - ELMER														25.00	100.00				TANK 307 AUTHORIZED AND COMPLETED
															8.51	100.00				
A-56-C	PIPE LINES - CMR AREA - ELMER																			NOT YET AUTHORIZED
A-58-C	INFILTRATION LINES - ELMER																			NOT YET AUTHORIZED
A-59-C	CAMP SEWERS ADDITION - ELMER										40.00	56.96	73.84	100.00 *			**	10.00	100.00	* BARRACKS & WHSE. BLDGS. 511 & 512 ** BLDGS. 504 THRU 510
											15.00	56.96	73.84	100.00				13.00	13.00	
A-60-C	WATER FACILITIES ADDITION - ELMER										5.00	7.04	35.21	100.00 *			**	13.00	100.00	
											5.00	7.04	35.21	100.00				13.00	90.00	
A-61-C	ADDITIONAL ELECT. FACILITIES - ELMER										8.00	16.19	16.67	64.62	74.62	100.00 *	**	100.00		
											8.00	16.19	16.67	64.62	64.62	100.00		99.00	99.00	
A-62-C	ADDITIONAL COMM. FACILITIES - ELMER												16.76	78.97	100.00					
													8.60	78.97	100.00					
A-68-C	MISC. CONSTRUCTION (PERMANENT)							2.00	5.00	10.00	16.00	25.00	35.00	50.00	65.00	75.00	85.00	95.00	100.00	AUTH. AFTER 1 JULY, 1953
								2.00	5.00	10.00	16.00	25.00	35.00	50.00	65.00	75.00	85.00	95.00	98.00	
A-71-C	BIOLOGICAL BLDG. NO. 218 - ELMER									25.00	75.00	99.00	100.00							
										45.00	76.00	99.00	99.00	100.00						
A-73-C	REPLACE P.O.L. TANKS - FRED												10.00	86.26	100.00					
													10.00	86.26	100.00					
	SUMMARY OF PROJECT 4015							4.93	20.86	38.50	39.00	41.58	65.33	73.67	77.47	80.01	85.84	94.70	99.65	100.00
								0.20	4.99	15.38	27.82	41.58	62.79	72.72	80.13	83.26	84.73	86.74	91.98	

LEGEND

CONSTRUCTION SCHEDULE ESTIMATED PERCENT

CONSTRUCTION IN PLACE PERCENT COMPLETED

Figure 15. Construction Progress of Permanent Construction, Project 4015.

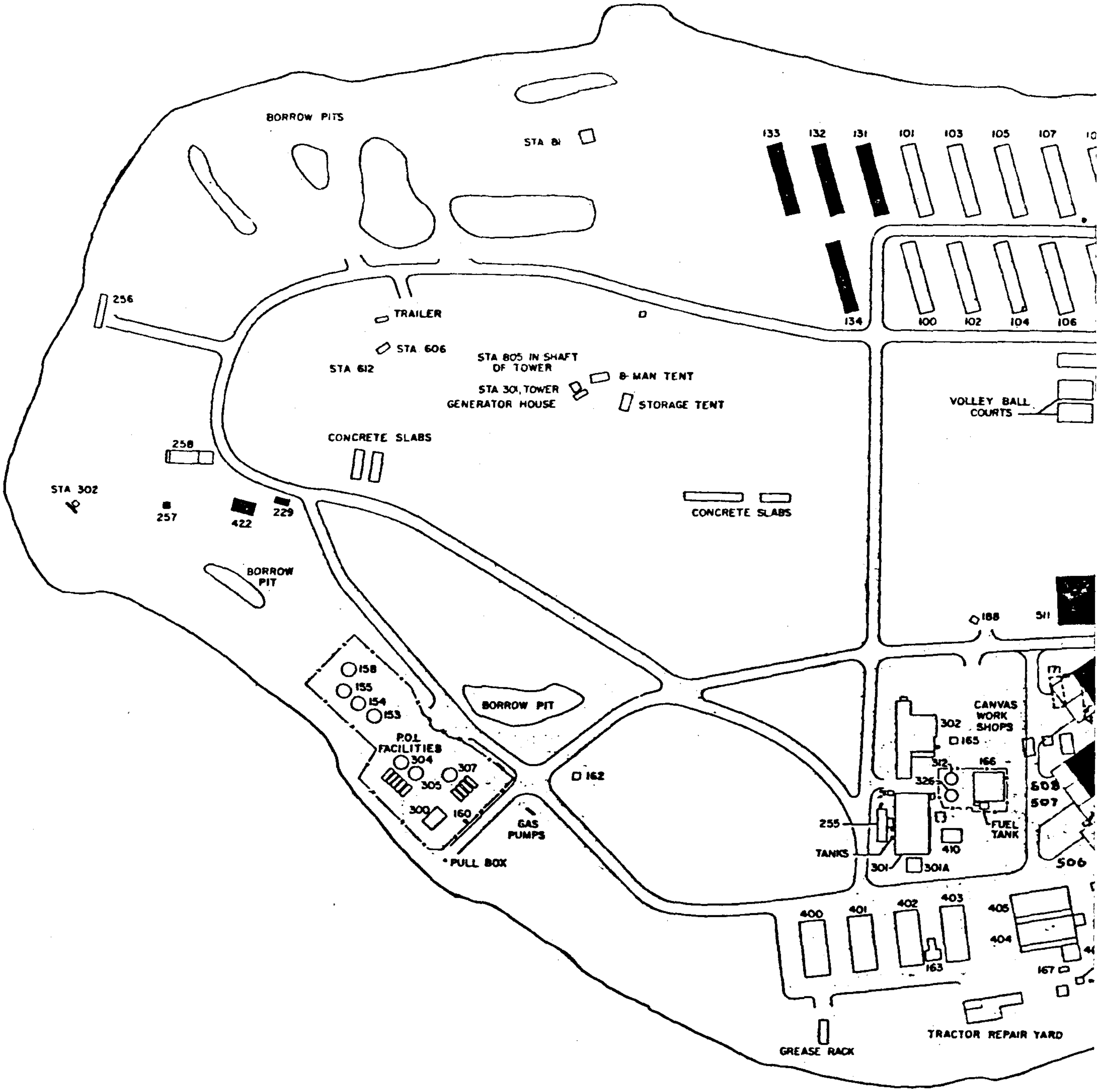
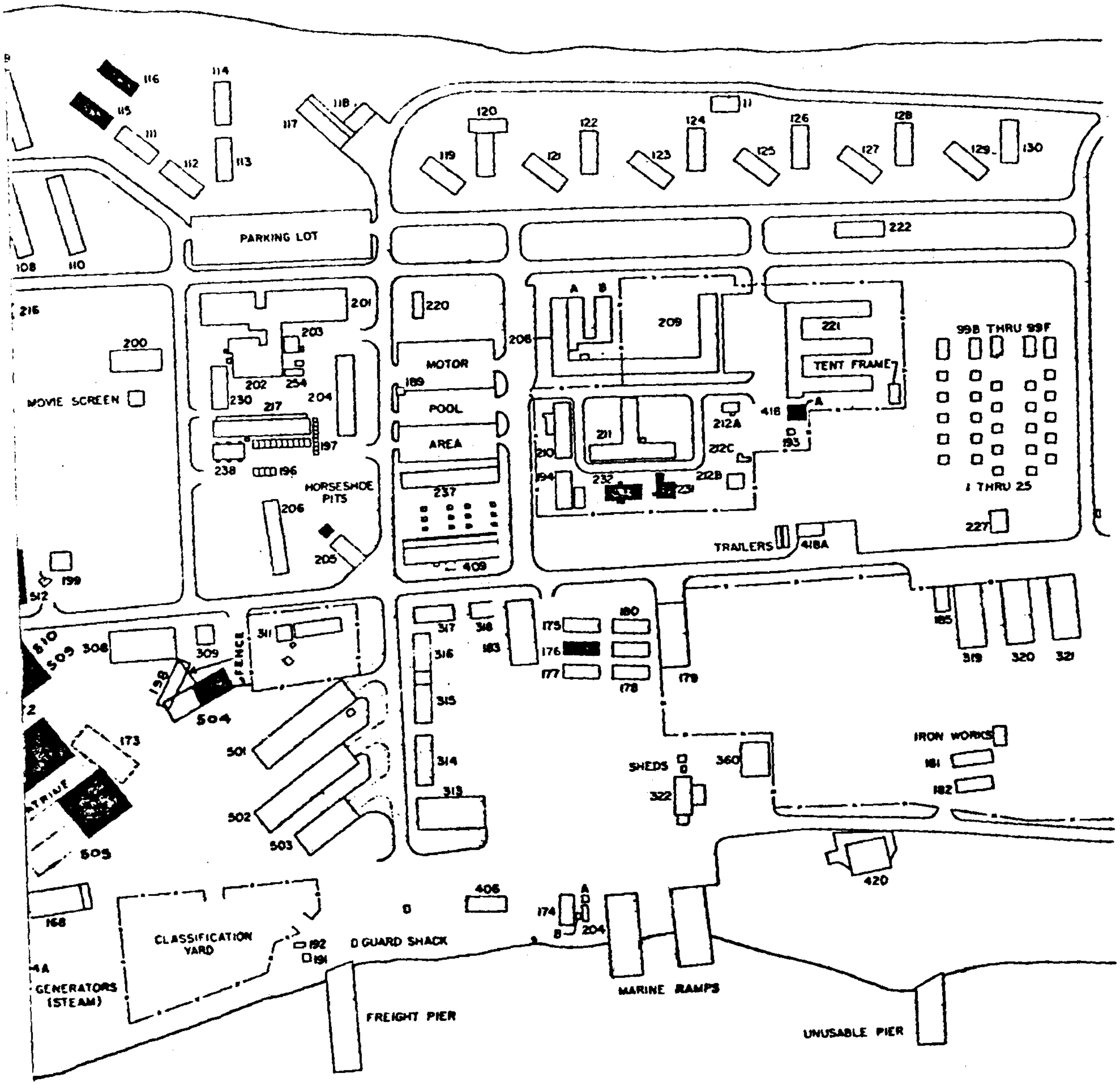


Figure 16. Elmer Campsite, Eniwetok Atoll

FOR BUILDING SCHEDULE, SEE SHEET 2



BLDG NO	DESCRIPTION
1 THRU 50	4-MAN QUARTERS
51 THRU 99A	8 MAN QUARTERS
100 THRU 110	36-MAN QUARTERS
111 THRU 116	18-MAN QUARTERS
117	INFIRMARY
118	NURSES QUARTERS & DENTIST
119	18-MAN QUARTERS
120	QUARTERS & LANAI
121 THRU 130	18-MAN QUARTERS
131 THRU 134	36-MAN QUARTERS
135 THRU 149	
150	GARBAGE CAN BUILDING
151	BEACH CLUB
152	BEACH CLUB
153 THRU 158	DIESEL FUEL STORAGE
159	
160	HOSE SHELTER
161	HOSE SHELTER
162	FIRE PUMP HOUSE
163	STATIONARY LOCKER
164	OPERATIONS BUILDING
165	LATRINE
166	RESERVOIR
167	CONCRETE
168	BATTERY & TIRE SHOP
169	
170	
*171	DISTILLATION REPAIR SHOP
*172	POWER PLANT REPAIR SHOP
*173	PLUMBING WAREHOUSE
174	MARINE RIGGING LOFT & MARINE WAYS OFFICE (A & B)
175	CHAPEL
176	HOBBY SHOP
177	GUARD & CONSTRUCTION OFFICE
178	CAMP OFFICE
179	GYM
180	RADIO SHOP
181	SUPPLY FIELD OFFICE
182	WAREHOUSE - SUPPLY HARDWARE
183	WAREHOUSE
184	WAREHOUSE
185	AEC SUPPLY
186	SAW SHED
187	PIER GUARD SHELTER
188	H & N MOTOR POOL DISPATCHER
189	AEC MOTOR POOL DISPATCHER
190	BEACH CLUB
191	MARINE POL STORAGE
192	DIESE FUEL STORAGE
193	GENERAL LABORATORY
194	SHOP WITH DEHUMID ROOM

BLDG NO	DESCRIPTION
195	SHOE SHOP
196	REEFER BANKS
197	REEFER BANKS
198	MARINE ELECTRIC SHOP
199	SOFTBALL FIELD
200	OUTDOOR MOVIE
201	MESSHALL
202	BAKERY
203	BOILER HOUSE
204	P.O., PX & SNACK BAR
205	FIRE STATION
206	SECURITY HEADQUARTERS
207	STORAGE TENT - FIRE EQUIPMENT
208	H&N ADMINISTRATION
208A	H&N ADMINISTRATION
208B	H&N ADMINISTRATION
209	AEC ADMINISTRATION
210	PHOTO LABORATORY
211	INSTRUMENT LABORATORY
212 A, B & C	COUNTING & SAMPLING LABORATORY
213	GUARD POST
214	GUARD POST
215	LATRINE (MESS HALL)
216	DAY ROOM
217	REEFER
218	BIOLOGICAL LABORATORY
219	
220	FRESH & SALT WATER ELEVATED TANKS
221	TASK FORCE ADMINISTRATION
222	PASS & BADGE OFFICE
223 THRU 226	
227	LATRINE & SHOWERS
228	LATRINE & SHOWERS
229	TELEMETER & RECEIVER BLDG
230	COMMISSARY
231	LABORATORY
232	SHOP, SCIENTIFIC USERS
233 THRU 236	LATRINES & SHOWERS
237	RECREATION
238	CHILL STORAGE BUILDING
239	MP ORDERLY & SUPPLY TENT
240 THRU 249	
250	BASEBALL FIELD
251	ANNOUNCERS BOOTH
252	REFRESHMENT STAND
253	BARBEQUE PIT
254	GARBAGE CAN BUILDING
255	ACID HOUSE
256	EXPLOSIVE STORAGE
257	NITROGEN STORAGE
258	ACETYLENE STORAGE
259 THRU 299	
300	POL PUMP HOUSE
301	POWER & DISTILLATION PLANT

BLDG NO	DESCRIPTION
302A	BOILER HOUSE
302	LAUNDRY
303	ADDITION TO LAUNDRY
304	DIESEL FUEL STORAGE
305	DIESEL FUEL STORAGE
306	
307	GASOLINE STORAGE
308	WAREHOUSE, FOOD
309	MATERIAL TEST LABORATORY
310	
311	CONTROL BUILDING
312	FRESH WATER TANK
313	SUPPLY DIV. OFFICE & WAREHOUSE
314	SHEET METAL SHOP
314A	PLUMBING & REFRIGERATION
315	ELECTRICAL SHOP
316	SHEET METAL SHOP
317	CARPENTER SHOP
318	OFFICE MACHINE REPAIR SHOP
319	WAREHOUSE
320	WAREHOUSE
321	WAREHOUSE
322	MARINE REPAIR SHOP
323	RADSAFE BUILDING
324	RADSAFE HUTMENT
325	
326	FRESH WATER TANK
327	
328	
329	LABORATORY
330	LABORATORY
331	SHELTER
332	GUARD POST
333	AC BUILDING - CMR AREA
334	SHELTER
335	GUARD TOWER
336	GUARD TOWER
337	CALIBRATION STATION
338	
339	POWER PLANT
340	CYLINDER SHELTER
341	SHOP & STORAGE BUILDING
342	SHOP
343	
344	LABORATORY
345 A & B	CYLINDER RACKS
346	
347	SALT WATER INTAKE
348	
349	ELEVATED WATER STORAGE
350 THRU 359	
360	SEACRAFT REPAIR SHELTER
361 THRU 370	
371 THRU 375	DIESEL FUEL STORAGE
376 THRU 379	GASOLINE STORAGE
380 THRU 398	

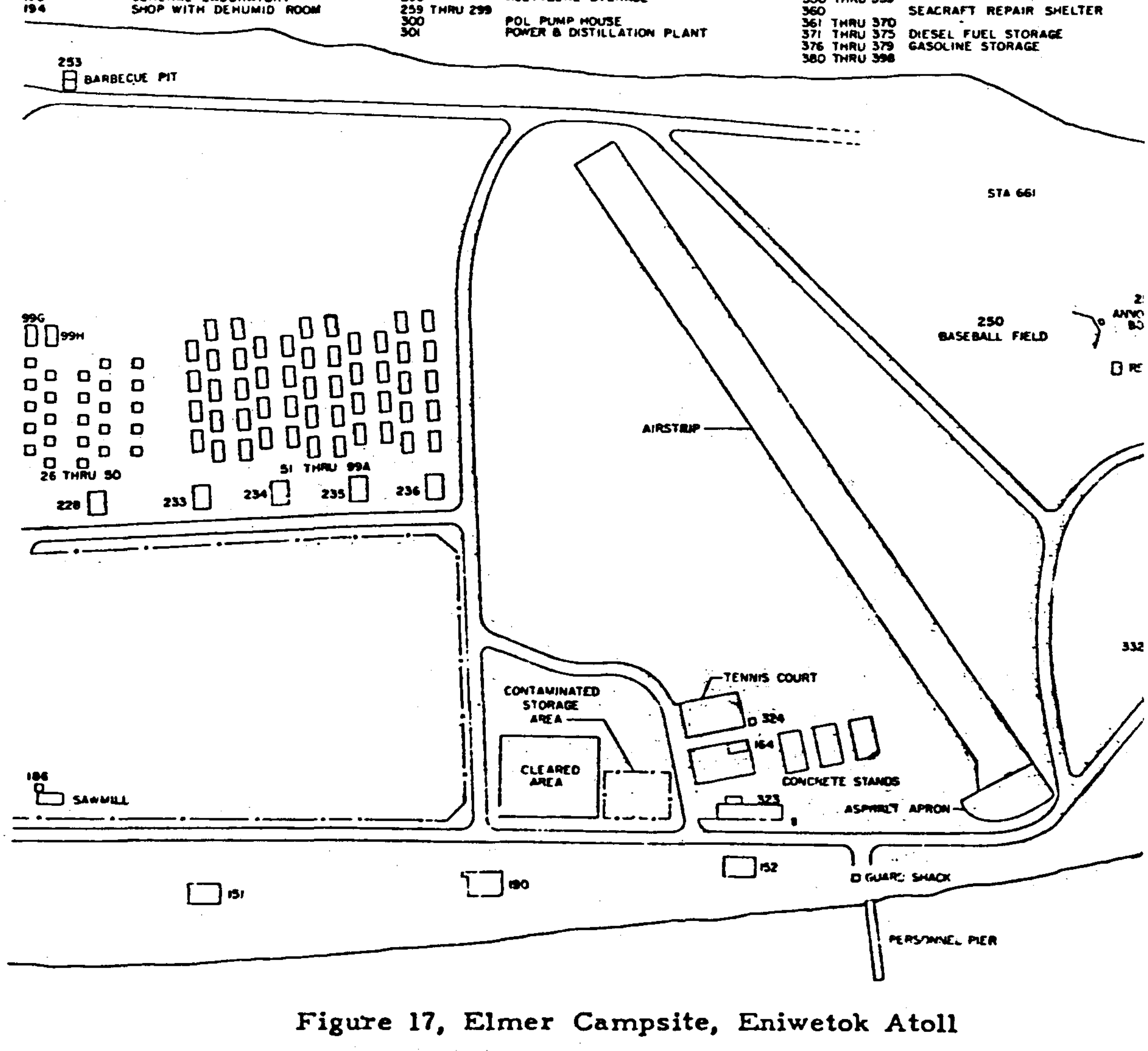
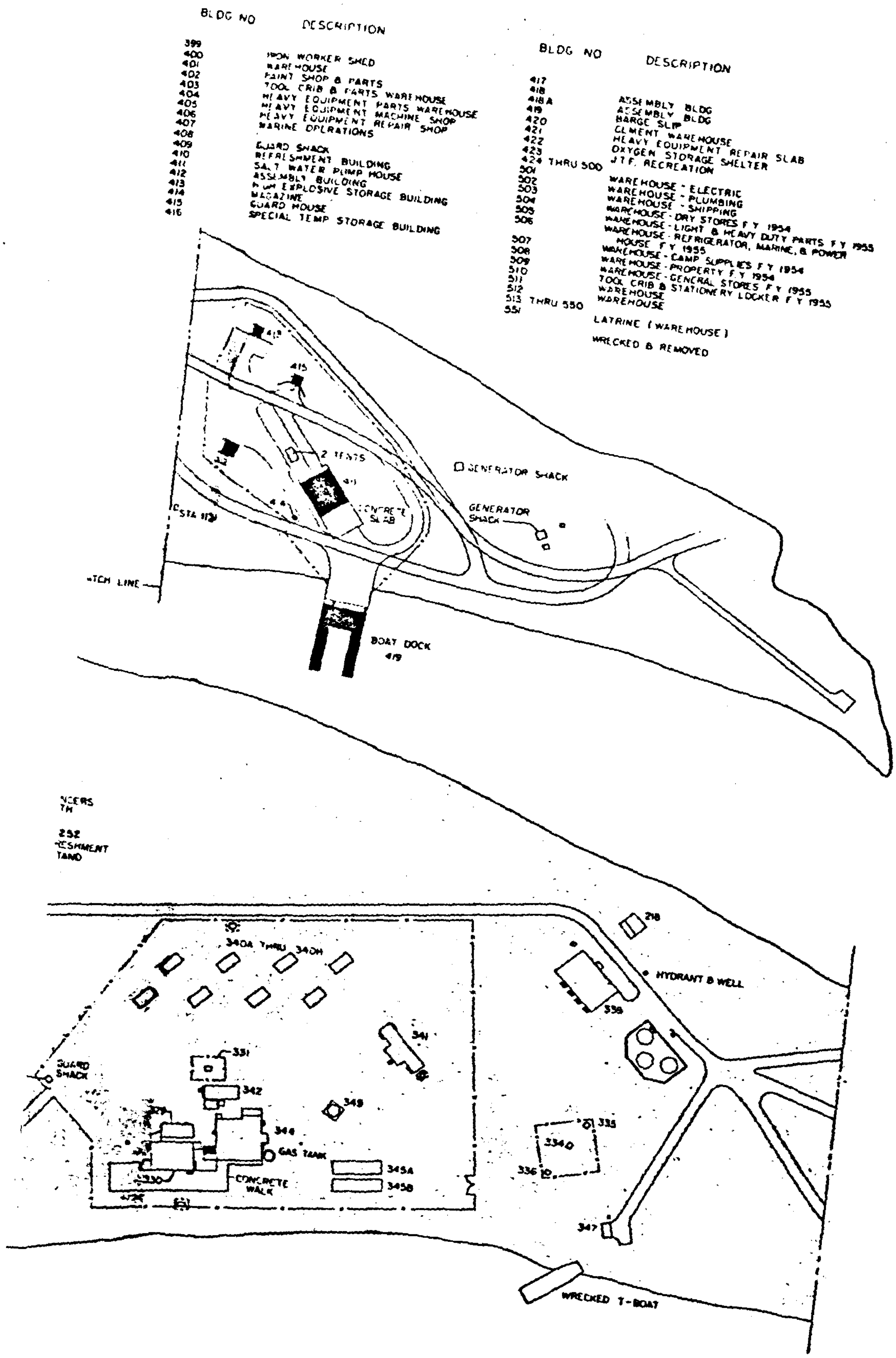


