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COMPLETION REPORT

U. S. ATOMIC ENERGY COMMISSION
CONTRACT AT-(29-2)-20

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ENIWETOK PROVING GROUND FACILITIES OPERATION IVY

PROPERTY ... U S GOVER...

VOL. I
BOOKS 1, 2 & 3

HOLMES & NARVER, INC.
LOS ANGELES, CALIFORNIA

31 December 1952

COMPLETION REPORT

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VOL. I BOOKS 1, 2 & 3

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COMPLETION REPORT
OPERATION IVY

VOLUME I
BOOK 1
GENERAL

SECURITY INFORMATION

INDEX

VOLUME I

Volume II contains Books 4, 5 and 6, detailing the activities of Job III and IV, Maintenance and Support Services, and Test Operations respectively.

The Appendix, an integral part of Volume II, contains detailed and itemized compilations of individual completion reports, drawings and specifications.

These two volumes, condensed as much as practicable, constitute a complete, comprehensive documented Completion Report on all activities of the A-E-C-M Contractor in connection with AEC Contract No. AT-(29-2)-20 on Eniwetok Atoll from October 1951 through 31 December 1952.

Respectively submitted,

HOLMES & NARVER, INC.

Edwin G. Bowen
Vice President and
General Manager

HOLMES & NARVER, INC.
ENGINEERS – CONSTRUCTORS
828 SOUTH FIGUEROA STREET
LOS ANGELES 17

JAMES T. HOLMES
PRESIDENT

D. LEE NARVER
VICE PRESIDENT

U. S. ATOMIC ENERGY COMMISSION
Contract No. AT–(29-2)–20

Field Manager
Eniwetok Field Office
Post Office 5400
Albuquerque, New Mexico

31 March 1953

Dear Sir:

Presented herewith is the Completion Report covering engineering, construction, operation and management of the Eniwetok Proving Ground facilities, in connection with OPERATION IVY. This report has been prepared in accordance with requirements of Contract No. AT-(29-2)-20 as set forth in Paragraph 7, Title III, Job No. I thereof.

The report is designed to provide a complete and detailed account of the stewardship of Holmes & Narver, Inc. as Architect-Engineer, Construction and Management Contractor for the Eniwetok Proving Ground, containing a careful evaluation of the work performance, and conclusions and recommendations which are based on the assumption that the Eniwetok Site will be used for future tests. It is compiled with a view to its reference value to the Atomic Energy Commission, or to any other participants in future projects of a similar nature.

The contents of the report have been segregated into specific subjects related to Job Numbers as specified in the Contract. This arrangement has permitted the treatment of each phase of the program with a minimum of repetition. Each subject is treated in its entirety under headings corresponding to the appropriate Contract Job Number.

The entire report is comprised of two volumes each containing three books. Volume I, Book 1 presents a general over-all picture of the Project from the administrative and contractual point of view, and includes recommendations for future operations. Book 2 is the historical record of Job I, covering in detail the Engineering, Design, Inspection and Construction activities. Book 3 presents Job II, Camp Operation and Management through comprehensive reports on Home Office and Jobsite Administration and Management, and Camp Operations.

BOOK 1

TABLE OF CONTENTS

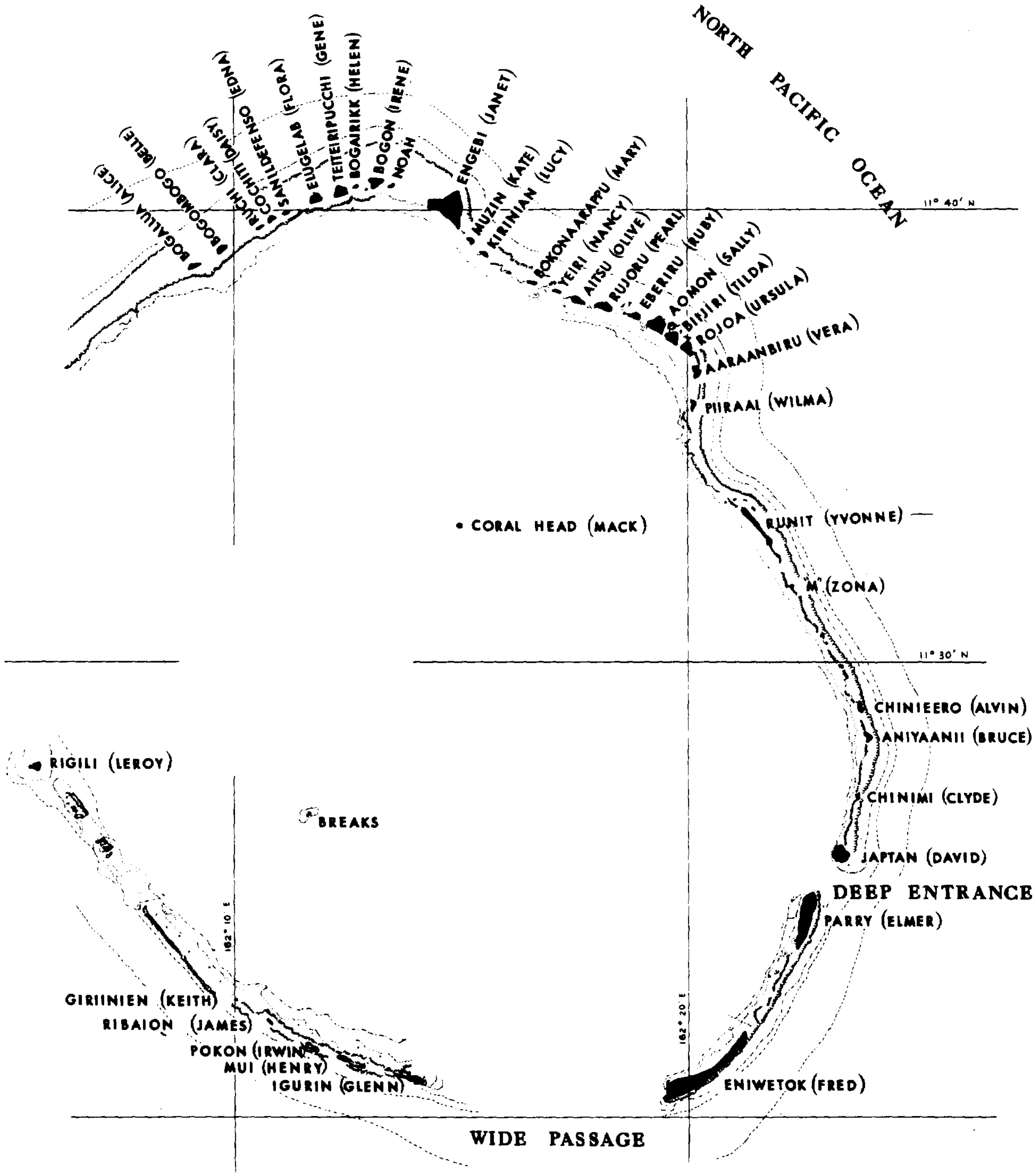

Figure 1-0. Eniwetok Atoll

CHAPTER I
ABSTRACT

SECTION 1. GENERAL DISCUSSION

Upon the completion of OPERATION GREENHOUSE during the spring and summer of 1951, the Contractor, Holmes & Narver, Inc., proceeded with the planned program of placing the Eniwetok Proving Ground in a standby condition. During this Roll-Up phase, the Atomic Energy Commission, together with the Joint Chiefs of Staff, and the Director of Military Applications, were planning future test operations. On 15 October 1951, the Atomic Energy Commission's Eniwetok Field Manager announced that the next series of tests would be held about 1 October 1952, and that the over-all test program would be called OPERATION IVY. In general terms, OPERATION IVY was described as consisting of two tests, one planned around a ground shot, the other an air drop. In addition, it was to require enlargement of the cryogenics facilities on Parry Island, including additional buildings and equipment for the production, handling and storage of gas. For the ground shot it was planned to connect several islands in the Alice group by means of a causeway to produce a total length of connected land which would be approximately 9,000 feet long. This would permit a straight zero line from the detonation point to a recorder station, and would contain coaxial cable which would be shielded by an earth cover approximately 30 feet high. The location of this test was later moved to the Gene group of islands with subsequent revisions in the manner of laying the coaxial cable, changes in the height of earth cover, and a corresponding reduction in the amount of earth moving required. In order to provide access to this group of islands, it was necessary to plan for an approach channel, turning basin and pier as well as to plan facilities for a 250-man camp, including an airstrip.

The second test was described at that time as consisting of an air drop over the northern end of Yvonne, which would necessitate the reactivation of the Yvonne Camp for approximately 250 men. The anticipated yield of the test to be held at Gene made it apparent that the blast pressures to be developed, as well as the possibility of sea wave action as a result of the tests, would make it necessary to plan a complete evacuation of personnel from the Atoll.

As soon as these basic criteria had been established, it was possible for the Eniwetok Field Manager and the Holmes & Narver staff to agree upon basic assumptions concerning number of men required by the Contractor to accomplish this work, the possible number of scientific and military personnel participating, and from these estimates make preliminary plans concerning the number of camps, size of camps and extent of supporting organization required.

This broad outline of work, although later modified in many details, proved to be a reliable guide for over-all program planning. The exact extent of the scientific program was unknown, but was described in terms of portions of previous scientific programs and was estimated roughly as requiring the expenditure of approximately $2,000,000. It was agreed that the previous surveys of the Atoll were to be expanded to include all islands in a primary network.

In addition to this construction program, Holmes & Narver was directed to continue the maintenance and operation of facilities already constructed during the previous tests; to provide for the support of their own employees and other personnel; to furnish men and equipment as required in support of the scientific program; and upon completion of the tests, to carry out a Roll-Up program similar to that performed under OPERATION GREENHOUSE.

In order to start on a program of such magnitude concerning which very few details were known, it was decided to enter into a contract of the same nature as that used for previous operations. This type of contract is described as A FIXED-FEE ARCHITECT-ENGINEER-CONSTRUCTION-MANAGEMENT CONTRACT. Within the framework of this type of contract, the Atomic Energy Commission has wide latitude to change the scope of work or services to be performed by the Contractor, at the same time protecting all the rights and interests of the government insofar as control of expenditure of funds is concerned. Without the freedom of operation which this type of contract provides, the Contractor would not be able to initiate simultaneous action on architect-engineer services, procurement of construction materials and equipment, recruiting and processing of man power and all of the various elements required for planning a complex operation against a rigid end-date.

On 18 October 1951, a Letter Order Contract was issued to Holmes & Narver, providing for architectural engineering, construction and management services, and setting an expenditure limitation of $500,000. Planning of all phases of the work was immediately initiated and by mid-December, preliminary cost estimates were assembled and submitted to the Eniwetok Field Manager. During the latter part of December, the tempo of the work increased sharply, and the Letter Order Contract was modified, increasing the obligated funds to $1,000,000. During January and February of 1952, substantial changes were made in the concept and scope of work which had been planned, and for this reason the Letter Order Contract was modified in January to increase funds to $3,500,000 and again in mid-February the obligated funds were increased to $5,500,000.

Wording and terms of the Definitive Contract required a complete understanding on the part of both parties in order to insure compliance with labor and wage statutes, description of Holmes & Narver services to be performed under the various portions of the contract, clarification of the method of reimbursement to Holmes & Narver for its portion of the allowable overhead and many other items. Typical of the problem of describing the scope of work, which required considerable thought and time, was the Scientific Structures Program. This was due to the fact that information was not available as to the number of structures involved, or their physical characteristics whereby the scope of work could be fixed. It was finally decided that an approximate amount of money be set aside for the Scientific Structures Program and that a descriptive qualifying paragraph would be appended to this item explaining the relationship of the cost of the program to the fixed fee allowed thereon, and establishing the basis for an adjustment of fee, the latter in the event the estimated cost of the Scientific Structures Program as determined from actual engineering drawings and specifications either increased or decreased the amount allocated for this purpose. The fixed fees for the entire project, based upon the scope of work as it was known on 18 January 1952, were then negotiated and referred by the Atomic Energy Commission to the Director of Military Applications in Washington, D. C., for approval. A copy of the fully executed Definitive Contract was received by Holmes & Narver on 16 April 1952.

During the entire term of the contract negotiations, there existed a complete mutual understanding of the various problems to be resolved. It is evident that only by close cooperation between Holmes & Narver and representatives of the AEC was it possible to reach a satisfactory Definitive Contract within this period.

The final Definitive Contract set forth five basic jobs to be accomplished, as follows:

JOB NO. I. ENGINEERING, DESIGN, INSPECTION, and CONSTRUCTION. Job No. I was further subdivided to provide four titles of work, Title 1 being necessary topographical and survey work, including preliminary studies, investigations and estimates. Title 2 covered the design, estimates of construction cost, estimates of the quantities of critical materials, checking of shop drawings, and procurement of materials, equipment and supplies and facilities. Title 3 covered the performance of complete architect-engineer supervision and inspection of construction, which included the necessary Resident Engineer and staff to perform these services. Title 4 required the construction of the facilities.

JOB NO. II. CAMP OPERATION and MANAGEMENT. This covered the operation and management of all camp and related service facilities.

JOB NO. III. MAINTENANCE. This covered the maintenance of all facilities and structures.

JOB NO. IV. SUPPORT SERVICES. This provided for a labor pool to assist the Commission's technical and scientific divisions in support of their programs.

JOB NO. V. ROLL-UP SERVICES. This covered the work required to place the base in a stand-by condition.

To strengthen the Company's over-all organization in view of expanding activities, and particularly because of the imminence of the new test operation at Eniwetok, Holmes & Narver had, in the fall of 1951, made some basic changes in the top management positions. A General Manager was appointed on 1 November 1951, who was responsible directly to the President and Executive Vice President, and who was to exercise supervision over all work in the Company, including the conduct of Contract AT-(29-2)-20, through the Chief of Operations, the Director of Engineering, the Controller, the Contract Administrator, and the Chief Security Officer. The responsibilities and authority of each of these five division heads was clearly defined, and each was authorized to maintain direct liaison with Atomic Energy Commission officials and with Jobsite supervisors on matters involving his particular activity. In addition, two staff positions of Executive Assistants, engineering and administration, were created without direct operational responsibilities, to assist the General Manager in examining and correcting any deficiencies which appeared in the conduct of any phase of the operation. This managerial arrangement assured a high degree of coordination and close supervisory control. All major decisions were coordinated with the President and the Executive Vice President, while the Division Heads were kept constantly advised by the General Manager on all aspects of the project by means of conferences and periodic reports.

To provide a close liaison on engineering matters between the Eniwetok Field Manager's Office and Holmes & Narver, the position of Project Engineer was established on 31 October 1951. The Project Engineer reported directly to the Chief of Operations in order that any new plans or change of plans might be quickly coordinated with Procurement, man power requirements and with the field. It was the Project Engineer's responsibility to transmit all information to the Engineering Division and to maintain constant surveillance over the progress of design work on this project. The assignment to the Project Engineer of the responsibility for the supervision of engineering developments on Contract AT-(29-2)-20 permitted the Chief Engineer to devote his undivided attention to his primary responsibility for engineering design work.

Recognizing the dual responsibility which would be placed upon the Procurement Department in securing a large volume of materials and supplies in a limited time and the responsibility for protecting the government's interests while securing these items, a procurement group was built up of carefully screened personnel who were set up to operate directly under the Assistant Chief of Operations. Procurement procedures were developed providing for controls at all critical points to determine that established procedures were being followed. At the Jobsite, a Supply Division was created and given a staff status.

The functions of the Accounting Division were reviewed critically to insure that an adequate Chart of Accounts be established which would tie in closely with the arrangement of preliminary cost estimates and so that direct comparisons of cost would be accumulated for future use. The Accounting Division was further strengthened in the Internal Audit Sections, and substantial advances made in the Accounting and Payroll Departments seeking to increase efficiency by installation of machine record keeping.

The Industrial Relations Department was strengthened by the addition of experienced personnel for the key positions. Close working relationships were established with the State of California Employment Offices which were able to provide considerable assistance in the way of personnel and office space for preliminary screening of many thousands of applicants. A program was instituted in this department for the accumulation and application of many company policies and procedures which could be incorporated into standardized personnel procedures. The employment agreements used under the previous Contract were carefully reviewed and rewritten in part to make them easier for administration and to clarify certain ambiguity. A study was made of prevailing wage rates in the Southern California area and in the Pacific area in order to determine and establish sound rate structures which should permit recruiting of personnel under competitive wage conditions. Considerable study was required to determine that all provisions of the Federal Government Wage and Salary Stabilization Boards were being complied with.

The Estimating Department was instructed to review all of its procedures with the view of simplifying and speeding up previous procedures to provide more accurate cost estimates and to work out with the Accounting Division a Chart of Accounts which would provide Management with the tools for evaluating the progress of work under this Contract.

The capabilities of the Honolulu Office were reviewed to determine if it was adequately staffed to handle the forthcoming operation. That office played a very important part in the coordination and control of all trafffic of personnel and materials being shipped through Honolulu to the Jobsite, plus control of movement of personnel from the Jobsite to the Mainland. It was necessary to add to the personnel at Honolulu in order to provide trained expediters for this phase of the work. In addition, examination was made into the Honolulu Office functions of recruiting, processing of personnel, maintaining liaison with representatives of the various armed forces in Honolulu, particularly the Pearl Harbor Navy Yard, and the procurement of a limited number of items which were classed as emergency purchases in the Honolulu area. For these related services it was determined that the Honolulu staff required additional assistance and therefore the total office force was increased to approximately 12.

In order to handle the anticipated volume of embarkation and shipping work in the Oakland area, it was necessary to retain the office which Holmes & Narver had set up in the Naval Supply Center at Oakland to act as a coordinating point for all transshipment of materials and supplies which were sent to the Jobsite by surface transportation. One man had previously been stationed at Travis Air Force Base to assist in the scheduling of personnel movements, both to and from Honolulu, and it was decided to augment this office by the addition of one man to coordinate the flow of all air freight shipments to the Jobsite. At this time the decision was also made to enter into a broad contract with the Pacific Ports Industries for packing, crating and packaging of a large volume of materials and supplies which would be processed for export shipment in that plant. In order to provide a closer control over this sub-contractor's operation and to provide inspection services, a Holmes & Narver inspector was placed in this plant as a resident inspector.

The building up of a Jobsite organization capable of undertaking a project of the magnitude of OPERATION IVY required a careful review of the potentialities of all personnel remaining with the project upon completion of OPERATION GREENHOUSE and concurrently a search for additional qualified personnel to round out the organization. Holmes & Narver was fortunate in finding an extremely well-qualified Project Manager who had started his orientation in the Home Office prior to notice to proceed on this operation. A new Jobsite Controller had been selected also during the fall of 1951 and had been in process of training at the Home Office and was therefore ready to take over his assignment at the commencement of the new project. All other key Jobsite personnel were selected from former employees and from the basic Home Office organization. It was interesting to note that in the build up of the Jobsite organization from a low point of approximately 300 employees during the fall of 1951 to the peak Jobsite employee total of over 1300 people that approximately half of the men employed for this work were rehired after having completed a previous Holmes & Narver contract at Eniwetok.

Having made a quick appraisal of the scope of the work to be accomplished during the coming operation and having made plans to augment the organization at various points in order to undertake the job, the next obvious step was to make an appraisal of the Jobsite to determine what had to be accomplished before another operation could be undertaken.

The original criteria established for the guidance of Holmes & Narver at the inception of OPERATION GREENHOUSE were based on the development of facilities limited in scope and permanence to two operations. The recognition of Eniwetok Atoll as a permanent Proving Ground, focused attention upon the desirability of re-examining the facilities then available and re-appraising future requirements. To implement such action the Field Manager authorized Holmes & Narver by letter of 27 May 1952 to make a study of probable future requirements and report thereon. In compliance, a report was prepared and submitted on 8 October 1952. This report evaluated the existing improvements at Eniwetok Atoll and made recommendations for a long range development program to meet requirements as they were then anticipated. It presented a plan for future improvement of the Atoll in respect to general site planning and utilities and facilities essential to orderly development of the site.

Estimates of the costs of the improvements proposed included in this report were as follows:

Parry Island (Elmer)

Personnel Facilities	$1,512,500
Administration and Laboratory Facilities	67,500
Shop Facilities	514,500
Warehousing	826,000
CMR Facilities	62,400
Electric Power Generation & Distribution	1,693,000
Emergency Power Plant	405,390
Control and Signal Systems	572,000
Telephone Facilities	310,600
Water Supply and Distribution	398,300
Sanitary Sewers	19,000
POL Facilities	185,400
Fire Protection	93,000
Security Fencing	127,000
Roads	91,000
Airstrip Improvements	26,520
Marine Facilities	1,715,000
TOTAL	$8,619,110

Eniwetok Island (Fred)

Warehousing	$ 912,800
Water Supply and Distribution	1,380,850
Electrical Power Generation & Distribution	861,000
POL Facilities	71,400
Marine Facilities	790,000
CTG 132.2 Requirements	225,440
Airstrip Improvements	373,670
TOTAL	$4,615,160

Eniwetok Atoll is a typical coral atoll located at the northwestern extremity of the Marshall Islands and forming a circular chain, roughly, of islands 22 nautical miles in diameter. It is situated about 4500 nautical miles from Los Angeles, with Honolulu at approximately the half-way point.

The islands along the westerly side are low in elevation, consisting mainly of coral reefs and sand bars which are usually submerged at high tide. The easterly half consists of a number of emerged islands of varying sizes covered with coral sand. The entire Atoll perimeter is a shelf-like coral reef dotted with projecting irregular masses of hard coral around and between the islands. On the ocean side this coral shelf dips abruptly into deep water, whereas on the lagoon side sandy beaches form a transition into the deeper waters. There are two navigable entrances to the lagoon, both of which are suitable for deep-water vessels. With the exception of a few coral shoals, the lagoon is navigable for all purposes. The weather is typically tropical, with an average humidity of 82 per cent and fairly uniform in temperature, averaging 84 degrees F. The Atoll has frequent rains and periodic squalls, there is no regularly defined rainy season. The average rainfall per year is 51.5 inches.

A number of the islands of the Atoll, particularly those used in previous operations, had been entirely denuded of vegetation. In December of 1951, those islands little used in previous operations, including Site David, were covered with varying degrees of underbrush and cocoanut palm trees. Following the completion of OPERATION GREENHOUSE, several post-shot surveys were made from which topographic maps and revised site plans were drawn showing the physical aspects of the Atoll with buildings and facilities in existence at the time of contract negotiations.

The two large camps, one on Site Fred and one on Site Elmer, had been partially placed in stand-by condition during the Roll-Up phase of the previous operation. At Site Fred, an army garrison force of approximately 400 men was stationed and most of the permanent camp facilities were kept in an active status. Large amounts of equipment and materials had been placed in a stand-by condition protected from the elements and an active maintenance program was being followed in order to place buildings, equipment, utilities, roads and airstrip in first class operating condition. On Site Elmer, approximately 300 Holmes & Narver personnel were employed in work such as the following: salvage and storage of coaxial cable and miscellaneous construction materials from the previously occupied "shot" islands; routine maintenance of buildings, equipment, utilities and overhaul of furniture; grading of roads; continuation of mothballing of equipment; sealing of selected Scientific Stations; hydrographic surveys; study of marine borer action on pier pilings; overhauling of marine craft, etc. At this camp, the Tent Area had been deactivated, tents stored, and frames were being painted. Barracks 100 thru 120 were in use for housing purposes, and Barracks 121 thru 130 and 206 were being used for warehouses.

The camp on David remained intact though completely deactivated. The aluminum buildings were being used to store camp and animal colony equipment. On Sites Yvonne, Ursula and Janet, the power plants were being operated periodically for maintenance purposes. The distillation plants at these sites had been mothballed.

There were piers at Sites Fred, Elmer, David, Ursula in varying condition as a result of OPERATION GREENHOUSE. Approximately one half of the deck on the inshore end of the pier at Yvonne had been blown off and had not been repaired. The pier at Janet was in bad shape as considerable undermining by sea action had taken place. Channels for boats through the reef shelf to various islands were in fair shape, though a number of channel markers were missing. Considerable shoaling by sand accretion had taken place in the channels into Mary and Kate. The channel into Gene could be entered only during times of high tide. There were telephone buoys off Sites Fred, Elmer, Yvonne, Tilda and Janet to which sea going vessels could be moored. A considerable number of small craft mooring buoys were in place off Sites Fred and Elmer, and a few were also located off various other islands used in previous operations. A floating dry dock had been acquired in early August and at this time was moored to the telephone buoy off Site Elmer.

There were 747,750 feet of submarine control and signal cable, and 392,990 feet of submarine telephone cables between various islands. These cables and the islands on which they terminate are shown diagrammatically in Book 2, Chapter VII of this Completion Report. Telephone exchanges were in operation on Sites Fred and Elmer. There were phones in operation on a number of other islands which were connected through Site Elmer Exchange. Radio communication extended between Site Fred and Oahu and direct radio teletype between Eniwetok Atoll and Los Alamos, New Mexico.

There were airstrips in varying degrees of repair on the Sites Elmer, Fred, Bruce, Yvonne, Tilda, Janet and Alice. The airstrip on Site Fred was designed and maintained for the operation of large transport planes. On other islands, the airstrips were small, being limited by topography, and could be used only by light planes for intra-atoll transportation.

Radioactivity was in evidence in certain areas; in these areas work was limited as prescribed by Rad-Safe officials who maintained continued observations and tests of radioactivity and who stipulated the limits of radioactive exposure.

To summarize the adequacy of existing installations, it appeared that the base facilities were generally adequate to meet the requirements of the proposed operation when considered in conjunction with the construction of a new 500-man camp at Gene, the reactivation of the 250-man camp at Yvonne, and the expansion of the cryogenics facilities as previously discussed. In general, the basic facilities were adequate to meet the required expansion. It was evident, however, that most base facilities would be taxed to their limit in order to provide the necessary facilities and as a result many ideas suggested themselves in the way of permanent improvements if this base were to be used on a continuing schedule of operations. Many minor additions and changes were made to existing structures, such as the modification of Bldg. 222 to make it adaptable for a pass and briefing office and the addition of Shop Bldg. 194 to provide additional machine shop facilities for the using agencies. The Eniwetok Field Manager recognized that the scope of OPERATIONS IVY and GREENHOUSE taxed the capabilities of the existing plant, and authorized a subsequent report on long-range planning which was later prepared by Holmes & Narver, indicating many basic improvements which could be economically justified on the basis of continuing operations at the Proving Ground for a period of ten years.

Preliminary plans for the causeway to be used in connection with the ground shot indicated that it would be necessary to move fill material in the order of 1 million cubic yards. To move this much material within the time limit allowed for construction, it appeared that it would be necessary to obtain the use of a dredge on a purchase or lease basis. Accordingly, preliminary talks were had with the Hawaiian Dredge Corporation, and several On-Continent corporations, with a view to determining the availability of such equipment. Subsequent downward revisions of the amount of material necessary to handle (because of change in plans) made it possible to schedule the construction of the causeway by use of draglines and trucks, which were selected, procured and shipped to the Jobsite. No other major equipment acquisitions were made, even though the bulk of the available construction equipment was of old vintage and required heavy maintenance.

Having evaluated the basic problem, the organizational setup with which to accomplish the work and the permanent base facilities, it was then possible to enter into detailed planning to implement the over-all program with the numerous details necessary for the successful start of a complicated program. That this organization was established with a large capacity for adaptability and accomplishment was demonstrated when on one week's notice a program for work on Bikini was initiated that resulted in placing 200 men at work on that island in a period of one month.

During the course of four years of mutual application to the problems inherent in developing a project of this nature, representatives of Holmes & Narver and the Atomic Energy Commission have by discussion resolved most areas of difference which might otherwise present a basis for general recommendations. Similarly, procedural technique has been evolved and matured to an extent that major policy recommendation is not necessary. Minor problems affecting particular phases of the work, and recommendations as to their solution, are presented, where applicable in the appropriate discussions which follow.

In succeeding books of this report, it will be shown in broad terms how each of the basic jobs described in the Definitive Contract was organized and carried out. Following that review, there will be described briefly the functions and problems of the various company divisions to show the part that each played in this over-all program.

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CHAPTER II
CONTRACT HISTORY

SECTION 1. CONTRACT NEGOTIATIONS, OPERATION IVY

In the fall of 1951 the Atomic Energy Commission reached a decision to conduct a third series of tests at Eniwetok Atoll, subsequently referred to as OPERATION IVY. As a result of this decision, a Letter Order Contract was issued to Holmes & Narver, Inc. on 18 October 1951 for the provision of Architectural, Engineering, Construction and Management Services with an expenditure limitation of $ 500,000. It further specified that a Definitive Contract would be executed prior to 31 December 1951, or at such later date as might be mutually agreed upon by the Contracting Parties.

A subsequent letter, conveyed by the AEC Project Manager, presented Holmes & Narver with an outline of the known scope of work which permitted determination of initial cost estimates. This furthered the basis for negotiations on behalf of the Definitive Contract.

In the beginning, AEC transmitted Modification No. 1 to the Letter Order Contract which established criteria for control of advanced funds. This was effected the latter part of October.

By mid-December, Holmes & Narver had assembled and submitted preliminary cost estimates. These were derived from the scope of work, as indicated by letters Holmes & Narver received from the Commission in October.

During the latter part of December the work impetus had increased sharply with expenditures approaching the $ 500,000 limitation established by the Letter Order Contract. Hence, AEC issued Modification No. 2 increasing obligated funds to $ 1,000,000. This modification also tendered an extension of the date for execution of the Definitive Contract to 31 January 1952.

The first rough draft of the Definitive Contract was received on or about 29 December 1951 and subsequently several conversations were held between representatives of Holmes & Narver and the Commission to resolve questionable articles and terms in the Contract. In January 1952, written recommendations were submitted to AEC on the draft of a Definitive Contract. During this month Holmes & Narver received a third modification to the Letter Order Contract increasing obligated funds to $ 3,500,000.

Due to substantial changes made in the concept and scope of work planned, it became evident that final agreement on the text of the Contract could not be reached in January. The Commission, therefore, issued a fourth modification to the Letter Order Contract extending the date of execution to 29 February 1952.

In February a meeting was arranged between representatives of Holmes & Narver and AEC in Albuquerque, New Mexico for the purpose of determining the final wording and terms of the Definitive Contract. The points involved concerned the legal responsibilities of both parties with regard to records, compliance with labor and wage statutes, description of Holmes & Narver services under the various Job Numbers of the Contract, and a clarification of the method of reimbursement to Holmes & Narver of its portion of the allowable overhead.

The Scientific Structures Program required considerable thought and time due to the fact that information was not available as to the number of structures involved, or their physical characteristics whereby the scope of work could be fixed. An approximate amount of money was set aside for this Program and it was upon this point that all efforts were concentrated. After some time, a descriptive, qualifying paragraph was appended to this item which explained the relationship of the cost of the Program to the fixed fee allowed thereon and established the basis for an adjustment in fee. Such adjustment to be negotiated in case the estimated cost of the Scientific Structures Program, as determined from the known scope and actual engineering drawings and specifications, was found to be greater or less than the amount allocated for this purpose. The fixed fees for the entire project, based upon the scope of work known as of 18 January 1952, were then agreed to and referred by AEC to the Director of Military Application in Washington, D.C. for approval.

Since the Definitive Contract had not yet been executed, a fifth modification to the Letter Order Contract was issued in mid-February increasing the amount of obligated funds to $ 5,500,000 and extending the execution date of the Contract to 31 March 1952.

On 28 February 1952 the Definitive Contract was executed by Holmes & Narver and returned to AEC for its execution. Through the month of March, Holmes & Narver was still operating under the Letter Order Contract, since technically no copy of the Definitive Contract had been received. The Commission therefore issued Modification No. 6 to the Letter Order Contract extending the date for the execution of the Definitive Contract to 15 April 1952.

A copy of the fully executed Definitive Contract was received by Holmes & Narver on 16 April 1952.

During the entire term of contract negotiations there existed a complete mutual understanding of the various problems to be resolved. It is evident that due to the close cooperation afforded Holmes & Narver by the representatives of the AEC, a satisfactory Definitive Contract was executed within a reasonable period.

SECTION 2. DEFINITIVE CONTRACT

The Definitive Contract, as finally executed and designating Holmes & Narver Inc. as Contractor, follows:

JOB NO. 1. ENGINEERING, DESIGN, INSPECTION and CONSTRUCTION

TITLE I. "To complete this portion of the work the Contractor shall:

1. Make all necessary topographical and other surveys and maps; arrange for and supervise necessary test borings and other subsurface investigations; provided, however, the Contractor will not be required to make real estate or boundary surveys.

2. Prepare for the approval of the Commission preliminary studies, sketches, layout plans, investigations, recommendations and reports; and estimates of cost of proposed construction items and utilities and appurtenance thereto.

3. Perform such other services as are related to items enumerated in paragraphs 1 and 2 above, as the Commission may require."

TITLE II. "To complete this portion of the work the Contractor shall.

1. After approval by the Commission of preliminary plans, sketches, or drawings, prepare final designs, detailed working drawings and specifications in accordance with Commission or governmental standards necessary for the effective coordination and efficient execution of the construction work and revise such drawings and specifications if and when necessary. All such drawings and specifications shall be prepared in a manner and in such numbers required by the Commission. Unless otherwise directed or authorized by the Contracting Officer, drawings shall be prepared in pencil on tracing paper or pencil on tracing cloth by such methods as will permit the revision of such drawings for record purposes and the making of satisfactory reproductions. Drawings shall be prepared in ink only upon the direction of the Contracting Officer. There shall be included in the specifications all provisions which the Commission may direct relating to the advertising, negotiating,

or awarding of construction contracts, conditions under which the work shall be done, or any other special provisions.

2. Prepare estimates of the cost of the proposed construction based on approved designs, drawings, and specifications therefor.

3. Should it become necessary in the performance of the work and services for the Contractor to secure the right of ingress and egress on properties not owned or controlled by the Government, the Contractor shall, if practicable, secure the consent of the owner, his representative, or agent prior to effecting entry on such property. In the event it is necessary to pay a fee for a license to enter upon or use such property the Contractor, when so directed by the Commission, shall pay such fees and obtain a receipt therefor. Any fee so paid shall be an allowable contract cost. Any license or easement procured hereunder shall be in the name of the Commission or shall be transferred by the Contractor to the Commission.

4. Prepare estimates showing quantities of critical and important materials required for the construction of the various items and the length of time after award of the construction contract when such materials will be required at the site of the work.

5. Check and approve all shop and working drawings in connection with construction work to assure conformance with approved drawings and specifications.

6. Procure all materials, equipment, supplies, and facilities (not furnished by the Commission) required for the effective prosecution of the work under this Title; and procure any special materials, equipment, supplies, and facilities which the Commission may request. Provided that any single purchase at a cost of $ 50,000.00 or more must have the prior approval of the Commission.

7. Perform such other services as are related to items enumerated in paragraphs 1 to 6 above which the Commission may require."

TITLE III. "To complete this portion of the work the Contractor shall:

1. Perform complete architect-engineer supervision and inspection of construction under the direction of a responsible representative of the Contractor.

2. Make all necessary field surveys required to adapt construction to terrain conditions; furnish all grades which are essential to the construction of the various items and stake out the base lines of all items of construction at the construction site.

3. Furnish a Resident Engineer and staff of assistants and other personnel approved by the Commission to: (i) assist in the interpretation of the plans and specifications; (ii) approve or design alternates for substitution or structural changes; and (iii) supervise and inspect construction to assure that every part of the work is done in accordance with the approved drawings and specifications and within the areas and boundaries designated for the project. Said Resident Engineer is to be responsible directly to the Resident Manager, only, and shall in no way be connected with the construction department.

4. Make or have made necessary field tests at the site of the work to insure conformity of the materials and equipment and workmanship to specifications. The Contractor shall procure and evaluate reports on such other tests of materials and equipment as may be required by the Commission.

5. The Contractor or any member of his organization, when requested, shall consult and advise with the Commission on any questions which may arise in connection with the work under this contract.

6. Prepare record drawings to show construction as actually accomplished. These drawings shall be prepared by correcting drawings as prepared for construction purposes or, where construction drawings cannot be satisfactorily revised for record purposes, by preparation of appropriate new drawings.

7. Prepare a completion report for the project after completion of test operation within ninety days after receipt of a directive from the Contracting Officer.

8. Supervise the testing of operating units to assure proper operation and their conformance with specifications and

furnish all engineering services necessary to secure such proper operation and conformance.

9. Prepare instructions for the proper operation and maintenance of all utilities and operating equipment designed or procured by the Contractor.

10. Prepare monthly narrative reports in approved form showing the progress of the engineering and construction and any deviation from the approved schedule. These reports shall also include schedules and charts showing the order in which the Contractor proposes to carry on the work, and the contemplated dates for completing the same. The schedule shall be in the form of progress charts to indicate the percentage completed at any time. The progress report and charts shall be corrected at the end of each month and delivered to the Contracting Officer.

11. Prepare proper cost control reports of all operations under the direction of the Contractor."

TITLE IV. "To complete this portion of the work the Contractor shall:

1. Furnish all services, labor, materials, tools, machinery, equipment, facilities, and supplies, except those furnished by the Commission, and perform all work necessary for the construction of the items listed in Appendix A. When it is determined by the Contractor that the performance of any particular portion of the work by a subcontract would be in the best interest of the Commission, such work may be subcontracted by the Contractor subject to the approval of the Commission.

2. Schedule and coordinate the construction work; negotiate and award subcontracts; direct and supervise work of subcontractor; store equipment and material for use in connection with the project; procure all materials, equipment, supplies and facilities (not furnished by the Commission) required for the work under this contract; and procure any special materials, equipment, supplies, and facilities which the Commission may request. Provided, that any single purchase in excess of $ 50,000 must have the prior approval of the Commission."

JOB NO. 2. CAMP OPERATION and MANAGEMENT

1. "The Contractor shall furnish all labor, equipment, materials, tools, and supplies to operate and manage all facilities at the site, including but not limited to housing, messing, commissary, medical services, recreational facilities, utilities, laundry, transportation, and communications as necessary to adequately meet the needs and requirements of the Commission, other authorized agencies, and the Contractor."

JOB NO. 3. MAINTENANCE

1. "The Contractor shall furnish all labor, equipment, materials and supplies to preserve property and maintain all facilities and structures, either existing or contemplated herein at the site, including but not limited to buildings, utilities, roads and airstrips, docks, equipment, materials and supplies, and technical structures not expended during tests."

JOB NO. 4. SUPPORT SERVICES

1. "The Contractor shall provide a labor pool of skilled and unskilled labor to assist the Commission's technical and scientific agents in instrumentation, equipment installation or erection, field engineering and construction, machining, and other related work connected with actual test operations. He shall also furnish unpacking and packing services and such equipment, operators, materials, and supplies as may be required in connection with these services."

JOB NO. 5. ROLL-UP SERVICES

1. "After test operations the Contractor shall rehabilitate buildings, structures, and facilities as determined by the Commission in order to place same in standby condition. The Contractor shall clean, repair, and 'mothball' all construction, marine, vehicular, shop, and installed equipment not necessary for his use in maintenance operations. He shall paint or otherwise protect and store extra beds, chairs, other furniture, construction materials and supplies, communications equipment, and any other supplies, materials, structures, or equipment deemed necessary by the Commission to demobilize the site to standby conditions."

DEFINITIVE CONTRACT APPENDIX MODIFICATION

The following tabulation is a comparison between Appendix "A", Part I as written in the Definitive Contract dated 18 February 1952, and Appendix "A", Part I as revised by Modification No. 10 dated 3 November 1952.

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION	
Item No. 1 Parry: Bldg. 338	
Cryogenics Compressor & Liquefier Building, 12,800 sq. ft.	Cryogenics Compressor & Liquefier Building, 12,800 sq. ft. (Titles I and II only. Est. related construction cost $815,000.00).
Est. Cost $ 815,000.00	
Item No. 2 Parry: Bldg. 339	
Electrical Generating Facilities, 4,595 sq. ft., 4,000 kw capacity.	Electrical Generating Facilities, 6,492 sq. ft., including 1,064 sq. ft. of wood structure to house compressors, pumps, oil coolers, etc.; 4,000 kw capacity.
Est. Cost $ 794,800.00	Est. Cost $ 889,685.00
Item No. 3 Parry: Bldg. 340	
Dewar Storage, 9,600 sq. ft.	Bldg. 340-A thru 340-H; Dewar Storage, eight buildings @ 800 sq. ft. each.
Est. Cost $ 75,600.00	Est. Cost $ 69,280.00
	Engineering Change Order 273 modifying Bldg. 340-H.
	Est. Cost $ 8,800.00
Item No. 4 Parry: Bldg. 341	
Dewar Assembly & Maintenance, 2,550 sq. ft.	Dewar Assembly & Maintenance, 3,123 sq. ft.
Est. Cost $ 235,000.00	Est. Cost $ 243,025.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION (Continued)	
Item No. 5 Parry: Bldg. 342	
Deleted.	Machine Shop; 1,816 sq. ft. plus adjacent structure of 360 sq. ft. to house dehumidification equipment. Est. Cost $ 85,890.00
Item No. 6 Parry: Bldg. 343	
Lab. & Telemetering 1,440 sq. ft. Est. Cost $ 29,500.00	Deleted.
Item No. 7 Parry: Bldg. 344	
Deleted.	Cryogenics Plant, 6,520 sq. ft. Est. Cost $ 459,455.00 Engineering Change Order 274, adding cooling water system. Est. Cost $ 14,475.00
Item No. 8 Parry: Bldg. 345	
Cylinder Storage, 5,400 sq. ft. Est. Cost $ 108,000.00	Gas Cylinder Storage (Title I only on related construction cost $ 108,000.00). Change Design Est. Cost $ 15,165.00
Item No. 9 Parry: Bldg. 346	
Control & Observation Blockhouse, 5,000 sq. ft.; deleted (Title I only). Related cost of construction $ 270,000.00.	Control & Observation Blockhouse, 5,000 sq. ft.; deleted after Title I was complete. Est. related cost of construction, $ 270,000.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION (Continued)	
Item No. 10 Parry:	
Protective Earth Berms. Deleted.	Protective Earth Berms. Deleted.
Item No. 11 Parry:	
Blast Protection Measures for Buildings & Structures; $ 300.00 each.	Blast Protective Measures for Buildings & Structures.
Est. Cost $ 63,000.00	Est. Cost $ 63,000.00
Item No. 12 Parry:	
Paving of Cryogenics Areas; 14,000 sq. yds.	Paving of Cryogenics Areas; 33,000 sq. yds.
Est. Cost $ 58,000.00	Est. Cost $ 66,000.00
Item No. 13 Parry:	
Security Fencing, Cryogenics Area; 3,000 lin. ft.	Security Fencing
Est. Cost $ 13,000.00	Est. Cost $ 22,750.00
	Fence Lighting
	Est. Cost $ 11,365.00
Item No. 14 Parry:	
Utility Connections & Extensions to Cryogenics Area.	Utility Connections
	Est. Cost $ 61,870.00
	Additional Tel. & Electrical
Est. Cost $ 45,000.00	Est. Cost $ 162,535.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION (Continued)	
Item No. 15 Parry:	
Deep-Water Dock (Titles I and II only). Est. related cost of construction, $484,000.00.	Deep-Water Dock (Titles I and II only). Est. related cost of construction, $484,000.00.
Item No. 16 Eniwetok:	
Blast Protection Measures for Buildings and Structures; $300.00 each.	Blast Protection Measures for Buildings and Structures.
Est. Cost $ 63,000.00	Est. Cost $ 63,000.00
Item No. 17 Japtan:	
Blast Protection Measures for Buildings and Structures; $45.00 each.	Blast Protection Measures for Buildings and Structures. Deleted.
Est. Cost $ 9,800.00	
Item No. 18 Coral Head:	
Landing Facilities.	Landing Facilities (Title I only). Est. related cost of construction, $8,000.00.
Est. Cost $ 8,000.00	Est. Cost $ 8,000.00
Item No. 19 Runit:	
Camp Facilities for 240 men.	Camp Facilities for 240 men.
Est. Cost $ 528,000.00	Est. Cost $ 192,000.00
Item No. 20 Teiteiripucchi:	
Camp Facilities for 500 men.	Camp Facilities for 500 men.
Est. Cost $ 928,700.00	Est. Cost $ 800,000.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION (Continued)	
Item No. 21 Teiteiripucchi:	
Airstrip: 100' x 1,500', 16,700 sq. yds.	Airstrip: 100' x 1,500'
Est. Cost $ 28,000.00	Est. Cost $ 70,000.00
Item No. 22 Teiteiripucchi:	
Channel, Turning Basin & Pier.	Channel, Turning Basin & Pier.
Est. Cost $ 425,000.00	Est. Cost $ 300,000.00
Item No. 23 Teiteiripucchi:	
Tower Cab.	Tower Cab.
Est. Cost $ 500,000.00	Est. Cost $ 566,825.00
Item No. 24 Los Alamos:	
Tower Cab Mock-Up. Deleted.	Tower Cab Mock-Up. Deleted.
	Buffalo: - Bridge Crane Mock-Up.
	Est. Cost $ 40,000.00
Item No. 25 Elugelab to Bogon:	
Causeway and Coax Cover, 186,000 cu. yds.	Causeway, Coax Cover & Station No. 204.
Est. Cost $ 2,180,000.00	Est. Cost $ 1,873,125.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION (Continued)	
Item No. 26 Flora to Engebi:	
Submarine Cables, 27,000 lin. ft.	Flora to Engebi: Bogallua to Noah; Engebi to Runit; Submarine Cables; 98,000 lin. ft.
Est. Cost $ 150,000.00	Est. Cost $ 315,395.00
Item No. 27 Parry:	
75-foot Photo Tower.	125-foot Photo Tower.
Est. Cost $ 35,000.00	Est. Cost $ 102,750.00
Item No. 28 All Sites:	
Scientific Structures.	Scientific Structures.
Est. Cost $ 2,000,000.00	Est. Cost $ 2,250,000.00
Note: The specific nature and number of such structures is not presently known, in consequence of which the amount estimated hereunder for the work contemplated to be performed is not based upon any definite data presently available to the Government or to the Contractor. Therefore, the title of this item, "All Sites: Scientific Structures" and the preliminary estimated cost of $ 2,000,000.00 shown therefor, are not descriptive of the scope of the work contemplated hereunder. Notwithstanding the provisions of Article III, Article V, and Article XII, the amount estimated hereunder is not intended to bind the Contractor or the Government to the monetary	Note: Based on the presently known scope of Scientific Structures, estimates have been prepared using approved drawings to the extent of approximately $ 2,250,000.00.

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION (Continued)	
limit of said preliminary estimate, nor to the extent of any fixed fees computed thereon for this item and presently included in the total fixed fees of this Contract until the conditions set forth in the succeeding paragraph are accomplished. It is, therefore, expressly understood and agreed that at such time as the Government furnishes the Contractor with more definite details of the proposed scope of work, including the location, type of construction, number and class of structures, the parties hereto will negotiate in good faith as to the estimated engineered construction cost for this item, upon which the Contractor's fixed fees shall be computed and the Contract shall be modified in writing accordingly, to reflect the understanding and agreement of the parties.	
Item No. 29 Parry: Bldg. 347	
Salt Water Pump House.	Salt Water Pump House, 550 sq. ft.
Est. Cost $ 103,800.00	Est. Cost $ 139,560.00
Item No. 30 Parry: Bldg. 348	
Heat Exchanger Building.	Heat Exchanger Building (Titles I and II only). Est. related cost of construction, $ 67,000.00.
Est. Cost $ 67,000.00	

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION (Continued)	
Item No. 31 Parry: Modifications to Bldgs. 329 & 330.	
Existing Cryogenics Plant.	Existing Cryogenics Plant.
Est. Cost $ 34,000.00	Est. Cost $ 80,000.00
Item No. 32 Parry: Modifications to Bldg. 222	
Pass Office & Briefing	Pass Office & Briefing.
Est. Cost $ 3,000.00	Est. Cost $ 15,070.00
Item No. 33 Parry: Structure 349.	
Elevated 500 bbl. Salt Water Tank.	Elevated 500 bbl. Salt Water Tank.
Est. Cost $ 8,000.00	Est. Cost $ 30,155.00
Item No. 34 Parry: Bldg. 194	
Shop Building 1,440 sq. ft.	Shop Building 1,475 sq. ft., plus additional structure of 555 sq. ft. to house dehumidification equipment.
Est. Cost $ 29,500.00	Est. Cost $ 64,185.00
	Item No. 35
	Construction Change Orders to 8/8/52.
	Est. Cost $ 278,545.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION (Continued)	
	Item No. 36 Japtan: Remove and store buildings. (Reassigned to Job V, Roll-Up).
	Item No. 37 Parry: JTF Recreation Building (Title I only). Est. related cost of construction, $ 18,900.00.
	Item No. 38 Parry: Warehouse (3 buildings) 18,400 sq. ft. Est. Cost $ 259,690.00
Sub Total - Construction Cost Est. Cost $ 9,337,700.00	Sub Total - Construction Cost Est. Cost $ 9,621,595.00
	Procurement Services Item No. 39 Two Portable Distillation Units Est. Cost $ 20,000.00
	Item No. 40 Equipment not related to construction. Est. Cost $ 250,000.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
A. JOB I - ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION (Continued)	
	Procurement of Item A-24 Est. Cost $ 40,000.00
	Sub Total - Procurement Est. Cost $ 310,000.00 This total is included in estimated cost of construction.
B. JOB II - CAMP OPERATION AND MANAGEMENT	
<u>Item No. 1</u>	
Camp Operation in Support of Personnel & Operations other than Holmes & Narver. Est. Cost $ 1,743,000.00	Camp Operation in Support of Personnel & Operations other than Holmes & Narver. Est. Cost $ 2,921,900.00
Sub Total - Camp Operation and Management. Est. Cost $ 1,743,000.00	Sub Total - Camp Operation and Management. Est. Cost $ 2,921,900.00
C. JOB III - MAINTENANCE SERVICES	
<u>Item No. 1</u>	
Maintenance of Base Facilities on normal continuing level. Est. Cost $ 3,646,000.00	Maintenance thru June 1953. Est. Cost $ 4,276,000.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
C. JOB III - MAINTENANCE SERVICES (Continued)	
Item No. 2	
Added Maintenance during Operation.	
Est. Cost $ 630,000.00	
Sub Total - Maintenance Est. Cost $ 4,276,000.00	Sub Total - Maintenance Est. Cost $ 4,276,000.00
D. JOB IV - SUPPORT SERVICES	
Item No. 1	
Lay Coaxial Cable.	Lay Coaxial Cable.
Est. Cost $ 541,000.00	Est. Cost $ 32,790.00
Item No. 2	
Installation of Cryogenics Equipment.	Install CMR Equipment
Est. Cost $ 181,500.00	Est. Cost $ 226,900.00
Item No. 3	
Labor Pool & Instrumentation Support.	Labor Pool & Instrumentation.
Est. Cost $ 1,250,000.00	Est. Cost $ 1,250,000.00
Sub Total - Support Services Est. Cost $ 1,972,500.00	Sub Total - Support Services Est. Cost $ 1,509,690.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
E. JOB V - ROLL-UP SERVICES	
<u>Item No. 1</u>	
Clean-up & Store Construction Equipment.	Clean-up & Store Construction Equipment.
Est. Cost $ 319,000.00	Est. Cost $ 319,000.00
<u>Item No. 2</u>	
Clean-up & Store Marine Equipment.	Clean-up & Store Marine Equipment.
Est. Cost $ 56,000.00	Est. Cost $ 56,000.00
<u>Item No. 3</u>	
Warehouse Construction Materials.	Warehouse Construction Materials.
Est. Cost $ 332,000.00	Est. Cost $ 332,000.00
<u>Item No. 4</u>	
Clean-up Generators, Stills & Pumps.	Clean-up Generators, Stills & Pumps.
Est. Cost $ 60,000.00	Est. Cost $ 60,000.00
<u>Item No. 5</u>	
General Clean-up.	General Clean-up.
Est. Cost $ 126,000.00	Est. Cost $ 126,000.00
<u>Item No. 6</u>	
Protective Maintenance; Buildings & Structures.	Protective Maintenance; Buildings & Structures.
Est. Cost $ 152,000.00	Est. Cost $ 152,000.00

APPENDIX "A" - PART I

DEFINITIVE CONTRACT DESCRIPTION	MODIFICATION NO. 10 DESCRIPTION
E. JOB V - ROLL-UP SERVICES (Continued)	
Item No. 7	
Clean-up & Store Camp Equipment.	Clean-up & Store Camp Equipment.
Est. Cost $ 150,000.00	Est. Cost $ 150,000.00
Sub Total - Roll-Up Services Est. Cost $ 1,195,000.00	Sub Total - Roll-Up Services Est. Cost $ 1,195,000.00
TOTAL ESTIMATED COST EXCLUSIVE OF FEE $ 18,524,200.00	TOTAL ESTIMATED COST EXCLUSIVE OF FEE $ 19,524,185.00

SECTION 3. CONTRACT MODIFICATIONS

A discussion of the various Modifications to the Definitive Contract can be limited to the nine which introduced conditions to the Contract, other than an increase in obligated funds. Reference to the following pages titled "Summary of Modifications - Contract AT-(29-2)-20" will show that Modifications 1, 3, 4, 6, 8 and 13 are concerned only with increases in the fund obligation and require no additional comment. It will be noted that Modification No. 1 to the Definitive Contract was issued prior to the date the executed Contract was received by Holmes & Narver.

Modification No. 2 effecting a change in contract provisions was issued by AEC on 24 April 1952. It pertained to purchasing procedure and required prior approval by AEC for all purchase orders in an amount exceeding $ 5,000. Previously the amount had been set at $ 50,000.

On 16 May 1952, a meeting was held between representatives of AEC and Holmes & Narver to discuss numerous minor changes to Appendix "B" of the Contract which dealt with Employment Practices and Personnel Policies. This meeting was occasioned by the fact that the final draft of Appendix "B" received by Holmes & Narver on about 9 May 1952 did not comply with agreements reached in Albuquerque on 5 February 1952 when the basic provisions of the Contract were negotiated. The matter of proper wage schedules to be inserted in Appendix "B" was also thoroughly discussed at the 16 May meeting, In general, the basic desire by both parties was to establish sound, practical and economical policies and still allow the maximum flexibility and simplicity of administration of these policies.

A question by AEC Auditors of Holmes & Narver's interpretation of Part 1, Section A, Paragraph 7 of Appendix "B" resulted in a request for a modification in an effort to clarify this matter. As a result, several discussions with the AEC were held during July 1952, and a complete clarification of the provisions of Appendix "B" was satisfactorily documented.

On 20 June the fifth Modification was executed. This provided an adjustment in percentage from 11.646% to 12.482% in the allowance of fringe benefits for the calendar year 1952 based on the experience factor gained in 1951.

In September, Article XXXVI was added to the Contract as a provision of Modification 7. This Article established the period of time to be allowed for examination of records. It stated that Holmes & Narver's own records should remain available for examination for a period of three years after final payment under the Contract. Clarification was requested of this condition in regard to its effect on our vendors, and the Home Office was subsequently advised that the vendor's three-year period started from the time he had received his final payment.

As a result of the meeting held in May, Modification 9 was made a part of the Contract on 31 October, and provided the requested clarification of Paragraph 7, Section 7, Section A, Part I of Appendix "B" permitting Holmes & Narver more flexibility in revising wage and salary rates to conform with prevailing conditions in industry.

Throughout the summer of 1952, certain other contractual obligations were introduced which properly should be mentioned at this point. On 12 June the Commission addressed a letter to Holmes & Narver which requested and authorized a reconnaissance trip and report for contemplated facilities at Bikini Atoll. This project will be the subject of a separate report.

On 12 and 13 August preliminary meetings between representatives of AEC and Holmes & Narver were held to establish the extent of increase in the scope of work under Appendix "A" of the Definitive Contract. August 8th had been established as a cut-off date for the purpose of fixing estimates of cost based on the known scope of work at that time.

During the August meetings, additional conferences were arranged to be held early in October. The purpose of the October meetings was to negotiate fixed fees to cover the increase in the scope of work established in the August meetings. At the October meetings, it was pointed out that estimated costs, which were based on approved engineering drawings and specifications, had been forwarded to AEC for approval. Modification No. 10, which was issued to cover the increase in the scope of work that had developed prior to 8 August, covered the previously submitted cost estimates and drawings. The changes to Appendix "A" of the Definitive Contract, which Modification No. 10 affected, are noted in Appendix "A", to the Definitive Contract which is transcribed in Section 2 of this Chapter. Due to the fact that additional changes in the scope of work developed after the negotiations which prompted the execution of Modification No. 10, it became necessary to forward a letter on 6 November to AEC outlining the inclusion of the additional items, and arranging for discussions to resolve them.

Modification No. 11 to the Definitive Contract was issued on 5 November. It established certain revisions in salary ranges for select engineering job classifications and was retroactive to 1 August 1952.

The justification for this Modification was derived from a reorganization of the Holmes & Narver Engineering Division which resulted in increased responsibilities and an increased work load for individuals in certain classifications, and from a comparative study of salary structures of similar classifications in the Los Angeles area.

Modification 12, dated 15 December 1952, was added to the Contract in order to establish an additional engineering classification of Architectural

Designer. This classification was inadvertently omitted from the classifications established by Modification No. 11. It was occasioned by Company internal organizational realignment to conform to existing labor market conditions.

About October 1952 it became apparent that the Atomic Energy Commission was planning to conduct another operation at the Eniwetok Proving Grounds. During the planning it developed that another atoll was going to be selected as an alternate test site. The scope of work had to be developed over a considerable period of time due to this selection of an alternate test site. Because of the various agencies involved, it was difficult to define the scope of work sufficiently to execute a definitive modification. Since AEC desired to have Holmes & Narver perform this additional work under Contract 20, Modification 14 was issued on 15 January 1953 to establish the fact that such additional engineering and construction work was going to be necessary, and that a fixed fee would be mutually agreed upon at a later date.

Since funds obligated under the existing Contract were insufficient to cover the period incidental to the final definition of the additional work, Modification 14 further obligated an amount of $ 9,000,000, thereby increasing the total obligated funds under this Contract from $ 19,482,000 to $ 28,482,000.

On 16 September 1952, AEC issued Modification No. 7 to the subject Contract whereby an article with regard to the Examination of Records was made part of the Contract. Previously, this article required the Contractor (Holmes & Narver) and all subcontractors to retain their records for a period of three years after final payment under Contract 20. It became evident that this was impractical in view of the fact that Holmes & Narver might continue to operate under Contract 20 for an extended period of time, whereas transactions with vendors or subcontractors might be completed years prior to the final settlement of Contract 20 between the AEC and Holmes & Narver. Modification 15 was therefore issued on 19 January 1953, revising the requirement of Modification 7 to the extent that Holmes & Narver's subcontractors would only be required to retain their records for a period of three years after final payment to them under their subcontract rather than for a period of three years after final payment to Holmes & Narver by AEC under Contract 20.

SUMMARY OF MODIFICATIONS
CONTRACT AT-(29-2)-20

LETTER ORDER CONTRACT	DATE	DESCRIPTION	AMOUNT OBLIGATED INCREASE	TOTAL
	10/18/51	Furnish all labor, materials and equipment for the performance of design, inspection, construction, camp operation and maintenance services for Eniwetok Proving Grounds	500,000	500,000
Modif. No. 1	10/26/51	Establishes control of Advanced Funds		500,000
Modif. No. 2	12/21/51	Increase Obligation of Funds and extend date for execution of Definitive Contract to 1/31/52	500,000	1,000,000
Modif. No. 3	1/5/52	Increase Obligation of Funds	2,500,000	3,500,000
Modif. No. 4	1/28/52	Extends date for execution of Definitive Contract to 2/29/52		3,500,000
Modif. No. 5	2/18/52	Increase Obligation of Funds and extends date for execution of Definitive Contract to 3/31/52	2,000,000	5,500,000
Modif. No. 6	3/31/52	Extends date for execution of Definitive Contract to 4/15/52		5,500,000

SUMMARY OF MODIFICATIONS
CONTRACT AT-(29-2)-20
(Cont.)

DEFINITIVE CONTRACT	DATE	DESCRIPTION	AMOUNT OBLIGATED INCREASE	TOTAL
	2/28/52	Executed Definitive Contract AT-(29-2)-20 dated 18 February 1952 and effective 18 October 1951, returned to AEC for signature		5,500,000
Modif. No. 1	3/25/52	Increase Obligation of Funds	1,600,000	7,100,000
Modif. No. 2	4/7/52	That contract provision which requires prior approval for all purchases in excess of $ 50,000.00 was reduced to $ 5,000.00		7,100,000
Modif. No. 3	4/24/52	Increase Obligation of Funds	1,000,000	8,100,000
Modif. No. 4	5/26/52	Increase Obligation of Funds	2,350,000	10,450,000
Modif. No. 5	6/20/52	Provides for an adjustment in the percentage of allowance for fringe benefits from 11.646% to 12.482% effective 1 January 1952		10,450,000
Modif. No. 6	6/26/52	Increase Obligation of Funds	2,732,000	13,182,000
Modif. No. 7	9/16/52	Provides for the addition of Article XXXVI, Examination of Records, to the Contract and increases Obligation of Funds	2,700,000	15,882,000

SUMMARY OF MODIFICATIONS
CONTRACT AT-(29-2)-20
(Cont.)

