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HISTORY OF OPERATION CASTLE

Pacific Proving Ground

39825

Joint Task Force Seven
Major General P. W. Clarkson
United States Army
Commanding

Spring 1954

NOTICE

This is an extract of History of Operation CASTLE, which remains classified SECRET/ RESTRICTED DATA, CRITICAL NUCLEAR WEAPON DESIGN INFORMATION as of this date.

Extract version prepared for:

Director
DEFENSE NUCLEAR AGENCY
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Operation CASTLE

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.

Major General P. W. Clarkson, USA, CJTF SEVEN

Dr. Alvin C. Graves, Scientific Director, JTF SEVEN

FOREWORD

Operation CASTLE was, in almost every sense of the word, an extension of Operation IVY. Except for the establishment of Joint Task Force SEVEN as a permanent organization and the formation of a fifth task group, very few changes occurred between the two tests which were separated only by a period of about fourteen months. The cut-off date for IVY and the beginning date for CASTLE were the matter, so to speak, of settling on an arbitrary date of 1 January 1953. Since an extensive and detailed history of Operation IVY had been written and published, it was decided early in CASTLE planning that the CASTLE history would follow a different orientation. Joint task forces have been conducting atomic tests in the Pacific since the end of World War II. By the time of CASTLE, these successive operations had been rather thoroughly documented by the individual histories which had been written. Enough experience and a wide enough variation of operational contingencies had been encountered to suggest certain major problems common to all atomic task forces. With this in mind, the CASTLE history is for the most part an attempt to point up broadly those general problems which any task force may anticipate. In addition, though not in the detailed narrative form of previous histories, a treatment of the major difficulties encountered during CASTLE is included. For these reasons, any detailed study of this effort should be made in conjunction with those of previous overseas tests, particularly GREENHOUSE and IVY.

Once again, and as stated in connection with the History of Operation IVY, it is hoped that this volume will serve as a testament to the outstanding joint effort of those combined agencies and personnel, both within and without Joint Task Force SEVEN, who worked together to achieve the great success of Operation CASTLE.

P. W. CLARKSON
Major General, United States Army
Commander, Joint Task Force SEVEN

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS, MAPS, AND CHARTS

ABBREVIATIONS

AACS - Airways and Air Communications Service

ACofS - Assistant Chief of Staff

AEC - Atomic Energy Commission

AIRCOMNET - Air Communications Net

AFB - Air Force Base

AFOAT - Air Force Office of Atomic Energy ? Sic!

AFSWC - Air Force Special Weapons Center

AFSWP - Armed Forces Special Weapons Project

AOC - Air Operations Center

ARDC - Air Research and Development Command

ASW - Anti-Submarine Warfare

ATCOM - Atoll Commander

AU - Army Unit

CIC - Combat Information Center

CINCPAC - Commander-in-Chief, Pacific

CINCPACFLT - Commander-in-Chief, Pacific Fleet

CJTF - Commander, Joint Task Force

CNO - Chief of Naval Operations

COMNAVSTAKWAJ - Commander, Naval Station, Kwajalein

COMPHIBTRAPAC - Commander, Amphibious Training Command, United States Pacific Fleet

COMSERVPAC - Commander, Service Force, United States Pacific Fleet

C/S, USA - Chief of Staff, United States Army

CTG - Commander, Task Group

CTU - Commander, Task Unit

CW - Continuous Wave

D/A - Department of the Army

DESDIV - Destroyer Division

DMA - Director of Military Application, AEC

DOD - Department of Defense

EG&G - Edgerton, Germeshausen, and Grier, Inc.

FAPUSJCEC - Frequency Allocation Panel, United States Joint Communications - Electronics Committee

FECOM - Far East Command

FY - Fiscal Year

HASL - Health and Safety Laboratory

H&N - Holmes & Narver, Inc.

HF - High Frequency

IBDA - Indirect Bomb Damage Assessment

JCS - Joint Chiefs of Staff

JTF - Joint Task Force

KT - Kiloton

LASL - Los Alamos Scientific Laboratory

LF - Low Frequency

LORAN - Long Range Aids to Navigation

MATS - Military Air Transportation Service

MINDIV - Mine Division

MLC - Military Liaison Committee

MOS - Military Occupational Specialty

MP - Military Police

MPE - Maximum Permissible Exposure

m/r - milliroentgen

MSTS - Military Sea Transportation Service

MT - Megaton

NAVSTAKWAJ - Naval Station, Kwajalein

NCO - Non-commissioned Officer

NPG - Nevada Proving Grounds

NRDL - Naval Radiological Defense Laboratory

NSA - National Security Agency

NYKOPO - New York Operations Office

OCSigO - Office of the Chief Signal Officer

PACDIVMATS - Pacific Division, Military Air Transportation Service

POL - Petroleum, Oil, and Lubricants

PPG - Pacific Proving Grounds

RACON - Radar Beacon

RADEX - Radiological Exclusion

R&D - Research and Development

r - rcentgens

SAC - Strategic Air Command

SACCOMNET - Strategic Air Command Communication Net

SAR - Search and Rescue

SFOO - Santa Fe Operations Office

SHORAN - Short Range Navigational Aids

SigO - Signal Officer

TAD - Temporary Additional Duty

T/D - Table of Distribution

TDY - Temporary Duty

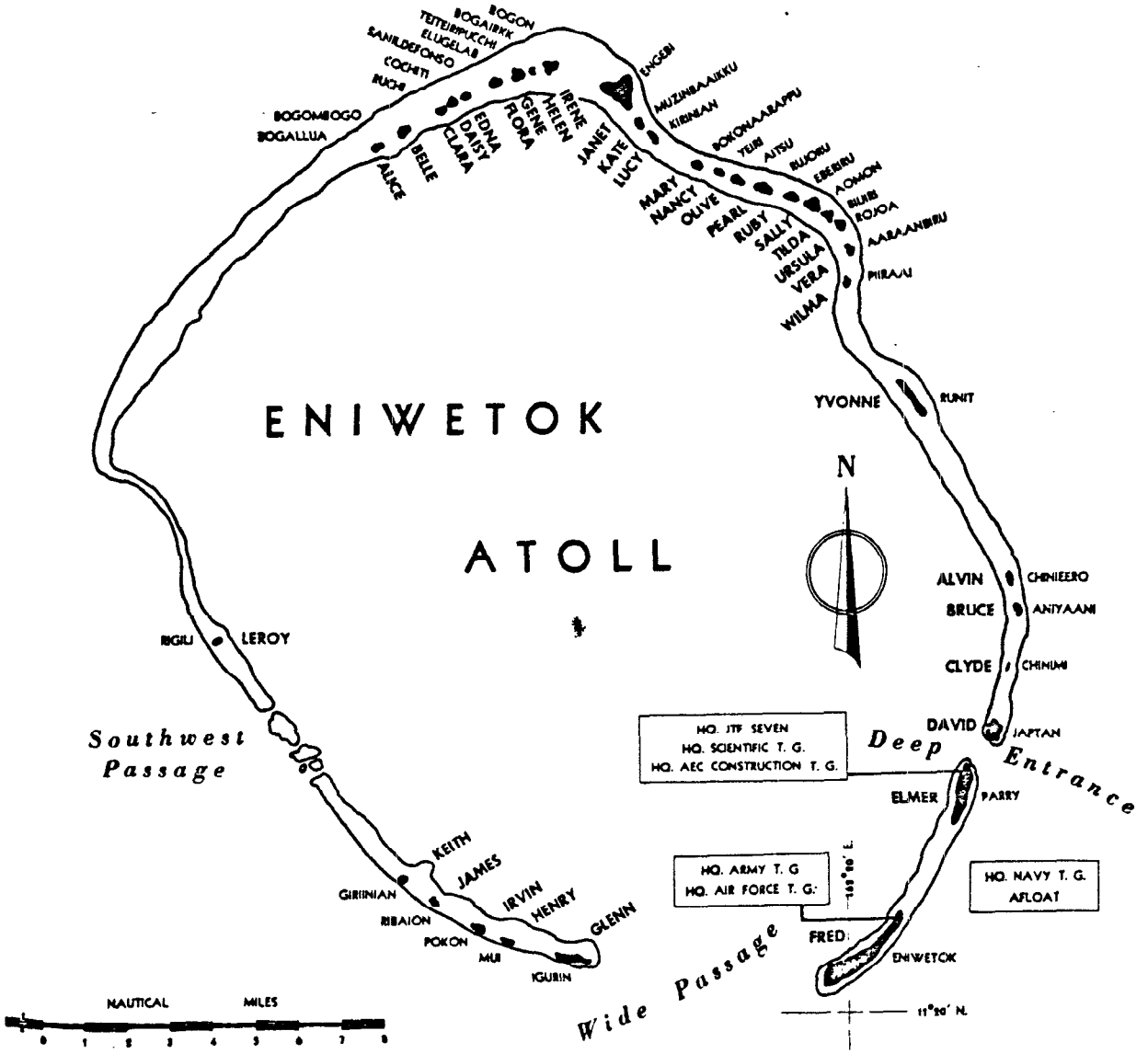
UCRL - University of California Radiation Laboratory

USARPAC - United States Army, Pacific

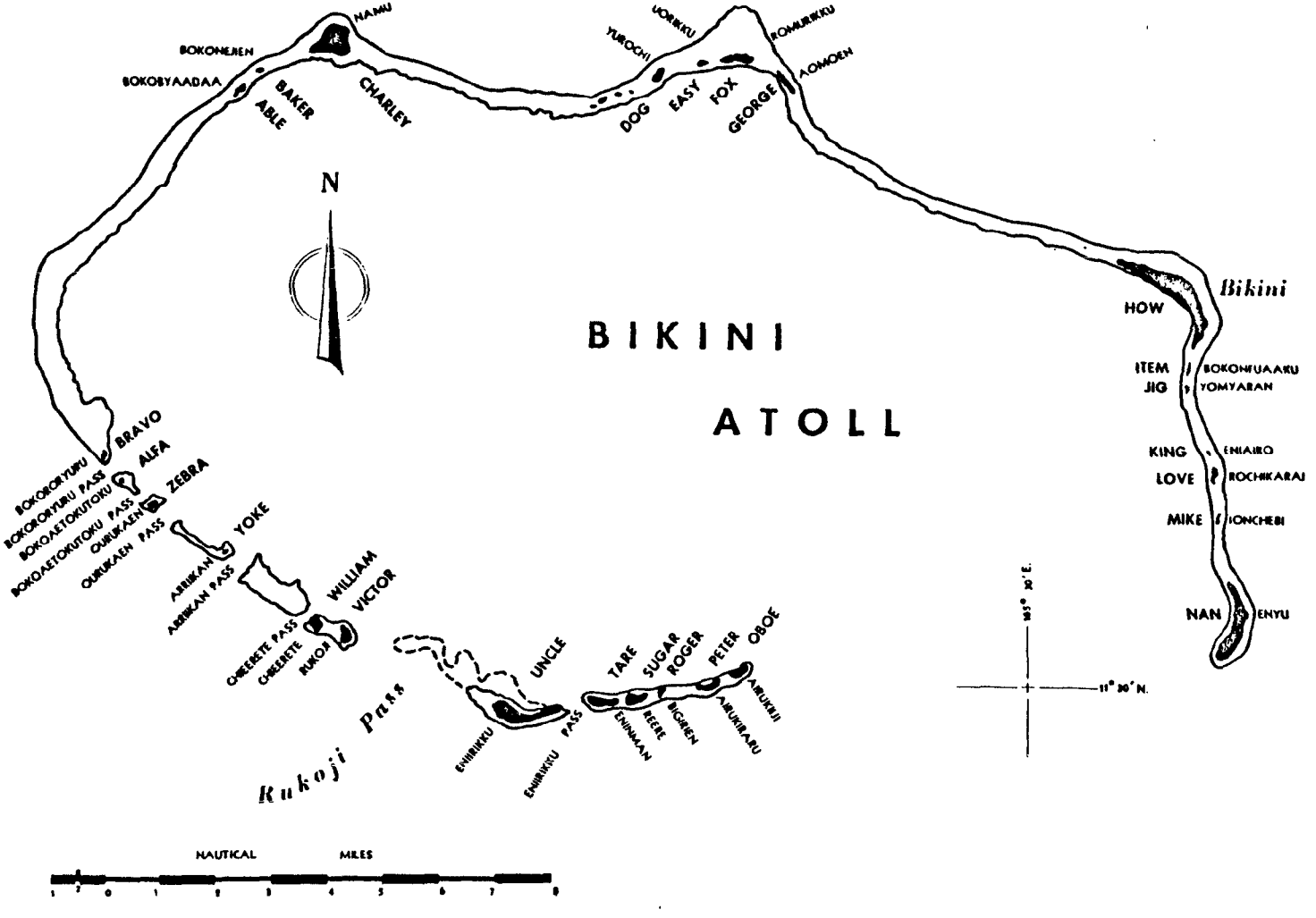
VHF - Very High Frequency

WADC - Wright Air Development Center

ZI - Zone of Interior



Eniwetok Atoll



Bikini Atoll

CHAPTER I

THE ORIGINS OF OPERATION CASTLE

The roll-up and redeployment of Joint Task Force 132 (JTF 132) after Operation IVY marked the successful conclusion of the fourth series of atomic tests to be conducted in the Marshall Islands. Each of these series--CROSSROADS, SANDSTONE, GREENHOUSE, and IVY--has generated valuable data from which significant progress in the military application of atomic energy has been possible. The latter of these tests--Operation IVY--witnessed the detonation of a device which marked the furthest advance as of that date (Fall, 1952) in a relatively new direction for military uses of atomic energy.

With the large amounts of data acquired during this test, the scientists at Los Alamos Scientific Laboratory as well as those of the newer University of California Radiation Laboratory (UCRL) at Livermore, California, continued in the urgent efforts to perfect the plans and designs of those weapons and devices scheduled for experimental testing in the soon forthcoming CASTLE operation.

Organizationally, the Task Force which had conducted Operation IVY was typical of those conducting earlier overseas atomic operations in that it had been administered from a joint headquarters and was composed not only of military personnel but of personnel from the Atomic Energy Commission (AEC) and its varied contractors. Specifically, JTF 132 was organized internally into

a Headquarters and four subordinate task groups--a Scientific Task Group, an Army Task Group, a Navy Task Group, and an Air Force Task Group. The Executive Agent for the Task Force had been the Chief of Staff, U. S. Army (C/S, USA), and Major General P. W. Clarkson, United States Army, had served as the Commander.

IVY, itself, witnessed two large yield detonations--the MIKE device and the KING weapon in that order--and by the time of the KING detonation in mid-November, the broad planning for a subsequent overseas test, to be known as Operation CASTLE, was already seven months advanced. As early as mid-April, 1952, informal knowledge had been received in the Task Force Washington Headquarters indicating that the next overseas test would occur about ten months after the completion of Operation IVY, i. e., on or about 1 September, 1953. This development immediately altered the complexion of IVY roll-up planning and stimulated thought with regard to efficient and economical continuity in Department of Defense (DOD) participation in overseas tests.

Because of the impact on IVY of the proximity of the CASTLE date, CJTF 132 had sent a letter on the matter to the Executive Agent on 12 May. This letter was followed within a few days with a Pentagon briefing of Service and Armed Forces Special Weapons Project (AFSWP) representatives by General Clarkson and his staff operations officer. This letter and the briefing outlined the major factors which would influence the nature of IVY roll-up and noted the implications for CASTLE planning carried by these same factors. At

that time the salient elements of the thinking which seemed to necessitate early and broad consideration of the problem were as follows:

1. The advisability of utilizing for CASTLE the ships, aircraft, and much of the equipment used during IVY which, in turn, would mean saving considerable amounts of effort and money.
2. The early designation of a CASTLE task force commander in order that he could familiarize himself with the problems and processes of IVY roll-up and the relation of these to the planning and mounting of the CASTLE operation.
3. The need for a briefing of the Joint Chiefs of Staff (JCS) so that directives could be promulgated to insure efficient and economical transition from the current Task Force to its successor.

The Pentagon briefing emphasized the importance of the earliest possible action on behalf of broad CASTLE planning. Because the time anticipated at that date to exist between IVY and CASTLE was relatively short, it was important in every sense to begin the planning of Operation CASTLE several months before the completion of IVY. The interim period was to be long enough to demand Task Force redeployment but not long enough to allow complete roll-up as had been characteristic of previous operations. This condition was to make CASTLE preparations unique when compared with those of preceding operations.

Very shortly after this Pentagon meeting, the C/S, USA, as Executive Agent for IVY, placed before the JCS the matters of determining the Executive Agent and of designating a Task Force Commander for CASTLE. At the same time he pointed out that CJTF 132 was desirous of having his successor nominated as soon as possible in order that he could participate in IVY and in the planning of IVY roll-up—thus avoiding a situation where the new commander would be pre-committed to a course of action over which he had had no voice.

JCS policy for overseas atomic tests called for the rotation of the executorship and command of atomic task forces between the three Services. Under this policy, CASTLE would normally have become a Navy responsibility; however, because of the existing plans for an underwater operation, it was felt that the Chief of Naval Operations (CNO) might well prefer the executorship of that operation to CASTLE. For this reason and because of the closeness between the two operational dates, a JCS decision was soon reached to extend the JTF 132 mission to include CASTLE and retain General Clarkson as the Task Force Commander.

Following the JCS decision General Clarkson briefed the Chairman, AEC, and certain AEC staff members on these preliminary plans and decisions relative to CASTLE. In short, the JCS had approved recommendations which would;

1. continue the C/S, USA, as Executive Agent,
2. continue General Clarkson as Task Force Commander,

3. retain the IVY Headquarters and Task Group staffs in being for the planning and execution of CASTLE,
4. designate for CASTLE the ships and aircraft which were already activated and modified for IVY,
5. retain in the forward area appropriate troops and equipment for the short garrison phase, and,
6. return critical personnel and equipment to home stations and custody with a proviso that they be earmarked for CASTLE.

As a result of these JCS decisions great economy in personnel and materiel accrued to the DOD and the initial firm planning of CASTLE was accomplished with a minimum of interruption in IVY progress. As a consequence, the period between June and November, 1952, witnessed few additional major decisions with regard to CASTLE, and IVY roll-up was planned in detail and executed with the best interests of CASTLE in mind. The transition between the two was unusually smooth.

During the summer months prior to movement of the JTF 132 Headquarters to Eniwetok for IVY operations, studies were initiated in order to determine more specifically the nature of military support required for CASTLE. By early August this effort had resulted in the consolidation of findings and the publication of a paper entitled, Report by CJTF 132 to the JCS on Armed Forces Participation in the 1953 Experimental Nuclear and Thermonuclear Tests at Eniwetok - Bikini. Though the complete approval of this paper by the JCS was not feasible until such time as more precise information on the scientific

aspects of CASTLE would be known, a go-ahead for planning purposes was soon forthcoming. Modifications in the stated military support requirements were to be made as late as February, 1953.

One of the basic considerations in early CASTLE planning was the stringent one of insufficient land area for foreseeable future developments. With the advancement into the thermonuclear era, "real estate" at Eniwetok became a cogent consideration. The complete elimination of Elugelab Island at the time of the MIKE detonation more than justified the earlier concern expressed on behalf of this problem. As early as June, 1952, correspondence from Dr. Alvin C. Graves, J-Division leader at Los Alamos and Scientific Deputy to the Task Force Commander, pointed up the necessity for exploring all possibilities of expanding the Pacific Proving Ground (PPG). As the matter was further studied, it also became more and more apparent that expansion for operational and logistical advantages would automatically follow any expansion which might occur for scientific and technical advantages. In August, studies by Dr. Graves and Holmes and Narver, Inc. (H&N), Los Angeles, concurred on the choice of Bikini Atoll as the best site for an auxiliary proving ground. Bikini was close enough to Eniwetok (180 nautical miles to the east) to take advantage of the base facilities there and it did not require evacuation of natives since this had already been accomplished during Operation CROSSROADS in 1946.

Over and above the single matter of "real-estate", certain operational and logistical considerations necessarily were included

in the early thinking with regard to Proving Ground expansion. Because an increased number of high-yield detonations was contemplated for CASTLE, thought was prominent from the beginning with reference to the blast risks to base facilities investment on Eniwetok and radiation risks to personnel. If Eniwetok only were utilized for future high-yield detonations, complete evacuation of personnel and much valuable equipment would be necessary. Such proved to be the case for MIKE shot of IVY when the actual evacuation of Eniwetok required a major and costly Task Force effort at a most critical period. In short, as the study of Proving Ground expansion progressed each successive consideration pointed more and more to the practicability of utilizing Bikini and making CASTLE a two-atoll operation.

On 12 September, Dr. Graves presented to AEC a formal justification for the use of Bikini as a supplement to Eniwetok. AEC, while approving the plan in principle and authorizing an initial survey of the atoll, noted that there were no budgeted funds for the work. With this condition in mind, AEC insisted that planning should envisage simplicity and austerity in facilities and stipulated that there would be no permanent construction at Bikini and that in every instance maximum economy would be exercised.

AEC approval of the use of Bikini for CASTLE became known beforethe end of September and Hon. Gordon Dean, the Chairman of the Commission, had written a letter on the subject to Hon. Robert LeBaron, the Chairman of the Military Liaison Committee (MLC) to AEC. Mr. Dean pointed out all those cogent arguments which had been

brought to light in the progress of studies on the subject during the previous months and requested DOD concurrence and support of CASTLE under these conditions. There remained the matter of securing the concurrence of Commander-in-Chief, Pacific (CINCPAC) and the High Commissioner of the Trust Territory. These were soon forthcoming after certain reservations with respect to the security and logistical implications of expansion were studied at CINCPAC Headquarters and resolved in discussions with JTF 132 representatives.

By the time the addition of Bikini Atoll to the PPG was coordinated and approved, the concept to govern its use was fairly firm. Eniwetok would continue to be the main base of operations and would be the normal site for the relatively low-yield PPG detonations. Bikini would be looked upon as a supplemental site for detonations with anticipated yields sufficient to cause damage to base facilities or create a requirement for Eniwetok evacuation. According to this concept, all facilities at Bikini would be kept to a minimum and would, in all cases, be of a temporary nature.

After the inclusion of Bikini became firm, the difficulties which were inherent to its use began to come to light. Inasmuch as Bikini had not been active as a test site since 1946, it was inevitable that a great deal of preparatory effort would be necessary prior to the establishment of temporary camps. Anticipating an affirmative reaction in Washington to enlargement of the PPG, Santa Fe Operations Office (SFOO) had directed the H&N Project

Engineer to make a reconnaissance of the atoll and a small survey party departed Eniwetok via LST on 15 September 1952 for this purpose. They were joined three days later by other H&N representatives as well as a small number of AEC and JTF 132 personnel. As a result of this initial survey, it was decided that the southern islands from Eniirikku to Airukiiji were best suited for base operations and Eninman Island was determined to be the most desirable campsite.

Shortly after this initial reconnaissance, H&N established Bikini construction requirements and the first echelon of thirty-nine H&N employees landed there on 2 October 1952. In the meantime, AEC approval for use of Bikini had been formally stated and by the first of November ashore facilities had been completed. There had occurred a gradual augmentation of personnel, bringing the total population to 200. Thus, the Bikini construction phase for CASTLE was begun well before the conclusion of IVY and construction of a base camp, a pier and dredged channel, a 4,500-foot airstrip, and a causeway were underway.

Many other requirements had to be satisfied before Bikini could be considered ready for the full-time construction program, however. Rehabilitation of the buoyage system; establishment of a local transportation system between the two atolls; coordination of supply movements; and consideration of security regulations were all problems to be resolved by the various groups at work on CASTLE planning.

As has been indicated, complete roll-up after IVY had not been feasible or desirable. Following the publication of CJTF 132 Op-Order 3-52 between MIKE and KING shots, a progressive redeployment and disposition of forces was initiated and ultimately those military personnel and that military equipment scheduled to remain at Eniwetok were consolidated under the control of the Army Task Group Commander. Civilian personnel and equipment were controlled by the AEC and its contractor, H&N.

Because of the rapid developments occurring in the military aspects of atomic energy, the concept of Operation CASTLE was to be altered many times before the actual tests. Many of the changes in concept occurred during the early period under discussion, both immediately before and after the IVY detonations. Though CASTLE had been planned for the Fall of 1953, perhaps as early as September, it was evident by January, 1953, that the operation would be delayed by as much as six months. Some of the reasons working toward this possible delay were changes in design criteria for the CASTLE weapons and devices; changes in the scheduled availability of certain materials necessary for use in the weapons and devices; and the potential conflict, personnel-wise, with tests which were then scheduled for Nevada during the Fall of 1953.

Early thinking had indicated three shots for CASTLE, possibly four--with the fourth being a device utilizing a new principle which was under development at UCRL. Early in October, 1952, a CASTLE conference was held on Parry Island at which time Brigadier

General K. E. Fields, USA, the Director of the Division of Military Application (DMA)--then visiting Eniwetok--brought the Headquarters up-to-date on current thinking regarding the CASTLE plans. At that time he envisaged four detonations--two of megaton (MT) range and two of kiloton (KT) range with only one of the two MT-range shots scheduled for Bikini. The possibility of having to plan an MT-range detonation at Eniwetok, even if very small, was not considered by the Task Force Headquarters at that time to be practical and this was the first notification of this possibility received by CJTF 132. This turn of events was somewhat counter to Headquarters and Service acceptance of the enlargement of the PPG to include Bikini, and it also would jeopardize the very desirable objective of basing the Air Force Task Group on Eniwetok rather than on Kwajalein as had been necessary in the case of IVY. In view of these considerations, CJTF 132 requested that AEC immediately submit a paper to the DOD explaining the evolving CASTLE concept. Following this meeting, however, IVY was climaxing with the MIKE and KING events and the matter was not given further intensive study for several weeks. By mid-December, a revised concept had already developed and was ready for presentation to the Executive Agent. By this time the Headquarters had been returned to Washington and both General Clarkson and Dr. Graves had briefed AEC on the new changes arising from the laboratory and developmental work which had been going on all during this period. Out of these new briefings the following conclusions were tentatively reached:

1. CASTLE could not commence until early 1954 because of "cogent scientific development reasons."
2. CASTLE would be a six-shot, two-month operation.
3. All detonations would be thermonuclear in nature with four being in the MT-range and with four shots scheduled for detonation at Bikini.

At the same time, a shot plan including anticipated yields and site locations was established to serve as a planning guide. Built into the new concept was a capability for an emergency evacuation of Eniwetok if such should become necessary and the original plan for complete evacuation of Bikini for the shots at that location was retained. The intervals between shots would be of about ten days duration and the first detonation was scheduled for 1 March 1954. Little was anticipated in the way of additional military support requirements other than increased helicopter capabilities and barges for shot-cab platforms; the latter requirement arising from the growing desire to utilize barges anchored close in to shore in the Bikini Lagoon. It was felt that this would avoid excessive waste of land and limit radiation fallout hazards which it was hoped would prove much less when the detonation occurred on a floating barge rather than on land.

By the end of January, 1953, the principal effort of the Task Force Headquarters was directed toward CASTLE planning. The concept was still to undergo much revision and it should be mentioned in passing that during these earlier months the Task Force was charged with

maintaining a capability for a "quickie", one-shot detonation in the Fall of 1953 in the event work on one of the CASTLE weapons progressed to the extent that such was feasible and desirable. This event did not materialize, however, and the Washington phase of planning passed with a minimum of disruption.

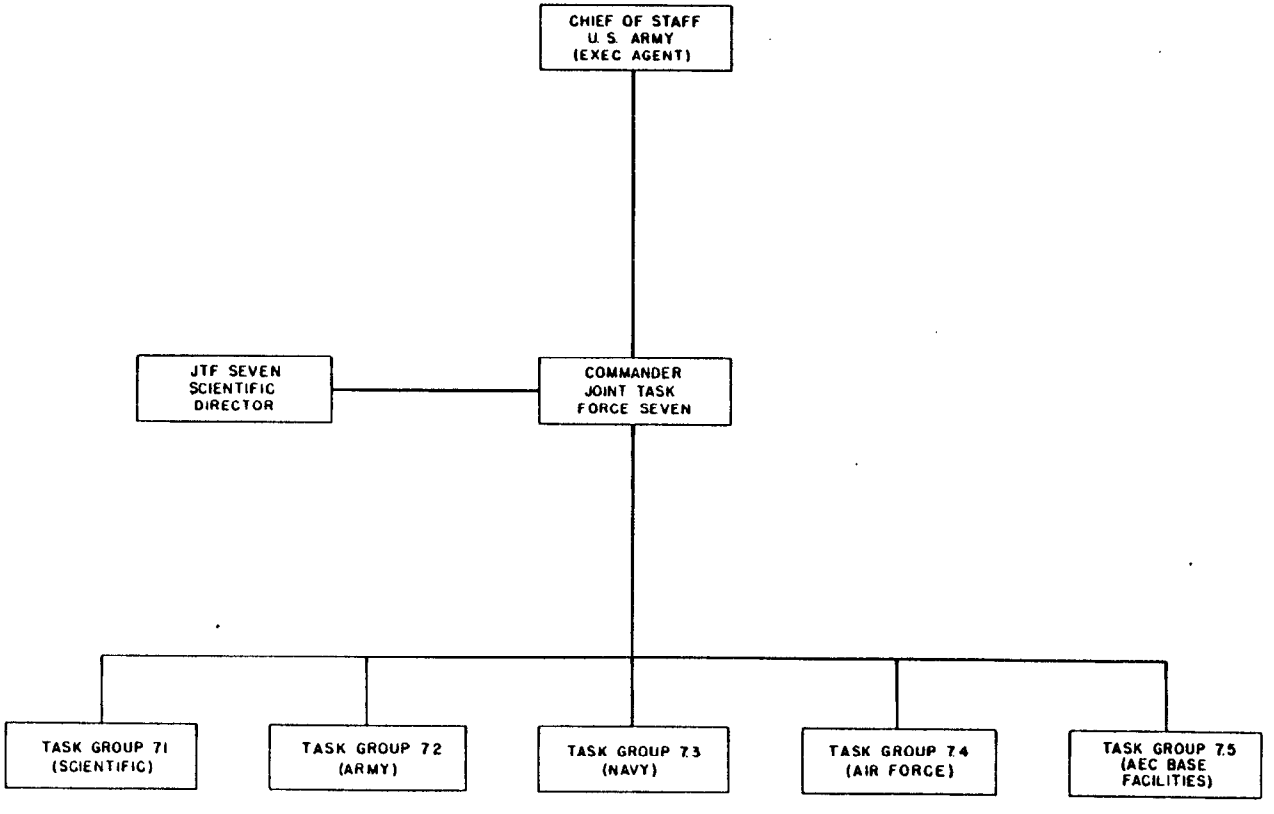
CHAPTER II

PLANNING AT THE TASK FORCE LEVEL

At the conclusion of IVY various JTF 132 groups and elements (with the exception of TG 132.2) were redeployed to their home stations in the United States. Scientific Task Group personnel returned to Los Alamos and to those places where various AEC contractors were located. The Navy Task Group staff returned to Washington and reestablished its headquarters at the Naval Gun Factory, while its boat pool and underwater detection unit returned to San Diego and reported to the Commander, Amphibious Training Command, U. S. Pacific Fleet (COMPHIBTRAPAC) for administration, control, and training during the interim period. All the ships and aircraft which had comprised the Task Group were released with the exception of an LST which remained at Eniwetok under Army Task Group control. The Air Force Task Group returned to Kirtland Air Force Base (AFB) in Albuquerque, New Mexico, where its staff was integrated into the Air Force Special Weapons Center (AFSWC) staff for the interim period. With the exception of six helicopters, fifteen L-13's, and four C-47's retained at Eniwetok, the many Air Force aircraft employed during IVY were released and returned to their parent organizations.

With the release or redeployment of major portions of JTF 132 to the continental United States, essentially completed by the end of 1952, CASTLE planning in detail at both the Task Force and Task Group levels was gotten underway during the early weeks of 1953.

ORGANIZATION FOR OPERATION CASTLE



Organization for Operation CASTLE

Among the first matters taken under consideration were the reorganization of the Army Task Group, the establishment of a new AEC task group, and the rehabilitation of Eniwetok facilities damaged by the typhoon which suddenly struck the atoll at the end of December, 1952.

Reorganization of the Army Task Group had been the matter of study and discussion for several months. Of all the military elements of an atomic joint task force, the Army Task Group is the one which has experienced the greatest continuity of activity at Eniwetok. Since the days of SANDSTONE, at the conclusion of which USARPAC established a small unit of garrison personnel on Eniwetok Island, the Army has garrisoned the atoll. After the completion of GREENHOUSE, a larger force consisting primarily of Army personnel was established for the interim period prior to the next series of tests. This same procedure was again followed at the conclusion of IVY. During these interim periods the Army Task Group fulfills those functions normal to any garrison. In addition to the functions of storage, maintenance of facilities and equipment, communications, and general housekeeping at the forward installation, the Army Task Group is responsible for preserving that local security of the PPG required by the special directives originating from CINCPAC, the area commander charged by JCS with the preservation of the security of the Eniwetok area. Because of these garrison functions and unlike the Task Force Headquarters and the other military task groups, the distinction between

planning and operational phases is not as clear-cut for the Army Task Group.

With the conclusion of IVY and the foreknowledge of CASTLE, the acceleration in the overseas testing program was obvious. Coupled with this development, the role played by the Army Task Group--unique to the rest of the Task Force--made it apparent that the time for reorganization of the Army Task Group into one integral unit had arrived. Prior to this time, the Army Task Group (or garrison force as it generally has been called during interim periods) had been augmented during build-up for actual test operations by special units coming from the Zone of the Interior (ZI) in either temporary duty or detached service status. By the time of IVY roll-up, this procedure clearly was no longer feasible from the standpoints of economy and efficiency, and the readjustment to changed conditions of the basis for Army participation in Eniwetok tests was actively begun. A new Table of Distribution (T/D), under study and preparation in Task Group 132.2 Headquarters for some time, was submitted to the Task Force Headquarters for further study. With the approval and adoption of this new T/D, the 7126th Army Unit (AU) would be established as the single Army unit of the Task Group while the various special units and companies which had been retained for the interim IVY-CASTLE phase would be eliminated paper-wise and absorbed into the Task Group organization. Provisions were made during this period for the redeployment or reassignment of excess personnel and equipment.

After study of the T/D in the Task Force Headquarters and after receipt of reports made by a manpower survey team during late Spring, 1953, a firm Army Task Group T/D was brought into being by midsummer. On Department of the Army (D/A) authority in July, the 516th Military Police (MP) Service Company, the 511th Transportation Company, and the 4th Transportation Truck Company, were inactivated by Task Force orders and their personnel spaces were absorbed into the 7126th AU bulk allotment. Because of the approaching CASTLE build-up phase, the full authorized strength T/D was activated at that time so as to absorb with greater facility the spaces being transferred. At the same time, further studies of a T/D best suited to interim period needs were continued. This important organizational change in the Army Task Group consolidated all Task Group elements into one administrative unit, the 7126th AU, and greatly facilitated the manner in which Army participation in overseas atomic tests would be subsequently administered.

With the successful completion of both Operations GREENHOUSE and IVY, the position of the AEC participants within the Task Force organization had become a matter for review and consideration. Once again, the general acceleration which had occurred in the overall AEC program had made itself felt by enlarging the scope of SFOO operations and by greatly increasing the AEC investment in base facilities at Eniwetok. Until Operation CASTLE, direct AEC-SFOO participation in tests had occurred within

the organizational framework of the scientific task group. The belief in SFOO had grown to be that this status did not exemplify the actual relationships and responsibilities which had come to exist.

The matter of the SFOO position in the CASTLE Task Force organization was brought under discussion during the period between MIKE and KING shots of IVY when a second CASTLE planning conference was held on Parry Island. Participating in the conference were Brigadier General Fields (AEC), CJTF 132, and other senior members of the Task Force. General Fields, offering the AEC view, introduced the subject and General Clarkson indicated that he had no objection to the establishment of a fifth task group to be composed principally of personnel from the Eniwetok Field Office of SFOO if it were determined by AEC that such an organizational scheme was desirable. Certain stipulations were enumerated at the same time, however. No military personnel were to be assigned to the new task group; AEC would continue to be responsible for financial support of the task group and no Task Force military funds would be available; and the Task Force Commander, in the accomplishment of his scientific mission during the on-site phase, would control and direct the Base Facilities Task Group (as it came to be known) along with the Scientific Task Group through his Scientific Deputy. This same position of the CJTF was reiterated in February, 1953, when he stated in a formal letter to DMA, AEC, that, though he was not seeking such an organizational change, he offered no

objection to the new task group provided his stipulations were acceptable to AEC.

Following this February letter, the CJTF was formally advised that AEC desired the inclusion of the fifth task group in the CASTLE Task Force organization and that the conditions stipulated were acceptable to the Commission. As a consequence, Commander, JTF SEVEN (CJTF SEVEN) activated Task Group 7.5 early in March and Mr. James E. Reeves of SFOO was announced as Commander. Very shortly Mr. Reeves assumed command and appointed Mr. Paul W. Spain as his Deputy Commander. Ultimately, the new task group was composed of personnel from SFOO's Eniwetok Field Office; from SFOO's Office of Test Operations; and from Holmes and Narver, Inc., the AEC contractor. By late spring, the detailed organization of the new task group was complete and responsibilities and assigned functions had been published.

The third matter receiving early consideration throughout the Task Force was recovery from the typhoon which struck Eniwetok just after the completion of the Task Force redeployment. At 2320 hours on 28 December, 1952, the Atoll Commander (ATCOM) was alerted by the Eniwetok weather office and informed that there was a possibility of high winds on the morning of 29 December. By 0630 on the morning of the 29th, wind velocity had reached a thirty-four knot reading and swells were reaching a height of six feet. This condition continued to prevail throughout the morning and at 1000 an emergency meeting was called by ATCOM (CTG 132.2), Colonel Robert

H. Cushing, USA. As a result, Typhoon Condition I of the Typhoon and Natural Disaster Plan was set. Condition I was an advanced state of emergency with winds expected to exceed fifty knots.

The remainder of the morning was spent in activities preparatory to the passing of a full typhoon. Classified and RESTRICTED DATA documents and material were stored in a concrete vault; lashings were placed on the water towers; emergency rations were prepared; and sand bags were prepared and placed. By 1420 of that afternoon the LORAN (Long Range Aids to Navigation) Station reported flooding of the generator room necessitating cut-off of the transmitters. In a little more than an hour waves variously estimated to be of thirty to fifty feet in height were breaking over the ocean reef and inundating portions of Eniwetok Island while the winds were being clocked at seventy knots. Shortly afterwards all Eniwetok Island power was shut down. This was the peak of the storm and by 2050 that evening the weather office indicated that the worst had passed. At 0336 on the following morning, 30 December, the normal high tide occurred but there was no further inundation. At 0400 the "all clear" signal was passed.