Figure 17, Elmer Campsite, Eniwetok Atoll



SHEET 2 OF 2 SHEETS

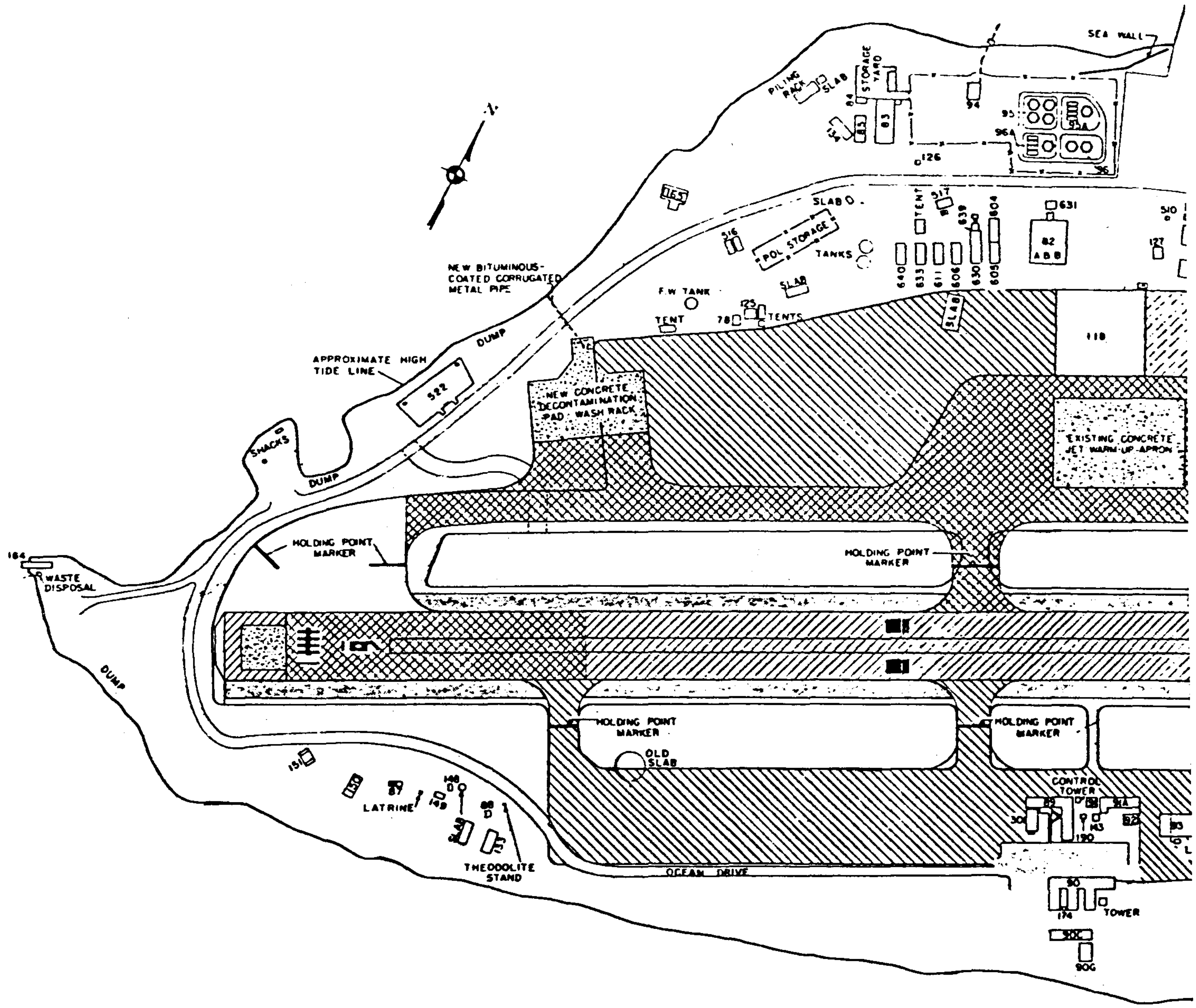
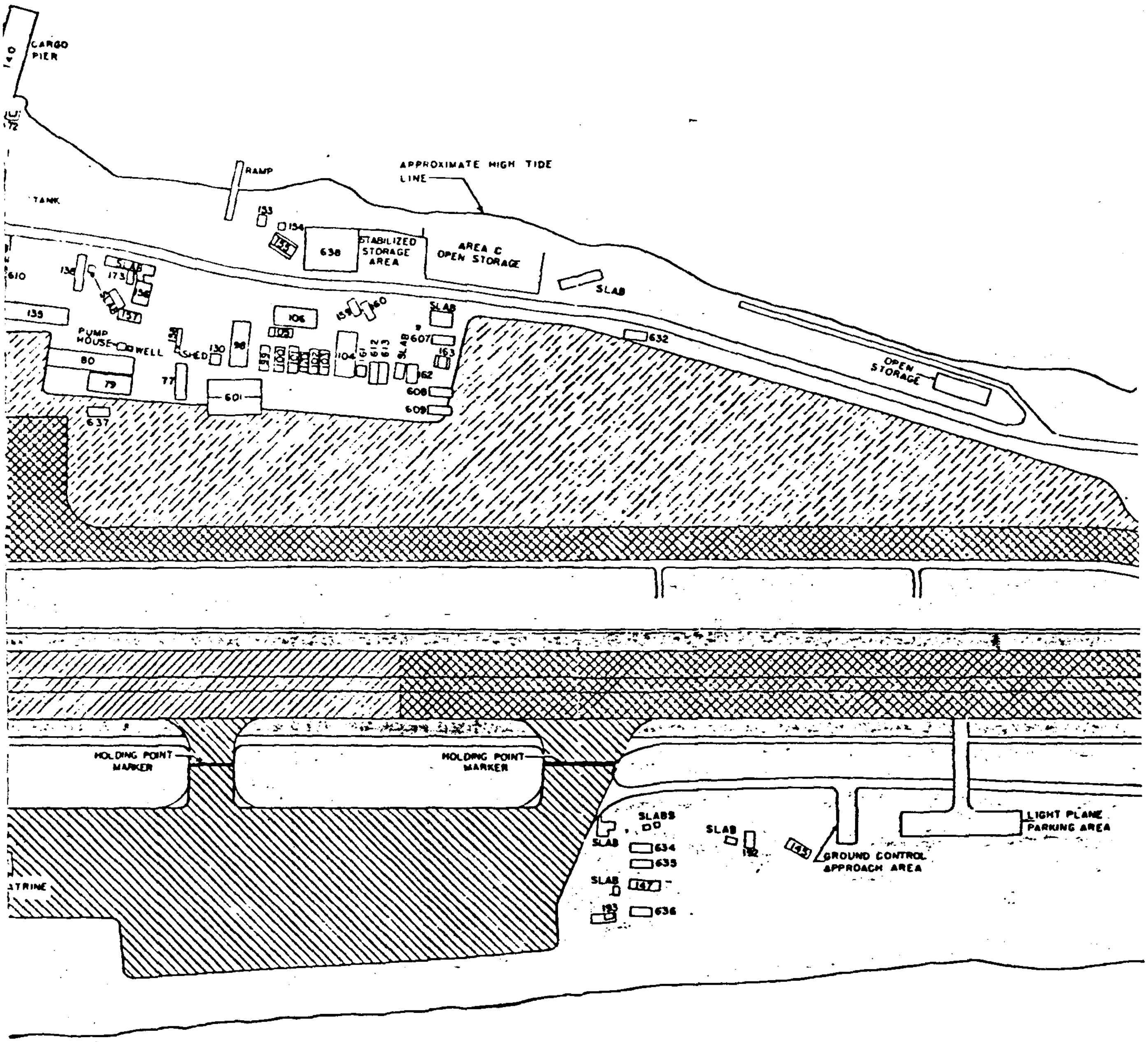


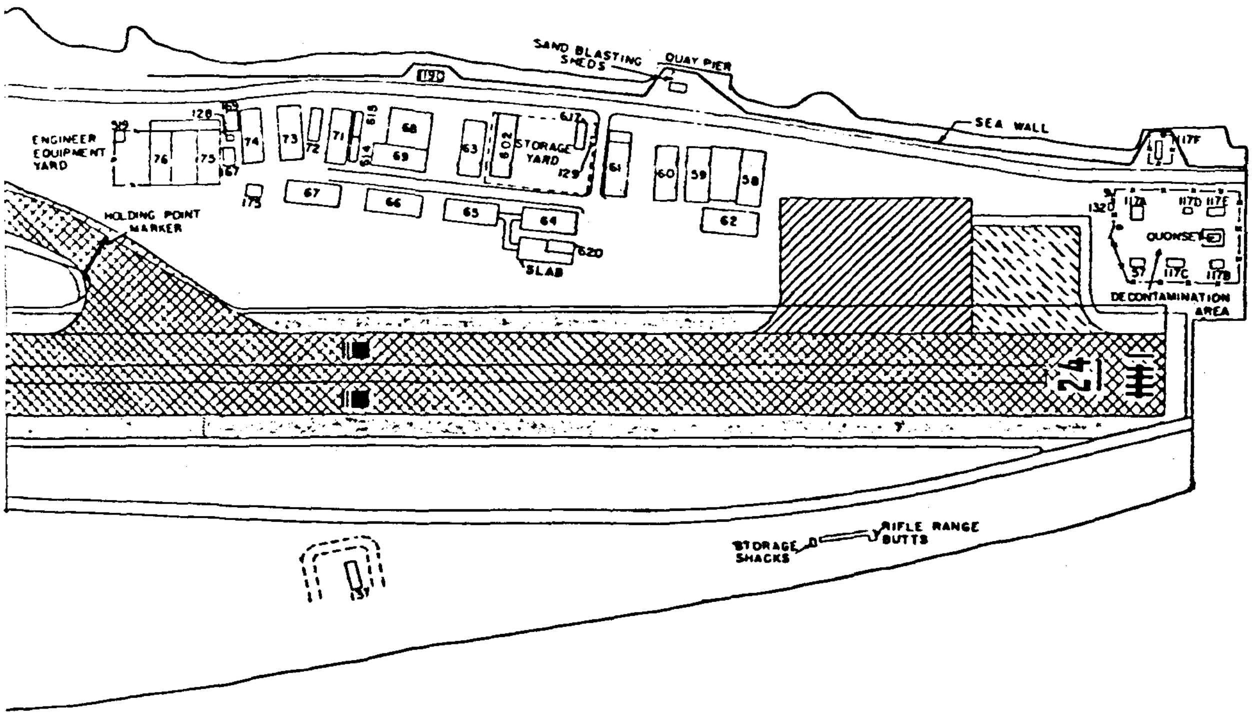
Figure 18. Site Fred, Eniwetok Atoll



CARGO PIER
140
RAMP
APPROXIMATE HIGH TIDE LINE
TANK
STABILIZED STORAGE AREA
638
AREA C OPEN STORAGE
SLAB
OPEN STORAGE
PUMP HOUSE
WELL
SHED
601
632
HOLDING POINT MARKER
HOLDING POINT MARKER
SLABS
SLAB
GROUND CONTROL APPROACH AREA
LIGHT PLANE PARKING AREA
634
635
147
636

LEGEND

- DUST PALLIATIVE
- EXISTING ASPHALT - PATCH AND SEAL
- OVERLAY WITH 2" PLANT MIX
- 5" CRUSHED ROCK PLUS DUST PALLIATIVE
- CORAL BASE, 2" ASPHALT SURFACE
- 40' SHOULDER - DUST PALLIATIVE
- CONCRETE



BLDG NO.	DESCRIPTION
1	E. M. RECREATION
1A	LATRINE
2	OFFICERS BEACH CLUB
3	TRANSMITTER (POWER)
4	RECEIVER
4A	GENERATOR HOUSE
5 THRU 8	SHOWER & LATRINE
9	OPEN AIR SHOWER
10	QUARTERS, 36-MAN
11, 12, 13	QUARTERS, 72-MAN
14	DISPATCHER SHACK
15	GROUP HEADQUARTERS
16	P.O. & P.X. BLDG.
17	LATRINE AND SHOWERS
18 THRU 21	QUARTERS, 18-MAN
22, 23	HOSPITAL WARD
24	DISPENSARY
25	NUMBER NOT USED
26	ATCOM RESIDENCE
27	OFFICERS CLUB
28	NUMBER NOT USED
29	FIRE STATION
30	MOVIE, OPEN AIR
31	LAUNDRY
32	CHAPEL
33	NUMBER NOT USED
34	BOILER HOUSE
35	BAKERY
36	MESS HALL
37	COMMISSARY
38 THRU 42	QUARTERS, OFFICERS, 18-MAN
43, 44	LATRINE & SHOWERS
45	NUMBER NOT USED
46 THRU 50	QUARTERS, 72-MAN
51 THRU 55	LATRINE & SHOWERS
56	POWER & DISTILLATION PLANT
56A	BADGER SHED
57	LABORATORY
58 THRU 67	WAREHOUSE
68	REEFER BANK
69	AUXILIARY POWER
70	REEFER SHELTER
71	WAREHOUSE
72	SUPPLY OFFICE
73 THRU 76	WAREHOUSE
77	DRONE HEADQUARTERS
78	AIR OPERATIONS
79	ELECTRONIC CONTROL
80	ELECTRONICS MAINTENANCE
81	NUMBER NOT USED

BLDG. NO.	DESCRIPTION
82A	WAREHOUSE
82B	WAREHOUSE
83	WAREHOUSE
84	TRANSMITTER (POWER)
85	RECEIVER
86	NUMBER NOT USED
87	HYDROGEN STORAGE
88	WEATHER STATION
89	BASE OPERATIONS & TOWER
90	AIR TASK FORCE GROUP HDQTRS.
90C	AIR OPERATION CENTER
90G	POWER HOUSE
91	ALERT CREW - CRASH TRUCK
91A	SHELTER
92	L-13 OPERATIONS
93	L-13 MAINTENANCE
94	POL PUMP HOUSE
95	STORAGE, 100 OCT. AV. GAS
95A	STORAGE, MO. GAS & 91 OCT. AV. GAS
96	STORAGE, JP1 FUEL
96A	STORAGE, DIESEL
97	NUMBER NOT USED
98	WAREHOUSE
99	WAREHOUSE
100	WAREHOUSE
101	WAREHOUSE
102	WAREHOUSE
103	WAREHOUSE
104 THRU 106	WAREHOUSE
107	STORAGE, FRESH WATER
108	MOVIE, OPEN AIR
109 THRU 113	LATRINE & SHOWERS
114	NUMBER NOT USED
115	LATRINE & SHOWERS
116	LORAN
116A	LORAN ANNEX
117A	NRDL
117B	NRDL
117C	NRDL
117D	NRDL
117E	NRDL
117F	NRDL
118	B-50 HANGAR
119C & D	RADAR UNITS - HARD STANDS
120	NUMBER NOT USED
121	ELEVATED WATER STORAGE
122, 123	LATRINE & SHOWERS
124	NUMBER NOT USED

BLDG NO.	DESCRIPTION
125	LATRINE & DECONTAMI SHOWER
126	LATRINE
127	LATRINE
128, 129	LATRINE
130	LATRINE
131	BOOSTER PUMP HOUSE
132	SENTRY POST
133	WEATHER SUPPLY OFI
134	SIGNAL CORPS REPAII
135	DRONE CREW, BRIEFINI
136	GUARD HOUSE
137	MAGAZINE
138	AF AUXILIARY POWEI
139	NOSE HANGAR
140	CARGO PIER
141	NUMBER NOT USED
142	PERSONNEL PIER
143	AACS EMERGENCY PI
144	ICE PLANT
145	BASE FLIGHT WAREHC
146	NUMBER NOT USED
147	BASE FLIGHT MAINTEI
148	INFLATION SHELTER
149	HYDROGEN GENERATC
150	AACS UG STORAGE
151	AACS UG STORAGE
152	NUMBER NOT USED
153	NAVY BOAT SUPPLY
154	NAVIGATION TOWER
155	SMALL BOAT REPAIR
156	HEADQUARTERS, HDQT
157	WAREHOUSE
158	VEHICLE WASH STANI
159	WAREHOUSE
160	WAREHOUSE
161	WAREHOUSE
162	WAREHOUSE
163	WAREHOUSE
164	GARBAGE RAMP
165	MAGAZINE
166	NUMBER NOT USED

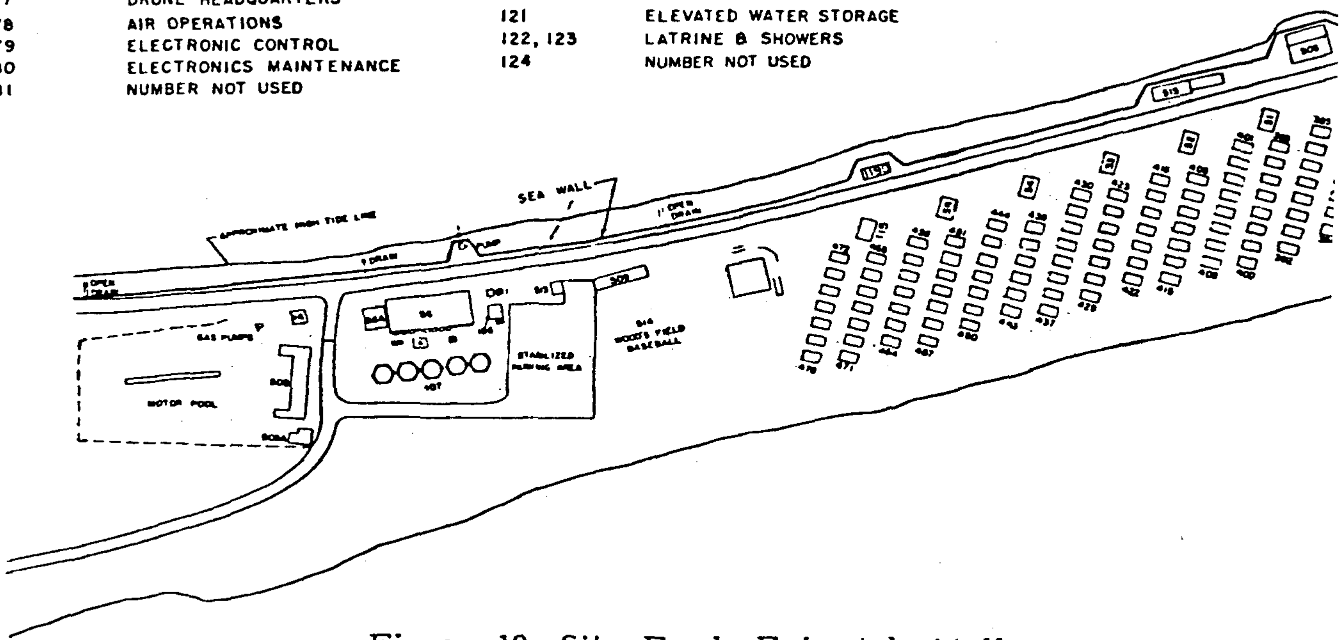
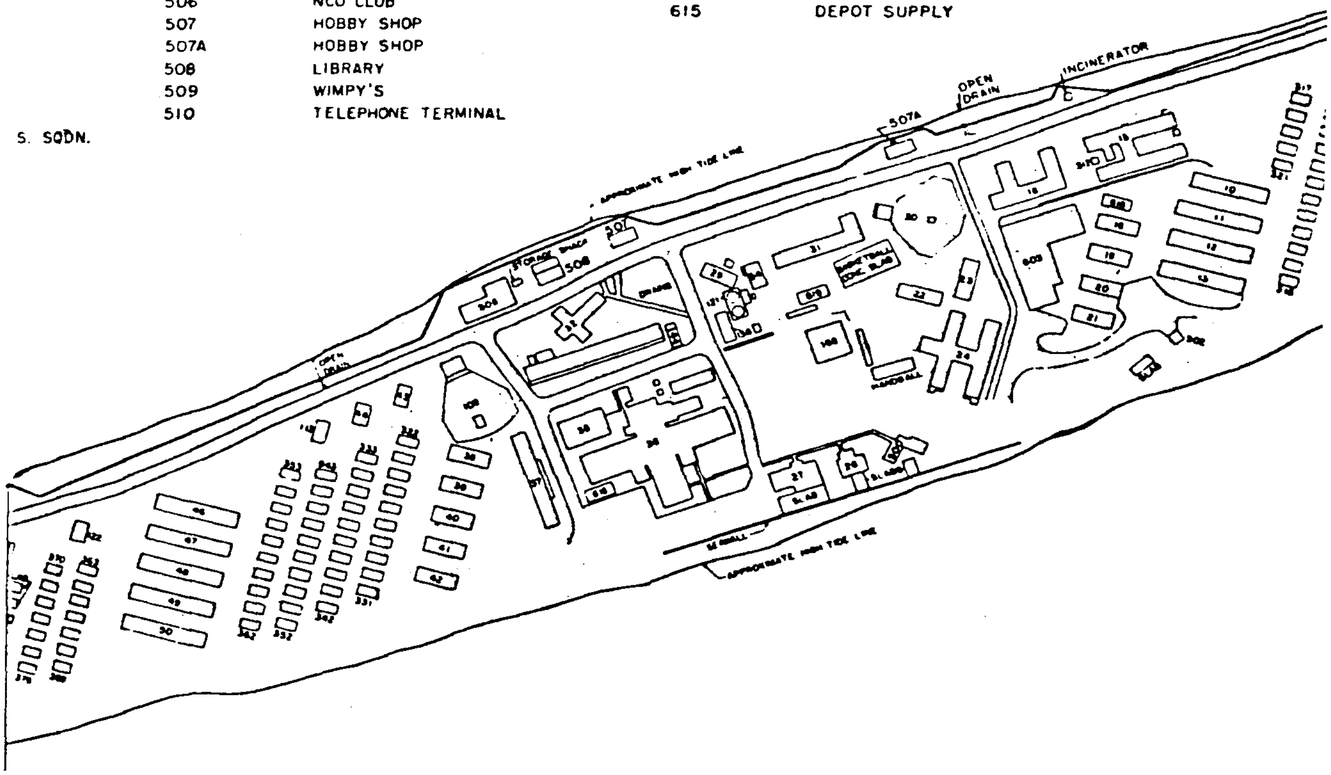


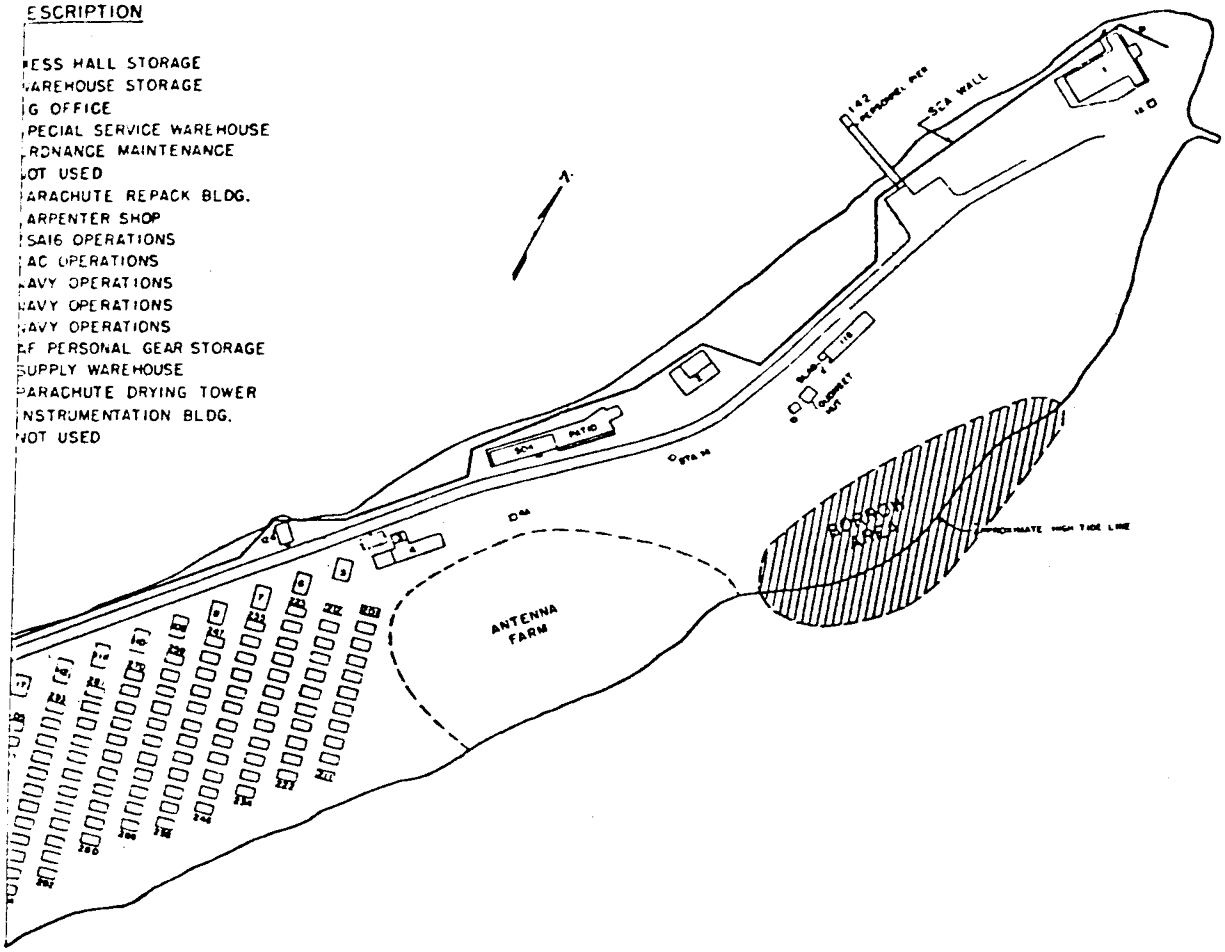
Figure 19. Site Fred, Eniwetok Atoll

	BLDG NO	DESCRIPTION	BLDG NO	DESCRIPTION	BLDG NO
VATION	167	UTILITY OPERATION	511	LATRINE	616
	168	PERSHING FIELD PARADE GROUND	512	GENERATOR SHED	617
	169	HBN MAINTENANCE OFFICE	513	GENERATOR SHED	618
	170	OFFICE	514	WOOD'S FIELD, BASEBALL	619
	171	NUMBER NOT USED	515	ENGR. MAINT. OFFICE & MORTUARY	620
	172	PIER OFFICE	516	EXPERIMENTAL LAUNDRY	621 THRU 629
	173	REFRESHMENT STAND	517	POL OFFICE	630
	174	WEATHER RADAR TOWER	518	NUMBER NOT USED	631
ICE	175	TOOL ROOM	519	ENGINEERS PAINT SHOP	632
	176 THRU 189	NOT USED	520, 521	NOT USED	633
& OPERATION	190		522	SKEET RANGE	634
	191	NOT USED	523 THRU 600	NOT USED	635
	192	SLAB	601	LATRINE	636
	193		602	WAREHOUSE	637
	194 THRU 200	NOT USED	603	SPECIAL SERVICES	638
	201 THRU 478	QUARTERS, 8-MAN	604	ELECTRONICS MAINTENANCE	639
	479 THRU 490	QUARTERS, 8-MAN, TEMP	605	ELECTRONICS MAINTENANCE	640
	491 THRU 499	NOT USED	606	FLY-AWAY KIT STORAGE	641 THRU 692
WER	500	GENERAL OFFICER QUARTERS	607	AIR WEATHER SERVICE	
	501	NUMBER NOT USED	608	AIR WEATHER SERVICE	
SE	502	G-2 SUB-STATION	609	AIR WEATHER SERVICE	
	503	MOTOR POOL REPAIR SHOP	610	PHOTO LABORATORY	
ANCE	503A	GREASE RACK	611	PERSONAL EQUIPMENT	
	504	SWIMMERS TAVERN	612	SUPPLY	
	505	DUFFY'S TAVERN	613	SUPPLY	
	506	NCO CLUB	614	DEPOT SUPPLY	
	507	HOBBY SHOP	615	DEPOT SUPPLY	
	507A	HOBBY SHOP			
	508	LIBRARY			
	509	WIMPY'S			
	510	TELEPHONE TERMINAL			
S. SQDN.					



ESCRIPTION

ESS HALL STORAGE
AREHOUSE STORAGE
G OFFICE
PECIAL SERVICE WAREHOUSE
RDNANCE MAINTENANCE
OT USED
ARACHUTE REPACK BLDG.
ARPENTER SHOP
SAI6 OPERATIONS
AC OPERATIONS
AVY OPERATIONS
AVY OPERATIONS
AVY OPERATIONS
F PERSONAL GEAR STORAGE
UPPLY WAREHOUSE
ARACHUTE DRYING TOWER
NSTRUMENTATION BLDG.
NOT USED



2.4 MAJOR SCIENTIFIC CONSTRUCTION

After it had been decided to use Bikini Atoll as an auxiliary test site, it was first necessary to set up an extensive horizontal control network covering all major islands of the atoll. Survey work was started early in the program and required a considerable amount of clearing on most of the islands as well as the establishment of a control point on a coral head in the lagoon.