DEFINITIVE CONTRACT	DATE	DESCRIPTION	AMOUNT OBLIGATED INCREASE	TOTAL
Modif. No. 8	10/30/52	Increase Obligation of Funds	2,000,000	17,882,000
Modif. No. 9	10/31/52	Clarifies Paragraph 7, Section A, Part I of Appendix "B" to provide more flexibility in revising wage and salary rates		17,882,000
Modif. No. 10	11/6/52	Covers increased scope of work negotiated as of 8 August 1952		17,882,000
Modif. No. 11	11/5/52	Effective 1 August 1952 revise salary ranges for select engineering job classifications		17,882,000
Modif. No. 12	12/15/52	Establishes additional engineering classification		17,882,000
Modif. No. 13	12/22/52	Increase Obligation of Funds	1,600,000	19,482,000
Modif. No. 14	1/15/53	Provides an increase in Obligated Funds pending the execution of a Definitive Modification for additional engineering and construction work	9,000,000	28,482,000
Modif. No. 15	1/19/53	Revises wording of Modification No. 7 pertaining to examination of Records		28,482,000

CHAPTER III
PARTICIPATING AGENCIES

PROGRAM 1 - RADIOCHEMISTRY

Agency: LASL - Los Alamos Scientific Laboratory

PROGRAM 2 - PROGRESS OF THE NUCLEAR REACTION

Agency: NRLK - Naval Research Laboratory - Krause
SC - Sandia Corporation

PROGRAM 3 - SCIENTIFIC PHOTOGRAPHY

Agency: EGG - Edgerton, Germeshausen, and Greer, Inc.
LASL - Los Alamos Scientific Laboratory
ARDC - Air Research and Development Command
LML - Lookout Mountain Laboratories
DOD - Department of Defense
USAF - United States Air Force

PROGRAM 4 - NEUTRON MEASUREMENTS

Agency: LASL - Los Alamos Scientific Laboratory

PROGRAM 5 - GAMMA RAY MEASUREMENTS

Agency: LASL - Los Alamos Scientific Laboratory
UCRL - University of California Radiation Laboratories
DOD - Department of Defense
USN - United States Navy
NRDL - Naval Radiological Defense Laboratory
ACC - Army Chemical Corps
SC - Sandia Corporation

PROGRAM 6 - BLAST MEASUREMENTS

Agency:	LASL	- Los Alamos Scientific Laboratory
	SC	- Sandia Corporation
	EGG	- Edgerton, Germeshausen, and Greer, Inc.
	DOD	- Department of Defense
	ONR	- Office of Naval Research
	SIO	- Scripps Institute of Oceanography
	NEL	- Naval Electronics Laboratory
	ARDC	- Air Research and Development Command
	WADC	- Wright Air Development Center
	USAF	- United States Air Force
	AFSWP	- Armed Forces Special Weapons Project
	AFCRC	- Air Force Cambridge Research Center
	NOL	- Naval Ordnance Laboratory

PROGRAM 7 - LONG RANGE DETECTION

Agency:	DOD	- Department of Defense
	USAF	- United States Air Force
	AFOAT	- Air Force Office for Atomic Energy

PROGRAM 8 - THERMAL RADIATION MEASUREMENTS

Agency:	NRLS	- Naval Research Laboratory - Stewart
	DOD	- Department of Defense
	USAF	- United States Air Force
	ARDC	- Air Research and Development Command
	WADC	- Wright Air Development Center

PROGRAM 9 - ELECTROMAGNETIC PHENOMENA

Agency:	LASL	- Los Alamos Scientific Laboratory
	DOD	- Department of Defense
	USA	- United States Army
	ASC	- Army Signal Corps
	USAF	- United States Air Force
	ARDC	- Air Research and Development Command
	WADC	- Wright Air Development Center

PROGRAM 10 - TIMING AND FIRING

Agency:	EGG	- Edgerton, Germeshausen, and Greer, Inc.
	SC	- Sandia Corporation
	WPD	- Weapons Performance Division

PROGRAM 11 - PRELIMINARY GEOPHYSICAL AND MARINE SURVEY OF THE TEST AREA

Agency:	AFSWP	- Armed Forces Special Weapons Project
	ONR	- Office of Naval Research
	DOD	- Department of Defense
	LASL	- Los Alamos Scientific Laboratory
	USGS	- United States Coast and Geodetic Survey
	SIO	- Scripps Institute of Oceanography
	AFL	- Applied Fisheries Laboratory, University of Washington

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CHAPTER IV
FINAL SCOPE OF WORK

The scope of work completed under Contract AT-(29-2)-20, as reflected in the final Cost Statement dated 31 December 1952, is shown in the following tabulation:

SCOPE OF WORK COMPLETED UNDER CONTRACT AT-(29-2)-20
(as reflected in final Cost Statement - 31 December 1952)

CONTR. SECT.		DESCRIPTION	ESTIMATED COST	INCURRED COST
A.		Job I - Construction & Engineering AEC Permanent Construction		
A -	1	Elmer - Bldg. 338 (Title I & II only)	$ 21,000.00	$ 17,842.46
	2	Elmer - Bldg. 339	889,685.00	886,284.35
	3	Elmer - Bldg. 340	79,000.00	81,178.89
	4	Elmer - Bldg. 341	243,025.00	193,008.28
	6	Elmer - Bldg. 343	Deleted	75.31
	7	Elmer - Bldg. 344	563,800.00	541,078.42
	8	Elmer - Bldg. 345	15,165.00	12,525.08
	9	Elmer - Bldg. 346 (Title I only)	Inc. Item #1	3,283.93
	15	Elmer - Deep Water Dock (Title I & II only)	Inc. Item #1	4,561.47
	29	Elmer - Bldg. 347	148,500.00	126,517.86
	30	Elmer - Bldg. 348 (Title I & II only)	Inc. Item #1	139.78
	31	Elmer - Modifications to Bldgs. 329 and 330	80,000.00	91,021.98
	35	All Sites - Construction Change Orders, Project 2039	136,825.00	99,000.30

SCOPE OF WORK COMPLETED UNDER CONTRACT AT-(29-2)-20
(as reflected in final Cost Statement - 31 December 1952)

CONTR. SECT.	DESCRIPTION	ESTIMATED COST	INCURRED COST
A.	Job I - Construction & Engineering AEC Permanent Construction (Continued)		
37	Elmer - JTF Recreation Building (Title I & II only)	Inc. Item #1	567.49
5	Elmer - Bldg. 342	85,890.00	90,208.62
12	Elmer - Pave CMR Areas	94,420.00	74,009.12
13	Elmer - Protective Fencing and Security Lighting - CMR	35,110.00	27,411.51
14	Elmer - Utility Connections and Extensions	289,665.00	369,365.91
32	Elmer - Modifications to Bldg. 222	15,070.00	14,834.52
33	Elmer - Bldg. 349	30,155.00	28,946.41
34	Elmer - Bldg. 194	64,185.00	92,405.72
35	All Sites - Construction Change Orders, Project 3028	164,809.00	274,900.01
38	Elmer - Warehouse Construction (3 Buildings)	259,690.00	235,387.25
40	Equipment not included in Construction Projects	100,000.00	102,995.55
90	Long Range Improvement	(Report Only)	15,542.90
	Planning and Reconnaissance	(Report Only)	9,381.09
	Total AEC Permanent Construction	$ 3,315,994.00	$ 3,392,474.21

SCOPE OF WORK COMPLETED UNDER CONTRACT AT-(29-2)-20
(as reflected in final Cost Statement - 31 December 1952)

CONTR. SECT.	DESCRIPTION	ESTIMATED COST	INCURRED COST
A.	Job I - Construction & Engineering AEC Expendable		
A - 10	Elmer - Protection Earth Berms	Deleted	
11	Elmer - Blast Protection Measures for Buildings	63,000.00	90,847.74
16	Fred - Blast Protection Measures for Buildings	63,000.00	45,017.53
17	David - Blast Protection Measures for Buildings	Deleted	
18	Coral Head - Landing Facilities	Deleted	696.71
19	Yvonne - Camp Facilities	192,000.00	226,612.46
20	Gene - Camp Facilities	800,000.00	825,022.34
21	Gene - Airstrip	70,000.00	55,706.03
22	Gene - Channel Turning Basin & Piers	306,415.00	188,887.71
23	Flora - Tower	Inc. Item #28	
24	Buffalo Bridge Crane	40,000.00	20,517.82
25	Flora to Irene - Causeway and Coax Cover)	1,180,000.00	310,287.81
25	Construction Equipment)		519,511.19
26	Flora to Janet - Submarine Cables	315,395.00	275,809.87
27	Elmer - Photo Tower (75')	Inc. Item #28	
28	All Sites - Scientific Structures	3,992,525.00	3,662,996.17
35	All Sites - Construction Change Orders	20,765.00	31,576.89

SCOPE OF WORK COMPLETED UNDER CONTRACT AT-(29-2)-20
(as reflected in final Cost Statement - 31 December 1952)

CONTR. SECT.	DESCRIPTION	ESTIMATED COST	INCURRED COST
A.	Job I - Construction & Engineering AEC Expendable (Continued)		
36	David - Remove & Store Buildings	(Inc. Job V. E-3)	
39	All Sites - Two Portable Distillation Units	20,000.00	
40	Equipment not included in Construction Projects	150,000.00	220,644.82
43	Temporary Camp - Rojoa	(Job 884 in Process)	9,311.84
51	Temporary Camp - Tare	(Job 884 in Process)	428,961.68
52	Airstrip - Tare	(Job 884 in Process)	65,470.28
53	Pier - Tare	(Job 884 in Process)	56,019.40
54	Causeway - Tare	(Job 884 in Process)	
55	Surveys - Hydrography & Topography		21,809.10
56	Surveys - Triangulation		3,124.01
	Total AEC Expendable	7,213,100.00	7,058,831.40
	Total Job I - Construction and Engineering	10,529,094.00	10,451,305.61
B.	Job II - Camp Operation & Management		
B - 1	Support of Personnel other than Holmes & Narver	2,921,900.00	2,068,409.33
C.	Job III - Maintenance Services	4,276,000.00	3,085,971.00

SCOPE OF WORK COMPLETED UNDER CONTRACT AT-(29-2)-20
(as reflected in final Cost Statement - 31 December 1952)

CONTR. SECT.	DESCRIPTION	ESTIMATED COST	INCURRED COST
D.	Job IV - Support Services		
D - 1	Lay Coaxial Cable	32,790.00	77,540.74
2	Install CMR Equipment	226,900.00	339,541.70
3	Labor Pool and Instrumentation	1,250,000.00	473,218.37
	Total Job IV - Support Services	1,509,690.00	890,300.81
E.	Job V - Roll-Up Services		
E - 1	Clean up and Store Construction Equipment	319,000.00	643.55
2	Clean up and Store Marine Equipment	56,000.00	14,683.54
3	Warehouse Construction Materials	332,000.00	132,954.49
4	Clean up Generators - Stills - Pumps	60,000.00	10,313.27
5	General Clean up	126,000.00	
6	Protective Maintenance - Buildings and Structures	152,000.00	41,829.99
7	Clean up and Store Camp Equipment	150,000.00	23,409.62
	Total Job V - Roll-Up Services	1,195,000.00	223,834.46
	Total Distribution Costs - Jobs I, II, III, IV & V	20,431,684.00	16,719,821.21

COMPLETION REPORT
OPERATION IVY

VOLUME I
BOOK 2
ENGINEERING, DESIGN, INSPECTION AND CONSTRUCTION

BOOK 2
TABLE OF CONTENTS

BOOK 2
LIST OF ILLUSTRATIONS

BOOK 2
LIST OF ILLUSTRATIONS
(Continued)

BOOK 2
LIST OF ILLUSTRATIONS
(Continued)

BOOK 2
LIST OF ILLUSTRATIONS
(Continued)

INDEX
OF
TEST AND BASE FACILITY STRUCTURES

GENE

INDEX
OF
TEST AND BASE FACILITY STRUCTURES
(Continued)

INDEX
OF
TEST AND BASE FACILITY STRUCTURES
(Continued)

YVONNE

ELMER

INDEX
OF
TEST AND BASE FACILITY STRUCTURES
(Continued)

ELMER - CMR

INDEX
OF
TEST AND BASE FACILITY STRUCTURES
(Continued)

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VARIOUS SITES

VOL. I
BOOK 2

CHAPTER I
ENGINEERING - CONSTRUCTION HISTORY

SECTION 1. ENGINEERING

The engineering for OPERATION IVY began on 15 October 1951 when Holmes & Narver, Inc. was instructed to conduct hydrographic surveys of the northern group of islands of Eniwetok Atoll and make recommendations for the construction of a pier and causeway in order to utilize these islands for test operations. This was followed by the requirement that Holmes & Narver prepare designs for the expansion of the existing cryogenics facilities andfor the Scientific Program structures and utilities.

On 22 and 23 October 1951 a conference between representatives of AEC and Holmes & Narver was held for the purpose of discussing the proposed expansion of the cryogenics facility. This expansion was first contemplated as an extension of Building 330 and the construction of a new building designated No. 338. Many revisions in this original concept were made until 28 January 1952, at which time design work was generally determined to include: Alterations to existing Building 329; Alterations to existing Building 330; and construction of Structures 339, 340, 341, 342, 344, 345 and 347. These in turn were subsequently revised in many details.

The causeway design was predicated on the requirements for Stations 203 and 204. Station 204 underwent many design changes extending over a period from October 1951 to July 1952 including proposals for containing the coax cables, access to the coax cable containers, the amount of fill over the cables, and finally the use of a 9,000-foot box tunnel. However, due to the necessity of having a causeway to provide connection access to the islands, this construction was started on 30 January 1952 based on a minimum design that could be expanded when the station requirements became firm.

Details of the test operation itself were revised from time to time, which in turn resulted in revisions in design criteria. This is an inevitable situation during the early stages of an operation of this type. In the case of construction of major structures for which design criteria were required six months in advance of the scheduled time of their use, the engineering and construction had to be well integrated in order that the many changes would not delay the completion beyond the date the structures were required for the test program. The numerous changes in design criteria prior to final approval of drawings increased the engineering cost for this project above those of normal engineering projects. The costs, however, were kept at a minimum by deferring design of those structures considered most likely to be changed.

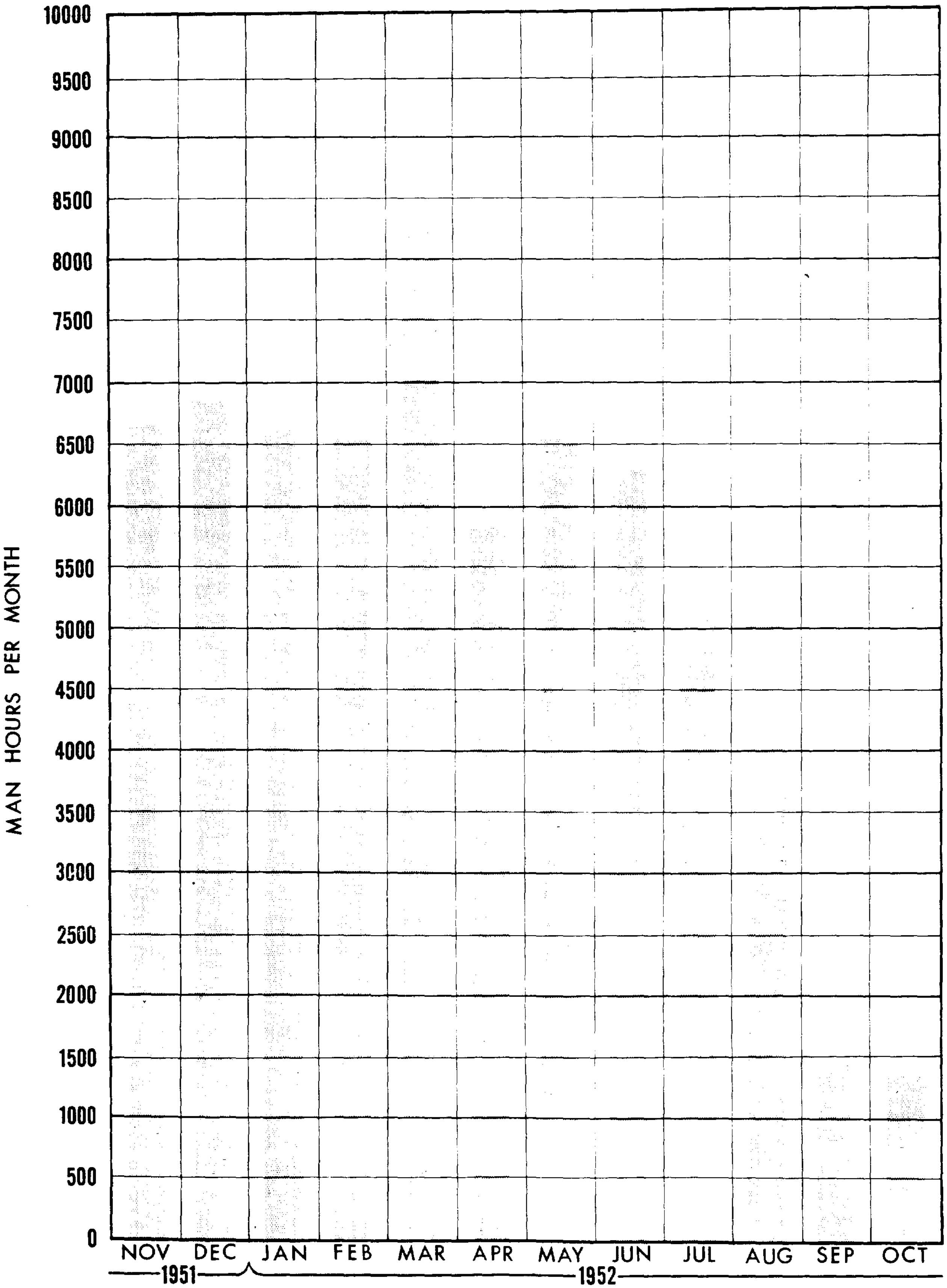


Figure 2-1. Engineering and Drafting Man Hour Chart - Home Office

From October 1951 through June 1952, the Engineering Division of the Home Office was utilizing 6,500 man hours per month, with the exception of March, during which 8,250 man hours were required to complete certain features of the cryogenics facilities. This is indicated in the Engineering Man Hour Chart, Figure 2-1. As the cryogenics design approached completion, the Scientific Program began to firm up, so that a fairly consistent level of employment of engineers was maintained. By September 1952, the heavy structure design, including mechanical and electrical, was practically completed, and during September and October only minor structural and civil design work was required. During October the basic design was shifted to the Proving Ground at Eniwetok Atoll in order that last-minute field revisions could be rapidly effected.

SECTION 2. CONSTRUCTION HISTORY

The three major items of construction which may be considered as having been critical in regard to expenditure for labor, receipt of materials, and completion dates were:

1. The CMR Facilities including a new Power Plant
2. The Gene Campsite including Power House, Airstrip, and Causeways
3. Scientific Structures adjacent to Gene

Other items of construction were scheduled in relation to the requirements of the foregoing three items so that a fairly constant level of employment was maintained with the resultant avoidance of excessive peak loads.

Erection of the additional facilities in the CMR Area was started early, as they were required by the Using Agency to be placed in use with power supplied from the new power plant on 1 July 1952. The construction of the buildings by Holmes & Narver and the installation by the scientific personnel of the process piping, control boards and associated equipment progressed as parallel operations, primarily due to the late date of the final determination of the actual facilities required in this area. The Scientific Station Program was started with the construction in the CMR Area still in progress, even though signed drawings had not been received on many stations and the scope of this work had not been definitely settled. The Project Engineer obtained approval where necessary to start construction in accordance with preliminary drawings. This was required in order to meet the scheduled completion date of the entire project.

Reduction of the time allotted for construction had its effect on the proper supply of materials and equipment. Electrical and mechanical materials, which were in short supply, were slow in arriving. The labor force to perform work which was delineated in only the broadest terms had to be estimated and requisitioned three months in advance of actual need. The three-month period was required for recruitment, obtaining Security Clearances and transportation to the project site. During the normal three-month period between requisitioning and arrival of the personnel, material revisions occurred in the amount of work to be accomplished.

The progress of construction is shown graphically in the Construction Progress Charts, Figures 2-2 thru 2-6. The salient features of the progress of the construction in the CMR Area, Gene Campsite and Scientific Stations adjacent to Gene present a general over-all view of the construction program and are detailed chronologically in the following paragraph.

In November 1951, surveys and advance preparations for construction were underway. In December the floor plan and plans for all underground installations of the CMR Power House were completed, the site was prepared and graded, and preparations to pour the foundations were made. At this time the Home Office was preparing causeway schematics; the Gene Campsite plans were 50% completed, and schematics for Stations 1 and 200 were started. In January the footings and floor slab for the CMR Power House were poured and the framework practically completed. Three generators were placed on their foundations. On Gene, the campsite plans having been approved, the layout of the airstrip was completed and in general the entire area was cleared. The plans for the tower structure of Station 1 were completed and steel was ordered, though additional criteria were required for final completion. In February the known scope of work was defined and, accordingly, a revised construction schedule was prepared. The scope of work so defined covered approximately 85% of the Scientific Stations. During this month, the General Site Plan for the CMR Area, and plans for the Gene Campsite and Causeways were completed. In March construction of Building 344 (CMR Area) was started with the excavation of the liquifier pit. As this pit extended below the water table, constant pumping was required. The work was slowed by a requirement that the hard coral excavation was to be accomplished without blasting. The roof and walls of the CMR Power House were completed. On Gene the camp was 65% completed, the causeway from Gene to Helen was opened to traffic, and the causeway from Gene to Flora was started. Plans for Station 1 were completed, but plans for Station 200 were being revised due to receipt of new Criteria. During April the CMR Power House structure was 95% completed, though the electrical work therein was only 60% completed, progress being temporarily delayed pending arrival of equipment. The slab for Building 344 was poured and this building was 20% completed. At Gene, the first camp increment was completed, and the Gene to Flora causeway was 52% completed. During periods of high tides, combined with high winds, there was always a noticeable slumping of the side slopes of the causeway. As the sea at high tide broke over the bulkhead at the original designed elevation of plus 7.0 above mean low low water, the finished grade elevation was raised to plus 9.0 on the lagoon side and to plus 10.5 at the bulkhead on the ocean side.

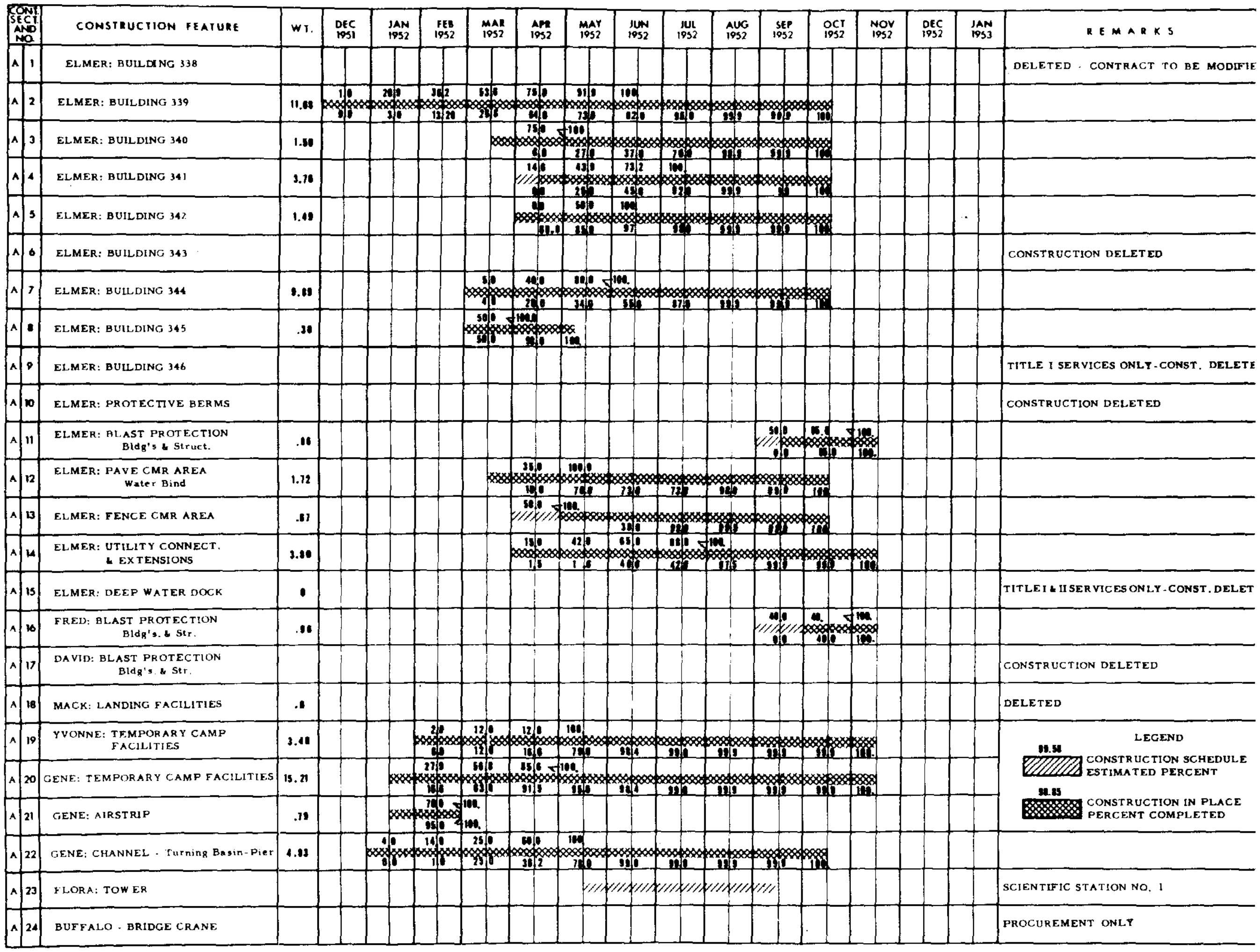


Figure 2-2. Construction Progress Bar Chart

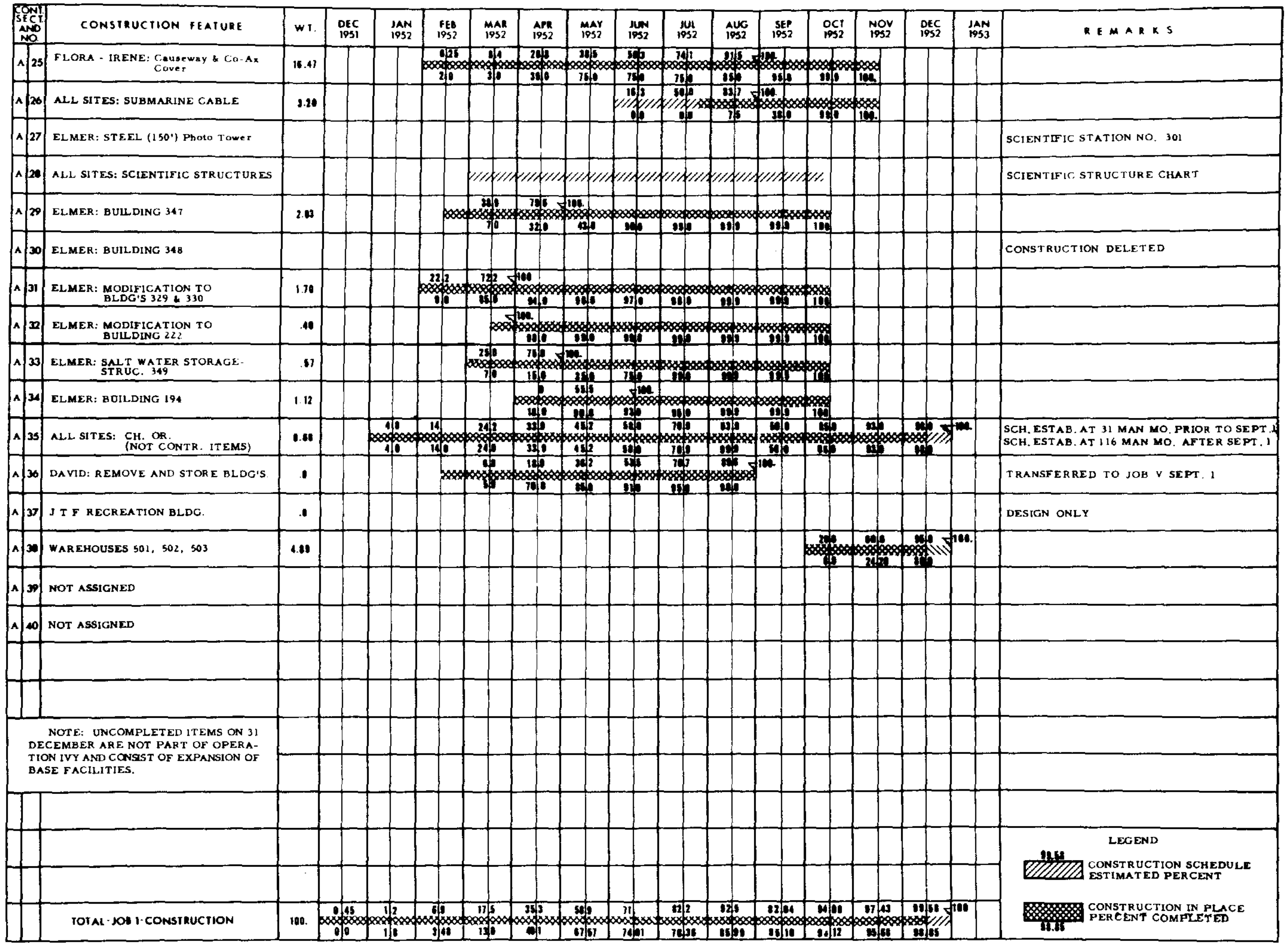


Figure 2-3. Construction Progress Bar Chart

In May the CMR Power House structure was practically complete and the installation of equipment therein was 75% completed. The other facilities of the CMR Area were 75% completed. On Gene, the power plant was completed and the entire causeway was 75% completed. Plans for Stations 1 and 200 had been approved with minor changes and redesign of the tower. In the CMR Area in June, the facilities were 90% completed and Generators 1 and 3 were cut in on the line to provide power for this area on 30 June, thus meeting the scheduled date of 1 July for the supply of power from this facility. During July final completion of the CMR Area facilities was delayed due to slow delivery of electrical material. The placing of Generator 2 in operation was held up five weeks due to the fact that the vendor had not supplied a proper salt water pump for this engine. On Gene the airstrip was completed, and excavation for laying coaxial cable was started. Station 1 was 50% complete, with some equipment installed. The floor slab of Station 200 had been poured and the walls were in the process of construction. In August the CMR Area facilities were ready for operation, and on Gene the coaxial cable was being laid; Station 1 was 83% completed and Station 200 was 55% completed. In September the work throughout the Jobsite progressed steadily until final completion in October.

CONSTRUCTION PROGRESS BAR CHARTS

The Construction Progress Bar Charts, Figures 2-2 and 2-3, were developed commencing with the month of January 1952 to depict the scheduling and construction in place of all items of construction under Job No. 1 of Contract AT-(29-2)-20 based on man power estimates and analysis of progress for each item of construction. The schedule of construction was developed through an analysis of the estimated direct labor required to construct each item to provide as nearly as possible a constant work load for the estimated working force. In January 1952 there were twenty-seven items of construction itemized on the bar charts. In February 1952 additional items of construction were authorized by the AEC and the estimated construction schedule and the Construction Progress Bar Charts were revised to include a total of thirty-five items under Job No. 1 of the Contract, exclusive of Scientific Stations. Construction features remained unchanged thereafter until August 1952, at which time additional construction items were added and a revision of the estimated schedule of construction was necessary due to an increase in the scope of work which was authorized at this time.

CONSTRUCTION PROGRESS - CONTRACT ITEMS (LESS A-28). The Construction Progress Chart, Figure 2-4, was compiled in the form of an "S" curve directly from the total estimated schedule of construction and the total construction in place as depicted on the Construction Progress Bar Chart. In August, additions to the scope of work relative to the Contract Items occurred and were added to the Construction Progress Bar Chart. As a result, the total percentages of estimated and completed construction in place were revaluated on the basis of the increase in construction work and resulted in the revised curves noted in this chart after September 1952.

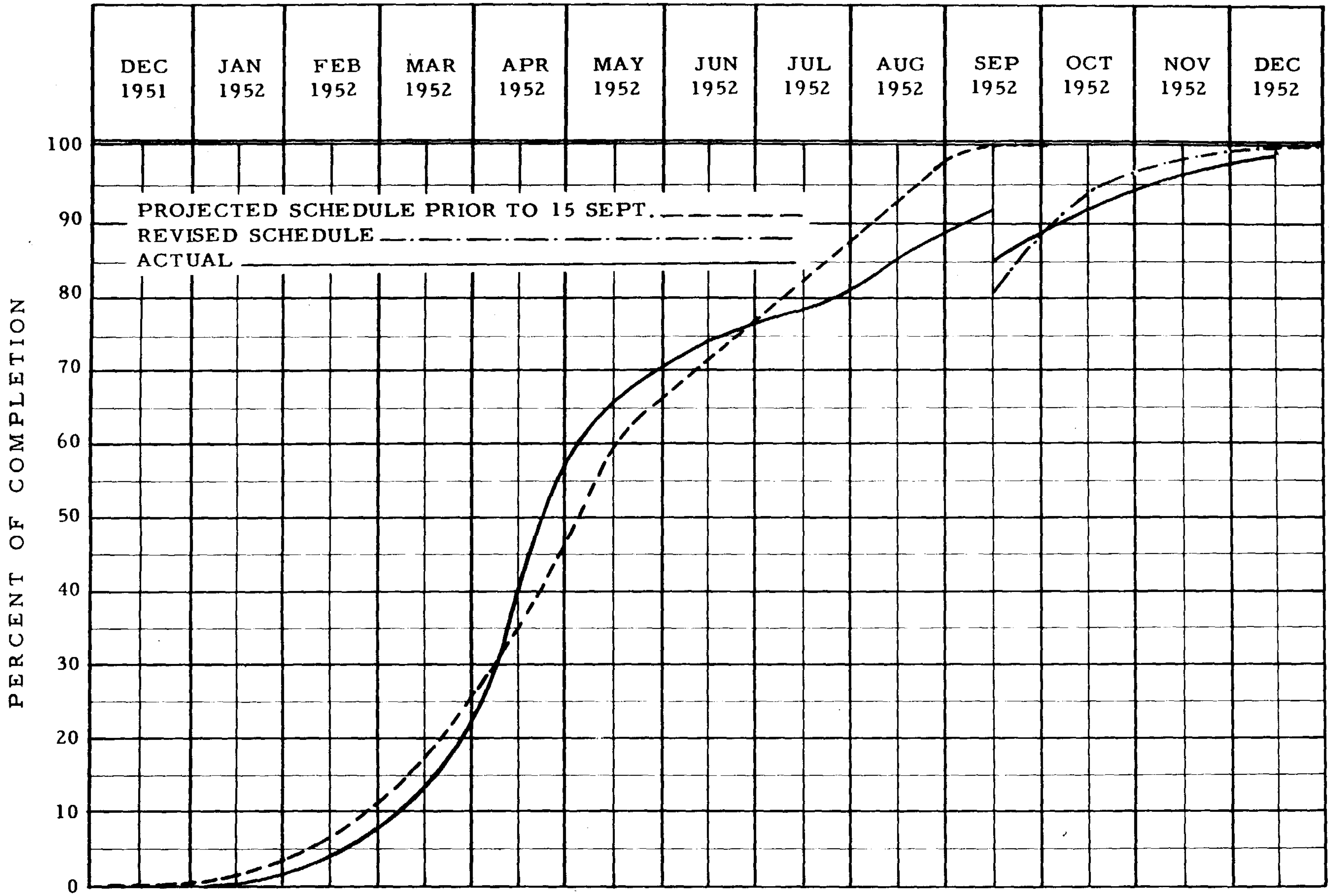


Figure 2-4. Construction Progress - Contract Items (Less A-28)

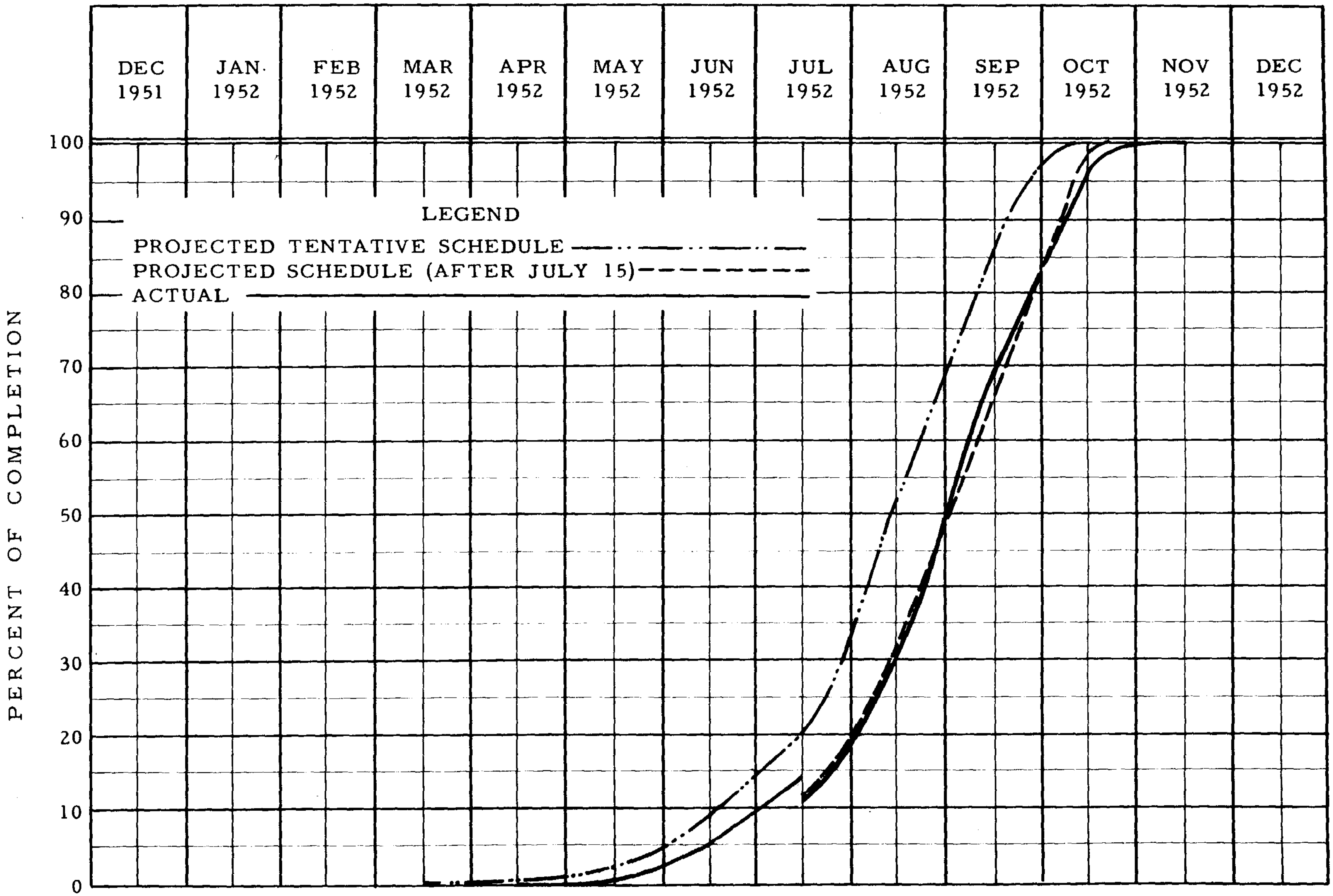


Figure 2-5. Construction Progress - Scientific Stations (A-28)

CONSTRUCTION PROGRESS - SCIENTIFIC STATIONS (A-28). Prior to July 1952, neither the total number nor the design cirteria for Scientific Stations were sufficiently known to be evaluated on a specific bar chart similar to the bar chart depicting construction progress for other Contract Items. However, by July 1952 details on approximately ninety-five percent of the total Scientific Station requirements were sufficiently firm to permit preparation of a curve depicting both estimated schedule and construction in place. This is shown in Figure 2-5. Prior to July 1952 completion of the Scientific Station Program was scheduled for 10 October 1952. The estimated construction curve for this scheduled date, as shown in this chart, was based on all information available at that time. With the establishment of firm design criteria and an increase in the scope of work, a new estimated schedule of construction was included on this chart based on completion of the Scientific Station Program on 20 October 1952. Extension of the completion date was made later in the program in accordance with the requirements of the OPERATION IVY tests, and construction was completed approximately 15 November 1952.

CONSTRUCTION PROGRESS - OVER-ALL CHART. With the establishment of the major portion of the Scientific Station Program in July 1952, it was possible to develop a curve showing over-all estimated and construction progress for all items of construction, Figure 2-6. This estimated construction curve and the actual construction curve as shown on this chart were developed from the weighted values of similar curves shown on the Construction Progress Chart for Contract Items (Figure 2-4) and the Construction Progress Chart for Scientific Stations (Figure 2-5). On this chart, the estimated construction curve remained intact until August 1952 at which time it was revised as a result of a similar revision in the Construction Progress Chart for Contract Items. After that date, estimates remained unchanged until the end of the program, although the actual completion date was extended as a result of the addition of items for permanent base facilities and of certain Scientific Stations.

EXPENDITURES AND COMMITMENTS CHART. The estimated commitments shown in Figure 2-7 were developed from separate estimates of requirements as to labor and materials in accordance with the construction schedule as indicated on the Construction Progress Bar Charts. However, the Chart was adjusted to provide for material procurement which would necessitate commitments for materials by a lead time of ninety days ahead of construction schedules. The actual commitments and actual expenditures reflected on this chart throughout OPERATION IVY were obtained from Purchase Orders issued and from actual expenditure reports assembled by the Controller.

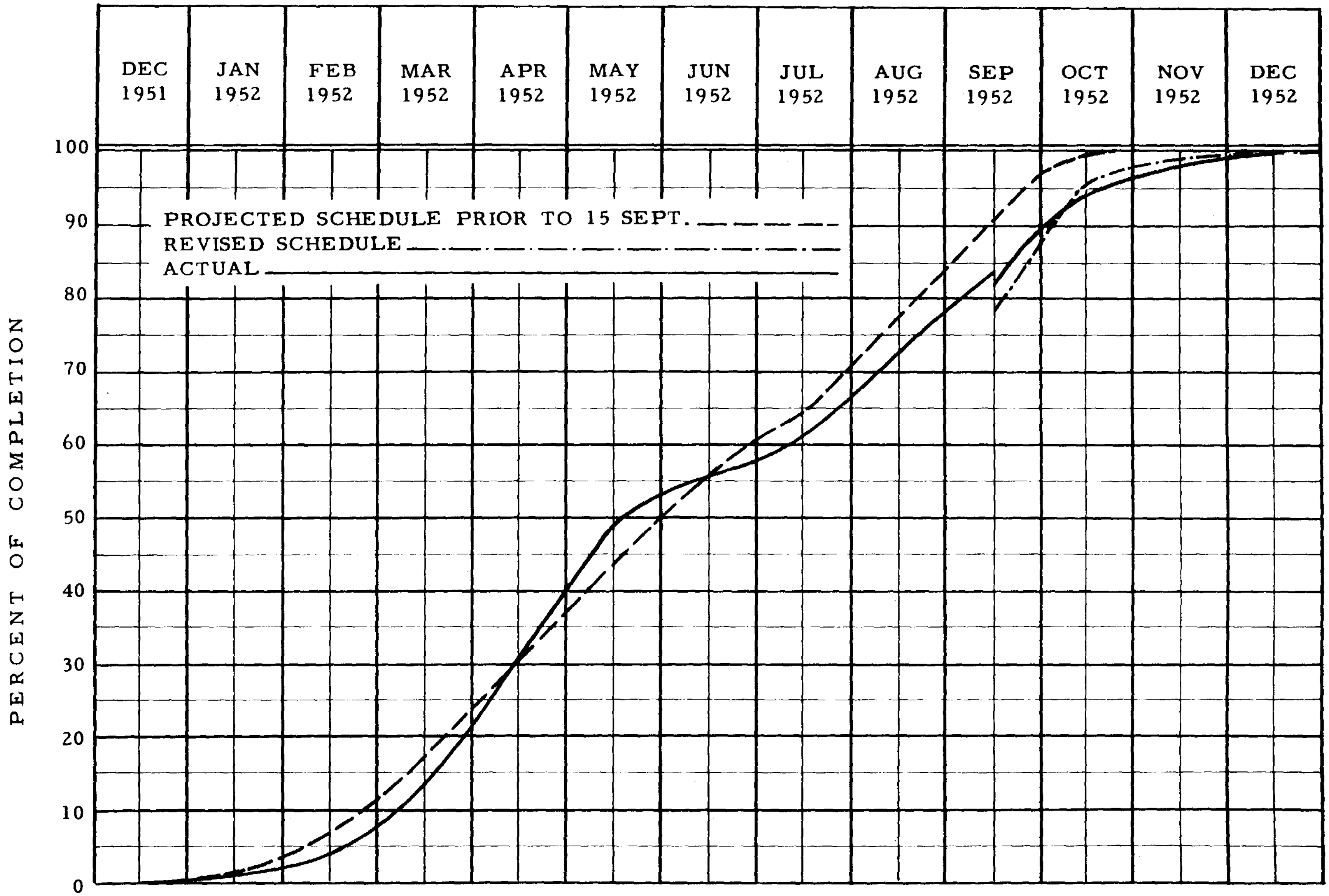


Figure 2-6. Construction Progress - Over-all Program

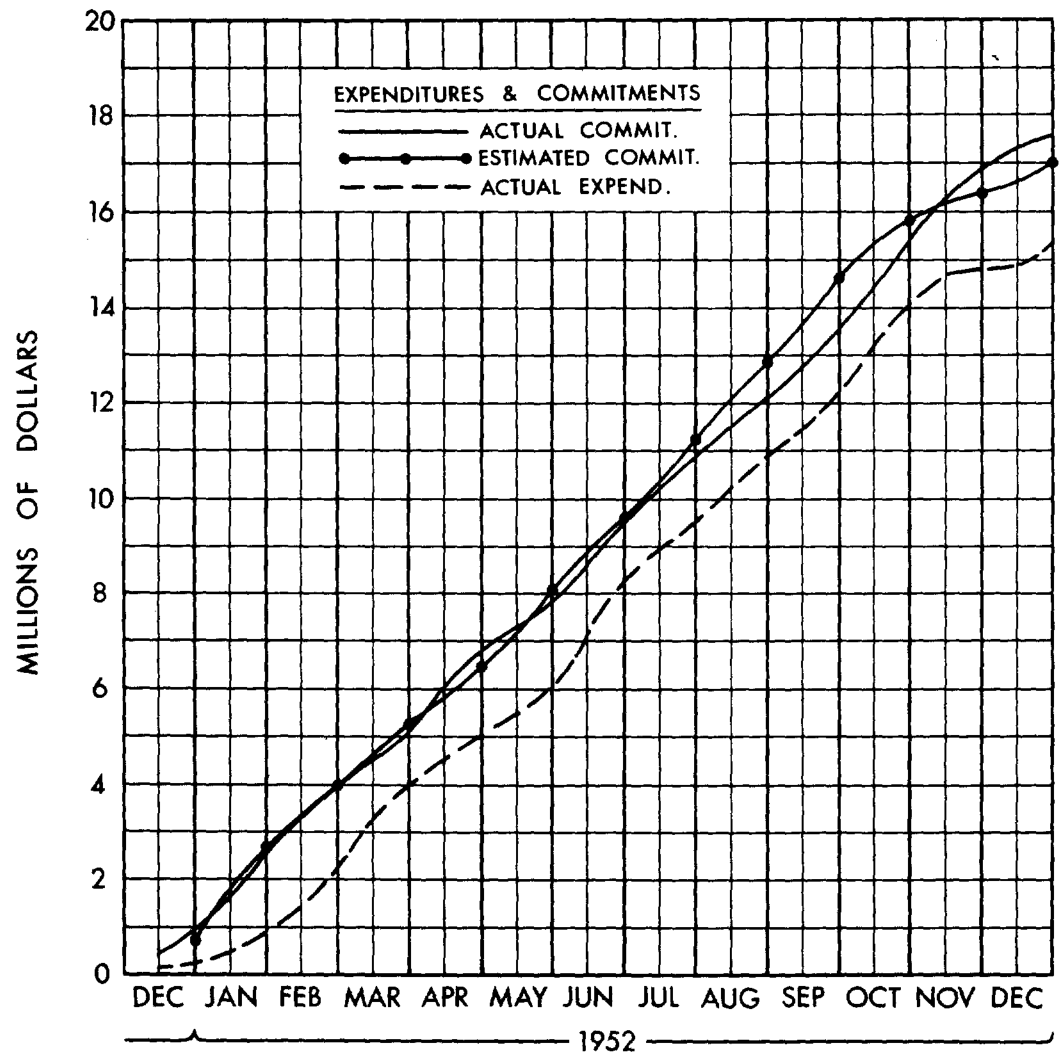


Figure 2-7. Expenditures and Commitments

CHAPTER II
SURVEYS - ATOLL CONTROL

The requirements of OPERATION IVY necessitated expansion and adjustments to existing surveys. Some stations of the earlier surveys had been destroyed, new stations added and more precise values were needed. The horizontal control scheme was expanded to include the entire Atoll. It consisted of a primary network of second order triangulation supplemented with third order stations at locations of lesser importance. The few remaining islands which were not included in the scheme can be located by single triangles from existing controls.

PREVIOUS SURVEYS. Some features of previous surveys were utilized in establishing the scheme. The earliest survey of which records are available was completed in 1944 by the USS BOWDITCH to control the hydrographic mapping of the Atoll. As this survey was of third order accuracy and most of the stations were not on project islands it was not adaptable to the requirements of this project. However, the geographic position of Station North Base on Runit Island and the azimuth of the line North Base-Sand became the origin of position and azimuth for the later surveys.

A survey was completed in 1947-48 by Joint Task Force Seven which consisted of a limited scheme covering the eastern portion of the Atoll. The scheme was stated to be of first order accuracy but it was only because of its limited extent that it could be considered of such high order. As the south end of the original base line had been destroyed a new base line, North Base-Runit, was established and the azimuth of the line was computed from its relation to the line North Base-Sand. Expansion of this scheme involved reoccupation of all its existing stations and it became obvious that to meet project requirements, a substantially new and stronger scheme was necessary which could be expanded as required.

1949-50 HORIZONTAL CONTROL SURVEY. This survey was designed to meet the requirements of OPERATION GREENHOUSE and to be adaptable to future expansion. It consisted of sixteen stations covering the eastern portion of the Atoll from Alice to Fred and included five stations of the previous surveys. As it was determined that Station North Base had been disturbed it was necessary to measure a new base line North Base #2-Runit to second order accuracy. The network expanding from this base line was executed to second order accuracy in accordance with specifications and procedures of the U. S. Coast and Geodetic Survey. The geographical position of Station Runit and the azimuth of the line Runit-Coral, as determined by the previous survey, were adopted as the origin of position and azimuth.

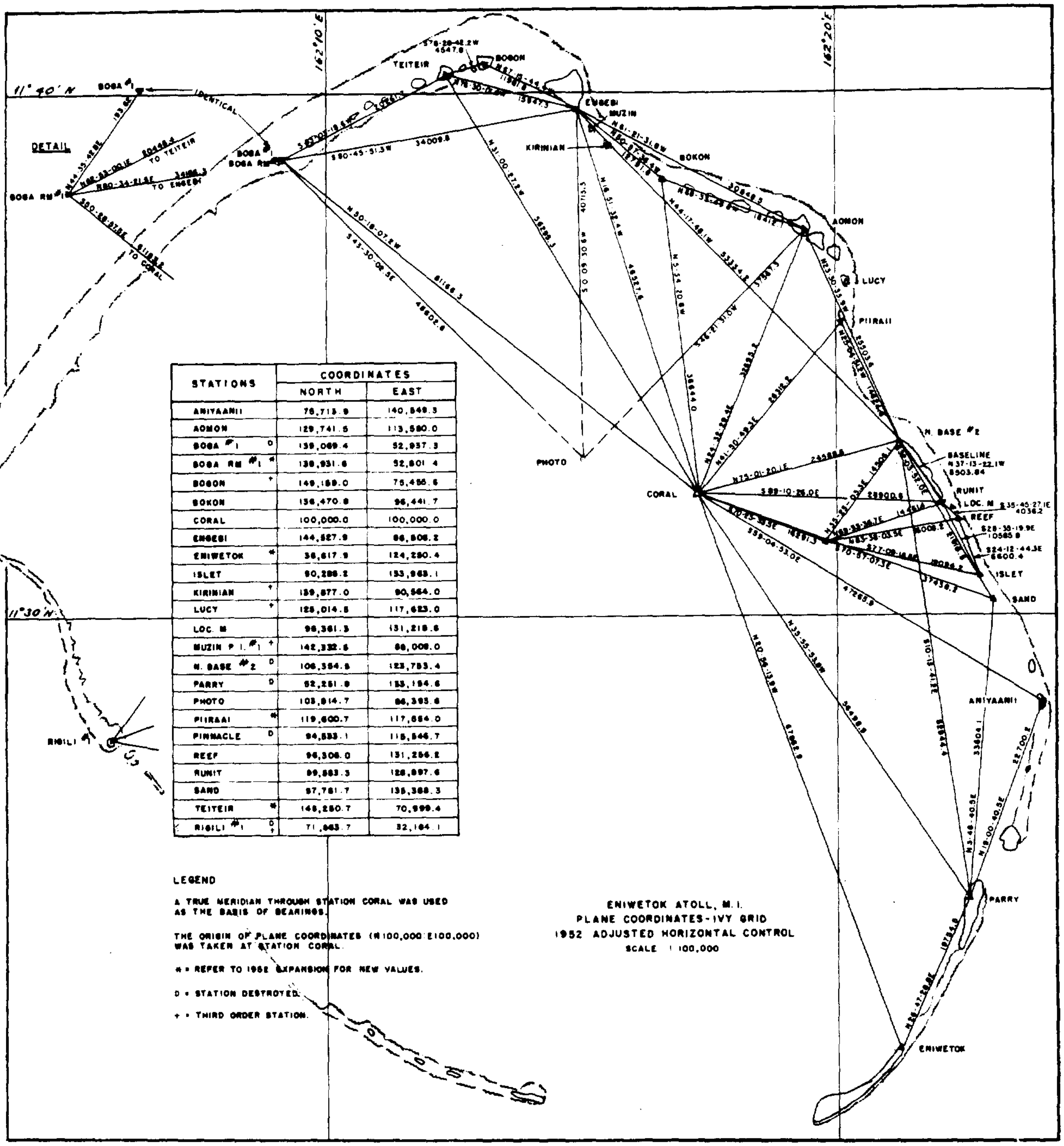
1951 EXPANSION. An expansion of the previous survey was necessary to meet additional requirements which could not be anticipated earlier. Several additional islands were located by local triangulation and photo tower and zero locations were determined. Local control traverses were established on all project islands. The accuracy of these controls depended on their uses and were generally of third order. The zero lines and some traverses for location of instrumentation were established to first order traverse specifications.

An independent plane coordinate grid was established at each of the zero areas for location of instrumentation. While satisfactory results were obtained, it brought out the desirability for an over-all Atoll grid.

1952 EXPANSION AND ADJUSTMENT. Requirements for OPERATION IVY necessitated an expansion of the scheme to include the entire Atoll. Some stations of the earlier surveys had been destroyed and additional stations were required. Fifteen stations were established, replaced, or more precise values determined. As the expansion permitted closing the survey around the Atoll to the Runit base line, a check on the previous work was obtained. The closing error of the survey before adjustment was determined as approximately 1:25000. An additional check was obtained by inclusion of the zero line traverse in the Flora-Gene area. This indicated a closing error of approximately 1:70000 before adjustment of the adjacent quadrangle. In order that the values of a station would remain the same independently of the direction of computation through the net, an adjustment was applied to the triangulation figures. This consists of a side equation adjustment which resulted in slight changes in the values previously reported but of little consequence in computations made to date.

PLANE COORDINATE SYSTEM (IVY GRID). A plane coordinate system was established which is common to all stations. The origin of coordinates is a plane through triangulation Station Coral with assumed values of North 100,000, East 100,000, at this station. A true meridian through this station was used as the basis of bearings and was determined by computing through the base expansion figure from the adopted azimuth of the Runit base line. The horizontal control network as it now exists should meet all future requirements with a minimum of field work. Sufficient controls are available to replace destroyed stations and establish required new stations. A new station can be located by forming a strong triangle with any two of the adjusted primary stations.

PRECISE ALIGNMENT. An unusual feature of the survey program was the alignment requirement of the 203 series stations. This included measurement of a zero line to a linear tolerance of not to exceed 1:25000 and establishment of a 9000-foot line of sight to a tolerance of plus or minus one quarter inch. Vertical control for this alignment was accomplished by establishing a series of bench marks by precise differential leveling and by applying a correction for curvature of the earth. Horizontal control stations were established by

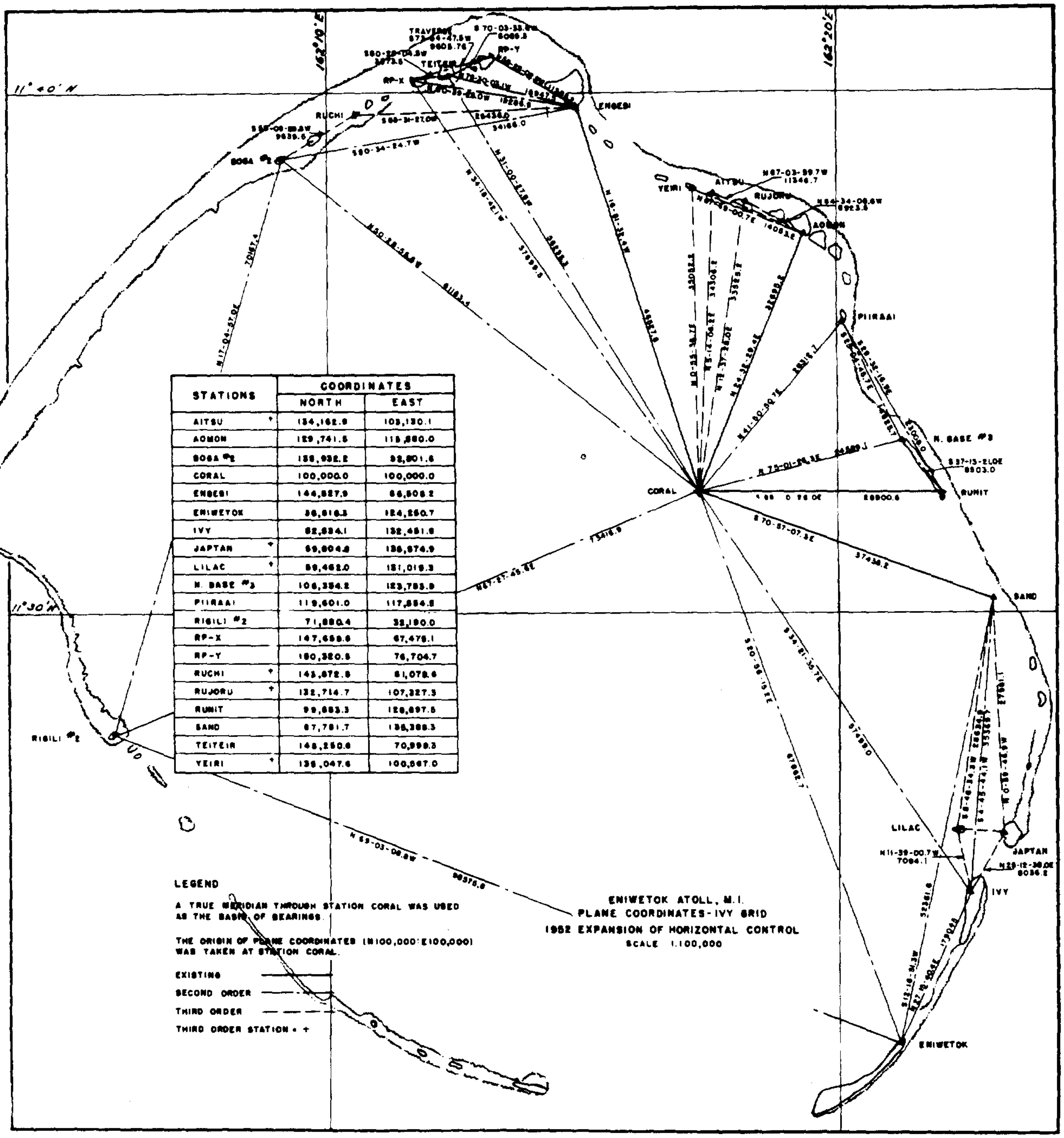


STATIONS		COORDINATES	
		NORTH	EAST
ANIYAANII		76,713.9	140,849.3
AOMON		129,741.5	113,580.0
BOGA #1	D	139,069.4	52,937.3
BOGA RM #1	*	138,931.6	52,801.4
BOGON	+	149,169.0	75,455.5
BOKON		136,470.8	96,441.7
CORAL		100,000.0	100,000.0
ENGEBI		144,527.9	86,506.2
ENIWETOK	*	36,617.9	124,280.4
ISLET		90,286.2	133,965.1
KIRINIAN	+	139,877.0	90,564.0
LUCY	+	125,014.5	117,623.0
LOC. M		96,361.3	131,218.6
MUZIN P I. #1	+	142,332.6	88,008.0
N. BASE #2	D	106,384.8	123,783.4
PARRY	D	52,251.8	133,194.6
PHOTO		103,814.7	86,395.6
PIIRAAI	*	119,600.7	117,684.0
PINNACLE	D	94,533.1	115,546.7
REEF		96,306.0	131,256.2
RUNIT		99,583.3	128,897.6
SAND		87,781.7	135,368.3
TEITEIR	*	148,280.7	70,999.4
RIGILI #1	D +	71,863.7	32,184.1

Figure 2-8. 1952 Survey-Adjusted Horizontal Control

night operations with precise equipment, and procedures were developed to produce the required accuracy. The alignment of the stations was accomplished by offset measurements from these controls to a pre-established working point on each station.

VERTICAL CONTROL. There has been no requirement for an over-all vertical control network; such a network would involve extensive observations over a considerable period of time. Bench marks for vertical control have been established independently at each of the project areas from tidal observations, and



STATIONS		COORDINATES	
		NORTH	EAST
AITSU	+	134,162.9	103,130.1
AOMON		129,741.5	115,880.0
BOGA #2		138,932.2	92,801.6
CORAL		100,000.0	100,000.0
ENGEBI		144,827.9	86,808.2
ENIWETOK		36,816.3	124,250.7
IVY		62,834.1	132,481.8
JAPTAN	+	69,804.8	136,874.9
LILAC	+	69,462.0	131,019.3
N. BASE #3		106,354.2	123,783.9
PIIRAAI		119,601.0	117,854.5
RIGILI #2		71,880.4	32,190.0
RP-X		147,658.6	67,478.1
RP-Y		150,320.5	76,704.7
RUCHI	+	143,872.8	81,078.6
RUJORU	+	132,714.7	107,327.3
RUNIT		99,883.3	128,897.5
SAND		87,781.7	138,388.3
TEITEIR		148,250.6	70,998.3
YEIRI	+	136,047.6	100,887.0

Figure 2.9. 1952 Survey-Expansion of Horizontal Control

the accuracy is considered consistent with project requirements. A check was obtained of the datum established by this method at Eniwetok Island when a tide gage was operated at this location for several months during OPERATION GREENHOUSE by the U. S. Coast and Geodetic Survey. A differential of 0.14 foot was determined which would be of no consequence in the tidal relation to project structures.

Figures 2-8 and 2-9, the survey maps for Atoll Control, resulted from the above work. Figures 2-10 thru 2-20 give the data obtained and developed for Traverse Computations and Geographic Positions.

GEOGRAPHIC POSITIONS SECOND ORDER TRIANGULATION 1952 ADJUSTED HORIZONTAL CONTROL

STATION	LATITUDE LONGITUDE	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE		
					Logarithm Meters	METERS	FEET
CORAL	N 11-32 20.254	129-41-52.7	309-40 17.5	BOGA #1	4.2705281	18643.53	61166.3
	E 162 17-10.944	129-31-02.4	309-29 26.9	BOGA RM #1	4.2706480	18648.68	61183.2
		148-59-32.7	328-58-34.0	TEITEIR	4.2344880	17158.84	56295.3
		163-08-27.6	343-08-00.2	ENGEBI	4.1517267	14181.64	46527.6
		174-25-39.2	354-25-31.9	BOKON	4.0480186	11169.11	36644.0
		204-32-29.4	24-32-56.8	AOMON	3.9985000	9965.52	32695.2
		221-50-49.3	41-51-24.7	PIIRAAI	3.9041728	8019.97	26312.2
		255-01-30.1	75-02-07.9	N. BASE #2	3.8747531	7494.68	24588.8
		270 49-34.0	90-50-32.2	RUNIT	3.9449227	8808.92	28900.6
		289-02-52.7	109-04-03.8	SAND	4.0573309	11411.19	37438.2
		289-36-26.5	109-36-57.4	PINNACLE	3.6959717	4965.60	16291.3
		300-55-07.1	120-56-28.4	ANIYAANII	4.1585639	14406.68	47265.9
		324-04-06.3	144-05-12.6	PARRY	4.2360559	17220.90	56498.9
		339-03-46.3	159-04-34.6	ENIWETOK	4.3156450	20684.65	67862.9
BOGA RM #1(*)	N 11-38-46.350	260-32 45.8	80 33-54.3	ENGEBI	4.0176138	10413.91	34166.3
	E 162-09-15.995						
BOGA #1 (D)	N 11-38-47.717	260 44 15.9	80-45-24.1	ENGEBI	4.0156200	10366.21	34009.8
	E 162-09-17.362	316-28-22.2	136-29-29.9	PHOTO	4.1706752	14814.10	48602.6
TEITEIR (*)	N 11-40-18.862	258-27-43.4	78-27-52.5	BOGON	3.1418165	1386.17	4547.8
	E 162-12-19.091	283-29-00.2	103-29-31.7	ENGEBI	3.6867033	4860.75	15947.3
BOGON (+)	N 11-40-27.884	292-43-25.9	112-43-48.3	ENGEBI	3.5625318	3652.06	11981.8
	E 162-13-03.934						
ENGEBI	N 11 39-41.964	298-38-00.7	118-38-55.7	AOMON	3.9732496	9402.64	30848.5
	N 162-14-55.151	309-01-56.1	129-02-16.3	BOKON	3.5909476	3898.95	12791.8

(+) - Third Order station. (*) - Refer to 1952 Expansion for new values. (D) - Station destroyed.