Following the "all clear" notification, local surveys of Eniwetok and Parry Islands were begun. The damage incurred at Eniwetok Island was much heavier than that at Parry Island. Almost immediately an inspection team, including General Clarkson, proceeded to Eniwetok in order to determine the extent and influence on the CASTLE schedule of the damage sustained. As a result of this

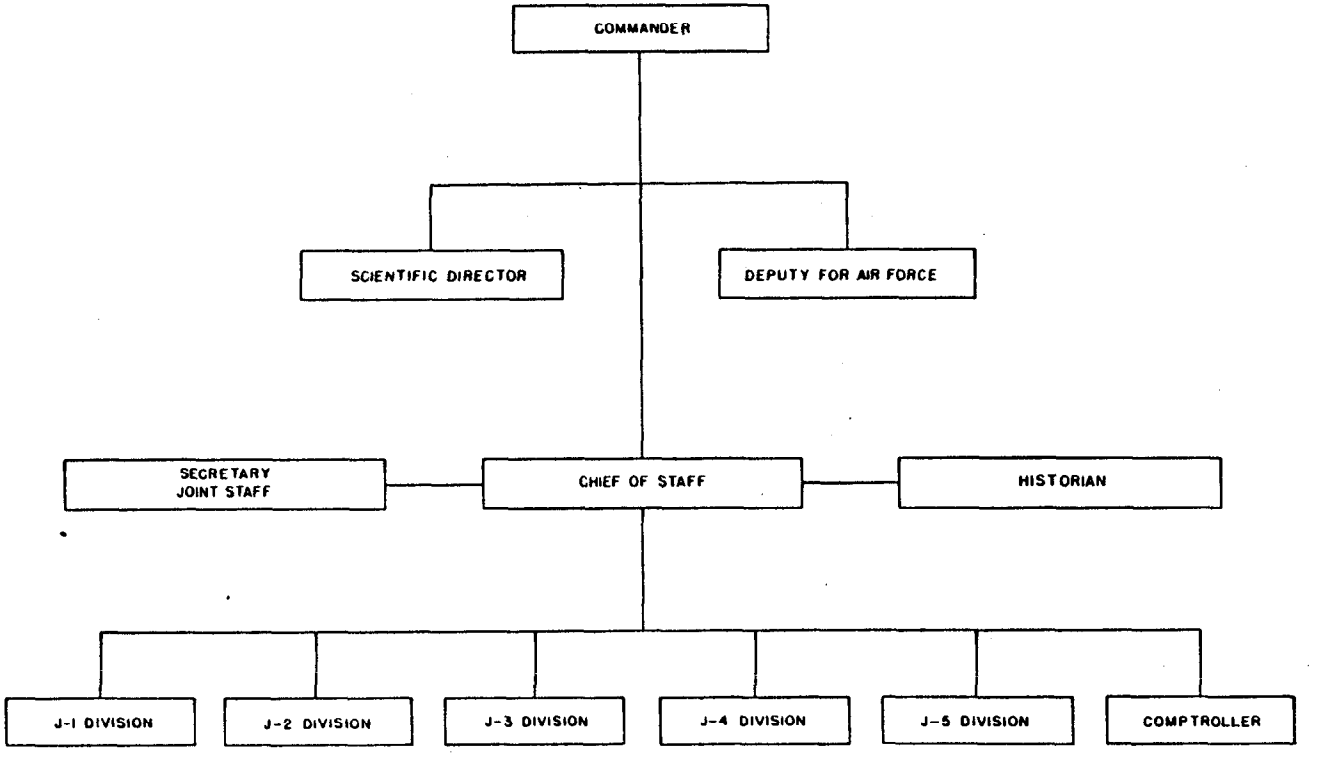
inspection, General Clarkson, in a letter to Mr. Gordon Dean, Chairman, AEC, suggested that repair should be effected as follows:

1. The cargo pier should be placed in serviceable condition at once.
2. A new road would be required to replace the road along the ocean side of the airstrip.
3. A retaining wall should be built in front of the officers' quarters and club located on the ocean side.
4. Clean-up of the island and repair of minor damage should be accomplished as soon as practicable.

In addition to the above, General Clarkson submitted recommendations for other facilities which were required before CASTLE but which were not related to the typhoon damage. These included:

1. Construction of a recreation building on Eniwetok Island.
2. Construction of three warehouses to replace presently unserviceable storage facilities.
3. Provision of six Pacific-type buildings to provide housing for the permanent Eniwetok garrison.
4. Provision of one small Pacific-type building to house the MP headquarters.
5. Rehabilitation of the petroleum, oil, and lubricants (POL) farm.
6. Removal of three small generators from the Parry Island power plant to the Eniwetok Island power plant to satisfy current

HEADQUARTERS, JOINT TASK FORCE SEVEN ORGANIZATION



Headquarters, JTF SEVEN Organization

needs on that island. (This requirement was later satisfied by the installation of a cable from Parry to Eniwetok.)

Some of the recommendations were approved, some were altered and, in general, the longer range aspects of the rehabilitation program were incorporated into the overall five-year plan which had been under development since October, 1953, and which continued to be the matter of planning and discussion throughout Operation CASTLE. Rehabilitation and clean-up on Eniwetok Island were immediately initiated by TG 7.2, with the aid of Holmes and Narver, and proved to be of such magnitude that the project was not completed until December of 1953.

This necessary rehabilitation did not occur without placing a unique handicap upon the normal activities of the Army Task Group. The majority of the man-hours required was necessarily supplied by Army Task Group personnel with a corresponding disruption in the normal pattern of training and operations. This was a particular disadvantage inasmuch as many of the replacement personnel arriving at Eniwetok for duty were lacking in the experience and training necessary for the jobs they were to perform. Though this condition was of a general, military-wide nature, it proved particularly disruptive at Eniwetok at the time because of the necessity for instituting a dual program of rehabilitation along with a minimum training schedule.

In one sense, Typhoon HESTER (as it was named) struck Eniwetok

at a most providential time—just after the conclusion of a vitally important test series. It caused much devastation but it and its after effects were admirably coped with by the permanent personnel at Eniwetok. There were few injuries during the actual storm, the most serious being a broken knee; damage to government property was extensive but repair was not beyond the capability of garrison personnel; and most important of all, the damage and subsequent disruption were not allowed to postpone the accomplishment of the CASTLE mission. The Army Task Group was confronted with a major problem after the passing of the typhoon. Its success in accomplishing the rehabilitation without causing appreciable delays in the overall missions of the Task Group and the Task Force is a credit to the organization and its personnel who performed their special tasks with such dispatch while meeting their regular responsibilities with the maximum efficiency that might be expected.

Simultaneously with the consideration of the three matters just discussed, the various divisions of the Task Force Headquarters were individually pursuing studies of their own distinctive problems. Once reestablished in Washington there had occurred certain upper-level personnel changes. Though the Task Force had been redesignated as Joint Task Force SEVEN (JTF SEVEN) in January, the internal organization of the Headquarters, itself, remained essentially the same as it had been during IVY. General Clarkson was continuing as the Task Force Commander and Dr. Graves as his Scientific Deputy, as well as the Scientific Director for Operation CASTLE.

Major General Eugene McGinley, USA, C/S, Headquarters, JTF SEVEN

The unexpected death in the spring of Brigadier General Walk, the Chief of Staff, made necessary the assignment of a new Chief of Staff. This position was filled in the summer by Major General E. McGinley, USA. Captain James R. Pahl, USN, and Colonel Murray A. Bywater, USAF, remained with the Headquarters to serve respectively as the Deputies for Navy and Air Force while Captain W. L. Knickerbocker, USN, continued as the Assistant Chief of Staff (ACofS) for the Logistics Division (J-4). Other ACofS positions were filled by new personnel—the Personnel Division (J-1) by Colonel Robert H. Cushing, Artillery, USA; the Security and Intelligence Division (J-2) by Colonel Samuel P. Walker, Armor, USA; the Operations Division (J-3) by Colonel William S. Cowart, Jr., USAF; the Communications Division (J-5) by Colonel Francis C. Bowen, Signal Corps, USA; and the Comptroller Division by Colonel Robert C. Davie, Finance Corps, USA. Later, during the on-site operations phase, Rear Admiral H. C. Bruton, USN, the Navy Task Group Commander, served also as the Deputy for Navy thus filling the position which had been vacant since the middle of the summer as a result of the reassignment of Captain Pahl.

An overseas test requires much in the way of military support, the estimates for which must be determined as far in advance of forward area operations as possible and must include flexibility so as to cope with additions and changes which inevitably occur. These estimates are incorporated in a study for the consideration and approval of the JCS. The preparation of this study is primarily

Rear Admiral Henry C. Bruton, U S Navy, Deputy Commander Navy and Commander, Task Group 7.3

Colonel Murray A. Bywater, USAF
Deputy Commander, Air

the responsibility of the Operations Division and the Logistics Division. This was greatly simplified for CASTLE because of the experience gained during IVY planning and execution. Close coordination with scientific personnel is vital. Through such coordination the J-3 Division planners are able to formulate a general concept of operations. The next step is to determine what type of personnel, ships, and aircraft are required. Estimates of requirements are tabulated in draft form and circulated throughout the Task Force and the various Service and AEC organizations which will be affected—e. g., Military Air Transportation Service (MATS) Headquarters, CINCPAC, SFOO, etc., for comments and suggestions. Thus most of the exceptions taken to the plans are overcome as a result of the coordination and consequent discussions with the various interested parties. A paper is then finalized for formal submission to JCS. By the time the paper goes to JCS there remains little change to be accomplished other than that desired by the JCS. At the same time, the Task Force Commander requests authority to approach the three Services separately and directly for changing or procuring any additional support in the event changes in concept warrant such action. In the event modification to plans becomes greater than anticipated, a second report to the JCS may become desirable as was the case during CASTLE when a "letter report" on modifications was forwarded to JCS in February, 1953, some seven months subsequent to the submission of the original CASTLE paper on military support.

Colonel R. H. Cushing, USA
ACofS, J-1, HQ, JTF SEVEN

Colonel S. P. Walker, USA
ACofS, J-2, HQ, JTF SEVEN

Colonel W. S. Cowart, Jr., USAF
ACofS, J-3, HQ, JTF SEVEN

Captain W. L. Knickerbocker, USN
ACofS, J-4, HQ, JTF SEVEN

Colonel F. C. Bowen, USA
ACofS, J-5, HQ, JTF SEVEN

Colonel R. C. Davie, USA
ACofS, COMPT, HQ, JTF SEVEN

The procedure for preparing the report to the JCS, narrated above, proves to be the quickest and most practical means of coping with the general problem of laying on firm requirements for military support. It should be mentioned again in passing, however, that the proximity of the original CASTLE date to IVY facilitated--to a degree which normally cannot be expected--an early determination of the nature of CASTLE military support requirements; and, as a consequence, IVY roll-up and redeployment were planned with these requirements in mind. Fortunately, this early determination remained basically sound despite the several changes in scientific concept which occurred. Even so, as plans progressed and as new test projects were incorporated into the scientific program, minor adjustments with respect to numbers and types of personnel, vessels, and aircraft had to be made from time to time. Because these adjustments were requested only after thorough study and justification, the Task Force enjoyed exceptional cooperation from those commands providing the needed resources.

Aside from the general problem of estimating and then insuring the efficient utilization of the resources made available to the Joint Task Force, the Operations Division is confronted with numerous other matters which must be resolved in coordination with the task groups, with the other Headquarters divisions, and with the various other organizations. Typical of these tasks are the negotiation and coordination required to plan effective cloud sampling; the determination of ship and aircraft modification for

special scientific missions; the determination of how and when nuclear components will be transported to the forward area; ascertaining the scope of the official observer program; and determining requirements for sample return. Each of these matters is directly connected with and influences military support and requires continuous monitoring and coordination from the Operations Division.

In addition to these matters, there are two other very significant areas of planning and operations which are given great attention in the Technical Branch of the J-3 Division. These are meteorology and radiological safety. They are treated with some detail elsewhere in the History. (See Appendicies A and B).

Closely interwoven with the problems falling upon the J-3 Division were those encountered by the Logistics Division (J-4). The two major areas of concern of this division traditionally are (1) the supply and service functions for the Task Force and (2) the transportation of persons and things to and from and within the forward area. In general there arose during CASTLE planning no problems which did not find resolution. Logistical channels and supply lines were firmly established as a result of the cumulative experience from previous operations and most of the J-4 planning had grown to be considered routine.

Typical of the supply and service activities of the J-4 Division was the procurement of such major items as vehicles and spare parts; additional reefers to meet needs which would arise due to the basing of the Air Force Task Group on Eniwetok Island rather than at Kwaj-

alein; miscellaneous radiac and radiological safety equipment; barges for mounting some of the devices; procurement of asphalt emulsion for resurfacing work on the airstrip; additional warehousing to meet Air Force Task Group needs; many unusual items of communications equipment; and materials for overhauling and planting additional navigational aids at both Eniwetok and Bikini.

The procurement of all this material was accomplished without great difficulty. The procurement of CASTLE vehicles, however, does illustrate very well the day-to-day perplexities confronting the J-4 Division. At the conclusion of IVY the Department of the Army determined that all WW II vehicles at Eniwetok would be transferred to the Far East Command (FECOM) and be replaced at Eniwetok with the new "M" series vehicles. Though an initial estimate of CASTLE vehicle requirements was submitted for planning purposes to the D/A in January, 1953, it was not until the late Summer of 1953 that all task groups had been able to submit firm estimates of their respective requirements. Inasmuch as the J-4 Division was obligated to hold to a minimum the number of vehicles to be shipped to Eniwetok and arrange for shipment of a six-months supply of spare parts for field maintenance, the late submission of firm estimates prevented the meeting of deadlines in all cases. As a result of this experience, it was concluded in the division that firm vehicle requirements should be made known at least nine months prior to the date required on-site and that a cut-off date should be established for all task groups in the submission of

requirements for major supply items which they could not obtain through their own supply sources. For the more normal supply items, experience has proven that a minimum order-shipping time of 120 days must be established for delivery to the port for shipment to the forward area.

The difficulties encountered by the Transportation Branch of J-4 Division were also typical of those experienced in prior operations. Two of the major problems are worthy of mention. The first is the matter of loading and discharging cargo and the second is the matter of phasing airlift.

Out-sized equipment, particularly vans and trailers for special scientific use, is common to the shipping requirements of the Task Force. Because of this, not all Military Sea Transportation Service (MSTS) vessels are adequate for Task Force needs, especially if below-deck storage is a governing factor. There are no docking facilities for ships at Eniwetok and cargo always must be lightered ashore. For this reason, the question of adequate shipboard heavy-lift gear is always important, especially if the cargo is out-sized. Generally, the entire matter of planning cargo shipment requires the very closest monitoring and detailed coordination throughout the Task Force and with the shipping agencies concerned. Also, by insuring that unusual or out-sized items of cargo carry built-in sling pads or lifting rings much of the cargo handling difficulty can be dissipated.

Actual discharge of cargo in the forward area oftentimes posed

problems which delayed schedules. Rough water, particularly at Bikini, slowed discharge; this condition could not be overcome and had to be accepted. The fact that CASTLE was a two-atoll operation also introduced problems which had not been encountered previously. Close attention to ship routing followed with a corresponding loading plan eased the problems of off-loadings whether first at Eniwetok and last at Bikini or vice versa. The provision of additional and adequately trained stevedore personnel at Bikini and placing ship-discharge in the Eniwetok-Bikini area under the authority of a single military port command are steps indicated as desirable by CASTLE experience.

As in previous operations, it was extremely difficult for task groups to accurately estimate air movement requirements for any given operating month. Despite the endeavor to produce realistic requirements both under and over-generation frequently occurred. Failure to generate traffic resulted in lost airlift capability and created unrealistic under-commitment of aircraft. Over-generation of traffic resulted in necessary action by the Executive Agent that deprived other users of their own allocations in order to meet the unallocated but high priority requirements of the Task Force. Only by the most careful scrutiny and continuous monitoring can the handling of this problem be improved upon; and, because of its significance the matter should be given high priority consideration in the Task Force Headquarters.

For Operation CASTLE the organization of the Headquarters

Comptroller Division remained substantially unchanged. With the exception of certain minor revisions in the AEC-DOD agreement, the criteria governing fiscal support of overseas tests were retained substantially as used during IVY. There occurred, however, changes in the mechanics of allocating certain Task Force funds which should be pointed out. In previous operations, the Task Force Headquarters had administered Research and Development (R&D) funds along with the extra-military funds needed to meet Task Force funding requirements. Inasmuch as DOD scientific participation in CASTLE was to be more extensive than in IVY, the entire matter of the AFSWP position in the JTF SEVEN organization came under consideration early in 1953. AFSWP traditionally has been the responsible agency for the preliminary budgeting for joint task forces. After much discussion, it was agreed that R&D funds would be allotted to using agencies by AFSWP rather than by the Task Force Headquarters. AFSWP, during the discussions, also proposed to administer the extra-military funds to be utilized by the Task Force, receiving such funds from the Department of the Army and then allotting to the Task Force. This plan proved incompatible with command relationships and with the respective missions of the parties concerned, however; and the extra-military funds originally scheduled for JTF SEVEN were withdrawn from AFSWP to be subsequently allocated to the Task Force by the Department of the Army in accordance with a concept arrived at in the DOD Comptroller's office after JTF SEVEN became a permanent organization.

No unresolved fiscal problems arose during Operation CASTLE. Certain of the financial operations may be resolved into problem areas for the purpose of discussion, however. Perhaps the single most important matter confronting the Comptroller Division was the one associated with securing authorization for funds needed for new construction and rehabilitation on Eniwetok Island. In addition to Typhoon HESTER damage, elsewhere described in this Chapter, this problem was affected by the decision to base the Air Force Task Group at Eniwetok. For tactical and administrative reasons, it was felt from the beginning that the Air Force Task Group should participate from Eniwetok. This had not been possible during IVY, but was a vital planning goal of the early consideration given to CASTLE. By March, 1953, the matter had been thoroughly studied and a survey of Eniwetok airbase facilities was initiated in order to determine what minimum improvements would be necessary. As a result of this survey improvements and repairs were recommended which would run to a total of one of two cost figures depending on whether improvements were to be made with a view toward long-range or short-range use. For the former the cost was estimated at $1,412,000 and for the latter the estimate was $938,000. Major items included in these estimates were extension and reinforcement of airstrip aprons, taxiways, and turnaround areas; improvement of runway pavement; and improvement of POL facilities.

The report of this survey was passed to AEC for consideration and implementation of the recommendations since construction of

such permanent facilities was the responsibility of AEC in accordance with the basic agreement between AEC and DOD on responsibilities at the PPG. AEC was unable, however, to fund all the improvements and associated work recommended. After conferences with Task Force representatives it was concluded that only a minimum of the long-range projects would be carried out.

Concurrently studies had been progressing on other facilities needed at Eniwetok Island for CASTLE operations. Among these were:

1. Erection of twenty new prefab buildings for warehousing and repair shops and the like and the dismantling and removal from Kwajalein to Eniwetok and re-erection of twenty prefab buildings which had been used by the Air Force Task Group during IVY, all at an estimated cost of $175,000.
2. Enlargement of signal facilities to provide space for an automatic dial telephone system and for larger cryptographic facilities at a total cost of $36,500.
3. Additional airfield improvements including parachute drying tower; concrete floor in the B-50 hangar; and rehabilitation of certain existing buildings, all at a cost of $139,000.
4. Warehouses, power cables from Parry Island, alterations to buildings, improvement of POL areas, and new barracks, at estimated costs amounting to $2,152,000.

After Task Force and AEC evaluation of the above projects on a "relative urgency basis in terms of available funds" it was

determined that AEC could fund the airfield improvements in the amount of $794,400 plus an additional amount which would be available for warehousing, power cables from Parry Island, new barracks, and the like. At the same time, AEC requested that the Task Force seek authority to utilize operational funds for the first three groups of projects listed above. This request was made on the grounds that they were of primary interest to the military and that AEC funds were not sufficient to cover their cost. This was agreed to by the Task Force and approval of the Secretary of Defense was obtained on 22 August 1953 to use $354,595 to carry out the work. Though this work began very shortly, it would have been a great advantage if the entire matter had been dealt with and settled at an earlier date.

A similar and allied problem arose later in CASTLE when it was realized that the erosion which had occurred on the lagoon side of Eniwetok Island during Typhoon HESTER was continuing through the ensuing year to such a degree that roadways, building foundations, and several other facilities were being greatly jeopardized. It became evident toward the end of 1953 that the only effective action for this condition would be provision of a 9,000-foot, concrete seawall. Once again, it was considered that this would be an AEC responsibility; and, once again, funds were not available without the sacrifice of other essential work. Continuing erosion became the matter of such urgency by early 1954 that in March, 1954, CJTF SEVEN approved the use of $210,000 of Task Force operational funds

for repairing and protecting the lagoon road. The project was thus one of maintenance rather than one of construction and Holmes and Narver began actual work several weeks prior to the conclusion of CASTLE.

Other fiscal matters considered in the Comptroller Division and resolved during CASTLE planning and on-site operations included the matter of MSTS ship rentals; the financial support of documentary film coverage of the Operation; and POL funding. This latter subject is of interest and reflects the manner in which operational changes bring about changes of funding responsibilities. During the early phase of CASTLE, procurement of POL products was financed in the same manner as in IVY. Commander, Service Force, U. S. Pacific Fleet (COMSERVPAC) delivered POL supplies to CTG 7.2 who was responsible for the operation of the tank farm on Eniwetok Island. CTG 7.2 was provided with Army funds with which to reimburse COMSERVPAC and he in turn obtained reimbursement to the Army from the Air Force for POL supplies consumed by Air Force activities. With CASTLE Air Force participation occurring from Eniwetok, Air Force requirements became the major ones and the Army Task Group found itself projected into the middle of what was essentially an Air Force and Navy transaction. In addition the Army Task Group was providing the paper work, providing and training personnel to operate the tank farm, and bearing the handling and evaporation losses of POL products. As a result of conferences at Departmental levels, it was decided that the Department of the Air Force would, on

1 July 1954, assume responsibility for the funding of all aviation type POL supplies required at Eniwetok. All other POL products would be financed from Task Force operational funds and in implementing its part of the arrangement the Air Force would establish an Air Force stock fund type of accounting.

The remaining Headquarters divisions were occupied during the planning phase by more specialized problems. The biggest of these confronting the J-1 Division was the matter of procuring and phasing military personnel for the Task Force Headquarters and for Task Groups 7.1 and 7.2. Because of the nature of the Task Force, the ACofS, J-1, and his assistants must be familiar with the personnel policies of the three military Services. With such an understanding, the J-1 Division is in a better position to know what currently may be expected in the way of filling specialized spaces and can act accordingly. Availability of qualified personnel varies from time to time and in many instances prompt decisions to accept personnel not considered completely qualified are advantageous to the Task Force. The maintenance of amicable relations with the personnel divisions of the three Services as well as giving due consideration to their problems in filling requisitions is important to establishing a working basis for the almost continuous negotiations which must be pursued by the Task Force.

Associated with the general problems attendant to CASTLE personnel procurement were, as previously pointed out, the ones of establishing Army Task Group T/D's in connection with the reorganization

of that Task Group and of procuring qualified replacements for the hard-pressed garrison force. Normal and emergency requisitions had been processed to the D/A in January and February just after Typhoon HESTER. Only a trickle of replacements resulted, however, and they were mainly in the grades of E-2 and E-3. The general shortage of skilled and experienced personnel throughout the military Services and the high priority given to replacements for FECOM had a great bearing upon the situation. By the Summer of 1953, the condition became more favorable though the balance of the non-commissioned officers (NCO's) never even closely approached the number authorized.

As a result of the spring decision of the Secretary of Defense to reduce surplus military manpower in the three Services, a joint Manpower Survey Board was appointed under the monitorship of G-1, D/A, to study JTF SEVEN with a view to establishing interim Task Force Headquarters and Task Group T/D's. Also, a manpower ceiling and uniform proportional reduction in operational T/D's was to be accomplished for each of the military Services as represented in the Task Force. The Board commenced its activities on 1 June 1953 and worked in Washington, in Los Alamos, in Albuquerque, and at Eniwetok. A report, carrying the general concurrence of CJTF SEVEN, was forwarded to G-1 for approval. New interim Task Force T/D's were thus established and though it was believed by the Task Force that they were austere they were considered workable.

By the time work on the interim T/D's was completed, the per-

iod of build-up was in its initial phase and the operational T/D's were placed into effect. The J-1 Division continued to fill remaining vacancies and it appeared that the operational T/D's were adequate except for military police, radiological safety personnel, and signal personnel. Arrangements were made to have assigned twenty-five additional MP's, fifty Army and Navy radsafe-trained personnel, and several Signal Corps specialists to serve on a temporary duty (TDY) basis in the forward area during the operational phase. This illustrates a peculiar personnel problem which regularly confronts the Task Force—that is, the recurring requirements for relatively short periods of time of highly qualified and security cleared personnel.

Planning in the J-2 Division occurred alongside the very large effort required for the paper work connected with personnel clearances. Though this work continues throughout an entire operation, the heaviest period for CASTLE occurred during the latter half of 1953 and then progressively fell off as the operational period approached. The mass of detail and the actual working hours consumed in the personnel security program must not be underestimated as it constitutes a very significant aspect of J-2 Division activity.

The J-2 planning for CASTLE--as for previous operations--had to be extensive and detailed, attempting to foresee every possibility for a compromise of the overall mission. The prevention of such compromise is a major problem for the Task Force. Existing regulations establish a security standard which is virtually

impossible of attainment because of the widespread press speculation regarding AEC and Task Force activities. Coupled with this almost continuous speculation are the facts that mail censorship is not imposed on Task Force personnel and, as the operational period approaches, the frequent, heavy movements of personnel to the forward area are virtually impossible to conceal.

Planning also had to envisage the possibility of intentional or unintentional security violations, either internal or external. Inasmuch as the physical execution of the security mission in the forward area fell to the task groups, particularly Task Groups 7.2, 7.3, and 7.5, planning was accomplished in conjunction with these groups and with a view toward the best utilization of the facilities and personnel of these groups which would be available in the forward area. As past experience had reduced the matter almost to one of routine, no significant problems arose in this connection.

In order to achieve the maximum of security within the Task Force, a detailed program of personnel indoctrination was planned from the beginning and implemented under the personal direction of the CJTF. A basic criterion adopted in the beginning was that the individual assigned to the Task Force was the key to security. Because he had received clearance, it could not be assumed that he was no longer vulnerable as a potential source for the release, intentional or unintentional, of valuable information either through correspondence or by careless conversation. With this criterion, the problem became a matter of impressing upon each of some 10,000

persons the stringent security responsibilities falling upon each Task Force member. Toward the accomplishment of this end, a highly successful program was devised. Each member of the Task Force was required to take an open-book, written examination which was based on JTF SEVEN Security Memorandum Number 2 entitled Basic Security Responsibility. The memorandum dealt, in detail, with the general principles of security and each individual was required to achieve a perfect score on his examination, even if this meant taking the test more than one time.

In addition to this test, all Task Force personnel whose regular duties would require them to handle classified material were required to take a second examination in the same manner as the one just described. This test was based on JTF SEVEN Security Memorandum Number 3 entitled Safeguarding Classified Information. This memorandum dealt specifically with the established procedures for the safeguarding of classified material.

In addition to these examinations, the security program included the dissemination, through task group commanders, of the official AEC-DOD releases with directives to periodically caution all personnel that only such officially released information could be mentioned in their correspondence.

An effective poster program was also instituted to remind individuals of their security responsibilities. The fifty-six different kinds of colored posters emphasized the various general security principles included in the security memoranda. Security

officers were instructed to place these posters in conspicuous places and a sufficient number of these posters was reproduced to permit a change of display once every two weeks.

Another aspect of the "security-consciousness" program was the utilization in the forward area of short movie briefs which were shown from time-to-time at all theaters just prior to the evening feature. These movies were produced by Lookout Mountain Laboratory and the U. S. Naval Photographic Center and each depicted a senior Task Force member giving a short talk on individual responsibility for security. Another special movie was produced in the forward area in which the CJTF re-emphasized security precautions and this was shown once at each theater and on each ship just prior to the first of the shot series. In addition to these films, a second group of ten, produced by Lookout Mountain Laboratory in the ZI, was designed for more frequent showing and was devoted to depicting various ways in which an individual might inadvertently cause a breach of security. A last group of films, also produced by Lookout Mountain Laboratory in the ZI, dealt with questions and answers similar to those included in the examinations on Security Memoranda Numbers 2 and 3.

Perhaps the single most difficult security problem to occur during CASTLE was the recurrent one of "Q" clearances. The time interval between submission of initial papers on an individual and the conclusion of the necessary investigation prior to granting clearance was such that personnel would oftentimes arrive at their

new Task Force duty stations several weeks prior to definitive action on clearance. This would result in time lost not only for the individual but also for the agency concerned. The only solution to this well-known and recurrent problem involves the initiation of clearance action as far in advance of actual reporting as possible and the most expeditious handling of clearance papers by all agencies concerned.

The J-5 Division of the Headquarters had the responsibility of planning the necessary communications for the Operation and in general the two most important factors here were equipment and personnel. It was necessary to determine what equipment would be necessary properly to support CASTLE and find competent personnel to operate that equipment. A study of the major communication deficiencies which occurred during Operation IVY served as an excellent guide for CASTLE planning and resulted in many improvements over the IVY procedures and systems. A more detailed account of communications planning is included as Appendix C.

CHAPTER III

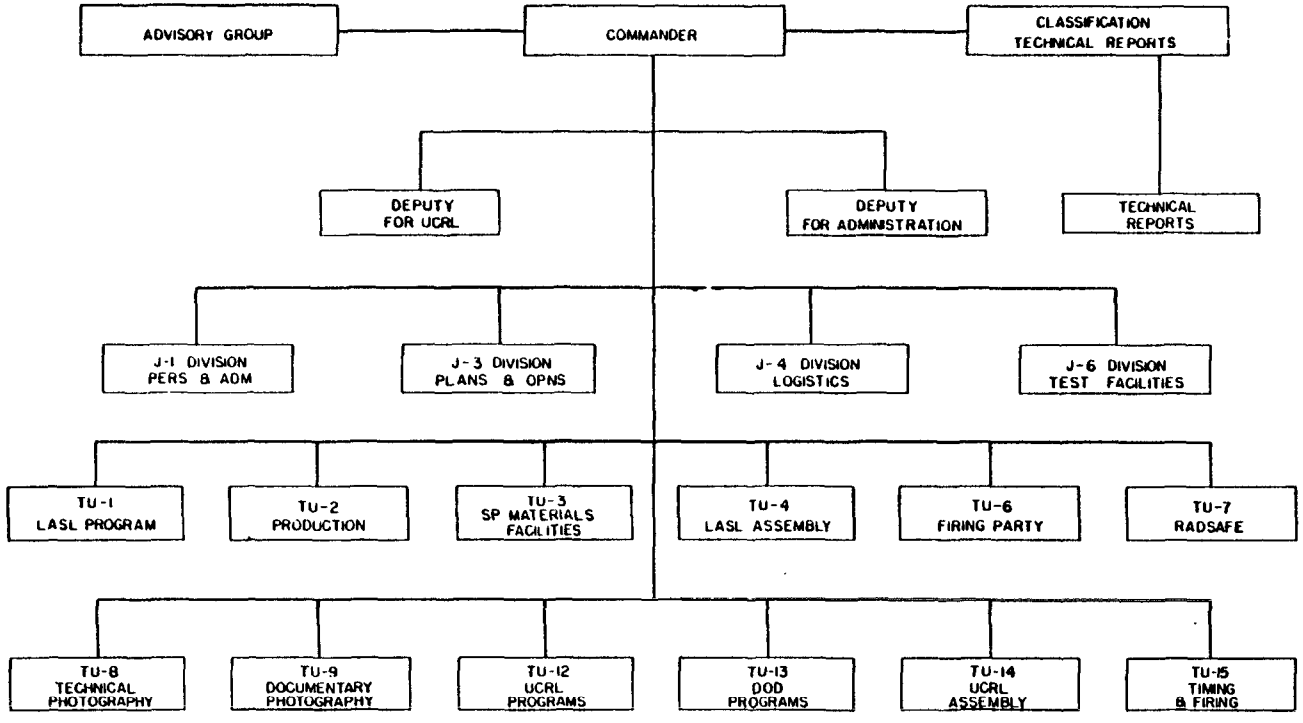
PLANNING AT THE TASK GROUP LEVEL

During the early months of 1953, planning also was gotten underway in the various task group headquarters. As with the Task Force Headquarters there was a sufficient amount of accumulated experience from previous operations to obviate the rise of problems which did not find resolution in one manner or another. For the sake of the record, however, a short account of the more significant developments within each of the task groups is included here.

Scientific Task Group

Concurrent with the redesignation of JTF 132 as JTF SEVEN and the redesignation of Task Group 132.1 as Task Group 7.1, certain organizational changes in the Scientific Task Group occurred. On 29 January 1953, Dr. William E. Ogle became the Commander of the Scientific Task Group, replacing Mr. S. W. Burris who was terminating his association with the Los Alamos Scientific Laboratory (LASL). During IVY, Dr. Ogle had been CTU 1 of Task Group 132.1 as well as the Scientific Deputy to the Task Group Commander. Because of his long experience with the scientific aspects of Eniwetok tests as well as his association with previous scientific task groups, the designation of Dr. Ogle was most appropriate. At the time of his assumption of command, the positions of Scientific Deputy, Chief of Staff, and all Assistant Chiefs of Staff were eliminated from the task group organizational scheme. In their place, the position of Deputy for Administration was established. This shift allowed,

TASK GROUP 7.1
SCIENTIFIC
ORGANIZATION



Task Group 7.1 Organization

direct access to the Task Group Commander from the various task units.

Because of the formation of a fifth task group certain other organizational changes were planned and went into effect when Task Group 7.5 was established. The Test Facilities Task Unit, with an altered mission, became the Staff J-6 Division. The Staff J-2 Division was eliminated and the reduced but necessary functions remaining were transferred to the new J-1 Division position of Security Liaison Officer. Likewise, it was possible to eliminate entirely the Base Facilities Task Unit from the Scientific Task Group organization.

Also new to Scientific Task Group organization was the inclusion in the task group of personnel from UCRL. Integration of UCRL interests into Task Group 7.1 was accomplished with the view in mind that subsequent to CASTLE, UCRL would be in a position to conduct overseas operations independently of LASL. For CASTLE, UCRL was scheduled to have responsibility for the design, fabrication, and assembly of two devices and for certain diagnostic experiments associated with these shots as well as other diagnostic experiments connected with LASL shots.

The only other significant organizational change was in the manner in which the scientific programs were to be administered. In IVY, all scientific programs had fallen into and under the control of one task unit. For Operation CASTLE, LASL, UCRL, and DOD scientific programs were given separate status and became the responsibility of Task Units 1, 12, and 13 respectively.

The tasks assigned to Task Group 7.1 for accomplishment in support of the CASTLE mission were formulated throughout 1953 and were outlined in CJTF SEVEN Operation Plan No. 3-53 as follows:

1. Position, arm, and detonate the CASTLE weapons and devices.
2. Conduct technical and measurement programs.
3. Complete the installation and calibration of the devices and all instruments and test apparatus.
4. Recommend to CJTF SEVEN safe slant range distances from ground zero for aircraft during shot periods.
5. Conduct the radiological safety program.
6. Provide technical and technical report film coverage.
7. Schedule the inter-atoll movement of weapons and devices and provide required technical assistance to other task groups in connection with their responsibilities for such movements.
8. Be responsible for the removal of all Task Group 7.1 personnel and necessary equipment from shot site danger areas.
9. When directed by CJTF SEVEN, evacuate Task Group 7.1 personnel from Bikini Atoll.
10. Be prepared, upon receipt of directives from CJTF SEVEN, to conduct emergency post-shot evacuation of Task Group 7.1 personnel from Eniwetok Atoll.
11. Keep CJTF SEVEN informed on test and technical developments affecting the operational plan and military support

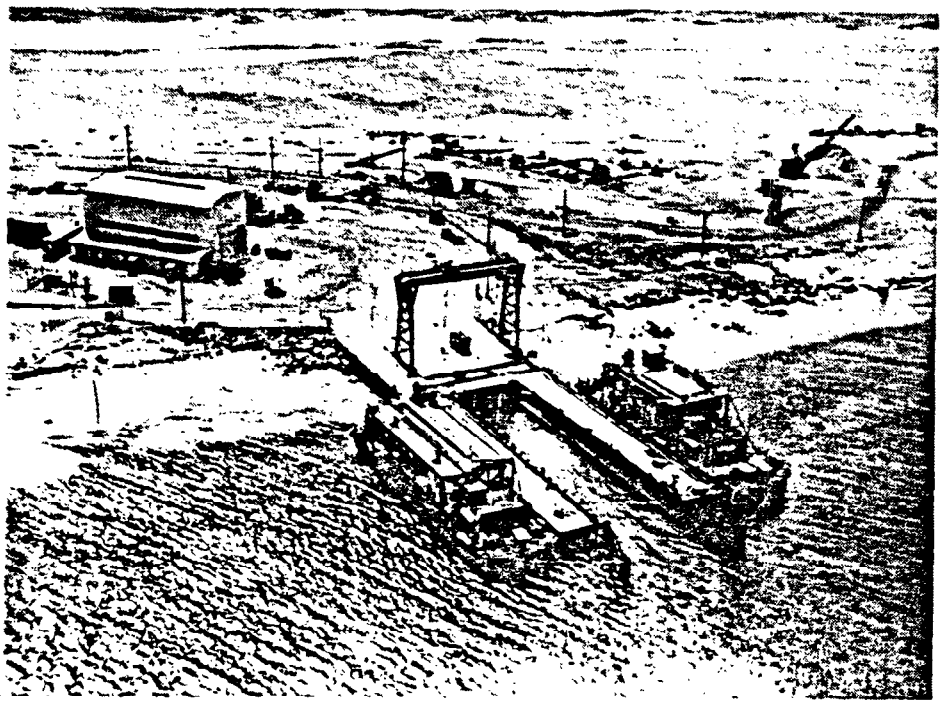
requirements therefor.

12. Prepare appropriate technical reports at the conclusion of each shot and at the conclusion of the overall operation.

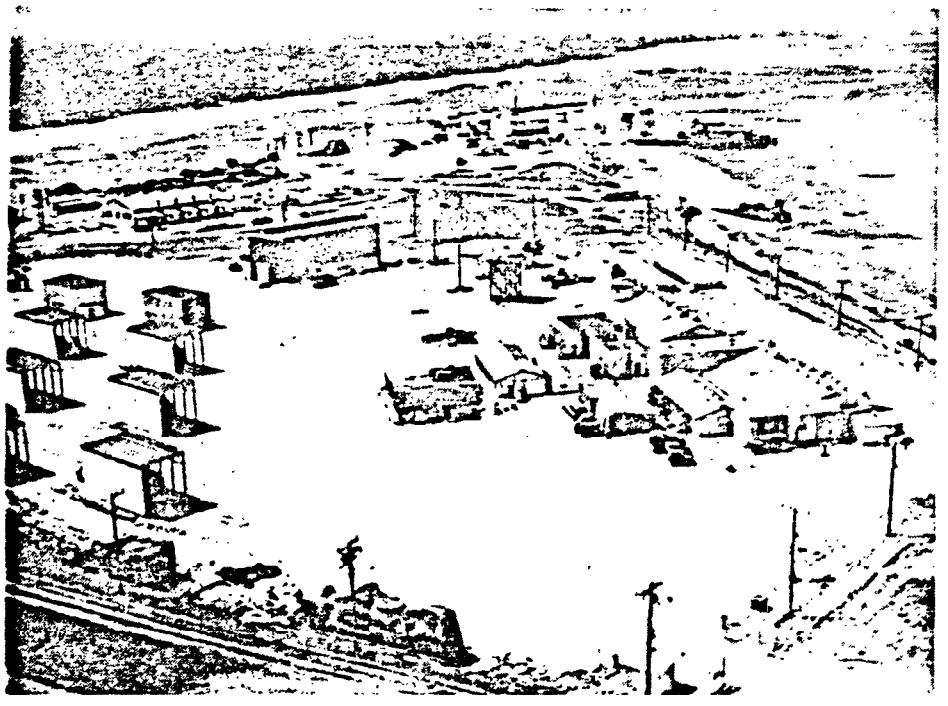
13. Provide CJTF SEVEN with statements of preliminary test results at H/1, H/12, and H/72 hours.

In order to accommodate the scientific concept of CASTLE to an operational focus, intensive operational planning was gotten underway at Los Alamos early in 1953. The general pattern of the scientific concept had been established by the first of February. A six-shot schedule was visualized at that time and it was to be changed very little during the next few weeks. By early April, however, a general concept carrying a revised schedule was published. This schedule was the end result of a lengthy series of conferences and extensive planning throughout February and March. It established dates and site locations for six detonations.

As has been indicated in Chapter I, a so-called "quick-and-dirty" shot capability was planned for the Fall of 1953 and though task group planning progressed during the period under discussion with this possibility in mind, the shot did not materialize. Another shot which was considered but not included in final plans was a surface shot over deep water. Toward the end of March, 1953, a message from AFSWP to CTG 7.1 stated that DOD could commit $300,000 for such a shot. By late May, however, the plan had to be abandoned because the yield of the device to be used was calculated to be too high for reasonable expectation of success in underwater pressure



Barge Slip and Assembly Area
Parry Island, Eniwetok Atoll



Cryogenics Plant, Assembly Area, and Barge Slip
Parry Island, Eniwetok Atoll

measurements.