Previous experience during Operation IVY with the 9000 ft. long plywood tunnel, which contained a controlled atmosphere for diagnostic measurements of the MIKE shot, led to a decision to use pipes to accomplish the same general purpose in Operation CASTLE. These pipes were 8-5/8" O.D. by 40 ft. long and were butt welded end-to-end to make up the following arrays: Namu, 12-pipe array, 7500 ft.; Eninman-Reere, two-pipe array, 5600 ft.; Eberiru-Aomon, two-pipe array, 2700 ft. Precise survey work was required to align

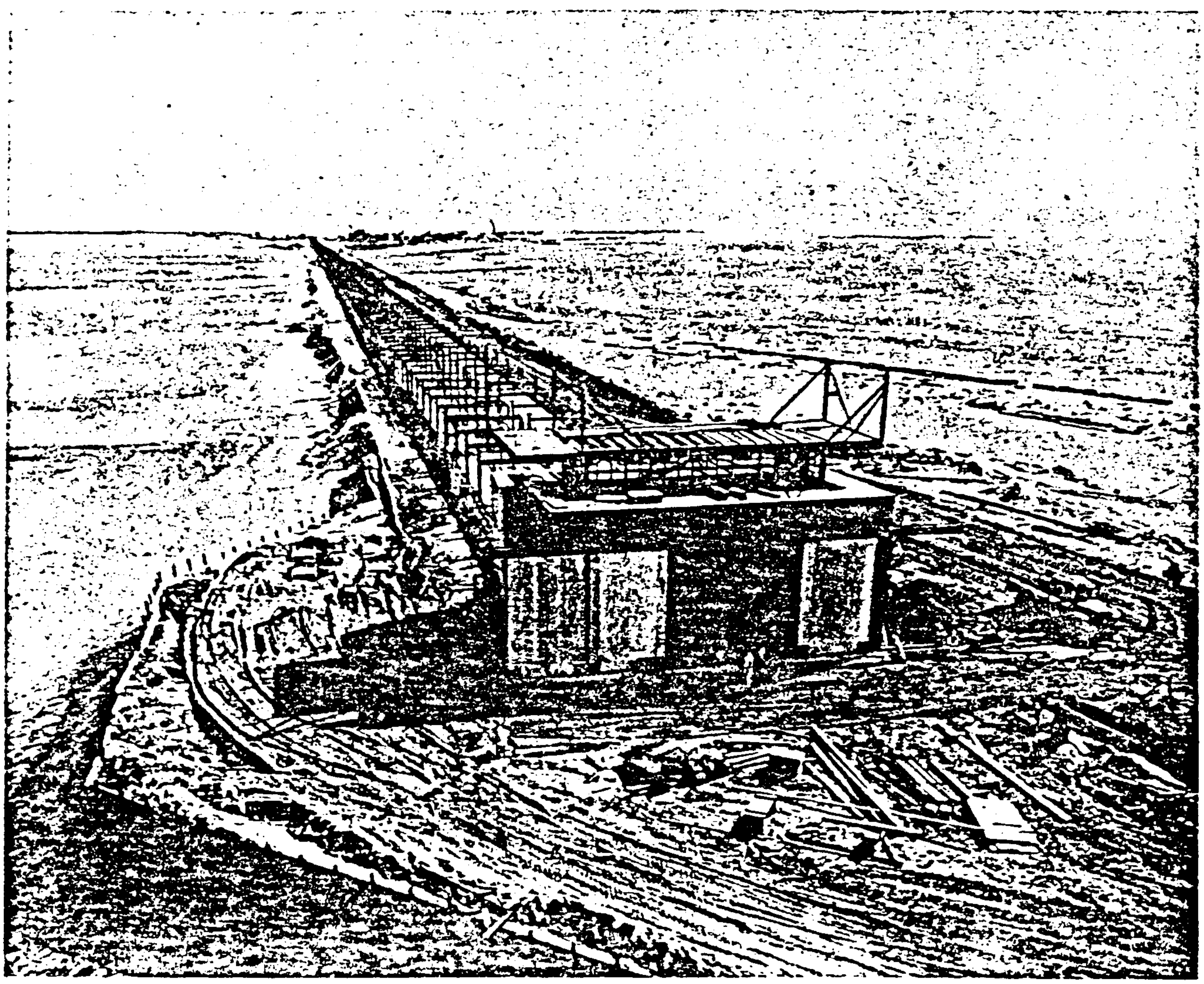


Figure 20. 12-pipe Array Under Construction - Namu

these arrays perfectly since a tolerance of plus or minus one inch had to be taken into account. Figure 20 shows the 12-pipe array at Namu traversing the causeway built for this purpose and terminating on a man-made island of approximately one acre. Figures 21 and 22 show other major scientific construction in varying degrees of completion. Figure 23 shows the manhours expended for design and drafting.

High density shielding concrete (limonite-steel aggregate) amounting to slightly less than 500 cu. yds. was placed during this Operation. With the

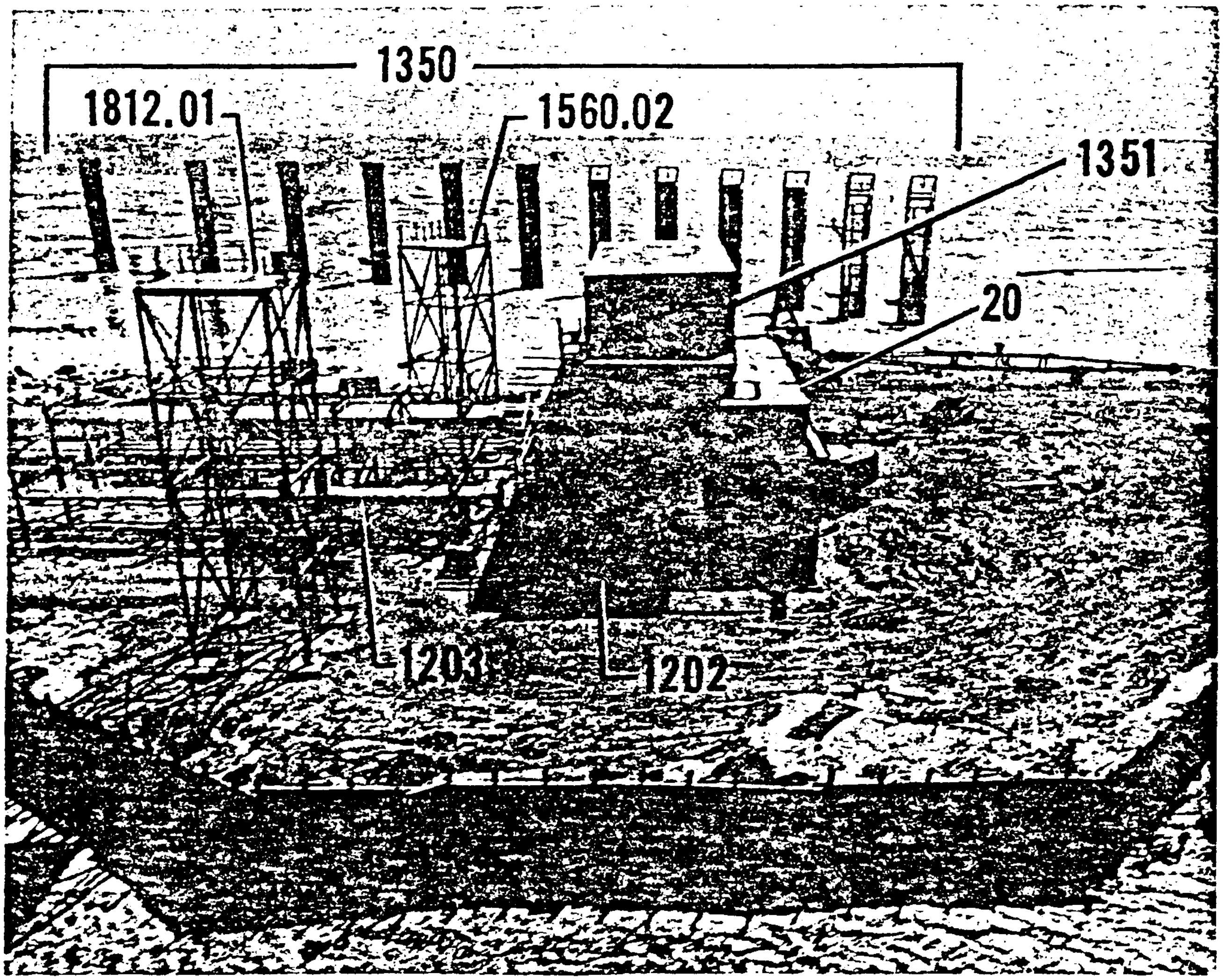


Figure 21. Stations on Charlie-Baker Reef - Looking Toward the Lagoon.

Stations indicated are listed as follows:

Station 20 - Zero
Station 1202 - Shield with Converters
Station 1203 - 12 Pipe Array
Station 1350 Series (1350.01 through 1350.12) - Mirror Towers
Station 1351 - Penthouse on Station 20
Station 1560.02 - 37 ft. Steel Tower
Station 1812.01 - 40 ft. Steel Tower

experience gained during the GREENHOUSE project and a further program of mix design for CASTLE, no particular difficulties were encountered. Limonite concrete pours were somewhat slower than coral concrete pours because the weight of a batch of this type concrete necessarily reduced the capacity of the concrete mixers. Although more cement per yard was utilized

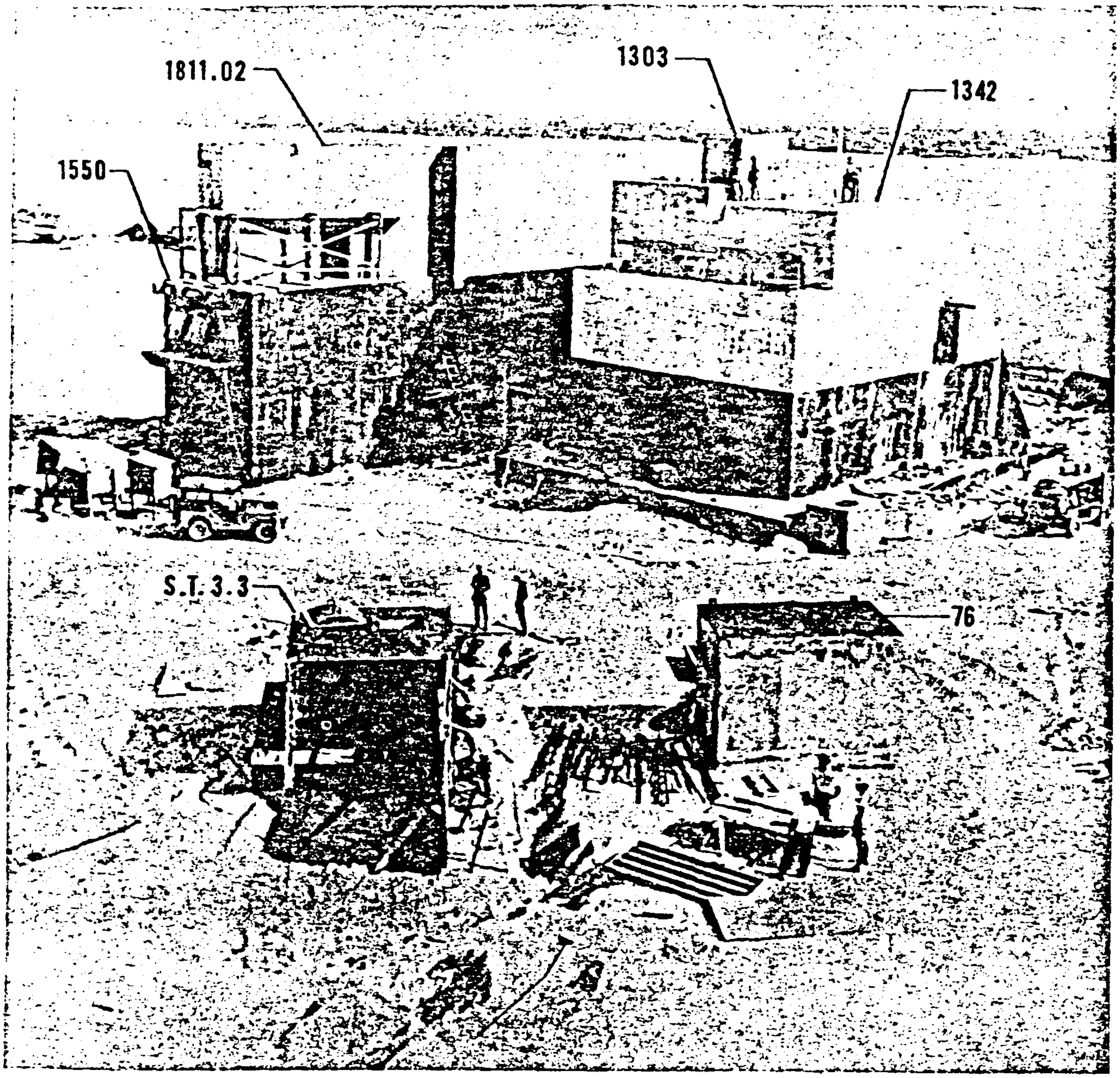


Figure 22. Major Stations Being Erected for Barge Tests and are Oriented Accordingly.

Station 76	-	Timing Shack
Station 1303	-	Camera Piers
Station 1342	-	Camera Bunker
Station 1550	-	Two Story Block House
Station 1811.02	-	Transmission
ST 3.3	-	Submarine Cable Terminating Station

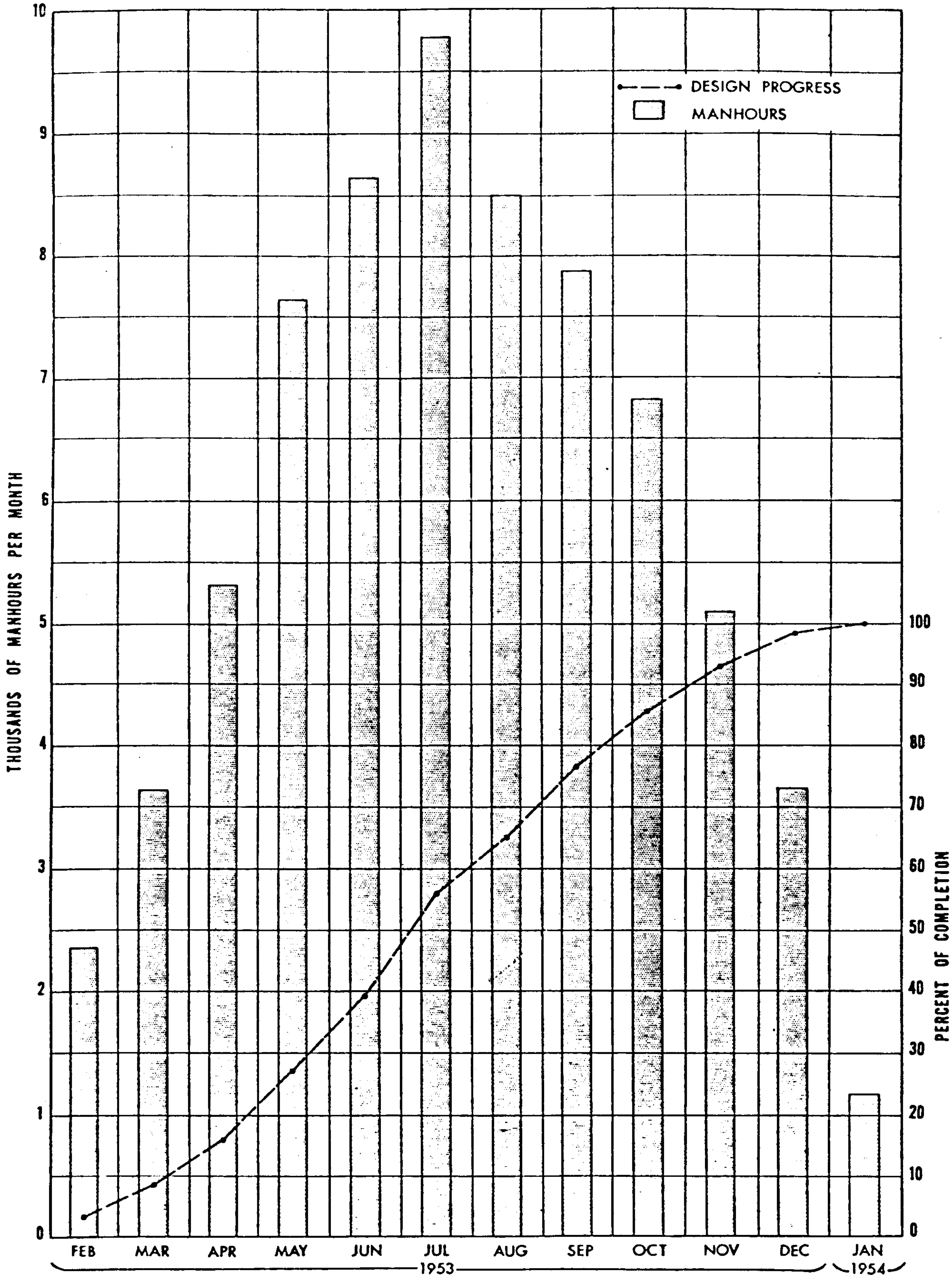


Figure 23. Scientific Structures, Design and Drafting - Progress and Manpower Chart

in these mixes than in coral concrete mixes, no adverse thermal cracking was noted. A limonite concrete mix was designed to produce a unit weight of 312 lbs. per cu. ft. for a small margin in excess of design requirements without increasing mixing and placing difficulties. Compressive strenghts in excess of 3000 psi were realized from these dense mixes but the amount of mixing water had to be sharply restricted in order to produce the required unit weights. Compressive strength and unit weights obtained on the limonite concrete were good. The results of all the limonite concrete test cylinders show that an average compressive strength of 3259 psi was obtained at 28 days. The in-place unit weights of limonite concrete structures were checked by carefully calculating the capacity of the forms and comparing the volume with the number and weights of all batches of concrete going into a particular pour. Very close or exact agreements were obtained between the unit weight of the mix design and the calculated in-place unit weight. Figure 24 shows monthly totals of all concrete poured.

Testing of the submarine cables remaining from the IVY Operation revealed that cables from Engebi to Bogallua were not intact. However, sufficient usable cable remained to meet the CASTLE requirement for termination at Bogon. The cable serving Bogallua and Bogombogo required replacements and repairs. Approximately 45,000 ft. of new six-pair and 10,000 ft. of new 16-pair telephone cable were required to serve the scientific stations. Despite the fact that firm criteria were not available when cable procurement was initiated, plus subsequent changes in the scientific program, the amounts of cable originally purchased for the Eniwetok Atoll system were less than ten percent in excess of final needs.

Submarine cables were laid from a modified LCM type landing craft and all splices were made aboard. Testing of the cable was continuous during laying operations and terminations were made in existing submarine cable terminals at the various island sites.

All cable work was completed as planned with the exception of the new six-pair telephone cable between Bogallua and Bogon. Installation of this cable was held up pending finalization of requirements, and early in April 1954, advice was received that this installation had been deleted from the program.

Since an entirely new submarine cable plant was required for Bikini Atoll, it was decided that combined telephone and signal usage of a single cable system was feasible instead of a double cable system as employed at Eniwetok Atoll. This single cable system required special splice boxes which provided inductive loading coils for those cable pairs used for telephone trunking or telemetering. However, considering the amount of cable involved, combined use permitted a reduction in length of over 500,000 lin. ft., or slightly more than 50 percent in submarine cable requirements. The saving in cost of the installation was directly proportional to the reduction in length.

Quotations were solicited on 90 miles (475,000 ft.) of 16-pair or 45 miles (238,000 ft.) of 32-pair cables. The 16-pair cables cost approximately 30 percent more than a single circuit 32-pair cable, but their deliveries could commence a month ahead of deliveries for 32-pair cables. In addition, the double circuit of 16-pair cable permitted a back-up path in case of failure of one cable and lower anticipated maintenance costs. Based on these considerations, the 16-pair cable was recommended and by 23 April 1953, when authorization was received to place the order, the quantity of 16-pair cable required had increased to 775,000 lin. ft.

The subsequent deletion of some of the scientific stations on atoll sites west of Eninman reduced the cable requirement, and the system finally consisted of 620,000 ft. of 16-pair, 19 gage submarine cable, running in a single cable from Bokobyaadaa to Namu and thence a double cable around the atoll to Airukiiji.

2.5 MINOR SCIENTIFIC CONSTRUCTION

Minor scientific construction was undertaken on nearly every island, on many reefs and in the lagoon of Bikini Atoll. Many of these minor stations were small in physical size, but it was nevertheless necessary to place a limited amount of construction equipment at each location. Though the scheduled date of occupancy or use was the determining factor when the construction was undertaken, where practicable, work was integrated with that of the major stations. It was thereby used as a "fill-in" so that a nearly constant level of employment could be maintained.

Prefabrication at established camp sites was resorted to when this was feasible. Placing of concrete was generally timed to permit the supply of concrete mix to be obtained from batch plants in operation for major construction requirements.

In the main, these minor scientific stations consisted of such items as small concrete pads in which were embedded short lengths of pipe, tents, small wood frame buildings or sheds, rafts anchored in the lagoon, and many others. Also included under minor scientific construction were several large stations such as the 500 series of power plants which were required to serve the major recording stations. The TA-500 (Eninman) and CH-500 (Namu) installations were housed in inexpensive wood frame structures with stabilized coral floors, the DO-500 (Yurochi) installation was set up without shelter, but a large reinforced concrete structure designed to withstand expected shock pressures was necessary for the NA-500 (Enyu) plant. For the completion dates of these items refer to Figures 14 and 15.

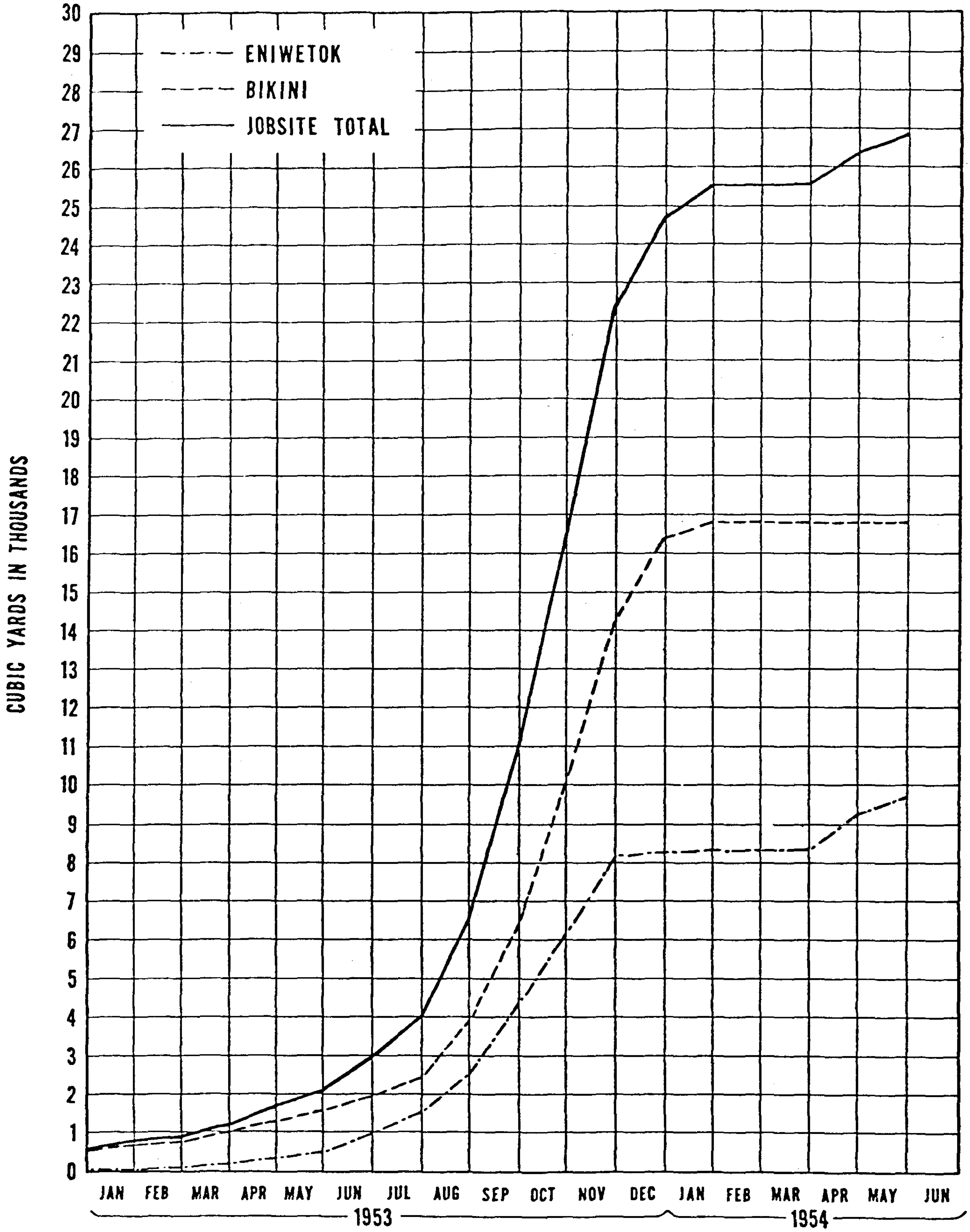


Figure 24. Accumulated Monthly Totals, Concrete Poured.

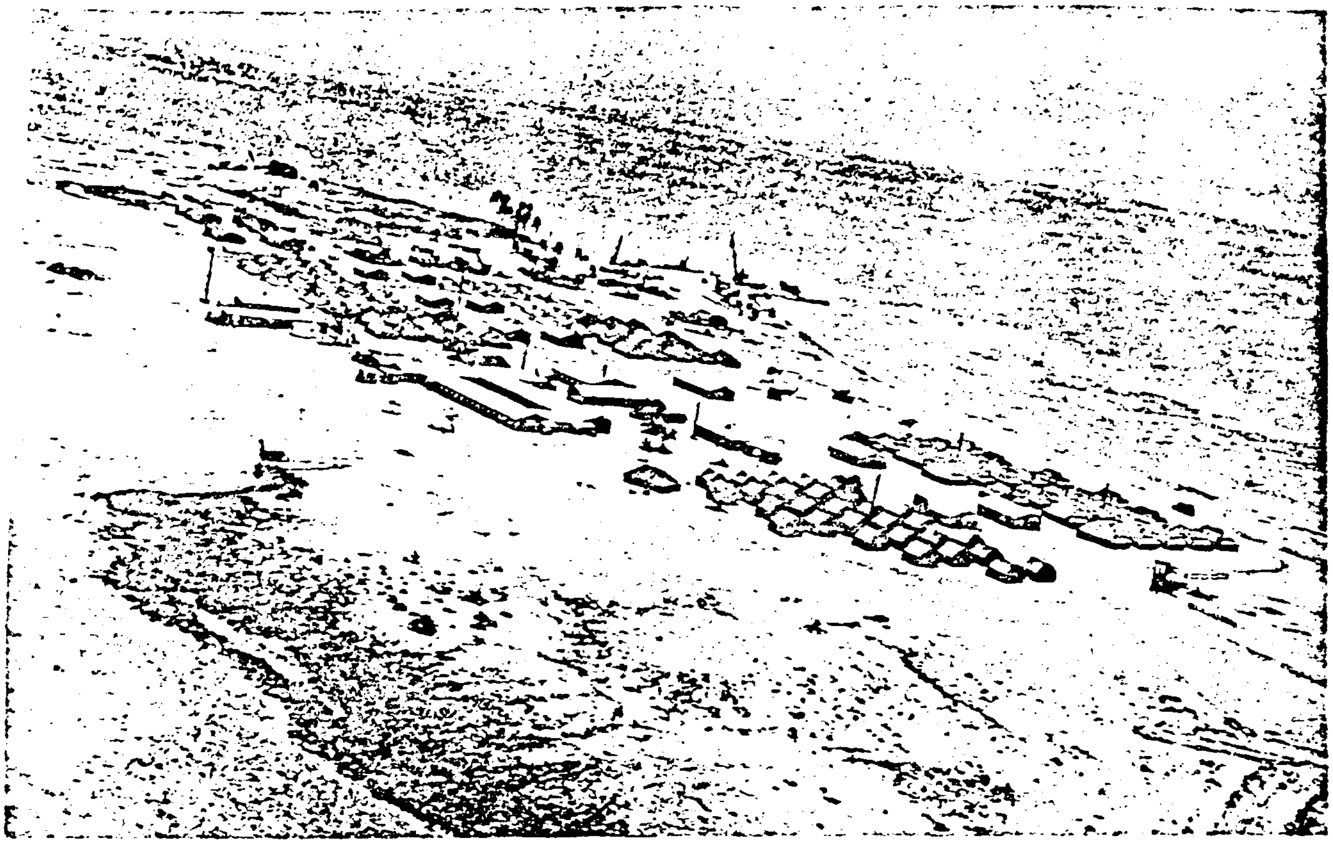


Figure 25. Eninman Campsite

2.6 AUXILIARY CONSTRUCTION

2.6.1 TEMPORARY CAMPS

The engineering and construction effort was self-sustaining during all of the proving ground facilities development. Quarters, facilities and services were operated by Holmes & Narver to house and sustain all personnel of Joint Task Force SEVEN except those living on Eniwetok Island, which was the Eniwetok Military garrison, and those living in Naval vessels. It was necessary to establish temporary camps at Eninman (Figure 25), Namu, Romurikku, and Enyu (Figure 26) at Bikini Atoll and at Rojoa on Eniwetok Atoll. For short periods, small camps with minimum facilities were set up on Bokobyaadaa and Bikini at Bikini Atoll.