Figure 2-10

GEOGRAPHIC POSITIONS SECOND ORDER TRIANGULATION 1952 ADJUSTED HORIZONTAL CONTROL

STATION	LATITUDE LONGITUDE	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE		
					Logarithm Meters	METERS	FEET
BOKON	N 11-38-22.046	291-26-06.9	111-26-41.7	AOMON	3.7491192	5612.02	18412.1
	E 162-16-35.139						
AOMON	N 11-37-15.283	336-29-53.5	156-30-14.0	N. BASE #2	3.8906172	7773.51	25503.6
	E 162-19-27.584	46-21-58.4	226-21-03.5	PHOTO	4.0588260	11450.54	37567.3
PIIRAAI	N 11-35-34.679	334-55-44.2	154-55-56.7	N. BASE #2	3.6491059	4457.65	14624.8
	E 162-20-07.552						
N. BASE #2 (D)	N 11-33-23.267	322-47-25.7	142-47-36.1	RUNIT	3.4136308	2591.9749	3503.84
	E 162-21-09.893	327-56-55.7	147-57-19.1	SAND	3.8247869	6680.16	21916.5
RUNIT	N 11-32-16.080	324-15-31.1	144-15-35.8	REEF	3.0899898	1230.24	4036.2
	E 162-22-01.621	331-25-38.3	151-25-48.5	ISLET	3.5087397	3226.56	10585.8
PINNACLE (D)	N 11-31-26.010	249-34-07.6	69-34-34.9	RUNIT	3.6442258	4407.84	14461.4
	E 162-19-45.307						
REEF	N 11-31-43.581	335-48-18.6	155-48-24.1	ISLET	3.3035870	2011.81	6600.4
	E 162-22-25.335						
ISLET	N 11-30-43.856	102-51-49.8	282-51-12.1	PINNACLE	3.7649170	5819.92	19094.2
	E 162-22-52.543						
SAND	N 11-30-18.986	3-49-51.5	183-49-47.0	PARRY	4.0104083	10242.55	33604.1
	E 162-23-06.870						
ANIYAANII	N 11-28-19.253	19-02-01.8	199-01-47.0	PARRY	3.8400452	6919.03	22700.2
	E 162-23-58.730						

(D) - Station destroyed

Figure 2-11

GEOGRAPHIC POSITIONS SECOND ORDER TRIANGULATION 1952 ADJUSTED HORIZONTAL CONTROL

STATION	LATITUDE LONGITUDE	AZIMUTH	BACK AZIMUTH	TO STATION	LOG. METERS	DISTANCE	
						METERS	FEET
PARRY (D)	N 11-24-46.373	26-48-35.1	206-48-17.4	ENIWETOK	3.7796816	6021.18	19754.5
	E 162-22-44.295						
ENIWETOK (*)	N 11-21-51.466	159-04-34.6	339-03-46.3	CORAL	4.3156450	20684.65	67862.9
	E 162-21-14.726						
MUZIN	N 11-39-20.189	145-35-54.3	325-35-51.3	ENGEBI	2.9089619	810.89	2660.4
	E 162-15-10.277	138-25-32.6	318-25-23.5	E-ZERO	3.3139747	2060.51	6760.2
KIRINIAN (+)	N 11-38-55.831	138-53-27.5	318-53-19.2	ENGEBI	3.2744627	1881.32	6172.3
	E 162-15-35.991	300-05-13.2	120-05-25.1	BOKON	3.3160962	2070.60	6793.3
LUCY (+)	N 11-36-28.384	139-28-05.6	319-28-05.6	AOMON	3.2778200	1895.92	6220.2
	E 162-20-08.256	133-17-25.0	313-17-09.8	V-ZERO	3.4956067	3130.45	10270.5
PHOTO	N 11-32-58.088	180-09-03.1	0-09-03.3	ENGEBI	4.0937522	12409.44	40713.3
	E 162-14-54.072						
RIGILI #1(D)(+)	N 11-27-40.914	216-44-34.6	36-46-24.0	ENGEBI	4.4417415	27652.94	90724.7
	E 162-05-48.977	249-19-20.6	69-22-24.3	N. BASE #2	4.4745754	29824.65	97849.7
		The following refer to "Greenhouse" stations					
E-ZERO (D)	N 11-40-10.356	313-48-51.6	133-48-57.7	ENGEBI	3.1003843	1260.04	4133.985
	E 162-14-25.132						
V-ZERO (D)	N 11-37-38.242	303-58-46.6	123-58-53.6	AOMON	3.1011110	1262.15	4140.9
	E 162 18-53.034						
C-ZERO (D)	N 11-33-21.519	107-20-32.0	287-20-30.9	N. BASE #2	2.2558030	180.22	591.27
	E 162-21-15.570						

(+) - Third Order Station (*) - Refer to 1952 Expansion for New Values (D) - Station Destroyed

Figure 2-12

GEOGRAPHIC POSITIONS SECOND ORDER TRIANGULATION 1952 EXPANSION OF HORIZONTAL CONTROL

STATION	LATITUDE LONGITUDE	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE		
					Logarithm Meters	METERS	FEET
CORAL	N 11-32-20.254	129-31-04.4	309-29-29.0	BOGA #2	4.2706495	18648.74	61183.4
	E 162 17-10.944	148-59-32.2	328-58-33.4	TEITEIR	4.2344880	17158.84	56295.3
		163-08-27.6	343-08-00.2	ENGEBI (ELGIN)	4.1517265	14181.64	46527.6
		180-55-36.7	0-55-37.8	YEIRI	4.0287311	10683.93	35052.2
		185-14-06.1	5-14-12.4	AITSU	4.0193859	10456.49	34306.0
		192-37-28.0	12-37-42.8	RUJORU	4.0093871	10218.50	33525.2
		204-32-29.4	24-32-56.8	AOMON	3.9985000	9965.52	32695.2
		221-50-50.7	41-51-26.1	PIIRAAI	3.9041814	8020.13	26312.7
		255-01-26.3	75-02-14.1	N. BASE #3	3.8747583	7494.77	24589.1
		270-49-34.0	90-50-32.2	RUNIT	3.9449227	8808.92	28900.6
		289-02-52.7	109-04-03.8	SAND	4.0573309	11411.19	37438.2
		325-38-24.3	145-39-29.2	IVY	4.2436761	17525.73	57499.0
		339-03-44.8	159-04-33.2	ENIWETOK	4.3156469	20684.59	67862.7
		67-27-45.6	247-25-29.6	RIGILI #2	4.3498120	22377.52	73416.9
BOGA #2	N 11-38-46.355	281-57-14.0	101-57-33.1	RUCHI	3.4680710	2938-13	9639.5
	E 162 09-15.997	260-32-49.1	80-33-57.5	ENGEBI	4.0176101	10413.82	34166.0
		17-03-22.1	197-02-40.6	RIGILI #2	4.3301513	21387.07	70167.4
RUCHI (+)	N 11-38-26.544	252-36-05.9	72-36-55.2	ENGEBI	3.8894648	7752.91	25436.0
	E 162-10-50.892						
RP-X	N 11-40-12.980	260-26-58.4	80-27-05.6	TEITEIR	3.0371076	1089.20	3573.5
	E 162-11-43.625	253-53-41.4	73-54-00.2	RP-Y	3.4665470	2927.84	9605.76
TEITEIR	N 11-40-18.861	250 02-34.7	70-02-46.3	RP-Y	3.2671553	1849.93	6093.3
	E 162-12-19.089	283-28-58.0	103-29-29-6	ENGEBI	3.6867087	4860.81	15947.5

(+)- Third Order station

Figure 2-13

GEOGRAPHIC POSITIONS SECOND ORDER TRIANGULATION 1952 EX[illegible]NSION OF HORIZONTAL CONTROL

STATION	LATITUDE LONGITUDE	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE		
					Logarithm Meters	METERS	FEET
RP-Y	N 11-40-39.409	300-34-09.8	120-34-29.8	ENGEBI	3.5403592	3470.22	11385.2
	E 162-13-16.502						
ENGEBI	N 11-39-41.964	343-08-00.2	163-08-27.6	CORAL	4.1517265	14181.64	46527.6
	E 162-14-55.151						
YEIRI (+)	N 11-38-07.928	292-11-00.4	112-11-26.8	AOMON	3.6317906	4283.42	14053.2
	E 162-17-16.650						
AITSU (+)	N 11 37-59.151	292-56-06.5	112-56-27.7	AOMON	3.5388853	3458.48	11346.7
	E 162-17-42.440						
RUJORU (+)	N 11-37-44.783	295-26-06.2	115-26-18.8	AOMON	3.3243483	2110.32	6923.6
	E 162-18-24.672						
AOMON	N 11-37-15.283	24-32-56.8	204-32-29.4	CORAL	3.9985000	9965.52	32695.2
	E 162-19-27.584						
PIIRAAI	N 11-35-34.682	334-55-49.6	154-56-02.1	N. BASE #3	3.6491323	4457.92	14625.7
	E 162-20-07.557						
N. BASE #3	N 11-33-23.262	322-47-26.8	142-47-37.2	RUNIT	3.4135881	2591.72	8503.0
	E 162-21-09.898						
RUNIT	N 11-32-16.080	90-50-32.2	270-49-34.0	CORAL	3.9449227	8808.92	28900.6
	E 162-22-01.621						
SAND	N 11-30-18.986	359-01-24.0	179-01-24.9	JAPTAN	3.9308808	8528.66	27981.1
	E 162-23-06.870	4-46-55.0	184-46-49.1	IVY	4.0326473	10780.71	35369.7
		8-47-45.2	188-47-36.5	LILAC	3.9409113	8727.93	28634.9

(+) - Third Order station

Figure 2-14

GEOGRAPHIC POSITIONS SECOND ORDER TRIANGULATION 1952 EXPANSION OF HORIZONTAL CONTROL

STATION	LATITUDE LONGITUDE	AZIMUTH	BACK AZIMUTH	TO STATION	DISTANCE		
					Logarithm Meters	METERS	FEET
JAPTAN (+)	N 11-25-41.449	25-13-49.8	205-13-43.0	IVY	3.3890668	2449.44	8036.2
	E 162 23-11.664						
LILAC (+)	N 11 25-38.264	348-22-01.5	168-22 04.3	IVY	3.3349139	2162.29	7094.1
	E 162 22-22.842						
IVY	N 11-24-29.334	27-16-45.2	207-16-28.9	ENIWETOK	3.7369778	5457.30	17904.5
	E 162-22 37.224						
ENIWETOK	N 11-21-51.469	110-57-39.0	290-54-35.8	RIGILI #2	4.4777861	30045.96	98575.8
	E 162-21-14.730						
RIGILI #2	N 11-27-40.883	197-02-40.6	17-03-22.1	BOGA #2	4.3301513	21387.07	70167.4
	E 162-05-49.036						

(+)= Third Order Station

Figure 2-15

PLANE COORDINATES - IVY GRID

1952 ADJUSTED HORIZONTAL CONTROL

		STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	COORDINATES NORTH	COORDINATES EAST	
	1	CORAL TO							100,000.0	100,000.0	1
	2	BOGA RM #1 *	N 50-28-57.5W	61183.2	63631200	77143181	+38931.6	-47198.6	138,931.6*	52,801.4*	2
D	3	BOGA #1	N 50-18-07.2W	61166.3	63874096	76942185	+39069.4	-47062.7	139,069.4	52,937.3	3
	4	TEITEIR *	N 31-00-27.2W	56295.3	85709938	51515110	+48250.7	-29000.6	148,250.7*	70,999.4*	4
	5	ENGEBI	N 16-51-32.4W	46527.6	95702136	29001744	+44527.9	-13493.8	144,527.9	86,506.2	5
	6	BOKON	N 5-34-20.8W	36644.0	99527421	09710425	+36470.8	-3558.3	136,470.8	96,441.7	6
	7	AOMON	N 24-32-29.4E	32695.2	90966067	41535223	+29741.5	+13580.0	129,741.5	113,580.0	7
	8	PIIRAAI *	N 41-50-49.3E	26312.2	74492867	66714412	+19600.7	+17554.0	119,600.7*	117,554.0*	8
D	9	N. BASE #2	N 75-01-20.1E	24588.8	25844392	96602626	+6354.8	+23753.4	106,354.8	123,753.4	9
	10	RUNIT	S 89-10-26.0E	28900.6	01441786	99989606	-416.7	+28897.6	99,583.3	128,897.6	10
D	11	PINNACLE	S 70-23-33.5E	16291.3	33557262	94201434	-5466.9	+15346.7	94,533.1	115,346.7	11
	12	SAND	S 70-57-07.3E	37438.2	32635970	94524565	-12218.3	+35388.3	87,781.7	135,388.3	12
	13	ANIYAANII	S 59-04-53.0E	47265.9	51381995	85789805	-24286.1	+40549.3	75,713.9	140,549.3	13
D	14	PARRY	S 35-55-53.8E	56498.9	80971801	58681918	-45748.1	+33154.6	54,251.9	133,154.6	14
	15	ENIWETOK *	S 20-56-13.9E	67862.9	93397269	35734438	-63382.1	+24250.4	36,617.9*	124,250.4*	15
	16										16
	17	BOGA RM #1 TO							138,931.6*	52,801.4*	17
	18	BOGA #1	N 44-35-42.8E	193.62	71208459	70209368	+137.8	+135.9	139,069.4	52,937.3	18
D	19	TEITEIR *	N 62-53-00.1E	20445.4	45580341	89008047	+9319.1	+18198.0	148,250.7*	70,999.4*	19
	20	ENGEBI *	N 80-34-21.5E	34166.3	16379707	98649406	+5596.3	+33704.8	144,527.9	86,506.2	20
	21										21
	22	BOGA #1 TO							139,069.4	52,937.3	22
D	23	PHOTO	S 43-30-02.5E	48602.6	72536603	68836337	-35254.7	+33456.3	103,814.7	86,393.6	23
	24	TEITEIR	N 63-03-18.6E	20261.7	45313239	89144323	+9181.3	+18062.1	148,250.7	70,999.4	24
	25	ENGEBI	N 80-45-51.3E	34009.8	16049709	98703631	+5458.5	+33568.9	144,527.9	86,506.2	25
	26										26
	27	TEITEIR to							148,250.7	70,999.4	27
	28	BOGON	N 78-28-42.2E	4547.8	19973753	97984943	+908.3	+4456.2	149,159.0	75,455.6	28
	29	ENGEBI	S 76-30-01.0E	15947.3	23344065	97237105	-3722.8	+15506.8	144,527.9	86,506.2	29

D-Station Destroyed

*Refer to 1952 Expansion for New Values

Figure 2-16

PLANE COORDINATES - IVY GRID

1952 ADJUSTED HORIZONTAL CONTROL

		STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	COORDINATES NORTH	COORDINATES EAST	
	1	ENGEBI TO	N 67-15-44.4W	11981.8	38651244	92228419	+4631.1	-11050.6	144527.9	86,506.2	1
	2	BOGON	S 61-21 31.8E	30848.5	47932256	87763881	-14786.4	+27073.8	149,159.0	75,455.6	2
	3	AOMON	S 50-57-36.4E	12791.8	62986128	77670764	-8057.1	+9935.5	129,741.5	113,580.0	3
	4	BOKON	S 44-17-48.1E	53334.2	71573302	69837380	-38173.1	+37247.2	136,470.8	96,441.7	4
D	5	N. BASE #2	S 0- 09-30.6W	40713.3	99999617	00276634	-40713.2	-112.6	106,354.8	123,753.4	5
	6	PHOTO	N 46-10-34.9W	4133.985	69244090	72147460	+2862.5	-2982.6	103,814.7	86,393.6	6
D	7	E-ZERO							147,390.4	83,523.6	7
	8										8
	9	AOMON TO	N 68-33-45.8W	18412.1	36548247	93081823	+6729.3	-17138.3	129,741.5	113,580.0	9
	10	BOKON	S 23-30-33.9E	25503.6	91699452	39889979	-23386.7	+10173.4	136,470.8	96,441.7	10
D	11	N. BASE #2	S 46-21-31.0W	37567.3	69014249	72367351	-25926.8	-27186.4	106,354.8	123,753.4	11
	12	PHOTO	N 56-01 33.8W	4140.9	55881583	82929178	+2314.0	-3434.0	103,814.7	86,393.6	12
D	13	V-ZERO							132,055.5	110,146.0	13
	14										14
D	15	N. BASE #2 TO	N 25-04-51.2W	14624.8	90571024	42389735	+13245.9	-6199.4	106,354.8	123,753.4	15
	16	PIIRAAI*	S 37-13-22.1E	8503.84	79628921	60491612	-6771.5	+5144.2	119,600.7	117,554.0	16
	17	RUNIT	S 32-03-52.0E	21916.5	84745152	53087279	-18573.1	+11634.9	99,583.3	128,897.6	17
	18	SAND	S 10-13-41.2E	52944.4	98410861	17756759	-52102.9	+9401.2	87,781.7	135,388.3	18
D	19	PARRY	S 35-25-03.3W	14506.1	81494999	57953129	-11821.7	-8406.7	54,251.9	133,154.6	19
D	20	PINNACLE	S 72-40-16.9E	591.3	29785206	95461204	-176.1	+564.5	94,533.1	115,346.7	20
D	21	C-ZERO							106,178.7	124,317.9	21
	22										22
	23	RUNIT TO	S 35-45-27.1E	4036.2	81149722	58435629	-3275.0	+2358.6	99,583.3	128,897.6	23
	24	REEF	S 28-35-19.9E	10585.8	87807370	47852116	-9295.1	+5065.5	96,308.0	131,256.2	24
	25	ISLET	S 69-33-36.7W	14461.4	34922313	93703959	-5050.2	-13550.9	90,288.2	133,963.1	25
D	26	PINNACLE							94,533.1	115,346.7	26
	27										27
	28	REEF TO	S 24-12-44.3E	6600.4	91203205	41011893	-6019.8	+2706.9	96,308.0	131,256.2	28
	29	ISLET	S 83-38-03.5W	16008.2	11087390	99383448	-1774.9	-15909.5	90,288.2	133,963.1	29
D	30	PINNACLE							94,533.1	115,346.7	30

D - Station Destroyed. * - Refer to 1952 Expansion for new values.

Figure 2-17

PLANE COORDINATES - IVY GRID

1952 ADJUSTED HORIZONTAL CONTROL

		STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	COORDINATES NORTH	COORDINATES EAST	
D	1	PINNACLE to							94,533.1	115,346.7	1
	2	ISLET	S 77-09-18.8E	19,094.2	22231053	97497591	-4244.9	+18616.4	90,288.2	133,963.1	2
	3										3
D	4	PARRY TO							54,251.9	133,154.6	4
	5	SAND	N 3-48-40.5E	33604.1	99778844	06646982	+33529.8	+2233.7	87,781.7	135,388.3	5
	6	ANIYANNII	N 19-00-40.5E	22700.2	94545463	32575380	+21462.0	+7394.7	75,713.9	140,549.3	6
	7										7
	8	ENIWETOK to							36,617.9*	124,250.4*	8
D	9	PARRY	N 26-47-28.8E	19754.5	89265401	45074260	+17634.0	+8904.2	54,251.9	133,154.6	9
	10										10
	11	MUZIN TO							142,332.6	88,009.0	11
	12	ENGEBI	N 34-23-41.3W	2660.4	82516472	56489220	+2195.3	-1502.8	144,527.9	86,506.2	12
D	13	E-ZERO	N 41-34-03.0W	6760.2	74817457	66350193	+5057.8	-4485.4	147,390.4	83,523.6	13
	14										14
	15	KIRINIAN TO							139,877.0	90,564.0	15
	16	ENGEBI	N 41-06-13.3W	6172.3	75352100	65742384	+4650.9	-4057.8	144,527.9	86,506.2	16
	17	BOKON	S 59-54-27.6E	6793.3	50139399	86521852	-3406.2	+5877.7	136,470.8	96,441.7	17
	18	CORAL	S 13-18-46.5E	40978.2	97312699	23026912	-39877.0	+9436.0	100,000.0	100,000.0	18
	19										19
	20	LUCY to							125,014.4	117,623.0	20
	21	AOMON	N 40-32-21.8W	6220.2	75995931	64997079	+4727.1	-4043.0	129,741.5	113,580.0	21
D	22	V-ZERO	N 46-43-10.6W	10270.5	68556921	72800746	+7041.1	-7477.0	132,055.5	110,146.0	22
	23										23
	24	LOC. M to							96,361.3	131,218.6	24
	25	REEF	S 35-06-13.3E	65.27	81811264	57505801	-53.3	+37.5	96,308.0	131,256.2	25
D	26	C-ZERO	N 35-06-13.3W	12000.0	81811264	57505801	+9817.4	-6900.7	106,178.7	124,317.9	26
	27										27
	28	RIGILI #1 TO							71,863.7	32,181.1	28
	29	N. BASE #2	N 69-21-37.0E	97849.7	35249052	93581538	+34491.09	+91569.25	106,354.8	123,753.4	29
	30	ENGEBI	N 36-46-51.3E	90724.7	80093084	59875687	+72664.21	+54322.04	144,527.9	86,506.2	30

D - Station Destroyed

* Refer to 1952 Expansion for New Values

Figure 2-18

PLANE COORDINATES - IVY GRID

1952 EXPANSION OF HORIZONTAL CONTROL

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	COORDINATES NORTH	COORDINATES EAST	
1	CORAL TO	N 50-28-55.6W	61183.4	63631911	77142595	+38932.2	-47198.5	100,000.0	100,000.0	1
2	BOGA #2	N 34-18-42.1W	57699.5	82598326	56369465	+47658.8	-32524.9	138,932.2	52,801.6	2
3	RP-X	N 31-00-27.8W	56295.3	85709788	51515360	+48250.6	-29000.7	147,658.8	67,475.1	3
4	TEITEIR	N 16-51-32.4W	46527.6	95702136	29001744	+44527.9	-13493.8	148,250.6	70,999.3	4
5	ENGEBI	N 0-55-36.7E	35052.2	99986916	01617608	+35047.6	+567.0	144,527.9	86,506.2	5
6	YEIRI	N 5-14-06.2E	34306.0	99582876	09124188	+34162.9	+3130.1	135,047.6	100,567.0	6
7	AITSU	N 12-37-28.0E	33525.2	97582361	21855958	+32714.7	+7327.3	134,162.9	103,130.1	7
8	RUJORU	N 24-32-29.4E	32695.2	90966067	41535223	+29741.5	+13580.0	132,714.7	107,327.3	8
9	AOMON	N 41-50-50.7E	26312.7	74492414	66714918	+19601.0	+17554.5	129,741.5	113,580.0	9
10	PIIRAAI	N 75-01-26.3E	24589.1	25841489	96603403	+6354.2	+23753.9	119,601.0	117,554.5	10
11	N. BASE #3	S 89-10-26.0E	28900.6	01441786	99989606	-416.7	+28897.5	106,354.2	123,753.9	11
12	RUNIT	S 70-57-07.3E	37438.2	32635970	94524565	-12218.3	+35388.3	99,583.3	128,897.5	12
13	SAND	S 34-21-35.7E	57499.0	82550854	56438963	-47465.9	+32451.9	87,781.7	135,388.3	13
14	IVY	S 20-56-15.2E	67862.7	93397044	35735027	-63381.7	+24250.7	52,534.1	132,451.9	14
15	ENIWETOK	S 67-27 45.6W	73416.9	38328534	92362999	-28139.6	-67810.0	36,618.3	124,250.7	15
16	RIGILI #2							71,860.4	32,190.0	16
17										17
18	BOGA #2 TO	N 59-09-59.8E	9639.5	51254333	85866136	+4940.6	+8277.0	138,932.2	52,801.6	18
19	RUCHI	N 80-34-24.7E	34166.0	16378117	98649659	+5595.7	+33704.6	143,872.8	61,078.6	19
20	ENGEBI	S 17-04-57.0W	70167.4	95588278	29374838	-67071.8	-20611.6	144,527.9	86,506.2	20
21	RIGILI #2							71,860.4	32,190.0	21
22										22
23	RP-X to	N 73-54-47.5E	9605.76	27709339	96084309	+2661.7	+9229.6	147,658.8	67,475.1	23
24	RP-Y							150,320.5	76,704.7	24
25										25
26	ENGEBI TO	S 88-31-27.0W	25436.0	02575530	99966828	-655.1	-25427.6	144,527.9	86,506.2	26
27	RUCHI	N 80-39-28.0W	19286.9	16233101	98673636	+3130.9	-19031.1	143,872.8	61,078.6	27
28	RP-X	N 76-30-03.1W	15947.5	23343075	97237343	+3722.7	-15506.9	147,658.8	67,475.1	28
29	TEITEIR	N 59-25-02.9W	11385.2	50877891	86089721	+5792.6	-9801.5	148,250.6	70,999.3	29
30	RP-Y							150,320.5	76,704.7	30

Figure 2-19

PLANE COORDINATES - IVY GRID

1952 EXPANSION OF HORIZONTAL CONTROL

	STATION	COURSE	DISTANCE	COSINE	SINE	LATITUDE	DEPARTURE	COORDINATES NORTH	COORDINATES EAST	
1	TEITEIR TO	S 80-28-04.5W	3573.5	16560464	98619303	-591.8	-3524.2	148250.6	70999.3	1
2	RP-X	N 70-03-33.6E	6069.3	34104685	94004630	+2069.9	+5705.4	147658.8	67475.1	2
3	RP-Y							150320.5	76704.7	3
4										4
5	AOMON TO	N 67-49-00.7W	14053.2	37756831	92598174	+5306.1	-13013.0	129741.5	113580.0	5
6	YEIRI	N 67-03.59.7W	11346.7	38966115	92095830	+4421.4	-10449.9	135047.6	100567.0	6
7	AITSU	N 64-34-08.6W	6923.6	42942295	90310350	+2973.2	-6252.7	134162.9	103130.1	7
8	RUJORU							132714.7	107327.3	8
9										9
10	PIIRAAI TO	S 29-32-16.9E	23008.0	87002868	49300112	-20017.7	+11343.0	119601.0	117554.5	10
11	RUNIT	S 25-04-45.7E	14625.7	90572155	42387319	-13246.8	+6199.4	99583.3	128897.5	11
12	N. BASE #3							106354.2	123753.9	12
13										13
14	N. BASE #3	S 37-13-21.0E	8503.0	79629243	62491186	-6770.9	+5143.6	106354.2	123753.9	14
15	RUNIT							99583.3	128897.5	15
16										16
17	SAND TO	S 0-59-46.9E	27981.1	99984880	01738891	-27976.9	+486.6	87781.7	135388.3	17
18	JAPTAN	S 4-45-44.1W	35369.7	99654778	08302127	-35247.6	-2936.4	59804.8	135874.9	18
19	IVY	S 8-46-34.3.W	28634.9	98829186	15257523	-28299.7	-4369.0	52534.1	132451.9	19
20	LILAC	S 12-16-51.3W	52361.6	97711647	21270495	-51163.4	-11137.6	59482.0	131019.3	20
21	ENIWETOK							36618.3	124250.7	21
22										22
23	IVY TO	N 11-39-00.7W	7094.1	97939871	20193601	+6948.1	-1432.6	52534.1	132451.9	23
24	LILAC	N 25-12-38.0E	8036.2	90474860	42594598	+7270.7	+3423.0	59482.0	131019.3	24
25	JAPTAN							59804.8	135874.9	25
26										26
27	ENIWETOK TO	N 69-03-08.8W	98575.8	35751327	93390806	+35242.1	-92060.7	36618.3	124250.7	27
28	RIGILI #2	N 27-15-40.4E	17904.5	88892744	45804803	+15915.8	+8201.2	71860.4	32190.9	28
29	IVY							52534.1	132451.9	29
30										30

Figure 2-20

LIST OF HORIZONTAL CONTROL STATIONS - OCTOBER 1952

ISLAND	IVY CODE	STA. NAME	ORDER	REMARKS
Bogallua	Alice	Boga #1	2nd	Destroyed 1951
Bogallua	Alice	Boga #2 - RM-1	2nd	
Bogombogo	Belle	Bogom	3rd	
Ruchi	Clara	Ruchi	3rd	
Cochiti	Daisy	Cochiti	3rd	Traverse Sta.
Santildefenso	Edna	Santil	3rd	Traverse Sta.
Elugelab	Flora	RP-X	2nd	
Teiteiripucchi	Gene	Teiteiripucchi	2nd	
Bogairikk	Helen	-	-	None
Bogon	Irene	Bogon	3rd	
W. of Engebi	Noah	Noah	3rd	Traverse Sta.
Engebi	Janet	Engebi (Elgin)	2nd	Re-estab. JTF-7 Sta.
Muzinbaarikku	Kate	Muzin Pl #1	3rd	
Kirinian	Lucy	Kirinian	3rd	
Bokonaarappu	Mary	Bokon	2nd	
Yeiri	Nancy	Yeiri	3rd	

LIST OF HORIZONTAL CONTROL STATIONS - OCTOBER 1952
(Cont.)

ISLAND	IVY CODE	STA. NAME	ORDER	REMARKS
Aitsu	Olive	Aitsu	3rd	
Rujoru	Pearl	Rujoru	3rd	
Eberiru	Ruby	V Zero	2nd	Destroyed 1951
Aomon	Sally	Aomon	2nd	Re-estab. JTF-7 Sta.
Biijiri	Tilda	Biijiri	3rd	Traverse Sta.
Rojoa	Ursula	Jake	3rd	Traverse Sta.
Aaraanbiru	Vera	Lucy	3rd	
Piiraai	Wilma	Piiraai	2nd	
Runit	Yvonne	H. Base #2	2nd	Destroyed 1951
Runit	Yvonne	H. Base #3	2nd	
Runit	Yvonne	Runit	2nd	Adopted JTF-7 Sta.
So. of Runit	Zona	Loc. M	2nd	Traverse Sta.
So. of Runit	-	Reef	2nd	
So. of Runit	-	Islet	2nd	
Lagoon				
Lagoon Photo Tower	Mack	Photo	2nd	Re-estab. JTF-7 Sta.

LIST OF HORIZONTAL CONTROL STATIONS - OCTOBER 1952

ISLAND	IVY CODE	STA. NAME	ORDER	REMARKS
Lagoon Tri. Sta.	Oscar	Coral	2nd	Re-estab. JTF-7 Sta.
Lagoon Tri. Sta.	-	Pinnacle	2nd	Destroyed 1951
Chinieero	Alvin	-		None
Aniyaanii	Bruce	Aniyaanii (Kodak)	2nd	Re-estab JTF-7 Sta.
Chinimi	Clyde	-		None
Jieroru	-	Lilac	3rd	Re-estab. Bowditch Sta.
Japtan	David	Japtan		
Parry	Elmer	Parry	2nd	Destroyed 1951
Parry	Elmer	Ivy	2nd	
Eniwetok	Fred	Eniwetok (Privilege)	2nd	Re-estab. Bowditch Sta.
Igurin	Glenn	Lantana		USS BOWDITCH Sta.
Mui	Henry	-	-	None
Pokon	Irwin	-	-	None
Ribaion	James	-	-	None
Giriinien	Keith	-	-	None
Rigili	Leroy	Rigili #1	3rd	Destroyed 1951
Rigili	Leroy	Rigili #2	2nd	

CHAPTER III
JOBSITE TESTS AND INSPECTION

SECTION 1. GENERAL

A Test and Inspection Department of the Engineering Division was organized in order to meet the methods and procedures for tests and inspections as detailed in the specifications and drawings as required in Title III of Job No. 1 of the Definitive Contract. This Department was divided into two sections: (1) the Laboratory and Materials Section and (2) the Field Inspection Section. Each section, headed by a Principal Engineer, was directly under the Resident Engineer, who was entirely independent of the Construction Division.

The Materials Testing Laboratory established during OPERATION GREENHOUSE on Elmer was used as the headquarters and laboratory. Representatives of the Laboratory Section were at all locations where: (1) aggregates for concrete were being obtained; (2) concrete was being made or transported: (3) Bitumuls were being mixed or placed; or (4) soil stabilization work was being performed.

The Field Inspection Section had offices at Elmer, Gene and Yvonne. The Elmer office covered all construction on Elmer and Fred. The Gene Office covered all items of construction from Alice to Wilma. The Yvonne office was maintained only for the short construction period at that site. Activities in the lagoon or at other island sites were covered by special assignments.

SECTION 2. TESTS

Tests were conducted by the Laboratory and Materials Section covering the period from the first explorations for aggregate and the first receipts of cement to the final testing and recording of strengths and characteristics of the finished concrete. Stockpiling and blending of aggregates was subject to continuous checks and tests. Test design mixes and analyses were made from each source of aggregate and the mixes to be used under each circumstance were established. The procedure for tests on concrete and constituents was as follows:

CONCRETE. Concrete compression tests were performed on standard 12" x 6" diameter cylinders which were cast at the site of construction. The test cylinders were cast in groups of three, and the method of casting and curing was in accordance with A.S.T.M. Designation: C31-49. One cylinder from each test group was tested in compression at seven days and the remaining two cylinders were tested at 28 days of age on a Baldwin Southwark, 300,000 pound capacity, hy-draulic testing machine.

Average compressive strength of concrete designed for ultimate strength of 2,500 psi (average of 50 breaks) was:

Age 7 Days - 2,140 psi
Age 28 Days - 2,770 psi

Average compressive strength of concrete designed for ultimate strength of 3,000 psi (average of 80 breaks) was:

Age 7 Days - 2,540 psi
Age 28 Days - 3,200 psi

Average compressive strength of EMBECO grout used for setting heavy machinery (average of 4 breaks) was:

Age in Days	Compressive Strength (psi)
3	4,130
5	4,670
6	4,980
7	5,600
8	5,640
9	5,750
10	5,990
12	6,060
13	6,280
14	6,430
15	6,730

AGGREGATE. Coarse and fine aggregates were tested during exploration, development, and throughout the construction period. Selective sampling and testing insured the selection of the best aggregates available, permitted economy in their development, and insured control of aggregate grading for economy in test mix designs and in final production.

The methods and equipment used in the tests were as specified in the following A.S.T.M. designations:

> Sampling coarse and fine aggregate - A.S.T.M. Designation D 75-48
>
> Specific gravity fine aggregate - A.S.T.M. Designation C 128-42
>
> Specific gravity coarse aggregate - A.S.T.M. Designation C 127-42
>
> Sieve Analysis - A.S.T.M. Designation C 136-46
>
> Absorption fine aggregate - A.S.T.M. Designation C 128-42
>
> Unit weight - A.S.T.M. Designation C 29-42
>
> Voids in aggregate - A.S.T.M. Designation C30-37
>
> Surface moisture in fine aggregate - A.S.T.M. Designation C 37-47

An exploration program was carried forward to locate the most suitable aggregate for concrete and road stabilization for future uses, with aggregate for concrete being of prime importance. A visual inspection was conducted in which the entire reef surrounding Elmer was investigated. The character of the coral was determined initially by studying the surface characteristics of the reef.

The initial investigation revealed a large expanse of reef which appeared to be of high quality, located on the ocean side at the south end of Elmer. To further reveal the character of the coral thus located, test holes were drilled to a depth of approximately three feet, and the coral blasted from that depth.

Laboratory tests conducted on random samples - taken from various depths in the blast craters - proved conclusively that the coral was of the highest quality. The tests proved, also, that the character of the coral was of uniform quality over the entire depth. To determine the extent of the high quality coral, blasting, sampling, and testing was continued. A blast pattern was set up which gave a reliable cross section of the area under investigation. With blasting, sampling, and testing completed, the area of high quality coral for aggregate was well defined. Results of these tests are as follows:

Specific Gravity Fine Aggregate		
(Sat. surface dry basis)	-	2.58
Specific Gravity Coarse Aggregate		
(Sat. surface dry basis)	-	2.65
Unit Weight Fine Aggregate (Oven dry, air cooled):		
Loose (per cubic foot)	-	88.7 lbs.
Rodded (per cubic foot)	-	98.8 lbs.
Unit Weight Coarse Aggregate (Oven dry, air cooled):		
Loose (per cubic foot)	-	80.3 lbs.
Rodded (per cubic foot)	-	91.0 lbs.
Percent Voids in Fine Aggregate (Oven dry, air cooled):		
Loose	-	44.9%
Rodded	-	38.7%
Percent Voids in Coarse Aggregate (Oven dry, air cooled):		
Loose	-	48.2%
Rodded	-	41.3%
24-Hour Absorption of Fine Aggregate		6.6%
24-Hour Absorption of Coarse Aggregate		3.7%

Figure 2-21. Typical Aggregate Stock Pile and Rock Crusher

CEMENT. Tests were conducted on cement and cement mortars to determine soundness of cement for use in concrete. The following tests were made in accordance with A.S.T.M. specifications:

Setting time of hydraulic cement or mortar - A.S.T.M. Designation C 229 49T

Soundness of hydraulic cement over boiling water (pat test) - A.S.T.M. Designation C 189-49

Fineness of hydraulic cement by the No. 200 sieve - A.S.T.M. Designation C 184-44

Sampling hydraulic cement - A.S.T.M. Designation C 183-46

BITUMINOUS PAVING. Bituminous paving mixes were tested in order to determine the percent bitumen in the mix. The original sample included water added at the mixing plant, bitumul, which contained 41.7% bitumen, and aggregate. The bitumul was removed from the aggregate by several washings in an alcohol-turpentine solution. The difference between the water added at the mixing plant and known water content of the bitumul determined the percentage of bitumul. No tests were run at the Jobsite to determine properties of bitumul as the testing laboratory was not equipped to conduct such tests.

MISCELLANEOUS TESTS. Miscellaneous tests were conducted for various departments as occasion demanded. For example: a test was conducted to determine the holding efficiency of different sizes of guy anchors, required for use in Blast Protection.

SECTION 3. INSPECTION

The Field Inspection Section inspected all phases of construction work from the first excavation and sub-grading until final completion and acceptance. All materials used in construction, their placement, and connections were under constant inspection and were checked for conformance with plans and specifications. Alignment and connecting of all underground utility lines were inspected continuously. All excavation, construction and installation of forms and placing of reinforcement were checked and approved before placement of concrete. Electrical, sanitary, mechanical and piping tests were completed and reported when required.

The Field Inspectors, when in their opinion, construction was not in accord with the plans or specifications, would inform the Superintendent of Construction of this and report the matter to the Resident Engineer. The Superintendent of Construction normally would take the necessary measures to rectify the unsatisfactory conditions. In case of a conflict of ideas between the Inspectors and the Superintendent of Construction the Resident Engineer, after consultation with the Project Manager, would make the final decision as to the measures to be taken in the matter.

Some substitutions in materials, as called for in the plans or specifications, were required so as to use materials that were available at the construction site. All such substitutions, with the exception of sizes of reinforcing steel, were referred first to the Home Office Engineering Division for approval. The Resident Engineer at the site approved changes in reinforcing steel. The AEC Resident Engineer was informed of those cases where materials were different from that called for by the specifications or plans.

The Field Inspectors made written reports weekly and semi-weekly, depending on the magnitude of construction involved, to the Resident Engineer. A true copy of these reports was furnished the AEC Resident Engineer. These reports contained pertinent information concerning the construction, substitution of materials, equipment used, progress, and unusual conditions found. These reports were also used as a check on progress of the construction.

Figure 2-22 depicts method of testing for leaks on spliced submarine communications cable by use of compressed air.

Figure 2-22. Compressed Air Tests for Leaks in Spliced Cable

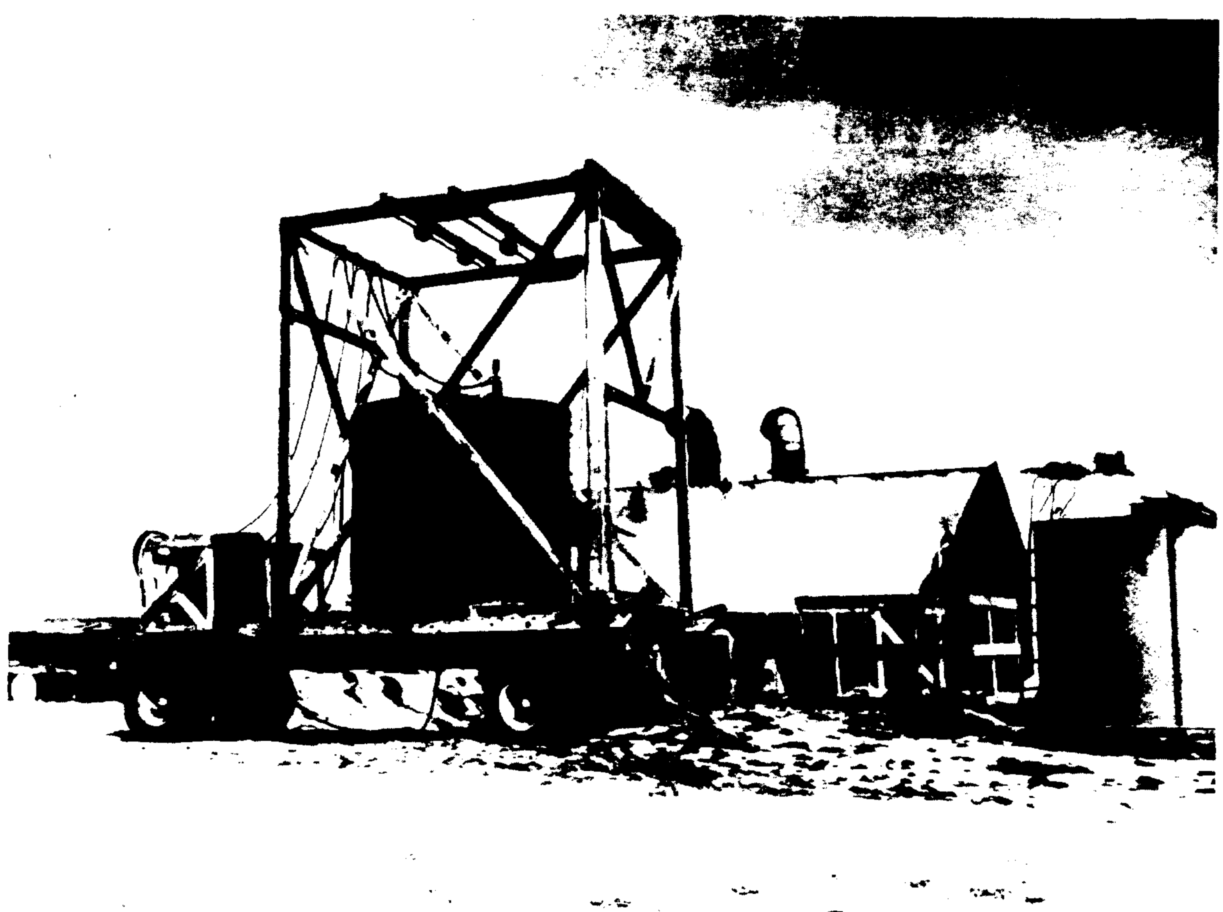


Figure 2-23. Portable Water Rheostat for Electrical Tests

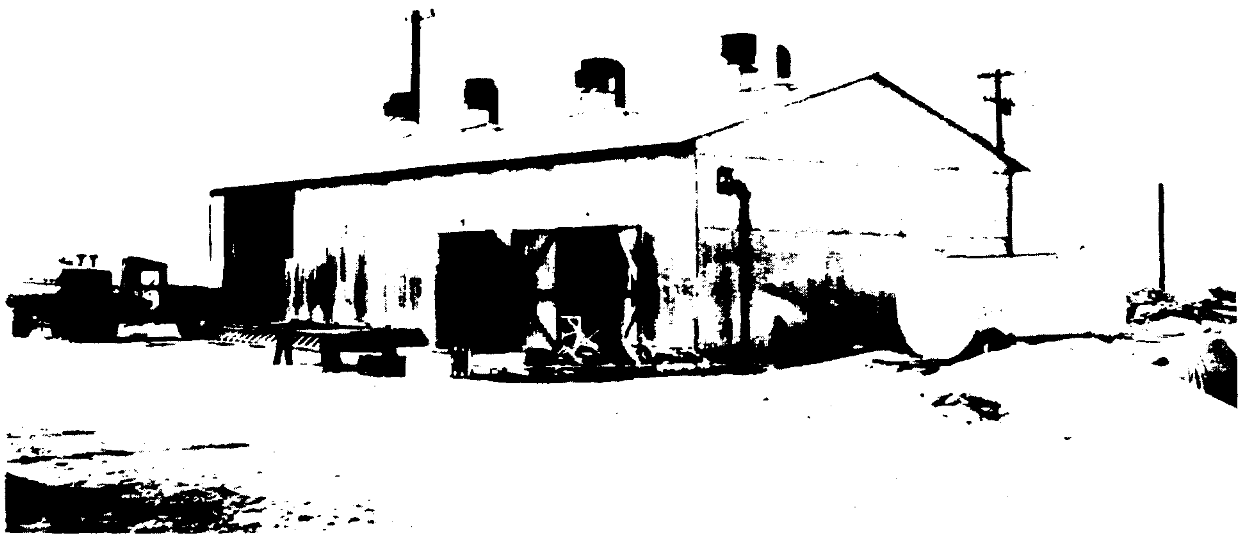


Figure 2-24. Gene Power House Nearing Completion

BLDG. 103 - SUB STATION

This sub station consisted of a concrete pad on which was mounted two transformers and necessary switches, and was surrounded by an eight-foot chain link and barbed wire fence with gate.

Construction Costs	$ 1,827.76
Total Over-all Costs	1,827.76

BLDG. 5 - WATER DISTILLATION PLANT AND BLDGS. 105 AND 108

Bldg. 5 was a one-story wood frame structure with corrugated aluminum siding (on both ends and one side only - west side open) and roofing. Outside dimensions were 85'-0" x 31'-0" x 8'-7-1/2" mean height resting on a reinforced concrete slab 6" thick with foundations 12" below grade. This building was designed and constructed as a distillation plant to house "Badger" type water distillation units with necessary auxiliary equipment, fresh water, salt water, gasoline, and acid piping with required mechanical and electrical fixtures.

Bldg. 105 was a diesel fuel oil tank and Bldg. 108 was a gasoline storage tank. Both buildings were Navy pontoons resting on wood platforms.

CHAPTER IV
TEST & BASE FACILITY STRUCTURES HISTORY

SECTION 1. GENERAL

The construction of the Base Facilities was simplified as a result of experience gained on similar work during OPERATION GREENHOUSE. The methods, equipment, materials and man power which would most effectively accomplish the job were known. The assembly of the prefabricated buildings, the use of coral aggregate and the mixtures suitable for the type of construction used in the facilities, the stabilization of areas, road work, the laying of submarine cable, the use of close fitting reinforcing steel and other construction details therefore presented no unusual problems.

In order to summarize the construction effort associated with the Base Facilities Program there follows a description of each item of work with significant engineering and construction details that were encountered. The descriptions of the items of work are grouped by sites.

SECTION 2. GENE

BLDG. 1 - POWER PLANT AND BLDG. 104 - DIESEL FUEL TANK

The construction of the Power Plant consisted of a one-story wood frame building, 64'-0" x 30'-0" x 16'-0" mean height. Corrugated aluminum was used for siding and roofing. This work included installation of all water, oil, fuel, air and other required lines, mechanical and electrical fixtures, conduits and utilities, provision and installation of generating units, and compressors. The original design contemplated only the use of the three generators formerly installed in the plant on Ursula. After installation of these units was completed, an additional generating unit was installed. This unit was obtained from the power plant on David. The Diesel Fuel Oil Tank was a welded steel structure resting on concrete saddles.

Design was started on 23 November 1951; drawings were approved by AEC on 11 January 1952 and were issued to the Jobsite on 24 January. Construction started 5 February and was completed on 10 May. AEC acceptance was received 30 September. Figure 2-24 indicates progress as of 18 April. Costs for both buildings were:

Engineering Costs	$ 8,551.53
Construction Costs	256,343.83
Total Over-all Costs	$ 264,895.36

BLDGS. 40, 41, 42, 101, 102, 109, 38 AND 38A - MESS HALL AND FACILITIES

This item consisted of: (Bldg. 40) a one-story woodframe construction, "F"-shaped, and included a mess hall (24'-0" x 96'-0"), a galley, meat room, and bakery (24'-0" x 66'-0") and scullery (16'-0" x 18'-0"), concrete slab corrugated roofing, plywood siding complete with wiring, fixtures, plumbing and equipment; (Bldgs. 38 and 38A) prefabricated "walk-in" type refrigerators, set on timber skids, complete with wiring and fixtures; (Bldg. 41) can washing room of wood frame construction 8'-0" x 10'-0"; (Bldg. 42) boiler house 10'-0" x 12'-10" of wood frame construction complete with wiring, plumbing, boiler, hot water generator and condensate unit; (Bldg. 101) a tent on wood floor 15'-10" x 31'-10" complete with wiring and fixtures, used for storage; (Bldgs. 102 and 109) welded steel fuel oil tanks on elevated wood platform. Design was started on 23 November 1951, was approved by AEC on 29 January 1952, and was issued for construction on 30 January 1952. Construction was initiated on 11 February 1952, and completed on 19 March 1952. AEC acceptance was received 31 May 1952. Figure 2-25 shows the mess hall on 7 March 1952. Costs for these eight buildings amounted to:

Engineering Costs (Including Design Work)	$ 536.60
Construction Costs	138,951.58
Total Over-all Costs	$139,488.18

Figure 2-25. Mess Hall on Gene as of 7 March 1952

Design started on 27 January 1952 and was approved by AEC on 30 January 1952. Construction was initiated on 14 February and was completed on 19 March. AEC acceptance was received 30 September. Costs for the three buildings amounted to

Construction Costs	\$ 78,954.69
Total Over-all Costs	\$ 78,954.69

BLDGS. 6 AND 113 - HEAVY EQUIPMENT REPAIR SHOP AND OFFICE

Bldg. 6 was of one-story wood frame construction, size 28'-0" x 40'-4" x 12'-8" mean height, set on a stabilized coral floor, with aluminum roof and siding, complete with electric wiring and fixtures, work benches and installed equipment for use as equipment maintenance.

Bldg. 113 was a one-story wood frame structure 6'-9" x 10'-9" x 9'-2" mean height with wood floor, plywood siding, composition shed roof, complete with electric wiring and fixtures. This structure was removed from David, rehabilitated and erected on Gene for use as an office building. The plan was issued to the Jobsite on 25 January 1952. Construction was initiated on 17 March 1952 and completed on 29 March 1952. AEC acceptance was received 31 May 1952. Costs for both buildings amounted to:

Engineering Costs	\$ 33.01
Construction Costs	2,866.57
Total Over-all Costs	\$ 2,899.58

BLDGS. 36, 37, 82 AND 83 - SHOWERS AND LATRINES

These four buildings were one-story wood frame construction, gable roof, size 25'-0" x 36'-0" x 10'-9" mean height, concrete floor slab, corrugated aluminum roofing and plywood siding; complete with electric wiring, fresh and salt water plumbing and equipment. The equipment in each unit included 8 toilets with enclosures, 6 urinals, 8 lavatories, 10 shower heads, 8 mirrors and 1 water cooler drinking fountain. Design started on 23 November 1951, was approved by AEC on 26 December 1951, and issued to Jobsite on 25 January 1952. Construction was initiated on 31 January 1952, the first unit was completed 23 February 1952 and the last unit was completed 20 March 1952. AEC acceptance was received 31 May 1952. Costs for these four buildings amounted to:

Engineering Costs (Including Design Work)	\$ 281.08
Construction Costs	53,781.42
Total Over-all Costs	\$ 54,062.50

Figure 2-26. Gene Carpenter Shop

on 18 August 1952 and completed on 5 September 1952. AEC acceptance was received 22 November 1952.

Engineering Costs	$ 26.52
Construction Costs	1,791.49
Total Over-all Costs	$ 1,818.01

ELECTRICAL FACILITIES

These facilities were constructed to provide overhead electrical distribution by a system of poles and wiring. This item included pier lighting, navigation lights at the end of the pier, and causeway lighting between Gene and Helen. Installed equipment included various sizes of pole and pad transformers. Drawings were released 25 January 1952 and construction started on 18 March 1952. All work was completed on 18 October 1952 and accepted by AEC on 22 November 1952. Final drawings were subsequently submitted to the AEC.

Engineering Costs (Including Design Work)	$ 476.98
Construction Costs	58,663.44
Total Over-all Costs	$ 59,140.42

AIRSTRIP - GENE

This item consisted of building an airstrip 1000' x 50' by grading, filling, compacting and stabilizing with approximately 3,000 cubic yards of coral aggregate. Design was started 23 November 1951, and was released to Jobsite on 25 January 1952, and final drawings were subsequently submitted to the AEC. Construction started 25 January 1952 and was completed on 22 February. AEC acceptance was received on 22 November 1952.

Construction Costs	$ 55,706.03
Total Over-all Costs	$ 55,706.03

BARBER SHOP - BLDG. 111

This building consisted of a one-story wood and pipe frame structure, size 8'-0" x 10'-0" set on wood skids, canvas roof, and canvas and plywood side, complete with wiring, fixtures, and one barber's chair. Drawing was released on 25 January 1952. One final drawing was subsequently submitted to the AEC. Construction started 21 February 1952 and was completed 13 March. AEC acceptance was received 31 May.

Engineering Costs	$ 4.14
Construction Costs	279.92
Total Over-all Costs	$ 284.06

CARPENTER SHOP - BLDG. 112

This building consisted of a one-story, wood frame structure, size 28'-0" x 32'-0" x 11'-2" mean height, with supporting wood columns, stabilized coral, floor, galvanized iron roofing, no siding, complete with electrical wiring, fixtures, and small portable wood working equipment. Drawing was released 25 January 1952 and was submitted to the AEC. Construction started 17 March 1952 and was completed on 29 March 1952. AEC acceptance was received 31 May 1952. Figure 2-26 shows shop in operation on 24 April 1952.

Engineering Costs	$ 24.61
Construction Costs	2,136.82
Total Over-all Costs	$ 2,161.43

CHAPEL - BLDG. 124

This building consisted of an 8-man tent 15'-10" x 31'-10" erected on concrete slab. Drawings were released on 18 August 1952. Construction started

ELECTRICAL SHOP BLDG. 133

This building consisted of a wood frame structure 26'-0" x 12'-0" x 10'-0" mean height, with plywood floor, sides and roof, with one layer of composition roofing; the structure was mounted on concrete piers. Construction was started on 18 August 1952 and was completed on 5 September 1952. AEC acceptance was received 22 November 1952. There were no drawings.

Engineering Costs	$ 8.57
Construction Costs	744.07
Total Over-all Costs	$ 752.64

FIRE STATION - BLDG. 115

This building consisted of a one-story wood structure, size 14'-0" x 32'-0" x 9'-6" mean height, set on mud sill with 4" x 4" posts buried 2' in the ground with stabilized coral floor, aluminum roofing, plywood siding, complete with electric wiring, fixtures, and fresh water connections. Drawing was released 6 May 1952, and was subsequently submitted to the AEC. Construction started on 7 May 1952 and was completed on 15 May 1952. AEC acceptance was received on 11 September 1952.

Engineering Costs	$ 59.29
Construction Costs	1,532.85
Total Over-all Costs	$ 1,592.14

FUEL DUMP - BLDG. 130

This item comprised a compacted stabilized area of approximately 224 square feet, covered with 4" x 4" wood sleepers. The area was allocated for the storage of lubricating and fuel oil. This work was undertaken in connection with stabilized roads and areas.

Engineering Costs	$ 6.15
Construction Costs	534.20
Total Over-all Costs	$ 540.35

GYMNASIUM - BLDG. 125

This building consisted of a wood frame structure 16'-0" x 32'-0" x 10'-0" mean height, with plywood floor, sides and roof, with one layer of composition roofing. Construction was started 18 August 1952 and was completed 5 September 1952. AEC acceptance was received 22 November 1952.

Engineering Costs	$ 26.51
Construction Costs	1,791.49
Total Over-all Costs	$ 1,818.00

INFIRMARY - BLDG. 45

This building consisted of a one-story wood frame structure 12'-0" x 27'-10" x 8'-10" mean height, set on wood sills, aluminum roofing, wood and screen siding, complete with wiring, fixtures, plumbing and first aid equipment. This structure was moved from David and rehabilitated on Gene. Design was started 28 December 1951 and was issued to the Jobsite on 21 February 1952. Construction was started 21 February 1952 and was completed 7 March 1952. AEC acceptance was received 31 May 1952. Figure 2-27 is a photograph of the completed structure.

Engineering Costs	$ 51.44
Construction Costs	1,329.79
Total Over-all Costs	$ 1,381.23

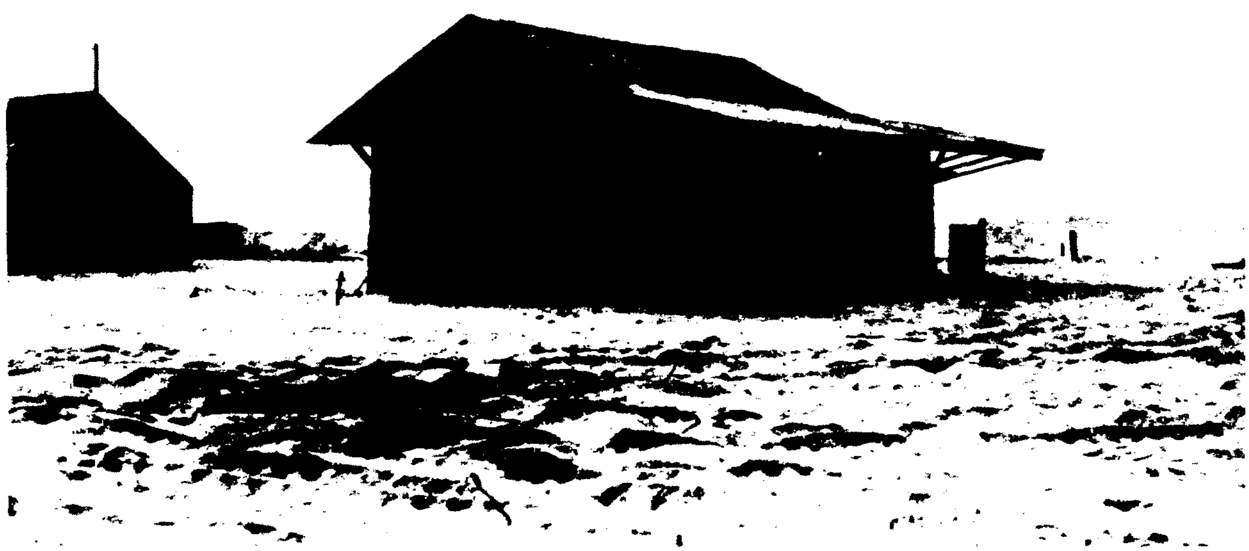


Figure 2-27. Infirmary on Gene

LIVING QUARTERS - GUARDS - BLDG. 127

This building consisted of a wood frame structure 32'-0" x 16'-0", x 10'-0" mean height with wood floor and canvas tent. It was authorized, constructed and accepted in conjunction with other housing facilities.

Engineering Costs	$ 26.51
Construction Costs	1,791.49
Total Over-all Costs	$ 1,818.00

MARINE FACILITIES

The Marine Facilities consisted of (1) construction of a coral fill jetty 944' x 50', 7 feet above mean low low water, (2) a personnel pier, (3) a cargo pier, (4) a reinforced concrete ramp 110' x 85', (5) a turning basin dredged to a width of 250', (6) a channel to the lagoon dredged to a width of 150'. Design was started on 23 November 1951, and issued for construction on 25 January 1952. Revisions were made on 16 April and 27 June 1952. Construction was started on 18 February, was completed on 13 June and was accepted by AEC on 30 September. Two drawings as modified were submitted. Blasting the coral heads for the channel and turning basin was more extensive and difficult than originally estimated. Surplus material was picked up for use as fill in the causeways. As this work was done offshore, it was necessary to move equipment and work with the tides. Artificial islands were constructed and equipment was moved at low tide to these islands for operations, as shown in Figure 2-28. Figure 2-29 denotes details of ramp construction and Figure 2-30 shows details of jetty, piers and ramps. Figures 2-31 and 2-32 show personnel pier and jetty bulkhead nearing completion.

Engineering Costs (Including Design Work)	$ 2,600.79
Construction Costs	175,339.50
Total Over-all Costs	$177,940.29

Figure 2-28. Off-Shore Dragline Dredging

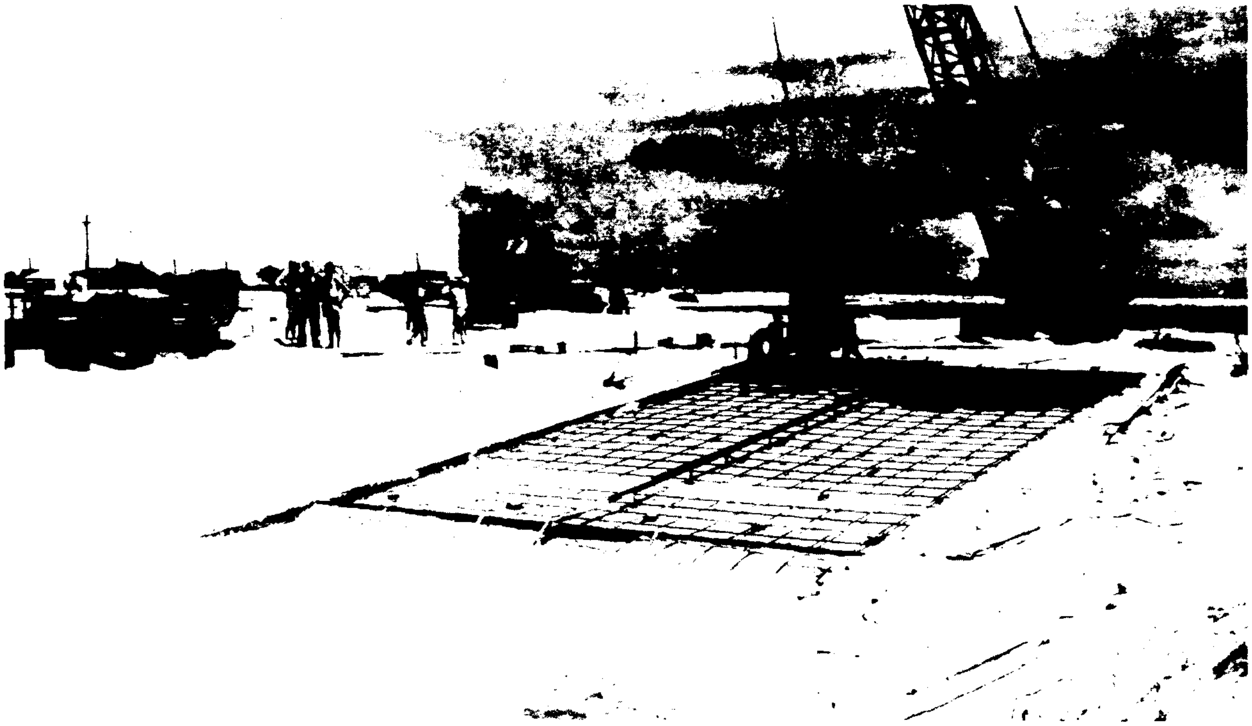


Figure 2-29. Pouring of Concrete on Marine Ramp at Gene Jetty

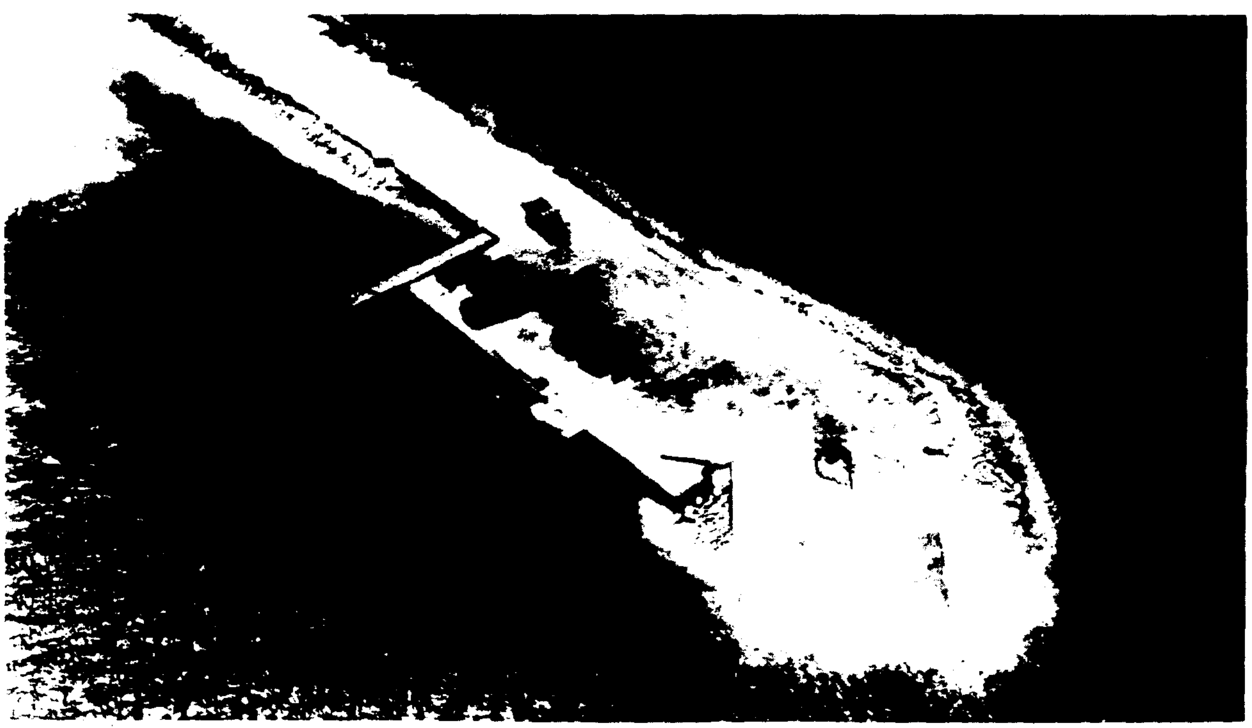


Figure 2-30. Aerial View of Jetty, Piers and Ramps at Gene

Figure 2-31. Personnel Pier at Gene

Figure 2-32. Jetty Bulkhead and Fill at Gene

OFFICE - AEC SECURITY - BLDG. 129

This building consisted of a wood frame structure 12'-0" x 10'-0" mean height, with plywood floor, sides and roof, set on wood skids. It was authorized, constructed and accepted in conjunction with other temporary camp facilities.

Engineering Costs	$ 5.00
Construction Costs	214.33
Total Over-all Costs	$ 219.33

OFFICE - AIR DISPATCH - BLDG. 114

This structure consisted of a wood frame 16'-0" x 16'-0" with wood floor and canvas tent. It was constructed in conjunction with other temporary facilities.

Engineering Costs	$ 10.68
Construction Costs	457.24
Total Over-all Costs	$ 467.92

OFFICE CONTRACTORS AND SURVEYORS - BLDGS. 2 AND 2A

These buildings were rehabilitated structures removed from David and erected on Gene and were of wood frame construction, gable roof, rectangular-shaped size 14'-0" x 17'-5" x 9'-1" mean height. Siding was of plywood and screen and the roof of composition. Construction was initiated on 21 February 1952 and was completed on 8 March 1952. AEC acceptance was received 31 May 1952. Costs for both buildings amounted to:

Engineering Costs	$ 5.93
Construction Costs	253.98
Total Over-all Costs	$ 259.91

OFFICE - INSPECTOR'S BLDG. 134

This structure consisted of a wood frame structure 10'-0" x 12'-0" x 8'-0" mean height, plywood sides, floor and roofing, mounted on wood skids. It was constructed in conjunction with other temporary facilities.

Engineering Costs	$ 4.01
Construction Costs	171.46
Total Over-all Costs	$ 175.47

OFFICE - HOLMES & NAR~~VER GUARD~~ - ~~BLDG~~. 126

This structure was identical to Bldg. 134.

Engineering Costs	$ 4.80
Construction Costs	205.76
Total Over-all Costs	$ 210.56

OFFICE - MARINE DISPATCHER'S - BLDG. 122

This building was similar to Bldg. 134 except that dimensions were 16'-0" x 16'-0" x 10'-0".

Engineering Costs	$ 10.68
Construction Costs	457.24
Total Over-all Costs	$ 467.92

OFFICE - MILITARY POLICE GUARD - BLDG. 128

This building was similar to Bldg. 134 except that dimensions were 12'-0" x 12'-0" x 10'-0".

Engineering Costs	$ 6.00
Construction Costs	257.20
Total Over-all Costs	$ 263.20

OFFICE - WAREHOUSE - BLDG. 3

This building was similar to Bldg. 134 except dimensions were 30'-0" x 12'-0" x 10'-0".

Engineering Costs (Including Design Work)	$ 101.66
Construction Costs	1,077.92
Total Over-all Costs	$ 1,179.58

OFFICE - TIMEKEEPER'S - BLDG. 43

This building was identical to Bldg. 134.

Engineering Costs	$ 4.00
Construction Costs	171.46
Total Over-all Costs	$ 175.46

PIPE SHOP - BLDG. 132

This building was a wood frame structure 26'-0" x 16'-0" x 10'-0" mean height, built in conjunction with and similar to the electric shop, Bldg. 133.

Engineering Costs	$ 11.42
Construction Costs	992.09
Total Over-all Costs	$ 1,003.51

P.O. - P.X. AND REFRESHMENTS - BLDG. 44

This building consisted of a one-story wood structure 16'-0" x 56'-10" x 8'-10" mean height, set on concrete slab with aluminum roofing, wood and screen siding, complete with wiring, plumbing, bar fixtures, refrigerator (walk-in), and flake ice-machine. This structure was removed from David and rehabilitated on Gene. Design was started 28 December 1951 and issued to the Jobsite on 25 January 1952. Construction started on 21 February 1952 and was completed on 13 March 1952. AEC acceptance was received 31 May 1952.

Engineering Costs	$ 47.08
Construction Costs	3,180.60
Total Over-all Costs	$ 3,227.68

RECREATION HALL - BLDG. 110

This building consisted of a one-story wood frame structure 15'-0" x 44'-6" x 10'-3" mean height, set on concrete with aluminum shed roof and siding, complete with electrical wiring, fixtures and an ice machine. Drawing was released 25 January 1952 and final drawing was subsequently submitted to the AEC. Construction started on 21 February 1952 and was completed on 13 March 1952. AEC acceptance was received 31 May 1952.

Engineering Costs	$ 31.07
Construction Costs	2,099.40
Total Over-all Costs	$ 2,130.47

ROADS AND AREAS - STABILIZED

This item provided for grading and stabilizing approximately 10,400 square yards of roads and areas; grades were determined in the field. Drawing was released on 25 January 1952, construction started on 4 February 1952, completed on 18 October 1952, and AEC acceptance of completion was received 22 November 1952 (with the acceptance of Camp Layout).

Engineering Costs (Including Design Work)	$ 264.03
Construction Costs	58,657.70
Total Over-all Costs	$ 58,921.73

SHOP - SHEET METAL - BLDG. 131

This building comprised a wood frame structure 20'-0" x 20'-0" x 10'-0" mean height, built in conjunction with and similar to the electric shop.

Engineering Costs	$ 10.99
Construction Costs	953.93
Total Over-all Costs	$ 964.92

SEWER FACILITIES

The complete sewer facilities on Gene consisted of various size piping from 2" to 8" for the outfall and included two manholes. Drawings were released on 25 January 1952, construction started 14 February 1952, work was completed on 15 March 1952 and was accepted by AEC on 22 November 1952. Figure 3-26, Sewerage Location Map details the entire system installed.

Engineering Costs (Including Design Work)	$ 255.52
Construction Costs	16,124.33
Total Over-all Costs	$ 16,379.85

TANKS - FUEL OIL STORAGE - BLDGS. 118 AND 119

Three Navy pontoons were used as tanks and mounted on an 8'-0" high wood platform resting on concrete piers. Costs for both structures amounted to:

Engineering Costs	$ 1.92
Construction Costs	166.94
Total Over-all Costs	$ 168.86

TELEPHONE FACILITIES

Construction of telephone facilities consisted of approximately 3400 lineal feet of two conductor overhead wiring with 14 telephone and service drops. Construction started 18 March 1952, work was completed 18 October 1952 and was accepted by AEC on 22 November 1952.

Engineering Costs	$ 238.49
Construction Costs	19,809.73
Total Over-all Costs	$ 20,048.22

TENTS - FOUR-MAN - BLDGS. 50, 51A AND 10B

These housing tents consisted of wooden tent frames 14'-2" x 14'-0" x 11'-6" bolted to concrete slabs. Costs for three tents amounted to:

Engineering Costs	$ 27.86
Construction Costs	1,616.59
Total Over-all Costs	$ 1,644.45

TENTS - EIGHT-MAN - BLDGS. 9 THRU 35, 46 THRU 49, 51 THRU 74, 76 THRU 81, 82A, 83A

These 63 housing tents were of wood and canvas construction, 15'-10" x 31'-10" x 11'-6", bolted to concrete slabs, complete with electrical wiring and fixtures. This item was a continuing project with tents erected as required. Design was started on 23 November 1951, received AEC approval on 26 December 1951 and was issued to the Jobsite on 8 January 1952. Construction was initiated on 10 January 1952 and the last increment was completed on 30 September 1952. AEC acceptance was received 22 November 1952. Costs for these 63 tents amounted to:

Engineering Costs (Including Design Work)	$ 1,462.70
Construction Costs	84,870.84
Total Over-all Costs	$ 86,333.54

TENTS - STORAGE - BLDGS. 120 AND 121

These structures consisted of wooden tent frames with wood floors, supporting 32'-0" x 16'-0" canvas tents. Costs for both amounted to:

Engineering Costs	$ 14.06
Construction Costs	1,221.03
Total Over-all Costs	$ 1,235.09

THEATRE - OPEN AIR MOTION PICTURE - BLDG. 39

This item consisted of (1) a projection room, wood frame structure 8'-0" x 11'-6" on concrete slab, aluminum roofing and siding, complete with electrical wiring and fixtures, equipped with two 16 mm. sound projectors; (2) a wooden frame canopy 17'-0" x 23'-6" to shelter five rows of seats or seating capacity for 239 persons; (3) a painted plywood screen 13'-0" x 16'-0" mounted on concrete piers and braced. Construction was initiated on 31 January 1952 and was completed on 23 February 1952. AEC acceptance was received 31 May 1952.