The shot schedule which was established before the end of April remained relatively unchanged until October, 1953, when the final schedule became firm. This revised October schedule called for seven shots tc be detonated beginning on 1 March 1954 and was as follows:

SEQUENCE	LAB	DEVICE	LOCATION	DATE	ESTIMATED YIELD
1	LASL	SHOT 1	BIKINI--On reef 2,950 feet, bearing 250°T from SW tip of Namu.	1 Mar	6 MT
	LASL	SHOT 4	BIKINI--(Barge) Intersection of arcs with radii of 6,900 feet from Yurochi and three (3) statute miles from Aomoen.	11 Mar	3-4 MT
	LASL		BIKINI--(Barge) UNION crater.	22 Mar	
	UCRL		ENIWETOK--Eberiru Island.	29 Mar	
	LASL	SHOT 6	BIKINI--(Barge) UNION crater.	5 Apr	1.8 MT
	LASL	SHOT 2	BIKINI--(Barge) UNION crater.	15 Apr	4 MT
	UCRL	SHOT 3	BIKINI--Eninman Island.	22 Apr	1 MT

In addition to the details of the shot schedule, planning between February and June was devoted to the objective of arriving at feasible interpretations of the nature and scope of the scientific programs and of analyzing the ramifications for scientific objectives

of major operational problems. Planning also looked more specifically at another subject which had to be given early consideration—that of cryogenics. It was imperative that the sub-contractor in this field be acquainted with initial plans in order that CASTLE cryogenic and cryogenic transport requirements could be met on schedule. A third important subject considered was the matter of cloud sampling. Though IVY roll-up plans had visualized the use for CASTLE of the IVY F-84G sampler aircraft, there were operational limitations in the use of this aircraft which the scientists wished as a matter of priority to overcome if at all possible. There was serious doubt at LASL that samples collected below 50,000 feet true altitude were representative of the materials contained in the main cloud. For this reason a number of conferences were held during this period for the specific purpose of determining what sampling techniques, both operational and scientific, might be devised. Considered as an allied matter was what type of bomb debris sample should be procured. It was essential that these requirements be defined early in order that Joint Chiefs approval could be obtained if aircraft other than the F-84G's were to be utilized. In the meantime the criteria for manned aircraft to be used for sampling had been established jointly by LASL and AFSWC as follows:

1. Be multiplace to enable one person to fly while another operates the sampling devices and radiological instruments and acts as a sampling director.
2. Be multiengine for long range overwater flying safety.

3. Maximum altitude capability (60,000) to obtain quality samples.
4. Minimum endurance of five hours to allow sufficient time in the cloud area to collect a full sample.
5. Speed of .84 Mach to prevent overexposure of crew to radioactivity.
6. Be structurally clean to facilitate decontamination.
7. Capable of obtaining a full sample per aircraft to assure accuracy of sample.

The Air Force position with regard to this matter was that aircraft which would more adequately meet sampling requirements were under development. At the time, several fighter type aircraft were available which would meet the altitude and speed requirements only. Also the B-47A aircraft could be used as well as the reliable B-36, which was considered to be the most desirable for obtaining the samples at 50,000 feet. Unmanned aircraft in drone configuration were not considered suitable in view of the LASL criteria. Guided missiles were available and, although not utilized for CASTLE for various operational reasons, were given consideration. One B-57 (British-built Canberra) was at the Glenn L. Martin plant at that time but spare parts were not available.

Because of the increasing complexity of cloud sampling, AEC had recommended to DOD after IVY that a permanent cloud sampling unit be established. Advantages of such a unit were numerous. Experienced personnel would be available at all times; more reliable samples could thus be assured; the same aircraft could be used for

several operations; and the impact of unscheduled demands would be greatly relieved. In January, 1953, CJTF SEVEN was advised that a permanent cloud sampling unit was being established within the 4925th Test Group (Atomic) at AFSWC in Albuquerque and ultimately it was concluded that the best solution to the CASTLE sampling problem was to utilize the IVY F-84G's plus two featherweight B-36 samplers and one RB-36 control aircraft.

Another subject taken under discussion and subjected to early planning was that of DOD participation in CASTLE. Because the early information on specific yields and locations of CASTLE devices was limited, DOD participation with a military effects program was first presented in the form of broad objectives. Eight weapons effects programs were under consideration in March, 1953, and included:

Program 1. Blast and Shock Measurement.

Program 2. Nuclear Effects.

Program 3. Structures.

Program 4. Biomedical.

Program 5. (None).

Program 6. Test of Service Equipment and Operations.

Program 7. Long Range Detection.

Program 8. Thermal Measurements.

Program 9. Supporting Measurements.

Study and revision of these programs as well as those of LASL and UCRL continued throughout the summer months. Toward the end of June a meeting of all project officers from LASL, DOD, and UCRL was

held. At this meeting, each project officer presented the objectives and methods of his respective project or projects. From this presentation it was possible to discern the operational requirements remaining to be fulfilled for the programs and to initiate action for finalizing arrangements. Subsequent to this meeting, the basic research necessary for the document to describe the projects, the ONO Book, was begun.

By the end of August, the combined experimental programs of DOD, LASL, and UCRL were twenty in number and were as follows:

Task Unit 13 - DOD Programs. (Col. H. K. Gilbert, USAF; Capt. N. E. Kingsley, USN)

Program 1. Blast and Shock Measurements.

Program 2. Nuclear Effects.

Program 3. Structures.

Program 6. Tests of Service Equipment and Operation.

Program 7. Long Range Detection.

Program 9. Supporting Measurements.

Task Unit 1 - LASL Programs. (Dr. R. L. Aamodt)

Program 11. Radiochemistry.

Program 12. Reaction History.

Program 13. Photography.

Program 14. External Neutron Measurements.

Program 15. Alpha Measurements.

Program 16. Gammas and Residual Contamination.

Program 17. Microbarography.

Program 18. Thermal Radiation.

Program 19. Marine Survey.

Task Unit 12 - UCRL - Livermore Programs. (Dr. A. J. Hudgins)

Program 21. Radiochemistry.

Program 22. History of the Reaction.

Program 23. Scientific Photography.

Program 24. External Neutron Measurements.

Program 25. Diagnostic Developments.

With the exception of minor changes in various projects; the addition of Project 3.4, "Neutralization of a Planted Sea Mine Field," Project 6.1 "Test of Interim IBDA Procedures for High Yield Weapons," and Program 4, "Biomedical Studies"; and the elimination of Program 25 in November, the experimental programs schedule was essentially firm as of this time.

One early decision relative to CASTLE which carried considerable operational significance was the decision to use barges anchored in the lagoon as ground zeros for certain of the detonations. This was in order to reduce contamination, to make better use of the limited amount of real estate available, and to speed up the tests by scheduling assembly operations at the proposed barge slip at Eniwetok, and moving each barge into position about five days before detonation. This made it possible to plan on using the same zero point, if necessary or desirable, regardless of the high radiation levels to be expected on the islands in the vicinity of the preceding shot. It also permitted late changes in the location of the zero point if operational developments warranted them.

The most immediately observed operational difficulty to arise as a result of the decision to use barges was with respect to Navy Task Group operations. The only dependable means of transporting the barges from Eniwetok to Bikini was by LSD. Task Group 7.1 recommended the procurement of a second LSD for CASTLE in order to avoid interrupting Navy boat pool operations which were dependent upon the LSD. A second LSD could not be secured, however, and a means of supporting the boat pool during those periods when the LSD was being utilized by Task Group 7.1 had to be devised. Since this was primarily a Navy problem, further discussion is found in the treatment of Task Group 7.3 planning.

Few major difficulties for Task Group 7.1 arose in conjunction with the remaining military support requirements under consideration during this period. Based on previous operational experience and on current information related to the scope of CASTLE operations, estimates of Task Group 7.1 boat, liaison aircraft, helicopter, and vehicle requirements were made and submitted to the Task Force Headquarters.

During the fall months, transportation overseas of the devices was the subject of much correspondence and was a problem which was of great concern to Task Group 7.1. Many factors required consideration—the security aspects; the safety aspects; the types of transportation to be utilized; and administrative instructions, all had to be calculated in detail. The USS CURTISS (AV-4), well equipped for such tasks, was to carry the bulk of the AEC materials and she departed with her highly classified cargo on 10 January 1954.

Certain special materials associated with the devices which could not be readied for the CURTISS departure were airlifted while, in the meantime, the other materials were transported by MSTS surface means beginning as early as 12 November 1953 when the USNS PVT JOSEPH E. MANN (TAK-253) departed Oakland with twenty-seven steel containers of

As has been implied, activities during the fall and the immediate pre-operational period looked to the finalizing of earlier planning as well as the preparation for movement to the forward area in anticipation of the beginning of the operational phase. Three activities, the aircraft positioning meeting on 19 October; Exercise TIGERCAT at San Diego on 27 and 28 October; and the Task Unit Commanders' meeting on 19 November were the significant fall events. The aircraft positioning meeting and Exercise TIGERCAT are discussed elsewhere. The Task Unit Commanders' meeting, however, was foremost the concern of Task Group 7.1. It was concluded at this meeting that, construction-wise, camps were ahead of schedule; large structures were on schedule; and some minor structures were behind schedule. With this information, all task group commanders agreed, in turn, that the capability of meeting the CASTLE schedule was well established.

Other conferences on the subjects of meteorology, sampling, experimental projects, shipping, radiological safety, and communications were held. With the completion of each of the conferences, plans became more firm and by 8 December 1953, Task Group 7.1 published its Operation Plan No. 1-53. This plan established the

concepts, relationships, functions, support plans, safety plans, and operational activities necessary for the successful completion of the Task Group 7.1 mission in Operation CASTLE. Because of the unique position of the Scientific Task Group in the Task Force, certain of the general principles included are of interest to note. They were:

1. Eniwetok Atoll will be the base of operations, irrespective of the scope of activities on Bikini Atoll.
2. Major work will be accomplished at Eniwetok Atoll.
3. All major refrigerated transport dewar repair and maintenance work will be accomplished on Parry Island.
4. Five of the seven devices and weapons will be assembled on Parry Island, one on Eberiru Island of Eniwetok, and one on Eninman Island of Bikini.
5. Machine shop, laboratory, photographic warehouse, and stockroom facilities will remain on Parry and Eniwetok Islands except for limited field facilities at Bikini.
6. The CURTISS will be the principal shipboard facility for project laboratories, the assembly team base, and task group office space.
7. Preliminary assembly, testing of experimental equipment, and rehearsals will be carried out on Parry Island for all LASL shots.
8. Temporary working camps will be located on Rojoa (Eniwetok Atoll) and on Eninman, Namu, and Romurikku (Bikini Atoll).

Enyu will have a small temporary camp to support project personnel necessary at that site.

9. The camp site facilities on Eniwetok, Parry, and the camp islands at Bikini will be severely taxed due to population congestion. Shipboard accommodations, especially aboard the CVE and AGC, will also be limited. Therefore, it is mandatory that:
   (a) Only those personnel necessary to accomplish the mission should be in the forward area.
   (b) Personnel should leave the forward area as soon as their tasks are completed.
   (c) Personnel should be at Bikini only as long as they are required.
10. The port of entry for aircraft and most shipping will be Eniwetok. All cargo ships will stop at Bikini to receive or discharge cargo.
11. Task Group 7.4 will be based on Eniwetok Island.
12. CTG 7.1 and major elements of Task Group 7.1 Task Units and staff sections will be located on Parry Island.
13. Radio links with Los Alamos and Oahu will be maintained on Eniwetok Island.
14. The capability to complete operations aboard ship, if Bikini Atoll is contaminated, will be maintained.
15. Except for firing party and its attached elements no personnel will be permitted within dangerous range of an armed weapon or device.

Dr. William E. Ogle, Commander, Task Group 7.1

Colonel Edward H. Lahti, USA
Commander, Task Group 7.2

By the end of December, preparations for movement to the forward area were well underway. Records were shipped by air on a special air mission flight which departed Albuquerque on 12 January 1954 and with the arrival of CTG 7.1, Dr. Ogle, in the forward area on 11 January 1954, the Forward Task Group Headquarters had been activated.

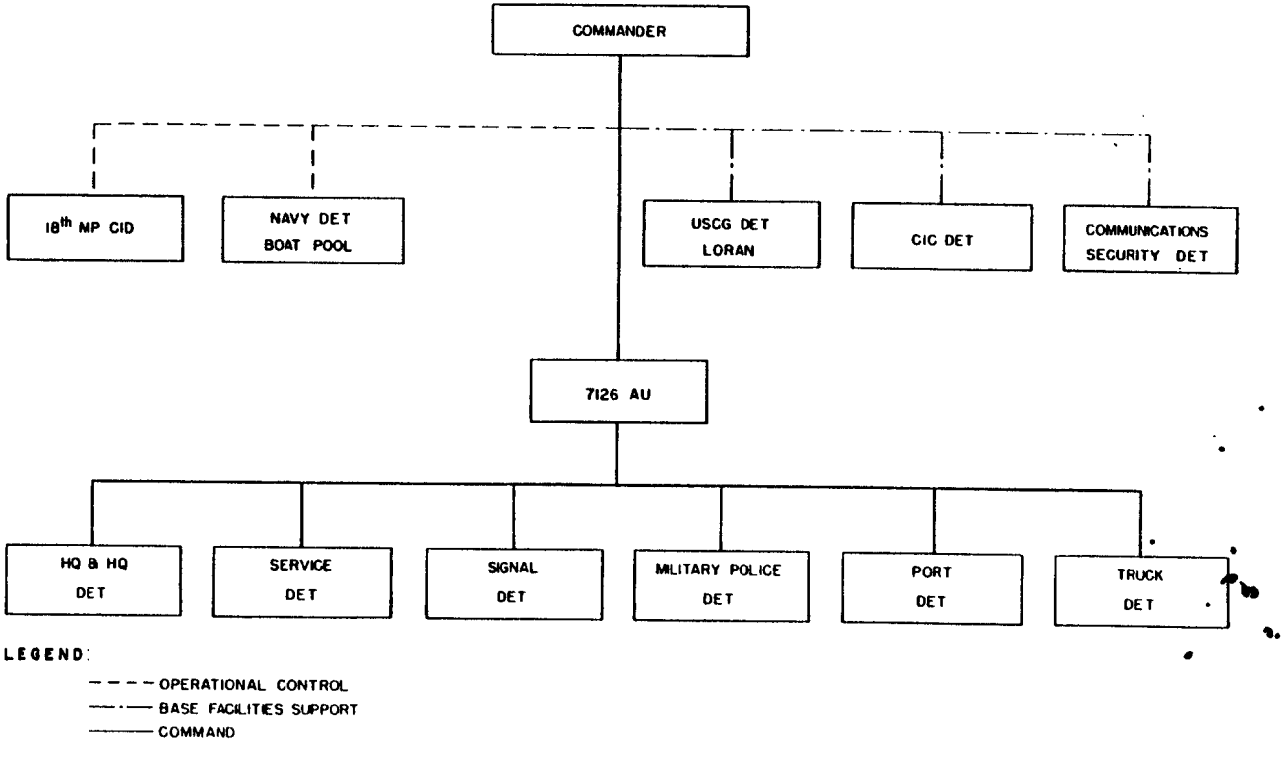
Army Task Group

As already narrated, Task Group 132.2 (later Task Group 7.2) had remained at Eniwetok as the garrison force. The immediate missions assigned to it included the assumption of control over all Task Force military personnel remaining in the forward area; reestablishment of the normal garrison force functions; provision of base facilities for tenant units; discharge of the responsibilities of ATCOM; and the provision of internal military security and ground defense of the atoll. The earlier difficulties encountered by the Task Group have been discussed elsewhere at some length and will not be repeated here.

It is of interest to note the extent and nature of the tasks assigned for Task Group 7.2 accomplishment as they were finalized by CJTF SEVEN Operation Plan 3-53. They were as follows:

1. Provide for the ground security of Eniwetok and Bikini Atolls.
2. Take measures to prevent unauthorized entry into exclusion areas, coordinating this activity with CTG 7.5.
3. With certain transportation support furnished by Task Group 7.3 and Task Group 7.4, provide for the general

TASK GROUP 7.2
ARMY
ORGANIZATION



Task Group 7.2 Organization

surveillance of Eniwetok and Bikini Atolls to insure against removal by unauthorized agents of significant samples from shot islands and to prevent unauthorized photography and trespassing.

4. Deny entry of personnel into Eniwetok and Bikini Atolls to those individuals not appropriately cleared.
5. Conduct liaison with CTG 7.5 to the end that his support requirements are met, particularly as they relate to security and stevedoring facilities.
6. Provide and operate the overall military communications system for handling of all forward area Task Force inter-atoll and long-haul traffic (exclusive of air operations, air weather, internal naval communications, and the Task Group 7.1 inter-atoll radio circuit).
7. Continue to operate all base facilities at Eniwetok Island, except those specifically allocated to CTG 7.4 and CTG 7.5, in accordance with existing agreements.
8. Conduct port and stevedoring operations at Eniwetok Atoll with stevedoring assistance made available by CTG 7.5 in accordance with existing agreements.
9. Operate and maintain a Task Group 7.2 Boat Pool at Eniwetok.
10. Provide support services for Headquarters, JTF SEVEN, as required.
11. Provide monitoring and decontamination services.

12. Be prepared, on order of CJTF SEVEN, to conduct emergency post-shot evacuation from Eniwetok Atoll of all personnel based on Eniwetok Island.

13. With certain personnel augmentation from Task Group 7.4, provide logistical support for those elements of the Joint Task Force based on Eniwetok Island.

14. Ship all equipment and materiel as it becomes surplus in accordance with instructions from CJTF SEVEN.

15. Support Task Group 7.1 as directed by CJTF SEVEN.

Except for the rehabilitation and recovery from Typhoon HESTER and the personnel procurement difficulties, the problems encountered were more or less of a routine nature. The command of the Task Group changed twice during 1953, Colonel Frank Sackton relieved Colonel Robert H. Cushing on 15 January and the CASTLE Commander, Colonel Edward H. Lahti, Infantry, USA, reported on 11 August to relieve Colonel Sackton.

Associated with and greatly influenced by the effects of the typhoon and personnel procurement difficulties had been, of course, the Task Group training program. It was not until early in the summer that the training mission could be given the attention it required. This was accomplished in June, however, and an extensive training program was placed in operation. It included the formation of a combat company composed of platoons furnished from nearly all components of the 7126th AU.

Logistically speaking, there were few problems which could be considered extraordinary. Supply of goods was continuous with few

shortages existing. Perhaps the greatest difficulty experienced by Task Group 7.2 was that involved in the mission of the Port Detachment. Non-availability of personnel and lack of training meant that men assigned other regular tasks had to be taken from these duties to aid the Port Detachment in the unloading of incoming vessels. This, of course, had a continuing and disrupting effect upon the fulfillment of other task group missions.

The communications system had been established in Operation IVY and thus the period from November, 1952, to September, 1953, was one of rehabilitation and maintenance. Some new equipment was installed so as to meet expanded requirements but for the most part, Task Group 7.2 continued the IVY communications mission which, while ever problematic and difficult, was well within the capabilities of the Task Group.

It may appear to the reader that the Army Task Group was not confronted with many difficult problems during the interim period. This is not supported in fact, however. From the time of Typhoon HESTER, the garrison personnel of the Army Task Group--including those Navy and Air Force men who were attached to the Task Group--worked on the principle that any assigned mission was within their capability. Without this spirit and attitude, the accomplishment of the overall Task Force mission, as well as the individual missions of the other four task groups might have been well nigh impossible. By bearing the brunt of Typhoon HESTER and the chain of aftereffects set in being by it and through the many long and

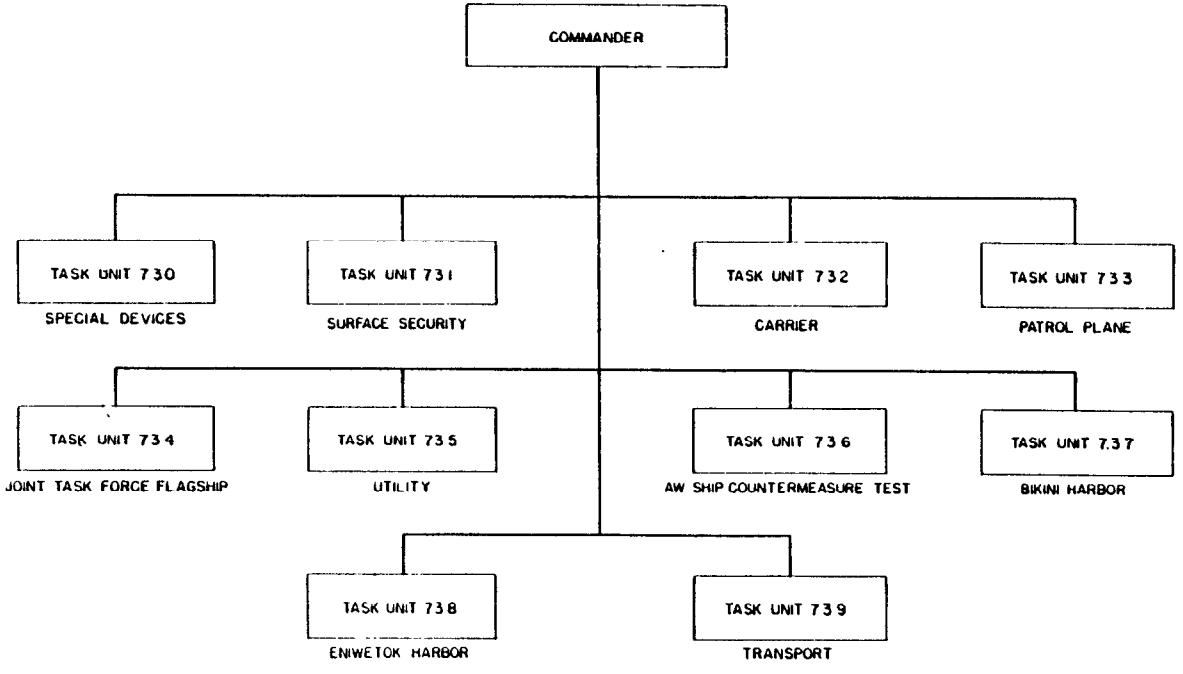
monotonous hours of overtime work, the personnel of the Army Task Group with the aid of H&N personnel performed an invaluable service for the Task Force. In short, the year of 1953 was in itself the problem confronting Task Group 7.2 and the achievements of the garrison force during that time reflect great credit upon all those military personnel who were stationed in the forward area during the interim period between IVY and CASTLE.

Navy Task Group

As with the other task groups, active planning for Navy participation in Operation CASTLE did not begin until the early months of 1953. Captain J. R. Pahl, USN, the Navy Deputy to CJTF SEVEN, assumed command of Task Group 7.3 early in February and served in that capacity until Rear Admiral H. C. Bruton, USN, reported on 1 June 1953. The scope of Navy Task Group planning is best indicated by the summary of Task Group 7.3 tasks as they were formalized in CJTF SEVEN Operation Plan No. 3-53. They were as follows:

1. Provide for the security of the Eniwetok-Bikini danger area.
2. Operate a boat pool at Bikini.
3. Provide an inter-atoll surface transportation system to support Task Force elements in the forward area.
4. Control harbor operations at Eniwetok and Bikini.
5. Detail two PBM's and required personnel to the operational control of CTG 7.4 to augment the Eniwetok-Bikini airlift system and provide amphibious airlift service

TASK GROUP 7.3
NAVY
ORGANIZATION



Task Group 7.3 Organization

between Eniwetok and Bikini when required.

6. Provide shipboard assembly facilities for the experimental weapons and devices as well as limited laboratory, shop, and office space for Task Group 7.1.

7. Transport, as directed, the experimental weapons and devices and the necessary barges and associated personnel between and within Eniwetok and Bikini Atolls. Provide suitable escort in transit and conduct rehearsals of this activity as required.

8. Operate a ship-to-shore and an intra-atoll helicopter lift system at Bikini to support pre-shot operations and post-shot flights for damage survey and recovery of scientific data. Be prepared to assist CTG 7.4 in the conduct of this activity at Eniwetok upon conclusion of Bikini operations.

9. Provide space on the CVE for a mobile radiochemical laboratory and a photodosimetry trailer as well as space for the associated operations of the radiological safety unit of Task Group 7.1.

10. Assume responsibility for all aircraft decontamination at Bikini Atoll. Aircraft decontamination operations aboard the CVE will be accomplished without outside assistance; however, operations ashore at Bikini will be conducted with assistance from CTG 7.1.

11. Provide decontamination crews for Task Group 7.3 aircraft at Eniwetok Atoll. Limited assistance will be

furnished by CTG 7.4 when required.

12. Provide shipboard command, control, and communications facilities for CJTF SEVEN and staff; communications and electronics facilities for Task Group 7.4 aircraft control; and command and administration space for Headquarters, Task Group 7.1 and Task Group 7.5.

13. Provide shipboard facilities to house elements of the Task Force while afloat at Bikini.

14. Provide capability for emergency post-shot evacuation of personnel (for less than 48 hours) when pre-shot evacuation has not been conducted.

15. Provide for radiological safety of embarked Task Force personnel during periods afloat.

16. With facilities available, be prepared to provide alternate emergency communications channels for the Task Force.

17. Provide facilities and aerological personnel aboard the AGC for the Task Force Weather Central as well as facilities required by communications security monitoring personnel.

18. Assist CTG 7.5 as required in positioning and mooring weapons barges and by providing standby support for moored barges in event of bad weather.

19. Position, service, and recover special buoyage systems and instrumentation for Task Group 7.1 projects.

20. Assist in carrying out crater surveys as required by

designated projects.

21. Direct the movement of drone vessels during shot periods, in coordination with CTG 7.1, and be prepared to assist in large-scale decontamination of these vessels and effects aircraft loaded thereon.

22. Assist CTG 7.4 in search and rescue operations as required.

23. Provide one DDE on station between Eniwetok and Bikini Atolls during the Bikini shot phases to assist in the control of aircraft.

24. Coordinate with CTG 7.4 in the integration of Task Group 7.3 aircraft into shot time aircraft positioning plans.

25. Effect positive positioning control of Task Group 7.3 aircraft in shot areas in accordance with shot time positioning plans and in compliance with orders issued from the Joint Task Force Air Operations Center in the AGC. Assume control of shot area as necessary for air defense, alerting CTG 7.4 accordingly to permit removal of test aircraft from the area affected.

26. Provide CTG 7.2 with personnel augmentation as necessary to support Task Group 7.3 elements on Eniwetok Island.

27. Place and recover free-floating buoys used for pressure and fallout measurements.

28. Provide additional support for Task Group 7.1 as directed by CJTF SEVEN.

As is evident from this list, Task Group 7.3 was presented with a diverse mission. Such problems as the security of the danger area; intra-and inter-atoll transportation; communications; ship and small craft modification; aids to navigation and buoy systems; and transportation of the special devices were all of paramount concern to the Navy Task Group.

The first Navy operational effort on behalf of CASTLE had come shortly after the firm decision to utilize Bikini in addition to Eniwetok for the CASTLE tests. Naval support was provided at this time (September, 1952) by diverting the USS LST 1126 from a portion of her planned IVY mission to inter-atoll cargo lifts to Bikini; by scheduling two Eniwetok-Bikini round trips by the LSD; and by scheduling weekly PBM flights between Eniwetok and Bikini.

At the completion of Operation IVY in November, 1952, disposition of the naval forces, personnel, and materials employed for IVY was made, as has been indicated, with further CASTLE use in mind. By the time the Navy Task Group staff was reestablished in Washington after IVY, the CASTLE postponement from Fall, 1953, to Spring, 1954, became known and a change of tempo occurred in Task Group 7.3 planning.

One of the principal efforts of the Task Group during this early period following IVY was in connection with the overhaul of navigational aids at Bikini Atoll. The move to Bikini meant a build-up of certain facilities at the atoll for it had not been in use since CROSSROADS. The inactivity at Bikini meant that there had been no maintenance of the buoyage system and rehabilitation of

navigational aids was necessary. As early as November, 1952, the USS OAK HILL (LSD-7) and the USS LST 1126 arrived at Bikini in conjunction with the initial build-up for CASTLE. The entrances into the lagoon were found to be dangerous and navigational aids were nonexistent. This was reported to Commander-in-Chief, Pacific Fleet (CINCPACFLT) by CTG 132.3 with a recommendation that the main entrances and channels into the lagoon be surveyed for the laying of buoys. This information was passed onto the Commander, Fourteenth Coast Guard District, with a request for action on the recommendation. In late January, 1953, a series of conferences between Navy Task Group staff personnel and Coast Guard representatives resulted in definite decisions. First, the buoyage system at Eniwetok would be maintained in good repair; second, the USCGC BASSWOOD (WAGL-388) would mark Eniirikku Pass at Bikini with obstruction buoys; and third, the BASSWOOD would conduct a survey of Bikini Atoll to determine the condition of any existing navigational aids. These tasks were accomplished during March, 1953.

The system was later augmented, however, when in May, 1953, CTG 7.5 requested additional lighted buoys for aiding night-time small boat operations. No Coast Guard funds were available and the matter was not resolved until August when substitute lighted range markers were installed on three Bikini islands—at considerably less cost than would have been involved in placing lighted buoys.

In September, the USCGC BUTTONWOOD (WAGL-306) pointed out the existence of numerous uncharted shoals in the Bikini Lagoon and as

a result CTG 7.3 requested CNO to initiate wire drag operations of all Bikini channels to a 30-foot depth and a 1,000-foot width. Approval of this project was obtained and Mine Division 74 (MINDIV 74) was diverted to Bikini to accomplish the task. Following the completion of the wire dragging in January, 1954, the BUTTONWOOD planted eight new buoys and moved six to mark the channel.

During Typhoon HESTER an AVR was lost because the shackle that connected the buoy to its anchor had broken. This loss indicated that other moorings at Eniwetok might be unsafe so CTG 132.3 requested that CJTF 132 direct the inspection of all mooring buoys at Eniwetok in order that necessary repairs and replacements could be made. During April, 1953, recommendations were made for the installation of a mooring buoyage system at Bikini as well as additions to the Eniwetok system. In July, CTG 7.3 resubmitted the request for inspection and overhaul of the large ship and small craft mooring buoys at the two atolls since only a few small craft buoys had been attended to as a result of the April request. CJTF SEVEN advised CNO of the situation and requested that necessary work be undertaken by the Navy since it was beyond the capabilities of CTG 7.5. The USS GYPSY (ARSD-1), with H&N assistance, commenced pulling and inspecting moorings at Eniwetok in September. Later, because of slow progress, the USS ELDER (AN-20) was ordered to assist the GYPSY.

Another buoy problem, though not related to the matter of navigational aids, was that raised by the radioactive fallout studies planned by the Naval Radiological Defense Laboratory

(NRDL) for CASTLE. This involved the use of about 100 dan bucys planted over 360 degrees out to a radius of fifty miles from ground zeros. CINCPACFLT objected to the plan as originally conceived, however, for it implied a problem in providing for security of the area. It was believed that the small buoys scattered about would create potential radar targets which could easily be mistaken for submarine snorkels. After many attempts to overcome this limitation, tests of newly developed equipment in November, 1953, were conducted successfully and the system was approved by CINCPACFLT. The equipment devised involved the installation of low frequency radio transmitters in the buoys, with the frequency range of radio direction finders installed in the DDE's, in patrol aircraft, in the PC, and in the ATF's likely to be employed in the project. The project, designated Project 2.5a under Task Unit 13 of the Scientific Task Group, was considered vital and together with the other fallout projects had been given the highest priority of all DOD test programs by AFSWP.

Another planning problem for the Navy Task Group occurred in procurement of small craft for special purposes. A request was made for an "L" boat for use by the Underwater Detection Unit; but since none was available, an LCM was modified for the task—that of maintaining a hydrophone system at the Eniwetok Lagoon entrances. Two additional modified LCM's were required to be included in the Task Group 7.3 Boat Pool. One was to be used in laying and recovering buoys in underwater pressure time-measurement studies and the other was to be used in Scripps Institute of Oceanography studies

of water wave action.

As has been noted, the LSD had been assigned a dual mission. It was to serve as tender for the Task Group 7.3 Boat Pool at Bikini and was also to be responsible for the transportation of barge-mounted special devices between Eniwetok and Bikini. The second mentioned task would require separation from the boat pool for a total period of about three weeks. In order that continued operation and maintenance of the boat pool would be possible, it was planned that overall responsibility would be assigned to the Bikini Harbor Unit with the LSD providing support during the period when she was not transporting the special devices.

An important consideration in the use of the LSD for transporting the barges between the atolls was the modification necessary for such an operation. In order that the barges might be loaded singly, a portion of the super deck had to be removed. A section of the deck was removed and stored at San Diego and two more sections were removed in the forward area. Following the movement of the barges, the two sections were replaced so that the LSD could continue with her other missions in inter-atoll transportation.

One of the more important concerns following IVY was the improvement of the communications facilities aboard the AGC, the Task Force Commander's flagship. Certain operational difficulties experienced during IVY were attributed to the failure of equipment and the lack of qualified operating personnel. Extensive alterations—including antennae relocation, cable rerouting, and general corrective survey

to locate local interference—were made during the period January-March, 1953. Upon CTG 7.3 request, a survey was then made of the communication support which would be required of the AGC by CJTF SEVEN, by the JTF SEVEN Weather Central, and by Task Groups 7.1 and 7.4 as well as any other elements of the Task Force to be embarked. The information thus gained was then passed on for action to COMPHIBTRAPAC and the USS ESTES (AGC-12). Equipment checks and communications tests were effected during Task Group 7.4's Exercise TIGERCAT off San Diego in October, 1953, with CJTF SEVEN, CTG 7.3, and CTG 7.4 aboard. The operation simulated a CASTLE shot and served, among other objectives, to point out certain deficiencies. These difficulties were partially corrected and by 18 January 1954, the ESTES was ready to proceed to the forward area. (Additional information on communication difficulties aboard the ESTES is contained in Appendix C.)

The matter of physical security gave rise to certain problems for Task Group 7.3. Enlargement of the danger area to include two atolls 180 miles apart meant an increase in the complexity of the security problem. In December, 1952, CINCPAC, having the security responsibility for the PPG, requested CJTF 132's report on the security aspects of Operation IVY as well as recommendations for CASTLE. CJTF 132, in turn, requested opinions and recommendations from CTG 132.3. The basic recommendation which resulted was that security forces for CASTLE be of the same strength and composition as existed during IVY with an augmented underwater detection unit and certain additional measures for the protection of Bikini Lagoon.

In August, 1953, CTG 7.3 recommended to CINCPACFLT that the then planned security forces--1 VP squadron (12 P2V-6's), 4 DDE's, and 4 F4U-5N's--be augmented in order to execute more fully the security mission. It was pointed out that the danger area for IVY was only sixty per cent of that prescribed for CASTLE and that only a slight augmentation would assure a significant increase in the capability to successfully support the security mission. CTG 7.3 recommended the assignment of an additional Anti-Submarine Warfare (ASW) ship (DDE or smaller) to assist at Bikini, unless the Eniwetok Underwater Detection Unit could be enlarged for that purpose. In addition, an increase in F4U's from four to six was proposed. CINCPACFLT assigned two additional fighter aircraft and indicated that a PC would be assigned for use as an additional ASW vessel; but the cost for the installation of a hydrophone system at Bikini was determined to be prohibitive.

Amphibious ship beachings constituted a knotty Task Group 7.3 problem. The LST operating between Eniwetok and Bikini played an important role in support of the CASTLE logistical mission but was severely hampered on many occasions in doing so by the inadequate beaching conditions at Bikini. A channel to the pier had been blasted out of the coral bottom creating a narrow trough which allowed only about ten yards clearance to the starboard of a beached LST. Before each beaching it was necessary for H&N to remove large amounts of sand from the channel to provide the proper beaching gradient. To alleviate the undesirable situation, H&N widened the channel to about 150 feet. This had an unexpected detrimental

effect, however, for the wave action now removed all the sand, leaving the coral bottom substantially bare. H&N then had to place sand in the channel before beachings in addition to constantly repairing the pier which was deteriorating. In spite of the extreme precautions taken, the LST 762 took three holes in her hull during various beaching operations.

Other problems during the interim period which proved well within the capability of the Navy Task Group to solve included certain procurement tasks, communications difficulties, ship modifications, and personnel requirements. All were met and disposed of without incident. By January, 1954, the Task Group 7.3 administrative staff was prepared to occupy its temporary headquarters on Parry Island and on 14 January the headquarters was officially activiated.

During the month of January, 1954, most of the supporting task group ships arrived in the forward area. The LST 762 had been in the area for some time and was joined in December, 1953, by USS LST 551. Other movements followed in quick succession:

2 January. USS BELLE GROVE (LSD-2) sailed from San Diego and arrived at Bikini 19 January. There she offloaded 3 LCU's and 3 LCM's plus a part of the boat pool detachment. She then proceeded to Eniwetok to load the advance boat pool detachment and 15 LCM's; and returned to Bikini on 21 January to place the Task Group 7.3 Boat Pool in operation.

2 January. USS TAWAKONI (ATF-114) departed Pearl Harbor with YCV-9 (helicopter landing large) and YFN-937 (covered lighter for

boat pool) in tow, and arrived at Bikini on 13 January. The YFN was moored at a place convenient for the boat pool and the YCV was moved to the general area at which shot number two was to be detonated.

4 January. USS APACHE (ATF-67) departed from Subic Bay and was scheduled to arrive at Bikini 30 January.

5 January. Patrol Squadron 29 left its base at Whidbey Island, Washington, and completed deployment to Kwajalein on 14 January. VP-29 provided air cover for the USS CURTISS as she approached within 500 miles of Eniwetok.

5 January. USS PC 1546 sailed from Pearl Harbor but because of a breakdown, put in at Johnston Island and USS PC 1172 stationed at Kwajalein was sent to assume her mission. PC 1172 arrived at Eniwetok 22 January.

9 January. USS BAIROKO (CVE-115) sailed from San Diego with Task Group 7.4 sampler aircraft (F-84's), L-13's, HRS-2 (helicopters) of HMR 362, F4U-5N (fighter aircraft) of VC-3, and the AUW detail of VP-29 on board. The AUW detail was offloaded at Kwajalein, six of the twelve HRS-2's at Bikini, and the 15 F-84's at Eniwetok.

9 January. USS SIOUX (ATF-75) left San Diego for Pearl Harbor and departed from there on 17 January with her arrival at Bikini scheduled for 25 January.

9 January. YAG-39 and YAG-40 sailed from San Francisco with the USS MOLALA (ATF-106) arriving at Pearl Harbor 18 January where they were scheduled for five days availability prior to departure for Bikini.

10 January. USS CURTISS (AV-4), after loading AEC cargo consisting of the bulk of the CASTLE test materials, sailed from Port Chicago, California, with CTG 7.3 embarked. The movement was conducted under radio silence, with ships darkened at night, and on a route away from normal ocean traffic. Escort was furnished by DESDIV 172 from San Francisco, which was relieved off Hawaii by DESDIV 12, consisting of USS EPPERSON (DDE-719), USS PHILIP (DDE-498), USS NICHOLAS (DDE-449), and USS RENSHAW (DDE-499). The USS MISPILLION (AO-105) joined the formation enroute to Eniwetok. Air cover was provided during periods when the formation was within 500 miles of San Francisco, Hawaii, and Eniwetok. Arrival at Eniwetok was on 24 January and at that time CTG 7.3 transferred his flag and operational staff to Parry Island.

18 January. USS ESTES departed San Diego with her arrival at Eniwetok scheduled for 3 February.

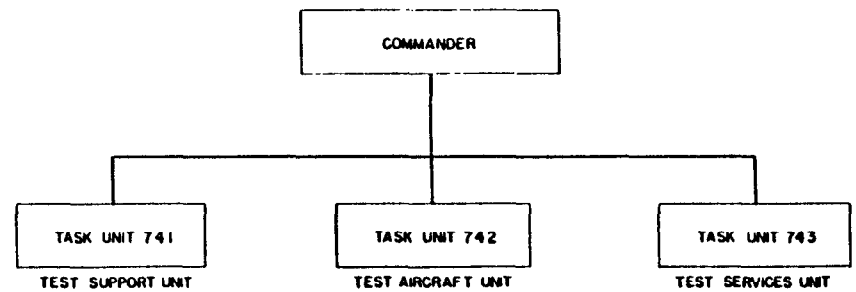
20 January. USS LST 825 sailed from San Diego as relief for LST 551 which had to be detached for repairs.