Except for the last two named, each of the camps was equipped with facilities for messing, housing, PX store, barber shop, postal outlets, laundry, light and power, fresh and salt water, and sewage disposal. The structures at the temporary camps were made as simple and inexpensive as circumstances would permit.

All camp buildings were either of simple wood frame with plywood siding

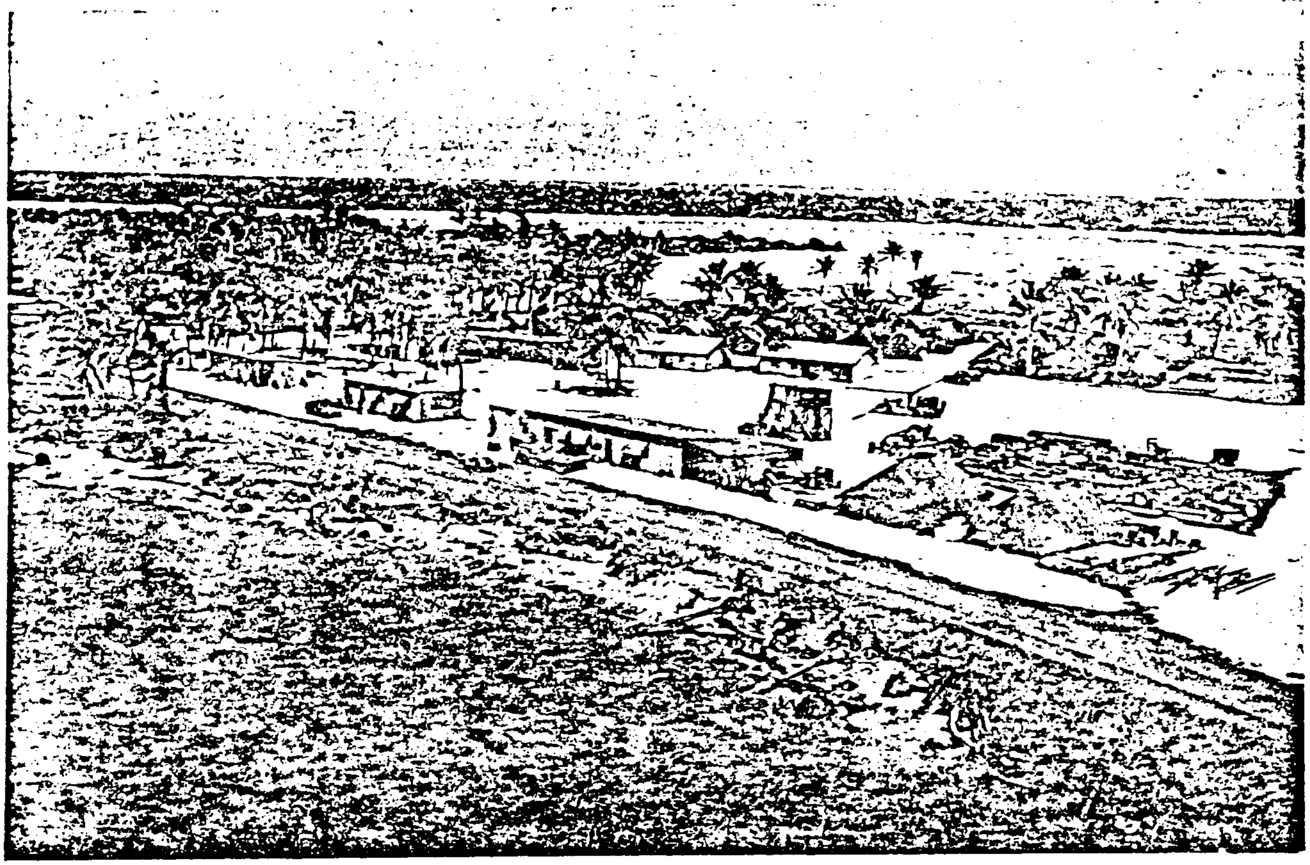


Figure 26. Enyu Campsite

construction or standard U. S. Army 8-man or 4-man tents. In view of the short period of occupancy of these structures, every possible step was taken to keep costs to a minimum. All floor slabs were poured with a minimum of low-strength concrete; power generation and water distillation plants were simple wood frame structures, enclosed only on the prevailing weather sides, and with stabilized coral floors. In view of the possibility of loss of equipment, the older and generally more obsolete equipment was installed in the various camp facilities at Bikini and the newer equipment was retained in the permanent camps at Eniwetok Atoll.

Electric power was provided by the installation of diesel-driven generators. Portable equipment was used to facilitate removal prior to shot time. For economy of operation the camp power plants were connected in at Namu and Eninman with the scientific power plants so that, when permissible by not interfering with scientific requirements, one plant could be operated to meet all power demands.

Fresh water was provided for mess hall, lavatories, showers and scientific purposes. This water was made available by the installation of vapor-compressor type distillation equipment. All distillation units installed at the camps on Bikini Atoll were identical in size and construction; the units so used were reaching the limit of their useful economic life and therefore could be expended with little loss if this became necessary. The installation identical units at Bikini Atoll afforded a degree of standardization which permitted free interchange of parts or units as required.

Salt water requirements were met through the use of shallow wells of simple construction and conveniently located adjacent to distillation plants. The casing used was a perforated spiral-welded steel pipe. For reliability of supply, particularly for fire protection, both gas engine and motor driven pumps were installed.

The distribution piping of both fresh and salt water systems was laid in shallow trenches and covered to natural grade. Elevated storage tanks provided the necessary head, and additional ground tanks were provided to permit storage of at least one day's supply of fresh water during peak demands.

Topography of the islands permitted the use of relatively short sewer lines with gravity flow. Vitrified clay pipe was used for collecting lines and steel or clay pipes for subaqueous outfalls. Manholes were suitably placed and fitted with standard prefabricated covers.

In order to hold plant and manpower requirements to a minimum for the construction effort on Bikini Atoll, the plant and the organization at Eniwetok Atoll was used as the main base for supply and shop facilities. However, limited maintenance and warehousing facilities were necessarily constructed at Bikini Atoll. The structures to house these facilities were inexpensive and on the order of camp structures previously discussed. Sheltered storage was provided only for food, hardware, electrical instruments and parts, cements, and other items which could not be satisfactorily protected by tarpaulins or left in open storage.

Bulk fuel storage was provided at Bikini by the erection of a tank farm on Reere with a loading line leading into the lagoon to POL buoys similar to the installations existing at Eniwetok. Fuel was delivered to the various sites by tank trucks and then generally stored in small tanks of the Navy cube type elevated on simple timber platforms.

Roads were installed at all camp sites, as needed, to serve camp operational and scientific facilities. Suitable surfacing of these roads was obtained by compacting layers of coral to sufficient thickness and density to withstand the traffic. These layers varied from four inches to six inches of coral depending on the expected traffic. Sprinkling with sea water was occasionally required to preserve the surface and ally the dust.

In order to obtain access to various sites by boats, the best natural approaches were located, then cleared of obstructions by blasting and dredging with bucket or drag line, followed by marking with properly placed buoys. The buoys were made from used gas or oil drums and anchored with concrete blocks. To facilitate boat or ship loading operations at Eninman, a mole was constructed by driving various lengths of wood piling which was backed horizontally with wood planking and then earth-filled. Moles were also constructed at both Namu and Bokobyaadaa with material removed in excavating a channel and turning basin at these sites. Due to wave erosion, it became necessary to construct a timber bulkhead on the western side of the mole at Namu.

2.6.2 AIRSTRIPS

Airport facilities were provided at Bikini by connecting sites Airukiraru and Airukiiji and constructing thereon an airstrip 4500 ft. long and 150 ft. wide with 25 ft. shoulders on each side. All structures needed for limited airport operations were erected and consisted of the operations, fire and crash, hangar, and power plant buildings plus an 8-man "ready" tent.

The construction of the airstrip required 172,800 sq. yds. of clearing and grubbing; 168,550 cu. yds. of excavation; filling and compacting approximately 75,000 cu. yds. of aggregate; and grading and stabilizing approximately 100,000 sq. yds. of 200 ft. wide, 4 in. thick runway on an 8 in. thick, 150 ft. wide compacted coral base. In addition, 9722 sq. yds. of compacted coral parking area was provided. The entire area surrounding the airstrip was cleared of all trees, brush and the natural surface bladed. The hangar building was of wood frame construction with aluminum siding and all other buildings were wood frame and plywood siding structures.

Due to the expanded air operations for this test program, occasioned primarily by shifting of air operations from Kwajalein to Eniwetok, extensive improvements of the airport facilities at Eniwetok Island were necessary. Prior to undertaking the improvements of the airstrip, it was tested for expected load pressures which indicated the need for replacement in some parts of the sub-foundations. The airstrip was resurfaced with bitumuls for approximately one-half its length, and additional parking areas and aprons as well as a concrete decontamination pad with wash rack were provided.

The airstrip on Parry was completely rehabilitated and additional taxiway and helicopter pads were installed.

The Engebi airstrip was rehabilitated and extended so as to provide an emergency landing for Jet planes.

2.6.3 CAUSEWAYS

In order to establish a zero line of the required length for Station 20, it was necessary to construct an earth-filled causeway approximately 3000 ft. long westward from Namu (Figure 27). This causeway terminated on a man-made island of approximately 0.8 acre in area having an elevation of +10 ft. MLWS and on which was located Station 20 and other related scientific installations. The causeway was 87 ft. wide at an elevation of + 9 ft. MLWS, and a

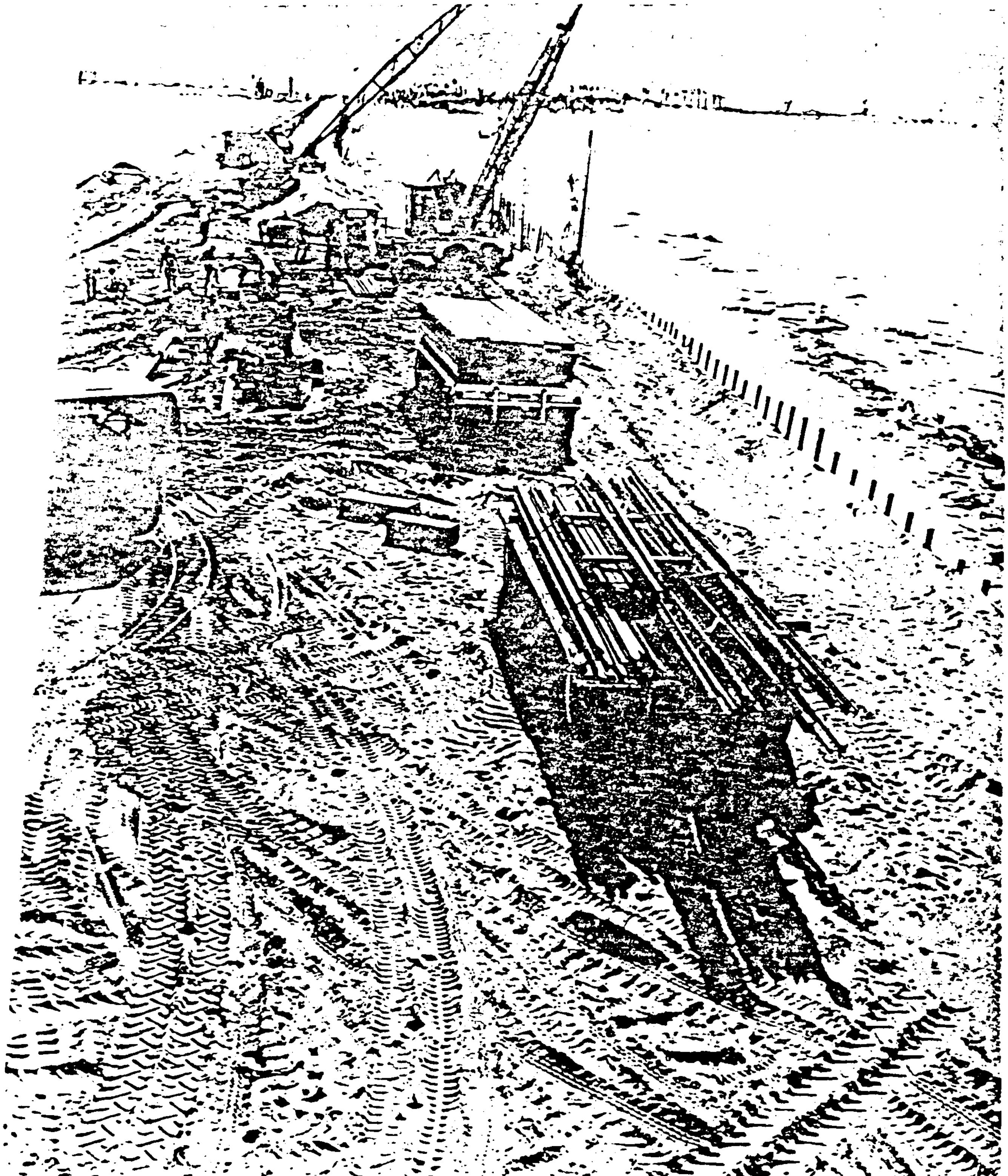


Figure 27. Namu Causeway Under Construction

bulkhead was provided on the lagoon side only. The width was necessary for the construction of a 12-pipe array and to provide room for an access road. The bulkhead was constructed by driving 60-pound used rails on four-foot centers which were horizontally backed up by three-inch thick timbers. This was then earth filled to provide the dimensions indicated above.

An earth-filled causeway 1100 ft. long between Reere and Eninman was constructed to provide the necessary zero line length required for Station 50. This causeway was 60 ft. wide so as to provide for construction of a three-pipe array, a 24 ft. access road, and a right of way for telephone and signal cables. Adequate protection was provided by riprap which was readily bulldozed in place from the adjacent reefs. In order to locate certain scientific installations 7500 ft. from Station 20, as required by the test program, it was necessary to construct an earth-filled island approximately 700 ft. west of Bokobyaadaa. This island, designated site Delta, was slightly over 0.5 acre in area and was built to an elevation of + 8.5 ft. MLWS. The perimeter was bulkheaded with three-inch width timbers supported by 60-pound used rails driven on four-foot centers without tie-rods. This island was connected to Bokobyaadaa by an earth-filled causeway to provide access to the site.

To provide for the zero line for Station 60 and the installation of the two-pipe array from this station, it was necessary to widen the existing access road between Eberiru and Aomon to 60 ft. Bulkheading was not originally provided, but during a storm in November 1953, the wave action caused sufficient erosion to threaten the pipe supports. To remedy this condition, bulkheads on both the lagoon and ocean sides of the causeway of the type previously discussed were installed.

To provide access roads to construction sites on the Yurochi and Aomoen group, the islands were connected as follows:

Yurochi - Uorikku	-	Approximately 3000 ft. of causeway
Uorikku - Romurikku	-	Approximately 1200 ft. of causeway
Romurikku - Aomoen	-	Improvement of connecting reef to permit vehicle traffic

Available bank and reef coral was used and the surface traffic-compacted. The causeways were finally built with a width of 25 ft. at an elevation of +8.5 ft. MLWS. During high tides the Romurikku-Aomoen road became inundated, but not sufficiently to stop traffic.

Land access from Eninman to the islands eastward to Airukiiji was a necessity for economical construction and operation of facilities and scientific stations located in this group of islands. Bank and reef coral was usen when available, and the surface was traffic-compacted. The access road between Airukiraru and Airukiiji later became a part of the airstrip built on these islands, and the reef between Reere and Eninman was utilized in the construction of the causeway to carry the pipe array for Station 50 which was previously discussed. These access roads were finally constructed so as to pro-

		1953												1954						
ITEM	DESCRIPTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	REMARKS
A-1 THRU A-24-C	TARE CAMP - (1,000-MAN)	47.28	54.41	61.56	77.44	83.97	89.57	90.57	91.57	92.10	92.19	99.22	100.00							
		47.49	54.41	61.55	75.77	83.79	88.65	92.10	95.07	98.48	98.70	99.22	99.80	100.00						
A-1 THRU A-24-C	TARE CAMP ADDITIONS							25.00	30.00	35.00	40.00	47.36	91.42	100.00						
								25.00	50.00	76.00	50.34	47.98	54.1	97.97	98.33	100.00				
A-25-C	AIRSTRIP - OBOE-PETER	60.00	65.00	74.00	75.00	88.89	90.00	100.00												
		60.04	68.46	73.82	76.47	88.00	89.68	90.00	90.00	99.00	100.00									
A-26-C	CAUSEWAYS							28.13	56.26	60.00	65.00	98.71	99.00	99.50	100.00					SITES CHARLIE & TARE
								53.00	84.00	98.00	98.43	98.71	98.71	98.71	100.00					
A-27-C	SCIENTIFIC STATIONS						0.75	6.91	16.06	32.53	45.00	53.84	79.61	95.60	99.89	100.00				
							0.50	0.83	3.13	12.73	23.85	53.84	89.93	93.78	99.91	99.91	99.99	100.00		
A-28-C	CONSTRUCTION EQUIPMENT																			PROCUREMENT ONLY
A-29-C	SUBMARINE CABLE							8.34	16.00	25.00	35.00	45.88	75.00	95.95	98.94	100.00				
								0.00	0.00	2.00	46.01	45.88	69.49	88.50	97.31	98.28	100.00			
A-31-C	URSULA CAMP	27.11	57.95	67.93	82.13	93.37	95.00	98.00	99.88	99.88	99.88	99.88	100.00							
		10.79	58.83	67.30	84.94	84.94	92.00	98.69	99.88	99.88	99.88	99.88	99.88	99.88	100.00					
A-32-C	CRATER FILL - RUBY		16.67	50.00	83.33	100.00														
				10.00	99.00	100.00														
A-33-C	MISC. CONSTRUCTION - ALL SITES	5.55	11.10	16.65	22.20	27.75	33.30	38.55	44.40	97.36	97.36	99.58	100.00							ALL WORK AUTH. PRIOR TO 1 JULY 1953
		5.55	11.10	16.65	22.20	27.75	33.30	38.55	44.40	97.36	97.36	99.58	99.58	100.00						
A-34-C	SPECIAL ENGINEERING REPORTS																			ENGINEERING ONLY
A-35-C	AIRPORT FACILITIES - PETER				33.33	66.67	90.00	99.00	99.00	99.00	99.00	99.54	100.00							
					4.47	65.06	95.80	99.00	99.00	99.00	99.00	99.54	99.94	100.00						
A-36-C	CHARLIE CAMP				9.31	30.50	48.71	76.83	89.60	99.00	99.00	99.00	100.00							
					12.00	25.39	60.89	85.01	96.37	99.00	99.00	99.00	99.00	99.67	100.00					
A-38-C	FURNITURE & FIXTURES - ALL SITES																			PROCUREMENT ONLY
A-39-C	TEST SUPPORT FACILITIES - ELMER							11.11	22.22	33.33	44.45	78.10	80.00	90.00	95.00	100.00				
								11.11	22.22	33.33	35.21	78.10	30.51	99.00	99.70	100.00				
A-39.3	DISTILLATION UNITS - ELMER																			PROCUREMENT ONLY

LEGEND

- CONSTRUCTION SCHEDULE ESTIMATED PERCENT (hatched bar)
- CONSTRUCTION IN PLACE PERCENT COMPLETED (solid bar)

Figure 28. Construction Progress of Expendable Construction.

ITEM	DESCRIPTION	1953												1954						REMARKS
		JAN	FEB	MAR	APR	MAY.	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	
A-40-C	TEST SUPPORT FACILITIES-FRED							6.00	12.00	18.00	24.35	35.21	85.67	90.67	95.83	100.00				AWAITS MINOR ELECT. INSTALLATIONS
								6.00	12.00	18.00	24.35	35.21	99.16	86.06	88.78	91.17	93.50	99.68	99.87	
A-40.1-C	AIRSTRIP IMPROVEMENTS-FRED						2.00	3.00	4.00	5.00	35.00	50.00	100.00							
							2.00	3.00	5.00	5.50	50.00	50.00	88.00	98.00	100.00					
A-40.2-C	ADDED DISTILLATION PLANT-FRED								8.00	20.00	25.00	30.00	75.00	93.00	100.00					
									7.00	14.00	25.00	30.00	45.00	100.00						
A-44-C	INCIDENTAL CONSTRUCTION-ALL SITES									2.00	16.00	35.00	60.00	85.00	100.00					
										2.00	16.00	35.00	60.00	85.00	100.00					
A-57-C	NAN CAMP						16.67	20.00	30.00	6.00	40.00	50.03	100.00							
							15.00	35.00	35.00	6.00	38.12	50.03	55.32	91.80	100.00					
A-63-C	FOX CAMP						2.00	5.00	40.00	80.00	96.00	99.91	100.00							
							2.00	5.31	38.33	76.00	96.56	99.91	99.91	100.00						
A-64-C	P.O.L FACILITIES - SUGAR							10.00	20.00	50.00	86.00	93.00	100.00							
								10.00	20.00	56.00	86.00	93.00	93.00	98.00	100.00					
A-65-C	EQUIP. (NOT IN CONST. PROJECTS)																			PROCUREMENT ONLY
A-67-C	MISC. CONSTRUCTION (EXPENDABLE)							2.00	5.00	10.00	16.00	25.00	35.00	50.00	65.00	75.00	85.00	95.00	100.00	ALL WORK AUTHORIZED AFTER 1 JULY 1953
								2.00	5.00	10.00	16.00	25.00	35.00	50.00	65.00	75.00	85.00	95.00	100.00	
A-68-C	J.T.F-SEVEN CONSTRUCTION-FRED										40.00	64.73	100.00							
											18.15	64.73	81.38	81.38	96.34	99.96	99.96	100.00		
A-69-C	CRYOGENICS FACILITIES																			ENGINEERING ONLY
A-69.1-C	SLAB-CAB MOCK-UP- U.C.R.L																			ENGINEERING ONLY
A-70-C	RADIO COMMUNICATIONS-ALL SITES										1.00	1.23	100.00							
											1.00	1.23	53.31	74.78	100.00					
A-72-C	SUBMARINE CABLE TO BUOYS-ALL SITES													46.40	100.00					
														46.40	100.00					
A-74-C	SEA WALL-FRED															31.00	75.00	100.00		
																31.00	67.00	91.00		
	SUMMARY OF EXPENDABLE CONST.	7.78	9.44	11.19	14.01	16.54	19.22	29.03	39.63	53.23	60.00	64.71	84.69	95.38	98.97	99.54	99.72	99.91	100.00	
		7.59	9.38	10.66	14.10	16.20	19.31	24.15	29.72	34.21	45.42	64.71	77.[illegible]	93.88	98.93	99.22	98.72	99.48	99.89	

LEGEND

CONSTRUCTION SCHEDULE ESTIMATED PERCENT

CONSTRUCTION IN PLACE PERCENT COMPLETED

Figure 29. Construction Progress of Expendable Construction.