Construction Costs	$ 1,134.52
Total Over-all Costs	$ 1,134.52

WAREHOUSE - BLDG. 116

This building consisted of a one-story wood frame structure 28'-0" x 50'-0" x 17'-0" mean height, set on concrete slab with aluminum roofing and plywood siding, complete with electric wiring and fixtures. Drawing was released on 25 January 1952, and construction was started on 25 February 1952 and was completed on 17 April 1952. AEC acceptance was received 31 May 1952.

Engineering Costs (Including Design Work)	$ 511.60
Construction Costs	5,424.64
Total Over-all Costs	$ 5,936.24

WATER FACILITIES - FRESH AND SALT DISTRIBUTION SYSTEMS BLDGS. 7, 106, 107 AND 123

The water distribution systems consisted of 4" salt water pipe and 3" fresh water pipe with steel storage tanks of 4200-gallon capacity for each system on 30-foot towers. Included was a salt water well, 22 feet deep, with lines to the pump station in the distillation plant. Drawing was released on 25 January 1952. Construction started on 28 January 1952, work was completed 22 March 1952 and was accepted by AEC on 22 November 1952.

Engineering Costs (Including Design Work)	$ 451.43
Construction Costs	19,535.55
Total Over-all Costs	$ 19,986.98

SECTION 3. YVONNE

BLDGS. 102, 122 AND 125 - 100-MAN MESS HALL WITH BOILER HOUSE, GARBAGE STORAGE SHED AND REEFER BUILDING

The mess hall, Bldg. 102, was a one-story double roofed, prefabricated aluminum building 24'-0" x 100'-8-1/2" x 10'-0" mean height. This structure was erected on an existing concrete slab. All windows and doors were screened and the building was completed with wiring, plumbing and piping systems and with installed kitchen and mess hall equipment. Construction was started on 4 April 1952 and Figure 2-33 shows progress as of 16 April 1952. Completion date was 2 August 1952 and AEC accepted on 6 December 1952. GREENHOUSE "As-Built" drawings were used.

The boiler house was a one-story frame structure with aluminum siding and roofing, 10'-0" x 12'-0" x 10'-3" high. Equipment included pump, steam generator, hot water generator and an exterior steel storage tank 6'-0" diameter x 10'-0" long mounted on existing concrete saddles. It was built in conjunction with the mess hall.

Figure 2-33. Yvonne Mess Hall Under Construction

Garbage storage shed, Bldg. 122, was a one-story wood frame structure, shed roof, plywood and plastic screen siding, aluminum roof, erected on an existing concrete slab and built in conjunction with the mess hall.

Reefer Bldg. No. 125, was a one-story wood frame trussed structure, 34'-0" x 33'-0" x 11'-6" mean height, connected to the mess hall. It was erected on a 5" concrete slab complete with wiring, fixtures, 4 walk-in reefers; each reefer had a compressor unit mounted on exterior of the building.

Engineering Costs	$ 588.96
Construction Costs	95,006.19
Total Over-all Costs	$ 95,595.15

ADMINISTRATION BUILDING - BLDG. 105

This was a reconstructed one-story, prefabricated aluminum building 24'-0" x 44'-8-1/2" x 12'-0" high, erected on existing concrete slab. Construction started on 22 April 1952. Figure 2-34 indicates progress as of 1 May 1952. Structure was completed on 24 May 1952 and accepted on 6 December 1952.

Engineering Costs	$ 114.73
Construction Costs	3,050.97
Total Over-all Costs	$ 3,165.70

Figure 2-34. Administration, Fire and Aid Buildings at Yvonne

CARPENTER SHOP - BLDG. 123

A wood frame structure 28'-0" x 20'-0" supporting a canvas tarpaulin top and erected on an existing concrete slab, complete with electrical wiring and fixtures.

Engineering Costs	$ 7.64
Construction Costs	1,211.78
Total Over-all Costs	$ 1,219.42

ELECTRICAL FACILITIES

This item covered the construction of an electrical distribution system for camp services, including overhead primary and secondary lines, underground secondary lines, poles, five transformers and service drops. Drawing was released on 1 April 1952, construction started on 17 April 1952 and facilities were completed on 10 May 1952. There was one "As-Built" drawing which had been furnished to AEC. AEC accepted these facilities on 6 December 1952.

Engineering Costs	$ 206.52
Construction Costs	18,123.56
Total Over-all Costs	$ 18,330.08

FIRE AND FIRST AID BUILDING - BLDG. 109

A one-story aluminum structure 24'-0" x 20'-8-1/2" x 10'-10" mean height erected on an existing concrete slab, complete with wiring, fixtures, plumbing and first aid equipment. Construction started on 28 April 1952 and was completed on 24 May 1952. There was one "As-Built" drawing which was furnished to the AEC. AEC acceptance was on 6 December 1952.

Engineering Costs	$ 53.54
Construction Costs	2,971.13
Total Over-all Costs	$ 3,024.67

GENERATOR SHED: AUXILIARY, BLDG. G

A wood frame structure 10'-0" x 5'-0" x 8'-0", plywood sides and roof, erected on an existing concrete slab, complete with wiring, fixtures and two auxiliary generators.

Engineering Costs	$ .68
Construction Costs	108.19
Total Over-all Costs	$ 108.87

LANDING PIER - CARGO AND PERSONNEL, REACTIVATION OF

The reactivation of this pier consisted primarily of the replacement of 1800 square feet of 3" timber decking. Work started on 1 February 1952 and was completed on 15 February 1952. AEC accepted work on 6 December 1952.

Engineering Costs	$ 267.71
Construction Costs	11,155.49
Total Over-all Costs	$ 11,423.20

POWER AND DISTILLATION PLANT - BLDG. 106, REHABILITATION OF

Work consisted of overhaul, repairs or replacements of parts for diesel generators, distillation units, pumps, piping, ventilation equipment, fans, compressors and incidental equipment. Work was started on 28 July 1952 and completed on 2 August 1952. There was one "As-Built" plan which was furnished to the AEC. Work was accepted by AEC on 6 December 1952.

Engineering Costs	$ 2,057.54
Construction Costs	15,170.79
Total Over-all Costs	$ 17,228.33

SHOWERS AND LATRINES - BLDGS. 101 AND 108

Two one-story aluminum structures 24'-0" x 36'-8-1/2" x 12'-0" high erected on existing concrete slabs. Plumbing fixtures were connected to existing services. Figure 2-35 (C 49-4) shows one of these structures as of 1 May 1952. Construction started 4 April 1952 and was completed 1 June 1952. AEC accepted them 6 December 1952.

Engineering Costs	$ 275.36
Construction Costs	23,537.76
Total Over-all Costs	$ 23,813.12

Figure 2-35. Completed Latrine on Yvonne

SEWER SYSTEM - REHABILITATION OF

Rehabilitation of the sewer system consisted of minor repairs and replacements. Work started on 5 May 1952 and was completed on 10 May 1952. AEC accepted work on 6 December 1952.

Construction Costs	$ 682.11
Total Over-all Costs	$ 682.11

TENTS - FOUR-MAN - BLDGS. 1 THRU 20, 41 THRU 56 AND 63

Four-man tents, totaling 37, of wood frame and canvas construction were bolted to existing concrete slabs. Construction started 3 April 1952 and increments were completed as required with the last increment completed on 2 August 1952. AEC accepted same on 6 December 1952.

Engineering Costs	$ 344.20
Construction Costs	25,028.11
Total Over-all Costs	$ 25,372.31

TENT - REFRESHMENT SHELTER AND P.X., BLDG. R

The shelter was a wood and canvas structure, 20'-6" x 46'-0" x 10'-0" with canvas roof over timber frame on posts secured to existing concrete piers with earth floor. The P.X. tent was canvas on wood, 14'-2" x 14'-4" x 11'-6" erected on an existing concrete slab. These two structures were completed with electric services, fixtures and equipment. Construction started on 22 April 1952 and completed on 10 May. AEC acceptance is dated 6 December.

Construction Costs	$ 20,305.21
Total Over-all Costs	$ 20,305.21

THEATRE - OPEN AIR MOTION PICTURE, BLDG. 103

The theatre had a seating capacity of 202, including 14 wood benches with back rests. The screen structure was 21'-0" x 17'-0" anchored on existing concrete piers; the transite screen was 16'-0" x 12'-0", 59'-6" from the projection booth. Figure 2-36 depicts progress as of 1 May 1952. The booth was aluminum erected on an existing concrete slab, and was complete with electrical services, fixtures and two 16 mm. sound motion picture projectors. Design used for this theatre was that used for off-island theatres in OPERATION GREENHOUSE. Construction was started 28 April 1952, was completed 10 May and accepted by AEC on 6 December.

Construction Costs	$ 1,294.53
Total Over-all Costs	$ 1,294.53

WAREHOUSES - GENERAL AND ELECTRICAL

Two wood frame 16-man canvas tents, 16'-0" x 32'-0" were erected on existing concrete slabs.

Engineering Costs	$ 6.98
Construction Costs	1,107.91
Total Over-all Costs	$ 1,114.89

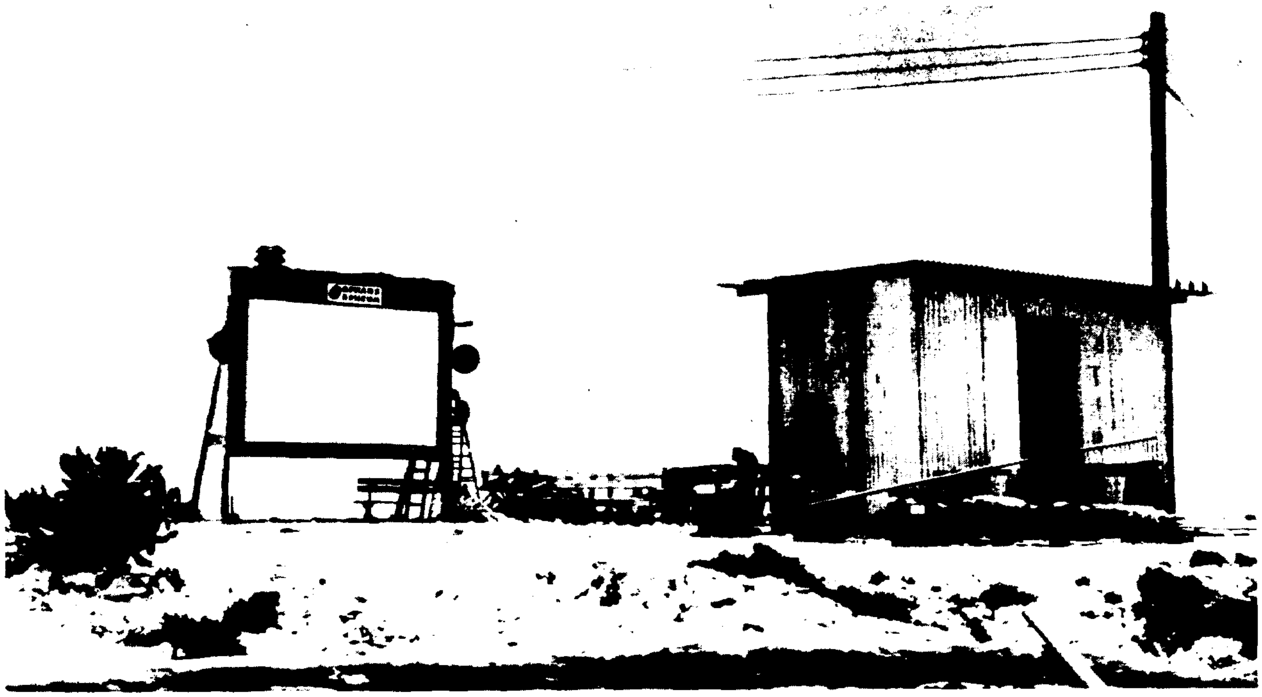


Figure 2-36. Open Air Movie Theatre at Yvonne

WATER DISTRIBUTION SYSTEMS - SALT AND FRESH - REHABILITATION OF; BLDGS. 104, 112 AND 120

The salt and fresh water distribution systems of approximately 1350 feet each of 4" and 3" transite pipe were rehabilitated. Elevated fresh and salt water tanks (Figure 2-37) were constructed on existing concrete piers. Each tank had 4200 gallons capacity. Bldg. 112 was a fresh water storage steel tank of 7500 gallons capacity. Bldg. 120 was an Acid Tank Building. This structure was a one-story wood and corrugated iron building 8'-0" x 12'-0" x 9'-0" mean height, erected on existing concrete slab. The redwood acid tank had a 240 gallon capacity. Construction was started on 13 February 1952, was completed on 17 May 1952 and accepted by AEC on 6 December 1952.

Engineering Costs	$ 290.66
Construction Costs	3,644.21
Total Over-all Costs	$ 3,934.87

SECTION 4. ELMER

BLDG. 194

This building consisted of two separate structures one of which was a prefabricated aluminum building with inside dimensions of 60'-8-1/2" long x 24'-0" wide and 10'-10" mean height set on a 6" reinforced concrete floor slab. The

Figure 2-37. Water Tower Re-erected at Yvonne

Figure 2-38. Bldg. 194 and Dehumidification Shed, Elmer

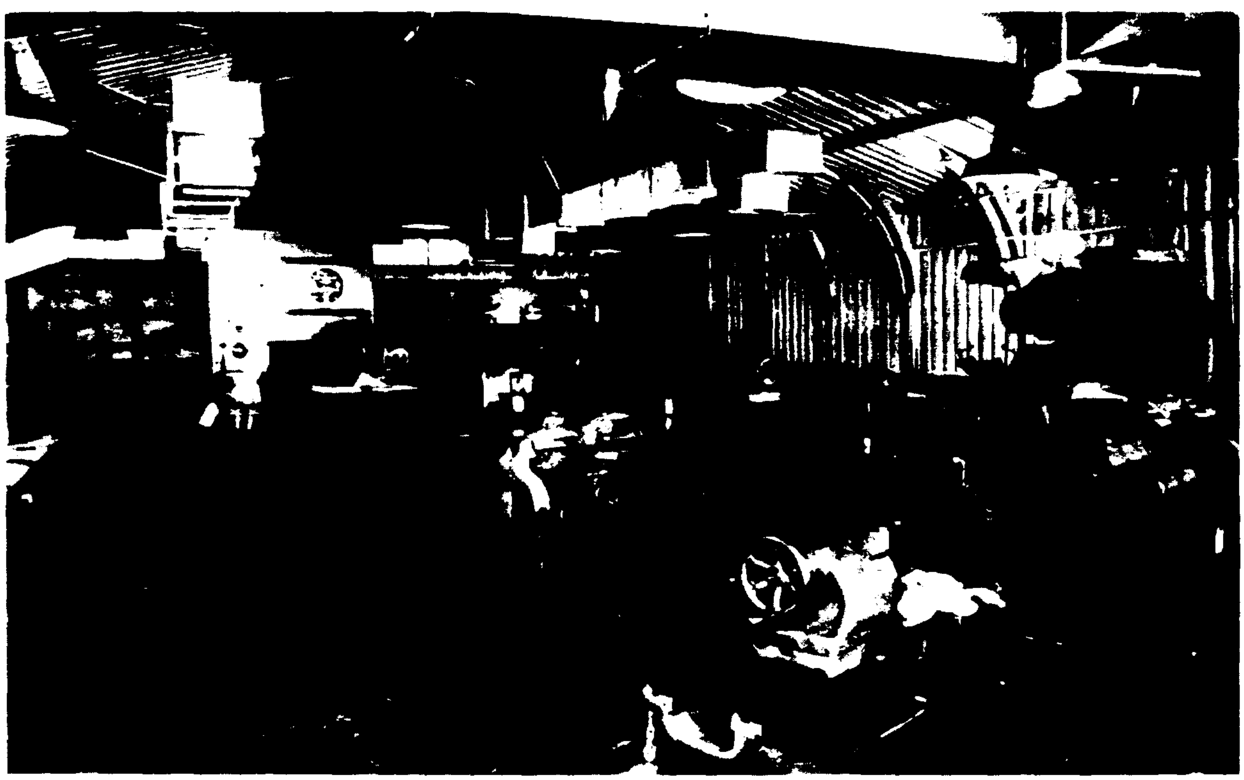


Figure 2-39. Interior of Bldg. 194, Elmer

other unit was constructed of wood 31'-0" long, 15'-2" wide x 9'-0" mean height. The larger building was constructed to house shop equipment and the smaller unit contained dehumidification equipment for the larger unit. Figure 2-38 shows the exterior of these two units. Design of this building was started on 23 January 1952 and drawings were submitted on 11 March 1952, which were approved by AEC on 24 March 1952 and then issued to Jobsite on 28 March 1952. Four final drawings were subsequently submitted to the AEC. Construction started on 28 March 1952 and was completed on 9 August 1952. AEC acceptance was received on 30 September 1952. Figure 2-39 shows the interior of the shop as of 13 June 1952.

Engineering Costs (Including Design Work)	$ 2,477.64
Construction Costs	71,737.75
Total Over-all Costs	$ 74,215.39

BLDG. 194 - SUB STATION (T-23)

A reinforced concrete slab 9'-0" x 8'-0" adjacent to the small unit of Bldg. 194 with angle frame to support oil fuse cutouts, surrounded by 6'-0" chain link fence, gate, barbed wire and installed equipment of three 50 KVA transformers; this station was constructed and accepted in conjunction with the dehumidification building.

Engineering Costs	$ 607.27
Construction Costs	17,583.06
Total Over-all Costs	$ 18,190.33

BLDG. 211 - ALTERATIONS TO

Bldg. 211 was a T-shaped prefabricated aluminum building constructed as an instrument laboratory. Work hereunder pertained to the addition of a new corrugated aluminum door with a rain hood, a 3'-6" x 5'-0" concrete entrance pad, and the installation of 2 new electrical convenience outlets and relocation of one panel and a wood bench. Engineering performed in the field was submitted on 21 August 1952 and received AEC approval same date. Construction of these modifications was initiated on 21 August, and was completed on 12 September. AEC acceptance was received on 18 November.

Construction Costs	$ 502.05
Total Over-all Costs	$ 502.05

BLDG. 212A - ALTERATIONS AND ADDITIONS TO

This building was a prefabricated aluminum building constructed as a counting and sampling laboratory. The work consisted of relocating dehumidification equipment on a new exterior concrete pad 5'-0" x 5'-6", removing existing interior partitions and relocating existing electrical panel with its necessary wiring and aluminum duct work. Engineering performed in the field was submitted on 22 August 1952 and received AEC approval the same date. A final drawing was subsequently submitted to the AEC. Construction of these modifications was initiated on 3 September and was completed on 9 September. AEC acceptance was received on 22 November.

Construction Costs	$ 1,604.25
Total Over-all Costs	$ 1,604.25

BLDG. 222 - MODIFICATIONS TO

This building was a standard prefabricated aluminum building used as the Pass and Badge Office. Work consisted of modifications dividing it into seven rooms by use of plywood partitions from floor to ceiling. One room was fitted as a dark room with necessary sink. Counters, work tables, benches and blackboards were added along with necessary waste and fresh water lines and electrical wiring as needed. The design was started on 14 January 1952, submitted on 8 February 1952, received AEC approval 15 February 1952 and submitted to Jobsite on 5 March 1952. Construction of these modifications was initiated on 17 March and was completed on 27 June. AEC acceptance was received 30 September.

Engineering Costs (Including Design Work)	$ 680.46
Construction Costs	14,154.06
Total Over-all Costs	$ 14,834.52

BLDG. 313 - MODIFICATIONS TO

Bldg. 313 was a prefabricated aluminum building used as a Supply Division Office and Warehouse. Work consisted of modifications to provide additional office space in this building and consisted of relocation of existing partitions, double roofing the additional office space, installation of shelving, vents, relocation of door and installation of electrical wiring and fixtures. Design was accomplished in the field, was submitted on 5 July 1952 and received AEC approval on 7 July 1952. Final drawings were subsequently submitted to the AEC. Construction was initiated on 14 July and was completed on 26 July. AEC acceptance was received on 30 September 1952.

Construction Costs	$ 4,966.93
Total Over-all Costs	$ 4,966.93

BLAST PROTECTION

This item (Item No. A-11) covered the complete blast protection to buildings and facilities. As the subject of blast protection is detailed in Book 6, the costs only are reported in this section.

Engineering Costs	$ 4,106.94
Construction Costs	86,740.80
Total Over-all Costs	$ 90,847.74

BLDGS. 301 AND 301A - BOILER HOUSE AND ALTERATIONS TO FRESH WATER DISTILLATION PLANT

Bldg. 301 was designed and used as the power and distillation plant. Work consisted of providing additional water distillation capacity. For the additional still capacity a new building, 301A, of prefabricated aluminum size 24'-8-1/2" x 24'-0" x 10'-0" mean height was constructed to house a new 30 HP vertical boiler and the old boiler formerly housed in Bldg. 301. Two 600 gph distillation units complete with auxiliaries were removed from the Northern Islands and installed in Bldg. 301. The engineering for the added water production facilities was accomplished in the field, was submitted on 10 June 1952 and received AEC approval by Eniwetok Field Manager's letter, Serial E-2345 (no date). Four drawings were subsequently submitted to the AEC. Construction of this work

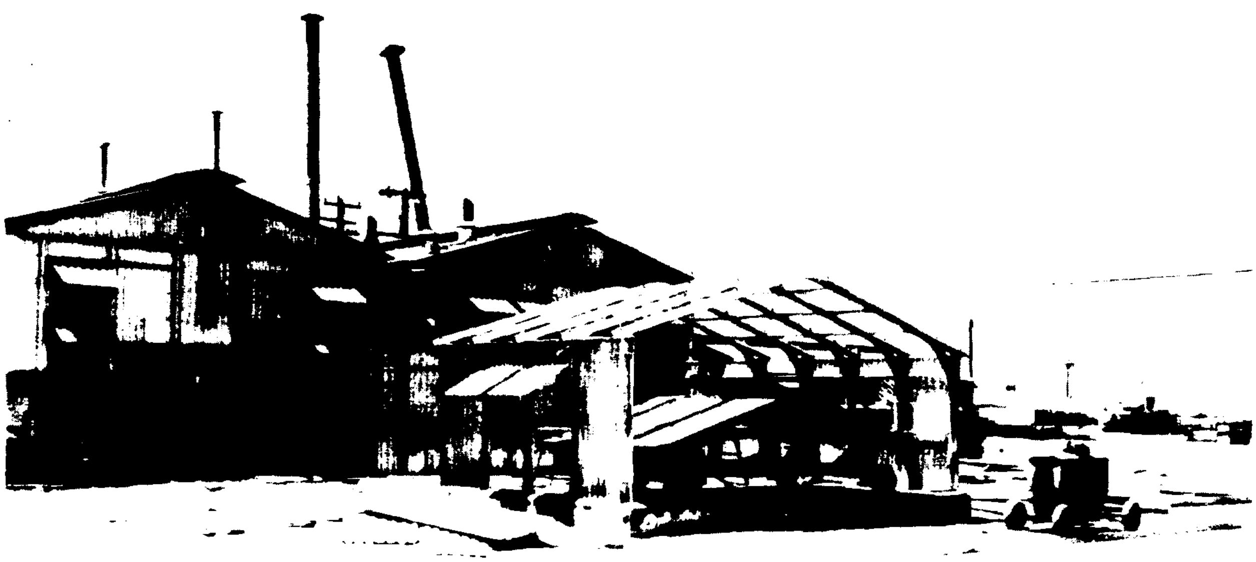


Figure 2-40. Bldg. 301A as of 15 July 1952

was initiated on 7 February, and was completed on 28 November 1952. AEC acceptance was received on 8 December 1952. Figure 2-40 shows the progress on Bldg. 301A as of 15 July 1952.

Construction Costs	$150,980.64
Total Over-all Costs	$150,980.64

BLDG. 209 - AEC ADMINISTRATION BUILDING - ALTERATIONS TO

This building of prefabricated aluminum was the AEC Administration Building; alterations consisted of installation of a standard aluminum partition dividing conference room into 4 areas; installation of one 3 panel wood door in existing frame of partition; installation of a standard partition and a standard door in Room A-16, and a door in the corridor at the east end of the south wing and installation of a 30 lineal foot 8" x 8" bumper block outside of the building. Engineering was done in the field and submitted from 15 July 1952 thru 24 September 1952 and received AEC approval from 15 July thru 25 September 1952. One final drawing was subsequently submitted to the AEC. Construction of these modifications was initiated at various times from 13 May thru 19 September and was completed from 24 May thru 20 September. AEC acceptance was received 25 November thru 8 December.

Engineering Costs (Including Design Work)	$ 68.58
Construction Costs	1,474.74
Total Over-all Costs	$1,543.32

BLDG. 221 - TASK FORCE HEADQUARTERS BUILDING - MODIFICATIONS TO

This building E-shaped of prefabricated aluminum having 3 wings was designed and constructed as the Task Force Headquarters. Modifications consisted of installation of dehumidification unit with necessary ducts for teletype and code rooms and spraying of these rooms with "Vapor Seal", rearrangement of lighting fixtures, and replacement of partitions around the toilet rooms. Design was started 17 March 1952, submitted 16 April 1952, AEC approval was received 21 May 1952, and issued for construction on 23 May 1952. After receipt of the drawings at the Jobsite an inspection of this building by Holmes & Narver disclosed that modifications to the building had been effected by military personnel which had not been entered on the GREENHOUSE "As-Built" drawings. As the present design was based on the "As-Built" drawings, it was necessary to redesign the modifications to fit the existing conditions. This resulted in a high engineering cost for these modifications. Final drawings were subsequently submitted to the AEC. Construction of these modifications was initiated on 18 June and was completed on 9 August. AEC acceptance was received 30 September. Costs for this item are shown on page 2-56.

Engineering Costs (Including Design Work)	$ 1,218.95
Construction Costs	13,056.45
Total Over-all Costs	$ 14,275.40

CARGO UNLOADING AREA - FLOODLIGHTING AT

This item covered the installation of three new floodlights on existing poles near the cargo unloading area.

Construction Costs	$ 1,152.19
Total Over-all Costs	$ 1,152.19

COMMUNICATIONS SYSTEM - ADDITIONS TO

This item covered the installation of a 26-pair telephone cable from Bldg. 208 to Station No. 1002, using existing poles.

Construction Costs	$ 2,471.00
Total Over-all Costs	$ 2,471.00

BLDG. 360 - DUKW REPAIR SHELTER - MODIFICATIONS TO

This building was built as a Seacraft Repair Shelter of canvas and wood construction. Work hereunder consisted of extension of the salt water distribution system by installation of two risers and fire hose cabinets inside the building in order to provide additional fire protection. Engineering performed in the field was submitted on 2 June 1952 and received AEC approval on the same date. One final drawing was subsequently submitted to the AEC. Construction was initiated on 25 June and the work was completed on 12 July 1952. AEC acceptance was received on 6 December 1952.

Construction Costs	$ 2,516.15
Total Over-all Costs	$ 2,516.15

FIRE HYDRANT ADDITION

This item covered the installation of an additional 6" standard cast iron fire hydrant to the north of Bldg. 323.

Construction Costs	$ 917.93
Total Over-all Costs	$ 917.93

BLDG. 421 - HEAVY EQUIPMENT REPAIR SLAB

This item covered the installation of an additional reinforced concrete slab; 60'-0" x 40'-0" x 6" thick. Construction started 22 April, was completed 26 April and accepted by AEC on 30 September.

Construction Costs	$ 3,108.44
Total Over-all Costs	$ 3,108.44

BLDGS. 117 AND 118 - INFIRMARY - MODIFICATION TO

These prefabricated aluminum buildings were designed as the infirmary and nurses quarters and dental office. The work consisted of: (1) installation of lead sheet on reception room wall for protection of patients from X-rays and (2) the removal of prefabricated aluminum partition and installation of plywood panels above and below existing aluminum partitions to make walls from floor to roof. This work was released at Jobsite 8 September 1952 and received AEC approval on 9 September 1952. Construction of these modifications was initiated on 12 September 1952 and was completed on 15 September 1952. AEC acceptance was received on 6 December 1952.

Construction Costs	$947.46
Total Over-all Costs	$947.46

BLDG. 404 - MACHINE SHOP - ALTERATIONS AND ADDITIONS TO

This structure was a quonset machine and welding shop. Rust had destroyed some existing trusses and sheathing. A steel beam was installed for support and the rusted sections were replaced with a shed, 16'-0" x 60'-0" x 11'-8" mean height, with corrugated galvanized iron roof, open sides and ends, supported by steel beams and pipe columns and mounted on a new 5" thick concrete slab. Construction started on 28 April 1952, was completed on 5 July 1952 and accepted by AEC on 6 December 1952.

Engineering Costs (Including Design Work)	$ 68.58
Construction Costs	9,292.84
Total Over-all Costs	$9,361.42

BLDG. 120 - "QUE" HOUSE - ADDITIONS AND ALTERATIONS TO

This was the quarters of the Task Force Commander. Alterations covered by ECO 261 pertained to additions and alterations consisting of the construction of a wood frame addition 10'-4" long x 20'-8" wide x 9'-0" high, to be used as a kitchen and the conversion of existing kitchen to bedrooms and installation of lavatory with necessary changes in plumbing and electrical wiring. Engineering work was accomplished in the field. It was recommended on 2 April 1952 and received AEC approval on 4 April 1952. A final drawing was submitted to the AEC. Construction of these modifications was initiated on 8 April and was completed on 17 May. AEC acceptance was received on 6 December.

Engineering Costs (Including Design Work)	$ 328.10
Construction Costs	4,844.23
Total Over-all Costs	$5,172.33

BLDG. 208 AND COMPOUND - SECURITY FENCING AND LIGHTING

This building of prefabricated aluminum was the Holmes & Narver Administration Building and work hereunder pertained to revision and alteration to the restricted area of the compound consisting of removal and relocation of the existing fence and addition of poles, wiring, transformers and accessories for security lighting. The design was approved 24 April 1952 and issued to Jobsite 28 April 1952. Three final drawings were subsequently submitted to the AEC. Construction of these modifications was initiated on 13 May, and was completed 15 September. AEC acceptance was received on 6 December.

Engineering Costs (Including Design Work)	$ 566.11
Construction Costs	11,675.30
Total Over-all Costs	$ 12,241.41

BLDG. 200 - THEATRE, OUTDOOR MOTION PICTURE - MODIFICATIONS TO

This building was an open-air theatre consisting of a wood and aluminum projection room, with wood shelter, seats and stage. Modifications covered by ECO 3700, pertained to enlargement of the projection room to accomodate installation of new projectors. Construction of these modifications was initiated on 10 November and was completed on 9 December and AEC acceptance was received on 6 December.

Construction Costs	$ 18,985.26
Total Over-all Costs	$ 18,985.26

BLDG. 420 - WAREHOUSE - CEMENT STORAGE

This was a new one-story steel, wood and aluminum structure, 50'-6" x 60'-6" x 12'-4-1/2" mean height, set on existing concrete slab, with shed roof of corrugated aluminum, complete with electrical wiring and fixtures. The purpose of this warehouse was to provide adequate cement storage area. Construction was started on 2 April, was completed 16 April and accepted by AEC on 31 May.

Construction Costs	$ 17,745.72
Total Over-all Costs	$ 17,745.72

SECTION 5. ELMER CMR AREA

BLDG. 329 LABORATORY - MODIFICATIONS TO

Bldg. 329 was a one-story double roof prefabricated building used as a laboratory. The work consisted of rearrangement of washroom, addition of a lavatory and water cooler, installation of 10" x 10" roof vent over washroom, construction of a wood frame wall with louvers at north end of passageway between Bldgs. 329 and 330, and the addition of three reinforced concrete pads. Design was started on 6 November 1951, was submitted on 5 January 1952, and AEC approval was received on 15 January. Drawings were issued to Jobsite on 16 January. Two final drawings were subsequently submitted to the AEC. Drawings were released for construction on 25 January, construction was initiated on 1 February and completed on 15 April. AEC acceptance was received on 30 September. There were two "As-Built" drawings. The design and engineering for these modifications was accomplished with that for Bldg. 330 and the engineering costs are included in the cost report for that building.

Construction Costs	$ 1,682.02
Total Over-all Costs	$ 1,682.02

BLDG. 330 - MODIFICATIONS TO

Bldg. 330 was a one-story steel and aluminum building used as a laboratory. The work consisted of modifications and additions to the building as follows: addition of a new pit and equipment foundations; addition of a wood frame shed to the west side with dimensions of 8'-8" x 5'-9" x 10'-2" mean height; removal of 46 feet of the west wall and addition of a wood frame extension with dimensions of 46'-0" x 9'-0" with average mean height of 12'-10"; addition of equipment foundations, concrete pads, cooling water lines, fresh water and waste lines with necessary mechanical and electrical fixtures, conduits and fittings for the additional equipment installed. Design was started on 6 November 1951, was submitted on 5 January 1952, received AEC approval on 16 January and was issued to Jobsite on 25 January. Final drawings were subsequently submitted to the AEC. Drawings were released at Jobsite for construction on 25 January 1952 with a construction time schedule 31 January to 19 April 1952. Construction started on 31 January 1952, was completed on 9 August, and AEC acceptance was received on 30 September. There were seven "As-Built" drawings. Figure 2-41 shows the installation of an additional compressor as of 7 May 1952 and Figure 2-42 shows the front view of the completed main pane[illegible]de oxo panel, and dryer panel as of 19 May 1952.

Engineering Costs (Including Design Work)	$ 5,096.69
Construction Costs	84,243.27
Total Over-all Costs	$ 89,339.96

SUB STATION 330 (T-17)

This was a typical sub station erected on a reinforced concrete slab 16'-0" x 8'-6", enclosed by an 8-foot fence and with a pipe framework for the suspension of insulators, bus bar, lightning arrestors and with three transformers and other miscellaneous installed equipment. Design was started on 25 January

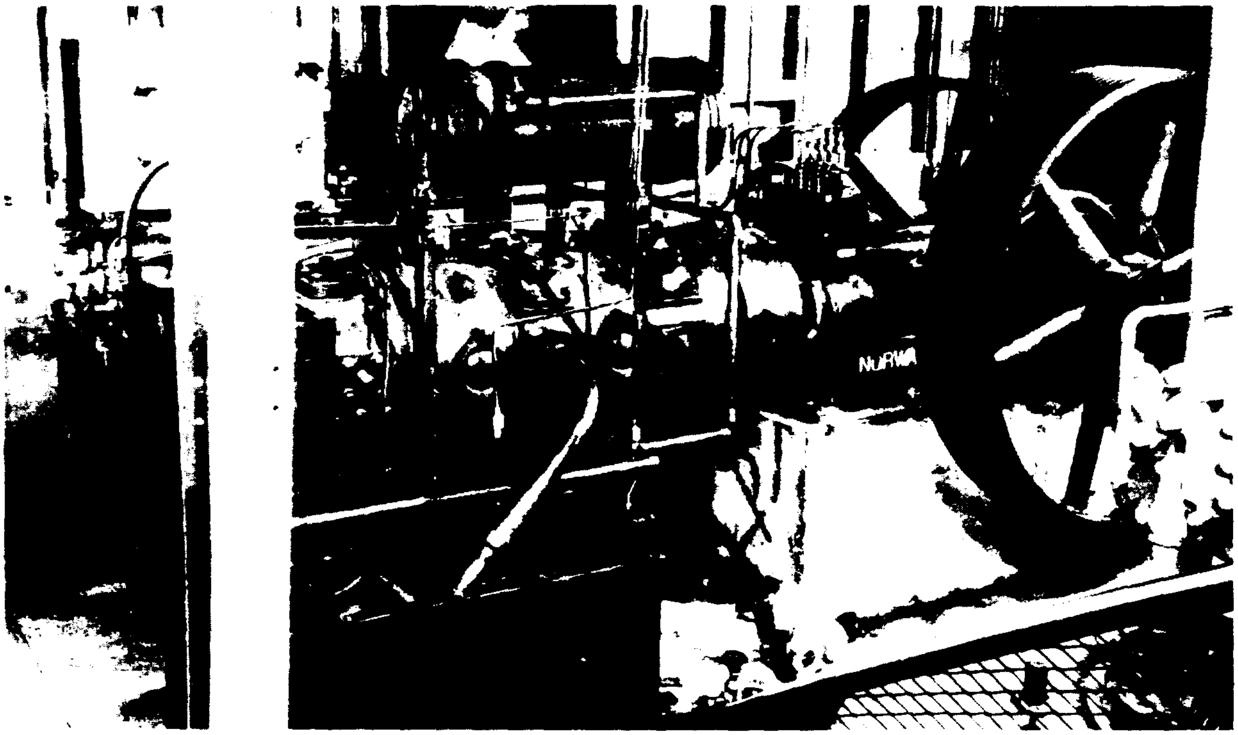


Figure 2-41. Installation of Additional Compressor

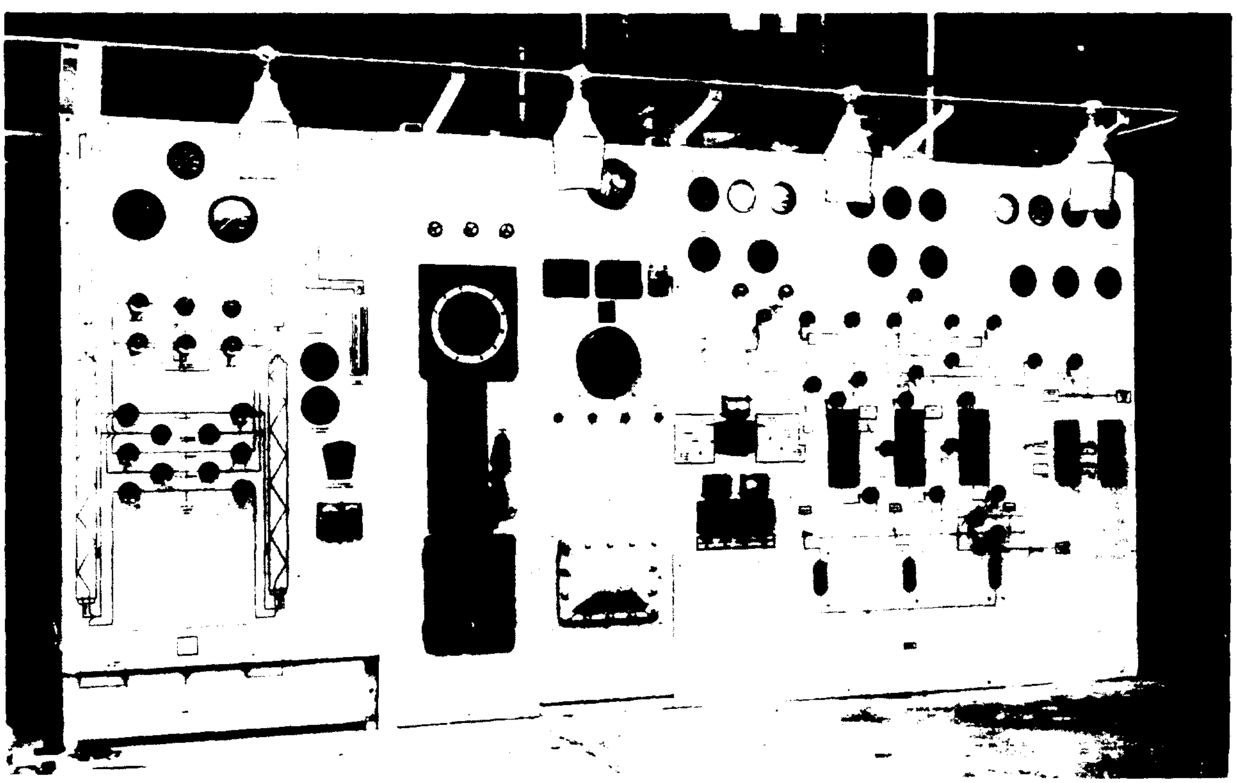


Figure 2-42. Control Panels, Bldg. 330

1952, was submitted on 10 April, received AEC approval on 17 April, and was issued to Jobsite on 22 April. Construction was in conjunction with other CMR Area work. One final drawing was submitted to the AEC.

Engineering Costs	
(Including Design Work)	$ 1,323.08
Construction Costs	35,092.71
Total Over-all Costs	$ 36,415.79

SUB STATION 339 (T-28)

This was the station service transformer bank, erected at the east side of Bldg. 339, on a reinforced concrete slab structure 9'-0" x 5'-6" with 8-foot high mesh chain link fence and entrance gate. Three outdoor transformers were installed. Design was started on 25 January 1952, was submitted for approval on 25 March 1952, received AEC approval on 28 March 1952, and was issued for construction on 1 April. One final drawing was subsequently submitted to the AEC. Construction was in conjunction with other CMR Area work.

Engineering Costs	
(Including Design Work)	$ 369.65
Construction Costs	9,804.40
Total Over-all Costs	$ 10,174.05

SUB STATION 340 (T-26)

A concrete slab structure, 13'-0" x 10'-6" and similar to the previous two sub stations. Equipment consisted of three outdoor transformers and one weather-proof power panel. One final drawing was submitted to the AEC. Construction was done in conjunction with other CMR Area work.

Engineering Costs	$ 1,202.56
Construction Costs	31,896.22
Total Over-all Costs	$ 33,098.78

BLDG. 340A THRU G - DEWAR SHELTER

The design of this building after several changes in design criteria emerged as seven wooden sheds 40'-0" x 20'-0" x 20'-5" mean height, with three open sides and the side to windward closed. Construction was of laminated wood girders and wood columns resting on concrete footings. A composition roof over wood sheathing was installed. The floor was stabilized coral. Design was started 1 November 1951, submitted 21 February 1952 and received AEC approval 24 March 1952, and issued to Jobsite 27 March 1952. One final drawing was subsequently submitted to the AEC. Time schedule for construction was

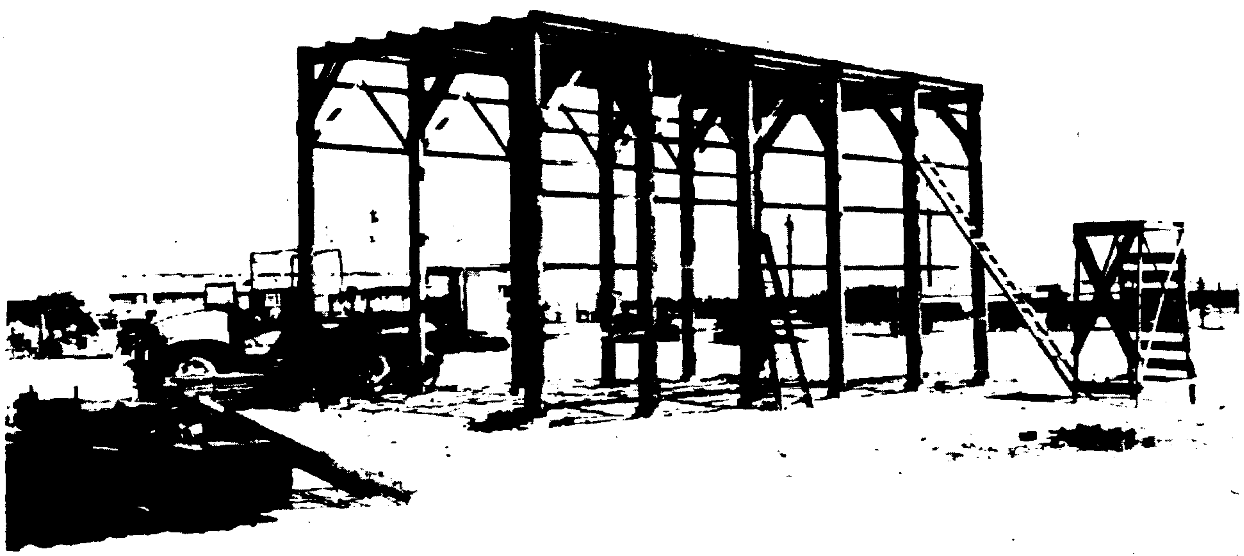


Figure 2-43. Typical Dewar Shelter Under Construction

9 April 1952 to 1 June 1952. Drawings were released 28 March 1952, construction started 9 April 1952 and was completed 2 August 1952. Figure 2-43 shows progress of construction and framing as of 6 June 1952. AEC acceptance was received on 30 September 1952. There was one "As-Built" drawing.

Engineering Costs	
(Including Design Work)	$ 353.00
Construction Costs	65,908.33
Total Over-all Costs	$ 66,261.33

BLDG. 340-H - STORAGE SHED

This new building was a wood frame structure having laminated wood girders and columns with corrugated aluminum siding on all four sides. It was originally designed as a Dewar Shelter but later modified so as to provide a storage shed for Cambridge Corporation supplies. It was similar to Bldgs. 340-A thru 340-G except that a 16'-0" x 20'-0" mezzanine floor was added at a height of 10'-5" above the main floor. Original design was started on 1 November 1951, submitted on 21 February 1952, and received AEC approval on 24 March 1952. Modifications to this design is shown on Field Sketch 773. Final drawings were subsequently submitted to the AEC.

Construction was started on 9 April 1952 on original drawings. Modified drawings were released 17 July 1952 and construction was completed on 9 August

1952. AEC acceptance was received on 30 September 1952. There was one "As-Built" drawing.

Engineering Costs	
(Including Design Work)	$ 50.43
Construction Costs	14,867.13
Total Over-all Costs	$ 14,917.56

BLDG. 341 - DEWAR REPAIR SHOP

This new building was a one-story structure consisting of a south wing of rigid steel frame construction with protected metal siding and a north wing of wood stud and corrugated aluminum siding. The building had a dehumidified room, equipment and toilet rooms and was fitted with an overhead trolley traveling crane so as to be used as a Dewar Repair Shop. The original design criteria called for a 40'-0" x 40'-0" x 30'-0" shop with two cranes, an electrically non-conductive floor and explosion-proof electric motors and fixtures. Prior to acceptance of plans, design criteria were changed. The size of the building was altered, one crane instead of two was to be provided, explosion-proof requirements were eliminated and a standard gauge railway track at floor level to run length of building was added and other changes made. The design was started on 1 November 1951, was revised on 3 January 1952, submitted from 3 January 1952 thru 22 February 1952 and was approved by AEC on 24 March 1952. Seven final drawings were submitted to the AEC. Time schedule for construction was 1 March 1952 - 15 July 1952. Drawings were released on 8 April 1952, construction started on 15 April 1952 and completed on 2 August 1952. Figure 2-44 is a general view showing the crane placed and roof partially placed and progress as of 6 June 1952. Figure 2-45 depicts the structure from the west and progress of work on 5 July 1952. AEC acceptance was received on 30 September 1952. There were six "As-Built" drawings and one supplement.

Engineering Costs	
(Including Design Work)	$ 5,807.65
Construction Costs	187,200.63
Total Over-all Costs	$ 193,008.28

SUB STATION 341 (T-27)

A concrete slab structure 9'-0" x 6'-6" located 9'-0" west of Bldg. 341. This sub station was similar to the other sub stations as previously reported for this area. One final drawing was furnished to the AEC.

Engineering Costs	
(Including Design Work)	$ 618.96
Construction Costs	
(Including three 50 KVA transformers)	16,417.01
Total Over-all Costs	$ 17,035.97

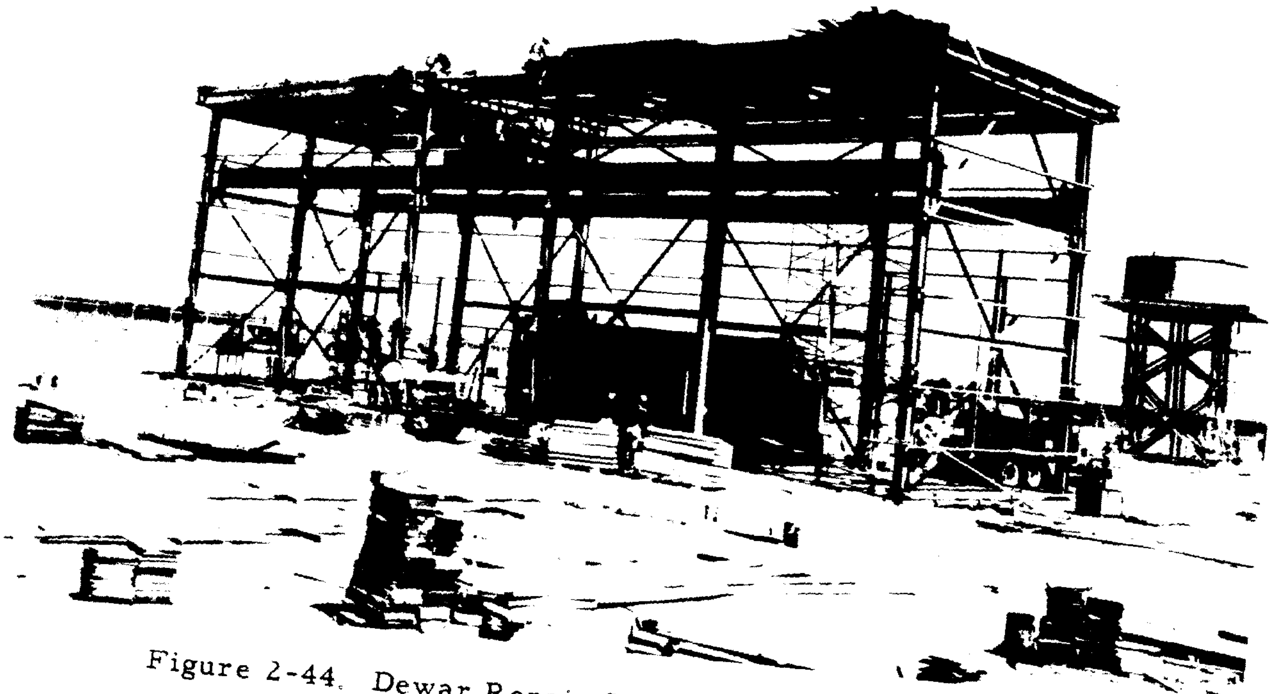


Figure 2-44. Dewar Repair Shop with Roof and Crane Placed

Figure 2-45. Dewar Repair Shop Nearing Completion

BLDG. 342 - MACHINE SHOP

This new building consisted of two separate one-story standard type aluminum buildings. The larger unit was designed and constructed as a complete machine shop with tool crib and office and was completely sealed from the exterior and dehumidified. The smaller unit contained the dehumidification equipment. Design was started on 29 October 1951 and submitted on 22 February 1952, received AEC approval on 12 March 1952 and was issued to Jobsite on 19 March 1952. Four final drawings were subsequently submitted to the AEC. Construction was scheduled from 28 March 1952 to 21 July 1952. Drawings were released on 26 March 1952, construction started on 28 March and was completed on 2 August 1952. AEC acceptance was received on 30 September 1952. There were four "As-Built" drawings.

Engineering Costs (Including Design Work)	$ 3,203.25
Construction Costs (Including installed machine shop equipment and tools)	87,005.37
Total Over-all Costs	$ 90,208.62

SUB STATION 342 (T-25)

This sub station was similar to previous sub stations reported. The slab was 9'-8" x 7'-6" and contained two built-in pull boxes, one power section and one communication section. Three 15 KVA transformers were installed.

Engineering Costs (Including Design Work)	$ 274.23
Construction Costs	7,273.57
Total Over-all Costs	$ 7,547.80

BLDG. 344 - CRYOGENICS PLANT

This was a new cryogenics plant. Plans for this plant were first discussed with representatives of the AEC on 17 October 1951 and initial work was based on drawings prepared for a similar installation at Boulder, Colorado. The original time schedule called for construction to begin 1 December 1951. However, design criteria changed frequently and with consequent delays. The building as finally designed and constructed was a one-story structure, irregular in shape and was of two types of construction. The main portion was a rigid steel frame with corrugated aluminum siding and roofing, separated into two production rooms by an 8" thick x 8'-0" high reinforced concrete wall. The remaining portion of the building was of wood stud and corrugated aluminum over plywood siding construction. One of the production rooms was explosion-proof with spark-proof flooring. The design was started on 26 October 1951, plans were submitted on 21 February 1952 thru 11 March 1952, received AEC approval on 4 March 1952 and were issued to Jobsite on 11 March 1952 thru 7 April 1952. Final drawings were submitted to the AEC. The time schedule for construction was 5 March 1952 - 15 May 1952. Drawings were released for construction on 4 March 1952 and construction was started on 5 March 1952. Modifications were made by field sketches during construction to provide an auxiliary compressor shed (ECO 288) and floodlights (ECO 284). Figure 2-46 shows foundation preparations and status as of 18 March 1952. Figure 2-47 depicts forms and reinforcement progress as of 27 March 1952. Figure 2-48 also depicts placement of reinforcing steel for the liquefier pit as of 19 April 1952. Figure 2-49 shows the uncrating of nitrogen tanks on 19 May 1952. Figure 2-50 shows the installation of the third layer of gas holders as of 29 May 1952. Figure 2-51 depicts status of work as of 29 May 1952. Figure 2-52 is a general view of the installed compressors on 10 June 1952. Figure 2-53 depicts progress of construction on 26 June 1952. The building was completed on 2 August 1952 and was accepted by AEC on 30 September 1952. There were 30 "As-Built" drawings and one field sketch.

Engineering Costs	
(Including Design Work)	$ 20,460.27
Construction Costs	511,432.33
Total Over-all Costs	$ 531,892.60

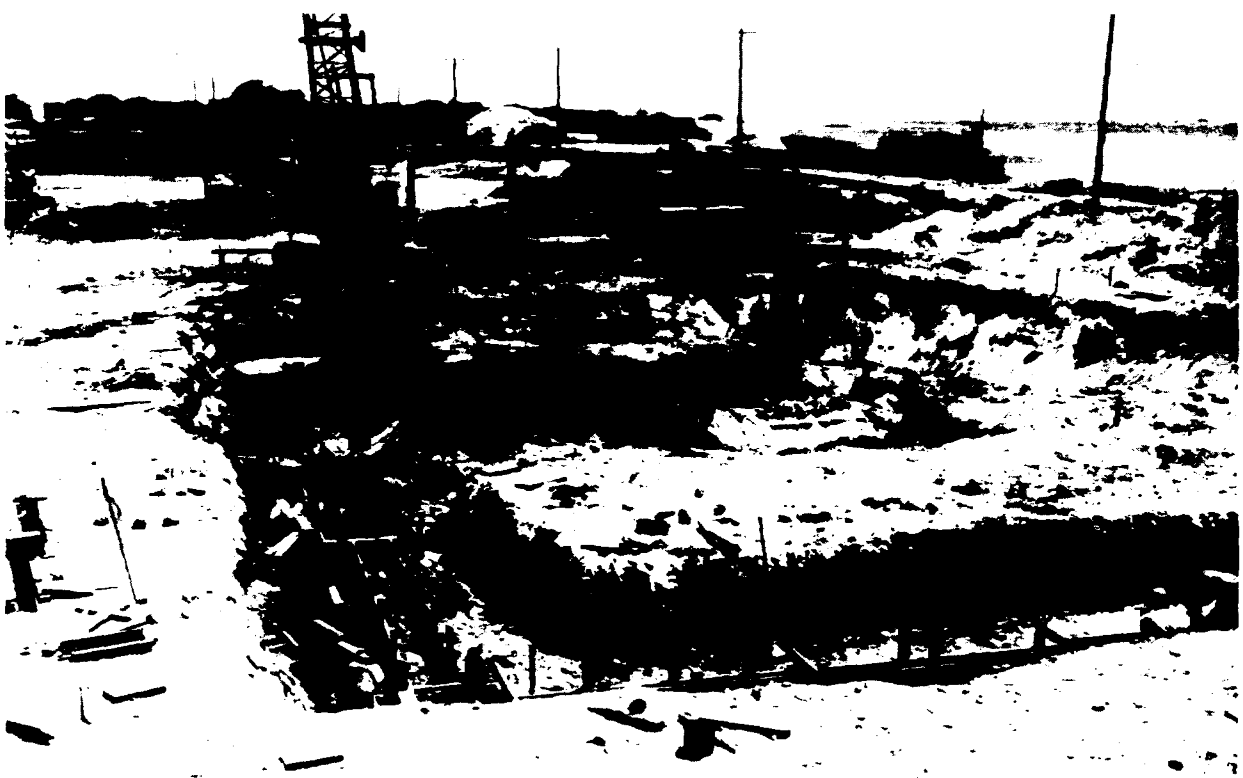


Figure 2-46. Foundations for Bldg. 344

Figure 2-47. Placing Reinforcing Steel for Bldg. 344

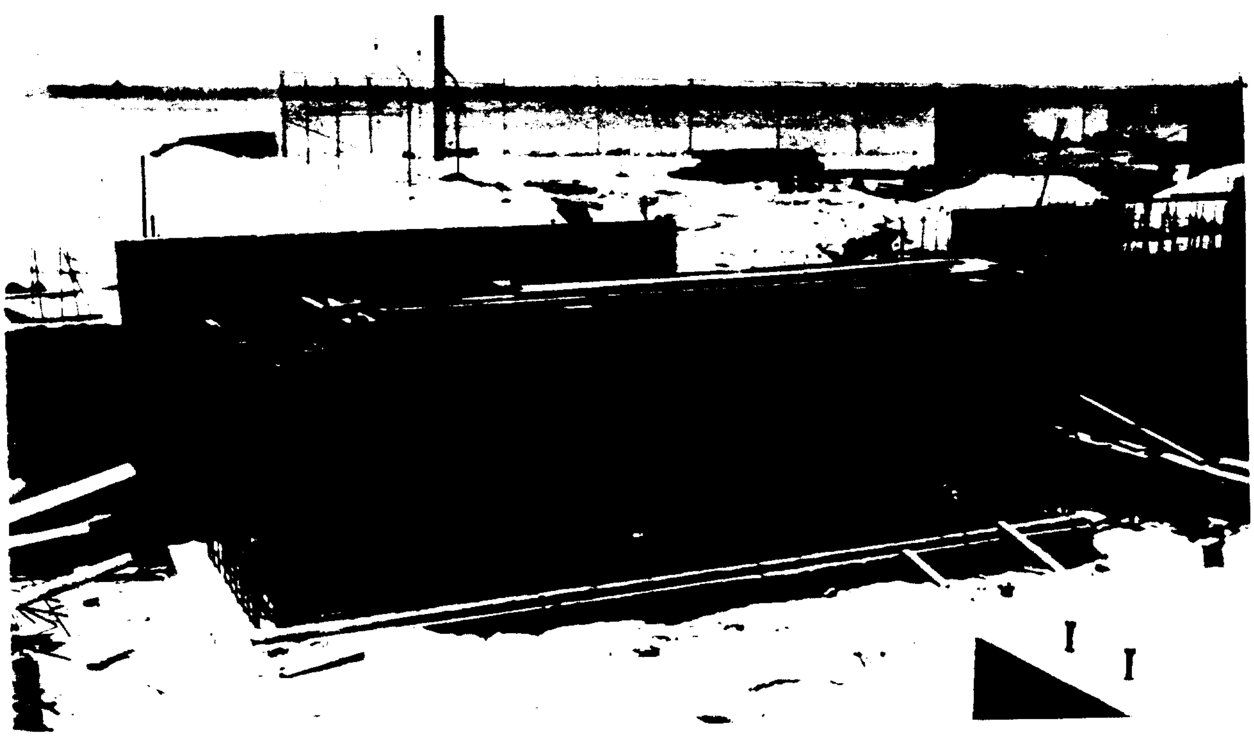


Figure 2-48. Liquifier Pit for Bldg. 344

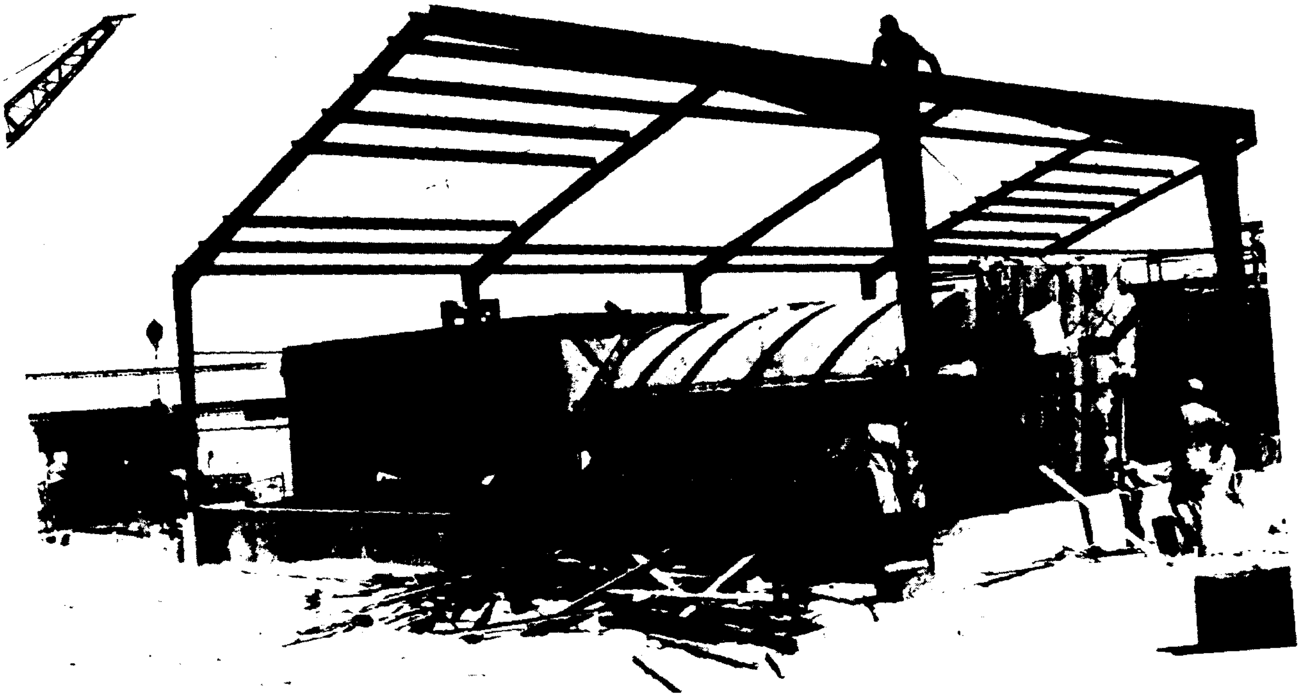


Figure 2-49. Uncrating Nitrogen Tanks for Bldg. 344

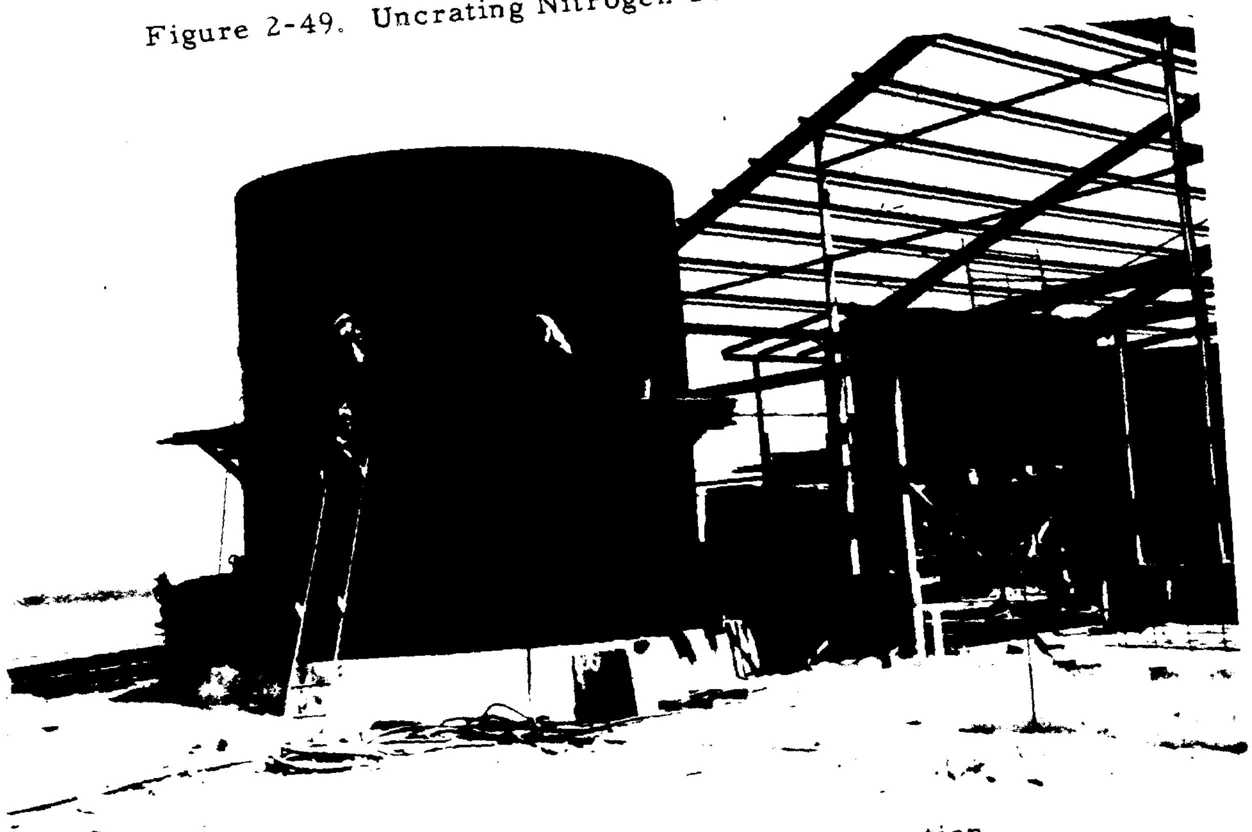


Figure 2-50. Gas Holer Under Construction

Figure 2-51. Progress on Bldg. 344 on 29 May

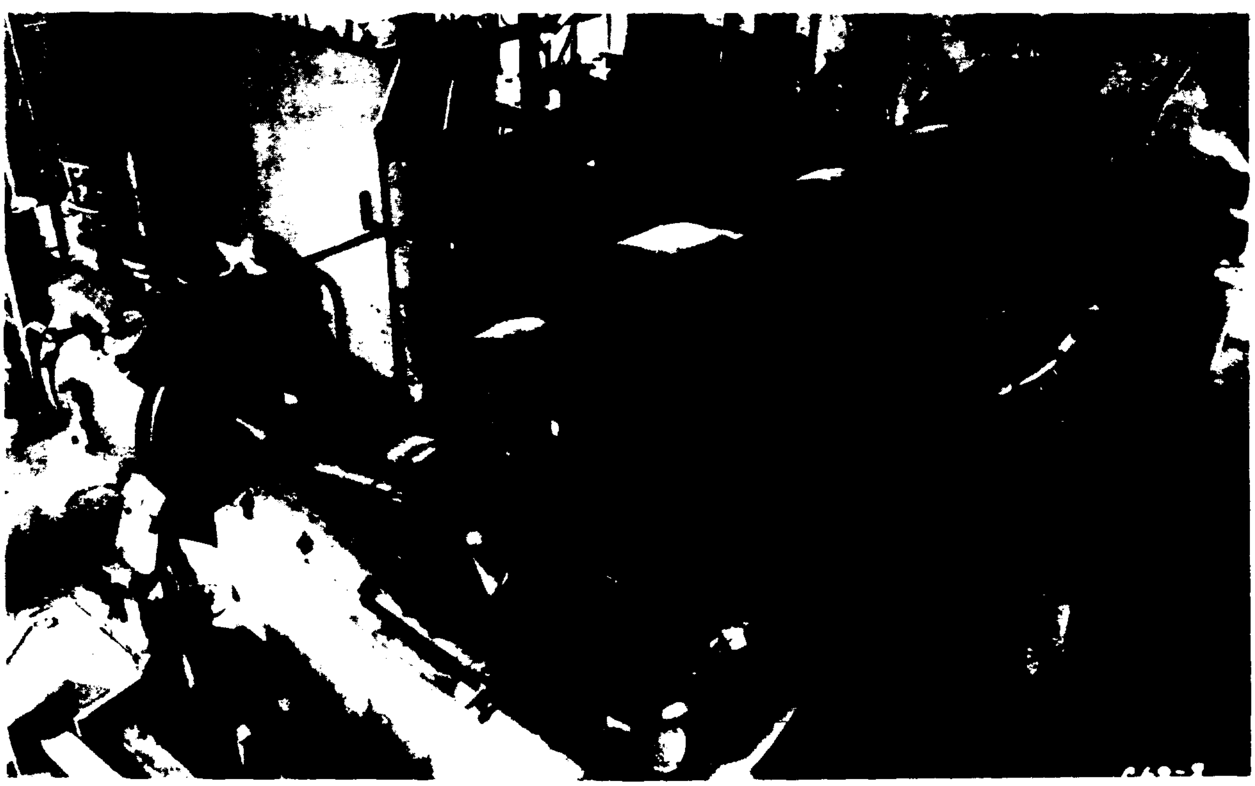


Figure 2-52. Compressors Installed on Bldg. 344

Figure 2-53. Progress on Bldg. 344 as of 26 June

SUB STATION 344 (T-24)

This sub station was similar to the other sub stations reported in this area. The slab was 8'-0" x 8'-0" and installed equipment included one 1250 KVA outdoor transformer. Two final drawings were submitted to the AEC.