With the headquarters established on Parry Island and the majority of the support vessels in the PPG by February, Task Group 7.3 was prepared for the on-site operational period.

Air Force Task Group

The first major CASTLE problem to confront the Air Force Task Group occurred prior to the conclusion of Operation IVY and that was the question of what geographical site would be chosen as the base for the Air Force Task Group. The Kwajalein location carried numerous disadvantages for the Air Force Task Group and for the Task

TASK GROUP 7.4
AIR FORCE
ORGANIZATION



Task Group 7.4 Organization

Force in general. Initial thinking had concluded that Eniwetok Island would be the base but AEC later indicated that possibly Kwajalein could serve as the base for the headquarters with additional bases at Eniwetok and Bikini. This was soon determined to lack operational feasibility, however, and by the end of 1952 all planning effort with regard to the matter was directed toward the objective of centering CASTLE air support on Eniwetok Island.

The original designation of an Air Force Task Group Commander for CASTLE was cancelled at the time it was determined that CASTLE would be delayed from the Fall, 1953, to the Spring, 1954. Shortly afterwards Brigadier General Howell M. Estes, Jr., USAF, was designated; however, General Estes would not be free to assume fully duties as commander until the Summer of 1953. Inasmuch as the Air Force Task Group Headquarters would not have a commander physically present at Kirtland for a period of several months, the Task Group 7.4 staff was integrated, at reduced strength, into the AFSWC staff. From that time, it was planned that the Task Group 7.4 staff would not officially be reestablished until about eight months prior to the first scheduled detonation of the CASTLE series.

The mission of the Air Force Task Group for the operational phase of CASTLE generally was to provide air transportation, aircraft for sampling, air operations control, and general air support for the other Task Groups. More specifically, the tasks assigned by CJTF SEVEN Operation Plan No. 3-53 were as follows:

1. Provide, maintain, and operate aircraft in support of

of the following scientific missions:

(a) Cloud sampling and cloud tracking.

(b) Measurements of blast, gust, and thermal effect on aircraft.

(c) Technical and technical report photography.

(d) Airborne direction of sampling aircraft.

2. Conduct weather reconnaissance flights to provide the Weather Central with required data.

3. Operate Task Force weather stations at Eniwetok, Ponape, Rongerik, Majuro, and Kusaie and support, in accordance with approved agreements, certain Task Group 7.1 requirements at weather stations.

4. Administer and logistically support the Task Force Weather Central.

5. Conduct resupply of weather islands utilizing PBM aircraft made available by COMNAVSTAKWAJ.

6. Operate an inter-atoll air transportation system between Eniwetok and Bikini to include C-47 flights to Kwajalein and other atolls as required.

7. Operate an intra-atoll airlift system at Eniwetok, utilizing liaison aircraft and helicopters.

8. As required, detail helicopters and associated personnel to CTG 7.3 to augment the Task Group 7.3 intra-atoll airlift system at Bikini.

9. Conduct administrative flights in connection with the

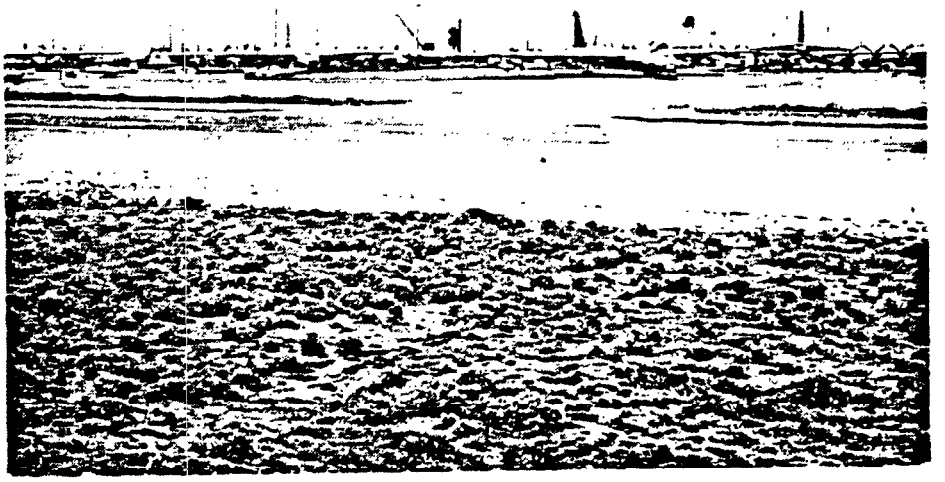
Task Force mission and maintenance of flying proficiency of rated Task Force personnel.

10. Provide search and rescue coverage in the forward area, assisted by CTG 7.3 and within cognizance of the SAR area commander.
11. Control and position flights for official observers as required by CJTF SEVEN.
12. Operate and maintain continuously an Air Operations Control Center on Eniwetok Island.
13. Provide supervisory personnel for the Task Force Air Operations Center aboard the AGC during shot phases.
14. Provide the senior naval aviator of Task Group 7.3—Air Defense Element at Eniwetok—with data and communications facilities to maintain air security of the Eniwetok portion of the Eniwetok-Bikini area.
15. Operate airdrome facilities on Eniwetok Island and Bikini, except for POL storage facilities at both locations.
16. Provide and operate complete MATS terminal facilities at Eniwetok, coordinating traffic management aspects of this activity with CTG 7.2.
17. Provide Airways and Air Communications Service (AACS) as required in support of Task Force operations.
18. Prepare shot time aircraft positioning plans, coordinating with CTG 7.3 in the integration of Task Group 7.3

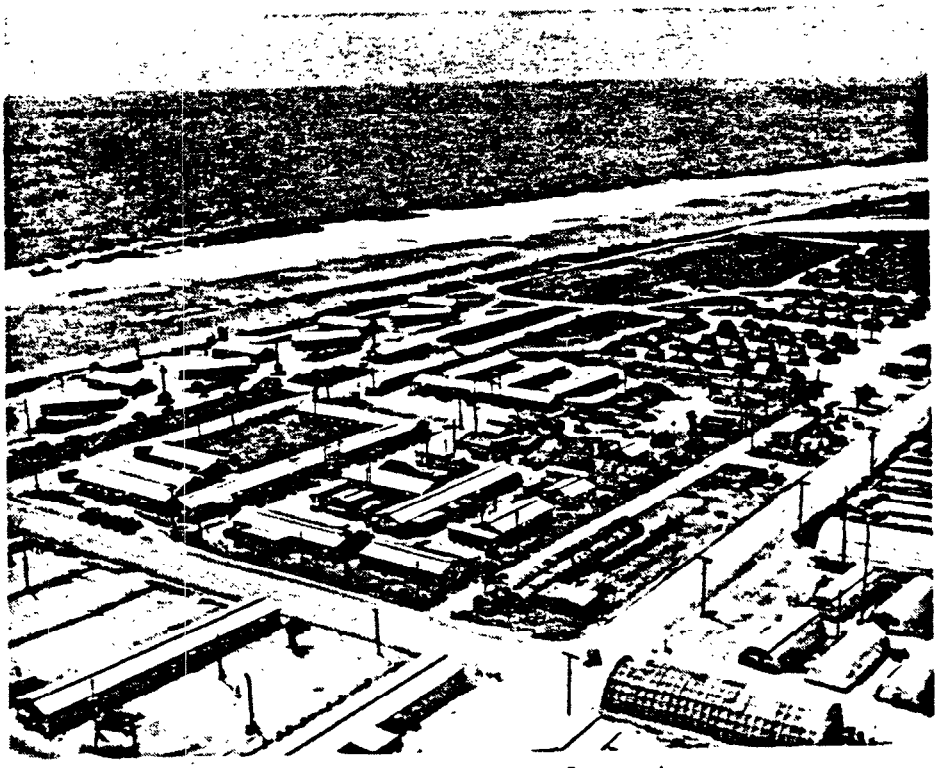
aircraft into the plans.

19. During shot periods, assume overall positioning control of Task Force aircraft, other than security forces, operating in shot areas. (Instructions to Task Group 7.3 test aircraft will be given through CTG 7.3 in the CVE.) In the event interception of unidentified aircraft becomes necessary in shot area, direct test aircraft to depart the area, passing control of the area to CTG 7.3 for the duration of the defensive effort.
20. Provide CTG 7.2 with personnel augmentation necessary to support Task Group 7.4 at Eniwetok Island.
21. Provide decontamination crews and facilities for Task Group 7.4 aircraft at Eniwetok Atoll and assist CTG 7.3 in aircraft decontamination as required.
22. Assist Task Group 7.2 in emergency evacuation of personnel based on Eniwetok Island.
23. Support Task Group 7.1 as directed by CJTF SEVEN.

The Task Group did not become fully manned until 15 July 1953. Prior to this time, the biggest problem was the one coming after the final decision to base the Air Force Task Group at Eniwetok; and that was the physical transfer of the base from Kwajalein to Eniwetok. During IVY roll-up, much Task Group 132.4 materiel had been placed in storage at Kwajalein. Equipment to be moved totaled 15,000 measurement tons, (including much heavy equipment), more than 37,000 line items, office equipment, and twenty prefabricated



B-36's and F-84G's, Eniwetok Airstrip, Eniwetok Atoll



Administrative Compound and Living Areas,
Parry Island, Eniwetok Atoll

buildings. This material had to be discharged at Parry Island and then moved to Eniwetok by LCM's since the LST which moved the bulk of the material could not beach at Eniwetok Island; and erection of the prefabricated buildings had to begin immediately so as to provide badly needed storage space.

Other Task Group 7.4 activities during this period were routine and typical. Tentative T/D's were drawn up in accordance with allotted spaces for CASTLE and requisitioning procedures to man the Task Group were established. All other administrative problems were solved and accounting procedures and funding arrangements were promulgated.

The problem in connection with high altitude cloud sampling aircraft has already been mentioned in the discussion of Task Group 7.1 planning. This, of course, was a matter of major concern to the Air Force Task Group and research and planning had to be initiated with reference to the requirements of Task Group 7.1. The capabilities of the B-47, the B-57, the B-36 Featherweight, the B-60, and the Canberra (the English version of the B-57) were investigated. At this time, the B-57 seemed to be the most impressive in fulfilling the criteria established by the scientists; but this aircraft would not be available in sufficient numbers for many months. Eventually a firm decision to use the F-84G's and B-36's was made, but with the possibility that the B-57 could be employed in the latter phases of the test.

Other problems arising before July, 1953, were construction

problems on Eniwetok Island; surveys to discern special Air Force requirements for CASTLE; finalization of personnel needs and requisitioning procedures; and coordination with other task groups in order to keep abreast of the ever-changing concept sc as to adjust accordingly Task Group 7.4 planning where necessary.

At the first official staff meeting of Task Group 7.4 on 16 July 1953, it was decided that the headquarters would be organized on a directorate basis under the operational control of AFSWC while in the ZI and under JTF SEVEN in the forward area. In the PPG the Task Group would assume operational control over three subordinate units--the Test Aircraft Unit, the Test Support Unit (4930th Test Support Group at Eniwetok as part of the garrison force), and the Test Services Unit.

The problems which faced the Task Group following the July activation were variant in terms of importance and peculiarity. Much time was spent solving the very ordinary difficulties concerning personnel, security, organization, logistics, and finances, all of which were experienced by the other task groups and all not necessarily peculiar to the Task Force. The most important problems, however, were of an operational nature.

The decision as to sampling aircraft to be used during CASTLE was still outstanding and thus much effort was devoted to the matter during the Summer of 1953. As has been previously mentioned, many aircraft were studied. The following aircraft were ultimately selected for achieving scientific objectives:

1. Four B-36 aircraft.
    (a) Two B-36 Featherweights for obtaining high altitude particulate and gas samples.
    (b) One B-36D for measuring blast, gust, and thermal effects on aircraft in flight.
    (c) One RB-36 for the primary purpose of aircraft control and secondary purpose of photography.
2. Fifteen F-84G aircraft for particulate and gas sampling.
3. Three C-54 aircraft for photography.
4. Seven H-19 helicopters for certain ground sampling recovery and general logistic support.

In October, some consideration was still being given to the possibility of utilizing the B-57 as a sampler aircraft during CASTLE. Following more study of that aircraft's capabilities, CTG 7.4 outlined several reasons why it would not be practical for use. The aircraft had developed an eight-cycle buffet at .72 Mach; it still wallowed considerably at altitude; its ceiling was 48,600 feet which was well below the required altitude for sampling; certain engine difficulties had been experienced; it had limited range, making flight from the West Coast to Hawaii impossible; and, finally, mission-required modifications would be difficult to effect. In view of the above all thought of using the B-57 in CASTLE was abandoned unless further tests proved more successful.

A companion problem to that above was the one of flight safety.

Upon receipt of the high altitude requirements for B-36 and F-84G aircraft from CJTF SEVEN Operations Order No. 1-53, the use of the T-1 High Altitude Suit for crew members was studied. It was determined that for flights above 45,000 feet the suits would be necessary. This meant that only B-36 sampler personnel would be required to wear them. Water-escape tests were also run in mid-September on the lead vests to be worn by the F-84G sampler pilots. The tests proved successful both from a radiological and flight safety standpoint.

Communications and electronics requirements, though late in becoming known, did not constitute great difficulty for Task Group 7.4. The bulk of the facilities needed for CASTLE had been retained in place from IVY so that the only problem encountered was in moving Task Group 7.4 equipment from Kwajalein to Eniwetok. Further, by being located at Eniwetok, Task Group 7.4 received extensive support from the more complete and permanent facilities of Task Group 7.2.

During the fall months the subject of aircraft positioning for the shots was the matter of extensive coordination between Task Group 7.4 and Task Group 7.1. At a Los Alamos meeting in August it was determined that Task Group 7.1 would be responsible for determining the positioning of the aircraft during CASTLE as had been the case during IVY. The Air Force Task Group Commander was to be charged with the operational aspects of controlling the aircraft. A September meeting further established the procedures to be fol-

lowed as well as the placement of responsibilities. The Air Force Task Group would prescribe limits of safe operation in terms of weapons effects for all of the aircraft participating. Task Group 7.1 would set up the positions based upon recommended positioning limitations established by the Wright Air Development Center (WADC) and Allied Research Associates, a contractor of the Air Research and Development Command (ARDC). In order that WADC would be abreast of the situation so as to recommend limits properly, Task Group 7.1 furnished that organization with expected weapons effects data pertinent to each weapon or device scheduled for detonation. The exact positioning would be determined by Task Group 7.1 just prior to each detonation and Task Group 7.4 would then be responsible for all operational aspects of the aircraft and the actual positioning as designated by CTG 7.1. Another meeting in October further clarified details relative to this entire matter.

On 27 October 1953, Exercise TIGERCAT was executed with the mission of testing planned operational procedures and communications for Operation CASTLE. The test, simulating a CASTLE shot, took place off the Pacific Coast at San Diego in accordance with plans established in CTG 7.4 Operations Order No. 2-53 published on 6 October 1953. Results of the Operation revealed many discrepancies which would require resolution before the on-site phase of CASTLE. Some forty-five separate discrepancies were listed by Task Group 7.4 Headquarters following TIGERCAT. Along with each discrepancy, explanations and corrective action to be taken as well as recom-

mended actions for other Task Force elements were made.

By the fall certain fiscal difficulties had been encountered by Task Group 7.4. At the request of Headquarters, USAF, the funding arrangement for the Task Group was changed in October. A memorandum published in March, 1953, made it the responsibility of Air Force major commands to fund for and to procure operating expenses of atomic weapons tests. At the time of the preparation of the FY 54 budget estimate, however, CTG 7.4 did not know of the extent of participation in CASTLE and therefore did not have certain requirements included in the budget. Each individual supporting unit was therefore requesting additional funds from its parent command and the various commands in turn were approaching Headquarters, USAF, for the necessary funds. Headquarters, USAF, desired only one contact point for requests in connection with Operation CASTLE and as a consequence Headquarters, AFSWC, was directed to assume the funding responsibilities for Task Group 7.4 and its supporting units.

The months of November and December, 1953, were marked by conferences designed to finalize Task Group 7.4 operational plans. Conferences on aircraft, personnel, security, construction in the forward area, operations, and supply were all held during these months so as to make firm the many details still outstanding in this immediate pre-operational period. One such meeting was held on 11 November between CTG 7.4 and Strategic Air Command (SAC), Headquarters, Offutt AFB, Omaha, Nebraska, to confer on SAC parti-

cipation. The two most important decisions to evolve from this meeting were in connection with CASTLE Indirect Bomb Damage Assessment (IBDA) experiments and the determination of aircraft positioning in space at shock arrival times. It was decided that three B-50 aircraft of a squadron located at Guam would be provided for IBDA participation. Three different aircraft and three different crews would be used for each participation.

The other decision, which did not become final until later in December, concerned equipment to determine the aircraft position at shock arrival times. After considering the K-17 visual camera; the O-15 radar scope camera; the MPQ-2, SHORAN (Short Range Navigational Aids); and the Raydist Navigational System; it was decided that Raydist would be the most accurate means but the cost involved in leasing them from the Hastings Corporation, the manufacturer, was prohibitive. When this was pointed out to the Hastings Corporation and the requirements redefined, a reasonable rental was agreed upon and Raydist was the equipment employed.

During the latter part of November, CTG 7.4 and members of his headquarters staff made a command inspection at the PPG to determine the state of readiness for receiving Task Group 7.4 in the forward area. Examination was made of the Eniwetok runway and runway shoulders; Building 135, which was to house part of the Task Group; and of the helicopter requirements at Bikini. Each of the above was a matter for discussion with General Clarkson in Hawaii when the inspection party returned from Eniwetok.

Recommendations were made and action was subsequently taken on the runway and Building 135. The helicopter lift at Bikini appeared adequate to CTG 7.4 at this time and on this basis he requested that the sailing of the USS BAIROKO, bringing additional airlift for Task Group 7.1, be delayed from 2 January 1954 to the middle of January so as to accommodate better the training schedule of the F-84G's which were to be transported on the BAIROKO as well. Decision on this matter was delayed until a discussion in Washington was possible.

Another problem allied to those raised by the inspection trip and considered during the inspection was that of aircraft parking facilities at Eniwetok. Late in November it was learned that the Navy Task Group had anticipated parking aircraft at Eniwetok in addition to those originally planned. Correspondence between CTG 7.3, CTG 7.4, and CJTF SEVEN compromised the situation by removing certain naval aircraft originally planned for parking at Eniwetok and by grading an additional parking area.

The question of the sailing date for the BAIROKO came up for decision in December. CTG 7.1 had requested the 2 January date so as to have needed helicopters in the forward area by 15 January. CTG 7.4 had explained that a delay in the sailing date was important to his task group so as to provide the needed training missions for F-84G sampler pilots and to allow for major inspections of some of the aircraft. The compromise reached was a 9 January departure date with the Pearl Harbor stopover being eliminated so

Brigadier General Howell M. Estes, USAF
Commander, Task Group 7.4

Mr. James E. Reeves, Commander, Task Group 7.5

as to save time.

Other activities of a routine nature during the Fall, 1953, period included the preparation of the Task Group movement directive; firming of personnel and equipment needs; solving certain ordinary comptroller problems, and complying with security requirements preparatory to the move to the forward area. The Task Group 7.4 Headquarters was opened at the PPG on 24 January 1954, and General Estes arrived shortly thereafter to assume command.

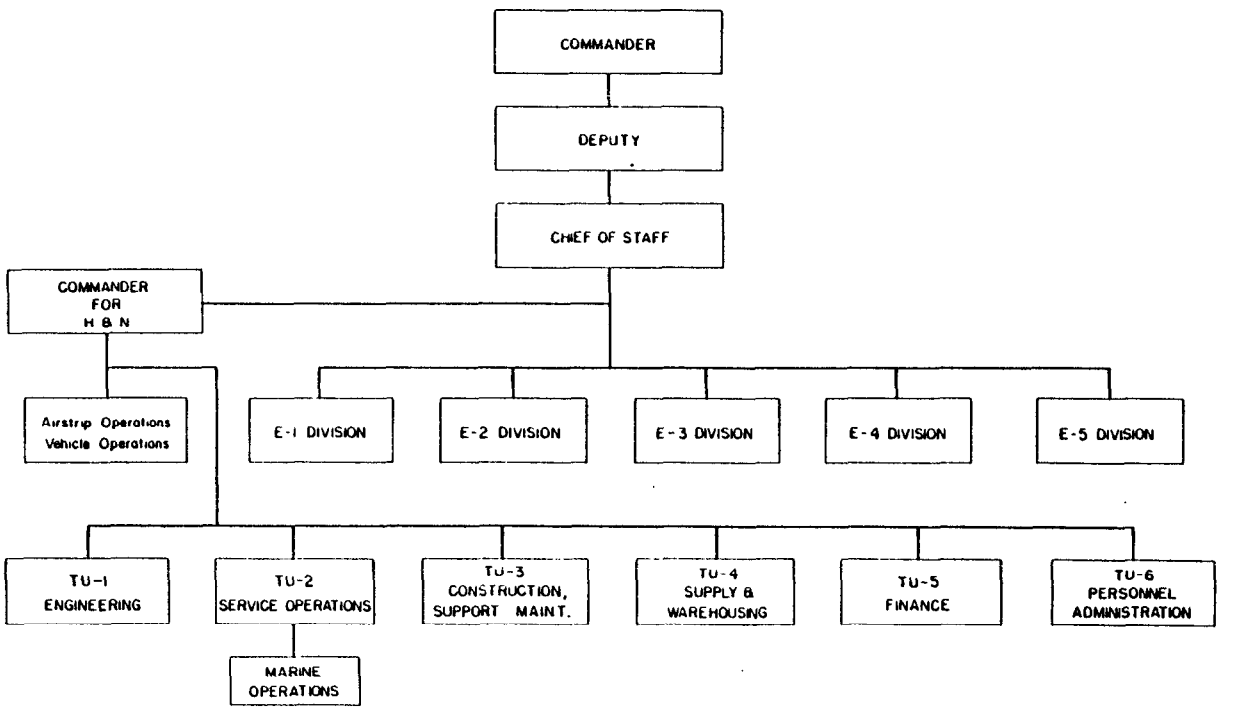
Base Facilities Task Group

The formation of a fifth task group made for a more clear-cut delineation of responsibilities within the framework of AEC participation in CASTLE. The functions to be assigned to Task Group 7.5 for the on-site operations phase were listed in the CJTF SEVEN Operation Plan No. 3-53 as here indicated:

1. Render necessary AEC contractor support to CTG 7.1 in the accomplishment of Task Group 7.1 missions.
2. Operate, manage, and direct camp facilities at Bikini and on all occupied islands of Eniwetok Atoll, except Eniwetok Island.
3. Conduct necessary liaison with CTG 7.2 to enable him to discharge his responsibilities toward preventing unauthorized entry into exclusion areas.
4. Operate and maintain local communications systems at Bikini and at Eniwetok Atoll, except Eniwetok Island.
5. Assist CTG 7.2 in the conduct of port and stevedoring

TASK GROUP 7.5

AEC BASE FACILITIES



Task Group 7.5 Organization

operations at Eniwetok in accordance with existing agreements.

6. Conduct port and stevedoring operations at Bikini.

7. Operate and maintain a Task Group 7.5 boat pool at Eniwetok and Bikini Atolls.

8. Be responsible for removal of Task Group 7.5 personnel (and supporting military personnel) and equipment from the shot site danger area.

9. When directed by CJTF SEVEN, evacuate Task Group 7.5 personnel (and supporting military personnel) from Bikini Atoll.

10. Be prepared, upon directive from CJTF SEVEN, to conduct emergency post-shot evacuation of Task Group 7.5 personnel from islands of Eniwetok Atoll other than Eniwetok Island. Assume responsibility for the emergency evacuation of Task Group 7.2 MP personnel from Eberiru Island.

11. Assist CTG 7.1 in decontamination of AEC facilities and equipment as necessary.

12. Augment the shipboard housekeeping personnel of CTG 7.3 with such personnel as necessary to support Task Group 7.1 and Task Group 7.5 elements afloat.

13. Provide support services for Headquarters, JTF SEVEN, as required.

14. Continue to redeploy contractor personnel expeditiously,

commensurate with progress of the construction program.

In general, Task Group 7.5 represents a continuation of the AEC organization having the continued responsibility of administering, operating, maintaining, and constructing facilities at PPG. This responsibility is vested in the Manager, SFOO, and is redelegated to the Manager, Eniwetok Field Office. During interim periods, Task Group 7.5, as such, exists only for planning coordination with CJTF SEVEN, becoming truly operational only upon delegation of the AEC's responsibility to CJTF SEVEN.

AEC and TG 7.5 responsibilities were discharged in the greater part through a contract with Holmes & Narver, Inc. This contract was a Fixed-Fee, Architect-Engineer-Construction-Management Contract with the AEC, administered by the Manager, Eniwetok Field Office, under the direction of the Manager, SFOO. AEC had wide latitude to change the scope of work or services to be performed by the contractor, protecting the rights of the Government insofar as control of expenditures was concerned. The centralization of authority and responsibility by the execution of the single consolidated contract permits simultaneous action on architect-engineer services, procurement of construction equipment and materials, recruiting and processing of manpower, construction, and operation; all of which are essential ingredients in planning a complex operation against a rigid end date.

As was true of TG 7.2, the most immediate problem for TG 7.5 after IVY was the extra work load caused by Typhoon HESTER. Although the damage incurred on Parry Island was not as severe as

that on Eniwetok Island, H&N had to initiate rehabilitation on Parry in addition to aiding TG 7.2 in the clean-up and rehabilitation of Eniwetok. At this time H&N was in the process of establishing the camp-sites at Bikini Atoll (See Chapter I).

Construction of the additional facilities on Parry Island was accomplished in the Summer and Fall of 1953 as time could be spared from the scientific program. Eniwetok Island construction was co-ordinated with the priorities established by the using agencies, and in many cases construction schedules were made contingent upon help supplied by TG 7.2. Many prefabricated structures that had formerly been at Kwajalein were re-erected, using a large percentage of TG 7.2 labor. The paving of the airstrip and related items of work were correlated with air operations and were accomplished with a minimum of interruption to air traffic.

Organizing the test structure construction phase of Operation CASTLE required a considerable amount of logistical planning because of the large area over which the construction activities were conducted. In order to use as few men as possible on Bikini Atoll and to avoid duplication of facilities, it was decided that all materials would be shipped through the Parry Island central warehousing and accounting facilities, and that only a limited warehousing activity would be set up at Eninman Island to handle construction in that area and to act as a redistribution point for materials destined for other sites in the Bikini Lagoon.

One of the main construction problems involved in a program of this magnitude was that of scheduling materials to avoid delays in

the program. The normal procurement and shipping time on materials was three to four months. Realizing that this had to be shortened for stations which were designed late in the program, it was necessary to take unusual action in all phases of the supply process. In many cases, changes were received too late to be incorporated during the initial fabrication, but it was possible to re-fabricate at the jobsite without any serious loss of time.

In moving to Bikini Atoll, where the then existing survey data were inadequate, it was 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 its progress required a considerable amount of brush and tree clearing on most islands as well as the rather difficult feat of establishing a rigid control point in mid-lagoon.

As critical need arose for certain classifications, security clearances became a problem particularly with respect to the long investigating and processing period that was required before an applicant or employee's services were available to the project. Such problems were resolved through liaison with the Los Angeles office of the AEC and the security section of the office of the Eniwetok Field Manager.

Quarters, facilities, and services were operated by H&N to house, sustain, and support all personnel of JTF SEVEN, except those who lived on Eniwetok and aboard naval vessels. To accomplish this, temporary camps at Eninman, Namu, Romurikku, and Enyu, at Bikini Atoll and Biijiri at Eniwetok Atoll, were provided and the permanent

camp at Parry Island was expanded. Each camp was laid out to be self sufficient. Power, fresh and salt water systems, sewage disposal, and recreational, medical, and communication facilities were installed.

The principal difficulties reported in Operation CASTLE appear to have been related to the scheduling of the pre-operational phases of construction. The remoteness of the site, and lead time necessary for procurement and mobilization, the difficulty of effective distribution of men and equipment on widely dispersed areas, and transport over considerable water separation; all contribute to an extended construction period. Yet, in the earlier phases of the pre-operational period, few criteria are firm except the end date, which, being inflexible, demands careful planning. Detailed schedules based on firm scope are not possible until late in a program when they were often too late for effectiveness, and early schedules tend to be fragmentary. However, experience in the problems of GREENHOUSE and IVY has enabled the contractor increasingly to anticipate and evaluate missing factors, and thus make realistic forecast. The momentum of scientific progress makes most of the resulting engineering and construction problems inherent to the project. Although the operational phase was changed in scope as a result of the first detonation, the rapid solution of the problems which followed indicated that the existing procedural techniques and organizational set-up were functional and flexible enough to accommodate not only an orderly progression in the operation, but also radical changes in plans.

CHAPTER IV

ON-SITE OPERATIONS

Forward echelons of the Task Force and Task Group Headquarters began arriving at Eniwetok as early as the middle of December, 1953. Within a month, the greater number of personnel from these headquarters was in the forward area and on 17 January 1954, Headquarters, JTF SEVEN, was officially activated on Parry Island. At that time, CJTF SEVEN Operation Plan No. 3-53 became Operation Order No. 3-53. Three days later General Clarkson arrived on Parry to assume overall command.

The on-site phase of operations fell into two distinct periods—the pre-shot, rehearsal period and the actual shot period. The areas of activity witnessing the greatest number of problems during these two periods were those of security, logistics, communications, and operations. And, in most every sense, the first three of the above categories were dependent upon or influenced by developments in the last of the above categories.

The pre-shot period saw the rise of few significant problems for any of these categories, except for discrepancies revealed in various of the rehearsals and shake-downs. As the Operation passed into the shot phase on 1 March 1954, however, the unanticipated results of the [SHOT 1] detonation, along with the new weather criteria imposed by these results, profoundly altered the course which operations were to follow; and this, in turn, brought corresponding changes in security, logistics, and communications

plans.

During the on-site phase most of the security planning of the previous several months moved toward fulfillment. It is difficult to overemphasize the impact on the Task Force of the security program—the overall mission of which was to promote security from within and without. Though it was concluded after the completion of CASTLE that no attempts were made by hostile forces to penetrate or compromise the operation, it had been necessary to maintain a widespread and continuous patrol over the area throughout the course of operations. And for Operation CASTLE, the use of Bikini Atoll introduced an entirely new perspective. The danger area became almost twice the size of that established for IVY and, after the first shot, had to be further enlarged. Since the naval air and surface forces provided for security patrol were not greatly augmented beyond those provided during IVY, the actual physical accomplishment of the security mission was complicated. In spite of this enlargement, however, there arose few critical difficulties which were greater than anticipated.

The major internal security problem in the forward area, although routine in a sense, was in connection with the initiation of the badge system. Each individual located on Parry Island or on the Eberiru group to the north at Eniwetok Atoll, as well as each individual at Bikini Atoll, was required to wear a badge which indicated his clearance status and the degree of access he held to restricted or limited areas. The failure on the part of some

security personnel to completely understand the detailed memorandum containing instructions for the completion of badge request forms resulted in some personnel possessing badges which did not allow sufficient freedom of movement for the proper performance of assigned duties. This same situation arose during the course of the Operation when individuals assumed new duties which necessitated new badges authorizing greater access to limited areas. The badge system further meant that those individuals requiring badge identification whose "Q" clearances were pending or who did not hold "Q" clearances were granted interim TOP SECRET military clearances, when eligible, so that they could perform assigned duties without restriction.

This condition, plus the many other minor security problems occurring during the entire period, as well as the anxiety on behalf of circumventing any possible security breach, meant that security personnel were confronted with the onerous and time-consuming routine of maintaining the strictest coordination throughout the area at all times. This coordination included the monitoring of movements of individuals to and from and within the forward area; the initiation of a sea and air personnel patrol system; the control over the movement of test materials in the forward area; the insuring of the security of British participation in Operation CASTLE; and the perpetuation of a continuous system for reminding personnel of their security responsibilities.

Certain additional complications for security arose after the

first detonation on 1 March. Because of its high yield, SHOT 1 was clearly observed by personnel located more than three hundred miles away at Kwajalein Atoll. Furthermore, as a result of the evacuation to Kwajalein of natives and Air Force personnel from Rongelap, Utirik, and Rongerik due to fallout, Task Force operational activities became more difficult to conceal. All personnel at Kwajalein were informed by the station commander that the evacuation was to be considered as confidential. However, on 11 March, a Cincinnati newspaper printed a letter written by a transient in which his view of the detonation as seen from Kwajalein was described. A second letter revealing that Navy ships had brought the native evacuees to Kwajalein also was printed. The resulting speculation and Congressional inquiries forced an AEC announcement relative to the evacuation. A second result of the first detonation was the enlargement of the danger zone which meant an even greater search responsibility for the patrol ships and aircraft of TG 7.3. In short, security requirements were all-pervasive during the on-site phase. Flexibility was vital and the manhours, paper work, and the vast detail associated with fulfilling the security mission proved to be a formidable portion of the CASTLE accomplishment.

Logistical problems arising during the on-site operational phase were never sufficiently complex to cause a delay or serious disruption in the course of operations. This is not to say, however, that difficulties did not arise. One of the more recurrent,

though never critical, problems was the one associated with unloading MSTS and other supply vessels. Insuring the discharge of cargo at the appropriate atoll of destination required extensive coordination and monitoring. After the Bikini effort was forced to move afloat, this problem became even more acute. The dispersion of Navy units; the passing from one operational area to another of many units; and the distances involved made the phasing of discharge and operational schedules even more complex and usually extended the unloading of MSTS ships beyond the normal period of one to two days.

Another difficult problem which complicated the execution of the logistical mission was that of continual damage to LST's. In January, the LST 551—engaged in placing the weather stations—damaged her hull while beaching at Rongerik Atoll. The damage was of such a nature that she had to be replaced and the LST 825 was sailed from San Diego on 20 January. The beaching problem which existed at Eninman Island at Bikini already has been discussed. The condition continued to create difficulties throughout the pre-shot period and was the cause of grave concern right up to the time of the initial detonation. Late on the 26th of February, just two days before the first scheduled shot, the LST 825 was heavily grounded on the landing beach at Eninman. Though with the assistance of tugs she was clear of the beach with no apparent damage on the morning of the 27th, there had been great fear that the shot might have to be delayed if the ship could not be retracted

in time. This problem, of course, interrupted the smooth accomplishment of the many other last-minute operational requirements.

Bad luck in an area beyond the control of planners caused additional logistical problems. Early in February, a considerable backlog of airlift developed at Travis AFB. Messages to determine the cause of the pile-up revealed that inclement weather had impaired scheduled movements out of Travis. Fog and high head winds, described as the worst in years, had resulted in the stacking up of aircraft, maintenance, material, and passengers. The Task Force backlog on 11 February had reached 75,909 pounds of cargo and sixty-three passengers. Though movement returned to normalcy within a few days, certain critical items were unavoidably delayed in reaching the forward area.

With the influx of large numbers of personnel into the PPG, the peak period housing and messing plan was activated. Housing space on Eninman Island at Bikini and on Parry at Eniwetok was furnished to the task groups by Task Group 7.5 while space on Eniwetok Island was furnished by Task Group 7.2. Under Task Force Headquarters guidance, allocation of spaces was made according to forecasts and planning. Though crowded at times, there was adequate housing at all camps and conditions never became critical inasmuch as large numbers of construction personnel were being returned to rear areas as they became surplus to the contractor needs. Severe crowding did occur just after the [SHOT 1] detonation when all Bikini personnel either had to go afloat or return to Parry. This

exigency had been taken into consideration and, while inconvenience was experienced for a short time, general conditions were soon alleviated when many personnel, who became excess to needs due to the shutdown of the Bikini camps, were transferred to rear areas.

The shot period saw additional logistical problems arise which, although within the capability of the Task Force to solve, were not totally expected. Due to unforeseen day-to-day delays in shot schedules, for example, considerable airlift capability was lost since personnel and equipment required on-site until a scheduled shot, could not be released on original movement schedules. Extreme watchfulness and prompt cancellation or adjustment of flight schedules were necessary, together with occasional resubmission of requirements for anticipated new estimates of shipping dates.

The delays due to weather and the general inability to predict completion dates for any one portion of the shot schedule or for the completion of the Operation itself meant added effort for the transportation planners. It made it almost impossible to forecast transportation requirements needed in support of the return movement to the ZI of Task Force personnel and equipment; and the matter was made more complex when the unusual turn of events following [SHOT 1] made necessary a relocation of equipment and set in motion additional inter-atoll backloading not previously considered. Such backloading became necessary inasmuch as it had been planned to load the bulk of Bikini scientific equipment at Bikini for shipment to the ZI. To illustrate this last point, the abandon-

ment of the Bikini island bases and the revision of the shot schedule which moved [SHOT 3] up from the final shot to the third shot, placed a considerable workload on the LST's and on the BELLE GROVE (LSD-2). There was several million dollars worth of equipment on Eninman Island which was originally slated to remain at Bikini until the final shot. The new schedule meant that it had to be returned to Eniwetok before the third shot. Fourteen LST trips were completed between [SHOT 1] and [SHOT 3] and 2,762 tons of equipment were evacuated.

Following [SHOT 1] a significant additional responsibility had to be assumed by the ships and small craft at Bikini. The original concept had called for a reentry into the Eninman and Enyu camp sites following [SHOT 1] but this was impossible and the movement to an afloat operation at Bikini very greatly added to small craft requirements. The move meant added responsibility for CTG 7.3 and placed a requirement on the Navy Task Group which, while anticipated as a possibility, was never considered probable previous to 1 March. It further caused basic revisions in Task Group 7.1 and Task Group 7.5 plans, and personnel of these groups became heavy users of the small craft capability at Bikini.

The adjustment to a Bikini afloat operation created many new logistical and operational problems for TG 7.3. Logistics-wise, the move meant that the Bikini boat pool, including both Navy and civilian elements, had a sharply increased workload in order to provide transportation to and from living quarters aboard ship to

work sites. The majority of the contractor personnel was quartered aboard the AINSWORTH since that vessel was best outfitted with large-scale accommodations. The ship did not carry to the forward area an accommodation ladder, however, and it was necessary to use jacobs ladders for boarding and departing the ship. This operation from LCM's was both hazardous and time-consuming. When possible, LCU's were used for AINSWORTH passenger runs since they offered a larger platform than did the LCM's. Later, a barge became available and was permanently placed alongside. The accomplishment of transportation in the Bikini Lagoon during the following several weeks with no significant injury to the thousands of personnel transported was a tribute to the skill and care displayed by those Naval and civilian personnel operating the boat pool at Bikini.

When the airstrip at Bikini had to be closed, it became necessary to provide surface ferry runs between Bikini and Eniwetok with one ship usually leaving each atoll each night, carrying passengers, light cargo, and mail. When possible, a ship making the trip for other reasons was utilized, but often one would have to be scheduled specifically for this purpose.

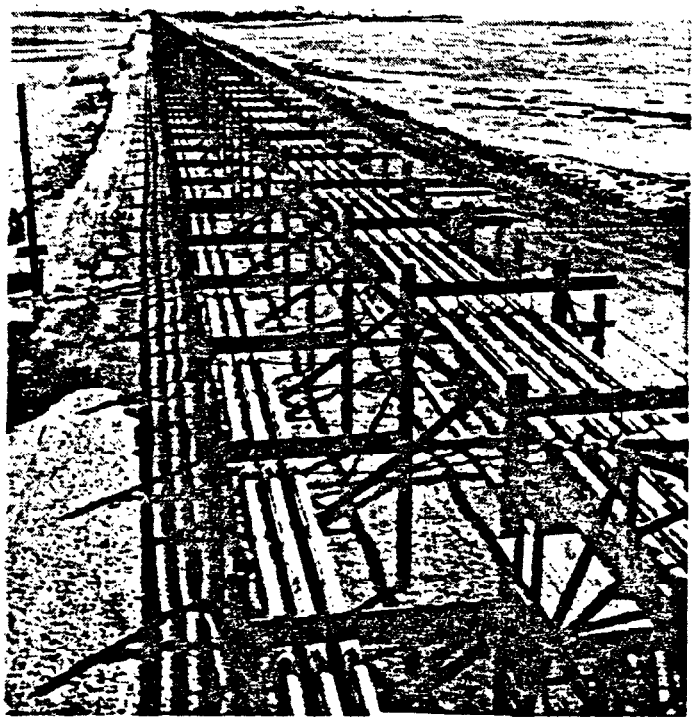
Another logistical problem was the increased consumption of stores and fresh water aboard ship. The increased workload on ships' laundries and messes and the phasing of refueling were all matters requiring innovation and hard work if the shift to afloat operations was to be successful. Refueling was particularly a problem as going to sea for that purpose was disruptive for TG 7.1

and TG 7.5 activities.