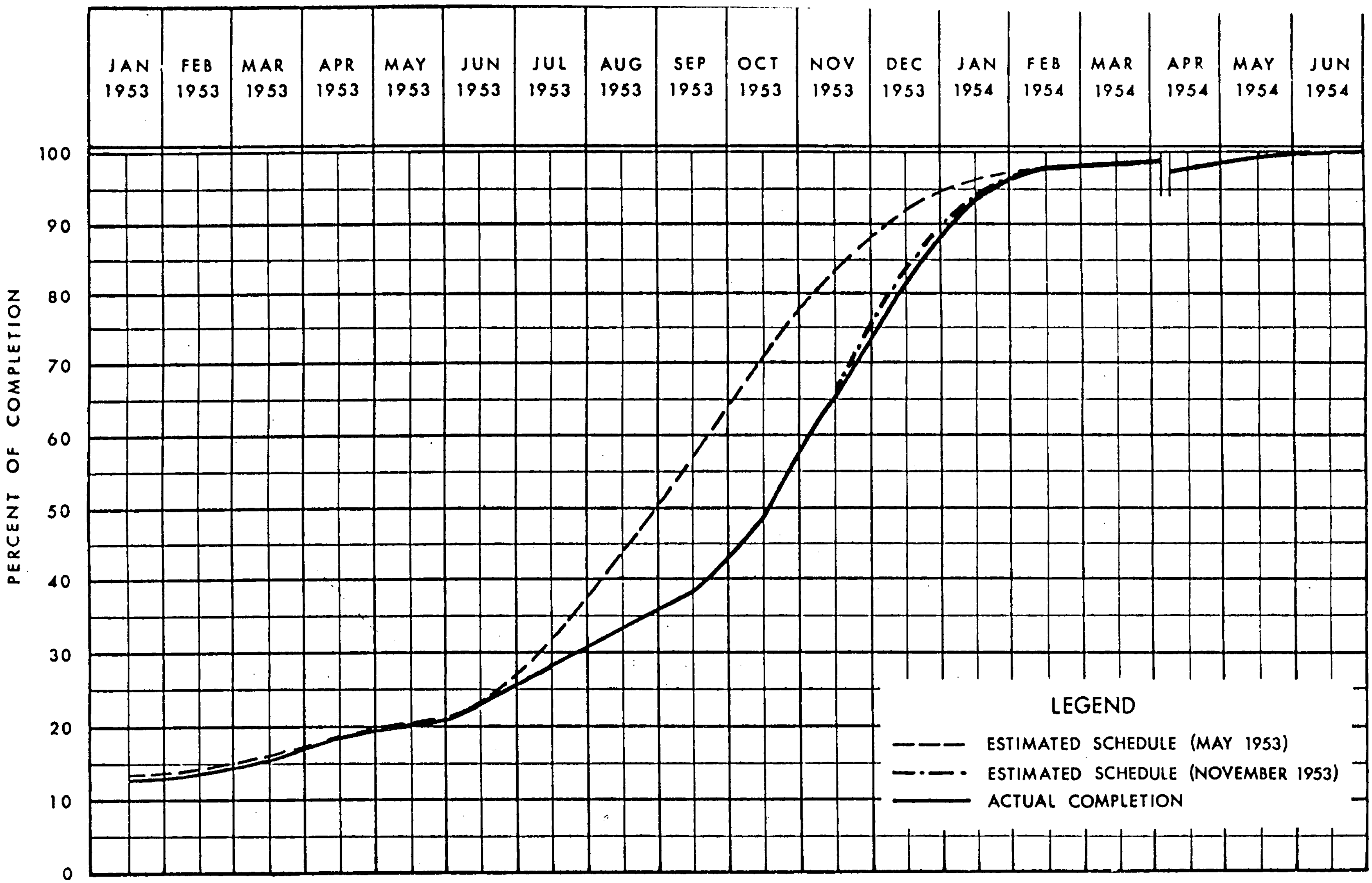


Figure 30. Construction Progress Curve, Over-All Program.

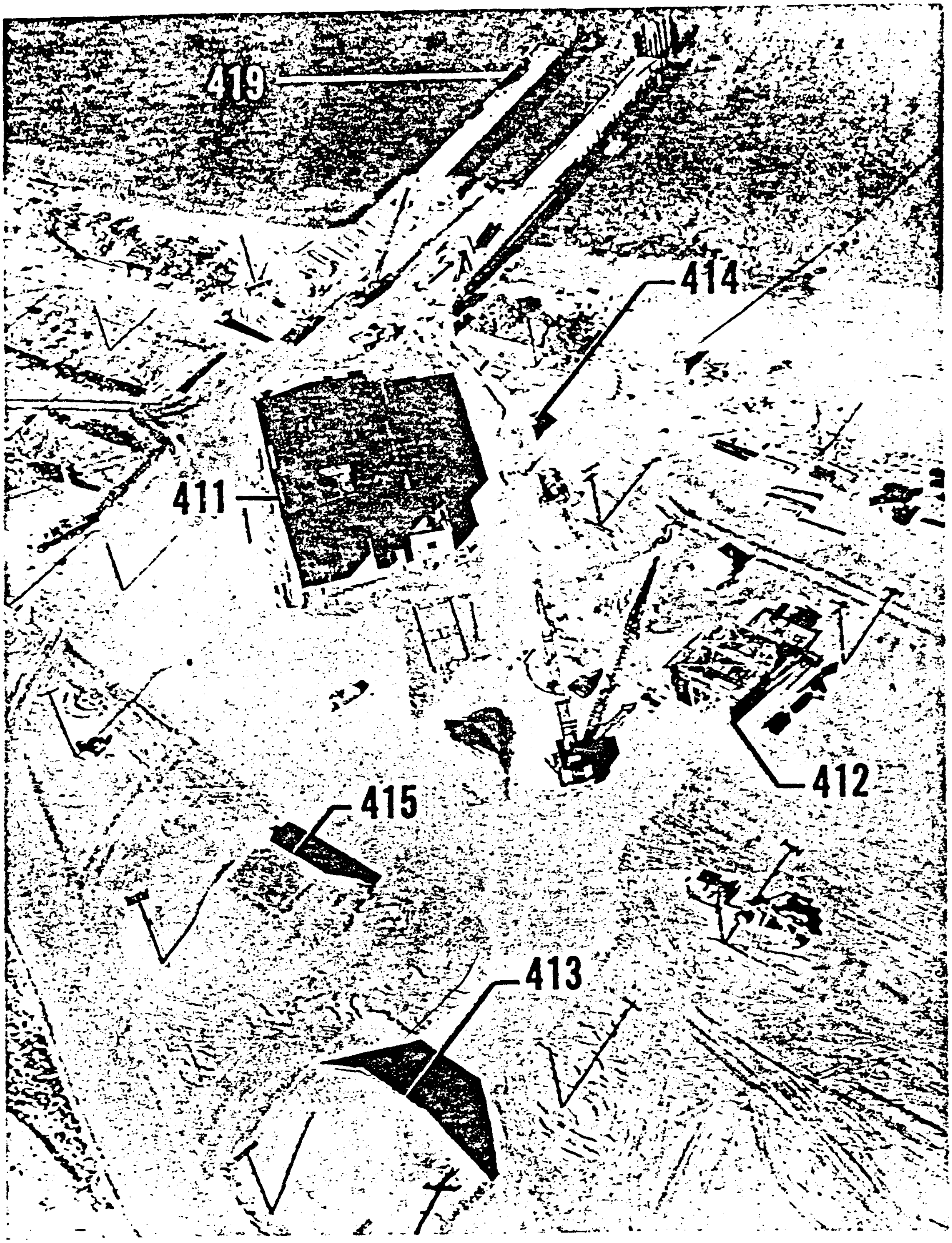


Figure 31. Assembly area on Parry
Numbers noted above are building numbers as detailed in text (pages 62 and 63).

vide a 25 ft. road at an elevation of +8.5 ft. MLWS. Figures 28 and 29 show the construction percentages and completion dates of all expendable construction. Figure 30 shows the monthly construction progress of the over-all program.

2.6.4 ASSEMBLY AREA

In order to outfit barges that were to be used as Zero Stations, it was necessary to design and construct a barge slip with a traveling gantry crane which could be used for the construction of the barge superstructure as well as the final installation of the test devices. To complement this barge slip, the design and construction of various buildings and facilities was necessary so that critical components could be stored, assembled and moved onto the barges. This entire project, shown in Figure 31, was known as the Assembly Area, within which the following construction was accomplished.

1. Building 411. The purpose of this building was primarily for the assembly of the test devices. It was a one-story steel frame structure with roofing and siding of steel, 44'-0" x 83'-0" x 34'-9" high with a steel frame leanto 16'-3 3/4" x 83'-0" x 8'-9" high erected on concrete footings and floor slab. Interior partitions of wood frame provided rooms for layout, a latrine, instruments and assembly. The instrument and assembly rooms were vapor sealed. Within the assembly room was installed a 25-ton traveling bridge crane, high intensity lighting, and other necessary utilities. The assembly and instrument rooms were dehumidified.

2. Building 412. The purpose of this building was for the handling, storing, and working of high explosive materials. This was a one-story steel frame structure with steel siding and roofing, 25'-6" x 31'-6" x 18'-6" high with steel frame leanto 9'-6" x 25'-6" x 8'-0" high, erected on reinforced concrete footings and floor slab. The building was vapor sealed, and within it were installed a five-ton traveling bridge crane; work benches, and necessary utility outlets. Part of the wiring was explosion-proof, and a ground grid was furnished outside of the building to provide a positive grounding system. The building was dehumidified.

3. Building 413. This was a magazine for the storing of explosives. It was a reinforced concrete structure of one room 22'-0" x 22'-0" x 14'-4" high with an earth covering of 3 ft. and side berm protection. Explosion-proof wiring was used.

4. Building 414. This was a wood frame shed 8'-0" x 12'-0" with corrugated aluminum roofing and siding erected on a 4 in. thick concrete slab. It was used as a guard house.

5. Building 415. The purpose of this building was for temporary storage of nuclear components. It was a reinforced concrete structure, 21'-4" x 25'-4" x 12'-6 1/2" average height surrounded by a sloping earth berm to the full height of the building and having diagonal wing walls for protection of the entrance.

6. Structure 419. This structure was the barge slip. It consisted of a sheet-steel pile enclosed earth-filled mole, 81'-8" wide by 86'-8" long to which were connected two creosoted pile finger piers, each 20'-0" x 132'-0" and separated 40 ft. to form the barge slip. Along the piers were laid the rails for the gantry crane, which had a capacity of 25 tons and a 37 ft. hook lift. Both sides of the slip as well as the slip proper were dredged to permit berthing of three barges at the same time.

7. In addition to the foregoing buildings, a number of 8-man tents were erected for temporary offices, working space and storage. Because the Assembly Area was designated as an "Exclusion Area", it was completely surrounded by a security fence. A salt water well was constructed within the area to augment the normal water supply in case of fire.

2.6.5 DECONTAMINATION

In December 1952, when the construction requirements for test and supporting facilities in the Eberiru-Rojoa area became firm, the radiation levels in that area, due to previous tests, were such as to require decontamination measures in order to preclude over-exposure of personnel. In the area of the Eberiru crater, shown in Figure 32 (March 1953), the radiation level at this time was 50 to 95 mr/hr, necessitating close Rad-Safe control over all personnel required to work there. The radiation level at Rojoa was such that men could not be based ashore, and therefore an LCU fitted out as a houseboat was used to quarter and subsist the personnel.

The most satisfactory method for decontamination of ground areas was the removal of all vegetation and the ground surface to a depth depending on the radiation level. Near the Eberiru crater as much as 12 inches of the earth was removed. The crater was filled and compacted with 77,490 cu. yds. of earth.

For the campsite on Rojoa, approximately 53,785 sq. yds. were cleared to a depth of about three inches, then approximately 24,775 sq. yds. were backfilled with uncontaminated coral to a depth of about two inches.

Due to having to quarter and subsist all personnel at Bikini Atoll afloat following BRAVO, it became necessary to provide a floating decontamination station for personal needs. This was accomplished by fitting out a 500-ton

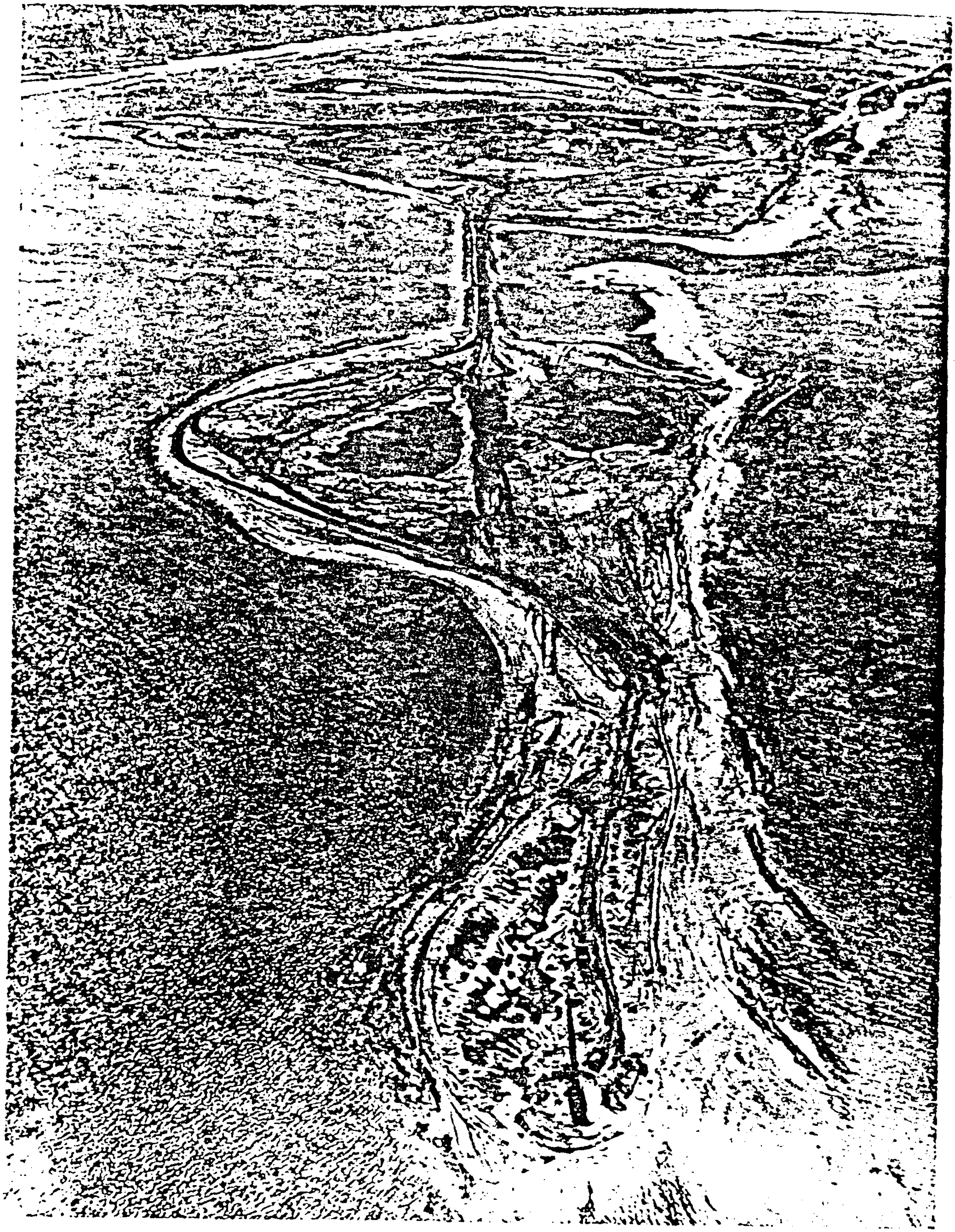


Figure 32. Crater on Eberiru Showing Fill Operations 10% Complete

barge on which were installed a salt water shower system with necessary pump and fuel systems and two 8-man tents; one for a dressing room and stowage of clothing and the other for an office and radio-phone station.

In order to provide for continuous operations in the dock area at Eninman after contamination (as a result of the BRAVO event), the area was cleared of several inches of surface. All equipment required for operations at Bikini which had become contaminated to an extent precluding operation without overexposure was decontaminated by washing down until the level was reduced sufficiently to permit safe operation.

Airukiiji - Airukiraru islands airstrip, which was non-operational for eight days due to wave-deposited debris from the BRAVO shot, was made operational when radiation levels permitted TG 7.5 working parties to re-enter the area. The wave from UNION also put the airstrip out of commission but it was placed in operational condition within three days after the shot.

Rolling stock, equipment and personal effects were shipped from the Bikini area to Eniwetok for decontamination. The existing Rad-Safe facilities at Parry Island, however, were taxed beyond capacity, especially in regard to heavy equipment. It was therefore necessary to build an additional fenced-in wash-down area on Parry, which was approximately 150 ft. x 200 ft. containing a 50 ft. x 50 ft. concrete slab for water run off. Fresh and salt water lines were laid, and a boiler was installed to supply the necessary live steam to clean off engine and chassis grease. Salt water was used for washing down the contaminated equipment. TG 7.5 personnel decontaminated the equipment without delay to allow the various Task Groups to make preparations for an early return of their equipment to the Z.I.

CHAPTER 3. CONSTRUCTION EQUIPMENT

3.1 COMMENTS

In June 1952 the Field Manager requested the Contractor to prepare a report on probable facilities required on Bikini Atoll. This request resulted in a careful study of construction equipment and other long delivery items for the purpose of evaluating the capability of carrying on construction work at two widely separated sites. Since reinforced concrete construction is one of the major items in any operation, the requirements for large scale coral aggregate production equipment were finalized. Two rock crushing and screening plants were ordered and were delivered in March 1953. By April 1953, the scientific construction scope was well defined for both atolls. Islands and locations were selected for material stockpiles, crushing plants were placed in operation and concrete batching plants were set up. Coral aggregate quarries were located at four locations on Bikini Atoll and at three locations on Eniwetok Atoll. Two crushing plants were assigned to Bikini and one plant to Eniwetok; all three plants were in production in April 1953. Having this equipment available for an early start on this work was one of the major factors in meeting scheduled construction completion dates.

Page 66 not in original.

3.3 EQUIPMENT SUMMARY

All equipment added to existing equipment at the PPG and required for Operation CASTLE is listed in Appendix B. Not listed is a relatively insignificant amount of automotive equipment such as jeeps and crash trucks which was borrowed by TG 7.5 for the Operation.

CHAPTER 4. LOGISTICS AND SUPPORT

4.1 TRANS-PACIFIC

Material scheduled for transshipment to the PPG via water was delivered to the Naval Supply Center (NSC) in Oakland where it was manifested and held for loading aboard cargo vessels. The Western Sea Frontier allocated space aboard these vessels according to the amount of Contractor's material to be shipped. As a general rule, space was allocated on one cargo and one refrigerated ship per month. During the peak period, two cargo vessels per month were assigned. Records covering the transportation of materials included a U. S. Navy ship's manifest which was prepared by Naval agencies and then forwarded to the Contractor's home office. During the period from 1 January 1953 through 31 April 1954, 33,695.60 long tons of cargo were shipped by water. To meet deadline construction dates, priority assistance was furnished by the Defense Requirements Branch, AEC, Albuquerque. Additional assistance through telephone calls placed by the Defense Requirements Branch to vendors and manufacturers also resulted in the improvement of delivery dates.

In many instances, shipment by water had to be changed to air freight due to the urgency of the work involved. A priority permit was required for all air shipments. Excellent cooperation was had from Air Force Base personnel. A few temporary delays of air shipments from Travis Air Force Base occurred due to priority of Military materiel. During the period from 1 January 1953 to 30 April 1954, 603,205 lbs. were shipped via air freight.

Contractor's personnel were flown by MATS aircraft to the PPG from Travis to Eniwetok via Hickam Field, Honolulu and Kwajalein. At the end of the Operation the procedures were reversed and returnees were expeditiously processed.

4.2 ENIWETOK ATOLL

At Eniwetok Atoll, TG 7.5 operated and maintained a small craft pool comprised of LCUs, LCMs, DUKWs, tugs, water taxis, and barges. The facility provided for scheduled runs between the various island camps, nonscheduled runs to outlying islands and lagoon stations, unloading of ships, recovery of records and samples after shots, and evacuation of personnel and equipment. During the period of peak demand, the TG 7.5 boat pool was augmented by craft from the TG 7.3 boat pool. The surface craft employed by TG 7.5 from December 1953 through May 1954, the most critical period of the Operation, averaged 26 per month. No accurate figures are available at this writing for the craft employed by TG 7.3.

Intra-atoll cargo and personnel movement activities for Bikini averaged approximately 12,000 tons of cargo per month, and 1800 passengers per month from January through August, 1953. In September a sharp increase took place in both cargo and personnel movement, and a peak of 60,250 tons of cargo was reached in December while a peak of 10,100 passengers was reached in April, 1954. For Eniwetok, these activities were considerably heavier. Cargo averaged 31,000 tons per month from January through August; passengers averaged 6000 per month for the same period. An increase was noted in September, and a peak of 73,000 tons of cargo was reached in April, 1954 and a peak of 19,000 passengers carried was reached during this same month.

The Eniwetok intra-atoll airlift was operated by TG 7.4 and dispatched by TG 7.5. Liaison aircraft (L-13) transported personnel to the four islands having suitable landing strips where two-place helicopters (H-13) were available for shuttling passengers to less accessible areas. In addition, larger helicopters (H-19) were employed for transporting personnel and equipment on direct flights. The average numbers of aircraft employed in this service were: five L-13s, four H-19s, and two H-13s. Air-passenger activities during the early stages of the Operation, January 1953 through July 1953, were relatively light. However, starting in August, L-13s and H-13s combined averaged eight daily flights and 15 passengers, while the H-19s averaged 15 daily flights carrying 66 passengers. Peak activities for all three types of aircraft were reached in January, 1954, when the L-13s averaged 50 flights per day carrying 65 passengers; H-13s averaged 16 flights carrying 10 passengers; and the H-19s averaged 75 flights per day carrying 256 daily passengers.

4.3 BIKINI ATOLL

At Bikini Atoll, water transportation was initially provided by the TG 7.5 boat pool which was subsequently augmented by craft from the TG 7.3 boat pool. Dispatching of all trips was performed by TG 7.5. Following BRAVO, when operations at Bikini became entirely waterborne, all trips were dispatched by TG 7.5 from the USNS Ainsworth in coordination with the TG 7.3 dispatcher aboard the USS BELLE GROVE. The average number of each type of craft available is listed below:

TG 7.5		TG 7.3	
LCU	5	LCU	5
LCM	9	LCM	16
DUKW	8	DUKW	8

The intra-atoll airlift at Bikini was placed in operation during May 1953 with a total of seveh H-19 helicopters operated by TG 7.4 and dispatched by TG 7.5. In January, regularly scheduled flights were initiated beginning at Eninman Island and circuiting the atoll, alternating between clockwise and counter-clockwise directions. Stops were made at Enyu, Romurikku, and Namu Islands where minimum-cost landing mats were provided. The number of flights began with 10 per day which was subsequently increased to 12 per day with the arrival of the TG 7.3 (Marine Corps Helicopter Squadron) during the last week in January. The TG 7.4 detachment continued to assist in the airlift operations until phased out to Eniwetok late in February. The flow of traffic hit a peak in February with a rate of approximately 3000 passengers per week. After BRAVO, all helicopter flights became special missions operating from the USS BAIROKO.

A TG 7.5 motor pool was established at all camp sites and the maintenance of all vehicles was the responsibility of TG 7.5.

Available land transportation vehicles were allocated to the various sites according to the actual needs of each site. Permanent assignment of vehicles from the pool was permitted for certain individuals where there was need for such assignment. This arrangement applied to Bikini Atoll as well as Eniwetok.

Bus service was initiated on 7 July 1953 with departure at 50 minute intervals from the Administration Building on Eninman to the airport terminal on Airukiraru.

In June 1953 there were 112 light vehicles at the PPG, including jeeps, pickups and personnel carriers. Additional pieces were received from July through March 1954 which brought the total up to 154.

4.4 INTERATOLL

Air transportation between Eniwetok and Bikini Atolls during the initial phase was on a non-scheduled basis by means of PBMs stationed at Kwajalein. Upon completion of the Airukiraru - Airukiiji Islands airstrip, TG 7.4 provided regularly scheduled C-47 flights over the 189 nautical miles separating the two atolls. The schedule began with two flights per week which was gradually increased to a frequency of from one to four flights per day. After BRAVO, the PBM planes were used to provide limited interatoll transportation and the C-47 airlift revived whenever radiation levels and debris removal permitted re-entry to the Bikini airstrip. From August 1953 through 9 May 1954, a total of 6428 C-47 flights were made between Eniwetok and Bikini Atolls.

Interatoll water transportation was principally by means of TG 7.3 LSTs. Early requirements were met with the services of one ship which was later increased to two ships. These ships alternately made round trips which averaged six days each. Scheduling of ships was performed by TG 7.5 as were all arrangements for loading and unloading. An LSD made two interatoll trips transporting LCMs and LCUs which in turn were carrying heavy equipment that could not be carried in other types of ships. Also, whenever the LSD (BELLE GROVE) transported a shot barge from Eniwetok to Bikini, the remaining well capacity of the ship was utilized by carrying LCUs.

4.5 EMERGENCY REQUIREMENTS

After the BRAVO event and on the morning of 2 March, all Bikini personnel were transported to Eniwetok Atoll. TG 7.2 provided facilities for about 200 men of TG 7.2 and TG 7.4 on Eniwetok Island. TG 7.3 personnel remained aboard Naval vessels. TG 7.5 provided facilities for 1130 men from TG 7.1 and TG 7.5 on Parry Island. These men had embarked in Naval vessels with instructions to bring aboard clothing and toilet articles for one night only. The Bikini personnel overflowed the facilities at Parry. Bedding was obtained from TG 7.2 on Eniwetok and all men had mattresses and linen. On 5 March, the population on Parry was greatly reduced by returning men to Bikini and by surplussing Contractor's personnel.

The men who returned to Bikini Atoll to prepare for the next event were quartered aboard Naval vessels. TG 7.5 supplied the necessary personnel aboard these vessels to supplement the Naval crews in supplying housekeeping services. These men were furnished by the Contractor and were carefully selected men who were qualified and well adapted for work aboard ship.

4.6 SUPPORT

Support services as defined in the Holmes & Narver contract were related only as an assistance to the technical or scientific groups engaged in instrumentation of the test series. Generally, the units of work called for were of minor magnitude, but because each detail of the complex test technique was important, the men, equipment, fabrication, and materials furnished were of high concern to TG 7.5.

There were 1479 Support Service work orders issued by 78 Using Agencies or Scientific Groups, and TG 7.5 supplied construction equipment, skilled workmen, shop repair and fabrication, installation and post-test recovery surveys, decontamination, packing, crating and shipping.

The need for support services was occasioned, in part, by factors which the best of long-range planning could not foresee or obviate. When scientific stations were equipped by their Users and tested, it was found necessary, occasionally, to make improvements. Some of the work involved was necessary because of unforeseen blast damage. Of the 179,424 man-hours expended on these services, a good proportion is attributable to the unexpected destruction and radioactive contamination resulting from the BRAVO event. In general, however, these services were a normal aspect of the Operation.

4.7 RECOMMENDATIONS

The sudden and unanticipated end to the usefulness of the temporary camps at Bikini Atoll due to the BRAVO fall-out has led to some thought on possible alternatives for future operations. A possibility presently under consideration is the use of quarterboats (houseboats) as a substitute for the smaller temporary camps. The quarterboats could be developed by the addition of appropriate superstructures to large steel barges or conversion of certain types of ships. It is contemplated having the Contractor explore the problem thoroughly before build-up for another operation is initiated.