Engineering Costs (Including Design Work)	$ 1,089.76
Construction Costs	28,904.25
Total Over-all Costs	$ 29,994.01

BLDG. 345 - CYLINDER RACKS (UNITS A AND B)

This building consisted of reinforced concrete foundations for cylinder racks. Each unit consisted of two parallel foundations 19'-0" c.c. extending from 1'-6" below grade to 2'-0" above grade, length 90'-0". Original design criteria received in November 1951 called for four tarpaulin covered sheds, which were later changed to four concrete walls and then changed to the final approved design. The design was started on 2 November 1952, submitted on 14 February 1952, received AEC approval on 19 February 1952 and drawings were issued on 22 February 1952. One final drawing was submitted to the AEC. Construction was scheduled from 7 March to 31 March 1952. Drawings were released on 4 March 1952, construction was initiated on 7 March 1952 and completed on 15

April 1952. AEC acceptance was received on 22 September 1952. There was one "As-Built" drawing.

Engineering Costs	
(Including Design Work)	$ 481.43
Construction Costs	12,043.65
Total Over-all Costs	$ 12,525.08

COMMUNICATION FACILITIES - CMR AREA

The communication system - CMR Area consisted of public address speakers, amplifiers and telephone terminal cabinets, outlets, and pull boxes with necessary wiring and conduits. Speakers were located one at pole 16. two each at poles 8, 20 and 23, one in Bldg. 342, two each in Bldgs. 329 and 341 and eight each in Bldgs. 330 and 344. Design was started on 21 November 1951, submitted for approval on 17 April 1952, received AEC approval on 30 April 1952 and issued to Jobsite on 3 June 1952. One final drawing was subsequently submitted to the AEC. Drawings were released at Jobsite for construction on 27 May 1952. No time schedule was established. Construction started on 30 May 1952 and was completed on 17 September 1952. AEC acceptance was received on 30 September 1952. There was one "As-Built" drawing.

Engineering Costs	
(Including Design Work)	$ 998.80
Construction Costs	39,778.92
Total Over-all Costs	$ 40,777.72

ELECTRICAL FACILITIES - POWER DISTRIBUTION - CMR AREA

Power distribution in the CMR Area consisted of 36 poles of various heights with fixtures and pull boxes, together with overhead and underground transmission lines and conduits. The transmission systems consisted of 2400 volt overhead lines, bare copper of various sizes and 2400 volt underground conductor in conduit and service drop triple brand W.P. wire. The system also feeds the baseball area. Design was started on 1 January 1952, submitted on 9 April 1952, AEC approval was received on 17 April 1952 and the drawings were issued on 25 April 1952. Two final drawings were subsequently submitted to the AEC. Construction was scheduled to start on 24 April 1952 and started on that date. It was completed on 2 August 1952 and AEC acceptance of this work was received on 30 September 1952. There was one "As-Built" drawing and one field sketch covering this work.

Engineering Costs	
(Including Design Work)	$ 2,872.74
Construction Costs	76,195.26
Total Over-all Costs	$ 79.068.00

SECURITY FENCING - CMR AREA

The security fencing, CMR Area, consisted of 2" wire chain mesh with 2" H-section posts set in concrete at approximately 10'-0" center. Each post had a bracket on top, which holds three strands of barbed wire. A typical fence is 8'-0" high including height of barbed wire top. Design of fencing started on 6 November 1951, was submitted on 15 February 1952 and was issued to Jobsite on 30 March 1952. One final drawing was subsequently submitted to the AEC. The construction of fencing was scheduled to start 31 March 1952 and to be completed 15 June 1952. It was completed on 11 July 1952 and accepted by AEC on 30 September 1952. There was one "As-Built" drawing.

Engineering Costs	
(Including Design Work)	$ 2,229.71
Construction Costs	15,119.81
Total Over-all Costs	$ 17,349.52

BLDG. 362 - GUARD SHACK

A wood frame building resting on a 12'-0" x 8'-0" concrete slab with average height of 8'-0", was completed on 2 August 1952, and accepted by AEC on 30 September 1952. One field sketch was submitted to the AEC.

Construction Costs	$ 625.00
Total Over-all Costs	$ 625.00

SECURITY LIGHTING - CMR AREA

The security lighting consisted of 29 series street lighting luminaires mounted on power distribution poles and miscellaneous flood lights throughout the area. Plans were submitted on 9 April 1952, approved by AEC on 17 April and issued to Jobsite on 25 April. Final plans were subsequently submitted to the AEC. Construction started on 15 May 1952, was completed on 11 July and accepted by AEC on 30 September. There was one plan which had one revision and one field sketch.

Engineering Costs	
(Including Design Work)	$ 1,097.26
Construction Costs	8,039.73
Total Over-all Costs	$ 9,136.99

ELECTRICAL FACILITIES - POWER DISTRIBUTION

A tie line of three #4/0 AWG bare copper wire each 6,920 feet long was installed with new crossarms on existing poles to feed power from the CMR Power Plant to the distribution panels in the old power plant, so that only one plant need be operated during periods of reduced power demands. Where this line passed the airport it was installed underground in three 4" transite ducts using for this section three single conductor #4/0 neoprene jacketed cables each 800 feet long.

Distribution lines to Station 606 and Tower Stations 301 and 805 were installed of three #1/0 bare stranded copper cables with twelve forty-foot poles and six transformers installed on poles. Two forty-five-foot poles, three #1/0 bare stranded cables with transformers were installed to provide service to new warehouse. Design was started on 1 January 1952, was submitted from 9 April 1952 thru 31 July, drawings were approved by AEC from 17 April thru 6 August and were issued from 25 April thru 13 August 1952. Final drawings were subsequently submitted to the AEC. Construction was scheduled as drawings were received throughout the period. Construction started on 25 April 1952 and was completed on 2 August 1952. AEC acceptance was received on 30 September 1952. There were 12 "As-Built" drawings covering this work.

Engineering Costs	
(Including Design Work)	$ 876.58
Construction Costs	23,249.77
Total Over-all Costs	$ 24,126.35

BLDG. 339 - POWER PLANT

This new power plant building 100'-6" x 64'-6" x 20'-10" mean height was constructed by using a prefabricated Butler-type building to which was added a lean-to along the entire wing of the building. The building was designed and constructed to house four 1000 KW diesel driven generators, with switchboard, panels and auxiliary equipment. As power requirements for the CMR Area were reduced on cancellation of Bldg. 338 only three generators were installed. The design was started on 26 October 1951, plans submitted from 15 November thru 25 March 1952 and AEC approvals were received from 3 December 1951 thru 7 April 1952. Plans were issued to Jobsite from 27 November 1951 thru 1 April 1952. Final drawings were subsequently submitted to the AEC. Drawings were released for construction 17 December 1951 and construction started same date, with time schedule 17 December 1951 to 1 July 1952. The prefabricated building received was not a standard structure and many modifications were necessary in erection. Figure 2-54 shows progress of construction on 13 March 1952. Bus bars were being installed by 19 April 1952. Figure 2-55 depicts a general view of the mechanical equipment adjacent to Diesel No.1. Figure 2-56 shows status as of 8 May 1952. Figure 2-57 depicts progress of installation of salt water supply piping on 20 May 1952. Figure 2-58 details the progress of installation of POL facilities for the power plant as of 6 June 1952. Figure 2-59 is a general view from the northwest and denotes exterior progress on

Figure 2-54. Progress on New Power Plant, Elmer, on 13 March

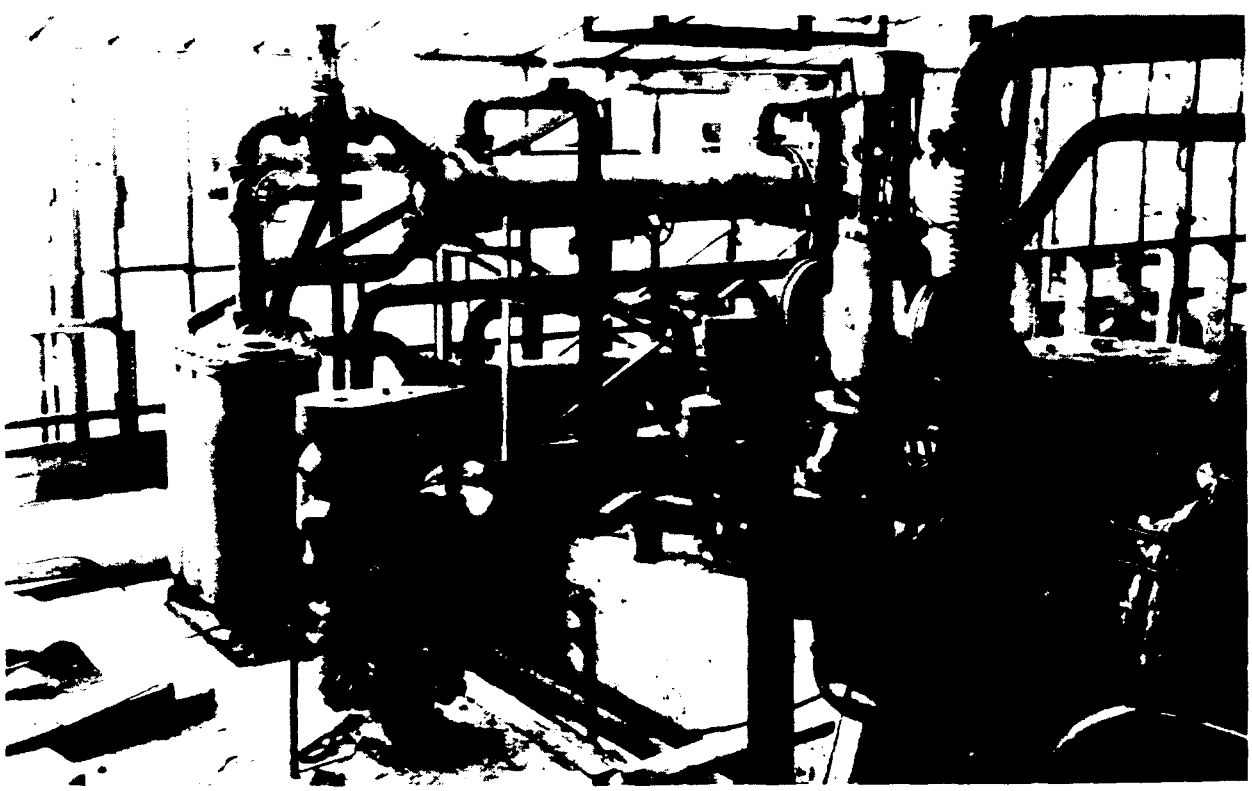


Figure 2-55. Diesel Unit No. 1 and Mechanical Equipment, Power Plant

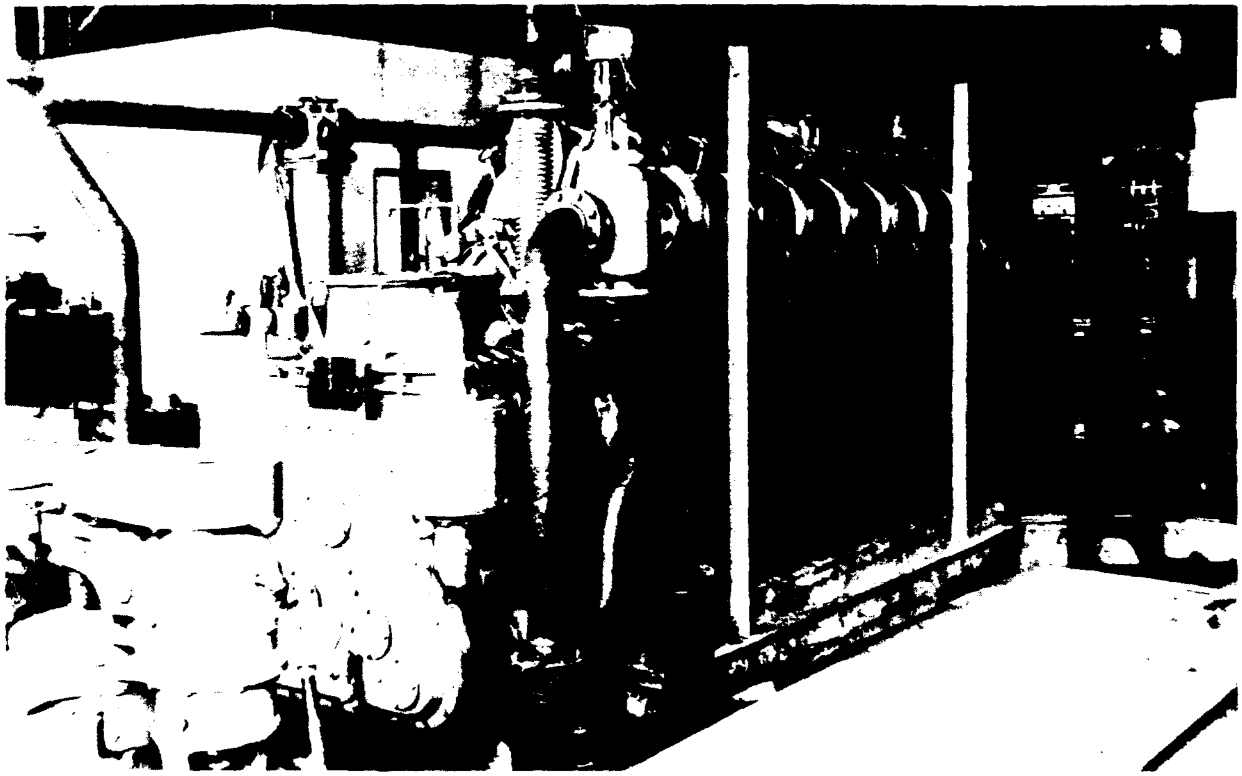


Figure 2-56. Diesel Unit No. 1, Power Plant

Figure 2-57. Installation of Salt Water Piping to Power Plant

Figure 2-58. Installation of POL Facilities, CMR Power Plant

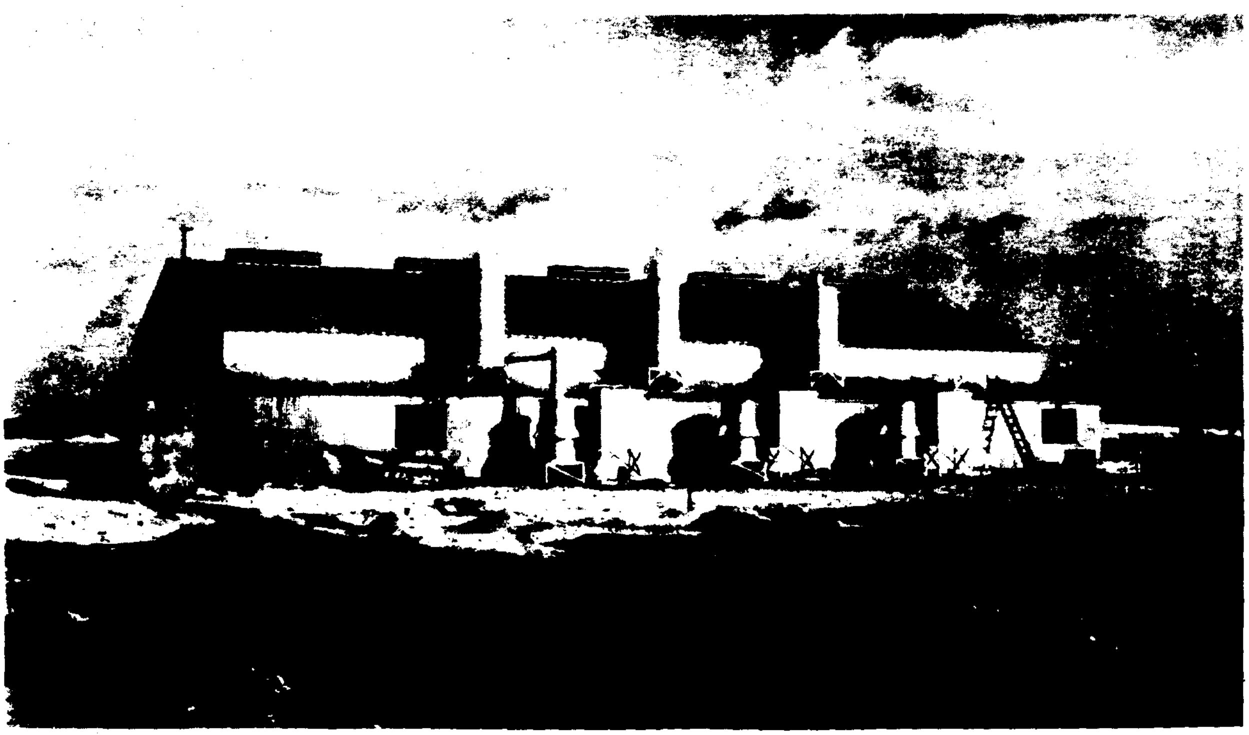


Figure 2-59. General View from Northwest of CMR Power Plant

10 June 1952. Construction was completed on 23 August 1952 and received AEC acceptance on 30 September 1952. There were 26 plans and 12 revisions thereto.

Engineering Costs (Including Design Work)	$ 24,894.43
Construction Costs	861,389.92
Total Over-all Costs	$ 886,284.35

BUILDING 347 - PUMP STATION - SALT WATER

This was a reinforced concrete structure 17'-6" x 28'-0" x 16'-6" high, with 12 inches only of the structure extending above grade, so as to be used as a salt water well to provide cooling water for heat exchangers and for fire protection in the CMR Area. The supply line extending into the lagoon consisted of 120 feet 42-inch diameter corrugated pipe on the inner end and 176 feet of 36-inch pipe on the outer end. Four 700 gpm pumps with automatic starts and stops were installed to provide salt water cooling for Bldgs. 330 and 344, and four 600 gpm pumps for the power plant with push button control in the power plant. Cross connections between the two systems were provided for emergency use. The design was started on 23 November 1951, was submitted from 5 January thru 12 February 1952, AEC approval was received from 5 January thru 6 March 1952 and plans were issued to Jobsite on 11 March. Five final drawings were subsequently submitted to the AEC. Drawings were released for

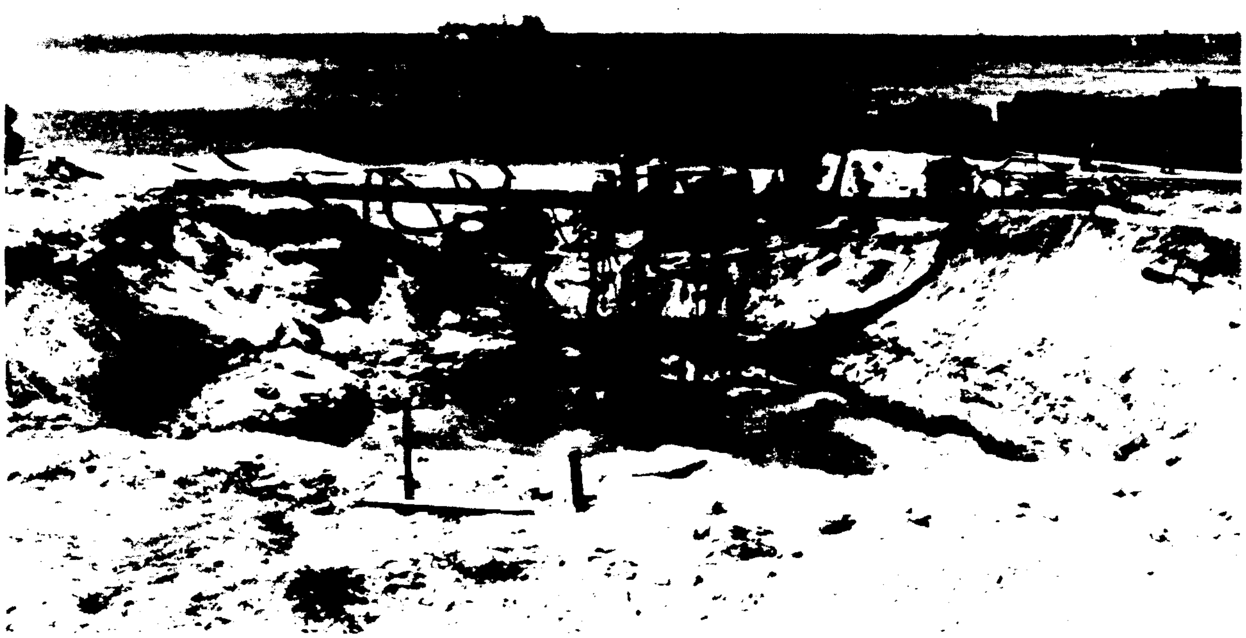


Figure 2-60. Pumping Operations at Pump Station Excavation

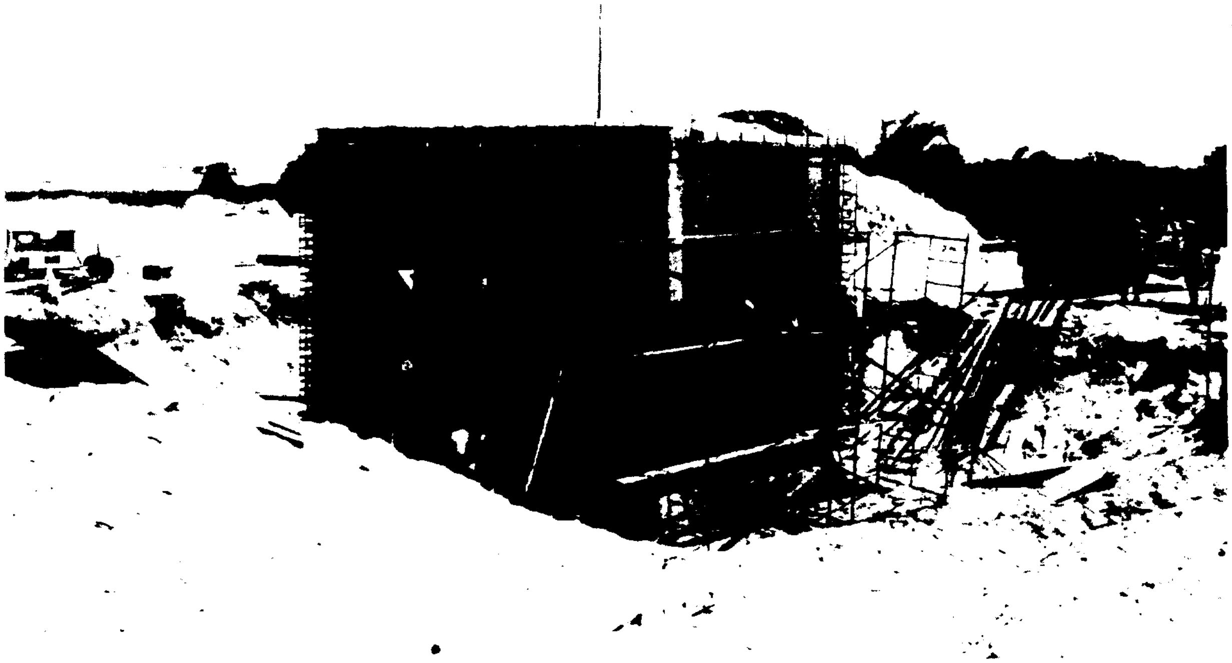


Figure 2-61. Erecting Wall Forms for Pump Station

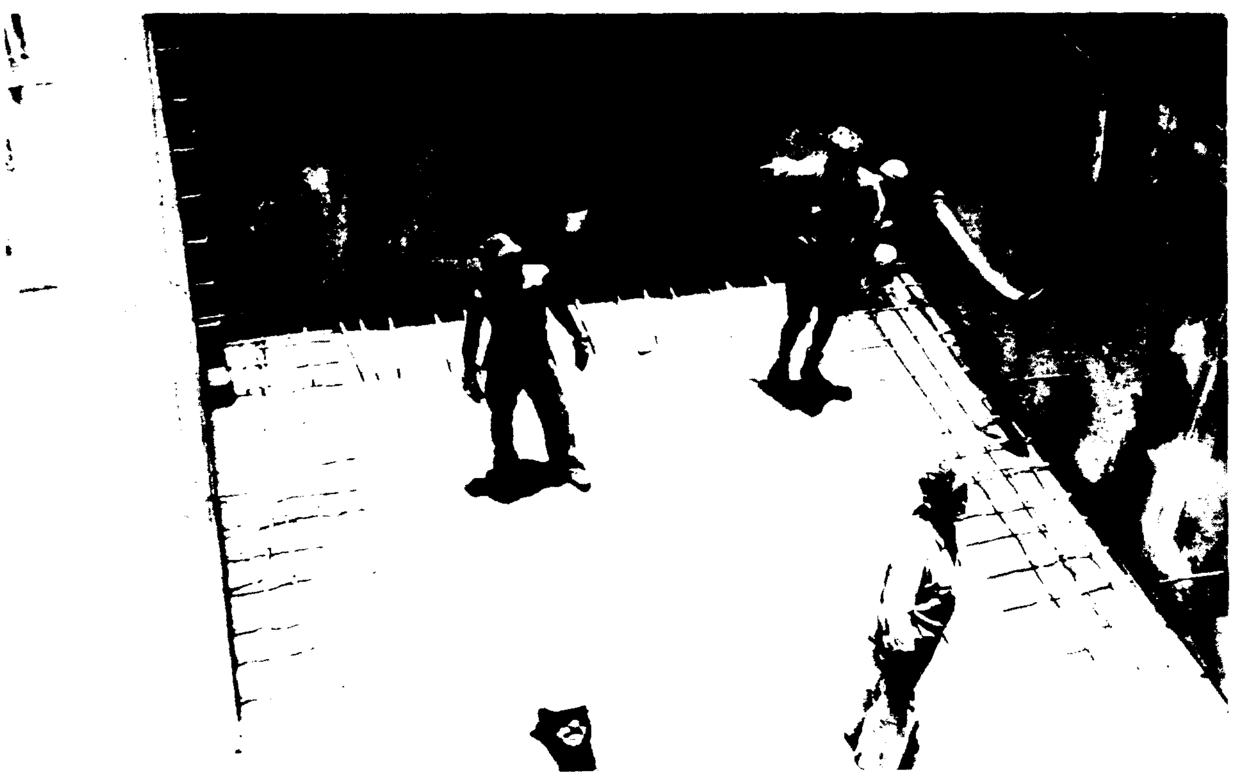


Figure 2-62. Pouring Sub-Floor Slab, Pump Station

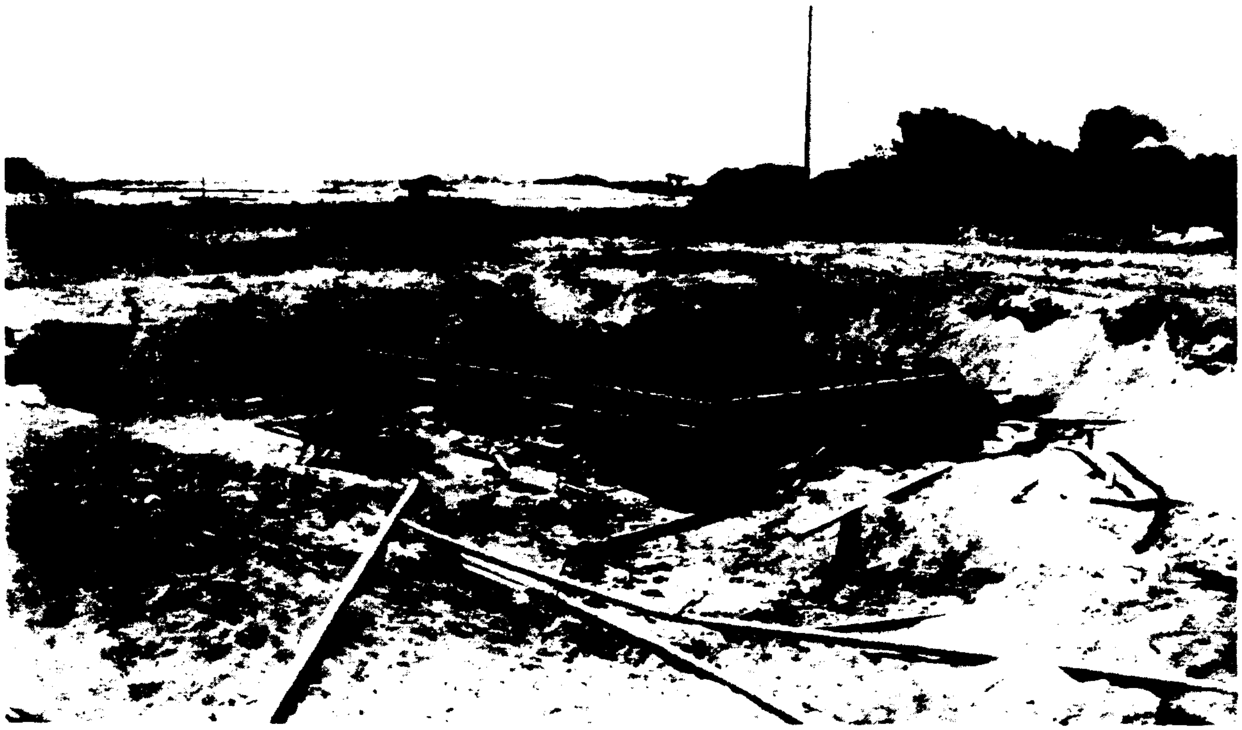


Figure 2-63. Steel Ballast in Place for Sinking Caisson

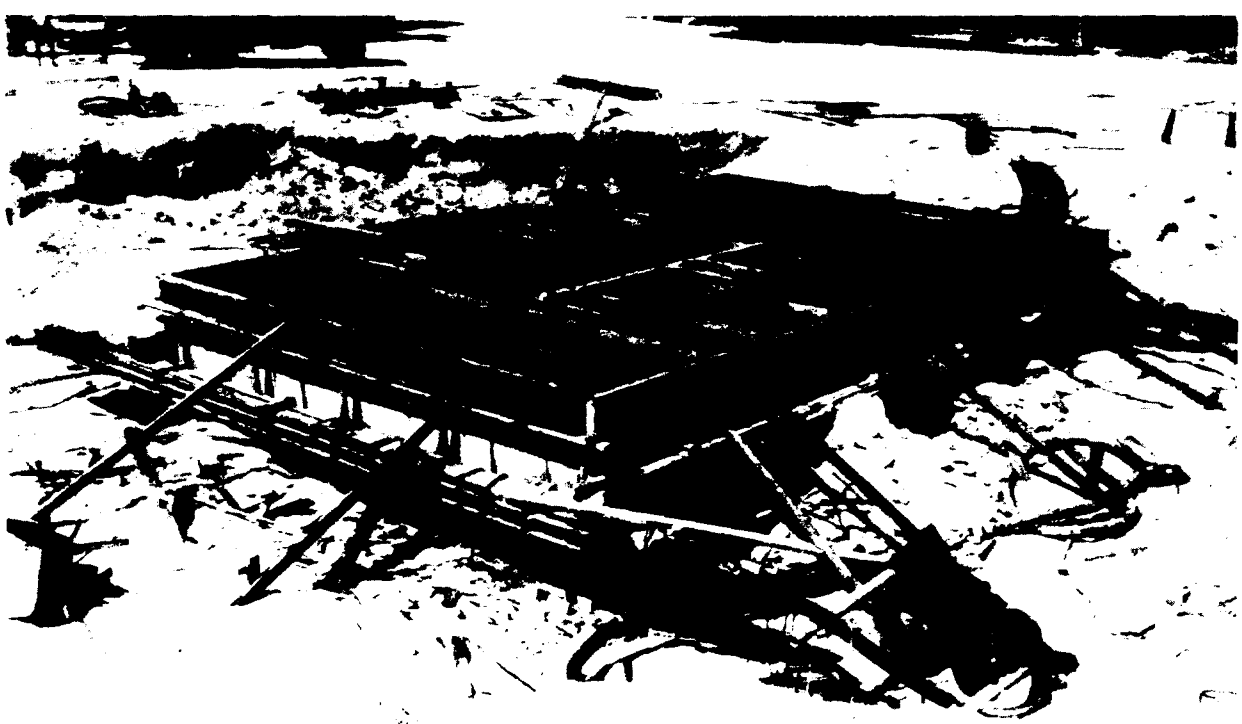


Figure 2-64. Roof Forms and Roof Reinforcement, Pump Station

Figure 2-65. Roof Poured and Pumps Set in Place

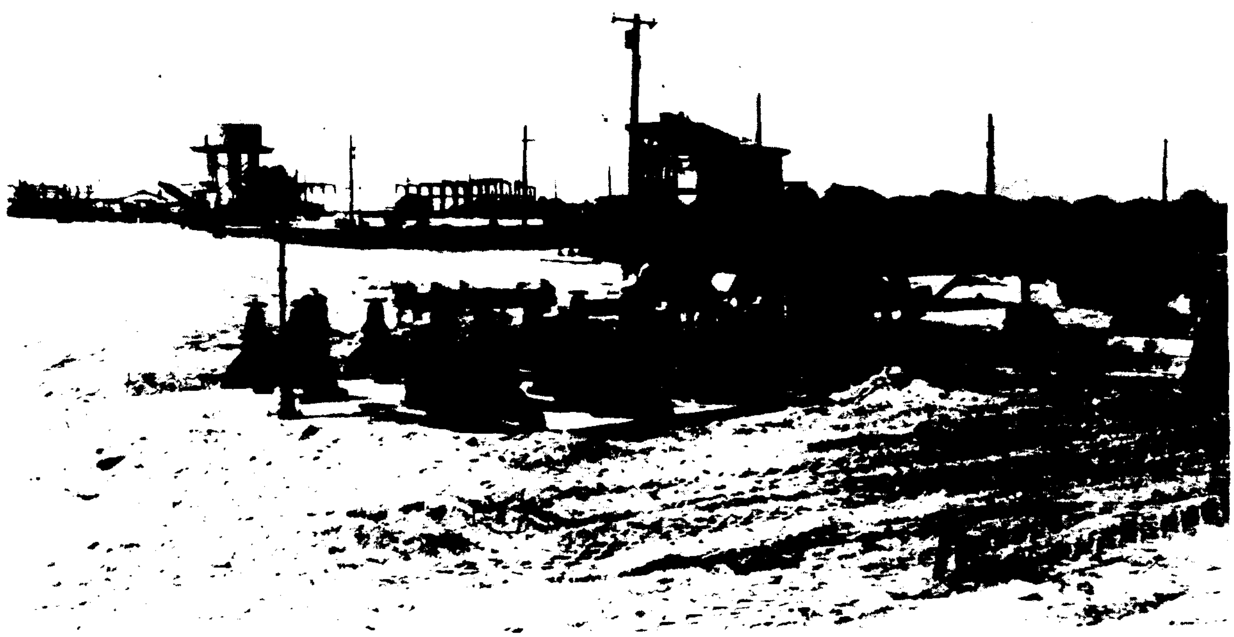


Figure 2-66. Pump Station Nearing Completion

construction on 15 February with a construction schedule set from 18 February to 30 April. Construction was started on 18 February 1952. Excavation encountered hard coral at a depth of 10 feet, requiring drilling and shooting. There was a considerable migration of sea water through permeable coral sands into the excavation which required pumping to keep the water at a workable level. Figure 2-60 shows pumping operations and construction progress as of 4 March 1952. When the coral excavation was of sufficient depth it was backfilled with sand to an elevation above water, so that the walls of the structure could be poured. This formed a caisson which was then sunk to the required depth by removing the filled-in sand by using air jetting (a compressor) and dragline. The floor was then poured and construction completed. Figure 2-61 denotes progress on 18 March and Figure 2-62 depicts preparations for pouring the subfloor slab on 19 April. Figure 2-63 was photographed on 24 April when the 20,000 lbs. of steel ballast was in place. Figure 2-64 shows the roof forms and reinforcing steel in place as of 10 May 1952. The pumps were set in place 10 June, as noted in Figure 2-65. Figure 2-66 depicts the electrical hook-up of pumps on 17 June. The need for modifications later developed and the following additional work was performed:

1. Extension of the 36-inch pipe an additional 110 feet into the lagoon to clear an area of marine vegetation in order to reduce the accumulation of this growth on pump intake grids. This was accomplished under ECO 276 issued on 21 July 1952, completed on 24 July and accepted by AEC on 22 September.

2. Erection of a wood and corrugated metal shelter adjacent to Bldg. 347 to protect pump electrical control equipment from the elements. This work was covered by ECO 278 released 11 August 1952, although work was started on 21 July. It was completed on 11 November and AEC acceptance was received on 6 December.

3. Installation of six expanded stainless steel screens in salt water pump house (Bldg. 347) to act as a strainer, as a heavy deposit of marine vegetation was still entering the well from the lagoon. This work was covered by ECO 293 released on 4 September and was completed on 13 September.

Engineering Costs (Including Design Work)	$ 2,945.05
Construction Costs	123,572.81
Total Over-all Costs	$ 126,517.86

ROADS AND AREAS - STABILIZED

The stabilized roads and areas consisted of stabilized coral, with grades determined in the field. There were 303,350 square yards of stabilized area, 3,725 square yards of new roads and 740 square yards of rebuilt roads. Design was started on 6 November 1951, submitted on 15 February 1952 and was issued to the Jobsite on 20 March. One final drawing was subsequently submitted to the AEC. Drawing was released at Jobsite on 29 March, with construction scheduled to start on 31 March. Construction was completed 21 August, and was accepted by AEC on 30 September. There was one "As-Built" drawing.

Engineering Costs	
(Including Design Work)	$ 188.27
Construction Costs	73,820.85
Total Over-all Costs	$ 74,009.12

SALT WATER COOLING DISTRIBUTION SYSTEM - CMR AREA

This was an underground transite piping system for distributing salt water for equipment cooling purposes from the salt water intake in Bldg. 347 to Bldgs. 330, 339, 344 and 349. Included in this system was a reinforced concrete combination standpipe and manhole located near Bldg. 339 of inside dimensions 3'-0" square and 12'-8" deep. All piping was approximately 4'-9" below grade. There was a total of 1,920 lineal feet of 4" transite mains. A dual strainer in a bypass of the main distribution line was added. This was found necessary to avoid excessive maintenance and shut downs due to clogging of tube sheets of heat exchangers by heavy deposits of sea moss. Original design was started on 6 November 1952, was submitted for approval by AEC on 27 March 1952 and was issued to Jobsite on 27 March 1952. Engineering and design for the strainers was accomplished in the field and drawings were released on 12 July 1952. Final drawings were subsequently submitted to the AEC. Drawings were released for construction at Jobsite on 2 April 1952; construction was initiated on 1 May 1952. The underground piping system was completed on 1 July 1952, and the strainers on 11 August 1952. Final acceptance by AEC was received on 30 September 1952. There were two "As-Built" drawings and one field sketch covering this work.

Engineering Costs	
(Including Design Work)	$ 1,217.66
Construction Costs	48,085.69
Total Over-all Costs	$ 49,303.35

SANITARY SEWER SYSTEMS AND COOLING WATER WASTE SYSTEMS

This was a combined system of cooling water waste and sanitary sewer consisting of three sections as follows: The northeast section from power plant to ocean reef of 383 lineal feet of 21" VCP, with two manholes and six service connections; the Central Section of 235 lineal feet of 18" VCP, 25 feet of 12" VCP, 519 feet of 8" VCP, 55 feet of 6" VCP with six standard manholes with outfall to the lagoon; the north section of 102 feet of 8" VCP with one standard manhole and outfall to the lagoon. Design was started on 21 November 1952, was submitted for approval on 21 February 1952, AEC acceptance was received on 27 March 1952, and plans were issued on 27 March 1952. A final drawing was submitted to the AEC. Construction was scheduled from 3 April 1952, indefinitely. Physical construction was initiated on 4 April 1952, and completed on 30 June 1952. AEC acceptance was received on 22 September 1952. There was one "As-Built" drawing.

Engineering Costs (Including Design Work)	$ 5,364.24
Construction Costs	29,878.14
Total Over-all Costs	$ 35,242.38

BLDG. 349 - SALT WATER TOWER TANK

Bldg. 349 was a 30-foot high salt water tower, with a 500 barrel tank. The tower was constructed of 10" x 10" wood columns with a 4" x 12" beam platform. This tank floated on the line of the salt water cooling supply from Bldg. 347 to Bldgs. 330 and 344. Design was started on 26 November 1951, was submitted from 17 January 1952 thru 13 March 1952, AEC approvals were received from 22 January thru 10 April and were issued to Jobsite from 31 January thru 15 April. Final drawings were subsequently submitted to the AEC. Drawings were released on 26 February, with construction scheduled to start on 3 March. Construction was started on 3 March, complete on 21 July, and accepted by AEC on 30 September. There were two "As-Built" drawings.

Engineering Costs (Including Design Work)	$ 575.56
Construction Costs	28,370.85
Total Over-all Costs	$ 28,946.41

DOMESTIC WATER SYSTEMS (FRESH AND SALT) - CMR AREA

A fresh and salt water distribution system for domestic use was installed consisting of 1920 feet of 4" transite pipe, with cast iron fittings and valves. Design was started on 21 November 1951, submitted on 21 February 1952 and AEC approval was received on 27 March. Plans were issued to Jobsite on 27 March. Final drawing was subsequently submitted to the AEC. Construction was scheduled to start on 3 April and was started on 1 May. The work was completed on 1 July, and received AEC acceptance on 22 September. There was one "As-Built" drawing.

Engineering Costs (Including Design Work)	$ 478.58
Construction Costs	15,288.95
Total Over-all Costs	$ 15,767.53

SECTION 6. FRED

BLDG. 4-A - ADDITIONS TO

A new antenna tuning box shelter, wood with corrugated aluminum roof and sides was constructed.

Construction started on 16 July 1952, was completed on 18 July 1952 and accepted by AEC on 6 December 1952.

Construction Costs	$ 351.77
Total Over-all Costs	$ 351.77

BLDG. 15 - MODIFICATIONS TO

This prefabricated aluminum H-shaped building was the Task Group Headquarters. Work hereunder covered by ECO 89A pertained to the installation of a dehumidification unit for the dehumidification of code and teletype rooms.

Construction of this addition was initiated on 27 May 1952 and was completed on 31 December 1952.

Engineering Costs (Including Design Work)	$ 1,036.34
Construction Costs	13,793.78
Total Over-all Costs	$ 14,830.12

BLDG. 61 - ADDITIONS TO

Bldg. 61 was a corrugated metal jumbo quonset hut used as a warehouse. Work hereunder pertained to the installation of a new three phase, 220 volt electrical service line. Engineering performed in the field was recommended on 29 July 1952 and had been approved by AEC approval of TG 132.2 Work Order 117.

Physical construction of this addition was initiated on 29 July 1952 and was completed on 15 September 1952. AEC acceptance was received on 6 December 1952.

Construction Costs	$ 379.17
Total Over-all Costs	$ 379.17

BLDG. 118 - ADDITIONS TO

A new 3 phase, 220 volt power line cable from transformer station adjacent to building to power panel inside building was installed.

Work started on 29 July 1952, was completed on 27 August and accepted by AEC on 6 December 1952.

Construction Costs	$ 419.22
Total Over-all Costs	$ 419.22

BLDGS. 153 AND 155 - MODIFICATIONS TO

Existing electric service lines were replaced. Work started on 10 October, was completed on 18 October and accepted by AEC on 6 December 1952.

Construction Costs	$ 153.36
Total Over-all Costs	$ 153.36

BLDG. 89 - ADDITIONS TO - BASE OPERATIONS

This building was used for Base Operations and consisted of an L-shaped prefabricated aluminum building with a wood and aluminum tower. Work covered by ECO 87A pertained to the construction of an additional one-story aluminum building of 13'-4" mean height and outside dimensions of 25'-2" x 50'-8-1/2". The building was set on a 7-inch thick x 30-inch high reinforced concrete wall. It had a 5-inch thick reinforced concrete floor. This addition was provided with two eight-foot sliding doors, double roof, and the necessary wiring and fixtures. Engineering and design accomplished in the field was recommended on 2 April 1952 and received AEC approval on 4 April 1952.

Construction of this addition started on 1 May 1952 and was completed on 7 June 1952. AEC acceptance was received 31 July 1952.

Engineering Costs (Including Design Work)	$ 34.29
Construction Costs	5,408.17
Total Over-all Costs	$ 5,442.46

BLAST PROTECTION - ALL BLDGS.

Blast protection to buildings and facilities. The details of work undertaken is covered in Book 6.

Engineering Costs	$ 4,109.62
Construction Costs	40,907.91
Total Over-all Costs	$ 45,017.53

DISTILLATION PLANT - ADDITIONS TO - BLDG. 56

This building used for the Power and Water Distillation Plant was a prefabricated aluminum building elevated on concrete walls. Work hereunder pertained to the installation of an additional 20 HP boiler with necessary auxiliary equipment to provide a needed stand-by boiler.

Construction of this addition was initiated on 7 April 1952 and was completed on 19 April 1952. AEC acceptance was received on 17 December 1952.

Construction Costs	$7,398.54
Total Over-all Costs	$7,398.54

FIRE HOUSE - ADDITIONS TO - BLDG. 29

This item consisted of extending the building 12 feet in length. Construction was accomplished by military personnel and the following costs represent material charges at Jobsite.

Construction Costs	$1,672.72
Total Over-all Costs	$1,672.72

LATRINE - 50-Man - BLDG. 185

A one-story wood and aluminum structure, 12'-0" x 12'-0" x 8'-8" set on concrete slab complete with wiring and plumbing, and included two lavatories, two urinals and two water closets.

Construction started on 18 March 1952, was completed on 18 April and was accepted by AEC on 31 July.

Construction Costs	$6,571.85
Total Over-all Costs	$6,571.85

MESS HALL - ADDITIONS TO

Work accomplished as authorized by ECO 88A consisted of additions to the mess hall as follows:

BUTCHER SHOP. This was a one-story aluminum construction, rectangular shape, 25'-2" x 25'-10-1/2" x 10'-10" mean height, set on 5" thick concrete slab. The double roof was separated by 3" x 4" redwood; vented window panels. The butcher shop was connected to the existing covered walk by an enclosed entry-way. It was complete with electrical wiring, fixtures and plumbing.

STORAGE ROOM. This was a one-story aluminum construction, rectangular shape, 25'-2" x 45'-10-1/2" x 10'-10" mean height, set on 5" thick concrete slab. The double roof was separated by 3" x 4" redwood. It was complete with electric wiring, fixtures and shelving.

DAIRY REFRIGERATOR. This was a portable refrigerator, 675 cubic feet capacity, set on timber skids. Complete with lighting and power wiring. Refrigerator was furnished by others.

ECO 3706 authorized the redesigning and rebuilding of a range hood, H & N No. K-349, AEC No. 5749, with three fans, and the installation of the hood into Bldg. 36.

Engineering Costs	$ 108.25
Construction Costs	9,086.56
Total Over-all Costs	$ 9,194.81

P.X. - ADDITIONS TO

Work accomplished as authorized by ECO 86A was the addition of a one-story aluminum structure, rectangular shape, 25'-2" x 28'-0" x 10'-10" mean height, set on a 5" thick concrete slab, with a double roof separated by 3" x 4" redwood. This was complete with electrical wiring and fixtures and shelving.

Construction Costs	$ 1,063.27
Total Over-all Costs	$ 1,063.27

SKEET RANGE - ADDITIONS TO

ECO 93A authorized the installation of new electrical service consisting of approximately 600 lineal feet of 2 - #8 weatherproof wire, and one weatherproof receptacle. The cost of this work was charged to maintenance.

SECTION 7. VARIOUS SITES

ALICE

AIRSTRIP EXTENSION. ECO 267 authorized the clearing, grading and shaping of a soil base, addition of a steel mat runway and turn-around area and extending the runway length from 800 to 1000 feet to improve aircraft operational safety. Work was started 26 May and was completed 26 July 1952.

Construction Costs	$ 4,399.46
Total Over-all Costs	$ 4,399.46

ALL SITES

GALLEY - MOBILE. ECO 260 authorized the construction of a six-wheel, flat bed trailer mounted frame structure, to be used as a mobile field galley, 8'-6" wide x 22'-2" long x 7'-0" high. It had plywood sheathed roof and sides, composition roofing, interior plywood partitions. It was complete with counters, galvanized iron sink, refrigerator, freezer, radio, lavatory, field ovens, electrical generating units.

Construction Costs	$ 6,250.31
Total Over-all Costs	$ 6,250.31

GALLEY - PORTABLE. ECO 3711 authorized the construction of a one-story wood frame structure to be used as a portable field galley, 22'-2" x 8'-6" x 8'-0" high, with 3/8" plywood sheathing on sides, composition roofing over 1/2" plywood sheathing roof, mounted on 6" x 8" x 23'-0" wood skids. It was complete with sink, ovens, refrigerator, freezer, work counter, and cabinets.

Construction Costs	$ 3,401.25
Total Over-all Costs	$ 3,401.25

VARIOUS SITES

NAVIGATION AID. These were pyramidal-shaped towers, constructed of 2" x 4" frame with 1" x 10" siding spaced 2" apart, painted white and topped with two 2'-6" x 3'-0" plywood targets painted black and white, one perpendicular to and above the other. Size of base was 14'-0", over-all height 20'-8", set in three concrete footings. These were located as per directions of Survey Department to replace existing beacons.

Construction Costs	$ 3,261.13
Total Over-all Costs	$ 3,261.13

BADGE CASE. This was a 5'-7" wide x 4'-0" high x 6'-1/4" wide wood case divided with 7 horizontal dividers and 15 vertical dividers, making 128 cubicles, each approximately 3-3/4" wide x -9/16" high x 3" deep. A 1/8" diameter x 5'-6" long steel rod was stretched horizontally from one side of the cabinet to the other in front of each horizontal divider. The construction of the case was of 3/4" plywood construction, including two 3/4" plywood doors and was supported by 2" x 6" posts set into the ground.

Construction Costs	$ 300.00
Total Over-all Costs	$ 300.00

The following Maintenance Work Orders are charged to Contract Item No. A-35 and are therefore included herewith.

MWO 122: SITE - ELMER: Stabilizer Unit No. 2 was installed as per FS-691. Included are a surge tank, sea water pump, and all the required pipes, fittings, insulation, concrete work, electrical wiring, conduits, and fixtures.

Engineering Costs	$ 147.90
Construction Costs	3,508.87
Total Over-all Costs	$ 3,656.77

MWO 123: ALL SITES: A new sea mule was constructed using materials available at the Jobsite, and salvage materials from the present barge, (a self-propelled pontoon barge, with A-frame). Figure 2-67 indicates sea mule nearing completion.

Construction Costs	$ 13,758.42
Total Over-all Costs	$ 13,758.42

Figure 2-67. Sea Mule, Completed on Ramp at Elmer

EMWO 125: SITE - FRED: Additional storage space in Bldg. 403. Constructed and installed parts bins and constructed second floor decking in Parts Warehouse, Jumbo Quonset No. 403. All work was accomplished in accordance with details furnished by the Warehouse Supervisor. Eight lights were installed in proposed hot locker room.

Construction Costs	$ 4,454.33
Total Over-all Costs	$ 4,454.33

MWO 128: SITE - FRED: A new fuel oil purifier and a new 4,000 gallon storage tank were installed in Bldg. 56, Power Plant. Installation included all the necessary pipe, valves, fittings, concrete work, electrical conduits and fixtures.

Construction Costs	$ 7,116.72
Total Over-all Costs	$ 7,116.72

MWO 129: SITE - ELMER: A new 4,000 gallon fuel oil storage tank and a new pump were installed adjacent to the existing storage tanks near the power plant, and 1-1/2" pipe line was installed from the new tank to the existing storage tank near the cargo pier.

Construction Costs	$ 2,990.86
Total Over-all Costs	$ 2,990.86

MWO 132: SITE - ELMER: Two stainless steel sinks mounted in a wood frame cabinet were installed, and a dry well was constructed, complete with the required plumbing. Also, a wood frame and plywood darkroom was constructed, complete with cabinets, shelving and electrical service.

Construction Costs	$ 972.80
Total Over-all Costs	$ 972.80

MWO 135: SITE - FRED: Electrical wiring and fixtures were installed, and necessary connections to the overhead distribution line were made in Bldg. 134, Signal Repair Building.

Construction Costs	$ 559.28
Total Over-all Costs	$ 559.28

MWO 138: SITE - ELMER: Approximately 37 lineal feet of 7'-0" high wood frame and plywood partitions were added to make two additional offices, and an existing wood rail was removed. This work was done in Bldg. 176, Personnel Office.

Construction Costs	$ 168.31
Total Over-all Costs	$ 168.31

MWO 141: SITE - ELMER: A concrete slab, 54'-0" long x 20'-6" wide x 4" thick poured under existing Bldg. 360, DUKW Repair Shelter.

Construction Costs	$ 1,134.27
Total Over-all Costs	$ 1,134.27

MWO 147: SITE - FRED: Repairs to asphalt runways and parking areas were made as follows:

1. Existing runway from Station No. 00-50 to Station No. 30-50 was seal-coated.

2. L-13, Parking area was repaired by scarifying the area, the loose material then bladed into windrows, flattened, sprayed with diluted Bituminal, mixed, bladed, sprayed evenly and rolled.

3. The existing runway was patched, broomed and cleaned, surfaced with tack coat of diluted Bituminal, and then cold mixture of sand and Bituminal, spread and rolled to a compacted thickness of 3/4".

4. The MATS parking area was patched, using cold mix as described in Paragraph (3).

Construction Costs	$ 27,472.66
Total Over-all Costs	$ 27,472.66

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CHAPTER V
SCIENTIFIC STATION STRUCTURES HISTORY

SECTION 1. GENERAL

Due to the changes in design criteria for the Scientific Stations and changes in the methods and procedures for obtaining test data, a complete list of the Scientific Stations could not be made available to the construction force until 19 August 1952. At this time information was still lacking as to the time that would be required, after completion of the construction, for the instrumentation and testing of each station. Therefore, it was necessary to obtain the concurrence of the Chief of Task Unit 6 in the establishment of a priority list for the completion of the construction of each station in order to allow the scientific agencies sufficient time to complete their work. At a conference held between representatives of Holmes & Narver and the Chief of Task Unit 6 these priorities were established and the over-all completion date for the construction phase was established as 20 October 1952, which date was met.

The details of the engineering and construction phases of the Scientific Structures Program are described in the following sections. The stations are grouped according to the scientific using agency. Some of the problems encountered were: frequent changes in design criteria; a number of the Scientific Stations were built in the lagoon and on the reefs, and due to the action of the sea water, equipment had to be serviced frequently; in some cases work could be accomplished only at low tide; men working in water were not as efficient as on dry land.

In the construction of certain stations concrete was placed in areas where so much reinforcing steel was required that it was impossible to insert a vibrator and due to the thickness of the slab or wall, exterior vibration was not effective. Figure 2-91 illustrates the amount of reinforcing steel used in Station 200.

The Scientific Stations are shown in the following tabulation in numerical order with location, the using agency, and the section of this chapter in which the stations are discussed.

SCIENTIFIC STATIONS LIST

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
1	Flora	LASL	2
2	Flora	LASL	2
3	Flora	LASL	2
4	Flora	LASL	2
5	Flora	EGG	3
6	Flora	EGG	3
7	Flora	LASL	2
10	Janet	DOD (AFSWP)	4
11	Edna	DOD (AFSWP)	4
12	Yvonne	DOD (AFSWP)	4
13	Leroy	DOD (AFSWP)	4
14	Fred	DOD (AFSWP)	4
50	Yvonne (Reef)	DOD (AFSWP)	4
51	Yvonne	DOD (AFSWP)	4
52	Leroy	DOD (AFSWP)	4
53	Fred	DOD (AFSWP)	4
120	Flora	LASL	2
200	Irene	NRLK	5
201	Flora	NRLK	5
202	Irene	NRLK	5
203.01	Flora-Gene	NRLK	5

SCIENTIFIC STATIONS LIST (Cont.)

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
203.02	Gene	NRLK	5
203.03	Helen-Irene	NRLK	5
203.04-.09	Irene	NRLK	5
204	Flora to Irene	NRLK	5
250	Yvonne	NRLK	5
251	Yvonne	NRLK	5
252	Yvonne	NRLK	5
300	Alice	LASL	2
301	Elmer	EGG	3
302	Elmer	EGG	3
303	Janet	EGG	3
304	Oscar	EGG	3
305	Ursula	EGG	3
306	Ursula	EGG	3
307	Yvonne	EGG	3
308	Elmer	EGG	3
309	Yvonne	LASL	2
330	Flora	LASL	2
331.01-.07	Flora	LASL	2
331.08-.09	Flora	LASL	2
332	Flora	LASL	2
333.01-.07	Flora	LASL	2

SCIENTIFIC STATIONS LIST (Cont.)

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
334	Alice (Reef)	LASL	2
335	Alice	LASL	2
352	Canceled	LASL	2
390.01	Janet	DOD (UAF)	4
390.02	Janet	DOD (UAF)	4
390.03	Yvonne	DOD (UAF)	4
390.04	David	DOD (UAF)	4
390.05	Elmer	DOD (UAF)	4
390.06	Elmer	DOD (UAF)	4
400	Canceled	LASL	2
410	Canceled	LASL	2
411.01-.47	Flora-Clara (Reef)	LASL	2
412.01-.05	Wilma & Yvonne	LASL	2
412.06-.24	Yvonne	LASL	2
430	Canceled	LASL	2
440	Edna	LASL	2
441	Yvonne	LASL	2
510.01-.07	Alice	LASL	2
510.08-.14	Belle	LASL	2
510.15-.19	Clara	LASL	2
510.20-.24	Daisy	LASL	2
510.25-.29	Edna	LASL	2

SCIENTIFIC STATIONS LIST (Cont.)

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
510.30-.35	Gene	LASL	2
510.36	Reef between Gene & Helen	LASL	2
510.37-.40	Helen	LASL	2
510.41-.45	Reef between Helen & Irene	LASL	2
510.46-.51	Irene	LASL	2
510.52-.66	Janet	LASL	2
511.01-.26	Yvonne	LASL	2
511.27-.39	Yvonne (Reef)	LASL	2
520	Clara	LASL	2
521.01	Belle	LASL	2
521.02	Daisy	LASL	2
521.03	Edna	LASL	2
521.04-.06	Yvonne	LASL	2
523	Canceled	LASL	2
530.01	Irene	LASL	2
530.02	Janet	LASL	2
531.01	Alice	LASL	2
531.03	Tilda	LASL	2
531.04	Yvonne	LASL	2
531.05	Elmer	LASL	2
531.06	Leroy	LASL	2

SCIENTIFIC STATIONS LIST (Cont.)

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
540.01-.20	Lagoon	DOD, BUSHIPS, NRDL	4
541.01-.33	*	DOD (ACC)	4
542.01	Alice	DOD, BUSHIPS, NRDL	4
542.02	Janet	DOD, BUSHIPS, NRDL	4
542.03	Nancy	DOD, BUSHIPS, NRDL	4
542.04	Wilma	DOD, BUSHIPS, NRDL	4
542.05	Yvonne	DOD, BUSHIPS, NRDL	4
542.06	Bruce	DOD, BUSHIPS, NRDL	4
542.07	Elmer	DOD, BUSHIPS, NRDL	4
542.08	Fred	DOD, BUSHIPS, NRDL	4
600	Irene	Sandia	7
601	Janet	Sandia	7
602	Kate	Sandia	7
603	Mary	Sandia	7
604	Sally	Sandia	7

*1 each at Alice, Belle, Clara, Irene, Kate, Lucy, Mary, Nancy, Olive, Pearl, Sally, Ursula, Vera, Wilma, Bruce, Glenn and Mack.
2 each at Janet, Ruby, Yvonne, David, Elmer, Fred, Keith and Leroy.

SCIENTIFIC STATIONS LIST (Cont.)

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
605	Yvonne	Sandia	7
606	Elmer	Sandia	7
610	Noah	Sandia	7
611.01	Janet	Sandia	7
611.02	Kate	Sandia	7
611.03	Mary	Sandia	7
611.04	Sally	Sandia	7
612	Elmer	Sandia	7
613.01	Olive	Sandia	7
613.02	Yvonne	Sandia	7
614	Gene	Sandia	7
615.01	Helen	Sandia	7
615.02	Irene	Sandia	7
616.01	Helen	Sandia	7
616.02	Irene	Sandia	7
617.01-.08	Yvonne (Reef)	Sandia	7
618	Yvonne	Sandia	7
619.01-.02	Yvonne	Sandia	7
620.01	Gene (Reef)	LASL	2
620.02	Helen (Reef)	LASL	2
620.03	Irene (Reef)	LASL	2
620.04	Noah (Reef)	LASL	2

SCIENTIFIC STATIONS LIST (Cont.)

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
621.01-.06	14 in Lagoon	LASL	2
621.10-.15	5 in Lagoon 1 at Mack	LASL	2
622	Elmer	LASL	2
623.01-.10	Janet	LASL	2
630.01	Janet	LASL	2
630.02	Lucy	LASL	2
630.03	Mary	LASL	2
630.04	Tilda	LASL	2
640.01-.04	Lagoon	LASL	2
641.01	Janet (Reef)	LASL	2
641.02	Ursula-Yvonne (Reef)	LASL	2
641.03	Yvonne (Reef)	LASL	2
641.04	Elmer (Reef)	LASL	2
642.01-.05	Janet (Reef)	LASL	2
642.06-.10	Ursula-Yvonne (Reef)	LASL	2
642.11-.15	Yvonne (Reef)	LASL	2
642.16-.20	Elmer (Reef)	LASL	2
650.01	Irene	Sandia	7
650.02	Janet	Sandia	7
650.03	Kate	Sandia	7

SCIENTIFIC STATIONS LIST (Cont.)

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
650.04	Mary	Sandia	7
650.05	Sally	Sandia	7
650.06	Elmer	Sandia	7
670.01-.04	Lagoon	Sandia	7
671	Gene	Sandia	7
672.01-.03	In Ocean (N. of Flora)	Sandia	7
690.01	Janet	LASL	2
690.02	Lucy	LASL	2
690.03	Mary	LASL	2
690.04	Sally	LASL	2
800	Janet	NRLS	6
801	Janet	NRLS	6
802	Tilda	NRLS	6
803	Tilda	NRLS	6
804	Bruce	NRLS	6
805	Elmer	NRLS	6
806	Mack	NRLS	6
810.01	Alice	NRLS	6
810.02	Irene	NRLS	6
810.03	Noah	NRLS	6
810.04	Janet	NRLS	6
810.05	Lucy	NRLS	6

SCIENTIFIC STATIONS LIST (Cont.)

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
810.06	Mary	NRLS	6
810.07	Olive	NRLS	6
810.08	Tilda	NRLS	6
810.09	Yvonne	NRLS	6
810.10	Yvonne	NRLS	6
810.11	Yvonne	NRLS	6
840	Alice	NRLS	6
841	Flora	NRLS	6
842	Flora	NRLS	6
850	Janet	DOD (USAF)	4
910	Elmer	LASL	2
1000.01	Alice	EGG	3
1000.02	Belle	EGG	3
1000.03	Clara	EGG	3
1000.04	Daisy	EGG	3
1000.05	Edna	EGG	3
1000.06	Irene	EGG	3
1000.07	Kate	EGG	3
1000.08	Lucy	EGG	3
1000.09	Mary	EGG	3
1000.10	Helen	EGG	3
1001.01	Janet	EGG	3

SCIENTIFIC STATIONS LIST (Cont.)

STATION NO.	ISLAND LOCATION	USER	CHAPTER V SECTION REFERENCE
1001.02	Ursula	EGG	3
1001.03	Yvonne	EGG	3
1002	Elmer	EGG	3
1020	Elmer	Sandia	7
1130	Flora	DOD	4
1131	Elmer	DOD	4
1300.01	Janet	LASL	2
1300.03	Yvonne	LASL	2
6101.01-.04	Yvonne	Sandia	7
6103	Janet	Sandia	7
6140	Yvonne	DOD (NRDL)	4
F-1	Flora	*	8
G-92	Gene	*	8
Security Fencing	Flora	*	8
Telephone Cable	As Shown	*	8
Signal & Control Cable	As Shown	*	8
Stabilized Area	Flora, Helen & Irene	*	8
Power Distr.	All Islands	*	8
Site Preparation	Flora - Irene	*	8

*Joint Distribution

SECTION 2. LASL

STATION 1 - FLORA

On 22 October 1951 Holmes & Narver was informed that a conference would be held at Los Alamos to discuss modifications to a 200-foot tower that was used for OPERATION GREENHOUSE, to adapt it for Station 1 for OPERATION IVY. At this conference the design was established which called for a tower cab structure 40'-0" x 40'-0" x 65'-0" high, containing a mezzanine floor, one or two bridge cranes, and with the cab being 26 feet above natural grade. On 2 November instructions were received that indicated the cranes would be explosion-proof. By 2 December the requirements had been further defined by setting the width of the structure as that necessary for a 40-foot crane span, the height to allow for a hook lift of 25 feet and the length for a 70-foot run of the crane, with the floor at ground level. With the crane under a full load of 20 tons the maximum allowable vertical displacement due to vibration, was to be 1/8-inch and the drive control would be able to place the load to an accuracy of 1/8-inch.