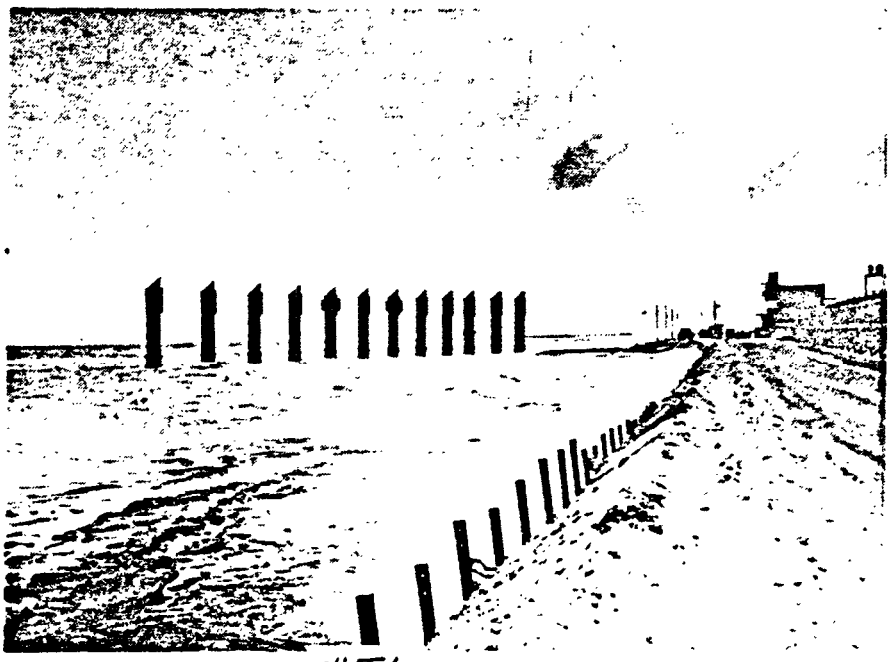
The contractor, H&N, was greatly affected by the shift afloat at Bikini and had to readjust to new procedures. This meant that further work at Bikini had to be accomplished at a great disadvantage and with fewer personnel. It meant, too, that facilities at Eniwetok would be grossly overtaxed until the Bikini personnel could either be returned to the ZI or be quartered aboard ship. And the subsequent overcrowding afloat meant that H&N had to provide personnel to supplement the Naval personnel for messing and other activities.

In an operational sense, the on-site phase varied in many respects from what had been indicated by CJTF SEVEN Operation Plan No. 3-53. Following the 1 March shot, much greater flexibility had to be introduced into the plan in order that every effort could be made to conclude the Operation somewhere near the originally scheduled completion date. The various operations planners for the Task Force had to maintain a constant and accurate appraisal of the situation as affected by every exigency so as to accomplish all aspects of the overall CASTLE mission. Prior to the first shot, there were few operational problems which were not of a planning or preparatory nature. Following 1 March, however, many innovations had to be brought into play.

What proved to be an important planning step during the pre-shot phase was the attention given to the routine establishment of an evacuation procedure. Evacuation conferences, under the



Instrumentation Pipes, SHOT 1 Shot,
Namu Island, Bikini Atoll



Reflector Stations, SHOT 1 Cab, and Instrumentation Pipes,
Namu Island, Bikini Atoll

monitorship of the Task Force Headquarters J-4 Division, were held on the 16th, 19th, and 22nd of February for the principal purpose of discussing the evacuation and reentry plans for Bikini. The evacuation was scheduled so that it would be completed, with the exception of the firing party remaining ashore, prior to 1800 local on H-1 day. Principally because of shipboard space limitations, it was planned to transfer to Eniwetok those personnel whose services were no longer critically required at Bikini. From there they were to be reassigned to other functions or returned to the United States as soon as it became clear that they were surplus to the forward area effort. At the same time, surplus equipment and stores were to be transferred to Eniwetok by LST. Reentry into Bikini was to be accomplished when directed by CJTF SEVEN.

An emergency personnel evacuation plan for Eniwetok and Ujelang Atolls was also established in the event of post-shot radiological contamination. In December, CINCPAC was advised by the Task Force Headquarters relative to the danger to native populations on nearby atolls. It was stated at that time that safety of native populations would be an important consideration in the Commander's decision to detonate and that Task Force security ships could be made available for post-shot evacuation if necessary. Ujelang Atoll was the chief concern in this connection for it is located directly downwind for prevailing winds from Bikini and Eniwetok. The responsibility for the capability of evacuating that atoll was assigned to CTG 7.3.

The operational rehearsals necessary to test plans, procedures, and communications for Operation CASTLE were conducted during January and February. Each of the task groups participated in those rehearsals relative to its participation in the detonations. CTG 7.1, with participation by supporting task groups, conducted practice loadings of devices and shot barges in late January and early February. The LST 762 and the BELLE GROVE made three trial runs prior to actual movement of the first test device from Eniwetok to Bikini. The tugs, APACHE and SIOUX, also rehearsed the laying and recovery of fallout collector buoys at both Eniwetok and Bikini.

CTG 7.4 conducted a rehearsal on 16 February in preparation for air participation in the initial shot. The aircraft participating were essentially those which would take part in SHOT 4. The Air Operations Center (AOC) on Eniwetok and the AOC in the ESTES were fully manned for actual control of aircraft. The rehearsal was a success from the Task Group 7.4 standpoint and better prepared that unit for successful participation in the [SHOT 1] detonation.

A general Task Force rehearsal for [SHOT 1] was executed on 23 February with H-hour set at 0645. TG 7.4 participated with a maximum air effort and TG 7.3 had all vessels except the GYPSY and the COCOPA participating. TG 7.1 took part to the maximum extent possible in view of instrumentation readiness, and evacuation procedures were tested although complete evacuation was not effected.

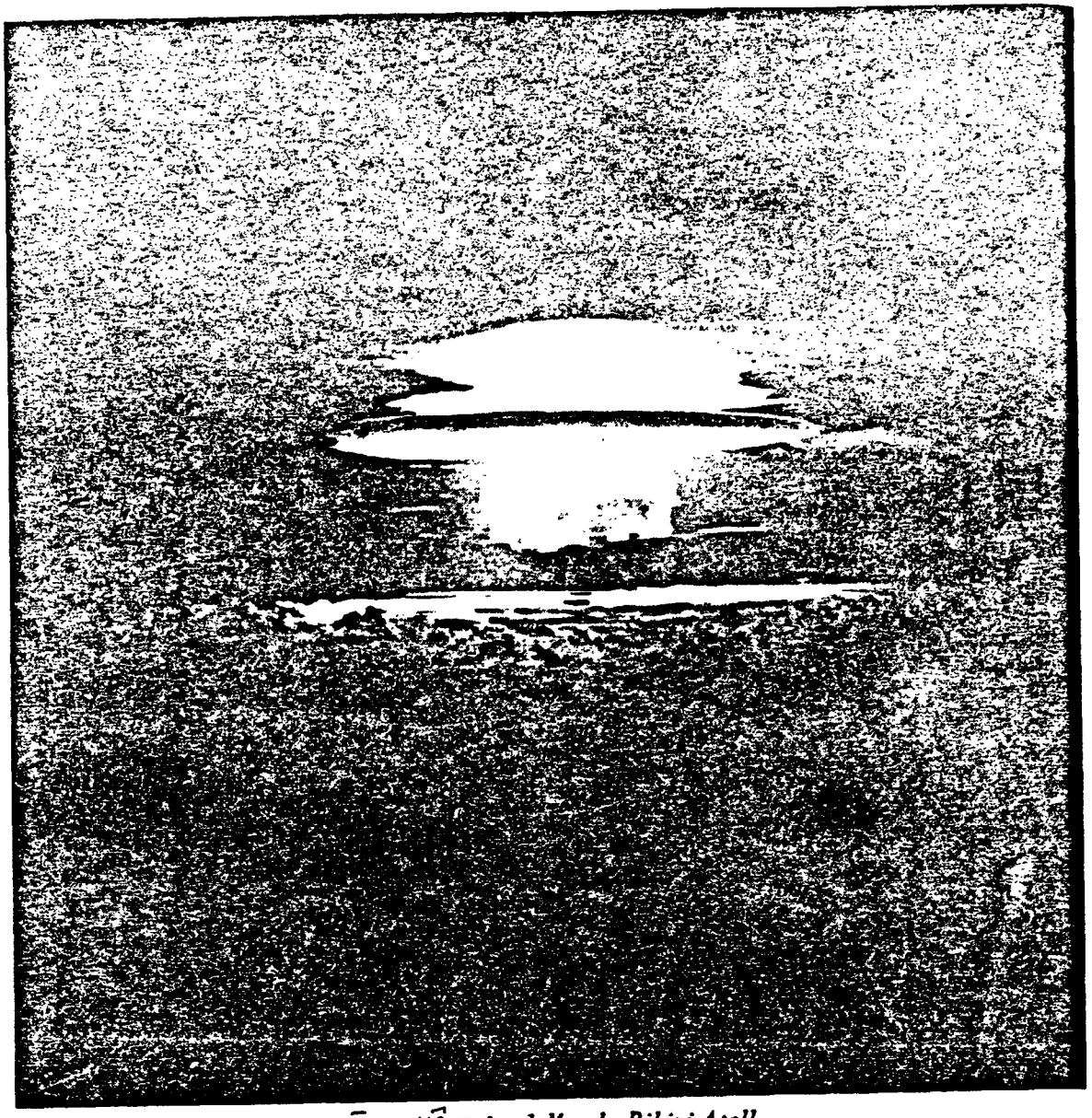
This test was successful in that it pointed out several areas where improvement was necessary if EVENT I was to go as scheduled. CTG 7.1 noted a number of technical deficiencies, most significant of which was the failure of the high speed camera firing circuit interlock to function. The device could not have been fired had the rehearsal day been shot day. CTG 7.3 also noted discrepancies. Many naval units could not participate, thus subtracting from a successful rehearsal; communications difficulties aboard ships were experienced; and the Task Group 7.3 Operations Order, due to late receipt of JTF SEVEN orders, had not been completely distributed to all Navy units in time. Immediate action was taken to remedy the noted deficiencies so that the shot-day schedule, as well as any subsequent rehearsals, would be executed satisfactorily.

The participation of British aircraft in the Operation, firmed up quite late, created an additional problem for the operations and security people. British participation would have proceeded almost without notice had it not been for the loss of one of the Canberras which was scheduled to take samples. The disappearance occurred between the Admiralty Islands and Kwajalein on 23 February 1954. Search and rescue operations were initiated almost immediately with United States aircraft from Kwajalein and Eniwetok as well as British planes from Australia participating. The search was carried on, with negative results, until 3 March 1954. Shortly after discontinuing the search effort a second Canberra enroute from Australia to Kwajalein was lost and another search had to be

placed into effect. This aircraft was found on 11 March, however, 110 miles southeast of Kwajalein, having crash landed on a sandy beach at Ailinglapalap Atoll with no injury to personnel.

During the forty-eight hours preceding SHOT 1, some 1,400 persons departed the island camps at Bikini and were shuttled by LCM, LCU, and helicopter to TG 7.3 ships in the Bikini Lagoon. All non-surplus and valuable material at the camps and work areas nearer the shot site had been shifted southward to Eninman and Enyu Islands in order to be at a safe distance from anticipated blast effects. Small craft which could not be accommodated aboard the BELLE GROVE were moored or anchored in deep water in the lee of Enyu. The firing party remained ashore on Enyu, sheltered in the specially constructed bunker from which the detonation of the device was controlled.

On the morning of 1 March at 0645 local the first shot in the test series--the [SHOT] device--was detonated on the reef off Namu Island at Bikini Atoll. The test was highly successful; indeed, the yield was much greater than expected, which resulted in certain effects not foreseen. The most immediate of these was the high radioactive contamination of the Bikini airstrip. It was such as to render it unusable until 10 March when it was reopened for limited service. During the time the airstrip was not available for use, air transportation between the two atolls was furnished by two PBM aircraft furnished by TG 7.3 and the SA-16 aircraft of TG 7.4. To supplement this transportation, TG 7.3 utilized as necessary the



SHOT 1, 1 March, Bikini Atoll

security DDE's and the available LST's to transport personnel to and from Bikini.

All the immediate, post-shot operations for [SHOT 1] were successfully initiated and conditions appeared normal until about 0707 local when the firing party reported sky shine and rapidly rising radiation readings outside the control building and subsequently within the building after it had been closed up. At about 0800 local, considerable radioactive contamination was reported on ship decks and CTG 7.3 directed all ships to proceed south at best speed; to a fifty mile range; to activate wash-down systems; and to use maximum damage control measures. The BAIROKO (CVE) and the PHILIP (DDE) received the heaviest contamination. Intensities on the deck of the BAIROKO reached 5,000 mr/hr with a maximum reading of 25,000 mr/hr in flight deck drains; and on the PHILIP average readings of 7,000 mr/hr were taken while the highest reading reached 20,000 mr/hr. Decontamination procedures were effective on all ships and the readings soon were down well below the danger point. At 1100 local, air sampling units indicated that local fallout had ended and all ships were ordered to move in to a range of ten miles from Bikini.

Ordinarily, scientific recovery operations would have begun almost immediately after the radsafe survey had been completed and after lagoon waters had been determined safe; but in this instance, contamination was too heavy to allow ordinary operations and a new plan was devised, which included early recovery of the firing party

by helicopter. The principal vessels of Task Group 7.3 returned to Eniwetok and task groups reorganized and prepared to resume Bikini operations from the afloat base.

During the early post-SHOT 1 period, critical personnel received the maximum permissible exposure (MPE) of 3.9 roentgens and a request was made by CTG 7.3 that the MPE be increased to 7.8 roentgens. These included certain helicopter pilots and plane captains, boat operating personnel of the Task Group 7.3 Boat Pool, and flight deck personnel of the BAIROKO. Many personnel aboard the PHILIP were also exposed and during the remainder of the Operation this vessel was utilized outside the vicinity of the shot atoll except in emergencies. In a letter to CTG 7.3, dated 23 March, CJTF SEVEN approved the recommendation to increase the MPE to 7.8 roentgens for critical personnel listed above.

To the east of Bikini, between 166° and 173° east and between 5° and 14° north, there are some thirty Trust Territory-administered atolls and islands of the Marshall chain. The safety of these populated islands has always been an important consideration in the final decision to detonate atomic devices or weapons in the PPG. As the size of the device increases, the possible radiological hazard likewise increases and CJTF SEVEN recognized this as a significant CASTLE operational factor from the beginning. Although pre-shot evacuation of natives for any of the CASTLE detonations was not considered necessary, preparations were made to accomplish such if the need should arise. The Navy Task Group was assigned the respon-

Post SHOT I Damage, Eninman Island, Bikini Atoll

sibility of providing ships and did so by utilizing the security DDE's. Further, it was agreed that CINCPACFLT could furnish additional ships if needed in an emergency or in case the vessels assigned to the Task Force were so engaged as not to be available for such a mission. Before [SHOT 1] a TG 7.3 representative was sent to Kwajalein for discussions with Trust Territory representatives and Naval Station personnel to insure that interpreters, Trust Territory representatives, and air transportation would be available should post-shot evacuation be necessary.

Before the end of [SHOT 1] day there were growing indications of heavy fallout from upper levels in a northeast direction. Late on [SHOT 1] plus 1 day, CJTF SEVEN directed that a DDE proceed immediately to Rongelap to begin evacuation of that atoll since indications from his radsafe advisors were that evacuation would be necessary. Shortly thereafter, another DDE was directed to proceed to Utirik Atoll to effect evacuation there. Eventually participating in evacuation were the PHILIP and the RENSHAW, both diverted from their security missions; a PBM provided by Commander, Naval Station, Kwajalein (COMNAVSTAKWAJ); and two DDE's from CINCPACFLT which were placed in a stand-by capacity to be utilized in case of need.

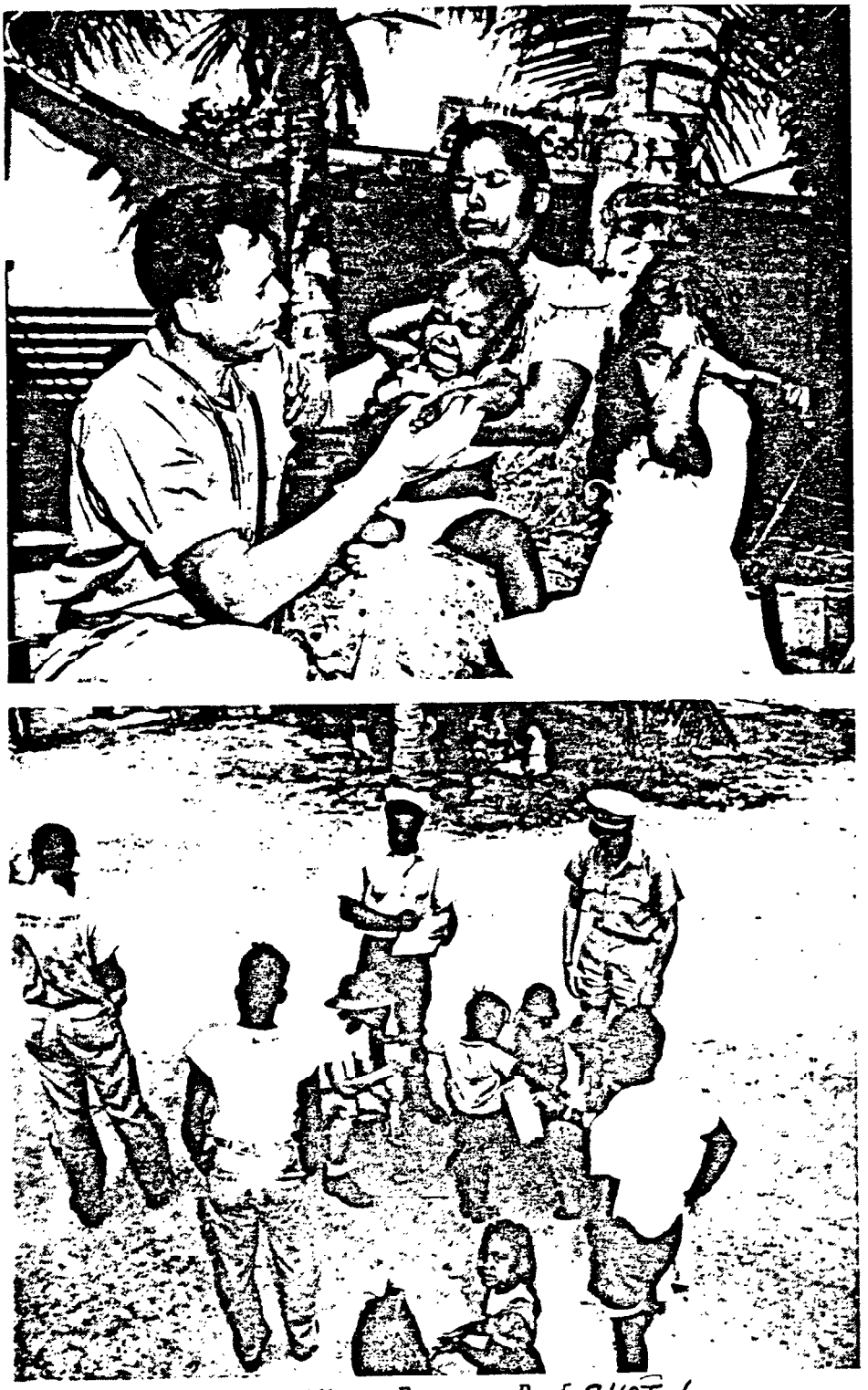
Heavy fallout occurred at Rongerik Atoll where a Task Force weather station and some scientific stations, manned by twenty-eight Air Force and Army personnel, were located. These personnel were evacuated to Kwajalein by an amphibian aircraft furnished by

COMNAVSTAKWAJ on 2 March. In accordance with the CJTF SEVEN directive, the PHILIP got underway from Bikini on 2 March and arrived at Rongelap Atoll early the morning of 3 March. A beaching party was sent ashore by whale boat and the situation was explained to the native magistrate of the atoll. Monitoring of the island commenced immediately and readings of the radioactivity were such as to substantiate the previous belief that the atoll would have to be evacuated. The natives gathered those personal belongings which would be necessary for their stay at Kwajalein and were transported to the PHILIP via whale boat without incident. Personnel decontamination procedures aboard ship were begun immediately.

The ship then proceeded to nearby Ailinginae Atoll to effect evacuation there. After the inspection of Enibuk Island revealed that no natives were present, a sloop was sighted off Sifo Island in the atoll. Eighteen Marshallese were found on Sifo and were transported to the PHILIP to join the others. The destroyer escort then departed at 1800 local on 3 March for Kwajalein arriving there at 0830 on 4 March.

Utirik Atoll was evacuated by the RENSHAW on 4 March. Upon arriving at the atoll it was discovered that there were no navigational aids and because of reef obstructions the ship was not able to enter the lagoon. After considerable difficulty a party, accompanied by an interpreter flown in from Kwajalein, succeeded in getting the RENSHAW gig through the surf and to the inhabited island of the atoll. Once ashore the circumstances of the situation

were explained to the natives. The RadSafe Officer and his team made a survey with radiac instruments and upon completion of the initial readings the natives were told of the procedures to be followed for evacuation. They gathered their belongings and proceeded to the ocean beach for movement to the RENSHAW. The women, children, and the aged were the first to be transported to the ship. The operation was complicated for the boats had to stand off from the beach about fifty yards and the natives had to be transported through the reef surf by life raft, transferred to the boats, and then taken to the RENSHAW. By noon, when the evacuation was about half completed, the wind had increased and the surf had become more hazardous. After serious consideration of postponement and of making a new attempt from the lagoon side, the decision was made to continue with as much speed as was possible under the existing conditions. The last raft load left the beach at 1245 local and all were transported to the ship without serious injury. The total number evacuated was 154. On the way to Kwajalein the RENSHAW met the USS DAVID A MUNRO (DDE-422), provided by CINCPACFLT, on her way to assist in the Utirik evacuation. Since she was no longer needed, she fell in astern for the return to Kwajalein. Aboard the RENSHAW, decontamination procedures were carried out and the natives were fed and bedded down for the night. Arrival at Kwajalein was early on the morning of 5 March. At Kwajalein, the natives were placed under medical surveillance and treatment. It soon became apparent that the Utirik natives had not received serious exposures



Examination of Native Evacuees, Post SHOT 1

and when it was determined that they would not suffer physically they were moved to another island, Ebeye, in the Kwajalein group where they remained under the care of COMNAVSTAKWAJ. The Rongelap natives received greater exposures which caused temporary lowering of blood counts, instances of temporary epilation, and skin lesions. From a blood picture standpoint, the Rongelap natives corresponded very well with the Japanese who were about 1.5 miles from ground zero at Hiroshima and Nagasaki. In this group two to three per cent lost some hair, ten per cent had sore mouths, and five per cent experienced hemorrhages under the skin.

A medical unit formed from the Naval Medical Research Institute in Washington and from other Service agencies began operations as Project 4.1 at Kwajalein on 8 March. They took frequent and periodic blood counts and urinalyses and made numerous other observations. The unit began to return to the ZI from Kwajalein in early May after it became evident that all exposed natives and U. S. personnel would recover without serious consequences.

The twenty-eight American personnel who had been exposed at Rongerik were kept under medical observation at Kwajalein until early May. At that time, they were removed to Tripler Army Hospital in Honolulu where they received thorough medical examinations. Shortly afterwards, they were returned to duty with their parent organizations in the ZI.

A survey party made up of native, Task Force, AEC, CINCPAC-FLT, Trust Territory, and H&N representatives visited Rongelap,

and Utirik 21-23 April to ascertain when the natives might be returned and to determine what rehabilitation effort would be necessary. As a result of the survey and the subsequent recommendations of the High Commissioner and CINCPACFLT, the following actions were taken:

1. The Utirik natives were returned to their homes in June and were furnished adequate water and food supplies.
2. Since the radioactivity level at Rongelap was still prohibitive, the Rongelap natives were moved in June to Majuro Atoll where H&N personnel had constructed a new village of wood and aluminum buildings. The village was financed by CJTF SEVEN (see Chapter VI). It was predicted that the Rongelap natives would not be able to return to their homes before May, 1955.
3. AEC made plans to continue to monitor the medical condition of the exposed natives and to have periodical visits made by AEC and other interested representatives.

Following [SHOT 1] detonation radiological surveys were made of the islands and atolls surrounding Bikini. One survey on 6-7 March was made of Likiep Atoll, Jemo Island, Ailuk Atoll, and Mejit Island with results showing very minor contamination--about 3 mr/hr. A second survey on 5-7 March was made on Wotje, Erikub, Maloelap, Wotho, and Majuro Atolls revealing the contamination at these locations to be also very small with most readings around 2 to 3 mr/hr. A third survey on 8-10 March was made of the locations in closest

proximity to the fallout area. This study included Rongelap, Utirik, and Rongerik again as well as Bikar and Ailinginae Atolls. The heaviest contamination was found at Rongelap and Rongerik Atolls with an average reading on Rongelap Island at the same atoll of 375 mr/hr and an average reading on Eniwetok Island at Rongerik Atoll of 280 mr/hr. Readings from soil samples taken from throughout Rongelap Atoll were as high as 2200 mr/hr and readings of water samples were high as 400 mr/hr.

Important conclusions based on the results of these surveys were drawn. First, it was proved that a large yield surface detonation can produce extremely serious radiological contamination over a distance of more than 120 miles and significant contamination for a distance of about 250 miles. The degree of fallout generated from such a high yield detonation had not been indicated by the MIKE detonation of Operation IVY. Second, the center of the contamination pattern for [SHOT] appeared to lie somewhat north of Rongelap and Rongerik Atolls and probably not far from a line drawn between Bikini and Bikar Atolls. Third, contamination was greatest on the north side of Rongelap Atoll and decreased by a factor of about eight over the downwind distance of fifty miles between Rongelap and Rongerik Atolls. Finally, it was seen that the standard military field housing being utilized by Task Force personnel on Rongerik provided a significant degree of protection from contamination to personnel inside.

There has been earlier discussion of the effect of the afloat

operations as related to logistical considerations and mention of the fact that operations were likewise greatly influenced by this shift. For TG 7.3 it is difficult to categorize any one result of the shift afloat as either logistical or operational as there was considerable inter-relationship. Perhaps the single most significant operational effect came in the employment of ships after the SHOT 1 detonation. All major vessels were required to remain permanently at Bikini for the purposes of housing. Originally it had been planned that the ESTES would be stationed at Eniwetok between Bikini detonations. To accommodate all personnel required at Bikini, however, this proved impossible and her planned function as Eniwetok Harbor Control was assumed by the senior vessel at that atoll. The BAIROKO had to prepare to conduct all Bikini helicopter operations from afloat. The Air Force helicopters and one L-13 were returned to Eniwetok Island and the responsibility of providing local air transportation at Bikini became solely that of the Navy Task Group. Because of the increased role played by the BAIROKO, the ship became excessively overcrowded until CTG 7.3 transferred his flag and staff to the CURTISS in order to relieve the situation.

In addition to the above, the problem of adequately fulfilling the security mission--an operational necessity--was hampered inasmuch as the security DDE's oftentimes had to be called upon to perform urgent non-security missions. It was also necessary to transfer the security fighter aircraft from Bikini to Eniwetok

due to the contamination and resultant restriction of Bikini airstrip operations. There was never a complete device at Bikini when the security forces were at their lowest efficiency, however, and no compromises resulted from the stretching of the security capability.

Other concerns for CTG 7.3 which influenced the pattern of operations were the reduction in training necessitated by the afloat program; the personnel morale problems which, although held to a minimum, could have been considerable under the circumstances; and the many logistical difficulties arising from decisions of an operational nature. In one respect, however, the move afloat eased one Navy mission as it eliminated further large-scale pre-shot evacuations at Bikini.

The shift from a land based to a shipboard operation for Task Group 7.1 multiplied the technical, operation, and personnel problems of that task group. Prior to the detonation of [SHOT 1], the Task Group 7.1 Operations Division, J-3, worked from two offices—one on Parry Island at Eniwetok Atoll and the other on Eninman Island at Bikini Atoll. After [SHOT 1], the Bikini office had to be maintained aboard the ESTES with additional representation aboard the BAIROKO, the AINSWORTH and, at times, the CURTISS. The Parry J-3 office worked closely with the Bikini J-3 office in coordinating operational requirements and assuring accurate completion of all details. Key scientific personnel were quartered aboard the ESTES while those people requiring laboratory or ship facilities

were quartered aboard the CURTISS where shop space was available. The remainder of the scientific personnel were quartered aboard the AINSWORTH whick also served as a main Task Group 7.5 base. Personnel not accustomed to living aboard ship found long tours afloat unpleasant and thus morale was adversely affected. Through rotation of personnel, however, the situation never grew to be serious.

Another result of the large yield and unusual aftereffects of [SHOT 1] was the enlargement of the danger zone surrounding the PPG. The old danger area was bounded by meridians 160° 35' and 166° 16' east longitude and the parallels 10° 15' and 12° 45' north latitude. The new zone provided an additional sector centered on a point 12° north and 164° east extending clockwise from 240° true to 095° true out to a distance of 450 nautical miles.

The necessity for creating a larger danger zone after [SHOT 1] arose from an incident which had international repercussions. Although careful, pre-shot searches were conducted with negative results, a Japanese fishing vessel, the Fukuryu Maru (or Lucky Dragon) was later discovered to have been within an estimated eighty-mile range of the center of the [SHOT 1] blast. As information became available, it was determined that the vessel had been just beyond the outer limits of the danger area as it existed at that time. The vessel with its crew was showered with radioactive fallout which contaminated the ship, the crew, and their catch. It was reported by the Japanese that when the Fukuryu Maru arrived in Japan on 14 March all twenty-three crew members, two of whom were

considered to be in serious condition, were hospitalized with radiation sickness. The wide press coverage in Japan given to the incident, much of which was garbled and erroneous, caused difficulties for the United States Government.

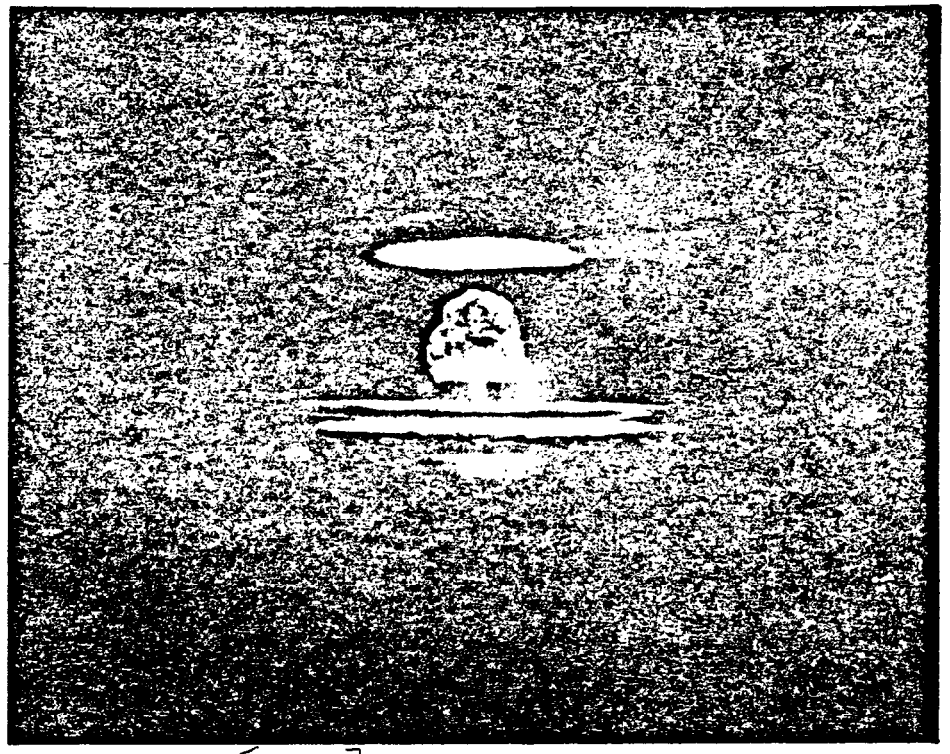
The extent of contamination of the Japanese ship, and the degree of radiation injury suffered by the Japanese fishermen was not reported officially to CJTF SEVEN. Based on the reported location of the ship, degree of radioactivity of nearby atolls, and stories carried by the press it is assumed that the exposure of the Japanese was probably no greater than that of the Rongelap natives.

In contact with Washington and providing all the information which was available to him, CJTF SEVEN stated on 17 March in a message to the Chairman, AEC, that he considered the present danger area should be extended in the direction of probable upper cloud travel. He noted that it did not seem likely that a new danger area could be established and notice thereof sufficiently promulgated in time for the remaining CASTLE shots but that a notice to mariners to avoid that additional area just described should be promptly issued. Immediate action on the part of the AEC and the Department of the Interior resulted, however, in the establishment of the new zone and CJTF SEVEN was so notified of the enlargement on 23 March.

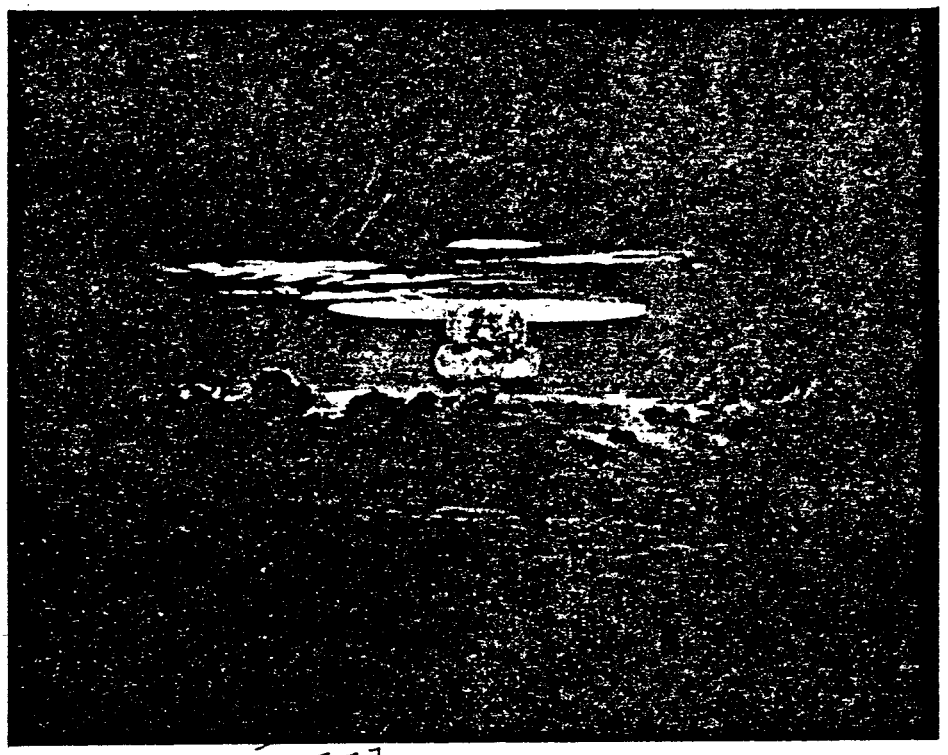
In addition to these more immediate results, the post [SHOT 1 effects induced the formulation of new weather criteria for sub-

sequent CASTLE detonations. The stringency of the new criteria had a profound effect upon the course of all following CASTLE operations and cannot be overemphasized in their determining influence upon the remainder of the Operation. The shot schedule planned and set well ahead of time was as set forth in Chapter III. The [SHOT 1] device was detonated as originally planned on 1 March 1954 (Eniwetok date). Fallout data, which the scientists did not have at the time of MIKE shot in 1952, became available as a result of [SHOT 1]. Allied with this development was a second long-range result--the necessity to reschedule the planned sequence of shots. The camp structures on Eninman at Bikini had suffered severe blast damage and this implied that the fixed [SHOT 3] installations on that island would be subject to further damage unless the shot schedule were revised. The detonations planned to follow [SHOT 1] were barge shots and were to be fired from sites off the Romurikku chain, an area closer to Eninman than the [SHOT 1] site. Thus, it appeared necessary to fire [SHOT 3] as soon as possible but since it could not be readied as soon as desired, SHOT 2 was scheduled as the second shot and it was relocated from the Romurikku chain to the [SHOT 1] crater in order to be at the maximum possible distance from Eninman. Following [SHOT 1] shot SHOT 2 was rescheduled for 13 March, however, it was not detonated until 27 March due to continuing adverse upper wind patterns.

Following the [SHOT 2] detonation, the shot sequence was again altered. Because of the long delays due to weather, the capability



SHOT 2] *Shot, 27 March, Bikini Atoll*



SHOT 5] *Shot, 5 May, Bikini Atoll*

of firing at either Eniwetok or Bikini (small-yield devices for Eniwetok) had to be established. If weather were bad at Bikini and good at Eniwetok, for example, then much time would be saved if a choice of shooting at either atoll were possible. Two shots, and SHOT 6 were planned for Eniwetok and the remaining three, SHOTS 3, 4, AND 5 (see next paragraph) were planned for Bikini with the provision that if weather were not satisfactory over a period of time at Bikini the possibility of firing additional shots at Eniwetok would be considered. Further, certain alternatives were included taking into account weather factors and the possible utilization of both atolls on an interchangeable basis.

The third shot in the series, SHOT 3, was detonated on 7 April on Eninman Island at Bikini. The test of this device was successful and as a result the device, , was cancelled from the program, thus reducing CASTLE to a six-shot operation. Also, since the unexpected success of SHOT , the device was cancelled and a revised , called SHOT 5 (already referred to) was added.

The SHOT 4 device was detonated successfully on 26 April and although SHOT 6 was planned to follow that shot, poor weather conditions at Eniwetok made it necessary to fire SHOT 5 at Bikini on 5 May with SHOT 6 finally being fired on 14 May. The 14 May

detonation ended the operation phase of CASTLE.

The final sequence of shots was as follows:

SEQUENCE	DEVICE	DATE DETONATED	ESTIMATED YIELD IN MT
1		1 March	15.0 ± 1.5
2		27 March	11.0 ± 1.0
3		7 April	0.13 ± 0.03
4		26 April	7.0 ± 0.7
5		5 May	13.5 ± 1.0
6		14 May	1.7 ± 0.3

Under the revised concept of the two-atoll capability following the detonation of SHOT 2, it was possible that there would be very short intervals between shots. This caused concern in the Air Force Task Group for post-shot maintenance and decontamination of aircraft had to be accomplished before aircraft could be employed for the following shot. CTG 7.4 pointed out that in order to have a full sampling effort, at least a three-day interval was necessary. Any reduction in this length of interim time between shots would mean that the sampling effort would have to be halved. If this condition was acceptable to the scientists, a one-day interval seemed possible. As it turned out, weather conditions did not allow intervals so short as to cause such a difficulty for the Air Force Task Group but such a capability did have to exist under the plan established after SHOT 2.

The general problem of maintenance was one which made the shot period a difficult period for TG 7.4. Many maintenance deficiencies

SHOT 4 *Shot, 26 April, Bikini Atoll*

SHOT 6 *Shot, 14 May, Eniwetok Atoll*

which occur in the Eniwetok climate could not be cleared up by the ground maintenance crews and it was necessary to conduct frequent flying of the aircraft to keep them in top condition. The risk involved in this procedure was great should good shot conditions develop unexpectedly. As a result, CTG 7.4 had to carefully analyze the weather reports in advance so as to avoid a situation where aircraft would not be available for a particular detonation.