CHAPTER 5. ADVERSE CONDITIONS

5.1 WEATHER

RAINFALL REPORT - ENIWETOK ATOLL

Total amount of rainfall by inches, average for each month, from January 1950 through May 1954:

	1950	1951	1952	1953	1954	Average by Month for 5 Years
January	.86	1.59	.98	.12	.60	.83
February	1.30	.49	.74	.43	1.75	.94
March	1.24	4.65	.39	.37	1.32	1.59
April	2.38	.40	.22	.49	2.26	1.15
May	14.89	5.76	5.34	.38	6.54	6.58
						Average by Month for 4 Years
June	7.65	1.44	1.12	2.59	-	3.20
July	12.89	4.34	2.34	1.36	-	5.23
August	9.05	4.59	5.56	6.95	-	6.54
September	12.93	3.03	4.11	1.07	-	5.29
October	10.81	13.84	3.36	2.62	-	7.66
November	4.87	6.81	6.23	2.78	-	5.17
December	3.80	3.10	1.86	4.74	-	3.38
Total	82.67	50.04	32.25	23.90	12.47	

Average for 4 Years - 46.72

During the interval between Operations IVY and CASTLE, both atolls were damaged by two typhoons, "Hester" in December 1952 and "Doris" in December 1953. Repairs were required on Parry, Eniwetok and Eninman Islands as a result of "Hester". The costs of these repairs are included in Contract Item A-33-C. Damage by typhoon "Doris" required repairs on Parry, Eniwetok, Rojoa and Bikini Atoll. The costs of these repairs are included in Contract Item A-67-C.

Weather conditions after shot BRAVO created some delays in the firing schedule. During periods of delay Contractor's personnel were fully utilized in constructing new stations and reactivating stations used in previous operations. Planning was of necessity extemporaneous in nature and the Contractor was occasionally confronted with new work requirements with as little as two-day advance notice. The numerous program modifications resulted in an increased work load for all participants and delays caused by weather conditions were used to advantage in meeting the added work demands.

The coverage given thus far to the effects occasioned by delays in the firing schedule have been logistical in nature. Of even greater significance, perhaps, is the effect such delays have on the over-all cost of a test program. To date no study of sufficient scope has been made which would provide accurate cost data of this nature. However, an approximation was made by Holmes & Narver during the latter part of March 1954 which indicated that increased costs for support furnished by TG 7.5 amounted to about $60,000 per day.[1] This figure does not include any additional costs which were borne by the other participating agencies. In this connection, it was estimated by the Scientific Director that the cost to TG 7.1 for shot postponements amounted to about $9,500 per day.[2] Both cost estimates were predicated on personnel strength during the last week of March and would be subject to decrease as the test program advanced and numbers of personnel at the proving ground declined.

CHAPTER 6. COST DATA

6.1 COST STATEMENTS

A consolidated summary of actual and anticipated costs resulting from AEC participation in Operation CASTLE, as of 30 June 1954, is shown in Appendix B, Exhibit 7. Appropriate explanatory remarks appear after the cost tabulations.

In addition to the consolidated cost summary, there is included the following cost statements reflecting costs at a more detailed level:

a. Consolidated scientific programs and projects, Exhibit 1

1. Ref. memo from CTG 7.5 to Director, DMA, dated 3 April 1954.
2. Ref. memo from Alvin C. Graves to James Reeves, dated 3 April 1954.

b. Organizational statements for the following scientific contractors:

Los Alamos Scientific Laboratory, Appendix B, Exhibit 2
University of California Radiation Laboratory, Appendix B, Exhibit 3
Edgerton, Germeshausen & Grier, Appendix B, Exhibit 4
Naval Research Laboratory, Appendix B, Exhibit 5
Sandia Corporation, Appendix B, Exhibit 6

c. Organizational statement for the logistical services contractor, Holmes & Narver, Inc., Appendix C, Exhibit 1.

Explanatory remarks have also been made on the foregoing statements where deemed appropriate.

It will be noted that budget estimates are not included on the scientific cost statements. This omission is due to the AEC budget policy for the Laboratories under which funds are budgeted by fiscal year without reference to specific test operations.

6.2 COMMENTS

At various times in the past the SFOO has been subjected to criticism of the inventory balances at the proving ground. The problem from an accounting and budgeting standpoint is fully described in a memorandum from Director of Finance, SFOO, to the Controller, AEC, Washington, dated 6 March 1953, subject "Accounting for Inventories of Construction Materials Related to Expendable Construction Projects." Apart from the unrealistic accounting procedures which SFOO has been required to adhere to, there are a number of valid reasons why inventories at the PPG appear to continue inordinately high. Some of these reasons are briefly described in the paragraphs which follow:

Very soon after receipt of initial criteria for a test program, the Contractor must schedule procurement of materials and equipment in a manner governed by availability and date required. Experience has shown that allowances must be made in excess of known demands for certain items such as portable generators, distillation units, and submarine cable to be adequately prepared for late program modifications and other emergencies. Situations requiring full utilization of the extra equipment may very well not materialize but, nevertheless, it should be easily recognized that the success of a multi-million dollar program should not be jeopardized by the lack of a few thousand dollars worth of parts. Isolation of the PPG from sources of supply is, of course, a pronounced factor in arriving at decisions involving procurement of adequate equipment and supplies.

Not infrequently, as preparations for a test program become appreciably advanced, major modifications are made which entirely eliminate a need for equipment procured for a specific purpose. The unique application of the equipment may very well make its salvage value less than the cost of shipping it back to the United States so that the best alternative is to place these items in stock. Whether or not any subsequent use can be made of them is problematical. It should be noted at this point, however, that several rigid checks of the proving ground inventory are made prior to all subsequent procurements in order to guarantee that no wasteful or unnecessary purchases are made.

At times the inventory appears to reflect over-stockpiling of coral aggregate. Again, experience has shown that advance work of this kind is both logical and economical in view of existing conditions. The aggregate is obtained from coral reefs, and rate of production is necessarily slow due to normal difficulties encountered in subaqueous excavation plus frequent shutdowns due to high tides and strong wave action. Therefore, if stockpiling is held in abeyance pending actual need of the aggregate, the discontinuity of the excavation results in corresponding shutdowns of the aggregate processing plant, and these delays may even extend to the concrete and-or stabilization work for which the aggregate is being produced. It should be noted also that advance stockpiling is scheduled so as to contribute to a desirable level of work for the skeletal force which the Contractor must retain at the proving ground during interim periods.

There is a substantial amount of expendable equipment installed in scientific facilities which receives little or no damage from the weapons tests. This equipment may have been funded by the AEC or by some other agency; but, in any event, it is recovered during the roll-up period and placed in stock because it may prove useful at some later date. Thus, actions of thrift tend to distort the inventory balance.

Probably the single largest factor contributing to unfavorable inventory balances is the wide range in makes and models of equipment employed at the proving ground. Acquisitions under equipment upgrading programs together with a requirement that purchases of new equipment be based on competitive bidding make impossible even a fair degree of standardization. Here again, the isolation of the PPG from sources of supply makes absolutely essential the stocking of a wide range of spare parts to insure that equipment is not kept immobile for indefinitely long periods. It should be noted, too, that non-standardization of equipment adds somewhat to the Contractor's manpower requirements in this age of specialists, and it also has a marked effect on warehousing requirements.

The foregoing remarks should not be construed to mean that it is useless to maintain a vigilant guard against excessive inventories but rather to give some idea of the problems associated with inventory levels at the PPG. The SFOO is making a continuing and concerted effort to achieve a generally acceptable inventory level at the proving ground. It is believed that adoption of a more realistic accounting procedure, as outlined in the foregoing reference, would greatly assist in reaching a satisfactory solution.

APPENDIX A

FUNCTIONS ASSIGNED TO TASK GROUP 7.5

May 25, 1953
(Rev. 10/1/53)

1. General Responsibilities -

   a. Engineer and construct all base facilities at the Pacific Proving Ground necessary to support the Task Force and AEC and its contractors in the conduct of test operations.

   b. Engineer and construct all test structures required for experimental work during test operations.

   c. Maintain all base facilities at the Pacific Proving Ground except for the military communications facilities on Eniwetok Island and military communications facilities at Bikini Atoll.

   d. Operate, manage, and direct camp facilities and supporting facilities at the Proving Ground, to include the following:

      (1) Provide subsistence, quarters, laundry, medical, recreational, and other camp services on all islands except Eniwetok, where these services are provided by Task Group 7.2. Blocks of housing will be assigned to Joint Task Force SEVEN Headquarters, TG 7.1, and TG 7.5, within which the respective groups may assign spaces according to their own wishes.

      (2) Provide land transportation service on all islands on Eniwetok and Bikini except in those circumstances where the use of vehicles organic to military units is appropriate. Operate a motor pool on Parry and other islands as required, to include all vehicles assigned to TG 7.1 and 7.5. Maintain all vehicles assigned to these two groups, regardless of ownership.

      (3) Between operational phases provide and operate boat pools at Eniwetok and Bikini to support operations and construction at these atolls and provide CTG 7.2 with AEC requirements for interatoll surface lift. During operational phases provide and operate boat pools and establish interatoll lift requirements in accordance with procedures to be mutually agreed upon with CJTF SEVEN.

      (4) Between operational phases provide CTG 7.2 with AEC inter-island liaison airlift requirements to support construction and operations at Eniwetok and Bikini. Dispatch such aircraft in coordination with CTG 7.2. During operational phases provide the appropriate Task Group with Joint TG 7.1 and 7.5 liaison airlift requirements and participate in dispatching such aircraft in accordance with procedures approved by CJTF SEVEN.

      (5) Operate all utilities on all islands, excepting the communications facilities on Eniwetok Island, the military radio commnications facilities at Bikini Atoll, and the POL farm on Eniwetok Island.

(6) Provide warehousing and property accounting facilities for all materials and equipment shipped to the forward area for TG 7.5 and TG 7.1 if requested. These services include the receiving, issuing, distribution, warehousing, and return packing and shipping as indicated or required. Stateside it includes port of embarkation and debarkation receiving, overseas packing, and transshipment.

e. Provide for radiological safety of TG 7.1 and 7.5 personnel in the periods between operations.

f. Provide support services in the way of labor and materials to assist scientists and technicians in their test programs.

g. Be responsible for formulating and operating a comprehensive security program at the Pacific Proving Ground, to cover the AEC interest at that installation between operations and during operations to provide at the Pacific Proving Ground the security servicing for AEC, AEC contractor components, and DOD elements participating as part of TG 7.1, in coordination with the staff of JTF SEVEN and AEC, Washington.

h. Develop in coordination with JTF SEVEN and TG 7.1 detailed operational plans for critical phases of operations.

2. Specific Responsibilities -

a. General - For the sake of brevity and avoidance of repetition in this document the various duties and responsibilities specified below are, for the various staff sections, responsibilities of an over all planning, administrative, and general supervisory nature. The detailed supervision, staffing, and execution of the various activities required to discharge the responsibilities are functions of the appropriate Task Units shown on the attached Organization Chart.

b. E-1

(1) Establish and administer policies concerning travel, work week, and other personnel administrative matters involving personnel assigned to TG 7.5.

(2) Prepare personnel for movement overseas, issue travel orders and identification cards, and make detailed arrangements for transportation to the forward area. Provide service in Honolulu to personnel of TGs 7.1 and 7.5 in expediting and assisting their movement to and from the forward area.

(3) Determine requirements for air and surface personnel in transportation for reporting to JTF SEVEN.

(4) Fulfill necessary requirements of JTF SEVEN, TG 7.1 and TG 7.5 for office and laboratory space and furniture; allocate space to TG 7.5 staff sections and Task Units as required.

(5) Administer and account for military funds allocated to TG 7.5 for construction and support for TG 7.1 or Department of Defense program.

(6) Organize, staff, and operate, in coordination with TG 7.1, a personnel reception unit at Eniwetok and Bikini to receive, billet, and orient personnel of TG 7.1 and 7.5, and to process them prior to their return to the U. S. Assignment of billets within assigned blocks of housing, however, will be performed by JTF SEVEN and TG 7.1 representatives, respectively.

(7) Provide postal service except on Eniwetok Island. Provide for reproduction and distribution of Task Group reports and documents.

(8) Assist E-3 in the preparation and execution of evacuation plans.

(9) Provide necessary recreational facilities for JTF SEVEN Headquarters, TG 7.1, and TG 7.5.

(10) Prepare administrative reports in coordination with other staff sections. Monitor the preparation and submission of periodic reports required by JTF SEVEN. Prepare Task Group historical and completion reports as required.

(11) Coordinate all arrangements for handling and billeting visitors to TG 7.5.

c. E-2

(1) Secure and coordinate AEC personnel and military crypto clearances of TG 7.5 personnel.

(2) Establish a system to assure that all personnel resident at the Pacific Proving Ground are in possession of proper clearances for required access to limited and exclusion areas and/or classified information.

(3) As required by CTG 7.1, approve correspondence channels for Restricted Data between Headquarters, TG 7.1, and DOD or other participating facilities upon determination of adequacy of security safeguards in effect at such facilities in accordance with Task Force and other AEC security standards and policies.

(4) Maintain clearance status rosters of all Task Groups of JTF SEVEN having access to limited or exclusion areas.

(5) Designate 7.5 personnel as "good security risks" and forward notices of such to CINCPAC in compliance with Serial 020.

(6) For TG 7.1 personnel, other than those having "Q" clearances or "P" approvals, upon request of CTG 7.1, designate such persons as "good security risks". TG 7.1 will forward actual notices as such to CINCPAC in compliance with Serial 020.

(7) Upon receipt from TG 7.1 of properly executed AEC visitor notifications (AEC Form 277) will notify AEC Resident Engineer (TWX or best method) of proposed visits of TG 7.1 personnel to the Pacific Proving Ground until assumption of operational controls by CJTF SEVEN.

(8) TG 7.1 will keep TG 7.5 informed of departures to the Pacific Proving Ground by forwarding one copy of travel orders on each TG 7.1 individual proceeding to the Pacific Proving Ground for notification to the State Department Passport Division. Notification of departure of TG 7.1 personnel from the forward area will also be forwarded to TG 7.5 for similar notification to the State Department of returns from the forward area.

(9) In coordination with CJTF SEVEN and CTG 7.1, and based on classification of areas as established by the JTF Classification Officer, will designate the classified TG 7.1 and TG 7.5 areas at Eniwetok and Bikini Atolls, and will design access control and badge systems at the Pacific Proving Ground to include access controls to all operational islands and exclusion areas.

(10) Provide TG 7.1 with policy material and operational detail to permit TG 7.1 to operate a program of security indoctrination for their personnel within the ZI, taking cognizance of CJTF policy on security indoctrination.

(11) Provide security indoctrination for all TG 7.5 personnel and perform a similar function for TG 7.1 personnel at the forward area.

(12) During the overseas phase of operations maintain liaison with other security agencies such as FBI, AEC Headquarters, SFOO, and JTF SEVEN relative to security violations and derogatory information involving personnel of TG 7.1 and 7.5 amounting to deviation from AEC security policies.

(13) Secure JTF security departure statements for TG 7.1 and 7.5 personnel at time of their departure from the forward area following the completion of a test operation.

(14) In coordination with interested Task Groups establish shipment security plans and courier plan, and recommend to CJTF the military guard requirements (including guard communications requirements) for TG 7.1 and TG 7.1 operations at the Pacific Proving Ground.

(15) Conduct security surveys of AEC interests at the Pacific Proving Ground in coordination with SFOO.

(16) Delineate responsibilities of the civilian guard force at the Pacific Proving Ground.

(17) Evaluate sabotage potential at the Pacific Proving Ground.

(18) Justify and initiate requests for construction of fences, special lighting, and other appropriate physical security safeguards at the Pacific Proving Ground and coordinate such requirements with CTG 7.1 and CJTF SEVEN. Subsequently monitor installation

and operation of such physical security safeguards at the Pacific Proving Ground for conformance with AEC and Task Force security policies.

(19) Provide security representation for TG 7.5 elements afloat and furnish personnel in security servicing capacity for elements of TG 7.1 afloat.

(20) Maintain liaison with security personnel of Headquarters, JTF SEVEN, and other Task Groups to assure adequate coordination of matters of mutual interest.

(21) Assist in the preparation and execution of security aspects of TG 7.1 documentary and technical photographic controls plans at the Pacific Proving Grounds.

(22) Monitor the storage, handling, and destruction of classified materials and documents in accordance with AEC standards.

(23) Function as Top Secret and Classified Reference Control Offi- and as Top Secret authenticating official for SFOO-AEC interests at the Pacific Proving Ground.

(24) Function as EFO Accountability Officer with responsibility for preparation of monthly SF materials balance report and for preparation of certificates of expenditures of SF materials during tests at the Pacific Proving Ground.

(25) Notify CJTF SEVEN of the current TG 7.5 clearance (except Holmes & Narver) status and furnish CJTF SEVEN, after the operation, a clearance status report of all Holmes & Narver participants.

(26) Prepare the security annex to TG 7.5 field and administrative orders and assist in the preparation of the security annex to TG 7.1's operation and administrative plans.

(27) Assist other Task Groups of JTF SEVEN in all other security matters when so requested.

d. E-3

(1) In coordination with TG 7.1 ascertain and submit TG 7.5 requirements for ships, boats, and aircraft to JTF SEVEN.

(2) In coordination with TG 7.1 collect and analyze total requirements for housing and personnel transportation, submit requirements to JTF SEVEN and Task Groups as appropriate, and assist in solution of related problems as necessary.

(3) Coordinate space utilization, including quarters, public spaces, warehouses, etc., to accommodate fluctuating requirements of various Task Groups and to assure most efficient utilization of available space.

(4) Maintain liaison with other Task Groups in connection with requirements for the use of their facilities for test and operational purposes.

(5) Prepare and supervise the execution of Task Group operation plans, orders, annexes, schedules of events, check-off lists, and evacuation and emergency plans.

(6) Coordinate operations orders and annexes with TG 7.1 to insure the safety of operations in contaminated areas and the scheduling of recovery operations within the capabilities of available support personnel.

(7) Establish and maintain at the forward area a readiness reporting system.

(8) In coordination with TG 7.5 staff establish necessary procedures and accumulate appropriate information for analysis of the operation and planning for future operations.

(9) Administer TG 7.5 interest in scheduling and dispatch of liaison planes and helicopters for intra-atoll transportation and aircraft for interatoll transportation in accordance with the operational system agreed upon with CJTF.

(10) Administer scheduling and dispatching of the TG 7.5 boat pool, as supplemented by the TG 7.3 boat pool. Cooperate with other Task Groups in establishment of ferry schedules and in connection with the use of TG 7.5 craft for JTF SEVEN purposes.

(11) Administer the dispatch and maintenance of TG 7.5 and 7.1 vehicles, including scheduling and operation of land transportation systems.

(12) Function as clearing house for inter-Task Group problems related to services and facilities provided by AEC and AEC contractors.

e. E-4

(1) Receive from JTF SEVEN, TG 7.1, 7.2, 7.3, and 7.4 operational and construction requirements and provide for facilities, equipment, and personnel to meet these requirements.

(2) In coordination with JTF Liaison Officers expedite material and equipment of TG 7.5 (and, if requested, TG 7.1) from the port of embarkation to the forward area and return.

(3) Continue the present system of accountability of property in the forward area procured by or for Task Groups 7.1 and 7.5 with AEC funds.

(4) Determine TG 7.5 cargo requirements for air and surface transportation and submit monthly and special reports to JTF SEVEN covering TG 7.5 air and surface transportation.

(5) Assist if requested in the movement of material and equipment of TG 7.1 from the point of origin to the port of embarkation.

(6) Obtain air priorities for all TG 7.5 material and equipment requiring overseas airlift and arrange with JTF for each such shipment.

(7) Arrange for booking of cargo on available ships.

(8) Maintain liaison offices at Travis and Hickam Air Force Bases and at the Naval Supply Center, Oakland, to assist as required or requested in the movement of TG 7.1 and 7.5 material, equipment, and personnel.

(9) Offload TG 7.1 and 7.5 material and equipment at Eniwetok and Bikini Atolls and receive, warehouse, and distribute such material and equipment as requested to the location where it is to be used.

(10) Provide necessary packing and documenting service for TG 7.1 and 7.5 material and equipment to be returned to the United States.

(11) Prepare and distribute transportation, shipping, and marking instructions as required by the Task Force.

(12) Prepare the supply, transportation, and property annexes of CTG 7.5 field and administrative orders.

f. E-5

(1) Ascertain communication requirements (except technical requirements) from TG 7.1 and either provide these facilities or submit requirements as appropriate to JTF SEVEN.

(2) Supervise installation, operation, and maintenance of the telephone system on all islands other than Eniwetok.

(3) Supervise installation and maintenance of the interisland telephone and signal cable system, including the assignment of telephone cable pairs to meet JTF SEVEN and TG 7.1 requirements.

(4) Supervise installation, operation, and maintenance of the boat pool radio system.

(5) Supervise installation and maintenance of the point-to-point radio system servicing airstrips on all islands except Eniwetok and Bikini Airport.

(6) Supervise operation and maintenance of the ZI terminal of the Los Alamos-Eniwetok RATT circuit.

(7) Provide cryptographic system for use of CTG 7.5 and CTG 7.1 for the exchange of messages classified Top Secret, Restricted Data.

(8) Supervise installation and maintenance of paging and intercommunications systems on all islands other than Eniwetok Island.

(9) Provide a Comcenter facility on Parry Island to receive electrically all incoming teletype messages (except Top Secret and Restricted Data) for TG 7.5 and TG 7.1.

(10) Supervise the publication and distribution of telephone directories for both Bikini and Eniwetok Atolls.

(11) Supervise the operation of motion picure facilities at Bikini and Eniwetok Atolls (except Eniwetok Island).

(12) Provide teletypewriter operators to support TG 7.1 Eniwetok-Bikini RATT circuit.

APPENDIX B
EXHIBIT 1

COST REPORT
AEC PARTICIPATION
OPERATION CASTLE
PERIOD ENDING 30 JUNE 1954

CONSOLIDATED - SCIENTIFIC PROGRAMS AND PROJECTS

No.	Scientific Programs Title	Scientific Operations	Expendable Construction	Direct Support	Total
1	Blast and Shock Measurements				
1.1	Blast Measurements by Photography	$	$ 4,487	$ 3,641	$ 8,128
a	Free Air Pressure (Rocket Trails)	42,786	27,284	346	70,416
1.2	Pressure Vs. Time on the Surface:				
1.2a	Pressures Less than 40 PSI	280,170	50,680	19,891	350,741
1.2b	Pressures Greater than 40 PSI		24,897	2,304	27,201
1.3	Shock Winds and Afterwinds	129,309	53,233	9,181	191,723
1.4	Underwater Pressure Vs. Time		41,843	26,243	68,086
1.6	Water Wave Studies		1,121	8,314	9,435
1.7	Close-In Ground Acceleration	129,309	44,019	8,430	181,758
1.8	Dynamic Pressure Investigations			1,408	1,408
1.99.6	Common to Program	31,890	16,824	212	48,926
	Total Program 1	$ 613,464	$ 264,388	$ 79,970	$ 957,822
	Less Reimbursable Work	147,845	264,388	79,970	492,203
	Net Cost to AEC - Program 1	$ 465,619	$ -0-	$ -0-	$ 465,619
2	Nuclear Effects				
2.1	Gamma Film Dosage Measurements		$ 8,396	$ 5,241	$ 13,637
2.2	Gamma Dose Rate Vs. Time		21,455	1,011	22,466
2.3	Neutron Flux and Spectrum Measurements		13,739	2,357	16,096
2.5a	Fall-Out Distribution Studies		45,864	42,507	88,371
2.5b	Fall-Out Distribution Studies		15,386	8,811	24,197
2.6a	RC Analysis of Ground Contamination Studies		2,243	2,185	4,428
2.6b	RC Analysis of Ground Contamination Studies			1,527	1,527
2.99	Common to Program		7,851		7,851
	Total Program 2		$ 114,934	$ 63,639	$ 178,573
	Less Reimbursable Work		114,934	63,639	178,573
	Net Cost to AEC - Program 2		-0-	-0-	-0-
3	Structures				
3.1	Loading of Structures		$ 53,823	$ 2,566	$ 56,389
3.2	Crater Survey and Evaluation		2,594	714	3,308
3.3	Tree Stand Studies		2,243	918	3,161
3.99	Common to Program		1,533		1,533
	Total Program 3		$ 60,193	$ 4,198	$ 64,391
	Less Reimbursable Work		60,193	4,198	64,391
	Net Cost to AEC - Program 3		-0-	-0-	-0-
4	Bio-Medical Studies				
4.1	Study of response of human beings exposed to significant beta and gamma radiation due to fall-out from high-yield weapons			$ 2,393	$ 2,393
	Total Program 4			$ 2,393	$ 2,393
	Less Reimbursable Work			2,393	2,393
	Net Cost to AEC - Program 4			-0-	-0-

APPENDIX B
EXHIBIT 1 (Cont'd)

CONSOLIDATED - SCIENTIFIC PROGRAMS AND PROJECTS

	Scientific Programs Title	Scientific Operations	Expendable Construction	Direct Support	Total
6	Tests of Service Equipment and Operations				
6.2	Effect of blast, gust, and thermal on aircraft in flight		$ 2,948	$ 7,247	$ 10,195
6.2a	Effect of blast, gust, and thermal on aircraft in flight (B-36 aircraft)			347	347
6.2b	Effect of blast, gust, and thermal on aircraft in flight (B-47 aircraft)			17	17
6.3	Electromagnetic effects		1,122	43,379	44,501
6.4	Proof testing of atomic warfare counter-measures		3,364	2,159	5,523
6.5	Decontamination and protection		7,091	1,686	8,777
6.6	Effects on ionosphere		6,073		6,073
6.99	Common to Program		4,486		4,486
	Total Program 6		$ 25,084	$ 54,835	$ 79,919
	Less Reimbursable Work		25,084	54,835	79,919
	Net Cost to AEC - Program 6		-0-	-0-	-0-
7	Long Range Detection				
7.1	EM radiation calibration		$ 5,493	$ 2,536	$ 8,029
7.2	Detection of airborne low-frequency sound from atomic explosions			130	130
7.4	Calibration analysis of A-bomb debris		3,364	988	4,352
7.99	Common to Program		1,122		1,122
	Total Program 7		$ 9,979	$ 3,654	$ 13,633
	Less Reimbursable Work		9,979	3,654	13,633
	Net Cost to AEC - Program 7		-0-	-0-	-0-
9	Supporting Measurements				
9.1	Cloud photography	$ 42,786			$ 42,786
	Total Program 9	$ 42,786			$ 42,786
	Less Reimbursable Work	42,786			42,786
	Net Cost to AEC - Program 9	-0-			-0-
11	Radiochemistry				
11.1	Analysis for fission and fusion energy yields	$ 268,404	$ 718	$ 1,805	$ 270,927
11.2	Sample collection	268,409		1,040	269,449
11.3	Heavy element investigations	270,808		3,274	274,082
	Total Program 11	$ 807,621	$ 718	$ 6,119	814,458
	Less Reimbursable Work	-0-	-0-	-0-	-0-
	Net Cost to AEC - Program 11	$ 807,621	$ 718	$ 6,119	$ 814,458
12	Reaction History				
12.1	[redacted] reaction history	$ 838,614	$ 930,955	$ 12,541	$ 1,782,110
12.2	Telemetered time interval	51,719	86,186	543	138,448
12.3	[redacted] reaction history	249,286	375,276	4,021	628,583
	Total Program 12	$ 1,139,619	$ 1,392,417	$ 17,105	$ 2,549,141
	Less Reimbursable Work	-0-	-0-	-0-	-0-
	Net Cost to AEC - Program 12	$ 1,139,619	$ 1,392,417	$ 17,105	$ 2,549,141
13	Photography				
13.1	Ball of fire photography	$ 149,860	$ 147,482	$ 4,256	$ 301,598
13.2	Cloud photography	64,069	147,482	177	211,728
13.3	Bhangmeters, etc.	85,571	147,485	1,506	234,562
13.4	High speed photography	162,191	469,482	44,804	676,477
13.5	Time interval measurement with Bowen cameras	162,191	686,160	482	848,833
13.99	Common to Program			268	268
	Total Program 13	$ 623,882	$ 1,598,091	$ 51,493	$ 2,273,466
	Less Reimbursable Work	-0-	-0-	-0-	-0-
	Net Cost to AEC - Program 13	$ 623,882	$ 1,598,091	$ 51,493	$ 2,273,466