The original plans, as of 22 October 1951, contemplated three of such structures: one each at Boulder, Colorado; Buffalo, New York; and the Eniwetok Proving Grounds. Holmes & Narver's responsibility was that of design and purchase of all three structures. By 4 December, this requirement had been changed to one structure at Eniwetok and one mock-up at Los Alamos. This was later revised to include sending to Buffalo a 20-ton crane with identical characteristics to the one being provided for Eniwetok, except that the Buffalo crane did not have to be explosion-proof.

On 14 December changes received involved the use of spark-proof roll-up type doors on the two longer sides of the structure, a minimum crane hook lift to 50'-2-1/2" and ventilation requirements to provide 15 changes of air per hour.

The first drawings of the structural framing were transmitted for approval by the Field Manager, Eniwetok Proving Grounds, on 20 December 1951. By 11 January 1952 the drawings had progressed sufficiently so that AEC authorized the purchase of the steel for the structure. On 14 January authorization was received to purchase steel for a second structure which, however, was cancelled on 28 January.

Original criteria required that the structure and prime assembly be placed on steel piling so as to be certain that settlement would not exceed 1/8 inch. With this criteria, piling of a minimum penetration of 60 feet was determined necessary. After a few piles had been driven it was found necessary to increase the length of the piling under the prime assembly to 90 feet.

Some difficulty arose in attempting to buy a Type B (hydrogen vapor) explosion-proof motor as required for the crane, since none had been manufactured except as small experimental models. Compressed air motors were considered, but rejected by Los Alamos in favor of a Type D (gasoline vapor) motor.

Design criteria for Station 1 continued to be received in the Holmes & Narver Home Office until 12 July 1952. Alterations included additional doors, placing the telephone outside the station to eliminate necessity of explosion-proof telephones, and the elimination of the conductive flooring requirement.

Because of the complicated embedded electrical wiring, it was possible to give only partial approval to the foundation plan by 18 April. On 28 April the electrical drawings were revised considerably due to changes in User needs. These changes involved the addition of outlets, deletion of some explosion-proof outlets, and a revision of master-switching for the various power circuits. Further revisions to the electrical drawings were made on 21 May and 6 June 1952.

The design criteria for Station 201, which called for heavy concrete construction and would be partially located in Station 1, was not completely known as of 9 April 1952. The positioning of the piling for this station inside Station 1 could not be determined as of this date and the design and construction of the foundation was then not possible. When the station had been finally located it was apparent that in order to perform the assembly work in Station 1, a working platform was required that traveled up and down the front face of Station 201. The information for this platform was received on 30 April and the design was approved on 8 July.

Designs of the various components of Station 1 were submitted for approval between 21 December 1951 and 16 June 1952, and AEC approvals were received from 1 February to 17 July. The final design consisted of a structural steel building 88'-0" x 46'-0" x 61'-0" high, resting on 61 H-piles-53 of which were driven to 60 feet, and eight to approximately 90 feet. Concrete footings and an eight-inch reinforced spark-proof concrete floor was provided. A steel trussed roof with composition roofing was installed. A 20-ton bridge crane was installed to travel longitudinally through the building. The entire structure was shop riveted and field-bolted.

The progress of construction may be gauged from the following figures: Figure 2-68 shows method of driving the 61 H-piles as of 12 May 1952. On 24 May all of the batter piles had been driven to at least 60 feet, as shown in Figure 2 69. The method used for forming the pile pad is shown in Figure 2-70, and Figure 2 71 shows the progress as of 18 June 1952 and Figure 2-72 shows erection progress on 26 June. Figure 2-73 is an exterior view during construction on 8 September. Figure 2-74 shows interior construction view with the front face of Station 201 on 11 September. Figure 2-75 shows Station

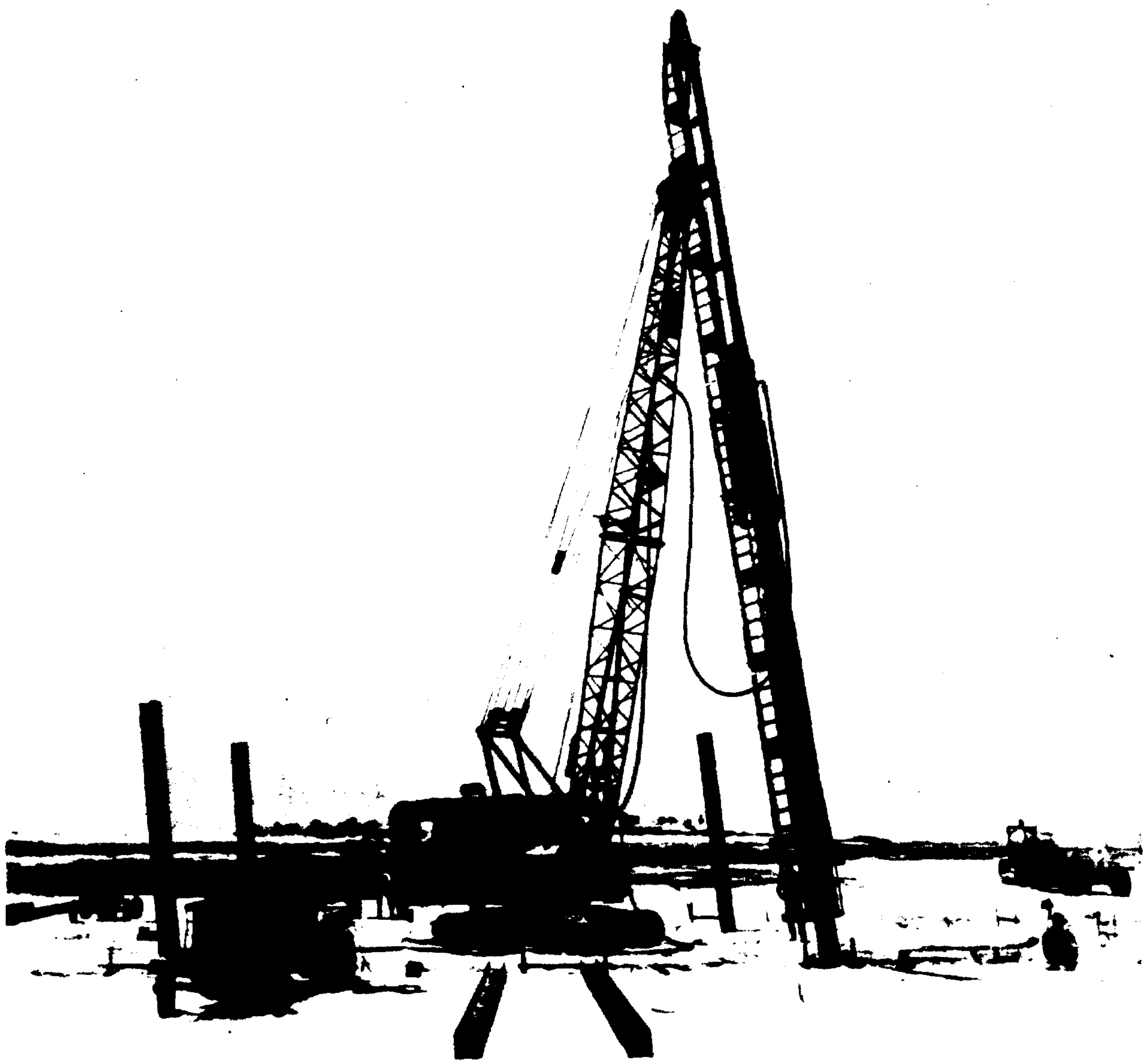


Figure 2-68. Driving H-Bearing Piles for Station 1

Figure 2-69. Batter Piles Driven 60 Feet Deep, Station 1

Figure 2-70. Pile Pad Form, Station 1

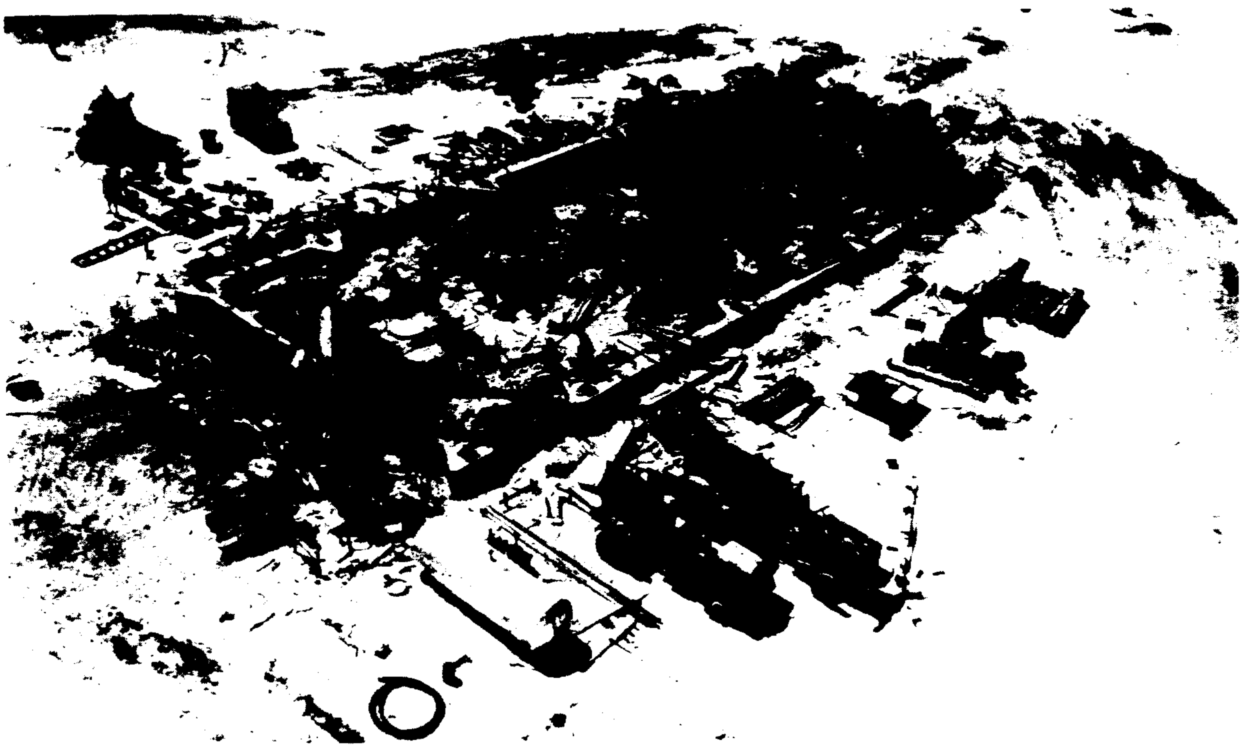


Figure 2-71. Foundation Progress, 14 June, Station 1

Figure 2-72. Erection of Columns for Station 1

Figure 2-73. Exterior View of Station 1 During Construction

1, with relative position to Stations 6 and 331 nearing completion. This view is from the west side of Flora and was taken on 27 September.

Eleven plans were prepared and "As-Built" prints were subsequently submitted to the AEC. Construction started on 5 May, was completed on 27 September and accepted by AEC on 22 November.

Engineering Costs	
(Including Design Work)	$ 24,784.28
Construction Costs	508,366.72
Total Over-all Costs	$ 533,151.00

STATION 2 - FLORA

This station was a one-story, four-room wood frame structure, 24'-0" x 48'-0" x 10'-11" mean height with plywood siding and composition roof. It was erected on a concrete floor slab, complete with wiring, fixtures, and dehumidification and ventilating equipment. This structure was used as laboratory space for Task Unit 4, for office storage and as an auxiliary building for subassembly work. Figure 2-76 shows status of this work on 24 April 1952. Design of this station was started on 22 January 1952, was submitted for approval on 7 February and 12 June. AEC approval was received on 15 February and 17 July. Three plans were prepared and "As-Built" prints were subsequently

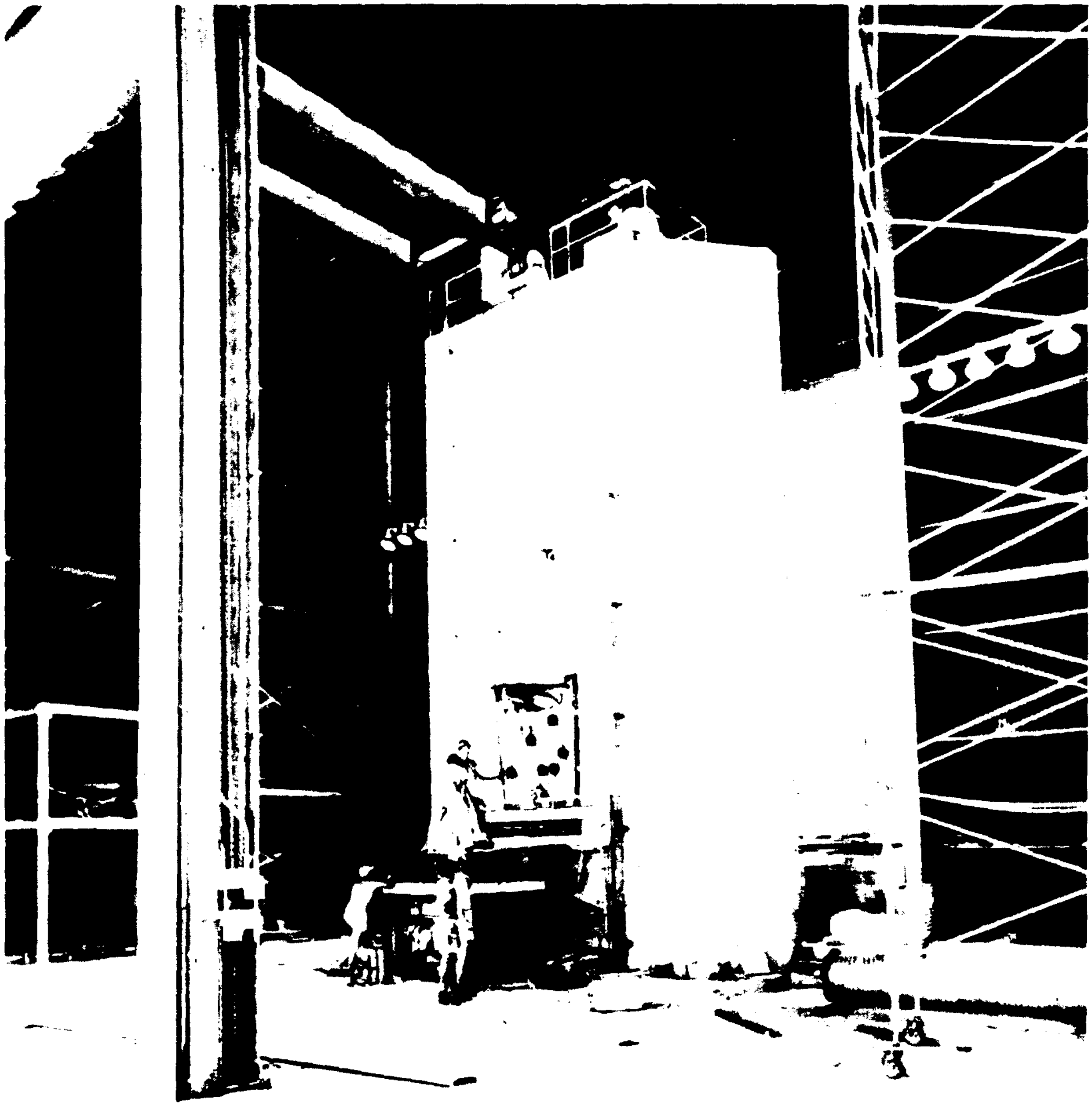


Figure 2-74. Interior of Station 1 and Front Face of Station 201

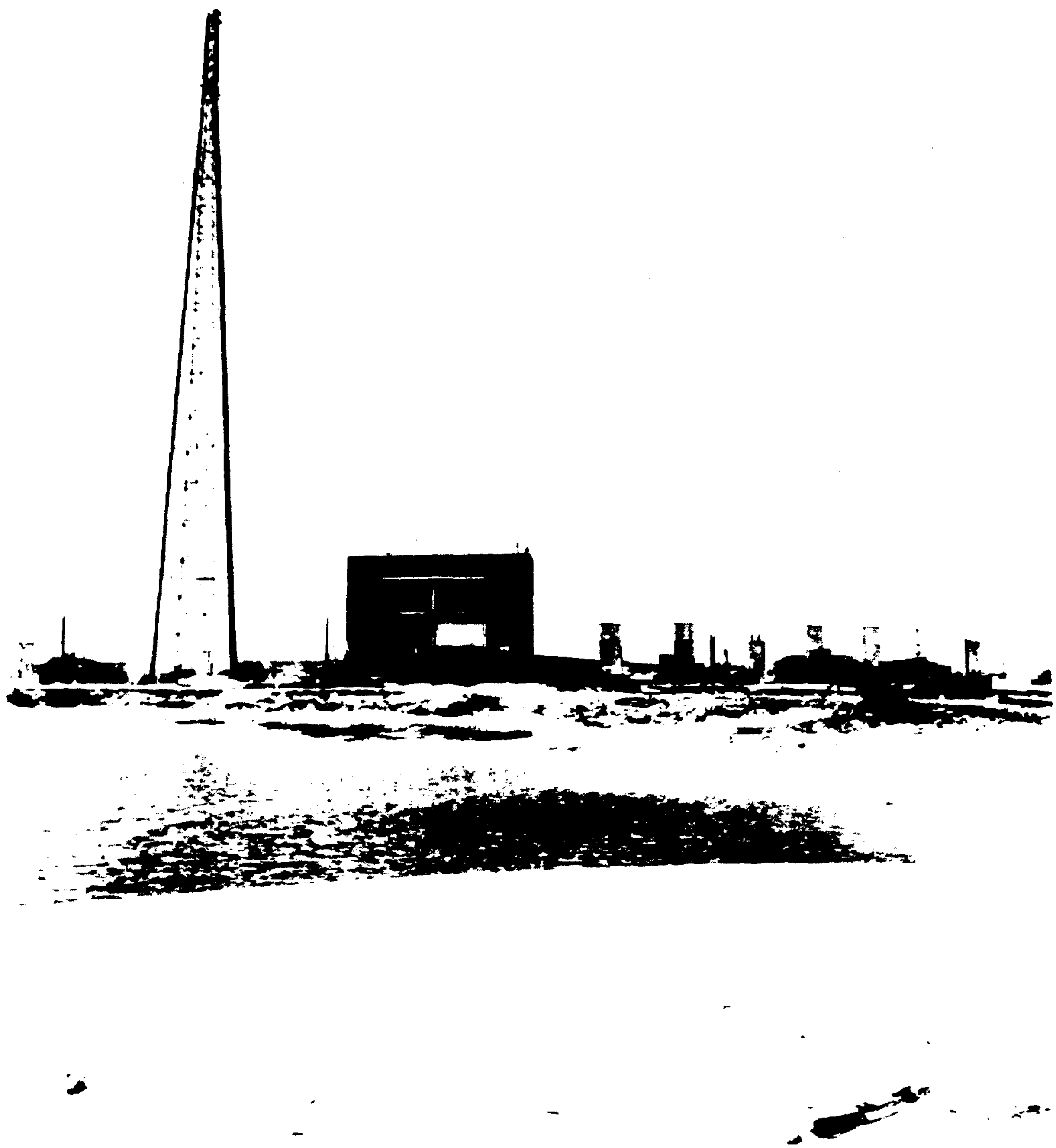


Figure 2-75. Stations 1, 6 and 331 from West Side of Flora

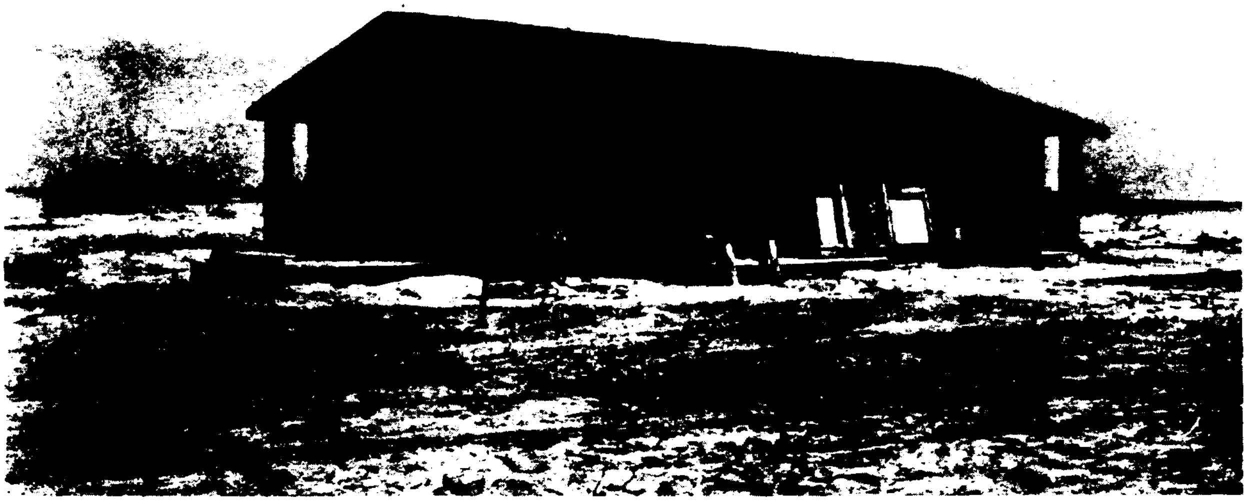


Figure 2-76. Station 2 During Construction

submitted to the AEC. Construction started on 5 March 1952, was completed by 2 August and accepted by AEC on 18 November.

Engineering Costs	
(Including Design Work)	$ 5,311.99
Construction Costs	38,686.55
Total Over-all Costs	$43,998.54

An outdoor electrical sub station was installed consisting of two 10 KVA and one 25 KVA transformers. This sub station was fenced and similar to the other sub stations.

Construction Costs	$1,154.56
Total Over-all Costs	$1,154.56

STATION 120 - FLORA

As no work was required of Holmes & Narver there were no charges. This item is reported for record purposes only.

Figure 2-77. Station 3 During Construction

STATION 3 - FLORA

This was a one-story wood frame structure, 12'-8" x 8'-8" x 8'-0" high with plywood sides and composition roofing, and was erected on a concrete slab. The interior was sprayed with vapor-seal. Design of this station was started on 2 January 1952, was submitted for approval on 12 February. AEC approval was received 19 February. One plan was prepared and an "As-Built" print was subsequently submitted to the AEC. Construction started on 13 March, was completed on 2 August and accepted by AEC on 22 November. Figure 2-77 shows status of progress on 19 April 1952.

Engineering Costs (Including Design Work)	$2,388.96
Construction Costs	7,249.06
Total Over-all Costs	$9,638.02

An outdoor electrical sub station was installed consisting of three 10 KVA transformers enclosed and similar to the other sub stations.

Construction Costs	$920.04
Total Over-all Costs	$920.04

STATION 4 - FLORA

This was a one-story wood frame structure 24'-9" x 16'-8" x 10'-6" high with an attached generator shed 8'-3" x 16'-8" x 9'-0". Both were erected on a concrete slab. There were installed dehumidification equipment, two 4 KVA generator motor sets, exhaust fans and miscellaneous equipment. Design of this station was started on 4 February 1952, was submitted for approval 8 May, and AEC approval was received on 3 June. Two plans were prepared and "As-Built" prints were subsequently submitted to the AEC. Construction started on 18 June, was completed on 13 September and accepted by AEC on 22 November.

Engineering Costs	
(Including Design Work)	$ 2,911.00
Construction Costs	
(Including Installed Equip.)	45,707.26
Total Over-all Costs	$48,618.26

STATION 7 - FLORA

This was an all-aluminum tower 9'-0" x 6'-0" x 14'-0" high, with 3/16-inch tread-plate platform decks, one at the 8-foot level, and one at the 14-foot level. Six-inch I-beam columns were anchored to the floor slab of Station 1. A 12-inch built-up beam extended from a pipe column above the upper platform and connected to a structural column of Station 1. It was used for Dewar support and reflux cooling system. Design of this station was started on 25 April 1952, was submitted for approval on 8 May and AEC approval was received on 22 May. One plan was prepared and an "As-Built" drawing was subsequently submitted to the AEC. Construction started on 8 July, was completed on 27 September and accepted by AEC on 22 November.

The platform decks were fabricated in the states and were not steady enough for instrumentation. Additional welding and bracing was required at Jobsite.

Engineering Costs	
(Including Design Work)	$ 471.59
Construction Costs	8,718.55
Total Over-all Costs	$9,190.14

STATION 300 - ALICE

Holmes & Narver received preliminary sketches on 15 January 1952 concerning this station. Two 12'-0" x 12'-0" rooms were planned; the lower floor would be 15'-0" high and an upper floor 9'-0" high. Twelve openings in the front face were to have lead shutters 9 inches thick. All possible straight-line paths of radiation entry were to be protected by either 9 inches of lead or its equivalent mass in concrete. Therefore, the walls and roof were 5'-0" thick. Sight tubes of the subject station were to be set to an allowable tolerance of plus or minus one-half of one degree. Three such stations were originally proposed, two being abandoned at an early date.

Initial criteria indicated Site Alice as the location for this station and the structural design was completed, based on pressures for that distance. On 7 February, the station location was changed to Site Belle and new computations were made. The station was relocated at Site Alice on 20 February. Design requirements were obtained on 21 March for air conditioning to provide approximately 72° F and 50% relative humidity, 1/2-ton electric hoist to lift cameras from first floor to second floor, and 1/2-ton chain fall on monorails to set cameras in place.

Final arrangements for shutting the lead shutters were clarified early. The shutters, weighing 1, 500 lbs. each, were hinged in such a manner that they would close by gravity. They were held open by cables attached to steel beams that overhung the front face of the station at roof level. An explosion link consisting of 2-inch O. D. pipe, which in turn contained a 2-inch length of dynamite and two blasting caps, was placed in the middle of the support cables. At this point a signal set off a small electrical current which detonated the dynamite and the shutters swung into place.

Figure 2-78. Placement of Reinforcing Steel, Station 300

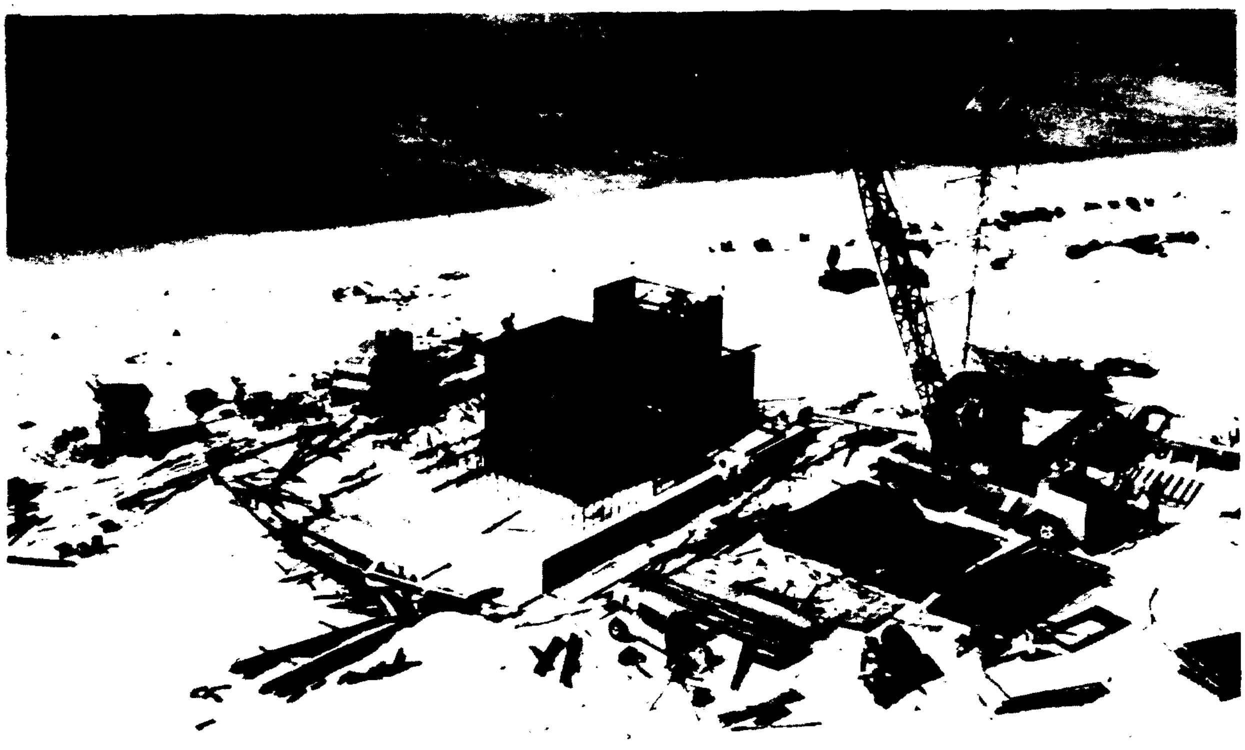


Figure 2-79. Aerial View of Station 300 During Construction

Design of this station was started on 14 January 1952, was submitted on 24 April, and AEC approval was received on 3 June. The design as approved consisted of a heavily reinforced two-story concrete structure of irregular shape. The first floor consisted of two rooms and a tunnel with 5'-0" thick walls, and 1'-6" thick ceilings. The tunnel and one room were covered with eight feet of earth fill. The second floor consisted of one room 12'-0" x 12'-0" x 10'-8" high with 5'-0" thick walls and ceiling. The entire structure was set on a reinforced concrete slab 24'-0" x 44'-0" x 4'-0" thick. The structure was equipped with blast doors, traveling hoists, electrical and communication wiring and fixtures, and dehumidification equipment and ducts.

Figure 2-78, taken on 18 June, shows the extensive quantity of reinforcing steel required in the foundation form. Figure 2-79 shows the status of the work on 26 June. Vertical reinforcing of walls was in progress on 10 July, as shown in Figure 2-80. Figure 2-81 is a rear view and Figure 2-82 a front view of the station as it neared completion and just prior to the placement of fill.

There were eight plans prepared and "As-Built" drawings were subsequently submitted to the AEC. Construction started on 10 June, was completed on 15 September and accepted by AEC on 6 December 1952.

Engineering Costs	
(Including Design Work)	$ 6,782.90
Construction Costs	203,951.56
Total Over-all Costs	$210,734.46

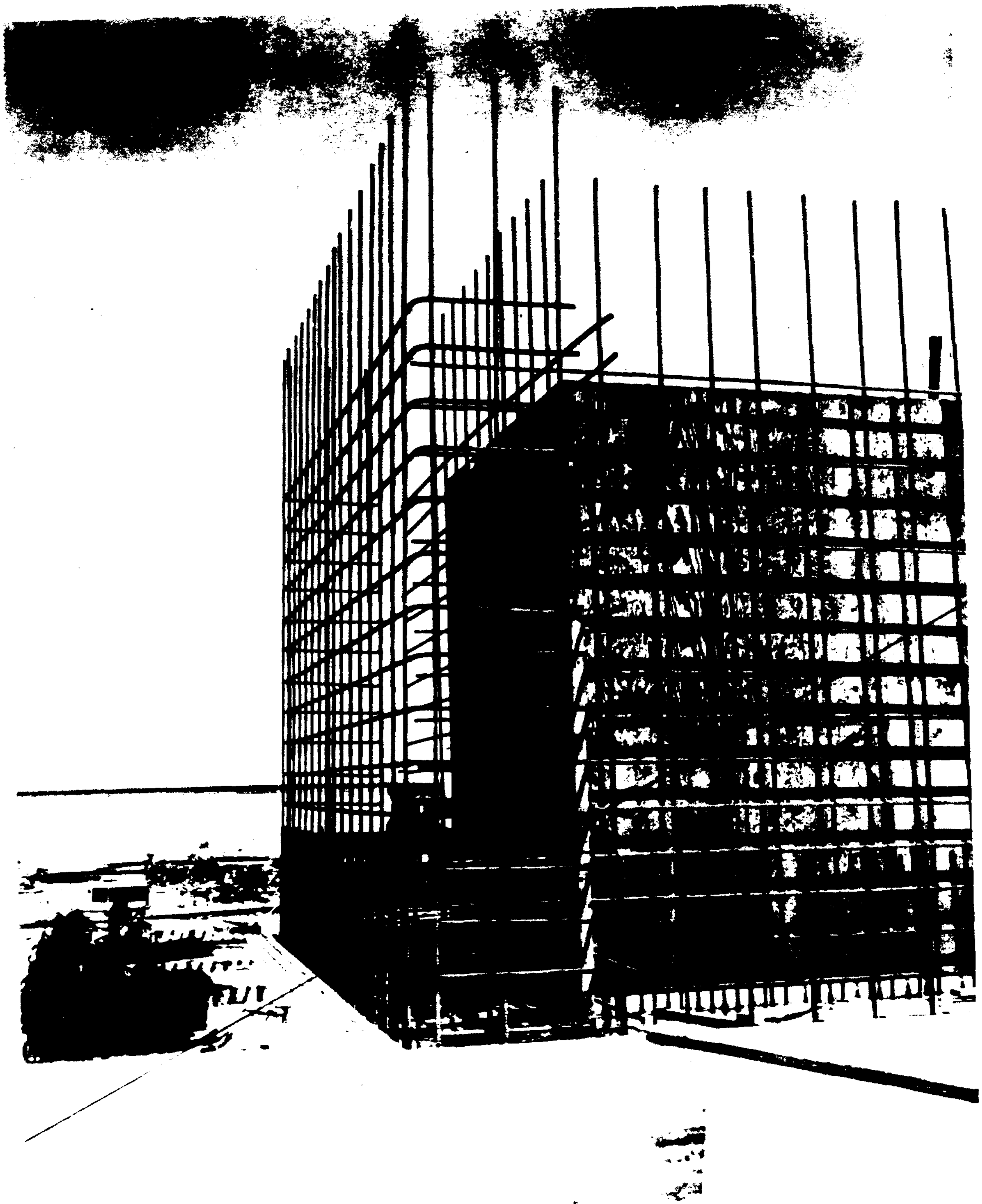


Figure 2-80. Wall Reinforcement, Station 300

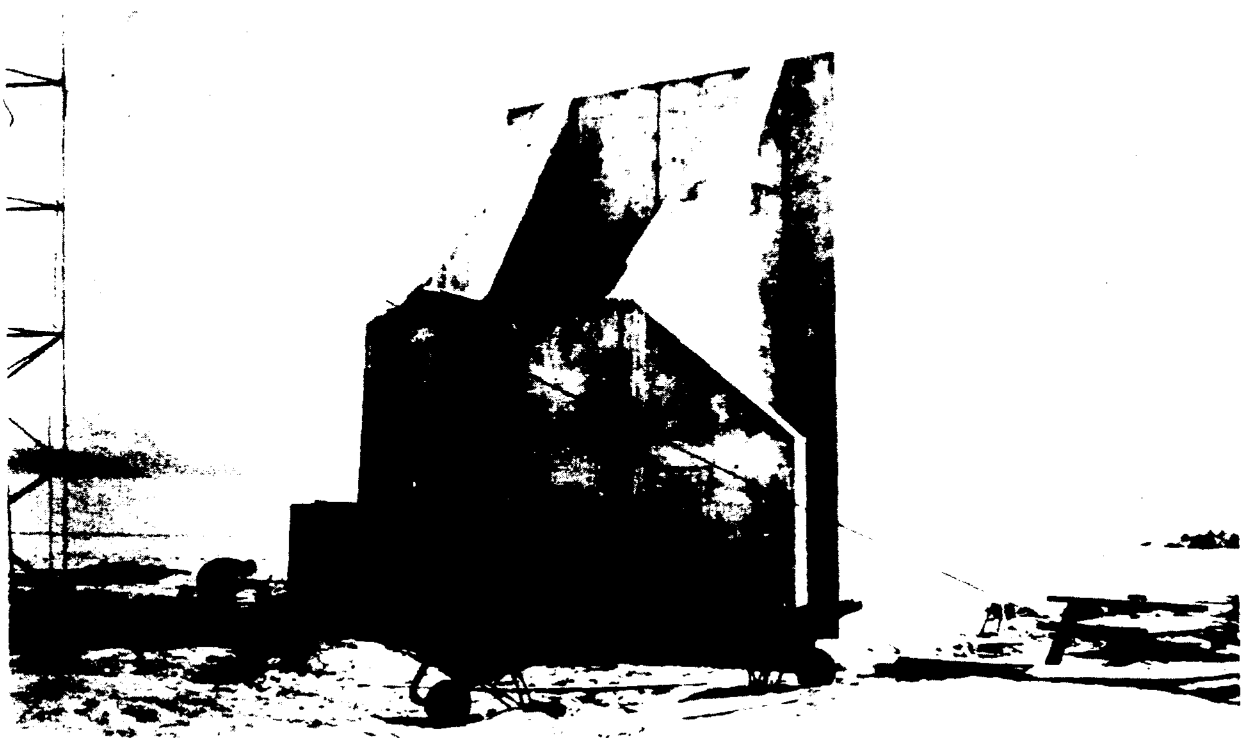


Figure 2-81. Rear View of Station 300

STATION 330 - FLORA

This station consisted of an array of helium-filled pipes set in the concrete floor of Station 1.

One "As-Built" drawing is listed with Station 1 drawings. Construction started on 24 June 1952 (work began before Work Order was issued), was completed on 9 July and accepted by AEC on 22 November.

Engineering Costs	$ 2.49
Construction Costs	1,079.77
Total Over-all Costs	$1,082.26

STATION 331.01 THRU 331.07 - FLORA

These were welded steel towers 4'-0" x 4'-0" x 26'-2-5/8" over-all height with 1/2-inch steel plate mounting platforms at 18'-8-5/8" and various other levels. The four legs were anchored to a reinforced concrete pad 9'-0" x 9'-0" x 1'-3". The towers were completely enclosed in wood frame shelters covered with 1/2-inch exterior grade plywood and were anchored to four concrete deadmen by cables. Openings and shutters were provided all stations at certain levels. Figure 2-83 shows a series of steel frames under construction with a side view of Station 1, and Figure 2-84 shows three of these stations in various stages of completion on 27 September 1952.

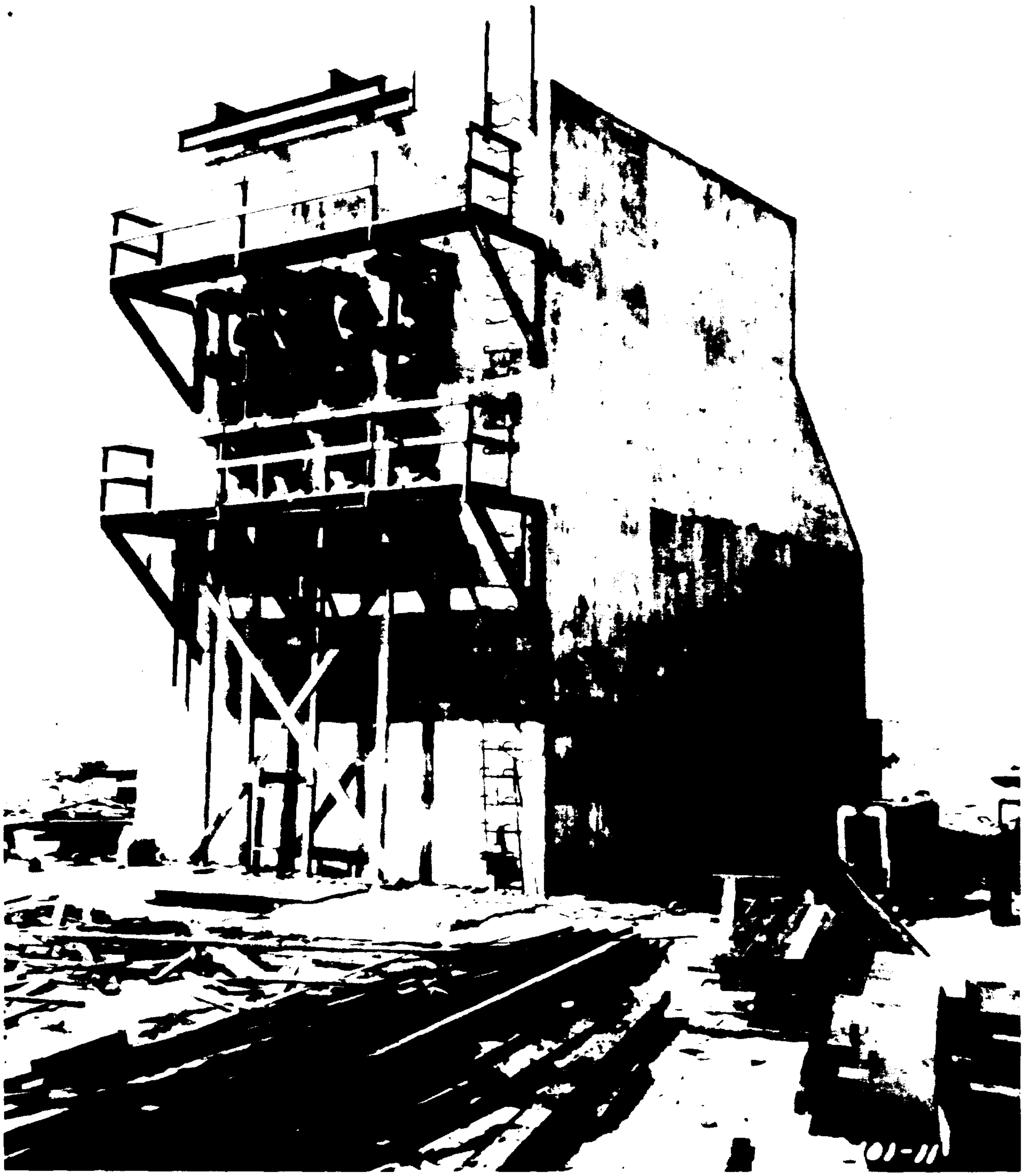


Figure 2-82. Front Face of Station 300

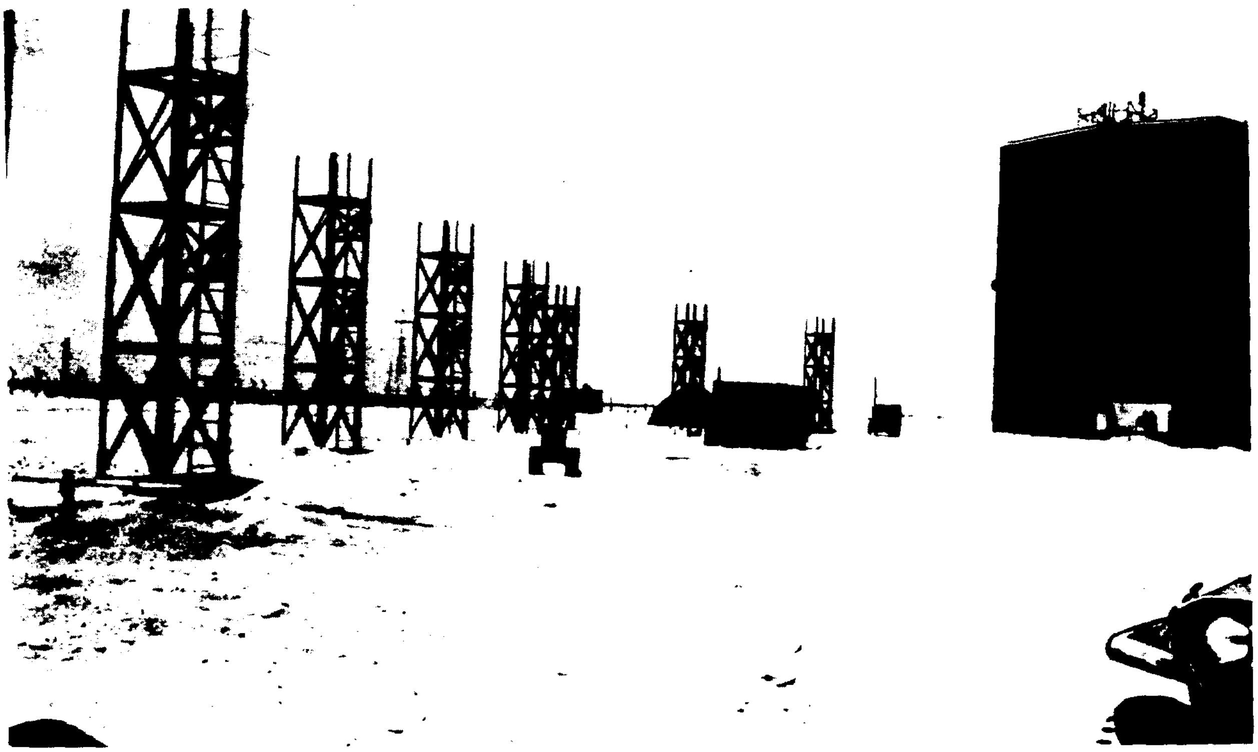


Figure 2-83. Station 331 Series Under Construction with Side View of Station 1

Design of these stations was started on 7 May, was submitted for approval on 12 June, and AEC approval was received on 25 June. Two plans were prepared and "As-Built" drawings were subsequently submitted to the AEC. Construction started on 23 July, was completed on 17 September and accepted by AEC on 25 November.

Engineering Costs	
(Including Design Work)	$ 1,834.61
Construction Costs	40,929.58
Total Over-all Costs	$42,764.19

STATIONS 331.08 AND 331.09 - FLORA

These were two added stations and were identical to Stations 331.01 thru 331.07 mirror-mount towers. Two field sketches were prepared and drawings were submitted to the AEC. Construction started week ending 4 October 1952, was completed on 11 October and accepted by AEC on 25 November.

Engineering Costs	
(Including Design Work)	$ 37.82
Construction Costs	9,825.40
Total Over-all Costs	$9,863.22

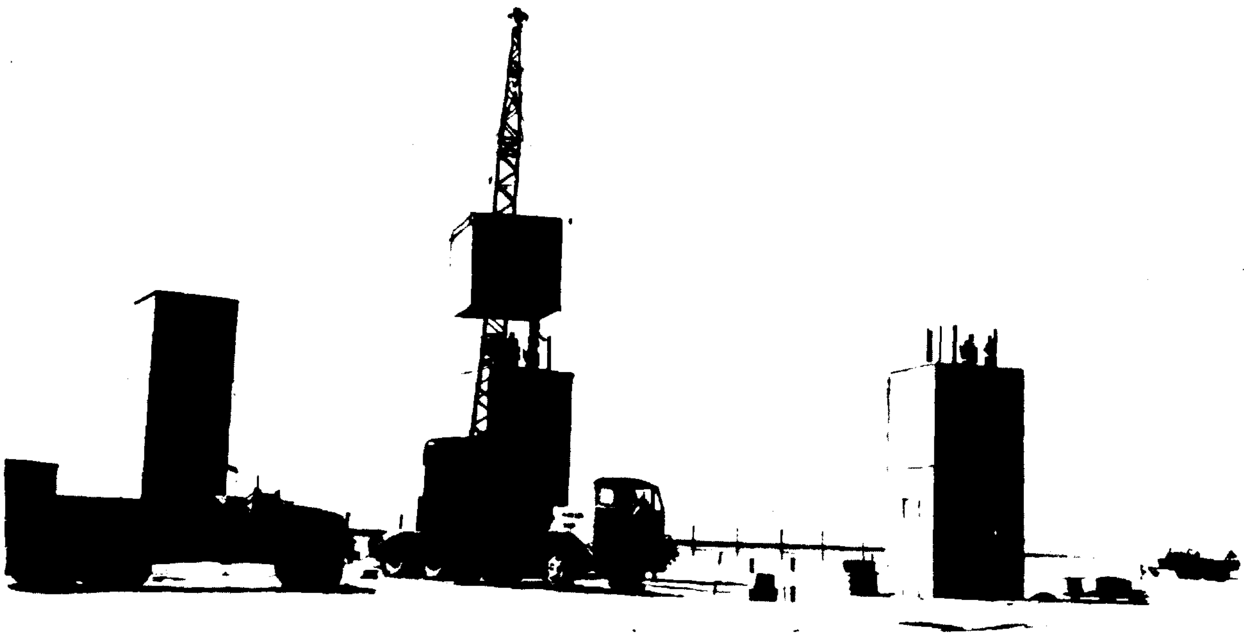


Figure 2-84. Three of Station 331 Group Nearing Completion

STATION 332 - FLORA

The work consisted of setting one 20-foot telephone pole in accordance with User's requirements. There were no drawings for this station. Construction was started on 31 August 1952, was completed on 1 September and accepted by AEC on 15 December. This work was performed as support services under Job 4.

STATIONS 331.01 THRU 333.07 - FLORA

These stations were of billboard-type structures 15'-0" long x 14'-0" high. The plywood-covered timber frame was mounted on two 35-foot telephone poles set in concrete and anchored by guy cables to four concrete deadmen.

Design of this station was started on 22 July 1952, having had prior approval by AEC. There was one plan prepared and a drawing of same was subsequently submitted to the AEC. Construction started on 14 August, was completed on 11 October and accepted by AEC on 22 November.

Engineering Costs (Including Design Work)	$ 170.38
Construction Costs	13,044.50
Total Over-all Costs	$13,214.88

STATION 334 - ALICE

This station was similar to Stations 333.01 thru 333.07, except that the dimensions were 16'-0" long x 8'-0" high, and it was mounted on two 35-foot telephone poles set in concrete and anchored by guy cables to four concrete deadmen.

Design of this station was started on 22 July 1952, having had prior approval by AEC. One plan was prepared as reported under Stations 333.01 thru 333.07. Construction started on 14 August 1952, was completed on 17 September and accepted by AEC on 22 November.

Engineering Costs (Including Design Work)	$ 141.15
Construction Costs	11,521.40
Total Over-all Costs	$11,662.55

STATION 335 - ALICE

This station was similar to Station 334 with dimensions of 16'-7" long x 11'-10" high.

Design of this station was started on 22 July 1952, having had prior approval by AEC. Construction started on 14 August, was completed on 15 September and accepted by AEC on 22 November. Costs are combined and reported under Station 334.

STATION 352

This station was canceled after preliminary engineering design was performed.

Engineering Costs	$102.00
Total Over-all Costs	$102.00

STATION 400

This station was canceled after preliminary engineering design was performed.

Engineering Costs	$70.00
Total Over-all Costs	$70.00

STATION 410

This station was canceled after preliminary engineering design was performed.

Engineering Costs	$19.00
Total Over-all Costs	$19.00

STATIONS 411.01 THRU 411.47

These stations were located on a reef between Clara and Flora. They were stakes made of 2-inch pipe set 4 feet above grade or high tide.

Design of these stations were started on 23 May 1952, were submitted for approval on 25 July, and AEC approval was received on 25 July. No drawings were required but these stations are noted on the survey drawing showing the general layout from Alice to Irene.

Construction started on 14 September, was completed on 4 October and accepted by AEC on 15 December.

Engineering Costs (Including Design Work)	$ 16.12
Construction Costs	16,921.97
Total Over-all Costs	$16,938.09

STATIONS 412.01 THRU 412.24 - WILMA - YVONNE

These were goal-post type supports consisting of two 2-1/2-inch diameter steel bars driven into the reef to a depth of five feet and supporting a 3/4-inch diameter steel horizontal bar approximately five feet above high tide level. Stations 412.01 thru 412.05 were located on the reef between Wilma and Yvonne. These stations were relocated in the field after construction as the original location was considered too close to the coaxial cable. Stations 412.06 thru 412.24 were located on Yvonne.

Design of this station was started on 23 May 1952, was submitted for approval on 12 June, and AEC approval was received on 20 August. One plan was prepared and a drawing of same was subsequently submitted to the AEC. Construction started on 13 September, was completed on 11 October, and accepted by AEC on 22 November.

Engineering Costs (Including Design Work)	$ 237.69
Construction Costs	4,067.57
Total Over-all Costs	$4,305.26

STATION 430

This station was canceled after preliminary engineering design was performed.

Engineering Costs	$288.00
Total Over-all Costs	$288.00

STATION 440 - EDNA

This station consisted of two fission-fragment cameras on a timber platform 10'-8" x 12'-0" placed five feet below grade with the vertical frame extending one foot above grade. It was protected by sandbags and backfilled.

Design of this station was started on 6 August 1952 having had prior approval by AEC on 25 July. One plan was prepared and drawing was subsequently submitted to the AEC. Construction started on 27 August 1952, was completed on 28 October and accepted by AEC on 22 November.

Engineering Costs (Including Design Work)	$ 166.03
Construction Costs	1,662.02
Total Over-all Costs	$1,828.05

STATION 441 - YVONNE

This station consisted of two fission-fragment cameras on sleds made up of eight 12" x 12" timbers bolted to two 4" x 12" stringers forming a framework platform 12'-0" x 15'-4". They were placed 2 feet below grade.

Design of this station was started on 3 July 1952, was submitted for approval on 17 July, and AEC approval was received on 25 July. One plan was prepared and drawing was subsequently submitted to the AEC. Construction started on 18 August, was completed on 19 September and accepted by AEC on 18 November.

Engineering Costs (Including Design Work)	$ 104.95
Construction Costs	1,448.16
Total Over-all Costs	$1,553.11

STATIONS 510.01 THRU 510.66 - ALICE TO JANET

These were five-inch I.D. asbestos-cement pipe 7 feet long buried to a depth of 6-1/2 feet with six inches of concrete grout inside and a fitted plywood cap. One plan was prepared and subsequently submitted to the AEC.

Design of these stations was started on 23 May 1952, was submitted for approval on 13 June, and AEC approval was received on 22 July. Construction started on 27 August, was completed on 27 September (Stations 510.01 - .51) and 21 September (Stations 510.52 - .66). They were accepted by AEC on 18 November. Many of these stations were relocated after construction, as required by the using agency.

Station locations were as follows:

510.01 thru 510.07 on Alice

510.08 thru 510.14 on Belle

510.15 thru 510.19 on Clara

510.20 thru 510.24 on Daisy

510.25 thru 510.29 on Edna

510.30 thru 510.35 on Gene

510.36 on reef between Gene and Helen

510.37 thru 510.40 on Helen

510.41 thru 510.45 on reef between Helen and Irene

510.46 thru 510.51 on Irene

510.52 thru 510.66 on Janet

Engineering Costs (Including Design Work)	$ 126.73
Construction Costs	13,065.96
Total Over-all Costs	$13,192.69

STATIONS 511.01 THRU 511.39 - YVONNE

These stations were 2-1/2" x 2-1/2" x 1/4" angles driven to a depth of three feet into the ground or the reef, and extending one foot above grade or three feet above high tide line, with the top twelve inches cut to 2" x 2" x 1/4".

Stations 511.01 thru 511.27 were located on Yvonne

Stations 511.28 thru 511.39 were located on a reef at Yvonne

Design of these stations was started on 3 June 1952, was submitted for approval on 16 June and AEC approval was received on 22 July 1952. One plan was prepared and drawing was subsequently submitted to the AEC. Construction started on 30 September 1952, was completed on 7 October and accepted by AEC on 18 November. Relocation of all stations of this series was requested by the User.

Engineering Costs	
(Including Design Work)	$ 76.74
Construction Costs	4,805.79
Total Over-all Costs	$4,882.53

STATION 520 - CLARA

Field sketches for this station were received on 29 April 1952. These described the interior arrangement, with no major changes being effected thereafter. The basic layout involved an instrumentation room 8'-0" x 14'-0" x 8'-0" clear height, and a corridor 30 feet in length with a 90° turn. Walls and roof were set for four-foot thicknesses; air conditioning criteria was approximately 72° F and 50% relative humidity.

Changes were effected on 2 July to completely shield the inside by enclosing the instrument room in a sheeting of 1/64-inch copper and 1/32-inch iron. At this time the same requirement was made for the generator house and power conduit into the station, but this was later deleted. All pipes leading into the instrumentation room were to be fitted with valves, whereby the room could be completely sealed when the doors were closed. Radiation shielding required the equivalent of 12 feet of earth. As one foot of concrete was considered equivalent to two feet of earth, the resulting earth fill over the four-foot thick concrete roof was four feet.

The final design and construction consisted of a heavily reinforced concrete structure consisting of one room, one L-shaped tunnel and two retaining walls with foundations approximately 9'-4" below natural grade. The single room was 16'-0" x 8'-0" x 8'-10-1/2" high inside with 4'-4" thick floor and walls and 4'-0" thick roof. A lead lined steel access door was provided. The tunnel had one leg 14'-3" long and the other 17'-0" long and was 3'-0" wide and approximately 8'-0" high inside with 3'-0" walls, 2'-6" floor and 2'-4" roof. The retaining walls each consisted of a base 14'-3" long, 1'-3" thick and tapered from 9'-7" wide to 2'-3", and the wall was 17'-3" high tapered to 6'-0" high and was 1'-0" thick at the base and 8" thick at the top. The station was equipped with an air conditioner and dry condenser. The entire structure was covered with coral and bags of cement to a depth of approximately 6 feet.

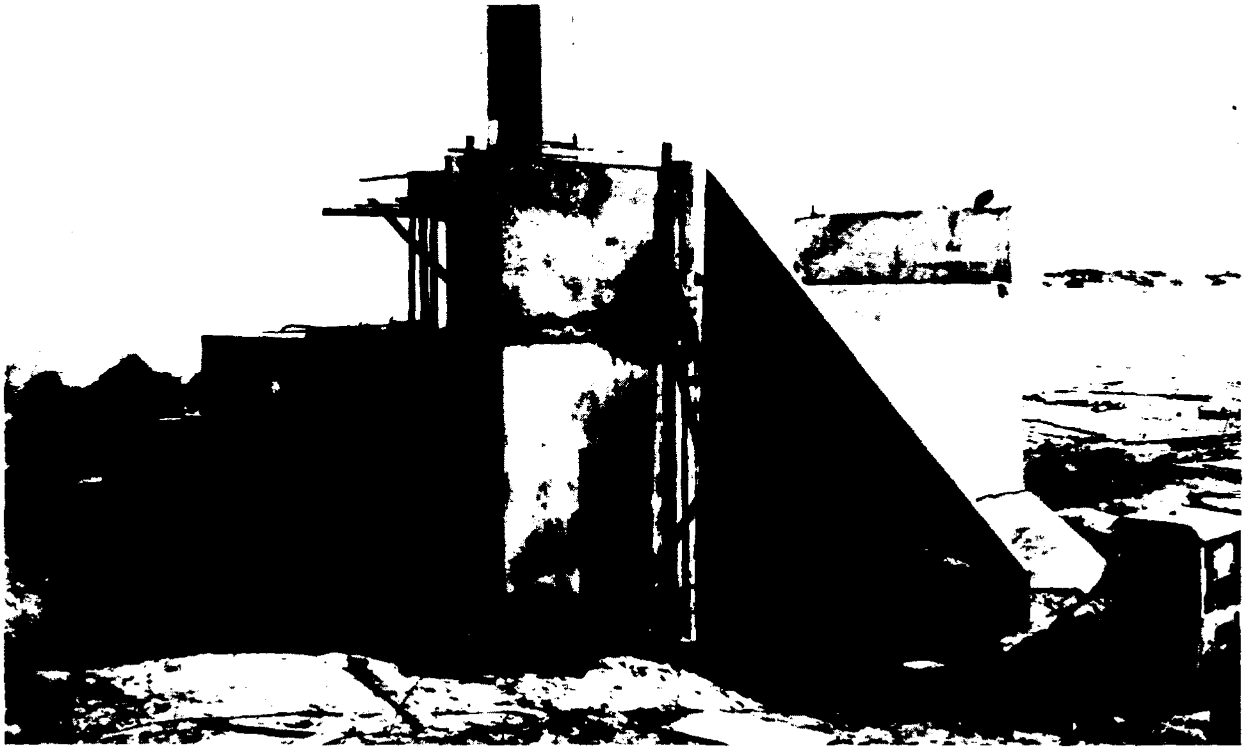


Figure 2-85. Forming of Wing Walls for Station 520

Figure 2-85 shows the forming of the wing walls, and Figure 2-86 shows the entrance side of the station just prior to the fill on 27 September 1952.

Design of this station was started on 9 May 1952, was submitted for approval on 17 June, and AEC approval was received on 11 July. Six plans were prepared and drawings were subsequently submitted to the AEC. Construction started on 28 July, was completed on 11 October and accepted by AEC on 25 November.

Engineering Costs	
(Including Design Work)	$ 8,850.00
Construction Costs	139,656.19
Total Over-all Costs	$148,506.19

STATIONS 521.01 THRU 521.06 - BELLE, DAISY, EDNA AND YVONNE

These stations consisted of 24-inch O.D. pipe sealed at the bottom with a steel plate. They were set 18'-0" below grade and collared at the grade level with a 6'-6" x 6'-6" x 1'-6" concrete pad. The stations were located as follows:

Station 521.01 on Belle
Station 521.02 on Daisy
Station 521.03 on Edna
Stations 521.04 thru 521.06 on Yvonne

Figure 2-86. Entrance Side of Station 520 During Construction

Design of these stations was started on 2 June 1952, was submitted for approval on 12 June and AEC approval was received on 23 June. One plan was prepared and a print was subsequently submitted to the AEC. Construction started on 4 August (521.01 thru 521.03), 28 July (521.04 thru 521.06), and accepted by AEC on 22 November.

Engineering Costs (Including Design Work)	$ 255.41
Construction Costs	22,144.24
Total Over-all Costs	$22,399.65

STATION 523 - CANCELED

This station was canceled after preliminary engineering design was performed.

Engineering Costs	$92.00
Total Over-all Costs	$92.00

STATIONS 530.01 AND 530.02 - IRENE AND JANET

Each of these stations consisted of a reinforced concrete block 1'-0" x 1'-0" x 6'-0" high, placed vertically with one foot extended above grade. Embedded in these blocks were 1-1/2-inch diameter conduit and eight anchor bolts. Station 530.01 was located on Irene and Station 530.02 was located on Janet.

Design of these stations was started on 16 July 1952, was submitted for approval on 16 July and AEC approval was received on 17 July. One plan was prepared and included Stations 531.01 and 531.03 thru 531.06. A print of same was subsequently submitted to the AEC. Construction started on 29 August 1952, was submitted for approval on 16 July, and AEC approval was received on 17 July.

Engineering Costs (Including Design Work)	$ 61.81
Construction Costs	1,289.00
Total Over-all Costs	$1,350.81

STATIONS 531.01 AND 531.03 THRU 531.06

These stations were identical with Stations 530.01 and 530.02 and were installed as follows:

Station 531.01 on Alice - outside Station 300
Station 531.03 on Tilda
Station 531.04 on Yvonne
Station 531.05 on Elmer
Station 531.06 on Leroy

Design status and approval is reported under Station 530.01.

Dates of starting and completion of work were:

STATION	STARTED	COMPLETED
531.01	29 August 1952	27 September 1952
531.03	13 September 1952	15 October 1952
531.04	13 September 1952	11 October 1952
531.05	29 August 1952	6 September 1952
531.06	1 August 1952	4 October 1952

AEC acceptance was received on 18 November 1952. A plan was furnished in connection with Stations 530.01 and 530.02.

Engineering Costs	$ 7.01
Construction Costs	3,740.49
Total Over-all Costs	$3,747.50

STATIONS 620.01 THRU 620.04 - GENE TO NOAH

These stations were 4-inch O.D. pipe standards eight feet high with instrument bases and eyebolts, the lower ends were encased in concrete and embedded in the reefs. These stations were located as follows:

Station 620.01 in reef at Gene
Station 620.02 in reef at Helen
Station 620.03 in reef at Irene
Station 620.04 in reef at Noah

Design of these stations was started on 23 May 1952, was submitted for approval on 2 June and AEC approval was received on 23 June. One plan was prepared and print was subsequently submitted to the AEC. Construction started on 25 August 1952, was completed on 27 September and accepted by AEC on 22 November.

Engineering Costs	
(Including Design Work)	$ 307.11
Construction Costs	7,145.64
Total Over-all Costs	$7,452.75

STATIONS 621.01 THRU 621.06 AND STATIONS 621.10 THRU 621.15 - LAGOON

These stations were rafts with wood-framed decks on eight oil drum floats and an angle iron stanchion and obstruction light. They were moored in the lagoon with an oil drum mooring buoy attached by 1/2-inch wire rope to a four-foot cube concrete anchor. Eleven stations were located in the lagoon and one at Mack. Design of these stations was started on 27 May 1952 and submitted for approval on 25 June. AEC approval was received on 9 July. One plan was prepared and a print was subsequently submitted to the AEC.

Engineering Costs	
(Including Design Work)	$ 553.64
Construction Costs	23,525.87
Total Over-all Costs	$24,079.51

STATION 622 - ELMER

Work consisted of Jobsite surveying and engineering services for location of station.

Construction Costs	$660.00
Total Over-all Costs	$660.00

STATIONS 623.01 THRU 623.10 - JANET

These stations consisted of a reinforced concrete base 12'-0" square x 4'-0" thick. It was provided with a 2'-0" radius circle of bolts for mounting 3-inch Navy guns. Design of these stations was started on 23 May 1952, was submitted for approval on 5 June, and AEC approval was received on 7 July. One plan was prepared and a print was subsequently submitted to the AEC. Construction started on 3 September, was completed on 27 September and accepted by AEC on 22 November.

Engineering Costs (Including Design Work)	$ 335.53
Construction Costs	30,541.24
Total Over-all Costs	$30,876.77

STATIONS 630.01 THRU 630.04 - JANET, LUCY, MARY AND TILDA

These stations were three two-inch pipe standards six feet high with steel plate leading fins welded thereto and cable guyed to two steel beams embedded in and extending from a concrete base 7'-6" wide x 8'-9" long x 3'-0" deep. The base was formed to contain a two-foot cube battery box with gasketed steel cover and connecting conduits. Through the concrete base a 24-inch diameter steel pipe extended 17 feet into the ground with a seal plate provided at the bottom. Design of these stations was started on 15 May 1952, was submitted for approval on 5 June, and AEC approval was received on 22 July. One plan was prepared and a print was subsequently submitted to the AEC. Construction started on 4 August, was completed on 20 September for Station 630.01, 11 October for Stations 630.02 thru 630.04, and all were accepted by AEC on 22 November.

Engineering Costs (Including Design Work)	$ 388.68
Construction Costs	17,487.11
Total Over-all Costs	$17,875.79

STATIONS 640.01 THRU 640.04 - LAGOON

These stations were rafts constructed of wood frame and decking, 24'-7-1/2" x 15'-5", supported on 26 oil drum floats. On each raft was installed four triangular louvered fins fabricated of a wooden frame covered with canvas, and forming a four sided pyramid which measured 10'-0" x 10'-5" at the base. Design of these stations was started on 28 July 1952, having had prior approval by AEC on 17 July. One plan was prepared and a print was subsequently submitted to the AEC. Construction started on 22 September 1952, was completed on 15 October and accepted by AEC on 6 December.

Engineering Costs (Including Design Work)	$ 1,566.88
Construction Costs	27,977.10
Total Over-all Costs	$29,543.98

STATIONS 641.01 THRU 641.04 - VARIOUS REEFS

These stations were telephone poles, 20'-0" high, set erect in the reef and painted with alternating 24-inch bands of black and white. They were located as follows:

Station 641.01 on reef near Janet
Station 641.02 on reef near Ursula and Yvonne
Station 641.03 on reef near Yvonne
Station 641.04 on reef near Elmer

Work was started on 22 September 1952, was completed on 25 October and accepted by AEC on 15 December.