The effects of SHOT 1, the rescheduling of all shots, and the relocation of SHOT 2 introduced several problems for the experimental projects. In many instances equipment had to be modified so as to gain satisfactory results. The delays also created general difficulties for DOD experimentation in that some of the projects had to be set in motion several days ahead of shot day to be successful and when the shot was delayed, equipment had to be checked out again and personnel deployed, sometimes on very short notice. The wide range in the predicted yields incident to novel experimental devices made it difficult to set recording equipment in the proper range, causing the loss of much information. One set of experiments suffered loss of nearly all data during SHOT 1 for, although the recording equipment functioned satisfactorily, the reinforced concrete station had not been designed for as high a yield as SHOT 1 had delivered and airborne contaminated particles had entered the structure and fogged the photographic film data records. Conversely, because of the existence of a rainstorm on Eninman Island at zero time and to some extent because of the low yield of SHOT 3

much data was not obtained. In spite of these and other obstacles, however, and because of the effort of the experimenters, the major programs planned for the tests were performed and satisfactory results obtained.

Following SHOT 1, a new project, Project 4.1, was officially added to the test program. This project, entitled "Study of Response of Human Beings Exposed to Significant Beta and Gamma Radiation Due to Fallout from High Yield Weapons," was sponsored by AFSWP and arose as a result of the native evacuation.

In view of the magnitude of Operation CASTLE, there were few problems which confronted the scientific, military, and construction personnel which did not find solution. What had been a problematic situation in previous operations had been reduced in many areas to routine by the time of CASTLE and even results which were not totally expected were met and dealt with without reducing the effectiveness of the overall operation. The first shot in the series, as has been discussed, produced a much larger yield than had been predicted and this meant change and review of the entire operational perspective. The flexibility included in the original plan, as well as the ability of the Task Force to choose among alternatives after the first of March, proved to be of inestimable worth to the accomplishment of the CASTLE mission.

CHAPTER V

CASTLE SHOTS AND PRELIMINARY EVALUATIONS

(Chapter V, pages 144-149, has been extracted and published as a separate document, classified TOP SECRET, RESTRICTED DATA, with limited distribution.)

CHAPTER VI

CASTLE ROLL-UP AND COSTS

Roll-up for Operation CASTLE was a smoothly functioning procedure. The action making the Task Force a permanent organization, of course, tended to simplify the process for it was not necessary to close down completely all facilities following the termination of the test. Further, as has been explained relative to many of the problems and procedures of CASTLE, the experience of the previous overseas tests had made roll-up planning and execution a routine procedure.

The final shot in the test series was detonated the morning of 14 May 1954, thus ending the operational phase of CASTLE. Roll-up and redeployment had begun in advance of this final shot so that the complete roll-up would be effected as expeditiously as possible after the conclusion of the Operation. As early as 16 February 1954, a letter from CJTF SEVEN to the task groups outlined specific roll-up policies. These were:

1. The Eniwetok garrison force would be reestablished.
2. Ships, aircraft, vehicles, and other equipment not required by the garrison force would be returned to proper commands having custody.
3. Temporary duty personnel would be returned to their permanent duty stations.
4. All Bikini camps would be closed with:
   a. the LSD providing inter-island surface transportation

until last shot plus 30 days;

b. the CVE remaining at Bikini to provide intra-atoll air transportation until last shot plus 15 days;

c. one LST remaining until last shot plus 15 days; and

d. one LST remaining to roll-up the weather stations.

On 16 May 1954, CTG 7.2 once again assumed the responsibility as ATCOM Eniwetok and Task Group 7.2 began operations as the garrison force in the forward area. Roll-up of supplies and equipment no longer required by the users and under the responsibility of Task Group 7.2 had been progressing during the closing weeks of the Operation so that by the conclusion of CASTLE activities were far beyond previous expectations. Unit schedules had been established so as to provide an orderly system for turn-in. Preservative containers and coverings had been constructed for the purpose of long-term tropical storage of many items. Maintenance work for Task Group 7.2 was considerable during roll-up for much equipment had to be sandblasted and repainted prior to storage.

The other permanent unit in the forward area, the H&N contractors, also had accomplished a great deal toward roll-up when [SHOT 6] was detonated. The final equipment roll-up of Bikini Atoll started on 8 May although the majority of the scientific station equipment had already been removed by 3 May, prior to [SHOT 5] The major portion of post [SHOT 5] roll-up consisted of removing the marine craft, the mooring gear, and the remainder of the scientific station equipment. This process was complicated because of the radioactive con-

tamination still prevalent in many of the Bikini areas. As a result, it was necessary to employ decontamination measures with the marine craft which had been anchored near Enyu during SHOT 5 in order to permit evacuation of these craft to Eniwetok Atoll. Also close control of personnel exposure records and assignment to contaminated work areas was necessary in order that no individual would reach or exceed the maximum permissible exposure. On 11 May the equipment roll-up at Bikini was considered complete.

On 12 May an LCU was dispatched to Rongerik Atoll via the USS BELLE GROVE to dismantle and remove the equipment from the JTF SEVEN weather station which had been evacuated after SHOT 1. With the return of this equipment to Eniwetok, all material involved in the post-SHOT 5 roll-up had been removed to Parry Island. The post-SHOT 6 scientific data and equipment recovery program was started 17 May at Eniwetok and progressed smoothly to completion on 20 May. Other equipment on Parry Island which had been brought from Bikini or Rongerik or which had been declared surplus for interim period needs was either removed or placed in mothballs. The unused test materials, regardless of classification or accountability, were returned to the ZI aboard the CURTISS and, upon arrival on the west coast, were transported to final destinations under the direction of AEC.

A major item of deactivation for the Scientific Task Group was the mothballing of the TU 2 cryogenics plant and associated equipment.

the plant was shut down and the decision made to condition it for storage "as is" rather than dismantle the equipment.

Task Group 7.1 personnel had been phased out in accordance with the status of their respective projects. Most of the UCRL personnel departed following the third and fourth detonations, some from Task Unit 13 departed after the fifth shot, and most of the Task Unit 2 and Task Unit 3 personnel left late in April. Those remaining personnel from Headquarters, JTF SEVEN, and from Task Groups 7.1, 7.3, and 7.4 were returned as expeditiously as was possible after 14 May. PACDIVMATS furnished additional aircraft during this period in order to support the increased movement requirements. The ships and aircraft of Task Group 7.3 and the aircraft of Task Group 7.4 were returned to their proper stations following the completion of their respective missions in the forward area to complete the CASTLE roll-up.

The total cost figure for Operation CASTLE from 1 January 1953 to 31 May 1954 was $96,097,649. This compares favorably with the total cost figure of $65,933,163 for a similar period during Operation IVY (9 July 1951 - 31 December 1952) in view of the increase in experimental programs, the number of shots, and the overall complexity of the Operation--CASTLE over IVY. The following table presents the operating costs, capital costs, and total costs of the DOD and AEC experimental and support programs for Operation CASTLE:

STATUS OF REPORTED COSTS*
(1 January 1953 - 31 May 1954)

Title	Oper. Costs	Cap. Costs	Total Costs
Experimental Programs			
1.0 (AEC-DOD)	$ 454,598	$ —	$ 454,598
2.0 (DOD)	602,072	336,555	938,627
4.0 (AEC-DOD)	4,780	—	4,780
6.0 (DOD)	603,828	386,804	990,632
7.0 (DOD)	289,774	—	289,774
9.0 (DOD)	225,395	—	225,395
11.0 (AEC)	761,781	91,605	853,386
12.0 (AEC)	2,808,153	365,713	3,173,866
13.0 (AEC)	2,492,158	236,765	2,728,923
14.0 (AEC)	154,659	16,950	171,609
15.0 (AEC)	765,180	172,666	937,846
16.0 (AEC)	129,860	—	129,860
17.0 (AEC)	3,693	—	3,693
18.0 (AEC)	751,632	398,261	1,149,893
19.0 (AEC)	1,705	—	1,705
21.0 (AEC)	584,060	30,966	615,026
22.0 (AEC)	1,984,200	113,604	2,097,804
23.0 (AEC)	1,044,034	26,831	1,070,865
24.0 (AEC)	196,665	2,718	199,383
25.0 (AEC)	14,986	4,594	19,580
Tot. Experimental Costs**	$13,873,213	$2,184,032	$16,057,245
Support Programs			
99.1 (Tvl & Per Diem)	586,699	—	586,699
99.2 (Mil Trans)	7,831,458	517,660	8,349,118
99.3 (Comm Trans)	140,039	—	140,039
99.4 (Communications)	955,179	517,341	1,472,520
99.5 (Admin Overhead)	3,224,443	35,841	3,260,284
99.6 (Common to Opns)	51,469,465	14,762,279	66,231,744
Total Support Costs	$64,207,283	$15,833,121	$80,040,404
Grand Total	$78,080,496	$18,017,153	$96,097,649

* This report is not a final report of costs. Additional costs will be reported and some adjustment will be made between operating and capital costs.

** This report does not include those experimental costs for the Department of Defense being controlled and funded by Task Unit 13, which amounted to $4,153,000.

It will be noted that Support Program 99.6 accounts for the greatest share of the total cost of the Operation and represents a substantial portion of the increase over the Operation IVY costs.

This program included the various task unit costs in addition to those costs entitled, "Costs Common to the Operation," and a breakdown of Support Program 99.6 seems necessary to explain the total figure of $66,231,744.

BREAKDOWN OF PROGRAM 99.6

		Oper. Costs	Cap. Costs	Total Costs
7.1 Military		$ 944,993	—	944,993
TU-1	LASL Program	493,111	1,439	494,550
TU-2	Production	114,281	311,161	425,442
TU-3	Special Maint. Fac.	6,517	—	6,517
TU-4	LASL Assembly	1,214,764	11,656	1,226,420
TU-6	Firing Party	1,164	—	1,164
TU-7	RadSafe	33,664	63,623	97,287
TU-8	Technical Photo.	304	40,172	40,476
TU-9	Docu. Photo.	53,700	—	53,700
TU-12	UCRL Program	39,692	136	39,828
TU-14	UCRL Assembly	495,351	2,171	497,522
TU-15	Timing and Firing	863,868	285,297	1,149,165
TG 7.1	Com. to Scientific Programs	6,718,907	179,471	6,898,378
7.5.1	Construction	6,632,834	2,795,199	9,428,033
7.5.2	Maint. & Op.	10,482,275	—	10,482,275
7.5.3	Sup. to Sci. Prog.	285,931	—	285,931
7.5.4	Roll-up	733,352	—	733,352
7.5.5	Com. to 7.5 Funct.	5,721,150	6,348,736	12,069,886
99.6	Com. to Operation	16,633,607	4,723,218	21,356,825
Total of Program 99.6		$51,469,465	$14,762,279	$66,231,744

A second breakdown of total costs presents the totals of the three Services and the AEC:

Departmental Costs	Oper. Costs	Cap. Costs	Grand Costs
AEC	$48,386,940	$11,499,734	$59,886,674
Army	6,788,495	2,476,476	9,264,971
Navy	8,169,819	888,753	9,058,572
Air Force	14,735,242	3,152,190	17,887,432
Total Departmental Costs	$78,080,496	$18,017,153	$96,097,649

The third breakdown is by Task Force unit and includes the Headquarters, JTF SEVEN, and the five task groups:

Hqs and Task Group Costs	Oper. Costs	Cap. Costs	Grand Costs
Hqs, JTF SEVEN	$ 1,499,770	$ --	$ 1,499,770
Task Group 7.1	12,384,034	895,126	13,279,160
Task Group 7.2	6,603,764	2,476,476	9,080,240
Task Group 7.3	7,064,584	165,394	7,229,978
Task Group 7.4	7,309,866	3,152,190	10,462,056
Task Group 7.5	23,955,542	9,143,935	32,999,477
Total Hqs and TG Costs	$58,717,560	$15,833,121	$74,550,681

A concluding table presents the obligation against DOD Extra-Military Funds, which funds were administered by Hq., JTF SEVEN.

OBLIGATIONS AGAINST DOD EXTRA-MILITARY FUNDS AS OF 31 MAY 1954

	FY 1953	FY 1954	Total
Travel	$ 53,023.23	$1,125,450.00	$1,178,473.23
Transportation of Things	22,819.50	159,900.00	182,719.50
Communications	52,193.38	88,000.00	140,193.38
Task Force Overhead Exp*	3,168.94	145,600.00	148,768.94
Activation, Modification and Inactiv. of Ships	137,100.00	135,200.00	272,300.00
Activation, Modification and Inactiv. of Aircraft	--	193,930.00	193,930.00
Maintenance and Constr. of Real Facilities	3,230.94	737,245.00	740,475.94
Documentary Photography	--	55,823.00	55,823.00
Radiological Safety	1,306.39	191,500.00	192,806.39
Weather Service	--	7,200.00	7,200.00
Operational and Logistical Support**	--	840,000.00	840,000.00
Ship Rental	--	640,000.00	640,000.00
	$272,842.38	$4,319,848.00	$4,592,690.38
POL (Non-operational Phase)	84,214.49	625,348.00	709,562.49
Total	$357,056.87	$4,945,196.00	$5,302,252.87

* Includes expenses such as local procurement of equipment, supplies, and services not obtainable from the military Services and not otherwise classified.

** Includes $806,000 issued for POL during operational phase.

An additional expense arose following the evacuation of natives incident to Operation CASTLE (see Chapter IV). In connection with the rehabilitation of the evacuees the following items were

charged to Task Force funds:

1.	Advance of funds to the Department of Interior, Trust Territory of the Pacific Islands, Guam, M. I., for purchasing swine, chickens, and other expenses incident to rehabilitation.	$28,544.00
2.	Reimbursement of AEC for construction of native facilities on Majuro Atoll, M. I.	$50,365.00
3.	Reimbursement of NAVSTAKWAJ for issues of supplies and stores to groups of rehabilitated natives.	$19,897.34
4.	Expense of medical team sent to assist natives.	855.75
		$99,662.09

APPENDIX A

METEOROLOGY

PART I

General.

A measure of the complexity of the meteorological problem confronting a joint task force, and more particularly its weather personnel, is indicated by two basic conditions which must be accepted at the outset of the approach to planning for atomic detonations at Eniwetok. The first condition is that weather statistics, though useful, prove nothing unless the results are subject to complete physical explanation. And, of course, most meteorological phenomena are not subject to such explanation. During short periods of a month or a season, for example, the atmosphere may behave in a manner strikingly in contrast to what statistical records might lead a planner to anticipate. The second condition is that knowledge of weather and wind in the Central Pacific is still surprisingly meager. The region lies far from the chief Pacific trade routes and, as a consequence, there does not exist the abundance of marine records from the area that exists for surface weather conditions occurring in the higher oceanic latitudes and along the American and Asiatic coasts. Despite the long occupations in the Marshalls first by the Germans and then by the Japanese, and despite World War II and AEC experience in the area, the Marshall Islands are among the least known, meteorologically speaking, of all the archipelagos of the Central Pacific. The reason lies partly in the

short and spotty observational records, but more importantly, perhaps, in certain preconceived ideas which have tended to obscure the essentials.

Confronted, then, with these two conditions, the Task Force Meteorologist—along with the various Task Force weather units—must assume the responsibility of detecting, evaluating, and predicting the many possible variations from those weather conditions which are predictable on the basis of the spotty records from the past; and, because the weather is tropical, the problem is compounded.

Historically, explorers, sailors, and scientists first became acquainted with tropical weather in the neighborhood of the great land masses—Europe, America, Africa, and Asia. With few exceptions, the torrid portions of these regions are subject to rather noticeable seasonal variations in both wind and weather. In some regions, the wet seasons are spoken of as monsoons. In all events, it has been general knowledge for centuries that rain tends to occur in most of these torrid areas in association with specific wind directions and seasons. The peoples of the high latitudes of Europe and America have found nothing surprising in this. Living on large, continental land masses they have historically adjusted--in both the physiological and psychological sense--to far greater seasonal extremes, particularly in temperatures. As a result, there has grown in the minds of most men a disposition to expect well-marked seasonal variations in winds and weather in all tropical regions, even in tropical regions far removed from continental land masses.

In the Central Pacific, especially to the eastward of the 180th meridian, it is very difficult to find any very reliable traces of this supposed universal seasonal variation in available data. It is true that there is a great variability in weather, but it seems to occur with little relation to the time of the year. In fact, the region overlapping the equator and covering the longitudes of the Hawaiian chain is a zone with probably the most highly variable rainfall of the entire globe. The Marshall Islands further to the southwest fall remotely under the Australian influence but, as a consequence, witness only slight seasonal variations in cloud and rainfall. And even this influence is overshadowed by a greater, aperiodic variability of the type found further east in the Central Pacific. Even to the south of the Marshalls this variation extends to the winds. For example, at Ocean Island lying near the equator and south of the Marshalls, west winds sometimes replace the more usual east winds for several days at a time. This change is only vaguely connected with season and it is incalculable in its occurrence from year to year. Records maintained by the British since 1900 show that there have been years in which westerlies prevailed at Ocean Island on as few as two days and as many as 167 days. At such a location, then, one could not conceivably depend upon the seasonal occurrence of west winds in any given year nor could one plan military operations there on the basis of statistical presumptions with any reasonable assurance. This, then, is an indication of the sum and magnitude of the meteorological problem confronting successful atom-

ic operations in the Marshall Islands.

To be less general, however, there has accrued enough meteorological experience and data from the Marshalls to permit certain tentative statements with regard to the climatology of the Marshall Islands for the months of January through May. During this period--the so-called "dry" or "trade" season--northeasterly winds blow with great persistence in the lower levels. Overlying the northeasterlies or trade winds, the aloft winds tend to become westerly. Both the trade winds and the higher, predominantly westerly winds are subject to cyclonic circulations or disturbances in the form of eddies, vortices, or minor perturbations; and many of the variations in weather over the Marshalls are attributable to these disturbances. In the lower levels, the eddies are most intense along the equatorward edge of the trade circulation (equator to 10° north in the Northern Hemisphere). These low-level eddies are rapidly damped to the north and rarely pass directly over the northern Marshalls. Nevertheless, their formation, movement, and decay contribute to significant day-to-day changes in the weather of the Eniwetok-Bikini area. For the purpose of being yet more specific, aspects of meteorological experience in the Marshalls for the months of January through May may be noted here.

A. Weather.

The term "dry" for this season is relative only. Small, widely scattered showers falling from the prevalent "trade" cumulus clouds are nearly always within sight of Eniwetok and Bikini. The

science of meteorology has not developed to the point where the precise location of individual showers can be reliably predicted.

During this period in the years from 1950 through 1954, inclusive, ceilings have never been observed at less than 500 feet. Visibilities have been observed below three miles on an average of one day in twenty with precipitation, including rain showers and thunderstorms, being the exclusive cause of the low visibilities. The duration of showers and low visibilities is generally thirty minutes or less.

B. Fronts.

The terms "Intertropical Front" and "Equatorial Front" are in actuality misnomers. A density discontinuity and proper wind shear must exist to define a front. Rather conclusive evidence exists that significant horizontal density discontinuities do not exist in the Marshalls. The areas formerly designated "Intertropical or Equatorial Fronts" are in reality the paths of low-level eddies and vortices. The pattern of circulation about these disturbances produces areas and lines conducive to vertical motion. It is along these lines and in the areas where vertical motions are predominantly upward that middle and high cloudiness becomes extensive, precipitation grows to be general, and thunderstorms develop. The weather associated with these lines appears similar to the weather accompanying the true fronts of higher latitudes. However, these lines do not form or move as do true fronts nor are they subject to the same forecasting techniques which are applicable to the mid-latitude

front.

C. Clouds.

At 0630 local time, an even chance exists that the total sky coverage (all clouds considered—low, middle, and high) will be 7/10 or more. But overcast (10/10 coverage) conditions may be expected only about twenty per cent of the time. There is a slight tendency for overall cloudiness to increase as the season progresses into May; also for a daily maximum of cloudiness to occur near sunrise.

About seventy-five per cent of the time, the "trade" cumulus—normally based at 1,800 to 2,000 feet with tops at 8,000 to 10,000 feet—will cover 2/10 to 4/10 of the sky. The middle clouds—10,000 to 25,000 feet—will be associated with the eddies previously mentioned. At times these clouds may become very extensive, very thick, and remarkably persistent. Cirrus clouds are very common. Difficulties in precisely observing and measuring these translucent, hazy type clouds make a complete analysis of present data on cirrus of dubious value.

D. Winds.

At the surface, the persistent trade winds blow from east-northeast to northeast at ten to twenty knots. Although such persistence in direction and speed is not found aloft, westerly winds are observed about sixty-five per cent of the time above 20,000 to 30,000 feet. The frequency of occurrence of the westerlies above 25,000 feet increases as the season progresses. The height at which

the westerlies first appear has a wide range and the prediction of this height constitutes a complex forecasting problem.

Eighty per cent of the time at Eniwetok, wind speeds at any level up to 50,000 feet may be expected to be thirty knots or less. However, in the area to the east of Eniwetok, the frequency of strong west winds increases considerably. During the latter part of the January through May period, westerly winds increase in speed in the upper levels.

E. Tropopause.

The tropopause is the transition zone between the troposphere and the stratosphere. It is most frequently found between 54,000 and 60,000 feet above the Marshalls. The temperature of the tropopause in this area will be minus seventy-five to eighty degrees centigrade with warmer temperatures above and below the tropopause. Temperatures near minus sixty-five degrees centigrade can be expected at 45,000 feet.

F. Typhoons.

The months of January through April experience a minimum of typhoon activity in the Southwest Pacific area. Usually about two typhoons occur during this four-month period. During May, typhoon activity increases in the Western Pacific. The chance is remote, however, that Eniwetok or Bikini will be directly affected by a typhoon during this period.

PART II

Categories of Weather in the Marshall Islands Area.

In the attempts to analyze and lend comprehension to the weather of the Marshalls area, it has been observed that one of three typical weather situations may reasonably be expected to exist. In the oceanic tropics, as in higher latitudes, cloud systems have been found associated with specific types of wind systems. In Central Pacific tropical areas, however, the connection between wind systems and the clouds is much more obscure than in higher latitudes and requires for its discovery more detailed and extensive research. At first sight the surface winds in the Marshalls, particularly to the northward near Eniwetok and Bikini, appear to undergo very minor variations whereas the clouds may change greatly from day to day in form, amount, and height. Nevertheless, recent research based on high-level observations taken during the course of atomic tests since 1946 reveals that cloud cover is correlated with major wind systems and that the general day-to-day weather situations fall into the following three general, but fairly well marked, categories.

A. Trade.

The first of these categories of weather situation may be called the "trade" situation. Over the Marshall Islands, north of 5^{o} north, east-northeast to northeast winds prevail in the lower levels of the atmosphere; the wind speeds range between five and ten knots from the equator to 10^{o} north, increasing to as much as

twenty knots in the regions between Eniwetok and Wake. Small amounts of cumulus cloud, usually about 5/10 coverage, are found in this current. They do not extend much above 8,000 feet in the north or 12,000 feet in the south. Rain sometimes falls from some of these clouds, particularly in the south, but it is usually in the form of light showers. No extensive middle or upper cloud decks are found. Although the lower winds are northeasterly and quite fresh, as one ascends in the atmosphere over the northern Marshalls one finds that the winds turn more westerly with increasing elevation until at about 20,000 feet they lie between northwest and southwest. The westerlies then extend upwards to the tropopause, increasing in speed to about thirty-five knots at 45,000 feet; above the tropopause the winds again become easterly. If the tropospheric upper winds in the region should be mainly southwesterly, rain from the trade cumulus is likely and the amount of cloud may increase from time to time to as much as 8/10. On the other hand, if these upper winds are chiefly northwesterly in direction, cumulus clouds may decrease to as little as 2/10 or 3/10 and showers are less likely. The variation between northwest and southwest is controlled by an upper level pressure trough which tends to be located just west of Eniwetok during trade weather. The difficulties in forecasting variations in trade weather, then, are associated with small movements of the trough line to and from across the northern Marshalls.

B. Upper Level Tropical Cyclone.

The second category of weather situation, the upper level tropical cyclone, is very easily confused with the first; especially if an adequate upper air observational network is not in operation. In the lower atmosphere the winds lie, as in the trade situation, between east-northeast and northeast. The fluctuations in speed, time, and space may be quite large, however, and the winds do not vary latitudinally in the regular manner that is typical of the trade situation. It has been observed, for example, that although the winds remain in the northeast, the entire Marshalls areas may show wind speeds of less than ten knots for a period of two or three days. The cloud cover, instead of being recorded as 5/10 trade cumulus, may consist of only 2/10 to 4/10 of small cumulus below 4,000 feet over most of the area. Here and there, a more or less stationary line of large cumulo-nimbus with heavy showers--or even thunderstorms on occasion--may be seen lying across individual atolls or may be observed from aircraft. The greatest difference lies, however, not in the lower cloud but in the middle and upper regions. A very extensive sheet of alto-stratus breaking here and there to alto-cumulus will blanket the southern Marshalls and extend from time to time to the latitude of Eniwetok and Bikini. From this sheet, wherever it is thick, will fall a continuous and oftentimes heavy rain. Cirrus cloud is much more extensive than normal and in the south may form a continuous overcast layer lying above and sometimes fusing with the alto-stratus decks. Cloud and

weather make aircraft operations above 20,000 feet difficult and occasionally hazardous during this weather situation.

The difference between this situation and trade weather, as far as winds are concerned, is most marked in the atmosphere above 30,000 feet. The lower easterlies turn as before to westerlies, but these westerlies are stronger and form part of a very large cyclonic circulation which lies more or less stationary between the Eniwetok-Bikini area and Wake Island. The circulatory system is known as an upper level tropical cyclone. Winds as high as 100 knots at 45,000 feet have been reported over the northern Marshalls during such situations. Once established, an upper level cyclone may remain in situ for ten days before moving out into higher latitudes. Even though there may be temporary clearing for a day or two at some points in the area, the weather remains generally unsettled as long as the cyclone lies between Eniwetok and Wake. There may be a very general deterioration in the weather as the stationary cyclonic circulation intensifies and reaches lower latitudes. Following the movement of the upper level cyclone into higher latitudes, however, the trade situation will re-establish itself and this is often accompanied by sudden and dramatic improvements in the weather.

C. Vortex.

The third category of weather situation, the vortex, is characterized by winds in the lower atmosphere which fluctuate between northeast and southeast in the northern Marshalls and be-

tween east and west in the southern Marshalls. The easterly winds extend to great heights, reaching in some instances from the surface to 60,000 feet. Fluctuations in the easterlies are due to the passage of atmospheric waves traveling from east to west at a speed of approximately twelve knots. Thus the eastern Marshalls are affected by the wind shifts before the western Marshalls. Some of these waves become transformed into cyclonic circulations which show up on wind maps as vortices or eddies, similar, though on a larger scale, to the eddies seen on the surface of rivers. In contrast with the just described upper cyclonic situation in which cyclones have their origin in the high atmosphere, the transformation from wave to vortex for this situation occurs first in the lower atmosphere and gradually extends upward. In general, bad weather is associated with the west-southwest and southeast winds accompanying the rear portions of the vortex. This is also true of the waves from which the vortices originate. The worst weather is associated with the southeast winds. There is a tendency for this weather to appear in the form of long lines of cumulo-nimbus cloud bearing striking resemblance to the cold fronts of high latitudes; but they are more numerous than the latter within an equivalent area. Many vortices are quite weak; that is to say, maximum wind speeds—usually found in the southeasterlies—do not exceed thirty knots. But there is always the likelihood of a vortex intensifying suddenly to become a typhoon. The best known examples were Typhoons GEORGIA and JOAN which intensified over the

Marshall Islands during Operation GREENHOUSE. Though typhoons are small in area in these longitudes, they can be extremely violent and can cause as much damage as the great Western Pacific typhoons. The damage, of course, is more restricted in area; usually being confined to one or more atolls unfortunate enough to lie directly in the track of the storm.

A vortex which is intensifying affects the winds up to 40,000 feet and above; and if a vortex should happen to form south of Majuro and move in a northwest direction to a position south of Eniwetok while intensifying, very bad weather accompanied by cumulonimbus and extensive decks of alto-stratus and cirro-stratus clouds may be expected in the test area. A good rule of thumb states that the right semi-circle of the storm is the most dangerous both for air and sea transportation as well as for fixed installations. Since Bikini and Eniwetok are situated just north of the usual summer tracks for the vortices, test operations in the period of August to October are subject to hazard.

As earlier mentioned, there is a slight seasonal tendency in the weather of the Marshall Islands and this now can be evaluated. The three classes of weather situation can occur in any one month of the year and any one may succeed the other. However, the low-level cyclone situation tends to be more frequent between the months of July to November than during the remainder of the year; though Typhoon GEORGIA was an exception which shows how unreliable this rule is. Similarly, the trade situation, while it can occur at any

time of the year, is to be expected more frequently during winter months with January, February, and March probably being the months of greatest expectation. The upper-level cyclone situation appears to have little, if any, dependence on season. Because of its persistence, up to ten days, it must always be taken into account in planning operations in the northern Marshalls.

PART III

Meteorology in Relation to Atomic Tests.

It is probably safe to assume in planning future atomic tests in the Marshall Islands that each of the three categories of weather situation described in Part II will occur at least once during any period longer than one month. As already stated, there will be a tendency for low-level cyclones to be more frequent in summer and fall while the trade situation should be expected to occur with highest frequency in summer and spring. In the past, there has been a tendency to assume in planning more complicated operations that the wind systems aloft are associated only at random with cloud and weather. Prior to Operation CASTLE, for example, there had been operational requirements that the winds over the Marshalls up to 60,000 feet be, in the period following a detonation, from the southeast or south. At the same time, corollary air operations had been predicated on the assumption that trade cumulus without middle or upper cloud would prevail over the entire Marshall Islands area. Experience indicates that this is stipulating an incompatible distribution of weather elements. It is true that such condi-

tions may occur at long intervals of time and for short periods; however, such conditions will represent a transition from one of the three categories of weather situation to another and cannot always be counted upon to be of sufficient duration to ensure the successful execution of a complex operational plan for a given detonation. Other meteorological incompatibilities would be the association of strong westerly winds of more than fifty knots above 20,000 feet in the Eniwetok-Bikini belt and cloud conditions appropriate for photography on the ground and in the air. Such conditions have existed during past operations and will occur again but they must be regarded as accidents of nature, accidents of short duration. Their occurrence and the ability of meteorologists to forecast them cannot be depended upon in planning operations.

Finally, it should be emphasized that the most that can be done--in the present state of tropical meteorology--is to forecast broadscale weather situations involving, in the most general terms, the association of wind systems with average cloud cover and precipitation. It is not possible to say twenty-four hours in advance that an individual cumulus cloud will be located in any particular spot at any given time. The average lifetime of a tropical cumulus cloud of any magnitude is only forty-five minutes and its rate of movement depends only partly on the speed and direction of the wind. Its shape and the height to which it will reach; the amount of overhang; and the rate of dissipation of the tips will all depend on the microstructure of the air--a problem in turbulence theory which is

beyond the power of any aerodynamist or meteorologist to forecast twenty-four hours before the event. Precipitation in the form of showers, likewise, depends upon complicated physical processes occurring within individual clouds. While it is possible to state something about the likelihood of precipitation of this type in a given area, it is not possible to say whether rain will fall on one or another of the islands of an atoll nor to state the exact time of the beginning and ending of individual showers. An experienced meteorologist who has devoted long hours to the study of cloud forms in the tropics might make forecasts of these elements as much as an hour or two in advance. More than this should not be expected of the forecaster.

PART IV

Probability of Occurrence of Upper Winds with Southerly Components in the Eniwetok-Bikini Area.

Winds with southerly components at Eniwetok are much less prevalent than winds with northerly components. Upper wind data obtained by rawinsonde equipment since 1945 have been compiled. The frequency of occurrence of winds with southerly components is shown in the attached graph (Attachment No. 1).

The upper portion of the graph shows that winds with southerly components (i.e., east-southeast clockwise through west-southwest) have occurred about thirty-five per cent of the time during the months of March through July at levels of about 10,000 feet. The lower portion of the graph shows that southeast through southwest

winds have occurred about twenty per cent of the time during the same months at the same levels. The differences are due to the high frequency of east-southeast winds at about 10,000 and 16,000 feet and the high frequency of west-southwest winds above 25,000 feet. A slight trend for higher occurrence of winds with southerly components is indicated as the season progresses.

Extreme care must be taken in drawing conclusions from these data for three reasons:

1. The sample is small. The 49,000 foot data consist of less than 100 observations for March and April.
2. The variation of Marshall Islands weather for a given month during successive years may be greater than the variation during successive months. Note the high frequency of southerly winds at 49,000 to 50,000 feet during March as compared to April, May, and June. The weather of March, 1951, constituted most of this abnormality.
3. The data are tabulated for each level without reference to adjacent levels.

To evaluate the importance of the third factor, Item 3 above, a time-wind graph of Eniwetok winds has been analyzed for the period 1 January through 14 May 1954 (Attachment No. 2). The winds aloft at Eniwetok and Bikini were very similar during the entire period except from 23 April through 5 May. The winds were more southerly at Bikini than at Eniwetok during that period; and Bikini winds are shown for comparison purposes. From this graph,

data were obtained as to the simultaneous occurrence of southerly winds at 50,000 feet and at levels below. The results are shown in Table 1 following:

TABLE 1

ALTITUDES	DIRECTIONS	
	120° through 240°	100° through 260°
50 to 30 thousand	3.4% (16)	10.8% (51)
50 to 20 thousand	2.1% (10)	6.0% (29)
50 to 10 thousand	.4% (2)	2.3% (11)

Note: Percentage frequency of winds of given directions occurring simultaneously at all levels below 50,000 feet. (474 observations during period 1 January through 14 May 1954. Cases in parenthesis).

Table 2 following, shows that winds with southerly components have occurred as frequently during these months of 1954 as they did in past years.

TABLE 2

1945, 1946, 1950, 1951, and 1952		1954	
3000M	32%	10,000 ft	30%
8000M	21%	25,000 ft	26%
15000M	35%	50,000 ft	40%

Note: Percentage frequency of winds with southerly components, January, February, March, April through mid-May 1954, as compared to previous years.

From the above tables, the following conclusions were drawn:

1. The upper winds during CASTLE were as favorable as past years for such an operation; this was a fairly "normal" year.

2. Winds with pronounced southerly components at all levels between 10,000 and 50,000 feet occur simultaneously about once every fourteen times that winds with southerly components occur at 50,000 feet. Winds with southerly components at all levels can be expected to occur about twice per month.

3. EVENTS 1 AND 2 of CASTLE occurred on the best possible days during March though a more favorable day for EVENT would have been 27 February. SHOT 2 day was the most favorable of the entire month. THE SHOT 3 device was detonated on the next possible day. While SHOTS 4 and 5 devices were detonated on the next occurrences of acceptable wind conditions, the conditions were not as markedly acceptable as on former test days. The winds were definitely more favorable at Bikini than at Eniwetok. SHOT 6 device was detonated on the very next favorable day. (Attachment No. 2).

For additional information concerning CASTLE meteorology, refer to JTF SEVEN Special Report, The Effects of CASTLE Detonations Upon the Weather, published in October, 1954, and History of the Task Force Weather Central, dated May, 1954.

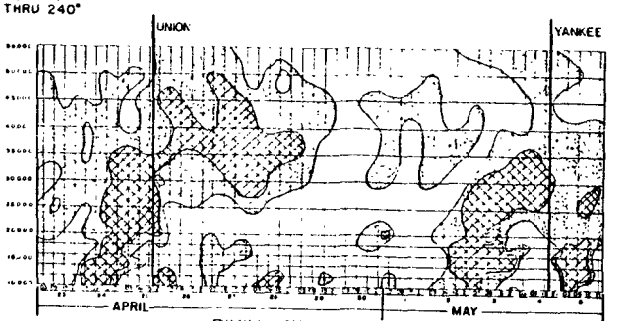
WIND TIME GRAPH

BIKINI ATOLL, M.I

23 APRIL - 5 MAY, 54

100°, 110°, 250°, & 260°

120° THRU 240°



BIKINI ATOLL

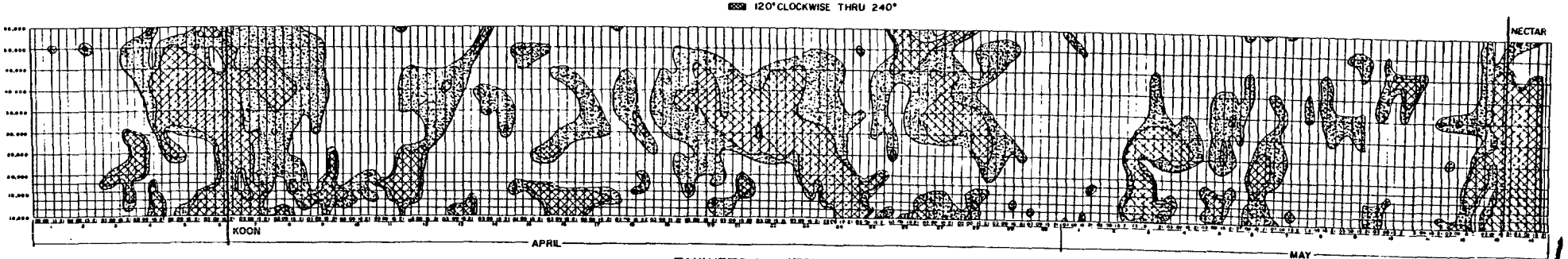
WIND TIME GRAPH

ENIWETOK ATOLL, M I.