CONSOLIDATED - SCIENTIFIC PROGRAMS AND PROJECTS

	Scientific Programs Title	Scientific Operations	Expendable Construction	Direct Support	Total
14	External Neutron Measurements				
14.1	Threshold detectors	$ 129,360	$ 14,835	$ 7,704	$ 151,899
14.2	Nuclear emulsion plates	12,967			12,967
	Total Program 14	$ 142,327	$ 14,835	$ 7,704	$ 164,866
	Less Reimbursable Work	-0-	-0-	-0-	-0-
	Net Cost to AEC - Program 14	$ 142,327	$ 14,835	$ 7,704	$ 164,866
15	Alpha Measurements				
15.1	Teller and scintillation alpha	$ 277,151	$ 233,366	$ 40,090	$ 550,607
15.2	Electromagnetic alpha		50,039	2,960	52,999
15.3	Telemetered alpha	126,861			126,861
15.99	Common to Program			1,764	1,764
	Total Program 15	$ 404,012	$ 283,405	$ 44,814	$ 732,231
	Less Reimbursable Work	-0-	-0-	-0-	-0-
	Net Cost to AEC - Program 15	$ 404,012	$ 283,405	$ 44,814	$ 732,231
16	Gammas and Residual Contamination				
16.1	Gamma intensity at late times	$ 55,259		$ 461	$ 55,720
16.99	Common to Program	83,587			83,587
	Total Program 15	$ 138,846		$ 461	$ 139,307
	Less Reimbursable Work	-0-		-0-	-0-
	Net Cost to AEC - Program 16	$ 138,846		$ 461	$ 139,307
17	Microbarography				
17.1	Microbarography		$ 3,440	$ 130	$ 3,570
	Total Program 17		$ 3,440	$ 130	$ 3,570
	Less Reimbursable Work		-0-	-0-	-0-
	Net Cost to AEC - Program 17		$ 3,440	$ 130	$ 3,570
18	Thermal Radiation				
18.1	Time interval between reactions	$ 111,635	$ 18,490	$ 29,425	$ 159,550
18.2	Power vs. time	41,728	13,519	138	55,385
18.3	Spectroscopy	179,198	13,519	578	193,295
18.4	Air transmission	108,041	24,844	1,779	134,664
18.5	Total thermal radiation	46,600	24,847	647	72,094
18.99	Common to Program	65,394	11,787	7,894	85,075
	Total Program 18	$ 552,596	$ 107,006	$ 40,461	$ 700,063
	Less Reimbursable Work	20,000	-0-	-0-	20,000
	Net Cost to AEC - Program 18	$ 532,596	$ 107,006	$ 40,461	$ 680,063
19	Marine Survey				
19.1	Marine survey			$ 1,750	$ 1,750
	Total Program 19			$ 1,750	$ 1,750
	Less Reimbursable Work			-0-	-0-
	Net Cost to AEC - Program 19			$ 1,750	$ 1,750
21	Radiochemistry				
21.1	Analysis for fission and fusion energy yields	$ 450,200		$ 947	$ 451,174
21.2	Sample collection	12,334		214	12,548
21.3	Heavy element investigation	92,507		1,276	93,783
21.4	Gas analysis	61,671		164	61,835
	Total Program 24	$ 616,712		$ 2,628	$ 619,340
	Less Reimbursable Work	-0-		-0-	-0-
	Net Cost to AEC - Program 21	$ 616,712		$ 2,628	$ 619,340
22	History of the Reaction				
22.1	Ganex	$ 279,538	$	$ 2,817	$ 282,355
22.2	Tenex	279,538			279,538
22.3	Alpha	279,538			279,538
22.99	Common to Program		939,602	20,945	960,547
	Total Program 22	$ 838,614	$ 939,602	$ 23,762	$ 1,801,978
	Less Reimbursable Work	-0-	-0-	-0-	-0-
	Net Cost to AEC - Program 22	$ 838,614	$ 939,602	$ 23,762	$ 1,801,978

APPENDIX B
EXHIBIT 1 (Cont'd)

CONSOLIDATED - SCIENTIFIC PROGRAMS AND PROJECTS

	Scientific Programs Title	Scientific Operations	Expendable Construction	Direct Support	Total
23	Scientific Photography				
23.1	,				
	measurements	$ 305,510	$ 621,809	$ 3,158	$ 930,477
23.2	Ball of fire photography	42,786			42,786
23.99	Common to Program			3,310	3,310
	Total Program 23	$ 348,296	$ 621,809	$ 6,468	$ 976,573
	Less Reimbursable Work	-0-	-0-	-0-	-0-
	Net Cost to AEC - Program 23	$ 348,296	$ 621,809	$ 6,468	$ 976,573
24	External Neutron Measurements				
24.1	Phonex	$ 78,840	$	$ 1,708	$ 80,548
24.99	Common to Program		110,302	1,340	111,642
	Total Program 24	$ 78,840	$ 110,302	$ 3,048	$ 192,190
	Less Reimbursable Work	-0-	-0-	-0-	-0-
	Net Cost to AEC - Program 24	$ 78,840	$ 110,302	$ 3,048	$ 192,190
25	Diagnostic Developments				
25.1	New methods feasibility test	$ 15,208		$ 33	$ 15,241
	Total Program 25	$ 15,208		$ 33	$ 15,241
	Less Reimbursable Work	-0-		-0-	-0-
	Net Cost to AEC - Program 25	$ 15,208		$ 33	$ 15,241
	Common to Scientific Programs				
TG 7.1	Scientific Programs				
TU 1	LASL Scientific Programs	$ 93,174	$ 272	$ 1,557	$ 95,003
TU 2	Production			109,514	109,514
TU 3	Special Materials Facilities			5,910	5,910
TU 4	LASL Assembly		1,121,497	44,214	1,165,711
TU 6	Firing Party			1,061	1,061
TU 7	Rad-Safe			36,222	36,222
TU 8	Technical Photography			276	276
TU 9	Documentary Photography (LML)	65,466		2,654	68,120
TU 12	UCRL Programs	9,169	191	26,610	35,970
TU 13	DOD Programs		112,933	2,824	115,757
TU 14	UCRL Assembly	92,341	344,813	24,465	461,619
TU 15	Timing and Firing	599,151	178,536	33,520	811,207
TG 7.1	Common to Scientific Programs	591,698	3,511,974	536,806	4,640,478
JTF 7	Construction-Contract Item 68		557,206		557,206
	Total Common to Scientific Programs	$ 1,450,999	$ 5,827,422	$ 825,633	$ 8,104,054
	Less Reimbursable Work	-0-	670,139	2,824	672,963
	Net Cost to AEC	$ 1,450,999	$ 5,157,283	$ 822,809	$ 7,431,091
	Total Scientific Programs	$ 7,813,822	$ 11,373,625	$ 1,240,298	$ 20,427,745
	Less Reimbursable Work	210,630	1,144,717	211,513	1,566,860
	Net Cost to AEC at 30 June 1954	$ 7,603,192	$ 10,228,908	$ 1,028,785	$ 18,860,885
	Estimate to Complete all Programs and Projects	$ 469,477	$ 105,660		$ 575,137
	Less Reimbursable Work	28,869	15,000		43,869
	Net Cost to AEC to Complete	$ 440,608	$ 90,660		$ 531,268
	Total Costs to AEC - Incurred and Estimated	$ 8,043,800	$ 10,319,568	$ 1,028,785	$ 19,392,153

APPENDIX B
EXHIBIT 1 (Cont'd)

CONSOLIDATED - SCIENTIFIC PROGRAMS AND PROJECTS

COMMENTS:

NOTE: For final accounting the net cost of operation of PG facilities was allocated on a labor basis to the following basic functions of the logistical contractor:

a. Construction
b. Maintenance of PG facilities
c. Support and Roll-Up
d. Support of personnel other than logistical contractor

Scientific Operations includes: Test direction, administration and engineering for field operation and for field experimental equipment; preparation for and carrying out of field measurements including fission and fusion yields by radiochemical sampling, reaction histories , weapons, the neutron multiplication rate as a function of time, and the nature of behavior of detonations using high speed framing cameras; other scientific measurements, cloud motion studies, microbarographic survey, instrumentation, data reduction and other technical duties involved in test planning and evaluation.

Expendable Construction includes: Cost of towers, scientific stations, temporary camps and appurtenances, causeways, marine landing facilities, submarine cable, and other expendable and/or temporary facilities required to prepare for and accomplish scientific experiments at Pacific Proving Ground.

Direct Support includes: Work order charges by support contractor for services, materials and equipment usage furnished upon specific request of Program and Project Directors.

This report includes only those costs budgeted as Full Scale Weapons Tests. There was some participation in various scientific programs on a "joint interest basis" by contractor employees of divisions whose activities are not so budgeted and the cost of such participation is not included in this report, but has been charged by the scientific contractor to other categories involved.

Common to Scientific Programs item includes: Those costs identifiable with scientific programs but not identifiable with specific programs, including such expendable construction as shot towers and other multi-user scientific structures.

Programs one thru nine are weapons effects programs sponsored by DOD. AEC costs limited to reimbursable items except for joint interest participation in program one.

Net Cost to AEC includes reimbursable work performed for AEC by other Federal agencies but does not include:

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

APPENDIX B
EXHIBIT 2

COST REPORT
OPERATION CASTLE
LOS ALAMOS SCIENTIFIC LABORATORY
PERIOD ENDING 30 JUNE 1954

No.	Scientific Programs Title	Scientific Operations
11	RADIOCHEMISTRY	
11.1	Analysis for Fission and Fusion Energy Yields	$ 268,404
11.2	Sample Collection	268,409
11.3	Heavy Element Investigations	270,808
	Total Program 11	$ 807,621
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 11	$ 807,621
12	REACTION HISTORY	
12.2	Telemetered	$ 51,719
12.3	Reaction History	249,286
	Total Program 12	$ 301,005
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 12	$ 301,005
13	PHOTOGRAPHY	
13.4	High Speed Photography	$ 162,191
13.5	Time Interval Measurement with Bowen Cameras	162,191
	Total Program 13	$ 324,382
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 13	$ 324,382
14	EXTERNAL NEUTRON MEASUREMENTS	
14.1	Threshold Detectors	$ 129,360
14.2	Nuclear Emulsion Plates	12,967
	Total Program 14	$ 142,327
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 14	$ 142,327
15	ALPHA MEASUREMENTS	
15.1	Teller and Scintillation Alpha	$ 277,151
15.3	Telemetered Alpha	126,861
	Total Program 14	$ 404,012
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 15	$ 404,012
16	GAMMAS AND RESIDUAL CONTAMINATION	
16.1	Gamma Intensity at Late Times	$ 55,259
16.99.6	Common to Program	83,587
	Total Program 16	$ 138,846
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 16	$ 138,846
18	THERMAL RADIATION	
18.99.6	Common to Program	$ 27,295
	Total Program 18	$ 27,295
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 18	$ 27,295
	COMMON TO SCIENTIFIC PROGRAMS	
	Task Unit 1 LASL Scientific Programs	$ 93,174
	TG 7.1 Scientific Task Group	591,699
	Total Scientific Programs	$ 2,830,361
	Less Reimbursable Work	-0-
	Net Cost to AEC at 30 June 1954	$ 2,830,361
	Estimate to Complete All Programs and Projects	$ 172,408
	Less Reimbursable Work	-0-
	Net Cost to AEC to Complete	$ 172,408
	Total Costs to AEC - Incurred and Estimated	$ 3,002,769

COMMENTS: Common to Scientific Programs Item includes costs not identifiable with specific programs and projects. These costs are associated with Task Units where possible and with Scientific Task Groups where not.

APPENDIX B
EXHIBIT 3

COST REPORT
OPERATION CASTLE
UNIVERSITY OF CALIFORNIA
RADIATION LABORATORY
PERIOD ENDING 30 JUNE 1954

No.	Scientific Programs Title	Scientific Operations
12	REACTION HISTORY	
12.1	Reaction History	$ 838,614
	Total Program 12	$ 838,614
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 12	$ 838,614
21	RADIOCHEMISTRY	
21.1	Analysis for Fission and Fusion Energy Yields	$ 450,200
21.2	Sample Collection	12,334
21.3	Heavy Element Investigation	92,507
21.4	Gas Analysis	61,671
	Total Program 21	$ 616,712
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 21	$ 616,712
22	HISTORY OF THE REACTION	
22.1	Ganex	$ 279,538
22.2	Tenex	279,538
22.3	Alpha	279,538
	Total Program 22	$ 838,614
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 22	$ 838,614
23	SCIENTIFIC PHOTOGRAPHY	
23.1		$ 305,510
	Total Program 23	$ 305,510
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 23	$ 305,510
24	EXTERNAL NEUTRON MEASUREMENTS	
24.1	Phonex	$ 78,840
	Total Program 24	$ 78,840
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 24	$ 78,840
25	DIAGNOSTIC DEVELOPMENTS	
25.1	New Methods Feasibility Test	$ 15,208
	Total Program 25	$ 15,208
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 25	$ 15,208
	COMMON TO SCIENTIFIC PROGRAMS	
	Task Unit 12 UCRL Programs	$ 9,169
	Task Unit 14 UCRL Assembly	92,341
	Total Scientific Programs	$2,795,008
	Less Reimbursable Work	-0-
	Net Cost to AEC at 30 June 1954	$2,795,008
	Estimate to Complete All Programs and Projects	$ -0-
	Less Reimbursable Work	-0-
	Net Cost to AEC to Complete	-0-
	Total Costs to AEC - Incurred and Estimated	$2,795,008

COMMENTS: Common to Scientific Programs Item includes costs not identifiable with specific programs and projects. These costs are associated with Task Units where possible and with Scientific Task Groups where not.

APPENDIX B
EXHIBIT 4

COST REPORT
OPERATION CASTLE
EDGERTON, GERMESHAUSEN & GRIER
PERIOD ENDING 30 JUNE 1954

No.	Scientific Programs Title	Scientific Operations
1	BLAST AND SHOCK MEASUREMENTS	
1.1a	Free Air Pressure (Rocket Trails)	$ 42,786
	Total Program 1	$ 42,786
	Less Reimbursable Work	42,786
	Net Cost to AEC - Program 1	-0-
9	SUPPORTING MEASUREMENTS	
9.1	Cloud Photography	$ 42,786
	Total Program 9	$ 42,786
	Less Reimbursable Work	42,786
	Net Cost to AEC - Program 9	$ -0-
13	PHOTOGRAPHY	
13.1	Ball of Fire Photography	$ 149,860
13.2	Cloud Photography	64,069
13.3	Bhangmeters, etc.	85,571
	Total Program 13	$ 299,500
	Less Reimbursable Work	-0-
	Net Cost to AEC - Program 13	$ 299,500
23	SCIENTIFIC PHOTOGRAPHY	
23.2	Ball of Fire Photography	$ 42,786
	Total Program 23	$ 42,786
	Less Reimbursable Work	-0-
	Net Cost to AEC- Program 23	$ 42,786
	COMMON TO SCIENTIFIC PROGRAMS	
	Task Unit 15 Timing and Firing	$ 599,151
	Total Scientific Programs	$1,027,009
	Less Reimbursable Work	85,572
	Net Cost to AEC at 30 June 1954	$ 941,437
	Estimate to Complete all Programs and Projects	$ 264,400
	Less Reimbursable Work	14,400
	Net Cost to AEC to Complete	$ 250,000
	Total Costs to AEC - Incurred and Estimated	$1,191,437

COMMENTS: Common to Scientific Programs Item includes costs not identifiable with specific programs and projects. These costs are associated with Task Units where possible and with Scientific Task Groups where not.

APPENDIX B
EXHIBIT 5

COST REPORT
OPERATION CASTLE
NAVAL RESEARCH LABORATORY
PERIOD ENDING 30 JUNE 1954

No.	Scientific Programs Title	Scientific Operations
18	THERMAL RADIATION	
18.1		$ 111,635
18.2	Power Vs. Time	41,728
18.3	Spectroscopy	179,198
18.4	Air Transmission	108,041
18.5	Total Thermal Radiation	46,600
18.99.6	Common to Program	38,099
	Total Program 18	$ 525,301
	Less Reimbursable Work	20,000
	Net Cost to AEC at 30 June 1954	$ 505,301
	Estimate to Complete All Programs and Projects	$ 5,000
	Less Reimbursable Work	-0-
	Net Cost to AEC to Complete	$ 5,000
	Total Costs to AEC - Incurred and Estimated	$ 510,301

APPENDIX B
EXHIBIT 6

COST REPORT
OPERATION CASTLE
SANDIA CORPORATION
PERIOD ENDING 30 JUNE 1954

No.	Scientific Programs Title	Scientific Operations
1	BLAST AND SHOCK MEASUREMENTS	
1.2a	Pressures Less than 40 PSI	$ 280,170
1.3	Shock Winds and Afterwinds	129,309
1.7	Close In Ground Acceleration	129,309
1.99.6	Common to Program	31,890
	Total Program 1	$ 570,678
	Less Reimbursable Work	105,059
	Net Cost to AEC at 30 June 1954	$ 465,619
	Estimate to Complete All Programs and Projects	$ 27,640
	Less Reimbursable Work	14,440
	Net Costs to AEC to Complete	$ 13,200
	Total Costs to AEC - Incurred and Estimated	$ 478,819

NOTE: All projects are of joint interest to AEC and DOD. Costs shared per agreement between AEC and DOD.

APPENDIX B
EXHIBIT 7

COST REPORT
AEC PARTICIPATION
OPERATION CASTLE
PERIOD ENDING 30 JUNE 1954

CONSOLIDATED SUMMARY

No.	Scientific Programs Title	Scientific Operations	Expendable Construction	Direct Support and Roll-Up	Total
1	Blast and Shock Measurements	$ 613,464	$ 264,388	$ 79,970	$ 957,822
2	Nuclear Effects	-0-	114,934	63,639	178,573
3	Structures	-0-	60,193	4,198	64,391
4	Bio-Medical Studies	-0-	-0-	2,393	2,393
6	Tests of Service Equipment and Operations	-0-	25,084	54,835	79,919
7	Long Range Detection	-0-	9,979	3,654	13,633
9	Supporting Measurements	42,786	-0-	-0-	42,786
11	Radiochemistry	807,621	718	6,119	814,458
12	Reaction History	1,139,619	1,392,417	17,105	2,549,141
13	Photography	623,882	1,598,091	51,493	2,273,466
14	External Neutron Measurements	142,327	14,835	7,704	164,866
15	Alpha Measurements	404,012	283,405	44,814	732,231
16	Gammas and Residual Contamination	138,846	-0-	461	139,307
17	Microbarography	-0-	3,440	130	3,570
18	Thermal Radiation	552,596	107,006	40,461	700,063
19	Marine Survey	-0-	-0-	1,750	1,750
21	Radiochemistry	616,712	-0-	2,628	619,340
22	History of the Reaction	838,614	939,602	23,762	1,801,978
23	Scientific Photography	348,296	621,809	6,468	976,573
24	External Neutron Measurements	78,840	110,302	3,048	192,190
25	Diagnostic Developments	15,208	-0-	33	15,241
	Common to Scientific Programs	1,450,999	5,827,422	825,633	8,104,054
	Total Scientific Programs	$ 7,813,822	$ 11,373,625	$ 1,240,298	$ 20,427,745
	Less Reimbursable Work	210,630	1,144,717	211,513	1,566,860
	Net Cost to AEC	$ 7,603,192	$ 10,228,908	$ 1,028,785	$ 18,860,885

Logistical Operations		Operations	Construction	Direct Support and Roll-Up	Total
Maintenance of PG Facilities Period - 1 January 1953 - 30 June 1954		$ 6,462,888	$	$	$ 6,462,888
Operation of PG Facilities Period - 1 January 1953 - 30 June 1954					
Gross Expense	$ 13,280,609				
Cash Revenue	2,639,026				
Net Costs Charged to Opr. PPG Facilities		$ 10,641,583*			$ 10,641,583
Field Office Administration		246,106			246,106
General Expense - Support Task Group		-0-	6,395,856	599,440	6,995,296
Total Logistical Operations		$ 17,350,577	$ 6,395,856	$ 599,440	$ 24,345,873
Less Reimbursable Work		5,670	-0-	-0-	5,670
Net Cost to AEC		$ 17,344,907	$ 6,395,856	$ 599,440	$ 24,340,203

Grand Totals and Projection To Completion	Costs to Date of Report	Estimate to Complete	Estimated Total Cost
Scientific Programs	$ 20,427,745	$ 469,477	$ 20,897,222
Logistical Operations	24,345,873	105,660	24,451,533
Reimbursable Work	1,572,530	43,869	1,616,399
Net Total AEC Costs	$ 43,201,088	$ 531,268	$ 43,732,356

*See Note on next page

APPENDIX B
EXHIBIT 7 (Cont'd)

CONSOLIDATED SUMMARY

COMMENTS:

NOTE: For final accounting the net cost of operation of PG facilities was allocated on a labor basis to the following basic functions of the logistical contractor:

a. Construction
b. Maintenance of PG facilities
c. Support and Roll-Up
d. Support of personnel other than logistical contractor

Scientific Operations includes: Test direction, administration and engineering for field operation and for field experimental equipment; preparation for and carrying out of field measurements including fission and fusion yields by radiochemical sampling, reaction histories ; the neutron multiplication rate as a function of time, and the ~~nature of~~ behavior of detonations using high speed framing cameras; other scientific measurements, cloud motion studies, microbarographic survey, instrumentation, data reduction and other technical duties involved in test planning and evaluation.

Expendable Construction includes: Cost of towers, scientific stations, temporary camps and appurtenances, causeways, marine landing facilities, submarine cable, and other expendable and/or temporary facilities required to prepare for and accomplish scientific experiments at Pacific Proving Ground.

Direct Support includes: Work order charges by support contractor for services, materials and equipment usage furnished upon specific request of Program and Project Directors.

This report includes only those costs budgeted as Full Scale Weapons Tests. There was some participation in various scientific programs on a "joint interest basis" by contractor employees of divisions whose activities are not so budgeted and the cost of such participation is not included in this report, but has been charged by the scientific contractor to other categories involved.

Common to Scientific Programs item includes: Those costs identifiable with scientific programs but not identifiable with specific programs, including such expendable construction as shot towers and other multi-user scientific structures.

General Expense - Support Task Group includes: Cost of construction of temporary camps, docks, roads, etc. related to Support Task Group functions as distinguished from Scientific Task Group functions.

Programs one thru nine are weapons effects programs sponsored by DOD. AEC costs limited to reimbursable items except for joint interest participation in program one.

Net Cost to AEC includes reimbursable work performed for AEC by other Federal agencies but does not include:

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

APPENDIX B
EXHIBIT 8

REPORT OF THE MANAGER - SFO

EQUIPMENT SUMMARY
1 January 1953 - 15 July 1954

(EQUIPMENT ADDED FOR OPERATION CASTLE)

Kind of Equipment	No. of Units	Manner Acquired		Cost
Air Conditioner	3	Bought	$	3,773.00
Ambulance	3	"		12,587.35
Batch Plant	1	"		20,112.00
Bender	1	"		2,440.00
Box, Windrow Spreader	1	"		945.00
Brake, Finger	1	"		985.00
Broom, Road	1	"		2,993.00
Bucket, Dragline	12	"		25,488.89
Carry-alls	3	"		5,357.73
Chamber, Decompression	1	"		2,800.00
Chev. Carry-all	2	"		1,093.57
Compressors	14	"		67,233.80
Conveyors	13	"		46,155.00
Crane	13	"		390,276.87
Crusher, Rock	5	"		115,502.00
Dehumidification Unit	14	"		15,678.20
Distributor, Road Oil	1	"		6,923.00
Dolly, Cable Reel	2	"		7,142.00
Drill, Wagon	2	"		3,825.00
Fans and Blowers	12	"		2,871.00
Fork Lift	14	"		82,679.85
Generators	14	"		67,218.22
Hammer, Pile Driver	1	"		2,407.53
Hoppers	5	"		8,481.14
Jeeps	15	"		22,586.35
Lockers, Aluminum	600	"		41,832.00
Machine, Earth Boring	1	"		5,390.00
Mixer	5	"		10,878.14
Motor Grader	3	"		20,529.15
Personnel Carriers & Pick Ups	45	"		128,969.73
Press, Hydraulic	2	"		815.90
Pumps	33	"		19,791.88
Refrigerators	12	"		5,047.97
Road Mixer	1	"		19,692.00
Shear, Metal	2	"		3,237.62

APPENDIX B
EXHIBIT 8 (Cont'd)

Kind of Equipment	No. of Units	Manner Acquired	Cost
Switchboard	1	Bought	$ 5,710.80
Tank	5	"	8,520.36
Tractor, Caterpillar	15	"	185,887.52
Trailers	29	"	109,297.24
Transformers	7	"	4,363.90
Trencher	2	"	23,927.48
Truck	74	"	448,398.74
Welders	15	"	22,814.92
Roller	8	"	32,654.81
Miscellaneous-General:	130	"	57,611.68
Corp. Shop	9	"	6,377.35
Distillation Equipment	6	"	4,313.60
Electrical	86	"	19,345.35
Engineering	24	"	9,549.65
Garage Equipment	5	"	9,825.90
Hospital Equipment	37	"	7,302.00
Machine Shop Equipment	7	"	18,034.68
Office Equipment	584	"	70,679.06
Paint Shop Equipment	7	"	2,897.02
Tools	157	"	30,655.15
		Total	$2,251,889.10

HOLMES & NARVER, INC.