Engineering Costs	$ 8.36
Construction Costs	5,745.94
Total Over-all Costs	$5,754.30

STATIONS 642.01 THRU 642.20 - VARIOUS REEFS

These stations were 55-gallon oil drums, painted white and anchored in the lagoon with 1/2-inch wire cable to a three-foot concrete cube. These stations were located as follows:

Stations 642.01 thru 642.05 - reef near Janet
Stations 642.06 thru 642.10 - reef near Ursula and Yvonne
Stations 642.11 thru 642.15 - reef near Yvonne
Stations 642.16 thru 642.20 - reef near Elmer

Work was started on 2 September 1952, was completed on 25 October and accepted by AEC on 15 December.

Engineering Costs	$ 6.24
Construction Costs	8,373.44
Total Over-all Costs	$8,379.68

STATIONS 690.01 THRU 690.04 - JANET, LUCY, MARY AND SALLY

These stations were concrete structures 7'-4" x 3'-4" x 3'-10-1/2" high with a 10-inch thick floor slab. Exterior and division walls were of varying thickness for two compartments. The larger compartment (unroofed) had an

18-inch O. D. spiral weld pipe 14 feet long buried vertically into the ground and collared by the floor slab. The smaller, heavy-walled compartment was closed at the top by a rectangular steel plate. Design of these stations was started on 24 April 1952, was submitted for approval on 7 May 1952, and AEC approval was received on 3 June. One plan was prepared and a print was subsequently submitted to the AEC. Construction started on 4 August 1952, was completed on 27 September (690.01), 11 October (690.02 thru 690.04), and accepted by AEC on 22 November.

Engineering Costs	
(Including Design Work)	$ 479.00
Construction Costs	17,924.70
Total Over-all Costs	$18,403.70

STATION 910 - ELMER

This was a wood frame platform 9'-10" wide by 19'-4" long decked with 2-inch planking and supported by four 4" x 6" timber columns on 2'-0" x 2'-0" x 1'-6" deep concrete footings. The platform was 15'-7" above grade. A telephone pole 50 feet high, extending through the center of the platform, was erected for the installation of an antenna. Design of this station was started on 29 July 1952, having had prior approval by AEC on 17 July. One plan was prepared and a print was subsequently submitted to the AEC. Construction started on 25 August 1952, was completed on 13 September and accepted by AEC on 18 November.

Engineering Costs	
(Including Design Work)	$ 179.48
Construction Costs	2,134.61
Total Over-all Costs	$2,314.09

STATIONS 1300.01 AND 1300.03 - JANET AND YVONNE

These stations consisted of telephone switchboards with main frame, cabinets, battery rack and lighting fixtures. These were installed in existing GREENHOUSE Stations 23a and 23b. Station 1300.01 was located on Janet and Station 1300.03 on Yvonne. Two sub stations were installed, each with three transformers, dehumidification units, portable generator, and all necessary switches, wiring, conduits and fittings. Design of these stations was started on 10 July 1952, was submitted for approval on 6 August and AEC approval was received on 22 August. Two plans were prepared and prints were subsequently submitted to the AEC. Construction started on 10 September 1952, was completed on 11 October and accepted by AEC on 22 November 1952.

Engineering Costs	
(Including Design Work)	$ 1,632.11
Construction Costs	46,188.49
Total Over-all Costs	$47,820.60

SECTION 3. EGG

STATION 5 - FLORA

This station was a one-story wood frame structure 33'-0" x 24'-9" x 11'-1" mean height erected on a four-inch thick reinforced concrete slab and had exterior walls of 1/2-inch plywood, trussed rafters with 1" x 6" diagonal sheathing and cold process composition roofing. The interior was furred ceiling of 1/4-inch plywood and cocoon treated. The building was completed with electrical wiring and fixtures, and a dehumidification system. ECO 3713 authorized the installation of ducts and vents from the electronic equipment; the covering of the west side and roof of the station with sisalation paper; the adjustment of the dehumidification air intakes to compensate for exhausted air from the electronic equipment; the covering of the dehumidification units with a wood frame and canvas structure to protect them from the sun; and the removal of the shed and winch to facilitate free air circulation around the dehumidification unit. ECO 3719 authorized the installation of a continuous ceiling on existing joists throughout the station. The main difficulty with this station was overheating and breakdown of equipment. The air was properly dehumidified but was not cooled and temperatures up to 103 degrees prevailed. With the installation of NRLK room coolers and the alterations noted above, overheating was corrected.

The design of this station started 18 February, drawings were submitted 5 June and approved by AEC on 9 July 1952. There were two drawings prepared and prints were subsequently furnished to the AEC. Prints were issued to the Jobsite on 19 July. Construction started 24 July, was completed on 13 September and AEC acceptance was received on 22 November.

Engineering Costs	
(Including Design Work)	$ 2,756.33
Construction Costs	41,063.35
Total Over-all Costs	$43,819.68

STATION 6 - FLORA

On 13 February 1952, Holmes & Narver was informed that the using agency was going to provide a 150-foot high antenna and that Holmes & Narver would be required to design the foundations. The location was to be any place within a 250-foot radius of Station 5. On 8 April information was received to the effect that Holmes & Narver would provide a tower 375 feet high on top of which a platform was to be constructed for the installation of an antenna and transmitter which would be furnished by the User. On 1 May 1952 approval for the purchase of the tower was received. The foundation drawings were approved on 25 June. On 3 July a design change was effected to provide an additional platform at the 325-foot level. The tower, as erected, was shop-welded and field-bolted.

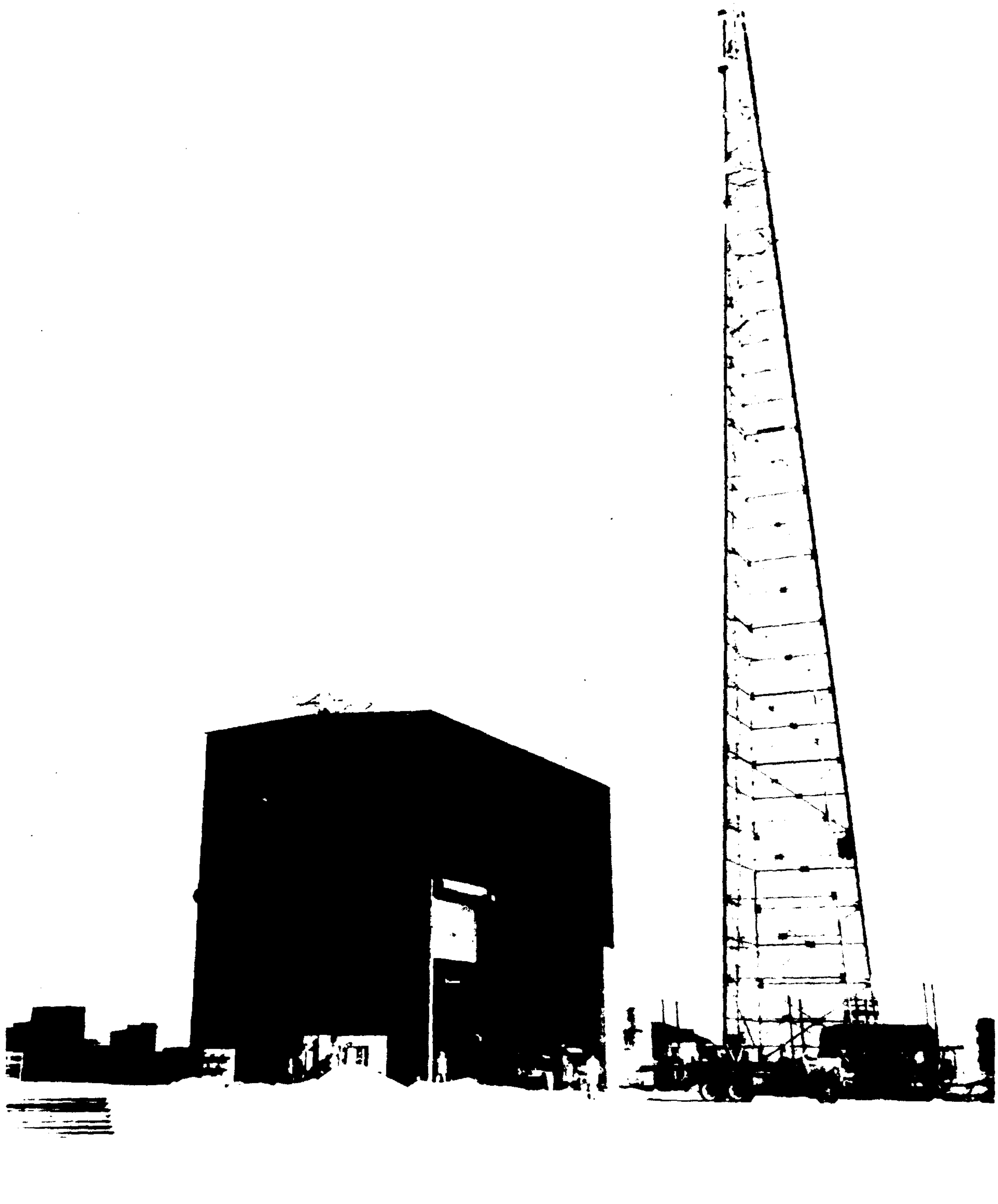


Figure 2-87. Station 6 Under Construction

It had four legs, and each leg was anchored to a separate reinforced concrete foundation 17'-0" x 17'-0" x 7'-6" thick. The horizontal section of the tower at the base measured 33'-9" x 33'-9" and the tower tapered so that at the 325-foot level the horizontal section measured 5'-6" x 5'-6". Platforms were provided at the 325- and 375-foot levels and a steel ladder with safety cages was installed for the full height with landings approximately 20 feet apart.

There were three drawings prepared and prints were subsequently submitted to the AEC. Holmes & Narver constructed the footings which were started on 15 July 1952, and completed on 13 August. The tower was erected on a sub contract with the Henry Robertson Co. The erection started on 15 August and was completed on 27 September. AEC accepted this station on 22 November. Figure 2-87 shows the tower prior to placement of cab and with Station 1 in the foreground.

Engineering Costs (Including Design Work)	$ 3,826.79
Construction Costs (Including Subcontract Work)	99,260.20
Total Over-all Costs	$103,086.99

STATION 301 - ELMER

This was a standard EGG photo cab on a strengthened photo tower 125 feet high. This tower was constructed by combining two existing 75-foot towers. A 14'-3" x 14'-3" x 8'-0" high cab was mounted above the 125-foot level. Four vertical legs were anchored to reinforced concrete footings. A steel stairway, dumb-waiter, wiring and fixtures including searchlights, floodlights, obstruction lights and power lines were installed. The tower was braced from the 112'-6" level by eight 1-1/4-inch guys to concrete anchors.

The design of this station started 14 January 1952 and was submitted 18 April 1952 and approved 22 May 1952. Subsequent revisions and changes necessitated later plans being submitted 4 June 1952 and approved 9 July. Six drawings were prepared, revised and subsequently furnished to the AEC. Construction started 18 July 1952, was completed 18 October, and accepted by AEC on 22 November 1952.

Figure 2-88 shows the station under construction on 12 September and just prior to placement of the cab. Minor difficulties encountered were occasioned by revisions received from the using agency at a late date. These included: a requirement that the structure be weatherproofed; that a second searchlight be installed, after a special boom of the hoisting crane had been dismantled; and that supplementary bracing be installed for additional openings and equipment. Costs for this item are shown on page 2-138.

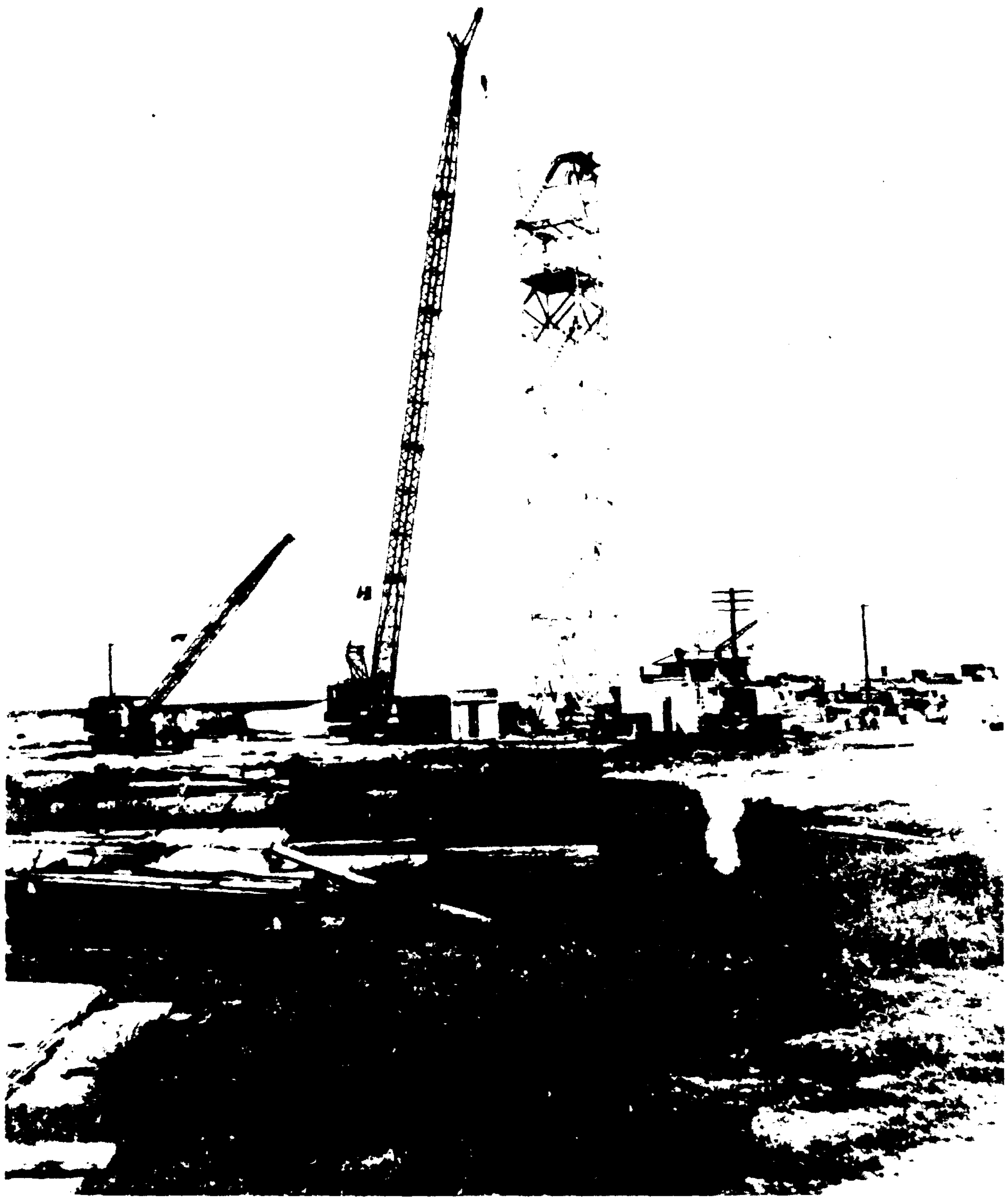


Figure 2-88. Station 301 During Construction

Engineering Costs	
(Including Design Work)	$ 4,810.63
Construction Costs	99,603.87
Total Over-all Costs	$104,414.50

STATION 302 - ELMER

This station was an array of cameras on a concrete pier. A reinforced concrete building 9'-4" x 9'-4" x 9'-4" high (outside dimension) was constructed on a continuous concrete footing one-foot below grade. Walls were 8 inches thick, floor and roof 4 inches thick. Adjacent to this station was a reinforced concrete block 25'-0" x 4'-0" x 4'-9" which was fitted with seven steel mounting plates, various embedded 3-inch O.D. pipe sleeves and 18-gauge galvanized sheet metal cable ducts.

Design of this station started 9 July 1952 and was preliminarily submitted 23 July 1952. AEC approval was received 5 August 1952. Two plans were prepared which were subsequently submitted to the AEC. Construction started 19 August 1952, completed 4 October 1952 and accepted by AEC on 22 November 1952.

Engineering Costs	
(Including Design Work)	$ 5,342.08
Construction Costs	12,904.07
Total Over-all Costs	$18,246.15

STATION 303 - JANET

These stations were two concrete piers anchored on the roof of Station 1001.01 (existing GREENHOUSE Station 69). One pier was 17'-0" x 4'-0" x 4'-0" high; the other was 17'-0" x 4'-0" x 3'-0" high. They were fitted with steel mounting plates, various embedded 3-inch O.D. pipe sleeves and sheet metal cable ducts.

The design of these stations was started 28 December 1951 and drawings were submitted 23 July 1952 and approved 5 August 1952. Two plans were prepared which were subsequently submitted to the Client. These plans also covered Stations 305 thru 308. Construction started 1 August 1952, was completed 15 October 1952, and accepted by AEC 22 November 1952.

Engineering Costs	
(Including Design Work)	$ 210.08
Construction Costs	7,592.78
Total Over-all Costs	$7,802.86

STATION 304 - OSCAR

The work undertaken for this station consisted primarily of installation and removal of User's cameras and strip planking which was performed as support services under Job 4. Only minor construction work was performed under Job 1.

Construction Costs	$38.00
Total Over-all Costs	$38.00

STATION 305 - URSULA

This was a concrete pier 12 feet square and 1'-3" thick with a reinforced concrete pedestal four foot cubed. The pedestal was surmounted by a 1/2-inch thick steel plate and various embedded three-inch O.D. pipe sleeves.

Design for this station was started 21 July 1952 and drawings were submitted for approval 23 July. The drawings were received with AEC approval on 5 August. Two drawings were reported under Station 303. Construction started 1 August (began before Work Order was issued), completed 4 October and accepted by AEC on 22 November.

Engineering Costs	
(Including Design Work)	$ 75.00
Construction Costs	2,988.00
Total Over-all Costs	$3,063.00

STATION 306 - URSULA

This was a concrete pier on the roof of Station 1001.02 (existing GREENHOUSE Station 69) and consisted of three concrete blocks, one 17'-9" x 4'-0" x 3'-0" high, one 16'-8" x 4'-0" x 2'-3" high, and one 4'-0" x 4'-0" x 4'-0" high, fitted with steel mounting plates, various embedded pipe sleeves and sheet metal cable ducts. These blocks were anchored to the concrete roof.

Design for this station was started 11 July 1952 and drawings were submitted for approval 23 July 1952. They were received with AEC approval 5 August 1952. Drawings were reported under Station 303. Construction was started 1 August 1952, completed 4 October 1952 and accepted by AEC 22 November 1952.

Engineering Costs	
(Including Design Work)	$ 191.36
Construction Costs	5,746.02
Total Over-all Costs	$5,937.38

STATION 307 - YVONNE

This was a concrete block 17'-0" x 4'-0" x 3'-0" high, on roof of Station 1001.03 (existing GREENHOUSE Station 69), similar to Station 306 with the exception that one 5 KVA transformer was installed.

Design for this station was started 11 July 1952 and drawings were submitted for approval 23 July 1952. The design received AEC approval 5 August 1952. Drawings were reported under Station 303. Construction started 1 August 1952, completed 27 September 1952 and accepted by AEC 22 November 1952.

Engineering Costs	$ 181.88
Construction Costs	3,516.95
Total Over-all Costs	$3,698.83

STATION 308 - ELMER

This station consisted of a reinforced concrete slab, 12'-0" square and 1'-3" thick, with a reinforced concrete pedestal 4'-0" x 4'-0" x 4'-0". The pedestal was fitted with a 1/2-inch thick steel mounting plate and various embedded 3-inch O.D. pipe sleeves.

Design for this station was started 21 July 1952 and drawings were submitted for approval 23 July 1952. They received AEC approval 5 August 1952 and were issued to Jobsite 7 August 1952. Drawings were reported under Station 303. Construction started 19 August 1952, completed 15 September 1952 and accepted by AEC 22 November 1952.

Engineering Costs (Including Design Work)	$ 65.73
Construction Costs	3,265.92
Total Over-all Costs	$3,331.65

STATIONS 1000.01 THRU 1000.10 - VARIOUS SITES

Station 1000.01 - Alice
Station 1000.02 - Belle
Station 1000.09 - Mary

The work for these three stations consisted of installing telephone and signal terminal cabinets in existing GREENHOUSE buildings. Portable generators were also installed.

Station 1000.03 - Clara
Station 1000.04 - Daisy
Station 1000.05 - Edna
Station 1000.06 - Irene
Station 1000.08 - Lucy
Station 1000.10 - Helen

The work for the above six stations consisted of constructing wood frame buildings 8'-7-1/4" x 12'-7-1/4" x 8'-6" mean height. The buildings had aluminum roofing and siding, a concrete floor, signal and telephone terminal cabinets.

Station 1000.07, located on Kate, was similar to the above six with the exception that the structure was erected on an existing concrete slab.

The designs for these stations were started 7 May 1952, were submitted 14 April 1952 and 17 June 1952 and were approved 9 July 1952. There was one drawing and two field sketches which were subsequently submitted to the AEC. Construction started 23 July 1952, the last station was completed 10 October 1952, and AEC acceptance was dated 18 November 1952.

Engineering Costs (Including Design Work)	$ 279.18
Construction Costs (All 10 Stations)	31,632.92
Total Over-all Costs	$31,912.10

STATIONS 1001.01 THRU 1001.03 - VARIOUS SITES

These three stations were similar (in scope of work) to Stations 1000.01, 1000.02 and 1000.09. Cabinets were installed in existing GREENHOUSE Station 69 at the following:

Station 1001.01 - Janet
Station 1001.02 - Ursula
Station 1001.03 - Yvonne

Construction on these three stations was started 22 September 1952, completed 24 September 1952 and accepted on 15 December 1952. Fabrication and installation of wooden work benches and installation of portable generators were required.

Construction Costs	$1,004.00
Total Over-all Costs	$1,004.00

STATION 1002 - ELMER

The work on this station consisted of installing a 45-foot telephone pole with power drop and connection to GREENHOUSE Bldg. 311. Work was completed 24 September 1952 and accepted 15 December 1952.

Construction Costs	$36.00
Total Over-all Costs	$36.00

SECTION 4. DOD

STATION 10 - JANET

This station was a reactivated GREENHOUSE Station, No. 771. It was a reinforced concrete structure 8'-0" x 14'-6" x 7'-6" high. Twelve-inch thick foundation footings were set 4'-6" below grade. Walls, roof and partitions were 12 inches thick.

There was no design or construction criteria. Reactivation work was accepted by AEC on 15 December 1952.

Engineering Costs	$ 61.47
Construction Costs	208.87
Total Over-all Costs	$270.34

STATION 11 - EDNA. DOD (AFSWP)

This station was a one-story frame building of rectangular shape, having outside dimensions of 10'-10" x 10'-10" x 7'-2", and set on a continuous reinforced concrete foundation. It had a 6'-0" x 6'-0" x 3'-6" concrete block centered inside the structure submerged to the finished floor grade of the building.

Design of this station was started on 1 February 1952, was submitted for approval 1 February. AEC approval was received on 4 March. One drawing was prepared and print was subsequently submitted to the AEC. Construction started 12 March 1952, was completed on 15 March and accepted by AEC on 31 May.

Engineering Costs (Including Design Work)	$ 237.62
Construction Costs	3,269.19
Total Over-all Costs	$ 3,506.81

STATION 12 - YVONNE. DOD (AFSWP)

This station was a reactivated GREENHOUSE Station, No. 773. It was a reinforced concrete structure 8'-0" x 14'-6" x 7'-6" high. Reactivation work was accepted by AEC on 15 December 1952.

Engineering Costs	$123.47
Construction Costs	208.87
Total Over-all Costs	$332.34

STATION 13 - LEROY. DOD (AFSWP)

This station was a one-story building constructed of wood, and was similar to Station 11. Outside dimensions were 10'-10" x 10'-10" x 7'-2".

Design of this station is covered under Station 11. Construction started on 10 March 1952, was completed on 16 March and accepted by AEC on 31 May.

Engineering Costs	$ 13.62
Construction Costs	6,065.19
Total Over-all Costs	$6,078.81

STATION 14 - FRED. DOD (AFSWP)

This station was a reactivated GREENHOUSE Station, No. 775. It was a wood building 10'-0" x 10'-0" x 7'-8" high erected on 1'-0" x 2'-0" reinforced concrete footing and having a concrete block 5'-0" square centered inside the structure with the top at the finished floor grade of the structure. Reactivation work was accepted by AEC on 15 December 1952.

Engineering Costs	$123.47
Construction Costs	208.87
Total Over-all Costs	$332.34

STATION 50 - YVONNE. DOD (AFSWP)

This station consisted of 117 55-gallon oil drums resting above high tide level on 2-1/2" diameter standard pipes driven into the reef. Drums were painted a luminous flame orange color, and arranged 5'-0" center to center to form a 100-foot cross, three drums wide. Installed equipment consisted of one 10 KVA transformer on a pole.

Design was started on 16 July 1952, completed on 29 July and AEC approval was received on 31 July. Two plans were developed and drawings were subsequently submitted to the AEC. Construction started 8 September, was completed on 15 October and accepted by AEC on 22 November.

Engineering Costs (Including Design Work)	$ 287.06
Construction Costs	19,963.50
Total Over-all Costs	$20,250.56

STATION 51 - YVONNE. DOD (AFSWP)

This station consisted of an asphalt base 200-foot square, on which was painted a white circle 200 feet in diameter. Within this circle was painted a white cross, the arms of which were 20 feet wide and extended to the periphery of the circle. A radar reflector which was 28'-3" square and 17'-0" high was erected in the center. On a timber frame around the radar reflector thirty-six 75-watt spotlights were installed. One 5 KVA transformer was provided.

Design criteria is reported under Station 50. Construction was started on 8 September 1952 (work began before Work Order was released), completed on 31 October and accepted by AEC on 22 November.

Engineering Costs	$ 50.71
Construction Costs	6,579.93
Total Over-all Costs	$6,630.64

STATION 52 - LEROY. DOD (AFSWP)

This station was a radar reflector, 28'-3" x 28'-3" x 17'-0" high. Design criteria was as reported under Station 50.

Construction started 8 September 1952, completed 4 November 1952 and accepted by AEC 22 November 1952.

Engineering Costs	$ 147.77
Construction Costs	7,373.35
Total Over-all Costs	$7,521.12

STATION 53 - ELMER. DOD (USAF)

This station was canceled and deleted from the program. The original program required a 28'-3" x 28'-3" x 17'-0" high radar reflector with one 10 KVA transformer mounted on a pole. This structure was prefabricated and ready for erection on the site when this station was canceled.

Construction was started 18 September, was canceled 15 October 1952 and costs to date of cancellation were accepted by AEC on 22 November 1952.

Engineering Costs	$ 137.49
Construction Costs	2,236.77
Total Over-all Costs (Up to Cancellation of Work)	$2,374.26

STATIONS 390.01 THRU 390.10 - VARIOUS. DOD (USAF)

These stations were 14-inch diameter holes in the ground, 4-feet deep.

The station locations were as follows:

Stations 390.01 and 390.02 - Janet
Station 390.03 - Yvonne
Station 390.04 - David
Stations 390.05 and 390.06 - Elmer

Stations were located as requested by the using agency. Stations 390.07 thru 390.10 were deleted by the User.

Survey drawings were accepted by AEC on 15 December 1952. Work performed as support services under Job 4.

STATIONS 540.01 THRU 540.20 - LAGOON. DOD (BUSHIPS, NRDL)

The work consisted of anchoring a 55-gallon drum with 1/2-inch wire cable to a 3-foot cube concrete anchor at locations in the lagoon in accordance with User's directions.

Construction started on 1 September 1952, was completed on 9 October, and accepted by AEC on 15 December.

Engineering Costs	$ 8.11
Construction Costs	10,281.77
Total Over-all Costs	$10,289.88

STATIONS 541.01 THRU 541.33 - VARIOUS. DOD (NRDL)

These stations consisted of a trapezoid-shaped concrete block set in the ground. The block was 6'-10" long, 2'-6" wide at one end, 4'-8" wide at other, and 1'-8-1/2" high, and was placed approximately 1'-4" below grade. The block contained one circular pit 3'-1/4" diameter x 1'-2-1/2" deep and one rectangular pit 2'-2" x 1'-8" x 1'-1" deep with steel cover.

Design of these stations was started on 19 July 1952, and had received prior approval by AEC on 14 July. One plan was prepared and a print was subsequently submitted to the AEC. Construction started 25 August, was completed 27 September (541.01 thru .04); 18 October (541.05 thru .33), and accepted by AEC on 18 November.

One station was located on each of the following sites: Alice, Belle, Clara, Irene, Kate, Lucy, Mary, Nancy, Olive, Pearl, Sally, Ursula, Vera, Wilma, Bruce, Glen and Mack. Two stations each were located on Janet, Ruby, Yvonne, David, Elmer, Fred, Keith and Leroy.

Several of these stations were relocated after installation at the direction of the using agency, in order to obviate obstructions between these stations and Station 1.

Engineering Costs	
(Including Design Work)	$ 256.08
Construction Costs	23,688.81
Total Over-all Costs	$23,944.89

STATIONS 542.01 THRU 542.08 - VARIOUS. DOD (NRDL)

These stations consisted of reinforced concrete shapes made up of horizontal slabs 9'-4" wide x 1'-0" thick varying in length from 7'-0" to 11'-1", with vertical wall 9'-4" wide x 1'-0" thick varying in height from 5'-8" to 10'-0".

Design started on 17 July 1952 and received prior approval by AEC on 14 July. A drawing was prepared and a print was subsequently submitted to the AEC. Construction started on 8 September, was completed on 27 September (542.01); 10 October (542.02 thru .06); 25 October (542.07 and .08), and accepted by AEC on 22 November.

The stations were located as follows:

Station 542.01 - Alice
Station 542.02 - Janet
Station 542.03 - Nancy
Station 542.04 - Wilma
Station 542.05 - Yvonne
Station 542.06 - Bruce
Station 542.07 - Elmer
Station 542.08 - Fred

Some of these stations were relocated after installation at the direction of the User in order to obviate obstructions between these stations and Station 1.

Engineering Costs	
(Including Design Work)	$ 451.99
Construction Costs	19,934.71
Total Over-all Costs	$20,386.70

STATION 850 - JANET. DOD (USAF)

Existing GREENHOUSE Structure 25 was utilized for this station. Services performed consisted of support in placing equipment in the station and was performed under a Job 4 Work Order.

STATION 1130 - FLORA AND STATION 1131 - ELMER. DOD

Station 1130 Flora was a hole eight inches in diameter drilled to 4,600-foot depth. Station 1131 was a similar hole drilled to 4,200-foot depth. Holmes & Narver provided minor support services under Job 4.

STATION 6140 - YVONNE. DOD (EGG)

These were timing cables furnished by the using agency, and installed in 36-inch trenches. Installed equipment consisted of one 5 KVA Gregory Transformer.

AEC approved Work Order on 5 August 1952.

Construction Costs (Including Equip.)	$253.00
Total Over-all Costs	$253.00

SECTION 5. NRLK

STATION 200 - IRENE

The first schematics for this station were received on 16 November 1951, which called for a concrete structure having two instrument rooms 12'-0" x 24'-0" x 9'-0" high, one coax room 14'-0" x 24'-0" x 9'-0" high and a maze-type entrance corridor approximately 4'-0" wide and 170'-0" long. The wall thickness of the entire structure was initially to be five feet but was later reduced to three feet.

With the exception of relocating the entrance corridor from one side to the opposite side of the building, the basic layout changed very little during the design period. However, design criteria for the mechanical and electrical installation were sufficiently uncertain that authority was granted for Holmes & Narver's Chief Mechanical Engineer to discuss this matter directly with representatives of the Naval Research Laboratory. As a result of these discussions engineering for this station was halted on 19 November until firmer criteria became available. On receipt of new schematics on 20 December the design work was resumed. Ventilation details were received on 11 February 1952, and on 13 February information was received that a coral sand cover for the structure of 15 feet minimum thickness would be required for shielding purposes. On 23 February a new electrical layout was received, but due to inconsistencies Holmes & Narver prepared a single line diagram of their interpretation of the drawings which was submitted on 5 March for clarification. A complete new set of schematics was received on 10 March which agreed in essence with the previous schematics but contained minor changes in electrical, mechanical and structural designs. Approval of the design of this station was received on 9 May 1952.

In order to eliminate electromagnetic influences it was proposed on 22 July to install a 75 KW motor generator in the line from the central power plant to the station. This was, however, canceled on 31 July, as it was indicated that the desired results could be obtained with the use of filters. The final power demands of this station were as follows:

Experiment Power	75 KW
Utility Power	30 KW
Lights	10 KW
Air Conditioning	40 KW
Total	155 KW

Foundation excavation for the building was started on 22 March. Figure 2-89 indicates the construction progress as of 9 June and Figure 2-90 as of 26 June. The design involved the use of considerable reinforcing steel which is indicated in Figure 2-91. Figure 2-92 indicates the progress as of 7 August.

The station as erected was a heavily reinforced concrete structure 44'-0" x 52'-0" x 15'-0" high with four rooms and a corridor along the entire length of one side of the building. The exterior walls were 4 feet thick and the floor and roof 3 feet thick. A maze entrance tunnel, approximately 130 feet long and 11 feet average width, led to a loading platform of approximately 260 square feet. This loading platform was approached via a concrete ramp 80 feet long and 20 feet wide, with the end of the ramp at the loading platform depressed approximately four feet below grade and the other end at natural grade. A stabilized parking area was provided alongside the ramp.

The interior doors of the building were of steel and lead and the exterior of steel. The entire structure was covered with coral sand to a depth of 15 feet, which was retained in place by sacks filled with a lean sand-cement mixture. The building was complete with salt water cooling supply, dehumidification system, power light and communication wiring and fixtures and exterior flood lighting.

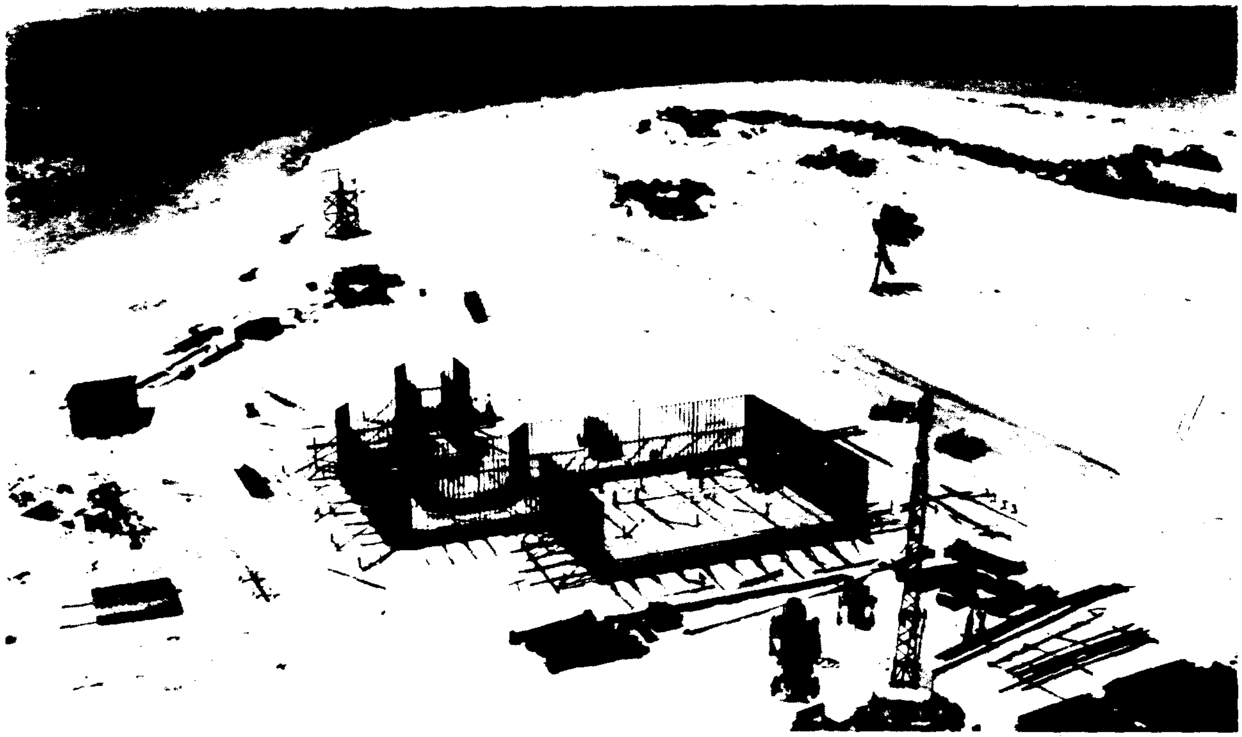


Figure 2-89. Aerial View of Station 200 During Construction

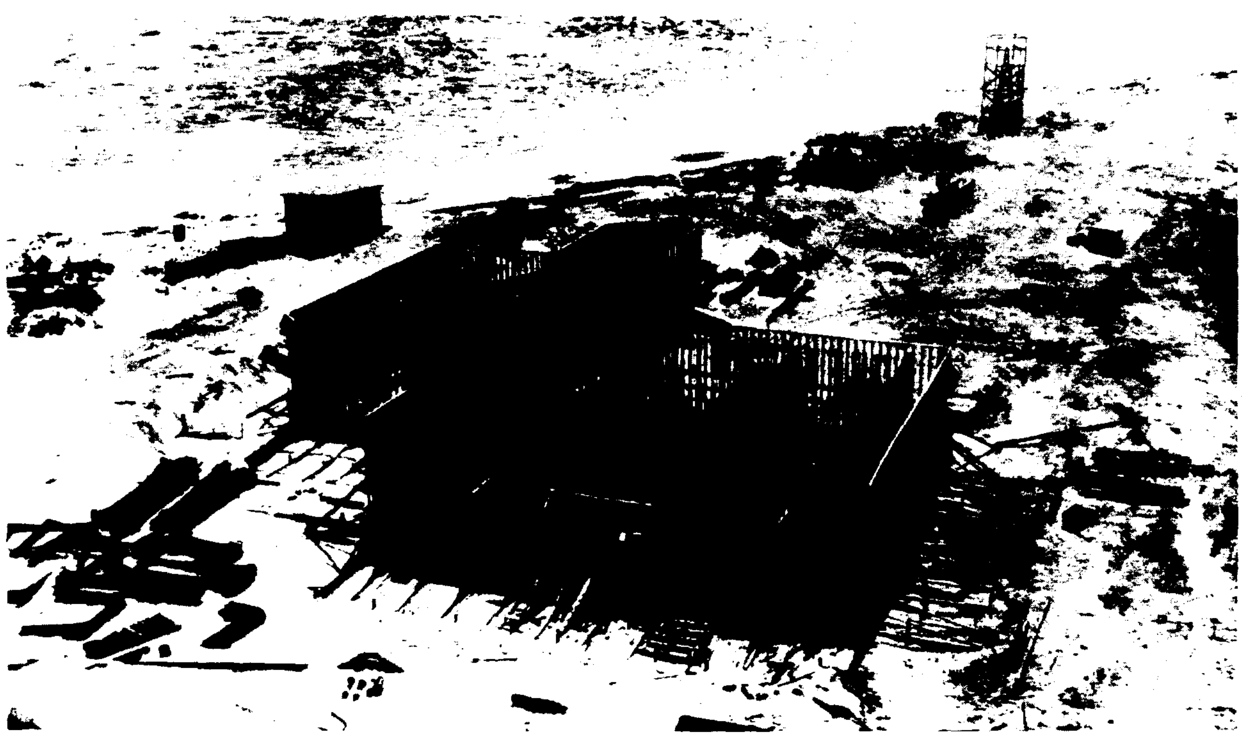


Figure 2-90. Station 200 from Southwest During Construction

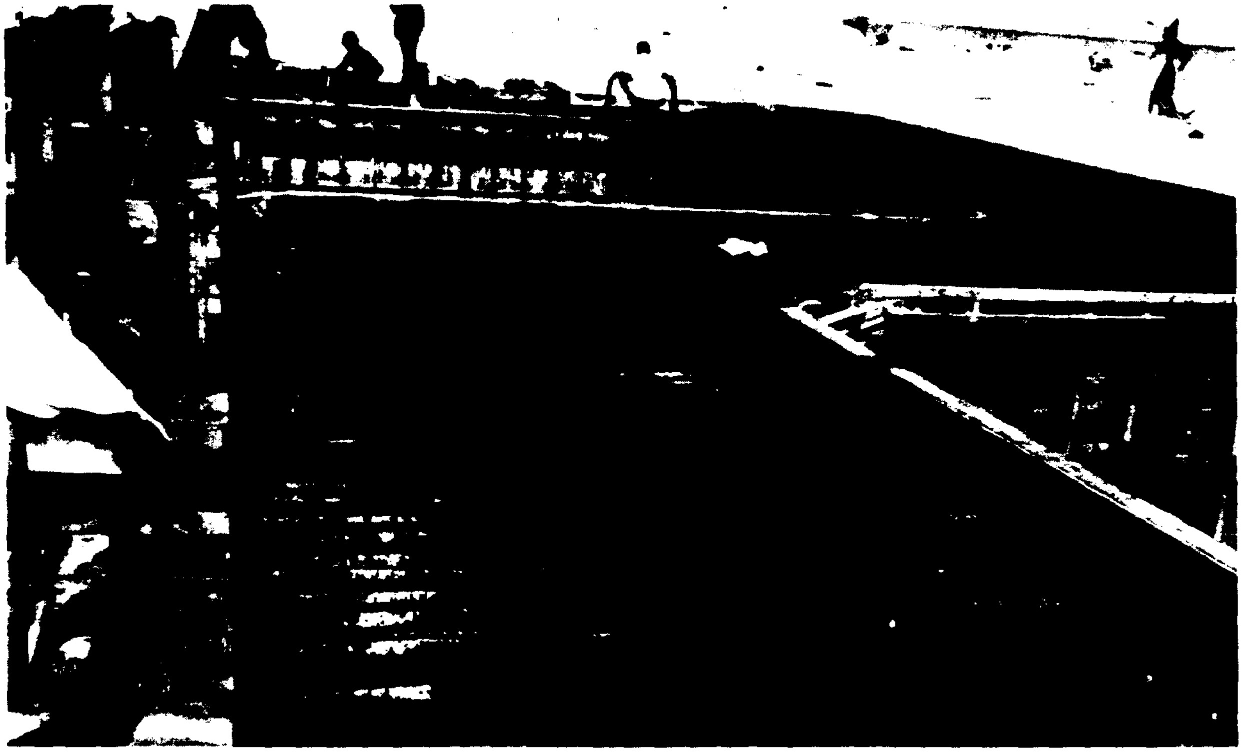


Figure 2-91. Massive Reinforcement over Corridor to Station 200

Figure 2-92. Forming the Side Walls, Station 200

After completion of this station settlement of the general area about the station was noted. Observations were made over a period of several days until the settlement stopped. The maximum displacement was 0.23 feet which was not severe enough to affect the instrumentation. Difficulty was experienced with the malfunctioning of the dehumidification system. This was rectified by disconnecting the humidostats, installing strip heaters and using thermostats to control the system. At shot time it was reported that the temperature was constant at 70° F with 40% relative humidity.

The construction of this station was started 22 March 1952, completed on 15 October and was accepted by AEC on 6 December.

Engineering Costs (Including Design Work)	$ 26,474.44
Construction Costs	560,156.94
Total Over-all Costs	$586,631.38

STATION 201 - FLORA

The first schematic of this station called for a limonite concrete wall 15'-3" wide, 35'-0" high and 1'-0" thick with a 6-inch sheet of water on the front face, the water being contained in a metal box. On 9 April this scheme was replaced by a coral concrete wall 6'-0" thick, 29'-6" high, with a front face 15'-7-1/4" wide, and rear face 24'-0" wide.

As of 9 May, all previous schematics were no longer valid and the Naval Research Laboratory furnished a drawing which increased the previous wall height by 10 feet and indicated several tubes and large holes through which the laboratory would run cables or set instruments.

Settlement of the wall was not desirable. Studies of soil bearing values indicated that it was necessary to support the wall on piling. The new scheme also increased the station to include an earth fill between the large concrete wall and a concrete retaining wall approximately 30'-0" wide and 30'-0" high. In the space to be earth-filled were several heavy structural steel beams to support lead baffles and pipes. The two sides of the station were of timber construction.

The structure as completed was rectangular-shaped and consisted of two reinforced concrete walls connected by a timber cribbing, with the area between the walls and cribbing filled with coral sand. This structure was 24'-11" wide by 32'-0" long by 24'-0" high. The western concrete wall was 6'-0" thick, extended 11'-0" above the top of the structure and was supported by 12 steel "H" beam piles. This wall was located within Station 1. The eastern concrete wall was 1'-6" thick and was located outside of Station 1.

Design for this station was started on 15 May 1952, plans were submitted on 11 July and were approved on 18 July. Two plans were prepared; one plan was revised 7 August and the other plan was voided. One "As-Built" drawing was subsequently furnished to the AEC.

Construction started 6 August, was completed 16 October and accepted by AEC on 22 November. Figure 2-93 shows the placing of collimators in Station 201 on 15 September 1952.

Engineering Costs	
(Including Design Work)	$ 2,953.36
Construction Costs	52,138.83
Total Over-all Costs	$55,092.19

STATION 202 - IRENE

A rectangular, all-reinforced concrete structure 16'-0" x 14'-0" x 20'-9" high was connected to Station 200 by a timber-framed tunnel, 87'-0" x 5'-3" wide x 9'-0" high with a concrete floor. A concrete and timber-framed retaining wall was built 92'-0" long and 19'-8" high complete with wiring, fixtures, ventilation and lead door. A compacted earth-fill cover was placed to a height of 10'-0" above the highest point of the structure.

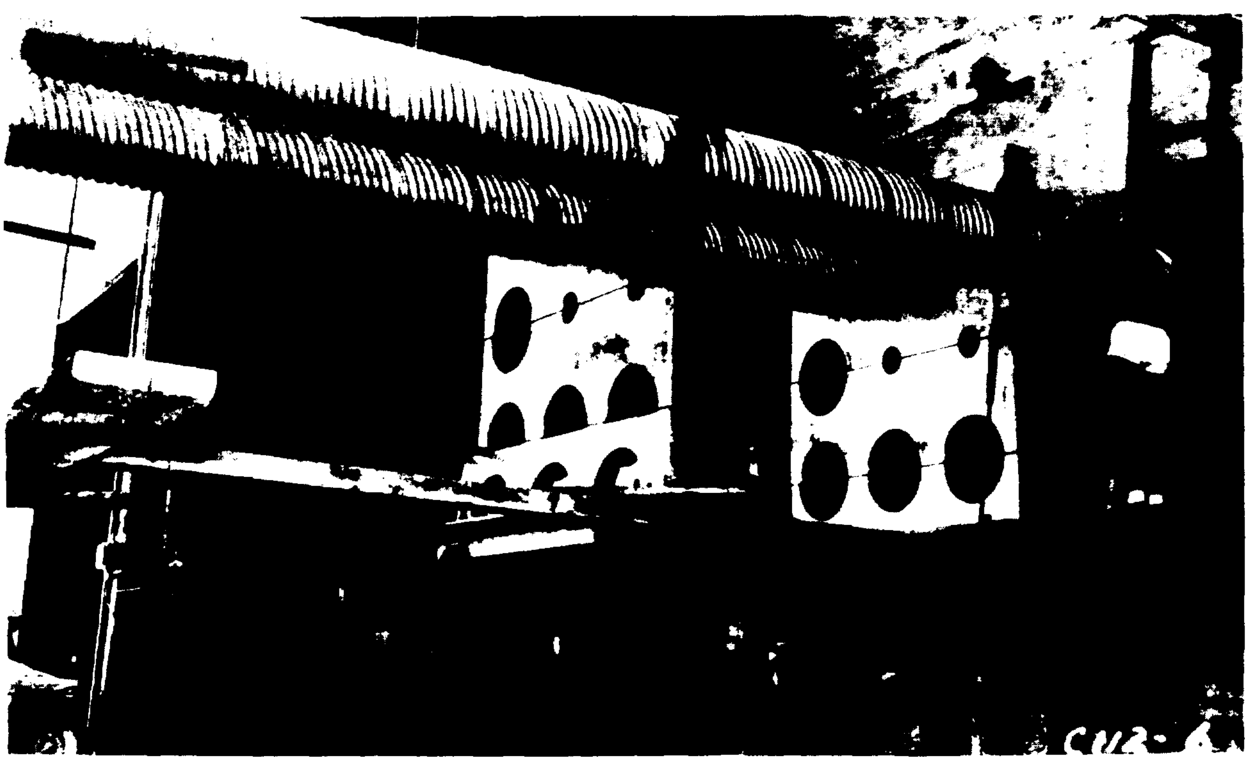


Figure 2-93. Placing of Collimators in Station 201

The design of this station was started on 7 July, drawings were submitted from 11 July through 13 August and approval was received on 23 July. The first revision was made on 7 August, a second revision was made on 19 August. Two engineering drawings and two field sketches were prepared and subsequently furnished to the Contractor.

Construction started on 19 August 1952, was completed 25 October and accepted by AEC on 18 November. Figure 2-94 shows the construction of the retaining walls in front of Station 202 and progress of work as of 25 September. Figure 2-95 shows the front face of Station 202 with Station 200 in the background. Figure 2-96 and Figure 2-97 note Stations 202, 203.09 and 204 prior to backfilling of Station 202.

Engineering Costs (Including Design Work)	$ 3,583.83
Construction Costs	70,390.70
Total Over-all Costs	$73,974.53

STATION 203.01 THRU 203.09 - VARIOUS

A rectangular reinforced concrete foundation slab 5'-4" x 10'-10" x 8" thick topped with 8-inch thick perimeter walls approximately 8'-0" high with bearing plates and anchor bolts. The walls supported a perforated lead baffle 8'-0" x 8'-0" x 1'-0" which was mounted on an I-beam stand. Figure 2-98 is a close-up view of a typical 203 Station.

These stations were located as follows:

Station 203.01 - Flora-Gene
Station 203.02 - Gene
Station 203.03 - Helen-Irene
Station 203.04 thru 203.09 - Irene

The design for these stations was started on 3 July 1952, was submitted on 11 July and approved 22 July. One revision was made as of 7 August. One "As-Built" drawing was made and print was subsequently submitted to the AEC.

The alignment of the lead baffles in connection with these stations was required to be within a tolerance of plus or minus one-quarter inch from a true line of sight between the working points of Station 1 and Station 200. To establish controls for vertical alignment a series of bench marks was established by precise differential leveling and corrections applied to the elevations of these marks to compensate for the earth's curvature. As the effects of horizontal refraction could not be pre-determined, it was necessary to accomplish the horizontal alignment under conditions which would hold refraction to a minimum. The most favorable conditions were obtained by controlling the movement of

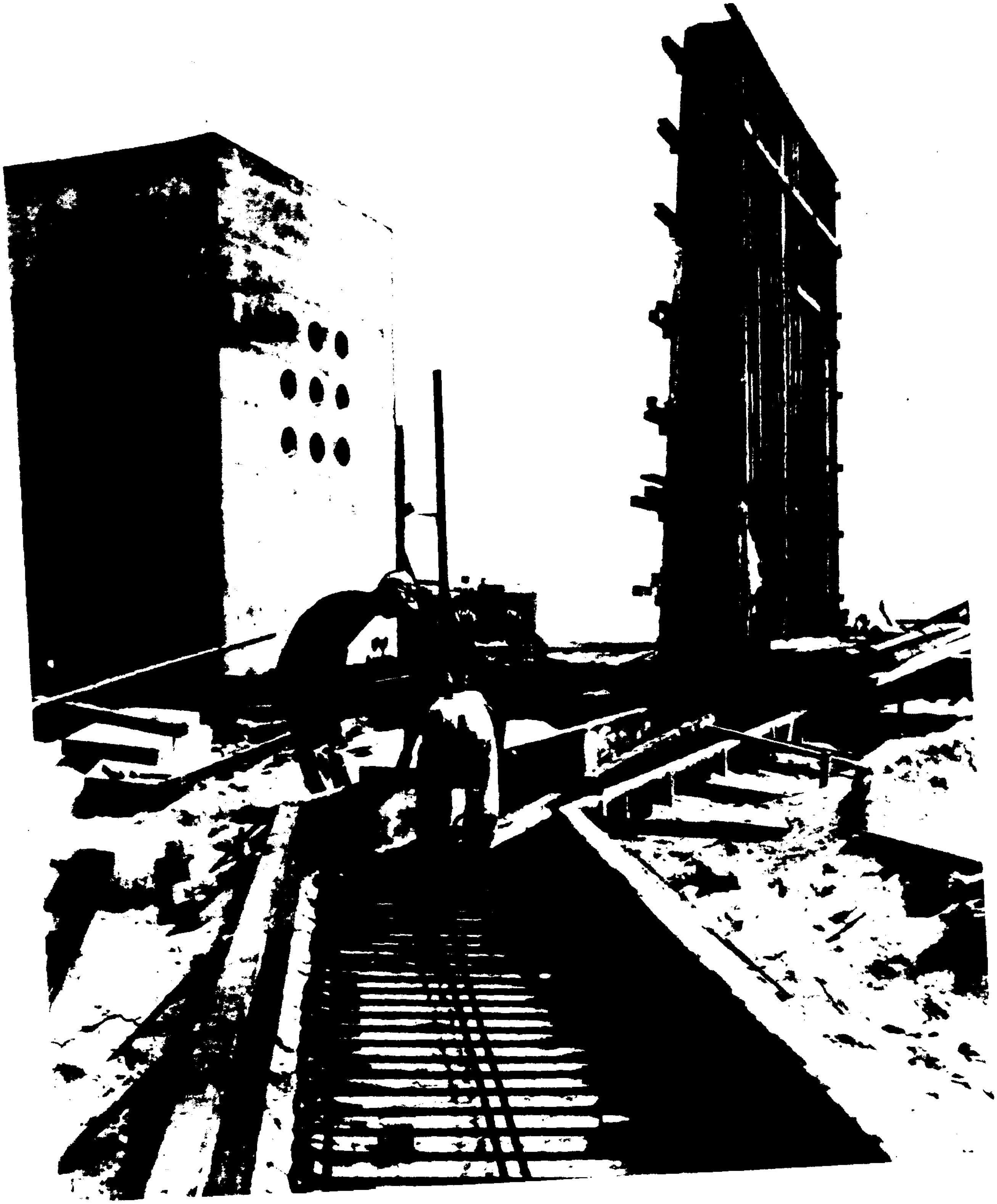


Figure 2-94. Construction of Retaining Walls in Front of Station 202

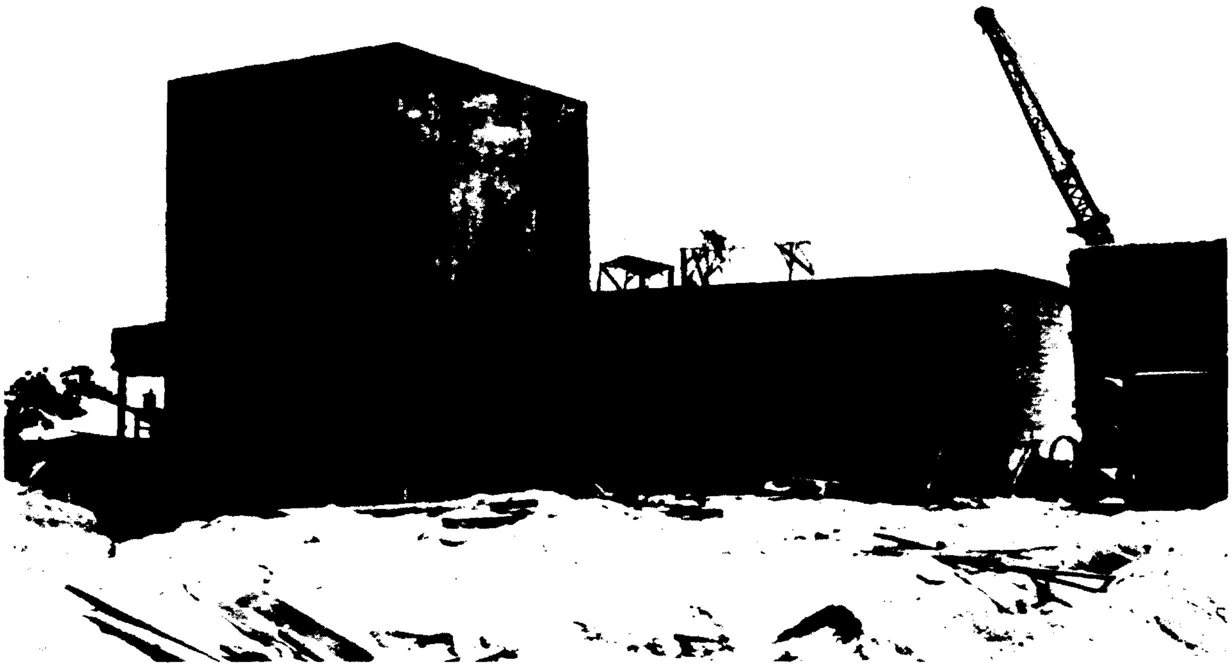


Figure 2-95. Station 202 with Station 200 in Rear

Figure 2-96. Stations 202, 203.09 and 204 Prior to Backfill

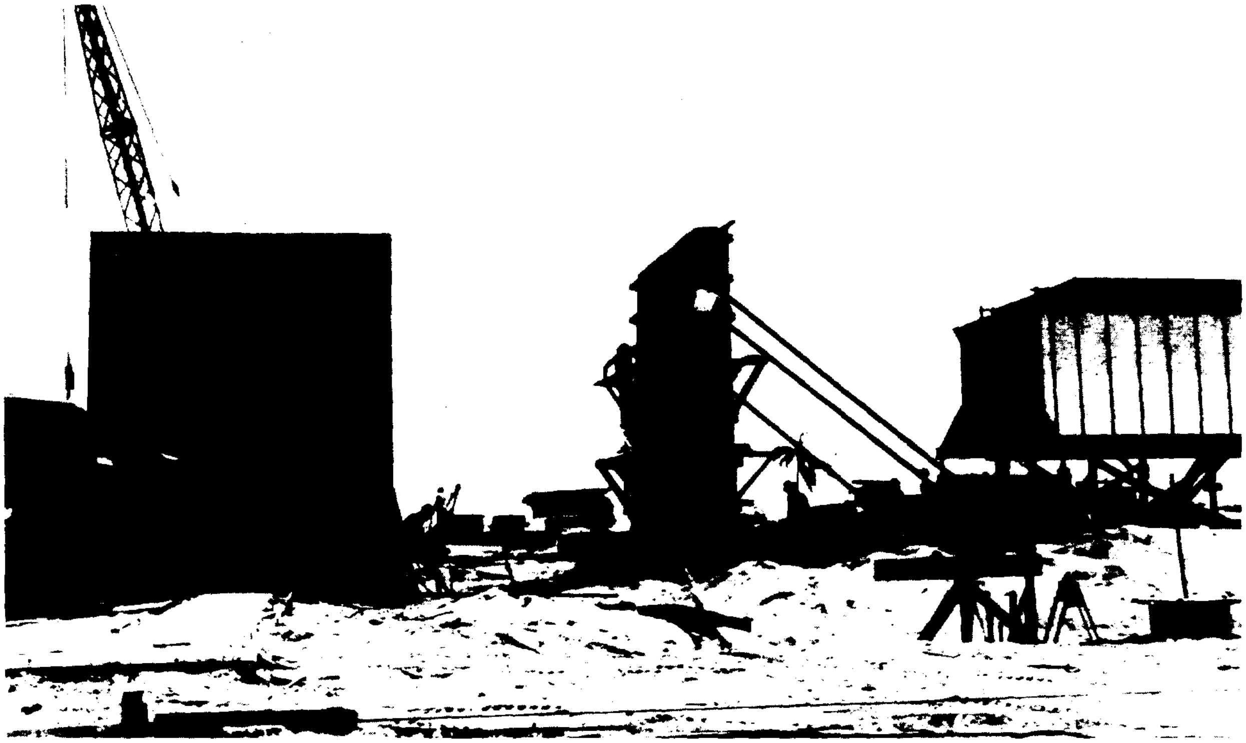


Figure 2-97. View of Stations 202 and 203.09, and End View of Station 202

air within Station 204 and operating at night when the temperature and density of air approached a constant condition throughout its length. Horizontal control points were established at intervals along the line with precise equipment and a modification of methods used at the Taylor Model Basin and techniques for checking the deformation characteristics of the Tygart Dam in Tennessee.

The alignment of the baffles was accomplished by offset measurements from the control points. The center hole in each baffle was brought to alignment first and the remaining eight holes by lateral rotation of the baffle.

Construction started 19 August, was completed 6 September and accepted by AEC on 25 November.

Engineering Costs (Including Design Work)	$ 286.27
Construction Costs	16,100.98
Total Over-all Costs	$16,387.25

STATION 204 - FLORA TO IRENE

By 2 November 1951 schemes to permit the laying of 18 coax cables in a causeway were under study. On 28 November six such schemes with cost estimates were submitted to the Eniwetok Field Manager. These schemes

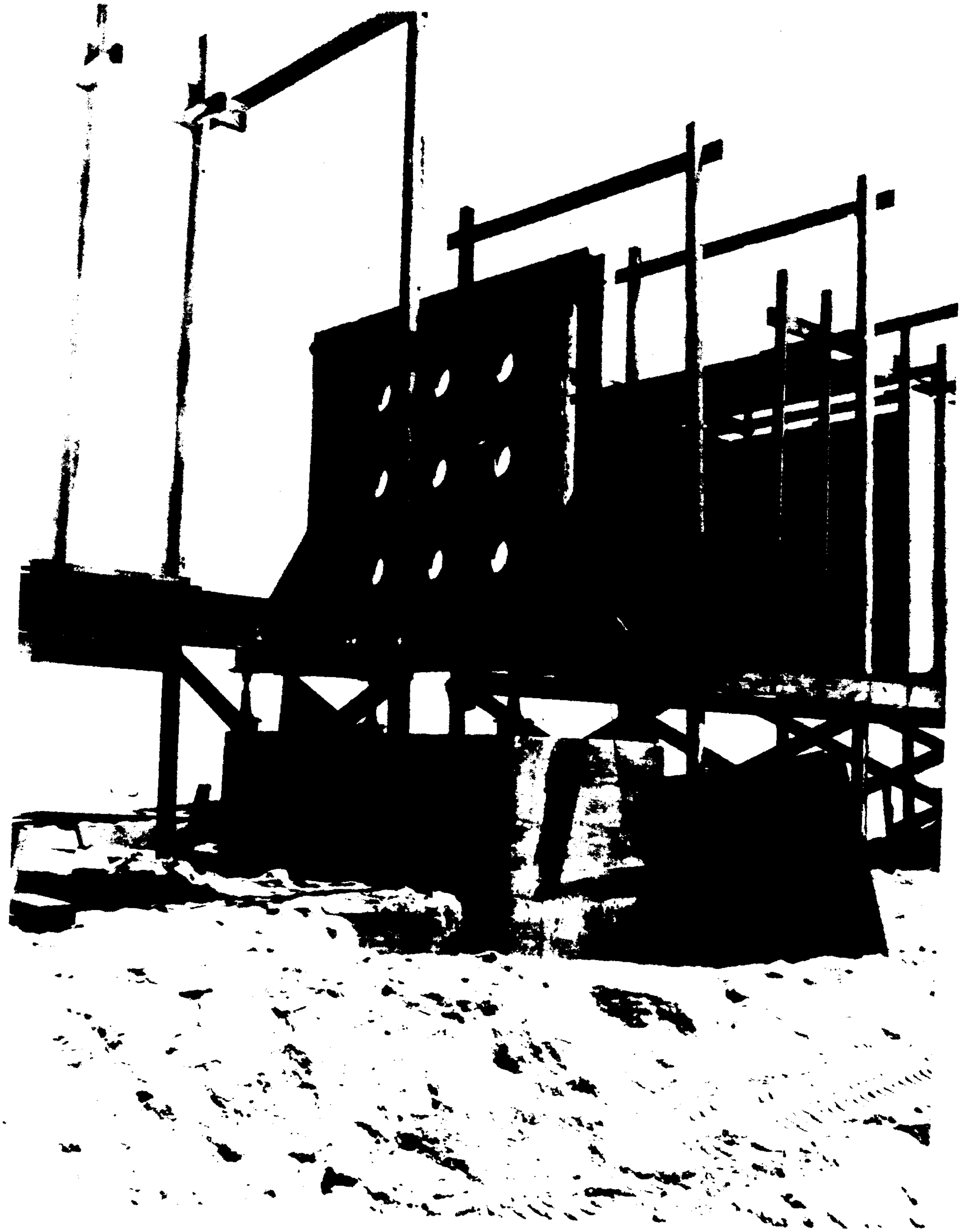


Figure 2-98. One of the Series 203 Stations During Construction

included the following: metal pipe, 6'-6" in diameter with horizontal racks equipped with rollers; metal pipe 5'-0" in diameter with vertical racks; concrete pipes 5'-0" in diameter with vertical and horizontal pipe supports; concrete troughs 1'-6" x 6'-6"; multiple pipe arch 5'-4" high and 7'-9" wide; and other schemes containing variations of the foregoing. All of the coax containers were to be covered with 20 feet of coral sand. The schemes included the placing of the coax cables at various depths from elevation minus 6'-0" to minus 1'-0".

To determine the most suitable access to the coax containers schematics for several types of manholes were also prepared. Each of these manholes had to be large enough to permit assembly of the coax cable prior to pulling them through the container. These were roughly 42'-0" wide, 16'-0" deep and 100'-0" long and were to be spaced at 1,000-foot intervals. The schematics and cost estimates for the manholes were submitted on 4 December 1951.

On 10 December a tentative location of the Zero Line, which the causeway would follow, was made. On 11 December three additional proposals for containing the coax cables were submitted which showed a coax cover of 10'-0". On 14 December requirements were revised to provide for pulling the cables through a 30-inch diameter metal pipe and approval was received for the purchase of 9,000 feet of this pipe. However, on 20 December the User requirements were again changed and it was then found possible to do away with the pipe and lay the coax in an open ditch which was then to be covered.

By 14 January 1952 the coax sand cover had been reduced to 5'-0", and the number of coax cables was then reduced to two. In order to obtain the desired scientific information additional proposals were necessary. On 21 June a plan for using a 9,000-foot collimator tube filled with helium was devised as a possible means of recovering the desired information. This tube, originally scheduled to be 8'-0" x 12'-0" in cross section, the center of which was to be 22'-0" above natural grade, was to be cocooned on the inside. It was to be built in a straight line with an established tolerance of ± 1 inch. On 23 June the design was again changed so as to provide for a structure with a cross section 8 feet square with the center of the structure elevated 11 feet above grade. A water level system consisting of a series of connected standpipes which were located at a spacing of 500 feet was proposed to provide a datum for the straight line. This was abandoned in favor of a controlled theodolite and precise-level survey.

The internal pressure which the structure was to withstand was approximately 72 lbs. per square foot.

The walls were plywood and due to heavy rains and high humidity the grain of the plywood raised, resulting in a rough surface. To correct this condition two coats of paint were applied to the interior. The results obtained from the painting were insufficient. It was therefore decided to completely paper the inside surface of this structure to assure that the raised grain of the plywood would not puncture the plastic envelope which was to fit inside the tube.