1 APRIL - 14 MAY, 1954

100°, 110°, 250° & 260°

120° CLOCKWISE THRU 240°



ENIWETOK ATOLL

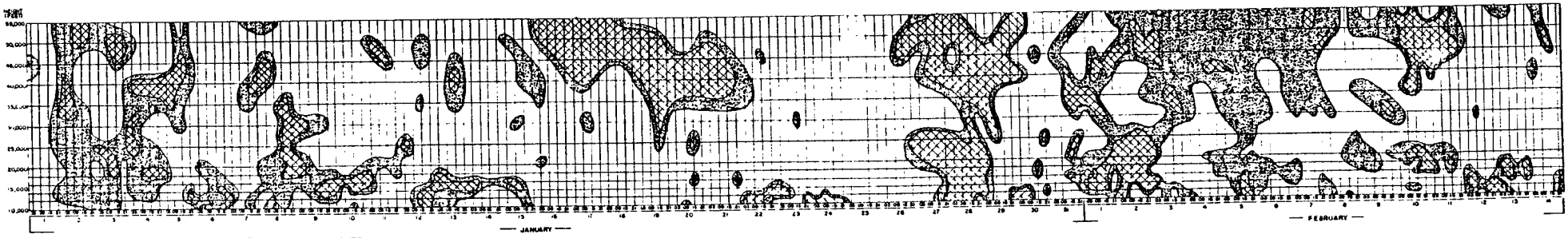
~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

WIND TIME GRAPH

ENIWETOK ATOLL , MI

1 JANUARY THROUGH 14 FEBRUARY, 1954



KEY - SHADED AREAS - WINDS WITH SOUTHERLY COMPONENTS

WIND DIRECTIONS 100°, 110°, 250° & 260°

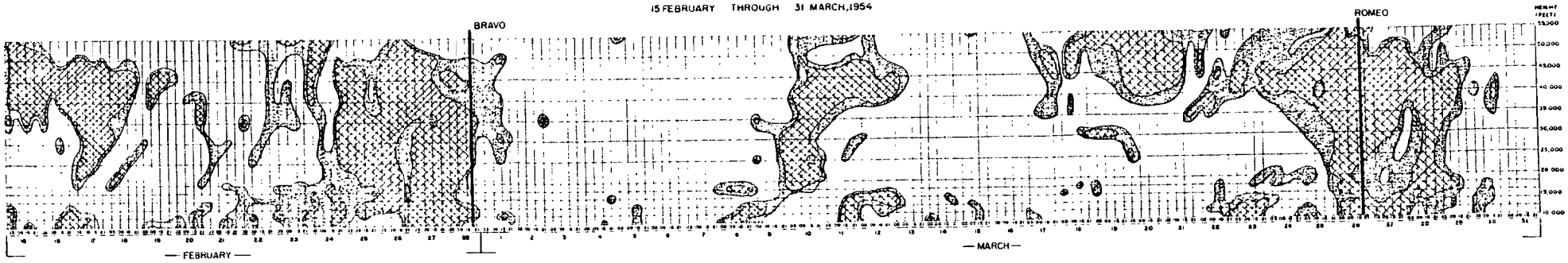
WIND DIRECTIONS 120° CLOCKWISE THRU 240°

ALL TIMES AND DATES - GREENWICH CIVIL TIME

WIND TIME GRAPH, (CON'T)

ENIWETOK ATOLL, MI

15 FEBRUARY THROUGH 31 MARCH, 1954



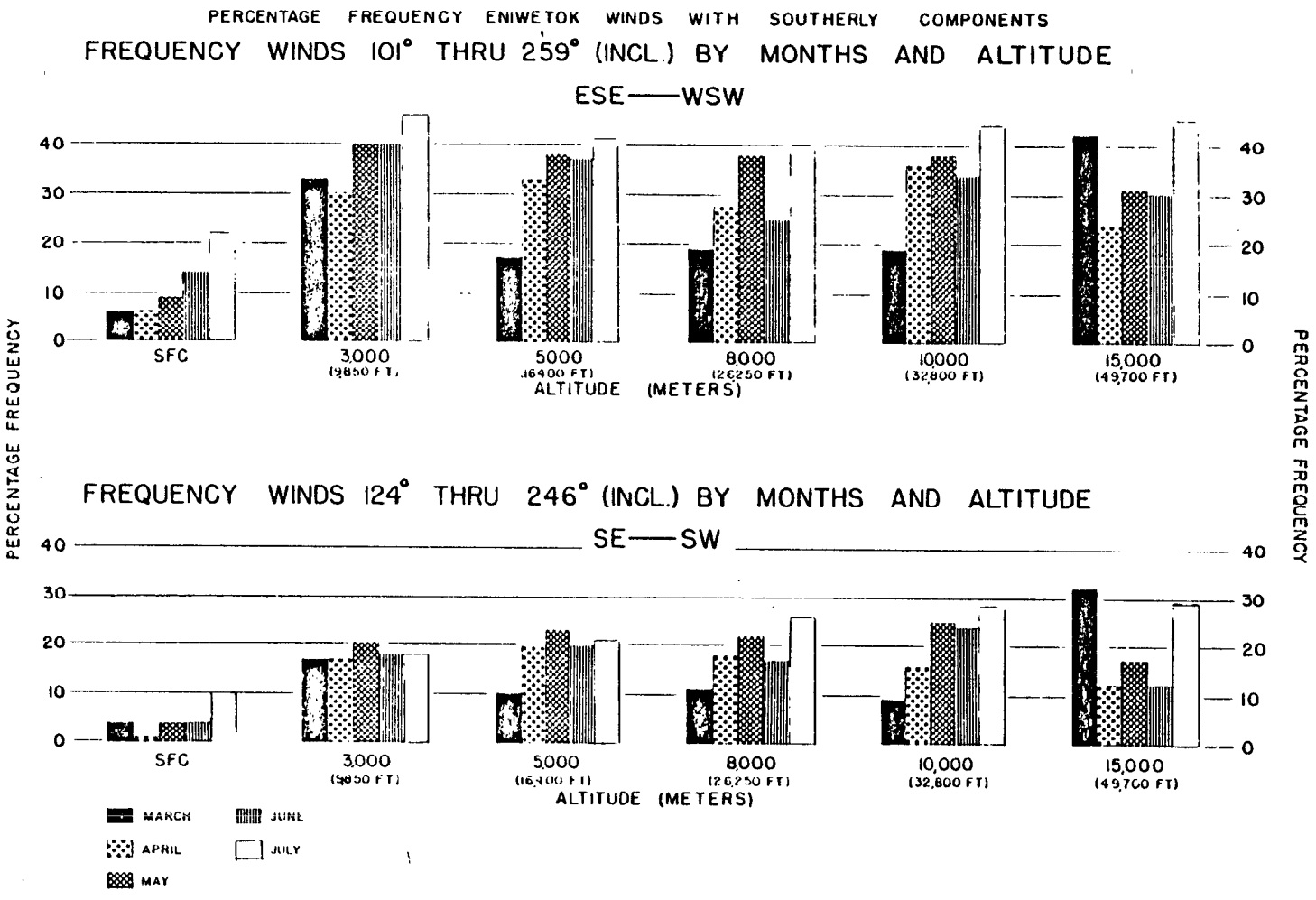
KEY - SHADED AREAS - WINDS WITH SOUTHERLY COMPONENTS

WIND DIRECTION 100°, 110°, 250° & 260°

WIND DIRECTION 120° CLOCKWISE THRU 240°

ALL TIMES AND DATES - GREENWICH CIVIL TIME

~~CONFIDENTIAL~~



Meteorology Chart

APPENDIX B

RADIOLOGICAL SAFETY

This appendix deals with the radiological safety activities and organization during Operation CASTLE. For the most part the problems encountered in this field will be recurrent in future operations but the CASTLE experience will fortify the radsafe planners with necessary solutions to many of the questions which will arise. In some respects radiological safety during Operation CASTLE was atypical as compared to previous overseas tests. The unique characteristics of the test itself created problems which had no previous counterpart and thus the radsafe planners had to rely on the flexibility of their planning and the capability of the Task Force to meet each situation in turn.

The appendix is organized into three broad parts. PART I discusses the aids which are available to the radsafe planners for predicting and determining fallout. PART II outlines the radsafe organization for Operation CASTLE and PART III discusses those radsafe problems, in both the planning and operational phases, which faced the Task Force.

PART I

Fallout Forecasting Aids.

In performing the significant function of forecasting the probable radiological fallout following a detonation, the radsafe personnel have certain tools or aids which are available to them. In general, these aids are closely related to and dependent upon weath-

er factors and information, for weather determines the major premises upon which the radiological safety program is based. Forecasts of radioactive fallout depend primarily on forecasts of the wind field and thus these forecasts will be no more accurate than the wind forecasts themselves. This means that the Task Force RadSafe Officer must work closely with the Task Force Meteorologist in determining the outlook for any one period. In cooperation with the Meteorologist and other specialists, the RadSafe Officer can depend on such aids as:

A. Winds Aloft Observations and Forecasts.

The weather observational network for CASTLE consisted of stations at Eniwetok, Bikini, Rongerik, Majuro, Kusaie, Ponape, and Kwajalein, with additional data coming from Midway, Wake, Marcus, Guam, Iwo Jima, and Johnston. Twice daily winds aloft runs were made as a routine matter with the number of runs being increased to as many as eight per day prior to a shot period.

Planning forecasts were issued forty-eight and thirty-eight hours prior to each shot hour and consisted of winds for the shot site for each ten thousand foot level from the surface to ninety thousand feet. Following the selection of a specific shot time, forecasts were issued at twenty-four, thirteen, eight, and four hour intervals prior to H-hour. These forecasts were much more detailed; winds were forecast to the nearest ten degrees and to the knot, and for each two thousand foot increment from the surface to twenty thousand feet, for each five thousand foot increment from

twenty thousand to seventy thousand feet, and for the eighty thousand and ninety thousand foot levels.

The above forecasts, along with all available observations, were plotted as hodographs (wind vector diagrams) for further convenient computations.

B. Air Particle Trajectory Forecasts.

In addition to the wind forecasts themselves, auxiliary air particle trajectory forecasts were issued at H minus 24 and H minus 8 hours. These consisted of trajectories from the shot site for the period of H-hour to H plus 72 hours, and were for each ten thousand foot level, from ten thousand to sixty thousand feet. Revised trajectories for the same period were issued at H plus 6 and H plus 15 hours. The forecasts were used by radsafe personnel primarily to assist in analysis of the long-range fallout aspects and to alert other units of the Armed Forces relative to the probable locations and altitudes of areas with airborne radioactive particles.

C. Constant Altitude Balloon Flights.

During CASTLE, a project was instituted whereby constant altitude balloons were used to determine the feasibility of tracking radioactive debris at selected levels. It was assumed that the movement of that part of the radioactive cloud debris remaining in the air at a particular level could be described by a balloon flown at the same level. This project was unsuccessful during CASTLE due to poor pre-launching checking procedure, an insufficient number of balloons, and improper type of balloon; however, this type of pro-

ject has potentialities and should be reinstituted on a larger scale for future tests.

D. Results from Previous Operations.

Due to the small number of surface shots detonated prior to CASTLE, only a limited amount of data was available on the long-range fallout aspects of this type burst, and in particular, only the close-in phenomena were available for the high yield type. As a consequence, although certain factors could be relied on, in general only assumptions could be made in reference to these devices prior to the operational period. The CASTLE experience, however, will be of inestimable value to radsafe planners in future operations.

For example, the CASTLE experience developed two important areas of radiological study about which little was known prior to the Operation. It had been predicted that significant fallout would occur during the first twelve hours following the firing of the device. Past experience in this matter seemed to favor a six-hour period for significant fallout; however, since the off-site fallout aspects of MIKE shot of Operation IVY were not known, the value of twelve hours was used as a margin of safety. The [SHOT 1 and [SHOT 2 experience revised this thinking somewhat for from the action of these shots it became apparent that something on the order of at least eighteen and possibly twenty-four hours would be more realistic, especially for surface land bursts. As a consequence, a new technique was developed to approximate the signifi-

cant fallout area for the first twenty-four hour period, taking into account changes in the wind patterns with time and displacement of the atomic cloud. No basic change was made in the fallout forecasting techniques as planned prior to [SHOT 1,] rather the new method was used and presented at briefings to augment and modify results from the original methods.

Also, MIKE shot indicated that the current methods of predicting fallout on the assumption of a point source (or at best, a very small source) were not acceptable for high yields. Consequently, CASTLE forecasting was originally made on the basis of a circular source approximately fifteen miles in radius (i.e., the approximate radius of fallout crosswind and upwind from MIKE). The results of SHOT 1, however, indicated this to be somewhat small, and the shape was probably more elliptical with a semi-minor axis of about twenty-five miles. For the barge shots, the fifteen mile circular radius (again more elliptical than circular) appeared to be more than adequate.

E. Construction of RADEXES and Fallout Plots.

Generally speaking the radiological exclusion area (RADEX area) was considered to be a limited fallout area for the first six hours post-shot in the vicinity of the test site and for the primary use of test personnel and equipment. The RADEX was used as an operational device to define dangerous areas and to deny entry of Task Force units into certain areas except under specific authorization. As a consequence, it was given wide dissemination through-

out the Task Force for the information and compliance of all. Area fallout plots considered the entire area of significant fallout, to include infinity isodose lines of at least fifty roentgens, and in some cases down to ten roentgens. These plots, being more general in application, were considered, with the RADEXES, at command briefings for the overall fallout impact on populated atolls in the vicinity of the shot atoll.

In support of the above, the previously mentioned hodographs (see A) played an important role in the determination of the radsafe picture at any one time. These wind vector diagrams graphically illustrated the favorable or unfavorable wind patterns at the two atolls in the PPG. As a general rule, the high and low winds in the Marshall Islands are relatively stable, being east northeasterly to easterly in the lower tradewind levels (surface to about 20,000 feet) and easterly in the high levels above the tropopause (above 60,000 feet). In view of these wind directions at various levels (see also Appendix A, Meteorology) a discussion of favorable and unfavorable hodographs is primarily concerned with those mid-levels where the winds are most variable and involve the most significant portion of the cloud from a fallout standpoint, i.e., between 20,000 and 60,000 feet. The limiting criteria for wind patterns were determined by the populated atolls of Ujelang, Eniwetok, and the Marshall Islands to the east of Eniwetok. In general, wind conditions acceptable for a shot at Bikini are acceptable at Eniwetok. The converse is not always true. An additional consideration is the fact

that the two atolls will not always have similar, or even acceptable, wind patterns simultaneously. Further, the relative favorability of any specific wind pattern is dependent on factors other than just wind alone.

At Bikini, patterns with mid-level winds from the sector southeast clockwise through southwest were considered favorable for all types of shots, with an extension of the sector to east southeast and west southwest for barge shots. For Eniwetok, the acceptable mid-level wind directions were more flexible; the limits on cloud travel to the east could be "stretched" somewhat to allow west southwest mid-level winds for all types of shots, and the western limits of the favorable fallout sector could be extended to the point of accepting winds from at least east northeast and, with reservations, from northeast.

The net result of the above was the relatively firm requirement for the mid-level winds to have directional components such that resultant winds to the levels involved lay within the acceptable fallout sectors, i.e., within the sectors west northwest clockwise to east northeast for Bikini shots and from about southwest clockwise to east northeast for Eniwetok shots. From this description it would appear that Eniwetok would be the more preferred of the two atolls from the radiological standpoint; however, other factors made this atoll less favorable. The primary considerations in this connection were the yields, the predicted range in yields of the devices, and the resultant contamination and blast damage predicted

for the populated camp sites at Eniwetok. These, of course, were much less important factors at Bikini.

For SHOT 1 an attempt was made to employ a method of elliptical approximations of the infinity isodose lines on all forecasts from about H minus 18 hours up through the final pre-shot forecast. This method consisted of circumscribing ellipses over the hodograph between shear levels. As the Operation progressed, it became apparent that a more meticulous method was needed to clearly define the fallout from high yields. The elliptical approximation method, and any extension of the surface RADEX, beyond about six to twelve hours, were limited by the fact that they are built upon the ground zero winds. A new and dynamic method was needed to take into account the changes in the wind systems as particles drifted farther and farther from ground zero. This resulted in a new technique developed on CASTLE which utilized air particle trajectory analyses and progressive forecasts of wind patterns in accordance with time and displacement aspects of the cloud. Practical methods were devised to apply such a system to the last three CASTLE shots for a valid forecast period of H to H plus 24 hours.

PART II

RadSafe Organization for Operation CASTLE.

A RadSafe Office was located in the Headquarters, JTF SEVEN, and this office had the ultimate responsibility for the CASTLE radiological safety program. During shot periods, this office was designed to be the primary Task Force shot-time agency for all rad-

safe matters requiring headquarters staff action and for all radsafe information having an impact on the various operational decisions which were expected to arise. The functions of the office included the preparation and presentation of the radsafe portion of the command briefings prior to the shot and the continual reconnaissance of the area to determine the relatively close-in and long-range fallout aspects after the shot. Additional responsibilities, which aided in the accomplishment of the above functions, involved the necessary liaison with representatives of the Air Force Office of Atomic Energy (AFOAT-1); the Health and Safety Laboratory, New York Operation Office, AEC (HASL, NYKOPO); with the Task Force Biomedical Advisor and Staff Surgeon; and with other special advisors to CJTF SEVEN.

Each task group was directed to set up a radsafe unit self-sufficient in terms of manpower, equipment, maintenance, and training. (TG 7.5's radsafe unit was self-sufficient only between operations). In addition to handling the routine task group radsafe matters, each task group unit was delegated special functions to perform for the primary benefit of the Task Force as a whole and for which the particular group designated had a direct interest or was specially adapted to accomplish the function. These functions were as follows:

1. TG 7.1. Execution of the major functions concerning on-site recovery operations, operation of field radiochemistry laboratories, and operation of complete photodosimetry ser-

vice for the entire Task Force.

2. TG 7.2. Provision of monitors for security sweeps and maintenance of a pool of trained monitors and decontamination operators to back up TG 7.1.
3. TG 7.3. Provision of facilities afloat for ship-based recovery operations together with the necessary helicopter services and execution of the lagoon water sampling plan.
4. TG 7.4. Execution of the radiological safety portion of the aircraft cloud sampling program and provision of aircraft and personnel for the conduct of the Task Force cloud tracking program.
5. TG 7.5. Assumption of radsafe responsibilities for the entire PPG (except Eniwetok Island) during the interim operational periods.

With the exception of TG 7.1, the greater portion of the radsafe personnel for the entire Task Force were "additional duty" types with only a few "primary duty" staff and supervisory personnel. (For necessary supervision, each task group was assigned at least one fully trained radiological defense engineer.) Thus, the Army Task Group trained radsafe personnel from each activity of the group; the Navy Task Group placed radsafe under Damage Control in accordance with routine Navy organizational practices; and the Air Force Task Group utilized flight crew members as monitors and maintenance personnel for aircraft decontamination. The one exception, TG 7.1, had been designated the major radsafe unit for on-site op-

erations and given the responsibility for specific centralized and highly technical radsafe services. Thus, considerable manning problems had to be solved to assemble the necessary "primary duty" technicians, most of whom were military personnel on a temporary duty basis. Even for this unit, however, the "additional duty" philosophy was utilized where possible for personnel economy.

PART III

This portion of the radsafe appendix will deal briefly with the unique aspects of the CASTLE radsafe situation and the problems, both planning and operational, which were encountered. Organizationally, Part III is divided into four subject headings: (A) the problem of radiation doses and protection of Task Force personnel, (B) off-site operational considerations, (C) the effect of the shot schedule and conditions, and (D) the aspect of lagoon contamination.

A. The Problem of Radiation Doses and Protection of Task Force Personnel.

The development of the CASTLE RadSafe Plan primarily revolved around two basic criteria, the so-called rule dose and the tactical dose. The rule dose is the MPE of 3.9r for the Operation set by the AEC and based on the industrial safeguard of 0.3r per week for thirteen weeks. This limit creates radiation control problems in work performed in contaminated areas and becomes progressively more significant when there is an increase in the yield, number of events, and the rapidity of detonation. The tactical dose is that higher exposure accepted by DOD authorities in the ra-

diation field for use in tactical or emergency situations and is based on the consideration that it will be received as an exception.

The CASTLE RadSafe Plan was designed to meet the requirements of the rule dose as modified by agreements with the authorities in the radiological field. However, due to the special nature of a field test such as Operation CASTLE, it was recognized that a policy of strict adherence to the radiological standards prescribed for routine laboratory or industrial use was not realistic. The intent of the CASTLE plan was to reach a reasonable and safe compromise considering conservation of personnel exposures, the international import of the tests, and the cost aspects of delays due to excessive radiological precautions. The effort established criteria for waiver of the MPE in certain cases, taking full consideration of the safety of the individual and the need for completion of the CASTLE mission. The MPE waiver provision was cleared with and approved by the Surgeons General of the three Services, and the Director, Division of Biology and Medicine, AEC.

In reference to the protection of Task Force personnel from radiation exposure, the basic plan was built on the premise that Eniwetok Atoll was the primary base of operations and Bikini was the forward shot area. Thus, personnel in the Bikini area were completely evacuated (except for the firing party during [SHOT]) and disposition of all ships was made so that personnel would be in the most favorable position with respect to the wind pattern and fallout area, and at a sufficient distance so as to be safe from

blast and thermal effects. For the Eniwetok area, the wind patterns were carefully studied both pre-shot and post-shot for possible adverse fallout effects in that direction. Cloud tracking was the primary post-shot method of assuring safety to the personnel at Eniwetok and while evacuation was not effected at that atoll, the capability existed to execute such an operation should the need arise.

B. Off-site Operational Considerations.

In addition to concern for the on-site area, the radsafe planners had to take into consideration many factors which are well outside this area. The possibility of contamination of the many native-inhabited atolls surrounding the PPG, for example, necessitates careful planning prior to a test series. In general, the radsafe off-site operations, based primarily on cloud tracking, aerial survey, and ground monitor stations, were carried out as planned and were adequate for the CASTLE tests. As the Operation progressed certain modifications were made to satisfy unusual circumstances.

1. Native Populations and Evacuation.

Previous to the Operation all atolls except Ujelang (and Eniwetok for Bikini shots) were considered to be in a favorable location with respect to fallout. However, there was a general movement of air particle trajectories to the east on all shots regardless of the initial direction of the winds near ground zero. The net consequence of this action was the eventual transport of the most significant portion of the cloud (i.e., approximately 20,000 feet to 60,000 feet) to the east where subsequent subsidence of the

debris could place a considerable amount in the trade wind flow to be brought back into the general area of the tests. The greatest effect from this mechanism occurred following the [SHOT 1]. The deposition of radioactive material on native atolls to the east of Bikini following [SHOT 1] was such as to necessitate evacuation of these atolls. (See Chapter IV). Although subsequent shots did not add appreciably to this initial deposit, continuous additions of small amounts of contamination can eventually create an appreciable background of long-lived fission products.

2. Interference with Air Routes and Protection of Transient Shipping.

In the detonation of devices as large as those tested during Operation CASTLE, a problem arises in connection with the protection of air and sea routes through this area. Again, the problem is a principal concern of the radiological safety planners. In reference to air routes, definitive data on this subject were passed to CINCPACFLT with specific recommendations for closing a specified route for a specified length of time.

In order to provide protection for transient shipping in the region, a high degree of coordination was necessary. CINCPACFLT was requested to make advance diversions of shipping outside a sector area from southwest clockwise through north to east, to 500 nautical miles from ground zero from H to H plus 24 hours. A further modification subsequent to [SHOT 1] provided that all U. S. shipping passing within 600 nautical miles of Bikini would come

under the operational control of CTG 7.3 for radsafe diversion if necessary. In addition, P2V aircraft and destroyer sweeps were made in order to detect the presence of any shipping in the area. The WB-29 aircraft on routine weather reconnaissance missions were also instructed to report all sightings. The information from all these sources was relayed to the Task Force Headquarters for evaluation and consideration at the weather/radsafe command briefings. A master plot of all shipping reported was presented by the RadSafe Officer at command briefings for consideration along with the many other factors involved in a shot decision. Except for one incident (the Japanese fishing vessel, see Chapter IV) all shots were detonated without significant effects on any shipping in the general area of the tests.

3. Cloud Tracking.

This operation of cloud tracking could be more precisely considered as "aerial surveys", being surveys of sensitive areas to detect the development of potentially hazardous conditions. Because of the unique circumstances presented in the PPG, a plan had to be worked out to reconcile critical requirements with available equipment to do the job. In general, the cloud tracking operations for CASTLE were highly successful considering the serious limitations on such an effort in the Pacific. The success of the activity is attributable to constant efforts to improve the techniques and aircraft utilized by analyzing the difficulties and circumstances of each of the shots as the test series progressed.

4. Support of the World-Wide Fallout Program.

In an attempt to document the long-range fallout aspects of high yield shots at the PPG, the Health and Safety Laboratories of the New York Operations Office, sponsored a program of ground, aerial, and shipboard monitoring stations in the Pacific covering an area generally bounded by the equator to the south, Japan-Alaska to the north, the Hawaiian Islands to the east, and the Philippine Islands to the west. The program was carried out in coordination with the Task Force and CINCPACFLT. JTF SEVEN Headquarters made space and clerical assistance available for HASL supervisory personnel; provided communication facilities to the many outlying ground stations; provided air transportation facilities to all of the outlying Task Force weather stations, Ujelang, and Wake; and provided transportation assistance to other sites outside Task Force control as was necessary. In turn, the HASL effort provided the Task Force with current data on the radsafe situation as reflected by readings at the various ground stations and from the aerial survey flights.

C. The Effect of the Shot Schedule and Conditions.

The final shot schedule agreed upon and included in CJTF SEVEN Operations Order 3-53 presented a real problem to the radsafe planners for this schedule included more total shots and many more high yield events than had ever before been attempted in an overseas test. This ambitious program meant that extreme care would have to be exercised in the acquisition of radiation

expcsures of personnel so as to spread the MPE of 3.9r for each individual over the entire period of participation. In recognition of the prcbable inadequacy of the 3.9r in some cases, provision for a waiver of the MPE was built into the CASTLE plan.

In planning for the radiological aspects of the shots themselves, some data could be utilized from previous detonations, both at the Nevada Proving Grounds (NPG) and the PPG, but in general the CASTLE program included shot conditions not previously encountered, i.e., surface shots on barges in relatively shallow water and one shot on a small sand spit. Past experience and general presumptions seemed to indicate that the local and long-range contamination problems would be most urgent for the Namu Island shot, [SHOT 1], at Bikini and considerably less urgent for the barge shots off Yurochi Island at Bikini.

As the shots progressed it became more and more apparent that the planning assumptions were justified. With the exception of [SHOT 1], the assumptions were sufficiently valid to predict the end result with a fair degree of accuracy. As a general statement, [SHOT 1] behaved much like a highly contaminating ground surface burst. The great amount of solid material carried up into the column and mushroom returned to the ground forming roughly an elliptical isodose line pattern on the shot atoll. Contamination of the Enyu and Eninman camp sites had been predicted from the [SHOT 1] wind pattern, although resultant intensities, particularly on Enyu, were higher than anticipated.

D. The Aspect of Lagoon Contamination.

Prior to the Operation, a considerable amount of study was devoted to the problem of contamination of the shot-atoll lagoon and the possible disruption of surface operations as a result. Considering the shot schedule and the flushing mechanism of the two lagoons (Eniwetok and Bikini), the primary problem of ship operation seemed real only at Bikini. In general, it was assumed that the problem would be more an operational nuisance than a health hazard and that ship operation could begin by H plus 24 hours. The eventual situation relative to lagoon operation was as predicted except that the bulk of the water transport of fallout was horizontal and downward. Very little, if any, upwelling of radioactive material occurred. On all shots, except [SHOTS 1 AND 5,] ships were able to re-enter the Enyu anchorages by approximately H plus 6 hours. Following [SHOT 1,] ships were kept clear of the lagoon until shot day plus 1 and following [SHOT 5,] re-entry was delayed until H plus 10 hours.

For additional information concerning CASTLE radiological safety, refer to the JTF SEVEN Final Report, Radiological Safety, Operation CASTLE, dated August 1954.

APPENDIX C

COMMUNICATIONS

Communications has been a dominant factor in the technological progress of the world. Without the development of modern facilities for carrying a message to almost any point on the globe, it would be nearly impossible to conduct the multitude of significant activities which occur daily in every area of life. For overseas atomic tests the variety of communications facilities plays an immeasurable role. Every aspect of the joint operation relies on the communication network which has been established in the forward area at considerable expense, both in terms of money and manpower. This appendix then will outline those general problems which face the communications planners and those specific difficulties occuring during Operation CASTLE.

PART I

Joint Task Force Communications Problems.

It is the purpose of this first portion of the appendix to present the unusual planning and operational difficulties, variant from the normal military procedure, and the special requirements which exist in order to provide communications support for an overseas atomic test. The discussion is not confined to Operation CASTLE but is based on experience from preceding operations as well so as to illustrate those problems which are recurring and can be definitely considered in the planning phase. Preliminary assumptions necessary previous to a narrative on communications planning are:

1. Adequate, rapid, and secure communications of high technical standards are essential to atomic test operations.
2. Eniwetok and Bikini Atolls will be utilized for future operations with Eniwetok serving as the logistical and operational base area.
3. A combination of shipboard and land-based command communications facilities will be required for future operations.
4. Evacuations of the test atoll and possible evacuation of other atolls will be required.
5. Task Group 7.4 will continue to be based on Eniwetok Island.
6. Major communications missions will be assigned to the various task groups and will remain essentially the same as those assigned for CASTLE with the exception of the trend of TG 7.5 to provide services for TG 7.1.
7. Task Group 7.2 will continue to provide and operate joint relay and cryptocenter facilities in addition to principal command and administrative communications circuits.

A. Planning and Preparation.

Early planning for communication facilities is essential since the exacting requirements placed upon communications for an overseas atomic test make it necessary that the facilities be carefully designed and engineered as a system. Because of the size of

the operations and the necessity for close and rapid coordination, the piecemeal installation of field equipment is not adequate to provide satisfactory service. Thus, for an adequate system to be established, a considerably longer preparatory period to allow for engineering and construction is needed following the firming of operational plans. Since the period is so short it is necessary to make certain assumptions based on preliminary plans, to formulate plans for base communications facilities adequate to meet the maximum needs of the operation, and to begin the engineering, requisitioning, construction, and installation activities well in advance.

During this phase it is essential that the task groups and the Task Force operation's planners coordinate with the communications personnel on all plans and changes thereto so as to avoid unsatisfactory and costly emergency action during critical periods. The wide geographical dispersion of the Task Force units and the security restrictions combine to complicate effective coordination but at the same time increase the need for it.

In accomplishing coordination at least two conferences between Task Force and task group communications officers are desirable; (1) to discuss preliminary planning and, (2) to finalize details prior to the operational phase. Other effective methods for assuring needed liaison include trips to the PPG by communications officers, field surveys, and some indication, formal or informal, of the periodic progress toward operational readiness of the various

communications units.

Other factors which influence the planning and preparation are:

1. The international and political sensitivity of test operations which result in a continuing demand for rapid, secure, and reliable communications.
2. The isolation of the PPG and the long lead time required for delivery of equipment, supplies, and personnel.
3. The relatively short tour of duty for permanent party personnel which creates problems of morale, orientation, and training.
4. The wide dispersion of Task Force elements during both the interim and operational periods.
5. The space limitations existing in the PPG affecting the expansion of fixed communications facilities.
6. The budgetary limitations affecting necessary transition from tactical to fixed plant facilities.
7. The requirements for as much speed in message handling service as is consistent with stringent communications security regulations and large volume of classified traffic.
8. The coordination of efforts and procedures of the three Services and of civilian agencies necessary to implement Task Force projects.

B. Personnel.

The procurement of a sufficient number of qualified communications personnel is of particular concern in a test operation requiring the assembly of a large force of highly efficient communications personnel for a relatively short period of time. The civilian task groups have acquired a good nucleus of well trained and experienced engineers and operators but for many reasons normal Service requisition methods do not provide personnel with adequate experience for the PPG operations. Early and aggressive action at the Departmental level of each Service is necessary to insure that adequately trained personnel will be available in time to permit shipment of all personnel to the PPG prior to the operation for training.

Personnel problems are especially apparent in TG 7.2. Increasing operational requirements demand a certain degree of flexibility in the organizational structure but because of the long time required to alter the table of distribution, it is difficult to satisfy new requirements immediately. For Operation CASTLE the T/D was revised to authorize an interim and an on-site communications strength. The T/D was inadequate, however, even at full strength and arrangements were made with the Office of the Chief Signal Officer (OCSigO) and the Signal Officer (SigO), U. S. Army, Pacific (USARPAC), to provide additional personnel on TDY for the duration of the Operation. From experience gained it appears that no fixed organization will ever be completely satisfactory and that arrangements should be made to insure a source of properly cleared, technically quali-

fied personnel who will be available for TDY with the Task Force when the need arises.

Well-trained personnel are of paramount importance to the Task Force communications mission. The short tour of duty (one year) for garrison force personnel precludes the assignment of unskilled or semi-skilled men for they will require training before they may be profitably employed. If a training program is carried on it means that; (1) competent men whose services are needed elsewhere will be required as instructors, and (2) by the time a man is competent to perform his duties little time remains before he is eligible for rotation. This is a difficult problem to resolve since the pipeline replacement personnel have received only basic training and primarily consist of men in the grades of E-2 and E-3. In order to remedy this for Operation CASTLE arrangements were made with G-1, D/A, and OCSigO to provide men from special levies placed on ZI communications installations under the control of OCSigO. Some shortages still existed, however, and these were filled with TDY personnel from both the ZI and USARPAC during Operation CASTLE.

C. Equipment and Facilities.

In construction of facilities and procurement of equipment, planning must begin well in advance of the operational period. All major equipment and construction requirements must be firm by at least 90 - 120 days prior to the commencement of on-site operations for it takes this long as a lead time for delivery of equipment and as a construction period for facilities. Any requirements submitted after that time will have to compete with the high priority needs

of the Scientific Task Group.

In previous operations equipment complications have arisen because Headquarters, JTF SEVEN, did not have information as to the quantity, type, and condition of the major items of communications equipment available at Eniwetok. This data is needed during planning in order to determine the existing capability for accomplishing the assigned mission and to assist in determining what additional and replacement equipment will be necessary. It is essential that future operations employ a continuous recording and reporting system.

Other problems encountered in establishing facilities on Eniwetok include space limitations and climatical conditions. Little or no space is available on Eniwetok Island for further expansion of existing fixed plant facilities. Both installation space within buildings and locations for new buildings are limited but most critical is the lack of area for antenna fields and long range planning should provide a solution of this problem. Long range planning at Eniwetok should also include provisions for dehumidifying or air conditioning both the transmitter and receiver stations. The climate in this Pacific area causes corrosion and rapid deterioration of expensive electronics equipment unless given adequate protection. A cocooning procedure had been employed previously but did not prove satisfactory.

A communication facility which plays a significant role in the overseas operation is the command ship. For Operations IVY

and CASTLE this ship was the USS ESTES (AGC-12). During IVY it was assumed that since the ship was primarily designed to provide communications support to a command afloat, that it was capable of performing the communications mission assigned without thoroughly checking the adequacy or operational readiness of the equipment or operating personnel. This mistake was not repeated for CASTLE since training was instituted and modifications implemented to insure the success of that ship's role in the communications network.

The difficulty of extending radioteletype operations to Task Force ships, particularly for on-line cryptographic operations, is one of major proportion since the ships are primarily designed for continuous wave (CW) operations. Under normal tactical operations the CW installations are both adequate and efficient, however, the system required slow off-line encryption of classified messages. In a large nuclear test operation, heavy volumes of highly classified traffic are handled and normal CW facilities are too slow for satisfactory service. Teletype equipment is capable of rapidly handling a large volume of traffic and is particularly suitable for the fast handling of classified traffic when on-line crypto facilities are provided in conjunction with the radioteletype terminals. This equipment requires considerably more space than terminal equipment on the same number of CW circuits and adequate space is normally not available in the communications quarters of most ships.

Another problem ever present in joint operations is the one of constant coordination and follow-up required to execute satis-

factorily Task Force communications projects by combined service and civilian organizations. It is necessary to have each agency appoint a project officer capable of making decisions for his organization. Numerous contacts with major headquarters are necessary to insure coordination and the project officer must continually take the initiative and act as a control point until all details have been completed.

PART II

Operation CASTLE Communications Problems.

A. Planning Phase.

In communications planning for Operation CASTLE it was possible to use as a starting point the major communications deficiencies experienced during Operation IVY. These included:

1. Lack of a properly planned, permanently located joint relay center.
2. Duplication of cryptographic facilities.
3. Excessively long message processing times.
4. Inadequate telephone exchange and outside cable plant facilities on Eniwetok Island.
5. Insufficient number of skilled, experienced personnel.
6. Severe radio interference on the command ship.

In all previous operations, the relay center had been moved from Eniwetok Island to Parry Island when the Task Force Headquarters was established in the forward area. This transfer of control of all administrative circuits from Eniwetok to Parry

resulted in decreased operating efficiency and poor utilization of both personnel and equipment. It was determined, therefore, that establishment of a permanent joint relay-crypto center on Eniwetok Island was a basic necessity for improvement of the overall communications system.

Concurrently with the planning for expansion and re-design of the Eniwetok Relay-Crypto Center, an investigation was conducted to determine methods and equipment required to process more rapidly large quantities of high precedence classified traffic and at the same time provide security analysis protection for unclassified traffic. After discussion of the problem with the National Security Agency (NSA) they recommended the use of SIGTOT (PYTHON) crypto system used in conjunction with SAMSON synchronous mixing equipment operated on-line.

Following the decision as to types of facilities to be utilized for the Operation, the network was established and the plan for routing traffic originated. It was planned to have scientific traffic routed on-line to Los Alamos and off-line SIGTOT, using commercial facilities, from Los Alamos to miscellaneous AEC and AEC contractor organizations. During the pre-shot period, scientific traffic between Eniwetok and Bikini Atolls was handled over direct SIGTOT-SAMSON facilities with terminal teletype and radio equipment controlled by Edgerton, Germeshausen and Grier, Inc., (EG&G) personnel and crypto equipment controlled remotely by TG 7.2 personnel in the Parry Island and Bikini Atoll Communications Centers.

Air Force classified traffic was to be routed on-line to USAF installations at Kwajalein, Hickam AFB, McClellan AFB, Kirtland AFB, and Washington, D. C. Addressees at McClellan AFB, Kirtland AFB, and Washington, D. C. [(AFOAT-1)]? were routed via SAC Communications Net (SACCOMNET) facilities. It was originally agreed that unclassified Task Force traffic received at Kwajalein would be processed at that point into Air Communications Net (AIRCOMNET) facilities, but this was altered to provide traffic analysis protection for Task Force traffic from Eniwetok to McClellan AFB, California. This additional security protection through two additional high frequency (HF) links (Kwajalein-Hickam and Hickam-McClellan) was of considerable benefit with only slight USAF equipment additions at these points. An alternate facility was provided to Kirtland AFB by installing on-line SIGTOT between Los Alamos and Kirtland AFB.

The Army and the bulk of the Navy traffic from the Eniwetok-Bikini area was processed through the Primary Relay Station (UHP) at Helemano, T. H. To insure rapid delivery of important traffic to USARPAC and CINCPAC and to increase greatly the telecon facilities between UHP and these points, direct on-line SIGTOT facilities were established between UHP-USARPAC and UHP-CINCPAC. Estimated traffic volume did not justify further westward extension of the on-line network from UHP.

In summary the basic plan was to get all classified traffic through SECRET to the major addressees on-line. Traffic for addressees not within the on-line network was encrypted off-line prior to transmission. In addition, to simplify the clearance

problem at intermediate relay points, all TOP SECRET and RESTRICTED DATA traffic (approximately three per cent) was encrypted off-line.

The fourth problem listed previously as one prevailing during Operation IVY concerned the overloading of the Eniwetok telephone exchange and cable plant facilities. Two position, 220 line, non-multiple Kellogg switch boards were employed but peak calling rates were far greater than the operators could satisfactorily handle. Further, it was found during both GREENHOUSE and IVY that the two principal cables serving the south end of Eniwetok were filled almost to capacity resulting in a lack of flexibility and a shortage of spare pairs. These inadequacies became more important when it was announced that the Air Force Task Group would be located on Eniwetok Island for Operation CASTLE.

Following a study of plausible solutions to the telephone exchange problem, it was decided to employ a 400-line dial exchange. Monetary savings obtained by the smaller number of operating personnel required offset the initial cost of the dial exchange while rapid, efficient service and the capability of handling widely fluctuating traffic loads greatly improved telephone service. The Signal Corps Plant Engineering Agency engineered the project, procured the equipment, and provided an experienced team to accomplish the installation. Change-over to the new system was made on 30 December 1953 and telephone service during Operation CASTLE was outstanding.

Plans for expansion of the outside cable plant began on 7 July 1953 when OCSigO was requested to authorize and establish a Class

Four Development project to provide for additions to the telephone cable system on Eniwetok Island. Engineering for the project was completed by the end of July and the port date specified in requisitions for project materiel was 1 September. Most of the materiel did not reach Eniwetok, however, until late October or early November.

Another major planning problem previously discussed as a recurrent difficulty in the first section involved the procurement of competent, technically qualified communications personnel for the Army Task Group. Most of the men shipped to Eniwetok were in the grade of E-3 and had very little active service. This situation was discussed with G-1, D/A and the Chief of the Personnel and Training Division, OCSigO, emphasizing the need for experienced supervisory personnel and the impracticability of attempting to conduct a training program during an operational period. To alleviate the condition, the Chief Signal Officer agreed to accept levies from G-1 for NCO specialists in the first four grades and to provide these men from organizations under his control. Further assistance was provided by the ACofS, J-5, Headquarters JTF SEVEN, who arranged for TDY assignment of a small group of experienced specialists to augment the TG 7.2 Signal Detachment in those MOS's not adequately provided for in allowances prescribed in their T/D.

In preparing the command ship for Operation CASTLE, primary consideration was given to elimination or reduction of radio interference and provision of qualified technical personnel to operate

and maintain the equipment. During its yard availability period (31 October - 14 November 1953) the USS ESTES underwent a thorough communications and electronics check to determine the causes of the severe interference experienced during Operation IVY. As a result of this check, repairs were made and the equipment tested to determine state of readiness. Although few HF facilities could be tested, all of the Combat Information Center (CIC) - Very High Frequency (VHF) equipment was checked and found to be operating satisfactorily with substantial improvement in efficiency and reduced interference.

In order that the communications personnel aboard the ESTES would be adequately prepared to assume their duties, one officer and ten enlisted men were placed on temporary additional duty (TAD) with the Army Task Group on Eniwetok. These men received approximately four weeks of on-the-job training in the Eniwetok communication, relay, and crypto centers. Also, a number of the communications personnel from the ESTES attended various electronics specialists schools to increase their technical proficiency.

In addition to those deficiencies pointed up by Operation IVY, other factors had to be taken into account in CASTLE communication planning. One such factor arose when the AEC announced the PPG would be extended to include Bikini Atoll for this expansion created a need for voice encoding equipment (ciphony). The ciphony requirement was given to the NSA in February 1953 and in April 1953, NSA replied that HF ciphony was not available at the time, but that experimental broad band VHF ciphony could possibly be made available.