Engineers - Constructors

Contract AT(29-2)-20

Cost-Budget Report - Operation Castle

18 Months - Period Ending June 30, 1954

CUMULATIVE COSTS

Description	Direct	Indirect	Total	Total Cos[illegible]	Budget	Costs Over-(Under) Budget
MAINTENANCE OF PG FACILITIES						
Maintenance - Aluminum Buildings			$ 237,167		$ 305,834	$ (66,667)
" - Tents			97,140		131,774	(34,[illegible])
" - Piers			49,129		44,900	4,[illegible]
" - Military Buildings - Location "FF"			48,353		49,692	(1,339)
" - Scientific Structures			38,310		44,579	(6,26[illegible])
" - Other AEC Buildings & Structures			175,954		229,742	(53,7[illegible])
" - Communications Systems			525,021		472,797	52,2[illegible]
" - Electrical Generation Equipment			710,316		838,238	(127,9[illegible])
" - Electrical Distribution Systems			151,750		158,597	(6,[illegible])
" - Distillation Units			748,568		685,531	63,0[illegible]
" - Water Systems			82,127		101,028	([illegible])
" - Sewer Lines			38,394		36,500	[illegible]
" - Refrigeration Equipment			493,371		475,549	17,[illegible]
" - Air Strip			14,266		11,840	2,[illegible]
" - Roads			72,888		53,689	19,[illegible]
" - Parking, Storage & Recreation Areas			56,904		57,783	(879)
" & Repair - Installed Equip.			179,839		210,080	(30,24[illegible]
" - General Transportation Equipment			264,736		264,736	-0-
" - Marine Equipment			2,412,218		2,412,218	-0-
" - Reimbursable Work Orders			5,671		5,671	-0-
Undistributed Costs as of 6/30/54			60,766		-0-	60,7[illegible]
Total Maintenance				$ 6,462,88[illegible]	6,588,778	(12[illegible])
Less Reimbursable Work				5,67[illegible]	5,671	-0-
Net Maintenance				$ 6,457,21[illegible]	$ 6,583,107	$ ([illegible])
OPERATION OF PG FACILITIES	Direct	Indirect				
Utilities	$ 1,148,159	$ 671,304		$ 1,819,46[illegible]	$ 1,944,581	$ (125,[illegible])
Transportation:						
Land	181,510	120,736	$ 302,246			
Water	1,104,212	609,642	1,713,854	2,016,10[illegible]	2,010,235	5,86[illegible]
Air						
Communications	82,226	44,405		126,63[illegible]	96,127	30,[illegible]
Housing and Messing:						
Housing	282,784	169,919	452,703			
Mess Operations:						
Operating Costs	1,542,930	855,889	2,398,819			
Food Costs	1,921,365	1,356,358	3,277,723			
Total Housing & Messing Costs				6,129,245	6,801,038	([illegible])
Revenue - Note (a)				(1,479,412)	(1,495,788)	[illegible]
Net (Profit) or Loss				$ 4,649,833	$ 5,305,250	$ [illegible]

HOLMES & NARVER, INC.

Engineers - Constructors

Contract AT(29-2)-20

Cost-Budget Report - Operation Castle

18 Months - Period Ending June 30, 1954

APPENDIX - C

EXHIBIT 1

PAGE 3 OF 3

CUMULATIVE COSTS

Description	Total	Total Co[illegible]	Budget	Costs Over-/Under Bu[illegible]
EXPENDABLE CONSTRUCTION				
Temporary Camps	$ 5,021,645		$ 5,269,654	$ (24[illegible]
Scientific Structures - Causeways	11,373,625		11,717,844	([illegible]
Other	1,374,211		1,495,180	([illegible]
Total Expendable Construction - Note (h)		$ 17,769,[illegible]	$ 18,482,678	$ ([illegible]
Less Reimbursable Work		1,144,[illegible]	1,144,717	- -
Net Costs to AEC		$ 16,624,[illegible]	$ 17,337,961	$ ([illegible]
GRAND TOTAL NET AEC COST		$ 34,525,[illegible]	$ 36,220,438	$ ([illegible]
SUMMARY OF TOTALS				
Total Gross Costs:				
Totals Shown		$ 39,019,[illegible]	$ 40,599,945	$ (1,5[illegible]
Total Revenue		(2,639,[illegible])	(2,524,267)	(11[illegible]
Total Reimbursable Work		(1,855,[illegible])	(1,855,240)	- -
Total Net Costs to AEC as of 6/30/54		$ 34,525,[illegible]	$ 36,220,438	$ (1,[illegible])
ESTIMATE TO COMPLETE - Note (i)				
All Programs and Projects		$ 105,[illegible]	-0-	$ [illegible]
Less Reimbursable Work		15,[illegible]	-0-	[illegible]
Net AEC to Complete		$ 90,[illegible]	-0-	$ [illegible]
TOTAL AEC - COSTS INCURRED AND ESTIMATED - Note (j)		$ 34,616,[illegible]	$ 36,220,438	$ (1,6[illegible]

Note (h) - See Schedule No. 1 for distribution by Task ([illegible])up, Task Unit, Program and Project level.

Note (i) - Budget amount and variances between cost a[illegible] budget included above.

Note (j) - Includes incurred costs for 18-month period [illegible] ded June 30, 1954 and an Estimated Cost to complete Expendable Con[illegible] iction, less amount appli- cable for Reimbursable Work for the JTF-7 [illegible] nstruction of Concrete Sea- wall - site Fred.

Excludes Depreciation Expense - Common t[illegible] G 7.5.5 consumed in Oper- ation. Depreciation Expense was previously [illegible] ported under Operatin[illegible] Costs, Column E of JTF-7 Cost Report.

Operation of P.G. Facilities excludes incurr[illegible] costs and related budget for Maintenance of General Transportation a[illegible] Marine Equipment. These two items are included in Maintenance of P.[illegible] Facilities.

To facilitate performance evaluation, costs [illegible] Camp Operation are show[illegible] intact without distribution to the maintenanc[illegible] f P.G. Facilities, Direct Support to Scientific Contractors, Roll-Up O[illegible] ations, Expendable Constru[illegible] ion, and support of personnel other than con[illegible] ctor personnel, as was d[illegible] in final accounting.

HOLMES & NARVER, INC.

Engineers - Constructors

Contract AT(29-2)-20

Cost-Budget Report - Operation Castle

Costs of Expendable Construction, Support & Roll-Up by Test Program & Project

18 Months - Period Ending June 30, 1954

APPE[illegible]IX - C
EXH[illegible]IT 2
PAGE [illegible] OF 6

Description	Expendable Construction	Direct Support & Roll-Up	Total	Bu[illegible]t	Costs Over-(Under) Budget
TASK GROUP 7.1					
Scientific Programs:					
Program 1					
Project 1.1	$ 4,487	$ 3,641	$ 8,128	$ 8,[illegible]8	$ -0-
" 1.1a	27,284	346	27,630	27[illegible]0	-0-
" 1.2a	50,680	19,891	70,571	70[illegible]1	-0-
" 1.2b	24,897	2,304	27,201	27[illegible]1	-0-
" 1.3	53,233	9,181	62,414	62[illegible]4	-0-
" 1.4	41,843	26,243	68,086	68[illegible]6	-0-
" 1.6	1,121	8,314	9,435	9[illegible]5	-0-
" 1.7	44,019	8,430	52,449	52,[illegible]9	-0-
" 1.8		1,408	1,408	1,[illegible]8	-0-
" 1.99.6 Common to Program	16,824	212	17,036	17,[illegible]6	-0-
Total Program 1	$ 264,388	$ 79,970	$ 344,358	$ 344,[illegible]8	$ -0-
Less Reimbursable Work	264,388	79,970	344,358	344[illegible]8	-0-
Net Cost to AEC - Program 1	$ -0-	$ -0-	$ -0-	$ [illegible]	$ -0-
Program 2					
Project 2.1	$ 8,396	$ 5,241	$ 13,637	$ 13[illegible]7	$ -0-
" 2.2	21,455	1,011	22,466	22[illegible]6	-0-
" 2.3	13,739	2,357	16,096	16[illegible]6	-0-
" 2.5a	45,864	42,507	88,371	88,[illegible]1	-0-
" 2.5b	15,386	8,811	24,197	24[illegible]7	-0-
" 2.6a	2,243	2,185	4,428	4[illegible]8	-0-
" 2.6b		1,527	1,527	1[illegible]7	-0-
" 2.99.6 Common to Program	7,851		7,851	7[illegible]1	-0-
Total Program 2	$ 114,934	$ 63,639	$ 178,573	$ 178[illegible]3	$ -0-
Less Reimbursable Work	114,934	63,639	178,573	178[illegible]3	-0-
Net Cost to AEC - Program 2	$ -0-	$ -0-	$ -0-	$ [illegible]	$ -0-
Program 3					
Project 3.1	$ 53,823	$ 2,566	$ 56,389	$ 56,[illegible]9	$ -0-
" 3.2	2,594	714	3,308	3,[illegible]8	-0-
" 3.3	2,243	918	3,161	3,[illegible]1	-0-
" 3.99.6 Common to Program	1,533		1,533	1,[illegible]3	-0-
Total Program 3	$ 60,193	$ 4,198	$ 64,391	$ 64,[illegible]1	$ -0-
Less Reimbursable Work	60,193	4,198	64,391	64,[illegible]1	-0-
Net Cost to AEC - Program 3	$ -0-	$ -0-	$ -0-	$ [illegible]	$ -0-
Program 4					
Project 4.1	$ -0-	$ 2,393	$ 2,393	$ 2,[illegible]3	$ -0-
Total Program 4	$ -0-	$ 2,393	$ 2,393	$ 2,[illegible]3	$ -0-
Less Reimbursable Work	-0-	2,393	2,393	2,[illegible]3	-0-
Net Cost to AEC - Program 4	$ -0-	$ -0-	$ -0-	$ [illegible]	$ -0-

H O L M E S & N A R V E R , I N C .

Engineers - Constructors

Contract AT(29-2)-20

Cost-Budget Report - Operation Castle

Costs of Expendable Construction, Support & Roll-Up by Test Program & Project

18 Months - Period Ending June 30, 1954

Description	Expendable Construction	Direct Support & Roll-Up	Total	Budget	Costs Over-Under Budget
TASK GROUP 7.1 (Contd)					
Scientific Programs: (Contd)					
Program 6					
Project 6.2	$ 2,948	$ 7,247	$ [illegible],195	$ 10,195	$ - -
" 6.2a		347	347	347	- -
" 6.2b		17	17	17	- -
" 6.3	1,122	43,379	[illegible],501	44,501	- -
" 6.4	3,364	2,159	[illegible],523	5,523	- -
" 6.5	7,091	1,686	[illegible],777	8,777	- -
" 6.6	6,073		[illegible],073	6,073	- -
" 6.99.6 Common to Program	4,486		[illegible],486	4,486	- -
Total Program 6	$ 25,084	$ 54,835	$ [illegible],919	$ 79,919	$ -
Less Reimbursable Work	25,084	54,835	[illegible],919	79,919	- -
Net Cost to AEC - Program 6	$ -0-	$ -0-	$ -0-	$ -0-	$ - -
Program 7					
Project 7.1	$ 5,493	$ 2,536	$ [illegible],029	$ 8,029	$ - -
" 7.2		130	130	130	- -
" 7.4	3,364	988	[illegible],352	4,352	- -
" 7.99.6 Common to Program	1,122		[illegible],122	1,122	-
Total Program 7	$ 9,979	$ 3,654	$ [illegible],633	$ 13,633	$ -
Less Reimbursable Work	9,979	3,654	[illegible],633	13,633	-
Net Cost to AEC - Program 7	$ -0-	$ -0-	$ -0-	$ -0-	$ -
Program 11					
Project 11.1	$ 718	$ 1,805	$ [illegible],523	$ 2,244	$ [illegible]
" 11.2		1,040	[illegible],040	1,135	[illegible]
" 11.3		3,274	[illegible],274	3,615	[illegible]
Total Program 11	$ 718	$ 6,119	$ 6,837	$ 6,994	$ [illegible]
Less Reimbursable Work	-0-	-0-	-0-	-0-	-
Net Cost to AEC - Program 11	$ 718	$ 6,119	$ [illegible],837	$ 6,994	$ [illegible]
Program 12					
Project 12.1	$ 930,955	$ 12,541	$ [illegible],496	$ 1,216,908	$ <27[illegible]>
" 12.2	86,186	543	[illegible],729	105,010	[illegible]
" 12.3	375,276	4,021	[illegible],297	442,369	[illegible]
Total Program 12 - Note (k)	$ 1,392,417	$ 17,105	$ 1,[illegible],522	$ 1,764,287	$ [illegible]
Less Reimbursable Work	-0-	-0-	-0-	-0-	-
Net Cost to AEC - Program 12	$ 1,392,417	$ 17,105	$ 1,[illegible],522	$ 1,764,287	$ [illegible]
Program 13					
Project 13.1	$ 147,482	$ 4,256	$ [illegible],738	$ 158,800	$ [illegible]
" 13.2	147,482	177	[illegible],659	156,001	[illegible]
" 13.3	147,485	1,506	[illegible],991	157,469	[illegible]
" 13.4	469,482	44,804	[illegible],286	511,795	
" 13.5	686,160	482	[illegible],642	851,899	[illegible]
" 13.99.6 Common to Program		268	268	294	
Total Program 13 - Note (l)	$ 1,598,091	$ 51,493	$ 1,[illegible],584	$ 1,836,258	$ [illegible]
Less Reimbursable Work	-0-	-0-	-0-	-0-	
Net Cost to AEC - Program 13	$ 1,598,091	$ 51,493	$ 1,[illegible],584	$ 1,836,258	$ [illegible]

Note (k) - Due to local conditions where this project was loca[illegible]d and to improved methods in assembling pipe arrays, it was possibl[illegible] o reduce costs below the budget.

HOLMES & NARVER, INC.

Engineers - Constructors

Contract AT(29-2)-20

Cost-Budget Report - Operation Castle

Costs of Expendable Construction, Support & Roll-Up by Test Program & Project

18 Months - Period Ending June 30, 1954

Description	Expendable Construction	Direct Support & Roll-Up	Total	Budget	Costs Over-(Under) Budget
TASK GROUP 7.1 (Contd)					
Scientific Programs: (Contd)					
Program 14					
Project 14.1	$ 14,835	$ 7,704	$ 22,[illegible]	$ 15,374	$ [illegible]
Total Program 14	$ 14,835	$ 7,704	$ 22,[illegible]	$ 15,374	$ [illegible]
Less Reimbursable Work	-0-	-0-	[illegible]	-0-	[illegible]
Net Cost to AEC - Program 14	$ 14,835	$ 7,704	$ 22,[illegible]	$ 15,374	$ [illegible]
Program 15					
Project 15.1	$ 233,366	$ 40,090	$ 273,[illegible]	$ 218,117	$ 55,[illegible]
" 15.2	50,039	2,960	52,[illegible]	35,244	17,[illegible]
" 15.99.6 Common to Program	-0-	1,764	1,[illegible]	1,947	⟨[illegible]⟩
Total Program 15 - Note (m)	$ 283,405	$ 44,814	$ 328,[illegible]	$ 255,308	$ 72,[illegible]
Less Reimbursable Work	-0-	-0-	[illegible]	-0-	[illegible]
Net Cost to AEC - Program 15	$ 283,405	$ 44,814	$ 328,[illegible]	$ 255,308	$ 72,[illegible]
Program 16					
Project 16.1	$ -0-	$ 461	$ [illegible]	$ 512	$ ⟨[illegible]⟩
Total Program 16	$ -0-	$ 461	$ [illegible]	$ 512	$ ⟨[illegible]⟩
Less Reimbursable Work	-0-	-0-	[illegible]	-0-	[illegible]
Net Cost to AEC - Program 16	$ -0-	$ 461	$ [illegible]	$ 512	$ ⟨[illegible]⟩
Program 17					
Project 17.1	$ 3,440	$ 130	$ 3,[illegible]	$ 6,164	$ ⟨[illegible]⟩
Total Program 17	$ 3,440	$ 130	$ 3,[illegible]	$ 6,164	$ ⟨[illegible]⟩
Less Reimbursable Work	-0-	-0-	[illegible]	-0-	-0-
Net Cost to AEC - Program 17	$ 3,440	$ 130	$ 3,[illegible]	$ 6,164	$ ⟨[illegible]⟩
Program 18					
Project 18.1	$ 18,490	$ 29,425	$ 47,[illegible]	$ 60,671	$ ⟨12,75[illegible]⟩
" 18.2	13,519	138	13,[illegible]	12,664	[illegible]
" 18.3	13,519	578	14,[illegible]	13,151	[illegible]
" 18.4	24,844	1,779	26,[illegible]	22,024	4,[illegible]
" 18.5	24,847	647	25,[illegible]	20,755	[illegible]
" 18.99.6 Common to Program	11,787	7,894	19,[illegible]	20,576	[illegible]
Total Program 18	$ 107,006	$ 40,461	$ 147,[illegible]	$ 149,841	$ ⟨[illegible]⟩
Less Reimbursable Work	-0-	-0-	[illegible]	-0-	[illegible]
Net Cost to AEC - Program 18	$ 107,006	$ 40,461	$ 147,[illegible]	$ 149,841	$ ⟨[illegible]⟩
Program 19					
Project 19.1	$ -0-	$ 1,750	$ 1,[illegible]	$ 1,520	$ [illegible]
Total Program 19	$ -0-	$ 1,750	$ 1,[illegible]	$ 1,520	$ [illegible]
Less Reimbursable Work	-0-	-0-	[illegible]	-0-	-0-
Net Cost to AEC - Program 19	$ -0-	$ 1,750	$ 1,[illegible]	$ 1,520	$ [illegible]

Note (m) - Part of this work was not included in the budget as it [illegible] not anticipated until after the budget had been developed.

HOLMES & NARVER, INC.

Engineers - Constructors

Contract AT(29-2)-20

Cost-Budget Report - Operation Castle

Costs of Expendable Construction, Support & Roll-Up by Test Program & Project

18 Months - Period Ending June 30, 1954

PENDIX - C
EXHIBIT 2
AGE 4 OF 6

Description	Expendable Construction	Direct Support & Roll-Up	Total	Budget	Costs Over-(Under) Budget
TASK GROUP 7.1 (Contd)					
Scientific Programs: (Contd)					
Program 21					
Project 21.1	$ -0-	$ 974	$ 974	1,062	$ ⟨88⟩
" 21.2	-0-	214	214	235	⟨21⟩
" 21.3	-0-	1,276	1,276	2,304	⟨1,028⟩
" 21.4	-0-	164	164	181	⟨17⟩
Total Program 21	$ -0-	$ 2,628	$ 2,628	3,782	$ ⟨1,154⟩
Less Reimbursable Work	-0-	-0-	-0-	-0-	-0-
Net Cost to AEC - Program 21	$ -0-	$ 2,628	$ 2,628	3,782	$ ⟨1,154⟩
Program 22					
Project 22.1	$ -0-	$ 2,817	$ 2,817	3,103	$ ⟨286⟩
" 22.99.6 Common to Program	939,602	20,945	960,547	787,696	172,851
Total Program 22 - Note (n)	$ 939,602	$ 23,762	$ 963,364	790,799	$ 172,565
Less Reimbursable Work	-0-	-0-	-0-	-0-	-0-
Net Cost to AEC - Program 22	$ 939,602	$ 23,762	$ 963,364	790,799	$ 172,565
Program 23					
Project 23.1	$ 621,809	$ 3,158	$ 624,967	634,556	$ ⟨9,589⟩
" 23.99.6 Common to Program	-0-	3,310	3,310	3,668	⟨358⟩
Total Program 23	$ 621,809	$ 6,468	$ 628,277	638,224	$ ⟨9,947⟩
Less Reimbursable Work	-0-	-0-	-0-	-0-	-0-
Net Cost to AEC - Program 23	$ 621,809	$ 6,468	$ 628,277	638,224	$ ⟨9,947⟩
Program 24					
Project 24.1	$ -0-	$ 1,708	$ 1,708	$ 1,882	$ ⟨174⟩
" 24.99.6 Common to Program	110,302	1,340	111,642	115,391	⟨3,749⟩
Total Program 24	$ 110,302	$ 3,048	$ 113,350	$ 117,273	$ ⟨3,923⟩
Less Reimbursable Work	-0-	-0-	-0-	-0-	-0-
Net Cost to AEC - Program 24	$ 110,302	$ 3,048	$ 113,350	$ 117,273	$ ⟨3,923⟩
Program 25					
Project 25.1	$ -0-	$ 33	$ 33	$ 37	$ ⟨4⟩
Total Program 25	$ -0-	$ 33	$ 33	$ 37	$ ⟨4⟩
Less Reimbursable Work	-0-	-0-	-0-	-0-	-0-
Net Cost to AEC - Program 25	$ -0-	$ 33	$ 33	$ 37	$ ⟨4⟩
Common to Scientific Programs					
Task Unit 1	$ 272	$ 1,557	$ 1,829	$ 1,666	$ 163
" " 2		109,514	109,514	102,117	7,397
" " 3		5,910	5,910	6,522	⟨612⟩
" " 4	1,121,497	44,214	1,165,711	,148,258	17,453
" " 6		1,061	1,061	1,170	⟨109⟩
" " 7		36,222	36,222	36,410	⟨188⟩
" " 8		276	276	304	⟨28⟩
" " 9		2,654	2,654	2,889	⟨235⟩
" " 12	191	26,610	26,801	29,443	⟨2,642⟩

Note (n) - The cost exceeded the budget because of technical difficulties countered in using new types of materials and to unanticipated User req ements.

HOLMES & NARVER, INC.

Engineers - Constructors

Contract AT(29-2)-20

Cost-Budget Report - Operation Castle

Costs of Expendable Construction, Support & Roll-Up by Test Program & Project

18 Months - Period Ending June 30, 1954

Description	Expendable Construction	Direct Support & Roll-Up	Total	Budget	Costs Over-(Under) Budget
TASK GROUP 7.1 (Contd)					
Scientific Programs: (Contd)					
Common to Scientific Programs (Contd)					
Task Unit 13:					
1. Support Services and Incidental Test Construction	$ 2,245	$ 2,824	$ 5,069	$ 5,06[illegible]	$ -0-
2. Clearing and Grading Sites - Uncle thru Zebra	10,411		10,411	10,41[illegible]	-0-
3. Buildings 418 and 418-A	23,392		23,392	23,39[illegible]	-0-
4. Pro Rata Share of Clearing and Grading on Nan, Fox, Charlie and Eniwetok Atoll	7,258		7,258	7,25[illegible]	-0-
5. Pro Rata Share of Submarine Cable	47,333		47,333	47,33[illegible]	-0-
6. Pro Rata Share of Scientific Power Houses	22,294		22,294	22,294	-0-
Total Task Unit 13	$ 112,933	$ 2,824	$ 115,757	$ 115,757	$ -0-
Task Unit 14	$ 344,813	$ 24,465	$ 369,278	$ 281,33[illegible]	$ 87,939
" " 15	178,536	33,520	212,056	159,85[illegible]	52,200
Task Group 7.1 Common to Scientific Programs	3,511,974	536,806	4,048,780	4,365,821	⟨317,041⟩
JTF-7 - Construction - Contract Item 68 - Note (o)	557,206		557,206	557,206	-0-
Total Common to Scientific Program	$ 5,827,422	$ 825,633	$ 6,653,055	$ 6,808,75[illegible]	$ ⟨155,703⟩
Less Reimbursable Work	670,139	2,824	672,963	672,963	-0-
Net Cost to AEC - Common	$ 5,157,283	$ 822,809	$ 5,980,092	$ 6,135,79[illegible]	$ ⟨155,703⟩
Total Task Group 7.1	$ 11,373,625	$ 1,240,298	$ 12,613,923	$ 13,078,39[illegible]	$ ⟨464,475⟩
Less Reimbursable Work	1,144,717	211,513	1,356,230	1,356,230	-0-
Net Cost To AEC - Task Group 7.1	$ 10,228,908	$ 1,028,785	$ 11,257,693	$ 11,722,168	$ ⟨464,475⟩
TASK GROUP 7.5					
7.5.1 Construction Services:					
Temporary Camps	$ 5,021,645	$	$ 5,021,645	$ 5,269,654	$ ⟨248,009⟩
Other	1,374,211		1,374,211	1,495,180	⟨120,969⟩
Total 7.5.1	$ 6,395,856	$	$ 6,395,856	$ 6,764,834	$ ⟨368,978⟩
Less Reimbursable Work					
Net Cost to AEC - 7.5.1	$ 6,395,856	$	$ 6,395,856	$ 6,764,834	$ ⟨368,978⟩

Note (o) - JTF-7 Construction - Item 68 - also includes cost of concrete seaw[illegible] site Fred, and trenching for telephone cable.

HOLMES & NARVER, INC.

Engineers - Constructors

Contract AT(29-2)-20

Cost-Budget Report - Operation Castle

Costs of Expendable Construction, Support & Roll-Up by Test Program & Project

18 Months - Period Ending June 30, 1954

APPENDIX - C

EXHIBIT 2

Description	Expendable Construction	Direct Support & Roll-Up	Total	Budget	Costs Over-(Under) Budget
TASK GROUP 7.5 (Contd)					
7.5.5 Support and Roll-Up Services	$	$ 266,567	$ 266,567	$ 185,181	$ 81,386
Less Reimbursable Work					
Net Cost to AEC	$	$ 266,567	$ 266,567	$ 185,181	$ 81,386
Total Task Group 7.5	$ 6,395,856	$ 266,567	$ 6,662,423	$ 6,950,015	$ (287,592)
Less Reimbursable Work					
Net Cost to AEC	$ 6,395,856	$ 266,567	$ 6,662,423	$ 6,950,015	$ (287,592)
Total Task Groups 7.1 and 7.5	$ 17,769,481	$ 1,506,865	$ 19,276,346	$ 20,028,413	$ (752,067)
Less Reimbursable Work	1,144,717	211,513	1,356,230	1,356,230	-0-
Net Cost to AEC June 30, 1954	$ 16,624,764	$ 1,295,352	$ 17,920,116	$ 18,672,183	$ (752,067)
Estimate to Complete:					
All Programs and Projects	$ 105,660	$ -0-	$ 105,660	$ -0-	$ 105,660
Less Reimbursable Work	15,000	-0-	15,000	15,000	-0-
Net AEC to Complete	$ 90,660	$ -0-	$ 90,660	$ (15,000)	$ 105,660
TOTAL AEC - COSTS INCURRED AND ESTIMATED	$ 16,715,424	$ 1,295,352	$ 18,010,776	$ 18,657,183	$ (646,407)