After discussions with JTF SEVEN operations planners, it was decided that a secure voice facility between the ESTES and the firing bunker on Enyu would be of benefit. NSA agreed to provide four sets of AFSAY 804 (x) if the Task Force would send four well qualified radio technicians for ciphony maintenance training and the operation of a test circuit in the Washington, D. C., area. This was accomplished and the test circuit was successful. NSA approved the facility for operation through TOP SECRET.

B. On-Site Phase.

The on-site period proved the extensiveness and the flexibility of the communications planning. The significant difficulties were successfully overcome and in no case did communications inadequacies or failures delay the completion of the overall CASTLE mission. Detonation of the first device had an effect on the communications plan but a swift adjustment to the altered concept was accomplished. The following narrative treats those difficulties which were of the greatest concern, communications-wise, during the CASTLE on-site phase.

During the early operational period the Eniwetok-Los Alamos radio-teletype circuit was placed in operation twenty-four hours a day, in contrast to the ten-hour a day operation previously employed. Continuous operation of this circuit soon revealed the unreliability of circuit operation during periods of propagation instability. The unstable conditions most generally existed during critical operational periods, resulting in high precedence traffic

delays. To improve circuit efficiency, it was decided to establish an electronic relay system of operation at Hawaii during those critical periods when the direct circuit operation was not satisfactory. An electronic relay was necessary because of the on-line SIGTOT-SAMSON crypto system employed. TG 7.5 concurred in the proposal and USARPAC agreed to provide the electronic patch facilities and equipment. OCSigO-FAPUSJCEC (Frequency Allocation Panel, U. S. Joint Communications - Electronics Committee) was requested to provide a full complement of high frequencies for the operation of the circuit. Since it was not intended that the direct Eniwetok-Los Alamos circuit and the patch system would be operating at the same time, it was recommended that the same frequencies assigned to the direct circuit be used for the electronic patch system. After installation of the patch system, a continuous seven-day test showed that this system provided about twenty-two hours daily usable circuit time as compared to only six hours daily on the direct circuit. As a result of this performance the electronic relay system was employed continuously for the remainder of Operation CASTLE.

Initially all the Bikini Atoll facilities providing inter-atoll voice and teletype communications were located at Eninman since the bunker on Enyu which would eventually house this equipment had not been completed at that time. On 16 January 1954, all TG 7.2 facilities were moved to the bunker on Enyu except for a small communication center retained on Eninman. Numerous operating difficulties were experienced following the move to Enyu for the space in the

bunker allocated to TG 7.2 was inadequate for the installation of equipment. The HF transmitting equipment was ultimately moved into another station which also housed the TG 7.4 low frequency (LF) homing beacon and Radar Beacon (RACON) equipment. Certain inadequacies in the antenna system at Enyu also arose but were corrected by changing, relocating, and installing new antenna feeders.

Since the unexpected effects of the first shot prevented the resumption of land-based communications operation at Bikini, the decision was made to continue operations from afloat. This move required that all the major ships of TG 7.3 remain at Bikini to provide communications and logistical support. Salvageable communications equipment from the sites at Bikini was removed and evacuated to Eniwetok. Equipment required for timing, firing, voice time broadcast, and TG 7.1 voice circuit to Eniwetok, was left installed in the bunker on Enyu.

During this phase following the first detonation, a major communications problem was generated by the establishment of four separate headquarters (JTF SEVEN, TG 7.1, TG 7.4, and TG 7.5) aboard the USS ESTES. The concentration of staff personnel on board the command ship increased the workload on the communication circuits and resulted in interference problems not normally encountered. Operational difficulties were increased and ordinary maintenance was affected for it was difficult to arrange periods when radio equipment could be silenced in order to perform this work. Several frequencies were changed and equipment closely monitored and attended to insure a minimum interference to operations. For future

operations it is recommended that only the Headquarters, JTF SEVEN, and the Air Force Task Group communications requirements be provided aboard the command ship with TG 7.1 and TG 7.5 communications dispersed to other Task Force vessels.

Differences in communication operating procedures, security, and cryptographic regulations of the Armed Forces and the AEC constituted a major operating problem and needs resolution before future test operations. Harmonious teamwork of AEC and Armed Forces personnel prevailed throughout the operation, and special approvals and agreements enabled major problems to be overcome. However, such special non-standard arrangements created additional supervisory and training burdens and entailed the risk of unintentional mishandling of messages. In order to expedite message handling over the long distance military radio teletype networks, Armed Forces communication procedures were used for all Task Force traffic but special modifications were made to meet AEC needs. Regulations of the AEC prohibit the use by AEC of certain cryptographic systems that are authorized and normally used by the Armed Services. Cryptographic systems required by the AEC for certain classes of traffic, and normally used by the AEC on long distance wire lines in the United States, were found to be impractical for long distance radio circuits during periods of unstable radio propagation. Uniform regulations and practices are essential to rapid and dependable communications and it is recommended that the AEC authorize the use of communication regulations of the Armed

Forces (JANAPs and ACPs) for all communications involving the Task Force or PPG. These practices have been evolved through many years of experience in handling large volumes of communication traffic and have stood the test of time.

APPENDIX D

STATISTICAL SUMMARY

I. Logistical Tables.

A. Transportation and Supply.

1. Task Force Transportation Facilities.

a. Ships Under Control of TG 7.3.

b. Task Force Yard and Harbor Craft, Barges, and Boats.

c. TG 7.4 Aircraft in the Forward Area.

d. TG 7.3 Aircraft in the Forward Area.

2. Cargo Movement To and From the Forward Area.

a. CASTLE Surface Lift.

b. CASTLE Airlift.

3. Cargo Movement Within the Forward Area.

a. Inter-Atoll Cargo Movement via Surface Means.

b. Intra-Atoll Personnel and Cargo Movement via Surface Means.

4. Personnel Movement To and From the Forward Area.

a. Via Surface Means.

b. Via Air.

5. Personnel Movement Within the Forward Area.

a. Inter-Atoll Personnel Movement via Surface Means.

b. Inter-Atoll Personnel Movement via C-47 Aircraft.

c. Intra-Atoll Personnel Movement via Surface Means. (Included in Logistical Table A3b)

d. Intra-Atoll Personnel Movement via Air.

6. Total MSTS Voyages and MATS Flights To and From the Forward Area.

B. Construction.

1. Construction Progress Curve--Overall Program.

2. Monthly Totals--Concrete Poured--Both Atolls.

3. Jobsite Personnel Chart--Eniwetok and Bikini Atolls.

II. Personnel and Administrative Tables.

A. Peak Personnel Strengths of Task Force Elements.

B. Authorized Military Strength--Operational Period.

C. Personnel "Q" Clearance Statistics.

D. Amount of SECRET, TOP SECRET, and RESTRICTED DATA Correspondence and Messages Handled by Headquarters, JTF SEVEN.

III. Communications Tables.

A. Traffic Volume.

B. Communication Traffic Volume (Graph).

C. Traffic Volume Totals.

D. Precedence and Classification of Messages by Percentages During the Operational Phase.

I. Logistical Tables.

A. Transportation and Supply

1. Task Force Transportation Facilities.

a. Ships Under Control of TG 7.3.

NAME OF VESSEL	TYPE AND NUMBER
USS ESTES	AGC 12
USS CURTISS	AV 4
USS BAIROKO	CVE 115
USS BELLE GROVE	LSD 2
USNS AINSWORTH	TAP 181
USS EPPERSON	DDE 719
USS PHILIP	DDE 498
USS RENSHAW	DDE 499
USS NICHOLAS	DDE 449
USS SHEA	DM 30
USS TAWAKONI	ATF 114
USS APACHE	ATF 67
USS SIOUX	ATF 75
USS COCOPA	ATF 101
USS MOLALA	ATF 106
USS PC 1546	PC 1546
USS GYPSY	ARS(D)-1
USS MENDER	ARS(D)-2
USS RECLAIMER	ARS 42
USS LST 762*	LST 762
USS LST 1157*	LST 1157
USS LST 551*	LST 551
YAG 39	YAG 39
YAG 40	YAG 40
Total Number of Ships in Forward Area	24

* Because of damage to the LST's in the forward area other LST's were sent as replacements from time to time. There were three LST's in the forward area at all times, however.

b. Task Force Yard and Harbor Craft, Barges, and Boats.

TYPE OF CRAFT	TG 7.2	TG 7.3	TG 7.5	TOTALS
LCU	-	5	9	14
LCP(L)	-	2	-	2
LCM	2	21	24	47
AVR	-	2	-	2
LCP(R)	-	2	-	2
YFN	-	1	-	1
YCV	-	1	-	1
YOGN	-	1	-	1
YO	-	1	-	1
YOG	-	1	-	1
YC	-	1	-	1
YTL	-	-	2	2
MWB	-	1	-	1
AFDL	-	-	1	1
TAXI	-	-	3	3
DUKWS	20	-	20	40
TOTALS	22	39	59	120

c. TG 7.4 Aircraft in the Forward Area.

TYPE OF AIRCRAFT	TU 7.4.1	TU 7.4.2	TU 7.4.3	TOTALS
B-36D	-	1	-	1
B-36H	-	2	-	2
RB-36	-	1	-	1
B-47	-	1	-	1
B-50	-	3	-	3
WB-29	-	-	9	9
C-54	1 (CJTF)	-	3	4
C-47	4	-	-	4
PBM	2	-	-	2
F-84G	-	15	-	15
SA-16	2	-	3	5
H-19	7	-	-	7
H-13	3	-	-	3
L-13	10	-	-	10
TOTALS	29	23	15	67

d. TG 7.3 Aircraft in the Forward Area.

TYPE OF AIRCRAFT	TU 7.3.2 (Carrier)	TU 7.3.3 (Patrol Plane)	TOTALS
HRS-2	12	-	12
F4U-5N	6	-	6
P2V-6	-	12	12
P2V-5	-	1	1
P4Y-2	-	1	1
PBM-5A	-	2	2
TOTALS	18	16	34

TOTAL AIRCRAFT (TG 7.3 and TG 7.4) in the Forward Area.....101

2. Cargo Movement To and From the Forward Area.

a. CASTLE Surface Lift (Measurement Tons).

MONTH	GENERAL & DRY CARGO Westbound	GENERAL & DRY CARGO Eastbound	REEFER SUPPORT TO FORWARD AREA	POL SUPPORT T. H. TO ENIWETOK
Jan '53	3,166.6	2,167.6	272.2	656.9
Feb	184.5	1,909.8	288.1	231.6
Mar	3,208.8	78.0	251.5	3,250.0
Apr	3,023.3	2,028.8	473.6	1,464.8
May	140.7	592.8	94.1	916.6
Jun	12,700.6	461.0	254.0	1,300.0
Jul	7,496.0	692.9	230.1	390.4
Aug	6,661.6	256.2	394.0	1,911.2
Sep	9,122.6	281.5	893.2	1,128.1
Oct	8,318.5	577.7	659.8	1,264.0
Nov	14,049.5	46.7	870.0	2,032.9
Dec	6,463.7	694.4	717.3	1,209.6
Jan '54	4,329.6	263.3	1,002.8	3,950.7
Feb	2,641.6	83.0	572.3	—
Mar	276.5	2,755.0	747.1	4,403.4
Apr	2,826.5	196.4	525.3	5,679.3
May	3,399.2	14,537.0	241.7	2,151.9
TOTALS	88,009.8	27,622.1	8,487.1	31,941.4

GRAND TOTAL....156,060.4

b. CASTLE Airlift (Short Tons).

MONTH	WESTBOUND (US - Eniwetok) CARGO	WESTBOUND (US - Eniwetok) MAIL	WESTBOUND (US - Eniwetok) TOTAL	EASTBOUND (Eniwetok - US) CARGO	EASTBOUND (Eniwetok - US) MAIL	EASTBOUND (Eniwetok - US) TOTAL
Jan '53	31.4	10.4	41.8	3.0	--	3.0
Feb	65.2	8.1	73.3	6.0	9.8	15.8
Mar	37.8	8.7	46.5	10.1	10.5	20.6
Apr	23.4	5.6	29.0	11.2	8.2	19.4
May	40.0	7.8	47.8	5.9	7.8	13.7
Jun	25.7	4.1	29.8	6.6	10.0	16.6
Jul	45.1	6.8	51.9	22.8	11.1	33.9
Aug	49.0	5.3	54.3	9.5	11.2	20.7
Sep	38.0	9.2	47.2	8.3	12.4	20.7
Oct	65.4	13.3	78.7	4.3	14.2	18.5
Nov	86.9	15.0	101.9	10.6	17.2	27.8
Dec	103.1	45.4	148.5	6.5	20.0	26.5
Jan '54	123.3	25.9	149.2	13.6	26.8	40.4
Feb	166.1	33.2	199.3	14.0	33.2	47.2
Mar	145.0	24.0	169.0	33.0	19.5	52.5
Apr	72.5	25.5	98.0	32.0	33.0	65.0
May	43.8	16.9	60.7	124.4	18.8	143.2
TOTALS	1,161.7	265.2	1,426.9	321.8	263.7	585.5

GRAND TOTAL.....2,012.4

3. Cargo Movement Within the Forward Area.

a. Inter-Atoll Cargo Movement via Surface Means.

MONTH	ENIWETOK TO BIKINI	BIKINI TO ENIWETOK
Jan 1953	1,856.7	919.8
Feb	1,492.0	972.5
Mar	2,644.2	905.7
Apr	7,555.4	619.0
May	5,800.0	1,372.0
Jun	3,249.8	814.0
Jul	4,870.7	1,589.4
Aug	3,583.0	1,910.2
Sep	3,140.5	959.6
Oct	2,795.1	2,477.5
Nov	3,219.3	845.0
Dec	3,426.8	1,560.0
Jan 1954	1,264.9	3,915.0
Feb	1,152.7	1,711.0
Mar	628.4	2,689.5
Apr	232.5	1,075.7
May	---	85.3
TOTALS	46,912.0	24,421.2

GRAND TOTAL.....71,333.2

b. Intra-Atoll Personnel and Cargo Movement via Surface Means.

	BIKINI		ENIWETOK	
MONTH	Passengers	Cargo*	Passengers	Cargo*
Jan 1953	2,354	3,455	13,207	18,089
Feb	863	5,086	6,954	63,300
Mar	1,263	11,132	5,807	50,081
Apr	1,784	9,187	7,125	31,443
May	2,325	14,589	7,198	35,101
Jun	2,107	17,852	8,899	38,561
Jul	1,167	19,446	8,448	44,409
Aug	1,564	26,697	9,840	39,769
Sep	2,056	36,931	13,239	61,660
Oct	2,532	45,380	12,731	61,052.9
Nov	2,726	54,684	14,560	51,570
Dec	4,599	62,604	15,113	56,330.7
Jan 1954	7,436	52,449	17,366	59,748
Feb	4,175	31,713	19,396	59,982
Mar	10,205	22,241	19,555	64,866
Apr	4,842	7,002	23,282	73,405
May	---	---	14,937	71,923
TOTALS	51,998	420,448	217,657	881,290.6

GRAND TOTAL (PAX).....269,655

GRAND TOTAL (CARGO)...1,301,738.6

* Measurement Tons.

4. Personnel Movement To and From the Forward Area.

a. Via Surface Means.

MONTH	WESTBOUND Cabin	WESTBOUND Troop	EASTBOUND Cabin	EASTBOUND Troop
Jan 1953	-	-	3	91
Feb	-	1	-	-
Mar	-	51	2	-
Apr	-	31	2	-
May	-	60	1	-
Jun	-	58	6	8
Jul	-	49	2	2
Aug	-	42	-	-
Sep	-	75	-	1
Oct	2	48	1	-
Nov	1	234	-	-
Dec	3	10	-	-
Jan 1954	94	82	-	-
Feb	7	38	-	-
Mar	-	-	1	6
Apr	-	-	-	-
May	-	-	24	250
	107	779	42	358

GRAND TOTAL.....1,286

b. Via Air.

MONTH	WESTBOUND	EASTBOUND
Jan 1953	446	60
Feb	359	312
Mar	353	428
Apr	366	346
May	583	272
Jun	608	323
Jul	805	369
Aug	582	379
Sep	591	347
Oct	635	343
Nov	607	400
Dec	777	593
Jan 1954	1,061	490
Feb	667	618
Mar	429	911
Apr	338	1,111
May	171	2,193
	9,378	9,495

GRAND TOTAL.....18,873

5. Personnel Movement Within the Forward Area.

a. Inter-Atoll Personnel Movement via Surface Means.

MONTH	ENIWETOK TO BIKINI		BIKINI TO ENIWETOK	
	Cabin	Troop	Cabin	Troop
Jan 1953	8	2	1	4
Feb	3	18	4	12
Mar	7	21	6	10
Apr	3	31	-	6
May	12	57	1	11
Jun	6	29	-	1
Jul	4	28	-	-
Aug	1	22	-	10
Sep	-	24	-	2
Oct	3	18	4	11
Nov	1	18	-	-
Dec	-	-	-	-
Jan 1954	-	7	-	-
Feb	-	-	-	-
Mar	196	270	6	67
Apr	11	164	4	120
May	3	14	23	64
TOTALS	258	723	49	318

GRAND TOTAL.....1,348

b. Inter-Atoll Personnel Movement via C-47 Aircraft.

MONTH	ENIWETOK TO BIKINI	BIKINI TO ENIWETOK
Aug 1953	154	123
Sep	250	160
Oct	288	204
Nov	406	314
Dec	282	237
Jan 1954	583	545
Feb	826	981
Mar	182	350
Apr	156	62
May	167	-*
TOTALS	3,294	2,976

GRAND TOTAL.....6,270

* No figures available for this month.

c. Intra-Atoll Personnel Movement via Surface Means. (See Table A3b above).

d. Intra-Atoll Personnel Movement via Air.

MONTH	PASSENGERS TRANSPORTED	
	Bikini	Eniwetok
Aug 1953	1,338	408
Sep	1,338	271
Oct	1,701	426
Nov	2,559	621
Dec	2,897	340
Jan 1954	6,676	1,975
Feb	*	2,314
Mar	596	2,705
Apr	**	4,736
May	6,862	1,317
TOTALS	23,967	15,113

GRAND TOTAL.....39,080

* No figures available for this month.
** The figure entered for May is a total of the April and May passenger lift.

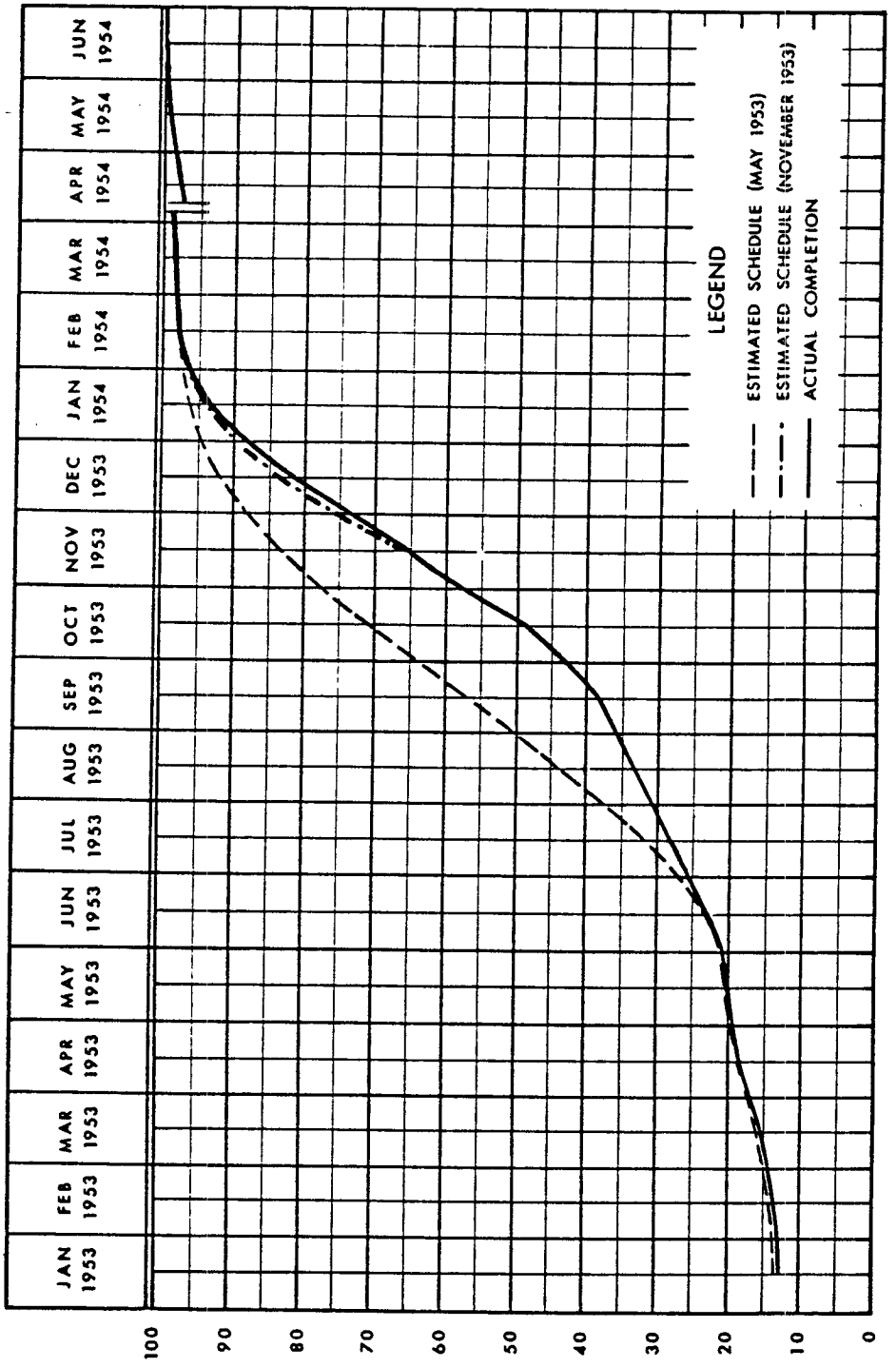
6. Total MSTS Voyages and MATS Flights.

MONTH	MATS FLIGHTS		MSTS VOYAGES	
	Westbound	Eastbound	Westbound	Eastbound
Jan 1953	29	29	2	2
Feb	26	26	-	1
Mar	29	29	1	1
Apr	26	26	2	1
May	29	29	1	-
Jun	29	29	3	1
Jul	33	33	2	1
Aug	33	33	2	1
Sep	33	33	3	1
Oct	28	28	2	1
Nov	36	36	3	-
Dec	34	34	2	2
Jan 1954	60	60	2	1
Feb	53	53	2	-
Mar	50	50	-	2
Apr	50	50	-	2
May	59	63	1	1
TOTALS	637	641	28	16

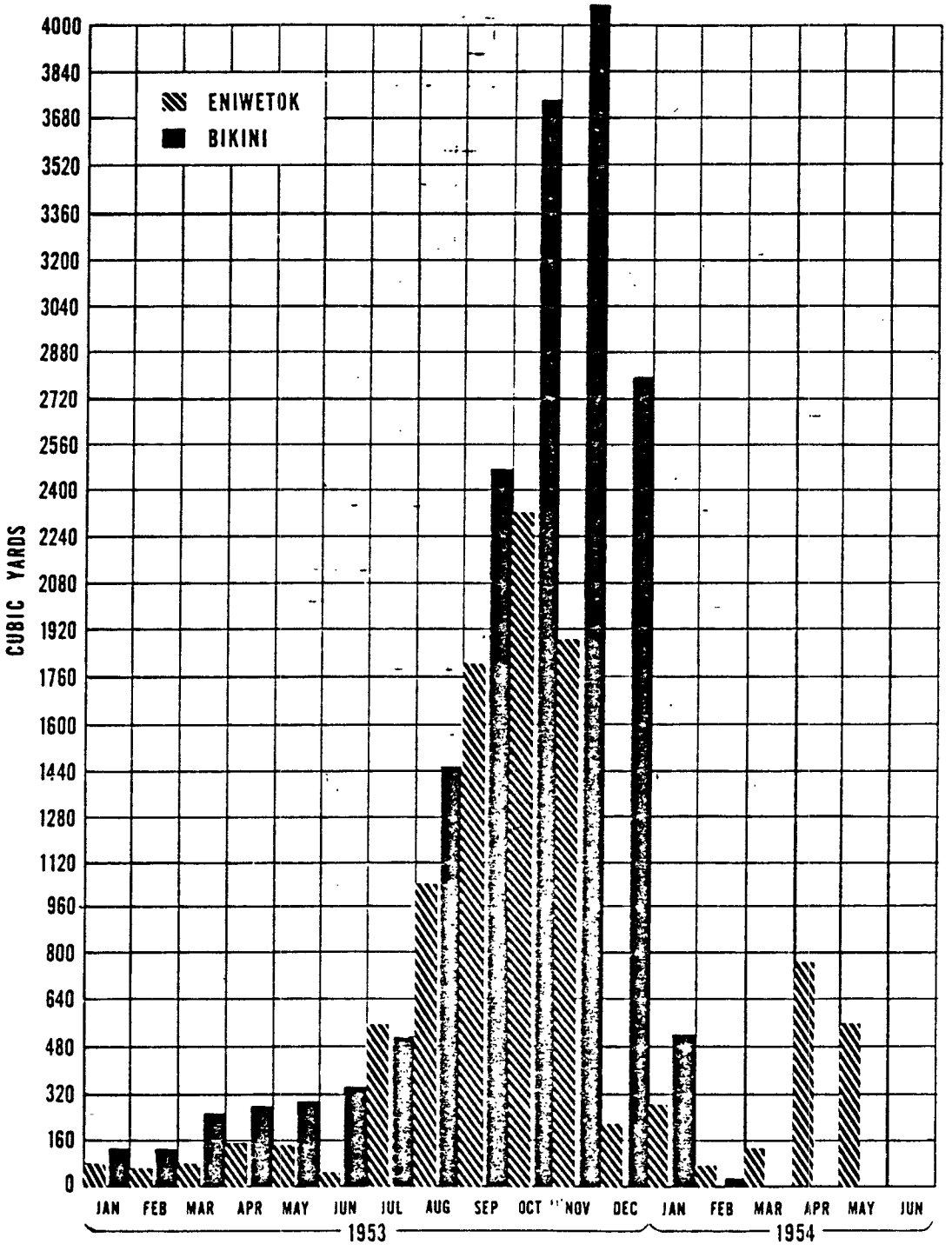
GRAND TOTAL (MATS Flights)...1,278
GRAND TOTAL (MSTS Voyages).....44

B. Construction.

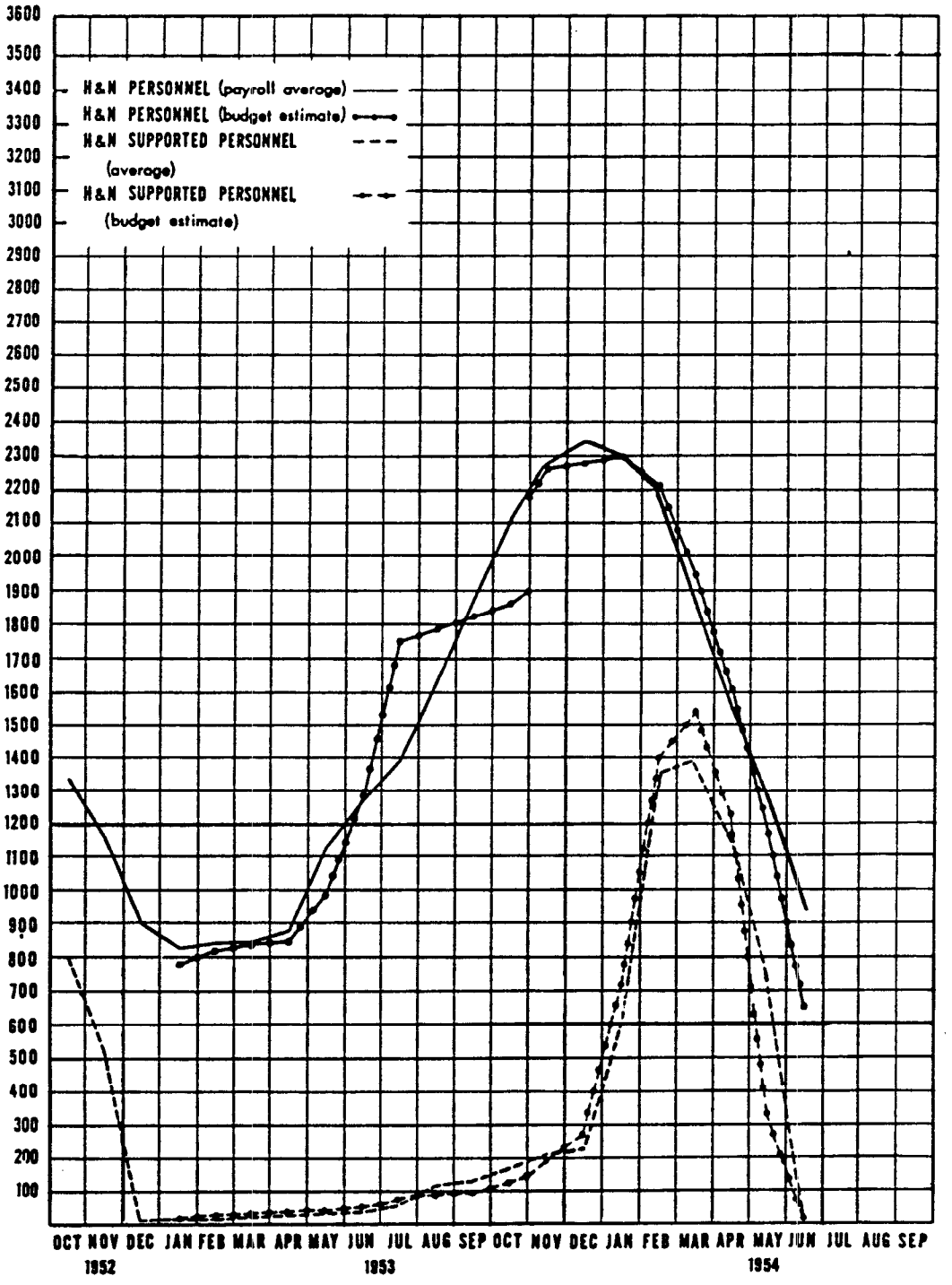
1. Construction Progress Curve--Overall Program.



2. Monthly Totals--Concrete Poured--Both Atolls.



3. Jobsite Personnel Chart—Eniwetok and Bikini Atolls.



II. Personnel and Administrative Tables.

A. Peak Personnel Strengths of Task Force Elements.

ELEMENT	OFFICER	ENLISTED	CIVILIAN	TOTAL	DATE REACHED
Hq JTF SEVEN (Fwd)	49	58	1	108	15 Mar 54
Hq JTF SEVEN (Rear)	15	41	-	56	15 Mar 54
TG 7.1	99	174	754	1,027	28 Feb 54
TG 7.2	94	1,184	-	1,278	4 Mar 54
TG 7.3	467	5,709	175	6,351	8 Apr 54
TG 7.4	301	1,479	20	1,800	24 Mar 54
TG 7.5	-	-	2,325	2,325	15 Dec 53
TOTALS	1,025	8,645	3,275	12,945	

B. Authorized Military Strength-Operational Period.

	ARMY			NAVY			AIR FORCE			TOTAL		
	OFF	ENL	TOTAL	OFF	ENL	TOTAL	OFF	ENL	TOTAL	OFF	ENL	TOTAL
HQ	26	37	63	14	26	40	29	35	64	69	98	167
TG 7.1	21	32	53	15	15	30	19	32	51	55	79	134
TG 7.2	74	993	1067	1	21	22	67	543	610	142	1557	1699
TG 7.3	0	0	0	22	287	309	0	0	0	22	287	309
TG 7.4	0	0	0	0	0	0	35	61	96	35	61	96
TOTALS	121	1062	1183	52	349	401	150	671	821	323	2082	2405

C. Personnel "Q" Clearance Statistics.

Clearances Processed Through Headquarters, JTF SEVEN.

"Q" Clearances Requested	1,983
"Q" Clearances Granted	1,604
Reinstatements Requested	128*
Reinstatements Granted	131*
Extensions Requested	385
Extensions Granted	381
QE's Requested	46
QE's Granted	3
"Q" Clearances Cancelled	254
"Q" Clearances Terminated	262

Clearances Granted Through TG 7.5 and Holmes and Narver.

TOTAL	4,208

Clearances Granted Through TG 7.1 (other than assigned personnel).

UCRL/AEC	264
AFSWP	889
TOTAL	1,153
GRAND TOTAL "Q" CLEARANCES GRANTED	6,965

* In some instances requests for "Q" clearances were eventually granted as reinstatements because the applicant had previously held a "Q" clearance.

D. Amount of SECRET, TOP SECRET, and RESTRICTED DATA Correspondence and Messages Handled by Headquarters, JTF SEVEN.

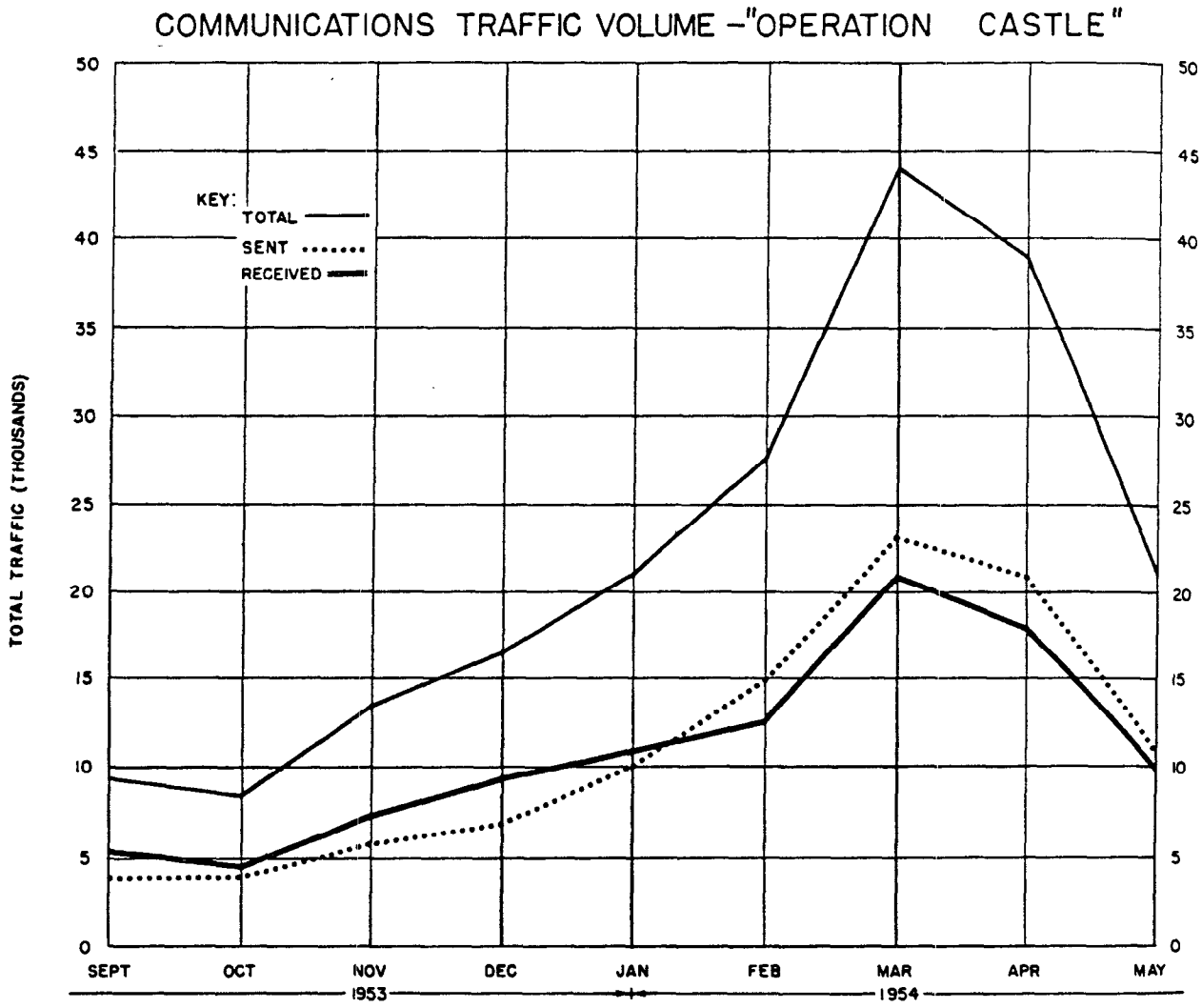
	SENT AND RECEIVED 1 July 53 - 31 Dec 53	SENT AND RECEIVED 1 Jan 54 - 15 May 54	TOTAL
Rear Area Corres.	695	224	919
Forward Area Corres.	-	310	310
Rear Area Messages	176	448	624
Forward Area Messages	-	1,296	1,296
TOT. DOCUMENTS HANDLED	871	2,278	3,149

Communication Center or Relay Station

MONTH		UHP	RHPJC	JHK	UHRJD	RHRJD	RHPJB	RHPJH	UHPJB	UHPJA	UWFJA
January	S	3,437	98	185	894		1,018		654	3,858	480
	R	4,390	111	42	1,040		1,045		397	3,713	257
	T	7,827	209	227	1,934		2,063		1,051	7,571	737
February	S	4,327	80	772	858	709	681	600	2,020	4,526	618
	R	3,793	71	300	998	477	627	984	1,841	4,591	382
	T	8,120	151	1,072	1,856	1,186	1,308	1,584	3,861	9,117	1,000
March	S	5,169	60	1,574	1,135	3,733		1,761	3,371	6,555	990
	R	5,729	118	1,128	1,037	3,196		2,388	2,765	5,562	599
	T	10,898	178	2,702	2,172	6,929		4,149	6,136	12,117	1,589
April	S	5,327	45	1,186	1,040	2,862		1,642	2,996	5,197	1,072
	R	4,871	76	743	1,202	2,589		2,021	2,426	4,814	621
	T	10,198	121	1,929	2,242	5,451		3,663	5,422	10,011	1,693
May	S	4,408	59	529	932	746	271	501	1,870	2,801	588
	R	3,721	117	261	1,317	529	374	855	1,574	2,986	262
	T	8,129	176	790	2,249	1,275	645	1,356	3,444	5,787	850
Grand Totals	S	22,668	342	4,246	4,859	8,050	1,970	4,504	10,911	22,937	3,748
	R	22,504	493	2,474	5,594	6,791	2,046	6,248	9,003	21,666	2,121
	T	45,172	835	6,720	10,453	14,841	4,016	10,752	19,914	44,603	5,869

KEY: S - Sent
R - Received
T - Total

UHP - Primary Relay Station, Helemano, Oahu, T. H.
RHPJC - Ship-Shore (Eniwetok) CW CKT.
JHK - Major Relay Station, Kwajalein
UHRJD - TG 7.2.
RHRJD - USS ESTES.
RHPJB - Bikini.
RHPJH - USS BAIROKO.
UHPJB - TG 7.4.
UHPJA - Ho., JTF SEVEN, TG 7.1, TG 7.5, TG 7.3 (Ashore).
UWFJA - Los Alamos, NM.



B. Communications Traffic Volume

C. Traffic Volume Totals.

	JAN	FEB	MAR	APR	MAY	GRAND TOTALS
Sent	10,624	15,191	24,348	21,367	12,705	84,235
Received	10,995	14,064	22,522	19,363	11,996	78,940
TOTALS	21,619	29,255	46,870	40,730	24,701	163,175

D. Precedence and Classification of Messages by Percentages During the Operational Phase.

MONTH	PRECEDENCE				PERCENT CLASSIFIED OF TOTAL MESSAGES SENT AND RECEIVED
	Emergency & Oper.	Immed.	Priority	Routine	Deferred	
Jan	S - 1%	32%	55%	12%	T - 24%
	R - 1%	29%	61%	9%	
Feb	S - 5%	32%	30%	33%	T - 40%
	R - 3%	30%	39%	28%	
Mar	S -21%	35%	30%	14%	T - 30%
	R -19%	39%	30%	12%	
Apr	S -21%	33%	31%	15%	T - 40%
	R -19%	35%	32%	14%	
May	S -18%	30%	31%	21%	T - 33%
	R -15%	30%	32%	23%	

Key: S - Sent
R - Received
T - Total