The exterior roof and sides of the structure had been covered with aluminized paper. After a period of heavy rains with high winds an inspection of the structure indicated the need for covering the roof with corrugated aluminum. This was necessary in order to preclude the possibility of moisture entering the space between the inner wall surface and its paper liner, creating bubbles which might deflect the helium-filled envelope and thereby interfere with its scientific adequacy. Operational priority air shipment for the needed corrugated aluminum roofing was authorized.

Due to the foregoing changes the scheduled completion date for this structure was advanced from 20 September to 10 October.

Station 204 as finally constructed consisted of an 8'-0" x 8'-0" inside dimension timber frame structure in nine lineal sections totaling 8,860 lineal feet. The plywood interior wall was painted and then covered with reinforced paper lining. The structure was supported above grade by 4" x 4" and 4" x 6" diagonally braced posts on 4'-0" deep concrete footings spaced 8 feet on centers for the 4" x 4" posts and on 12-foot centers for the 4" x 6" posts. The sides of the structure were shielded with aluminum-coated paper. A protective roof 12 feet wide was sheathed with aluminum-coated paper over which was placed corrugated aluminum sheet. This was supported 1'-2" above the roof of the structure. Figure 2-99 indicates the extent of this structure.

Adjacent to, and spaced along this building, were 24 auxiliary structures. These were wood frame sheds, 4'-0" x 4'-0" x 7'-9" high with plywood floors and exterior sheathing, and contained electrical wiring and fixtures.

Figure 2-100 shows the aluminized paper being applied to the exterior and indicates the progress as of 18 September. Figure 2-101 shows the interior of the structure during the final stage of construction.

The detail design of the structure that was finally erected was started on 30 June 1952 and drawings were submitted for approval from 9 July through 13 August. AEC approval was received from 29 July through 22 August. Construction of the structure was started on 19 August, final material shipments were received on 10 October, was completed on 18 October and was accepted by the AEC on 6 December.

Engineering Costs (Including Design Work)	$ 5,845.78
Construction Costs	556,253.94
Total Over-all Costs	$562,099.72

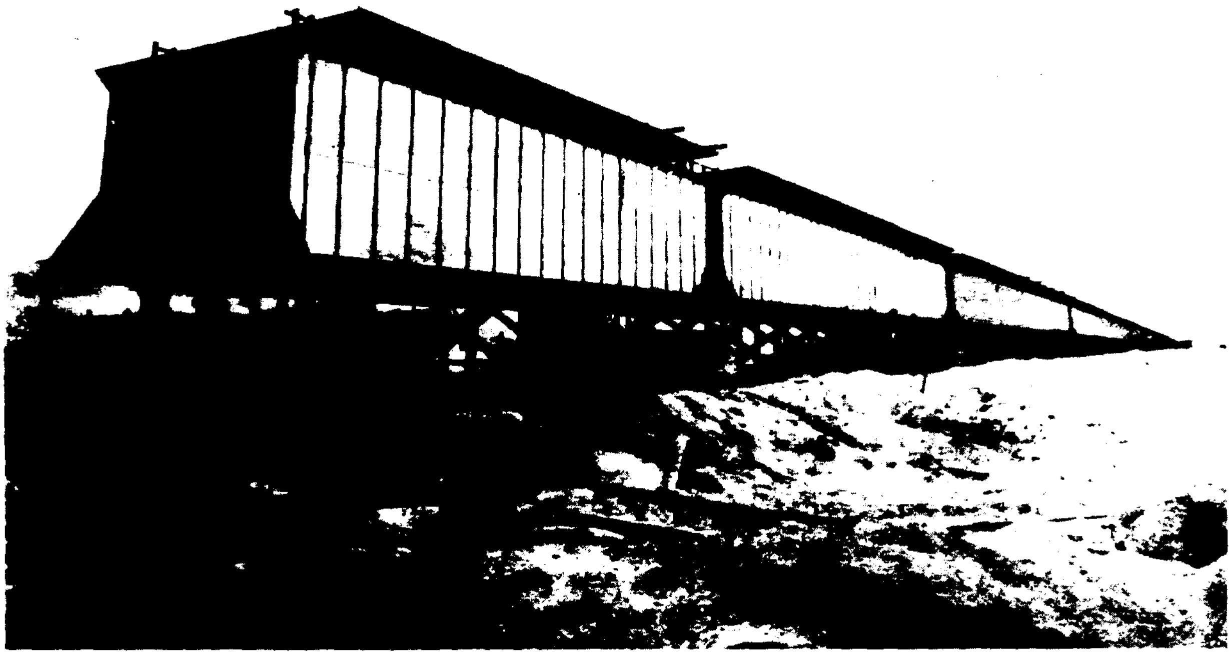


Figure 2-99. Station 204 Under Construction

Figure 2-100. Applying Exterior Aluminized Paper to Station 204

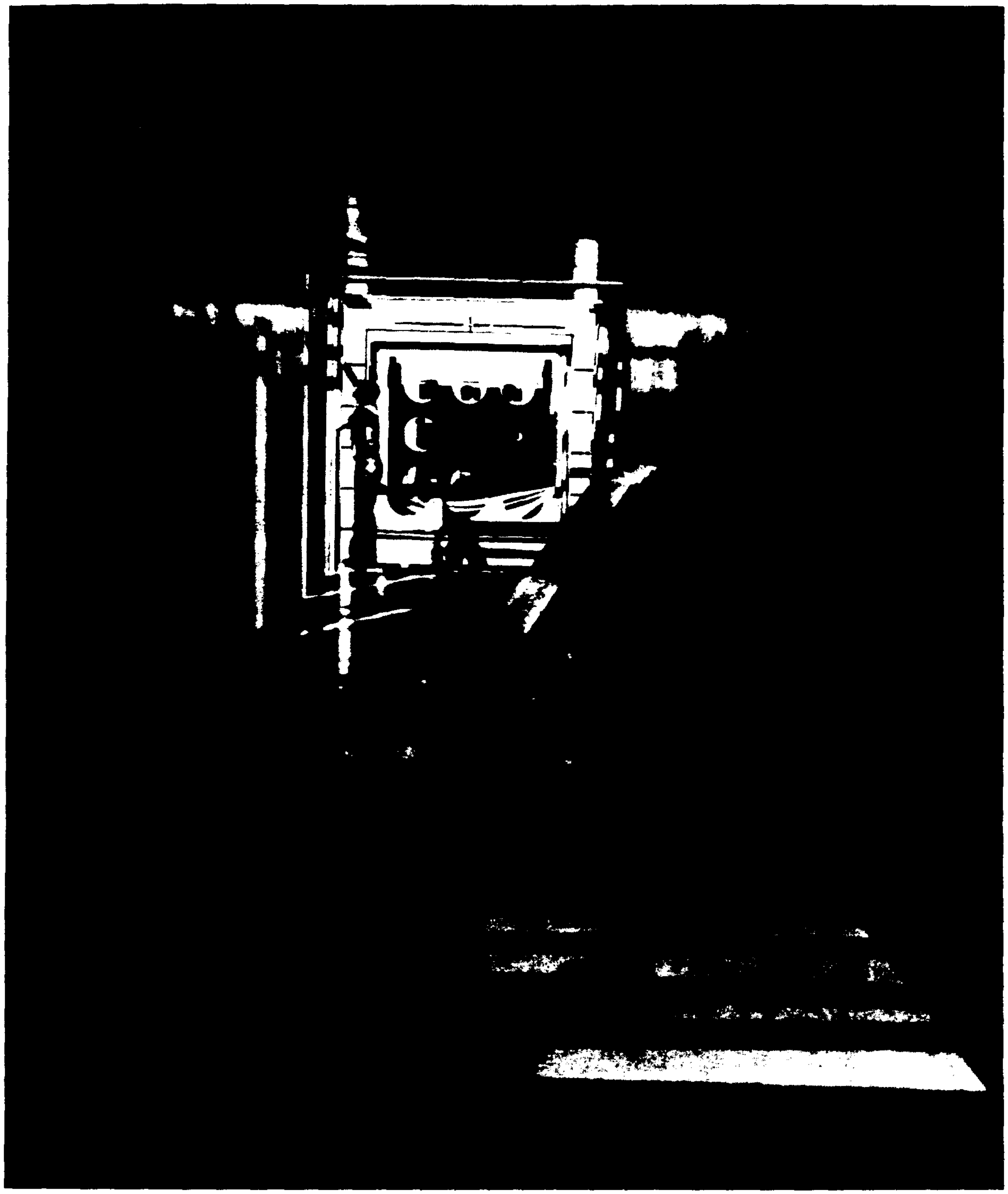


Figure 2-101. Interior View of Station 204

STATION 250 - YVONNE

The work involved consisted of reactivation of GREENHOUSE Station 6A, including new installations of dehumidification units, power, light and signal panels, safety switches for User's equipment, wiring for lights and receptacles and miscellaneous equipment.

Design work for this station and Station 252 started 5 June, plans were submitted from 25 June thru 16 July, and the plans were approved 24 July, 29 July and 1 August. Prints of four "As-Built" drawings were subsequently submitted to the AEC.

Construction started 4 August, was completed 15 October and was accepted by AEC on 25 November.

Engineering Costs (Including Design Work)	$ 2,794.50
Construction Costs	18,051.01
Total Over-all Costs	$20,845.51

STATION 251 - YVONNE

This station was a heavy timber frame structure, 8'-0" x 4'-0" x 8'-0" high mounted on concrete footings. It was earth-filled to the top of the structure with the fill sloping out and away at 1-1/2 to 1 maximum. One - 5 KVA transformer was installed.

Design of this station started 9 June, drawings were submitted for approval on 20 June, and were approved 3 July. One "As-Built" drawing was prepared and print was subsequently submitted to the AEC.

Construction started on 14 July, was completed on 15 October and accepted by AEC on 18 November.

Engineering Costs (Including Design Work)	$ 187.87
Construction Costs	1,219.08
Total Over-all Costs	$1,406.95

STATION 252 - YVONNE

The work involved consisted of reactivation of GREENHOUSE Station 6B. Work was similar to Station 250 and the construction was undertaken in conjunction with that station.

Plans were reported under Station 250. Costs for this item on following page.

Engineering Costs	
(Including Design Work)	$ 669.68
Construction Costs	22,230.80
Total Over-all Costs	$22,900.48

SECTION 6. NRLS

STATIONS 800 AND 801 - JANET
STATIONS 802 AND 803 - TILDA

The work involved consisted of reactivation of four existing concrete structures, GREENHOUSE Stations 6A and 6B at each site. Work also included installation of two dry condenser units and two air conditioner units, piping, wiring, and a protective earth fill over and around each structure. Station 800 had an electrical sub station with two 75 KW generators and three 10 KVA transformers. Station 802 likewise had a sub station with two 75 KW generators installed.

Design work on these structures started on 28 July 1952 but had prior approval on 22 July. Plans were completed and issued to Jobsite from 1 August thru 14 August. Two "As-Built" drawings and one field sketch were subsequently submitted to the AEC.

Construction started on 1 August 1952, was completed on 4 October and accepted by AEC on 25 November. The costs for all four stations were:

Engineering Costs	
(Including Design Work)	$ 686.53
Construction Costs	74,244.01
Total Over-all Costs	$74,930.54

STATION 804 - BRUCE

This station was a wood frame tower 12'-9" square by 34'-6" high containing three floors with connecting ladder and hatches. The structure was centered on a reinforced concrete base 16'-0" square and 3'-6" thick. The first and third stories were enclosed with two layers of 1" diagonal sheathing separated by 15 pound paper and the second story was open on all sides. Entrance to the first floor was by a steel blast door. Equipment installed included two protable generating units and one electric hoist.

Design work was started on 11 February 1952, was submitted on 21 May 1952 and approved 26 May 1952. Revision 1 was made on 17 June 1952. Four "As-Built" drawings and one field sketch were subsequently submitted to the AEC. Construction started on 18 July 1952, was completed on 18 September 1952 and accepted by AEC on 25 November 1952.

Figure 2-102 shows the erection of the framing on 7 August 1952 and Figure 2-103 shows the station as completed.

Engineering Costs (Including Design Work)	$ 3,408.99
Construction Costs	42,643.74
Total Over-all Costs	$46,052.73

STATION 805 - ELMER

Work consisted of installing two 3/16-inch checkered floor plates in the tower shaft of Station 301 making an enclosed room at the 100-foot level and a platform at the 113-foot level. A survey crew was also provided to help align the User's instruments. The cost of the plans, construction, and work performed is included with Station 301 costs.

STATION 806 - MACK

A wood frame structure 9'-0" x 9'-0" x 8'-6" high, with a composition shed roof and plywood floor was erected on an existing wood platform. The sides were sheathed over 2" x 6" studding.

The design of this station started on 29 July, was completed on 7 August 1952 and final drawing was submitted to the AEC. Construction started on 1 September 1952, was completed on 6 November 1952 and accepted by AEC on 18 November 1952.

Engineering Costs	$ 89.11
Construction Costs	2,649.77
Total Over-all Costs	$2,738.88

STATIONS 810.01, 810.02, AND 810.04 THRU 810.11

These were box-shaped reinforced concrete structures 4'-10" x 4'-10" x 5'-2" high (outside dimensions) with walls and base 14 inches thick.

STATION	LOCATION	STARTED CONSTRUCTION	COMPLETED CONSTRUCTION
810.01	Alice	8 September	27 September
810.02	Irene	22 September	27 September
810.04	Janet	15 September	27 September
810.05	Lucy	15 September	27 September

(Continued) STATION	LOCATION	STARTED CONSTRUCTION	COMPLETED CONSTRUCTION
810.06	Mary	15 September	27 September
810.07	Olive	13 September	1 October
810.08	Tilda	13 September	1 October
810.09	Yvonne	15 September	27 September
810.10	Yvonne	13 September	27 September
810.11	Yvonne	13 September	27 September

Design work for these stations was started on 12 May 1952, submitted for approval on 22 May 1952 and approved on 22 July 1952. One final drawing was subsequently submitted to the AEC.

AEC accepted all stations on 6 December 1952. Costs for eleven stations, including 810.03 were:

Engineering Costs	$ 464.42
Construction Costs	23,329.26
Total Over-all Costs	23,793.68

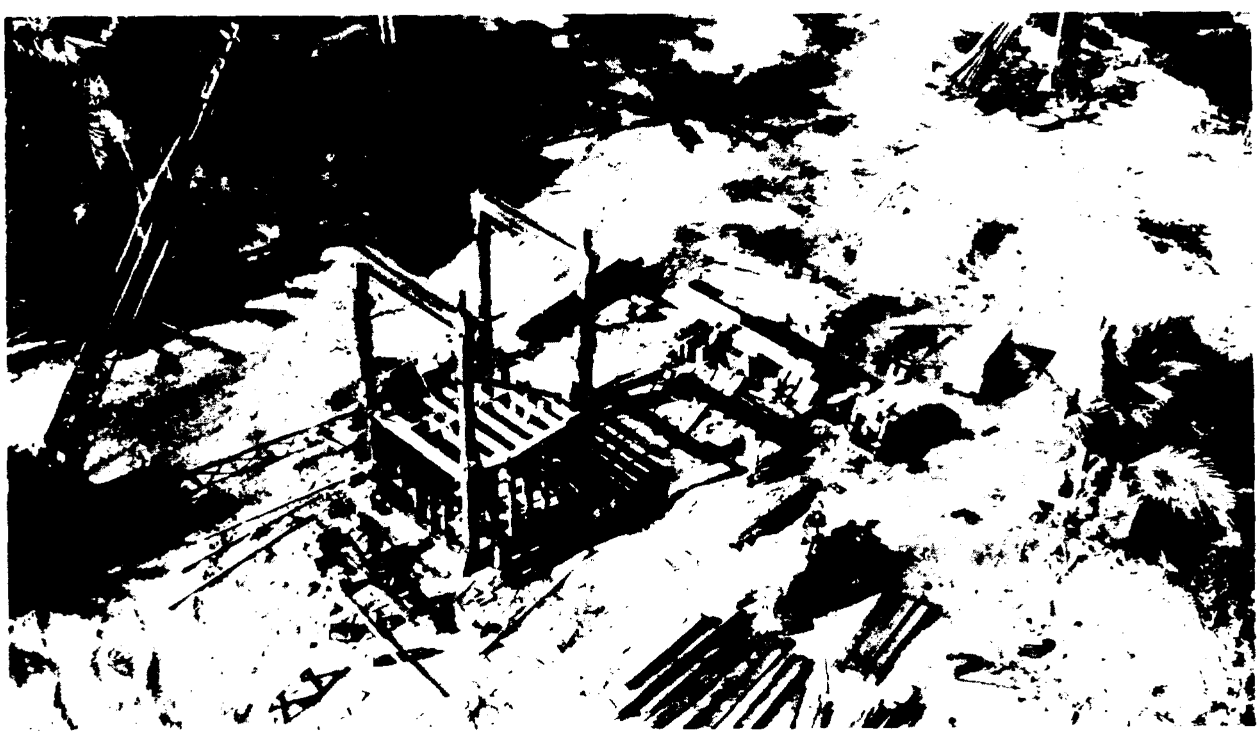


Figure 2-102. Structural Framing for Station 804

Figure 2-103. Station 804 Completed

STATION 810.03 - NOAH

Similar to 810.01 thru 810.11 except that structure was boat-shaped 12' 6" long x 4'-6" beam x 9'-6" high erected on a concrete base 6'-0" wide x 14'-6" long and 3'-0" thick. The upper face contained an open section 2'-6" x 2'-6" x 4'-0" deep.

Design, and construction costs are included in preceding Stations 810.01, 810.02, and 810.04 thru 810.11.

STATION 841 - FLORA

This station was a steel ladder which was secured to the exterior of Station 1. The ladder was 62'-5-1/2" high with one crossover platform. ECO 3712 added a 20'-0" high open wood frame tower, with an 8'-0" x 8'-0" wood decked platform on top. A railing and an additional 20-foot ladder was added. Telephone wire was extended to new platform and 4-2/C No. 12 Romex was extended from Station 5 to the top of the tower.

Design for this station was started on 19 February, was submitted on 13 March, and approved on 17 April 1952. Final drawings were subsequently submitted to the AEC.

Construction started 3 July, was completed by 27 September and accepted by AEC on 18 November.

Engineering Costs (Including Design Work)	$ 302.96
Construction Costs	5,537.06
Total Over-all Costs	$5,840.02

STATION 842 - FLORA

This station was an 8'-6-1/2" x 8'-6-1/2" x 20'-0" open wood frame tower, with a 2" wood plank platform and wood railing on top. The tower was erected on four concrete piers. A sub station adjoined and served Station 842 and contained one 15 KVA transformer.

The design for this station was started on 11 February 1952, was submitted for approval on 14 March and was approved on 17 April. Two revisions were made, one on 17 June and the other on 21 July.

Construction started on 19 May 1952, was completed by 20 September 1952. It was accepted by AEC on 22 November 1952.

Engineering Costs (Including Design Work)	$ 550.47
Construction Costs	7,665.23
Total Over-all Costs	$8,215.70

SECTION 7. SANDIA

STATION 600 - IRENE

This was a concrete structure 14'-0" x 28'-6" x 14'-6" high, outside dimensions, with 3-foot thick walls and roof, and 3'-6" thick floor slab. "Unistruts" were embedded in the walls, roof and floor. The structure was divided into two rooms by a 1'-6" thick partition which contained explosion-proof doors.

Design of this station was started on 12 March 1952, was submitted for approval from 24 April thru 18 June. AEC approval was received from 15 May thru 16 July. Construction started on 5 May, was completed by 20 September and accepted by AEC 22 November and 25 November.

Figure 2-104 shows the construction status as of 11 June 1952, Figure 2-105 as of 18 June and Figure 2-106 as of 7 August.

Engineering Costs (Including Design Work)	$ 4,428.23
Construction Costs	70,520.58
Total Over-all Costs	$74,948.81

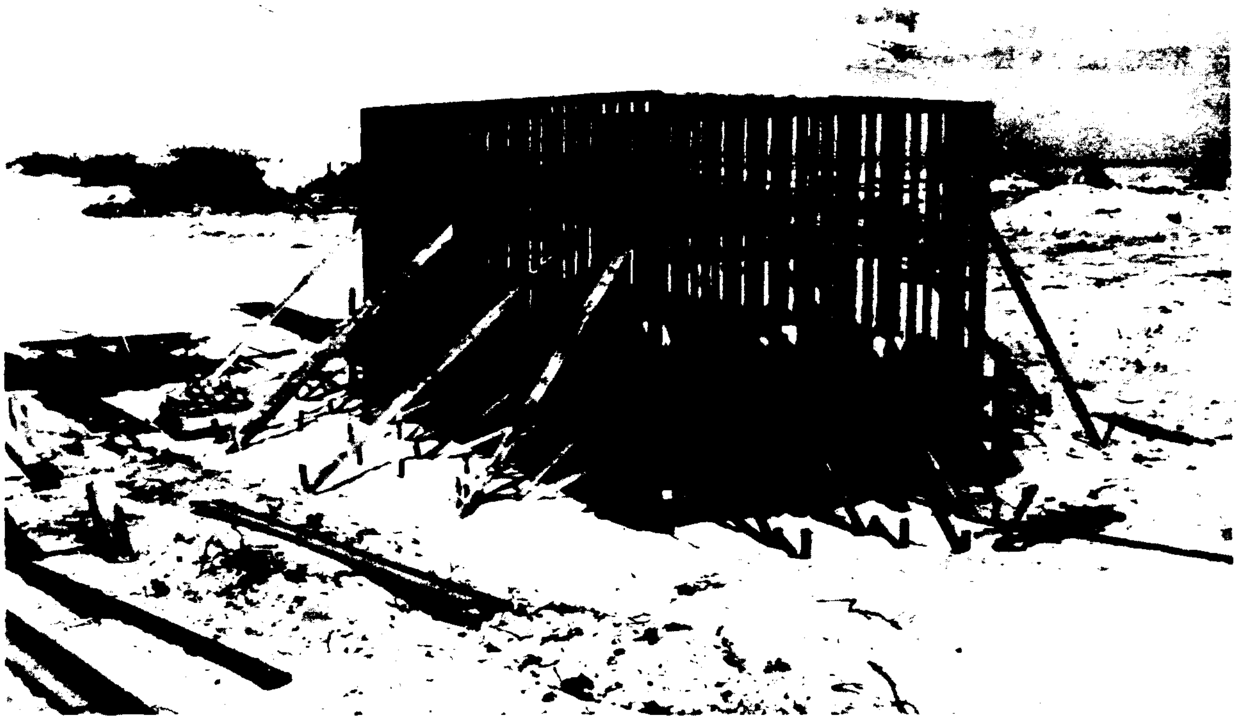


Figure 2-104. Forming for Station 600

Figure 2-105. Station 600 Under Construction

Figure 2-106. Station 600 as of 7 August 1952

STATION 601 - JANET

This station was a reactivated GREENHOUSE Station, No. 301J. It had complete light and power wiring and fixtures, ventilating and power generating equipment.

Design of this station was started on 7 April 1952, was submitted for approval on 21 May. AEC approval was received on 19 June. Reactivation started 15 July, was completed 27 September and accepted by AEC 22 November 1952.

Engineering Costs	$ 355.63
Construction Costs	11,641.27
Total Over-all Costs	$11,996.90

STATION 602 - KATE

This station was a reactivated existing GREENHOUSE Station, No. 301H, complete with light and power wiring and fixtures, ventilating and power generating equipment.

Design of this station was started on 10 April 1952, was submitted for approval on 5 May. AEC approval was received on 6 June. Reactivation started on 24 June, and was completed 27 September. It was accepted by AEC on 22 November.

Engineering Costs	$ 456.36
Construction Costs	8,378.48
Total Over-all Costs	$8,834.84

STATION 603 - MARY

This was a 10'-8" x 24'-8" x 10'-4" high concrete structure with one-foot thick walls and roof, and 1'-4" thick floor slab with "Unistruts" embedded in the walls, roof and floor. This building was divided into 2 rooms by a one-foot thick partition, which contained explosion-proof doors.

Design of this station was started on 12 March 1952, was submitted for approval on 22 April. AEC approval was received 15 May. Revision No. 1 was made 16 June. Construction started on 18 June, was completed on 4 October and accepted by AEC on 22 November. Figure 2-107 is an aerial view of the station from the northeast and shows construction progress as of 10 July 1952.

Engineering Costs (Including Design Work)	$ 2,671.33
Construction Costs	32,223.98
Total Over-all Costs	$34,895.31

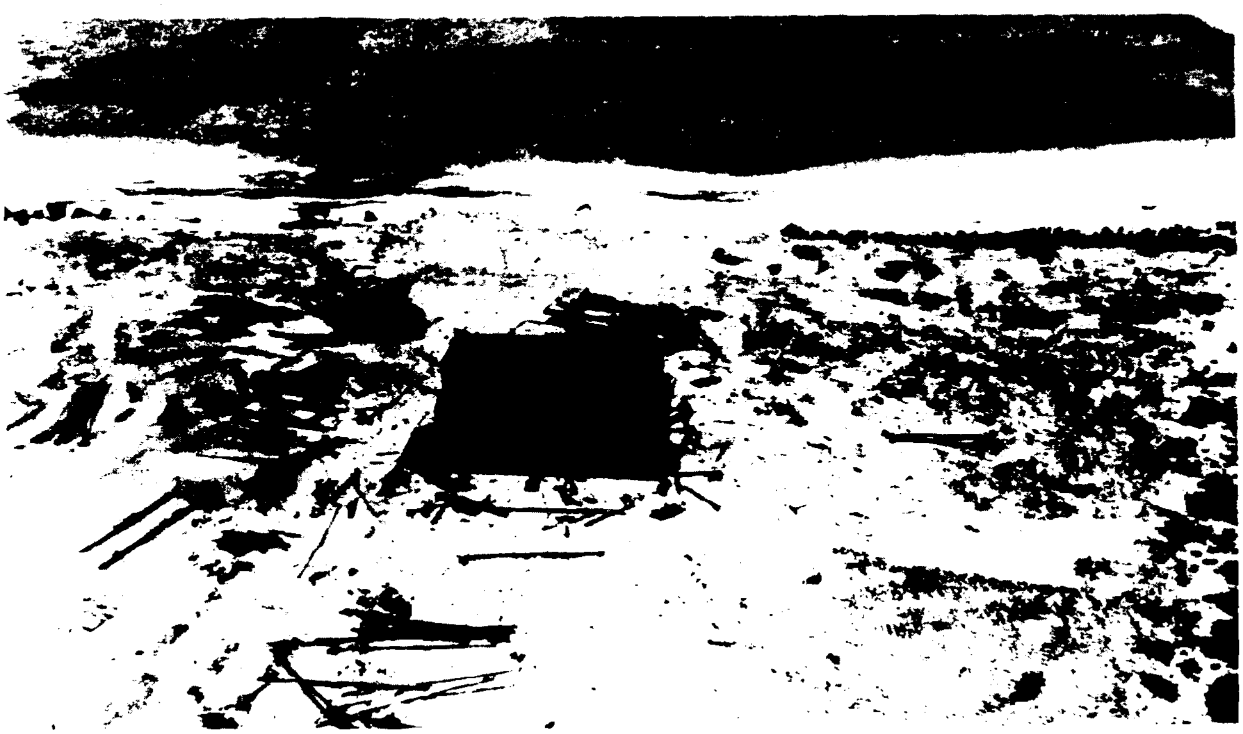


Figure 2-107. View of Station 603 During Construction

STATION 604 - SALLY

This was a reactivation of existing GREENHOUSE Stations, No. 132a and No. 132b including installation of one 50 KW portable generator.

Design for this station was started on 21 April, drawings were submitted for approval on 3 June, and approval was received on 16 June 1952. Reactivation started on 27 August, was completed on 4 October and accepted by AEC on 22 November and 6 December 1952.

Engineering Costs	
(Including Design Work)	$ 1,647.87
Construction Costs	19,303.53
Total Over-all Costs	$20,951.40

STATION 605 - YVONNE

This was a reactivation of existing GREENHOUSE Station, No. 55, including the installation of one 883 CFM fan and three 15 KVA transformers.

Design for this station was started on 18 April and drawings were submitted for approval on 3 June. Approval was received on 16 June 1952. Reactivation started on 4 August, was completed on 27 September and accepted by AEC on 22 November and 6 December.

Engineering Costs	
(Including Design Work)	$ 2,524.88
Construction Costs	10,512.19
Total Over-all Costs	$13,037.07

STATION 606 - ELMER

This was a heavy timber frame structure, 9'-4" x 23'-0" x 9'-3" high, and was erected on a 6" concrete slab. The exterior walls were diagonally sheathed, covered with felt, and lined with aluminum.

Design for this station was started on 17 March, drawings were submitted for approval on 24 April, and were approved on 15 May 1952. Construction started on 24 June, was completed on 25 September and accepted by AEC on 25 November.

Engineering Costs	
(Including Design Work)	$ 522.00
Construction Costs	29,131.99
Total Over-all Costs	$29,653.99

STATION 610 - NOAH

This station was a reinforced concrete pad 33'-0" x 4'-0" x 3'-0" thick and placed on the reef 1 foot below mean lower low water. An 8" diameter pipe extended vertically 16'-0" and was anchored by cables to two concrete deadmen. The work was accomplished in water through the use of a sandbag dike around the station area, Figure 2-108 shows a view of the station after completion. Design for this station was started on 18 February 1952, drawings were submitted on 22 February and approved on 14 March. Revision No. 1 was made on 15 April. Construction started on 9 May, was completed on 31 July and accepted by AEC on 22 November.

Engineering Costs (Including Design Work)	$ 260.18
Construction Costs	19,434.18
Total Over-all Costs	$19,694.36

STATION 611.01 - JANET

A reinforced concrete pad, 22'-6" x 12'-0" x 3'-9" thick, set at grade level, supported an 8" diameter pipe frame. The frame was 15'-0" high x 12'-6" wide with a connecting steel-covered concrete battery box 3'-6" x 4'-0" x 3'-9" deep.

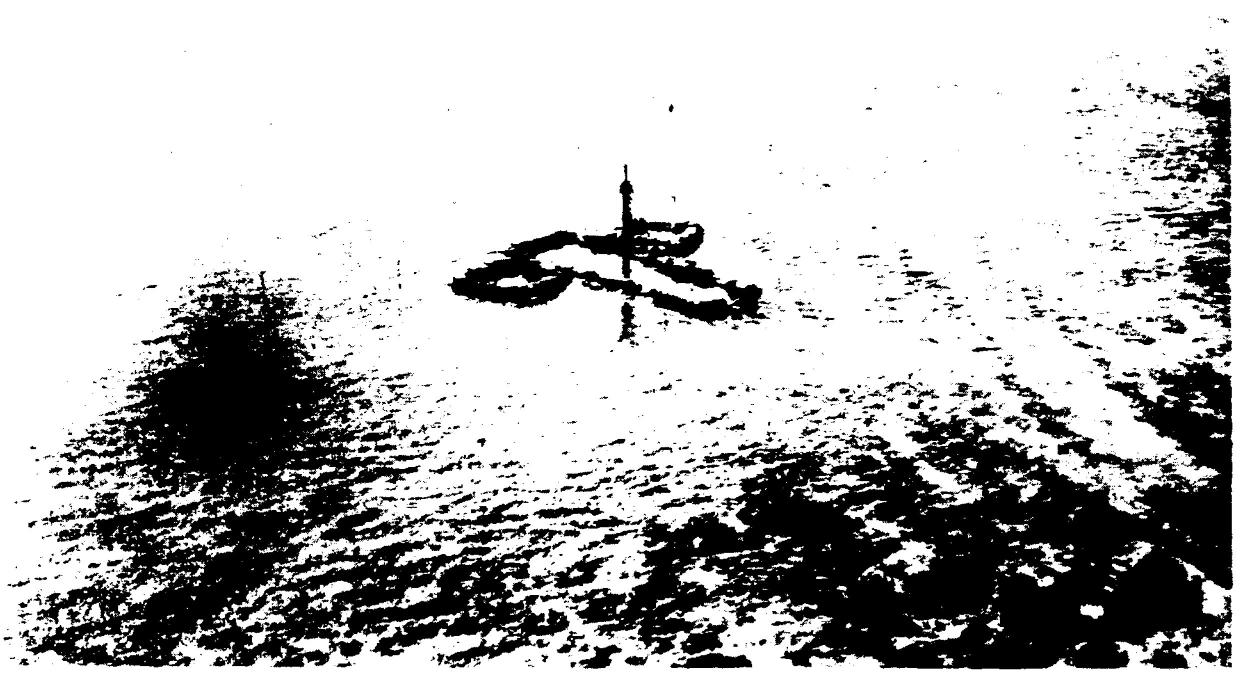


Figure 2-108. Station 610 with Sandbag Dikes for Construction

Design for this station was started on 11 April 1952, drawings were submitted for approval on 8 May 1952 and were approved on 6 June 1952. Construction started on 27 June 1952, was completed on 20 September 1952 and accepted by AEC on 22 November 1952.

Engineering Costs	
(Including Design Work)	$ 527.89
Construction Costs	10,913.52
Total Over-all Costs	$11,441.41

STATIONS 611.02 THRU 611.04 - KATE, MARY AND SALLY

Same as Station 611.01 with the exception that the slab was 12'-0" x 14'-0" x 3'-0" thick.

Designs for these stations were started on 18 April 1952, drawings were submitted for approval on 5 May 1952 and approved on 23 July 1952. Construction started on 4 August 1952, was completed on 20 September 1952 and accepted by AEC on 18 November 1952.

Engineering Costs	
(Including Design Work)	$ 1,134.09
Construction Costs	23,469.18
Total Over-all Costs	$24,603.27

STATION 612 - ELMER

This was a reinforced concrete slab, 5'-0" x 2'-0" x 5'-0" thick, placed at grade level, supporting two vertical 8" pipes 15'-0" high.

The design for this station was started on 11 April 1952, drawings were submitted for approval on 5 June 1952 and were approved on 16 June 1952. Construction started on 20 August 1952, was completed on 20 September 1952 and accepted by AEC on 18 November 1952.

Engineering Costs	
(Including Design Work)	$ 305.19
Construction Costs	3,263.92
Total Over-all Costs	$3,569.11

STATIONS 613.01 AND 613.02 - OLIVE AND YVONNE

A reinforced concrete pad 9'-0" x 3'-0" x 3'-0" thick at grade level, supported one eight-inch diameter vertical pipe 10'-0" high. Figure 2-109 shows Station 613.02 on Yvonne on 27 September 1952 and prior to the installation of User's equipment.

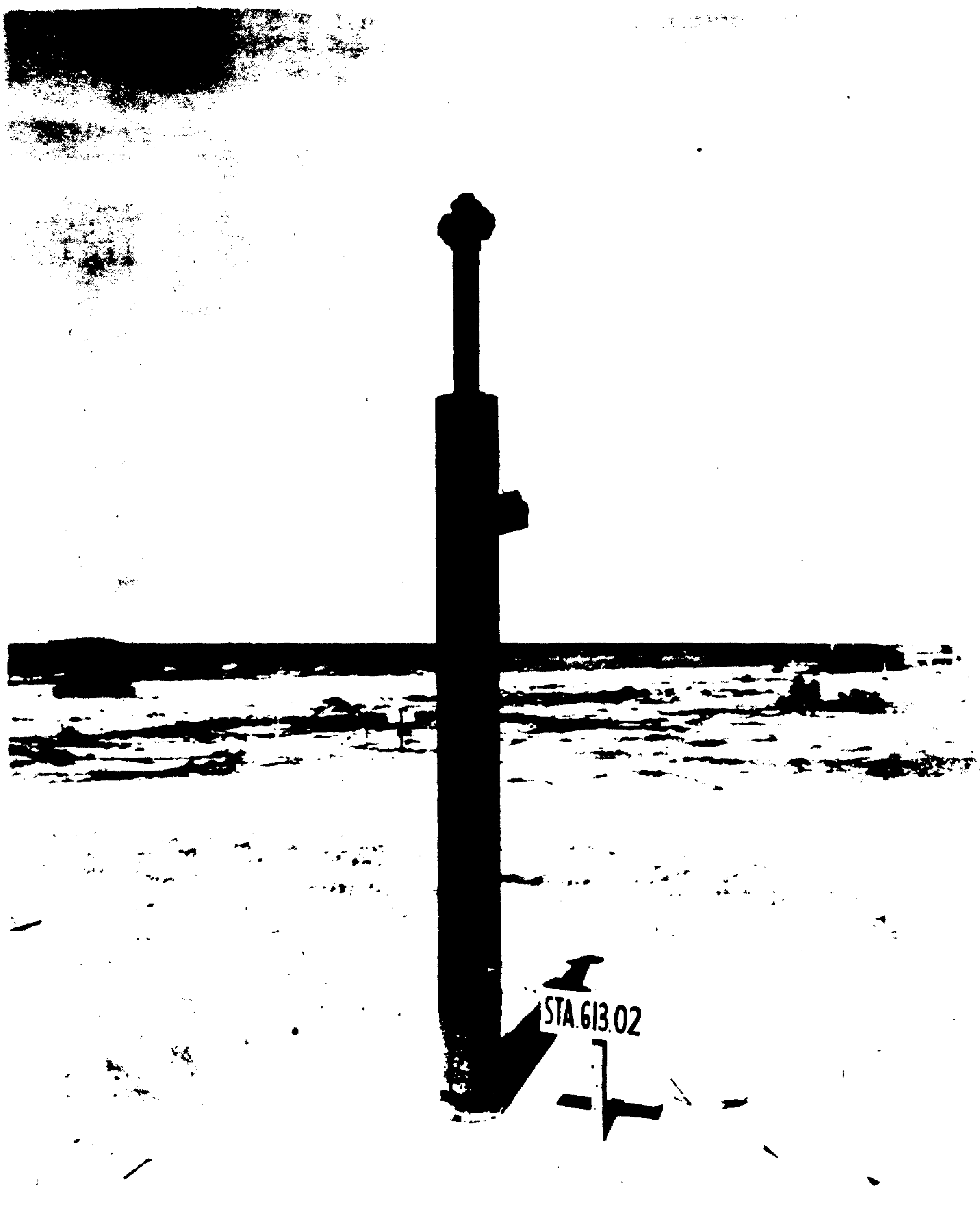


Figure 2-109. Station 613.02 Prior to Installation of Equipment

Designs for these stations were started on 11 April 1952, drawings were submitted for approval on 5 May 1952 and approved on 6 June 1952. Revision No. 1 was made on 19 June 1952. Construction started on 4 August 1952, was completed on 28 August 1952 and 30 September 1952 and accepted by AEC on 22 November 1952.

Engineering Costs (Including Design Work)	$ 294.54
Construction Costs	3,287.08
Total Over-all Costs	$3,581.62

STATION 614 - GENE

This was a ground baffle, consisting of a reinforced concrete cube 1'-6" x 1'-6" x 1'-6" with 2 embedded conduits which were furnished by the User.

Design of this station was started on 22 April 1952, was submitted for approval on 7 May 1952. AEC approval was received on 6 June 1952. Construction started on 28 July 1952, was completed on 4 August 1952 and accepted by AEC on 18 November 1952.

Engineering Costs	$ 54.34
Construction Costs	667.74
Total Over-all Costs	$722.08

STATIONS 615.01 AND 615.02 - HELEN AND IRENE

This station was a reinforced concrete cube 1'-6" x 1'-6" x 1'-6" with three embedded conduits furnished by the User. Figure 2-110 shows Station 615.02 on Irene completed and Figure 2-111 shows Station 615.01 with Station 616.01 in the background.

Designs for these stations were started on 22 April 1952, drawings were submitted for approval on 7 May 1952 and were approved on 6 June 1952. Construction started on 18 July 1952, was completed on 24 July 1952 and accepted by AEC on 18 November 1952.

Engineering Cost	$ 70.69
Construction Costs	1,654.49
Total Over-all Costs	$1,725.18

STATIONS 616.01 AND 616.02 - HELEN AND IRENE

This was a triangular-shaped concrete ramp 2'-0" wide and sloped from finish grade to 4'-0" above finish grade in 7'-0", with base slab 4'-0" wide x 2'-6" deep x 19'-0" long, poured monolithically. One embedded conduit was

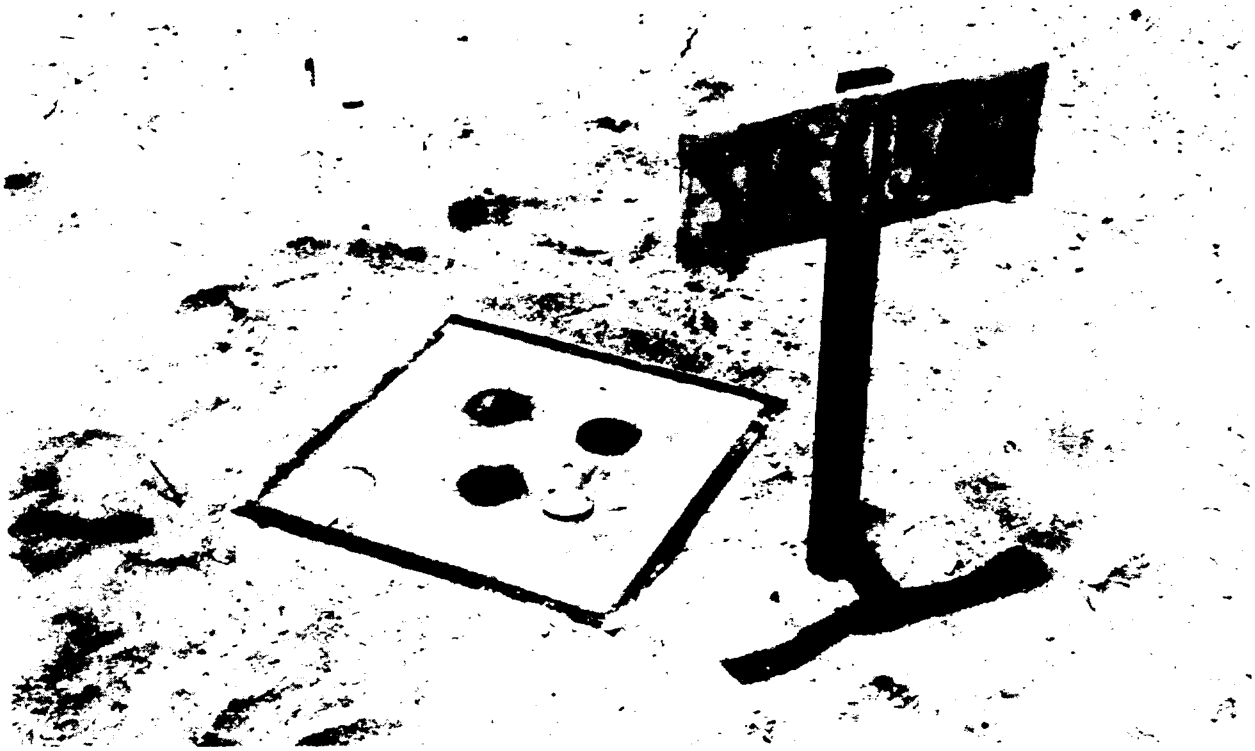


Figure 2-110. Station 615.02 Completed

Figure 2-111. Station 615.01 with Station 616.01

furnished by the User. Figure 2-112 shows Station 616.02 on Irene with Station 204 in the background.

Designs for these stations were started on 14 April 1952, drawings were submitted for approval on 7 May 1952 and were approved on 6 June 1952. Construction started on 18 July 1952, was completed on 24 July 1952 and accepted by AEC on 18 November.

Engineering Costs (Including Design Work)	$ 301.03
Construction Costs	6,058.69
Total Over-all Costs	$6,359.72

STATION 617.01 - YVONNE

This was a reinforced pipe column consisting of an eight-inch pipe embedded in and extending 12'-6" above a T-shaped concrete base. A three-inch pipe extension two feet long was connected to the top of the eight-inch pipe and this extension was capped with a cross fitting. The eight-inch pipe was guyed by steel rods which were secured on one end to deadmen anchored in the ends of the T-shaped concrete base and on the other end by welding to the top of the eight-inch pipe. The "T" base was 6'-0" wide x 22'-3" long x 4'-6" thick; the "T" crossbar was 3'-0" x 30'-0" long.

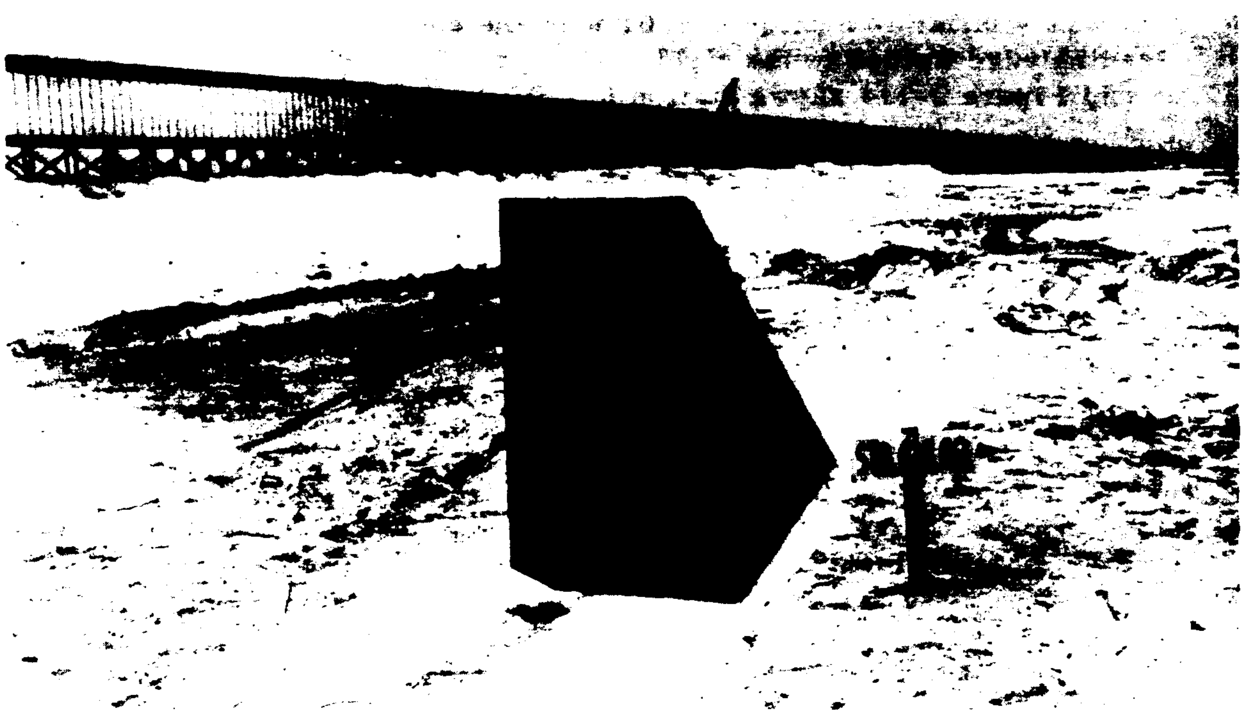


Figure 2-112. Station 616.02 with Station 204 in Background

Design for this station was started on 14 April 1952, drawings were submitted for approval on 17 June and were approved on 1 July. Revisions were made on 23 July and 31 July. Construction started on 20 August, was completed on 6 September and accepted by AEC on 22 November.

Engineering Costs	
(Including Design Work)	$ 753.66
Construction Costs	17,167.00
Total Over-all Costs	$17,920.66

STATION 617.02 - YVONNE

This station was similar to Station 617.01 with the exception that the eight-inch pipe extended vertically for 13'-0" above base.

Dates for the design, construction, and acceptance are the same as Station 617.01.

Engineering Costs	
(Including Design Work)	$ 437.50
Construction Costs	9,957.18
Total Over-all Costs	$10,394.68

STATIONS 617.03 THRU 617.08 - YVONNE

This was similar to Station 617.01 with the addition of a 1/2" x 9" steel plate leading edge welded to the eight-inch pipe. Figure 2-113 shows Station 617.05 and Figure 2-114 shows Station 617.07.

Design, construction and acceptance dates are the same as Station 617.01.

Engineering Costs	
(Including Design Work)	$ 2,148.25
Construction Costs	48,921.07
Total Over-all Costs	$51,069.32

STATION 618 - YVONNE

This was a 15'-0" mast of eight-inch double extra-heavy pipe with an opening for cable entrance. It was set in a concrete footing 6'-0" x 18'-0" x 3'-0" thick, with concrete battery box 2'-6" square x 3'-9" deep. The battery box had a removable steel plate and three-inch diameter steel conduit for cables.

Design for this station was started on 15 April 1952, drawings were submitted for approval on 28 April and were approved on 6 June. A revision was

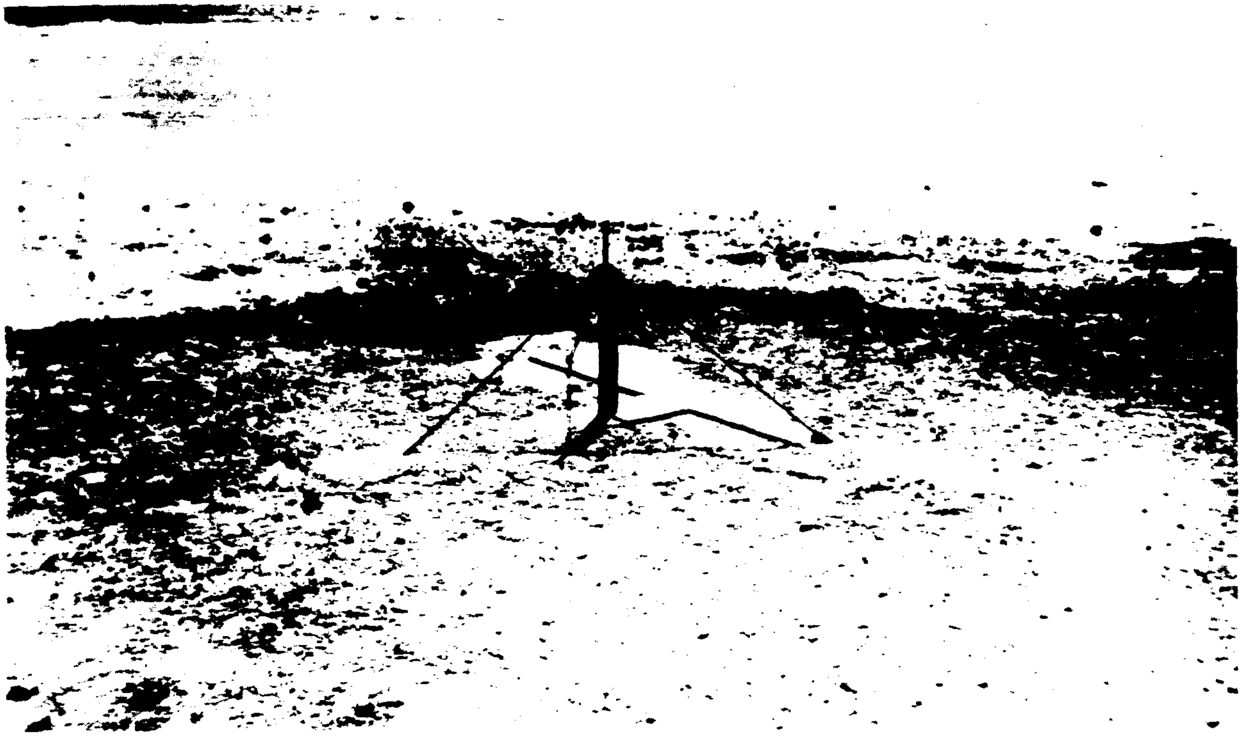


Figure 2-113. Station 617.05 Completed

Figure 2-114. Station 617.07 at Low Tide

completed on 19 June. Construction started on 28 July, was completed on 30 August and accepted by AEC on 22 November.

Engineering Costs	
(Including Design Work)	$ 278.07
Construction Costs	7,189.83
Total Over-all Costs	$ 7,467.90

STATIONS 619.01 AND 619.02 - YVONNE

These stations were double upright frames with a cross connection at the top. They were constructed of eight-inch diameter double extra strong pipe, with three instrument mounts on the crossbar. Lower ends were embedded in a concrete base 12'-0" wide x 16'-0" long x 3'-0" thick. Concrete battery boxes with gasketed steel plate covers were installed adjacent to the stations. Figure 2-115 shows Station 619.01 before the User's equipment was installed, with battery box cover at left and temporary staging for User's installation of instruments.

The design for these stations was started on 15 April 1952, drawings were submitted for approval on 5 May and were approved on 23 July. Construction started on 4 August, was completed on 30 August and accepted by AEC on 18 November.

Engineering Costs	
(Including Design Work)	$ 262.54
Construction Costs	14,902.28
Total Over-all Costs	$15,164.82

STATIONS 650.01 THRU 650.06

These stations consisted of a 10-inch diameter hole drilled approximately 10 feet deep. They were located on Irene, Kate, Janet, Mary, Sally and Elmer, were constructed in accordance with instructions from the User's representative. Figure 2-116 shows Station 650.01 on Irene prior to installation of User's equipment.

Construction started on 6 August 1952, was completed on 16 August and accepted by AEC on 15 December.

Engineering Costs	$ 14.96
Construction Costs	7,734.65
Total Over-all Costs	$7,749.61

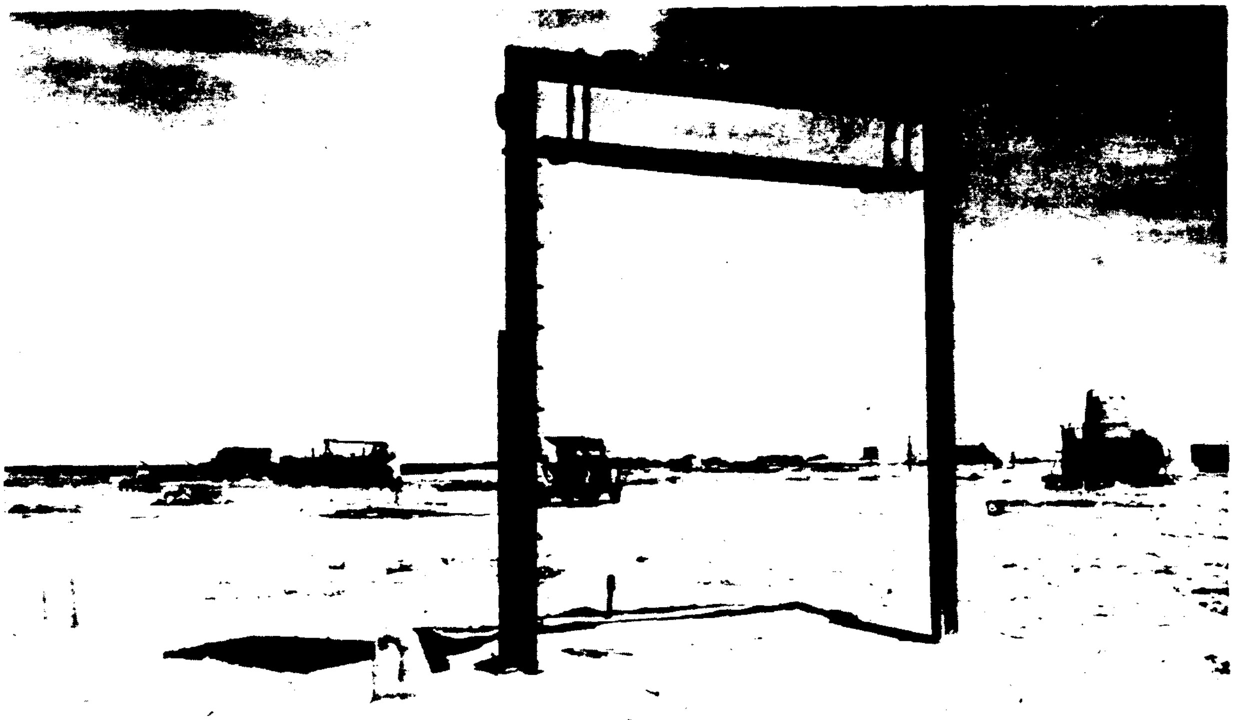


Figure 2-115. Station 619.01 Prior to Installation of Equipment

Figure 2-116. Station 650.01 Prior to Installation of Equipment

STATIONS 670.01 THRU 670.04 - LAGOON

The work involved for these stations consisted of placing tripods on the lagoon bottom and laying signal cable from the tripods to the shore recording stations. Tripods were furnished by the User. These tripods were placed in approximately 60 feet of water on the lagoon side of Gene, Janet, Ursula and Elmer.

Work started on 13 October 1952, was completed on 25 October and accepted by AEC on 15 December.

Engineering Costs	$ 12.47
Construction Costs	948.87
Total Over-all Costs	$961.34

STATIONS 672.01 THRU 672.03 - OCEAN

Work consisted of locating the positions for these stations on the ocean side of Flora. Costs were sufficiently minor that no separate allocation was justified.

STATION 1020 - ELMER

Installation of one wood telephone pole with single crossarm 50 feet above ground.

Construction was started and was completed on 12 September 1952 and accepted by AEC on 22 November.

Construction Costs	$832.00
Total Over-all Costs	$832.00

STATIONS 6101.01 THRU 6101.04 - YVONNE

These were reinforced concrete cubes 1'-6" x 1'-6" x 1'-6" with one embedded conduit in each. The conduit was furnished by the User, as in the case of Station 614.

Design of these stations was started on 22 April 1952, was submitted for approval on 7 May, and approved on 6 June. Design costs were reported under Station 614. Construction started on 28 July, was completed on 30 August, and accepted by AEC on 18 November.

Engineering Costs	$ 3.38
Construction Costs	1,069.39
Total Over-all Costs	$1,072.77

STATION 6103 - JANET

This was a reinforced concrete cube, 1'-6" x 1'-6" x 1'-6" with one embedded conduit which was furnished by the User. They were indentical to Stations 6101.01 thru 6101.04 and the costs of this station are included with those stations.

SECTION 8. JOINT PARTICIPATION

This section is concerned with facilities which were directly related to the use of the Scientific Stations and classed as Joint Participation by the Users. These facilities were not assigned station numbers and all costs were prorated to all stations.

SECURITY FENCING - FLORA

This was a barbed wire fence consisting of wood posts 7'-0" high set in concrete and having two-foot long outriggers. The fence was constructed with two point galvanized barbed wire strands spaced six inches apart and was 2,220 feet long. Construction was started on 7 July 1952, was completed on 27 September and accepted by AEC on 22 November.

STABILIZED AREAS - FLORA

The work on Flora consisted of a 16,000 square yard area cleared and graded with approximately 4,000 cubic yards of crushed aggregate used for fill. In the area of Station 1, 15,350 square feet was rolled and water stabilized. Construction started on 24 April 1952, was completed on 30 October, and accepted by AEC on 15 December.

STABILIZED ROADS

This consisted of 227 square yards of 24-foot wide road on Flora; 2,320 square yards on Helen; 3,520 square yards on Irene, and a parking area of 5,314 square yards on Irene. There was a total of 13,381 square yards of grading and stabilizing. Construction started on 20 August 1952, completed on 30 October and was accepted by AEC on 15 December.

POWER DISTRIBUTION - ALL SITES

Construction of the underground power distribution system for the Scientific Program included surveys, excavations, and the installation of 20,590 lineal feet of new 3/C 5 KV Neoprene JKT cable and backfill. Also included was the rehabilitation of previously installed cables to existing stations. The costs of building and equipping Sub Station 1 - Flora, Sub Station 200 - Irene, Sub Station 602 - Kate, Sub Station 800 - Janet, and Sub Station 802 - Tilda, were allocated to all stations. All other sub stations, portable generating units and transformers are included in the costs of the station in which they occurred. Design work was started on 17 January 1952. A set of nine distribution plans were completed by 23 July and were approved on 25 August.

SITE PREPARATION - FLORA, GENE, HELEN AND IRENE

This work consisted of the removal of palm trees and undergrowth, and clearing, grubbing, leveling and grading 782,000 square yards of surface areas.

COMMUNICATIONS SYSTEM - SIGNAL AND CONTROL, AND TELEPHONE SYSTEMS

ON SITE SYSTEM

This item consisted of approximately 156,131 lineal feet of 2/C #14 Romex Cable installed on sites between stations. The sites involved were Janet, Kate, Lucy, Mary, Sally, Tilda, Ursula, Yvonne, and Elmer.

SUBMARINE CABLE SYSTEM

This item consisted of 112,000 lineal feet of cable laid between sites, or buried in 36-inch deep trenches where cables crossed the sites. This system connected the Scientific Stations from Alice thru Irene.

TELEPHONE SYSTEM - ON SITES

This item consisted of approximately 17,000 lineal feet of telephone cable installed on individual sites for Scientific Stations, buildings and facilities. This item did not include camp telephone services or the submarine telephone system. However, it did include the following two terminal buildings and their equipment.

BUILDINGS F-1 - FLORA (TELEPHONE BOOTH)

This was a wood frame aluminum-covered building, 12'-6" x 8'-0" x 8'-3" high erected on concrete footings with a stabilized coral floor. Construction started on 11 June 1952, was completed on 21 June, and accepted by AEC on 22 November 1952.

BUILDING G-92 - GENE (TELEPHONE EXCHANGE BUILDING)

This was a one-story, two room wood frame building 13'-0" x 25'-0" x 9'-2" average height with exterior and interior plywood sheathing and a felt and mineral composition roof erected on four-inch thick reinforced concrete slab. It was dehumidified and was used to house a telephone switchboard. Construction started on 11 June 1952, was completed on 21 June and accepted by AEC on 22 November.

CHAPTER VI
CAUSEWAYS

It was originally planned to connect several islands in the Alice group by means of a causeway to produce a total length of connected land which would be approximately 9,000 feet long. The causeway had to be constructed in a straight line from the detonation point to a recorder station and would contain a coaxial cable which would be shielded by an earth cover of approximately 30 feet. Following extensive hydrographic and topographic surveys in September and October 1951, it was determined by the Eniwetok Field Manager on 20 November that in the interest of gaining more land space for stations and to provide fill, that it was necessary to move the zero point to Site Flora and to run the causeway and coax cable from Flora to Gene to Helen to Irene.

In July 1952, the requirement for a 30-foot earth cover over the coaxial cable was eliminated by the using agency.

The connection of these islands involved the construction of a 3,700-foot stabilized fill causeway in three sections of 1,350 feet between the sites of Flora and Gene, 700 feet between Gene and Helen, and 1,650 feet between Helen and Irene. This work was started on 30 January 1952. The causeway was constructed with a base of compacted coral rock and sand to elevations of plus 9.0 above mean lower low water on the lagoon side and plus 10.5 on the ocean side, with a width of 55 feet to 65 feet. On the lagoon side, a two to one slope was protected from wind and wave action by rip rap. Graded rock was dumped and spread so as to produce a minimum of voids; this construction was capped with larger rock. On the ocean side a bulkhead was constructed by driving railroad rails on four-foot centers to varying depths, controlled by the formations encountered, and fastening to them on the inside a sea wall of three-inch planking. After the planking was installed, backfill was placed using the largest coral rock available below the water line and compacted coral sand and rock above to the finished grade.

Figure 2-117 illustrates how the piling was driven on the ocean side; Figure 2-118 shows the original contours, finished contours, borrow areas, and a typical section of the causeway.

The causeway was originally designed with a top width of 35 feet, at elevation seven above mean lower low water. The need for an increase in height became evident early in the construction. During periods when high tide was combined with fresh winds, seas broke over the bulkheads on the ocean side and washed away considerable fill. Since the excavation of the boat turning basin in the lagoon area adjacent to the causeway provided a surplus of material which was

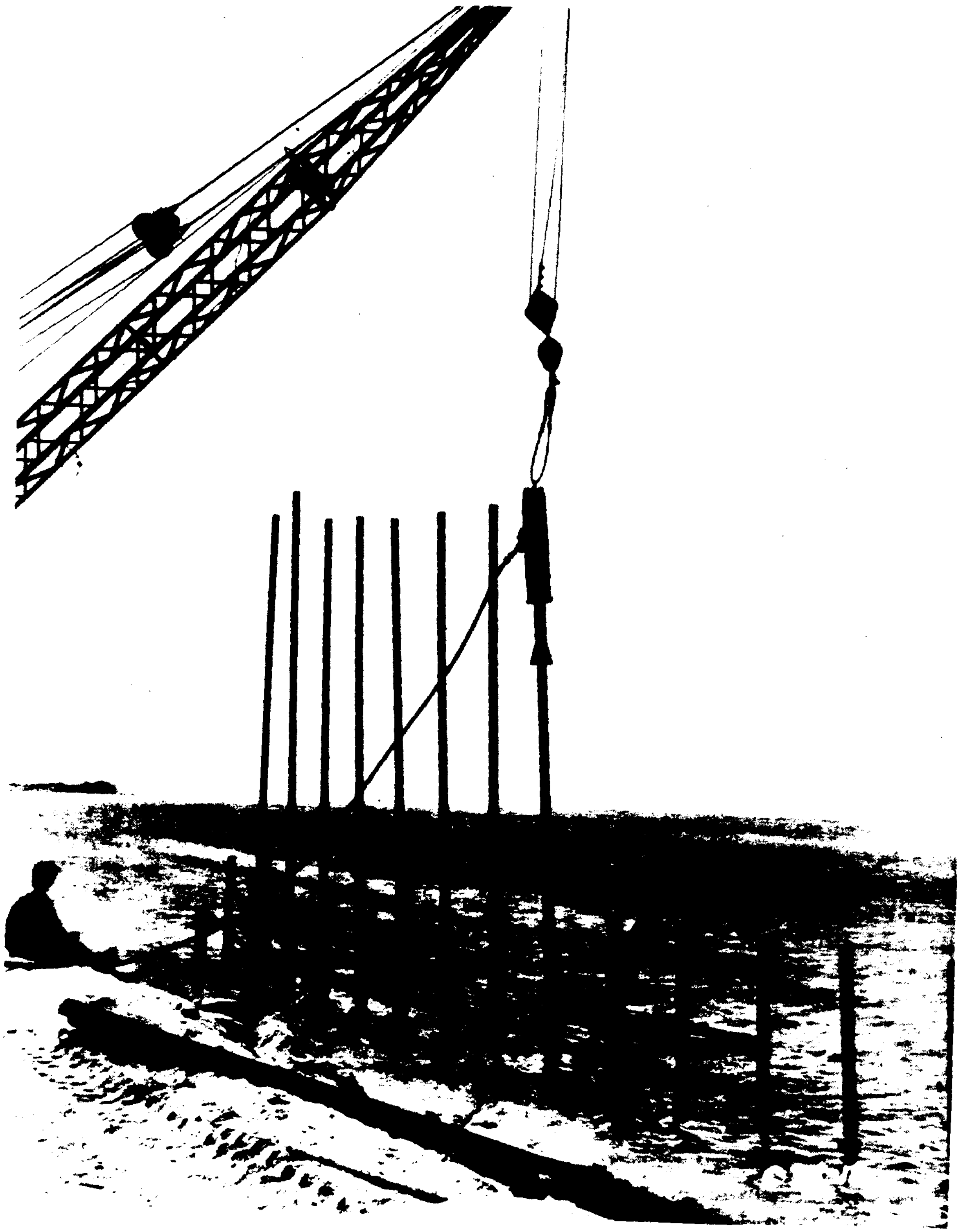


Figure 2-117. Driving Piling on Ocean Side for Causeway

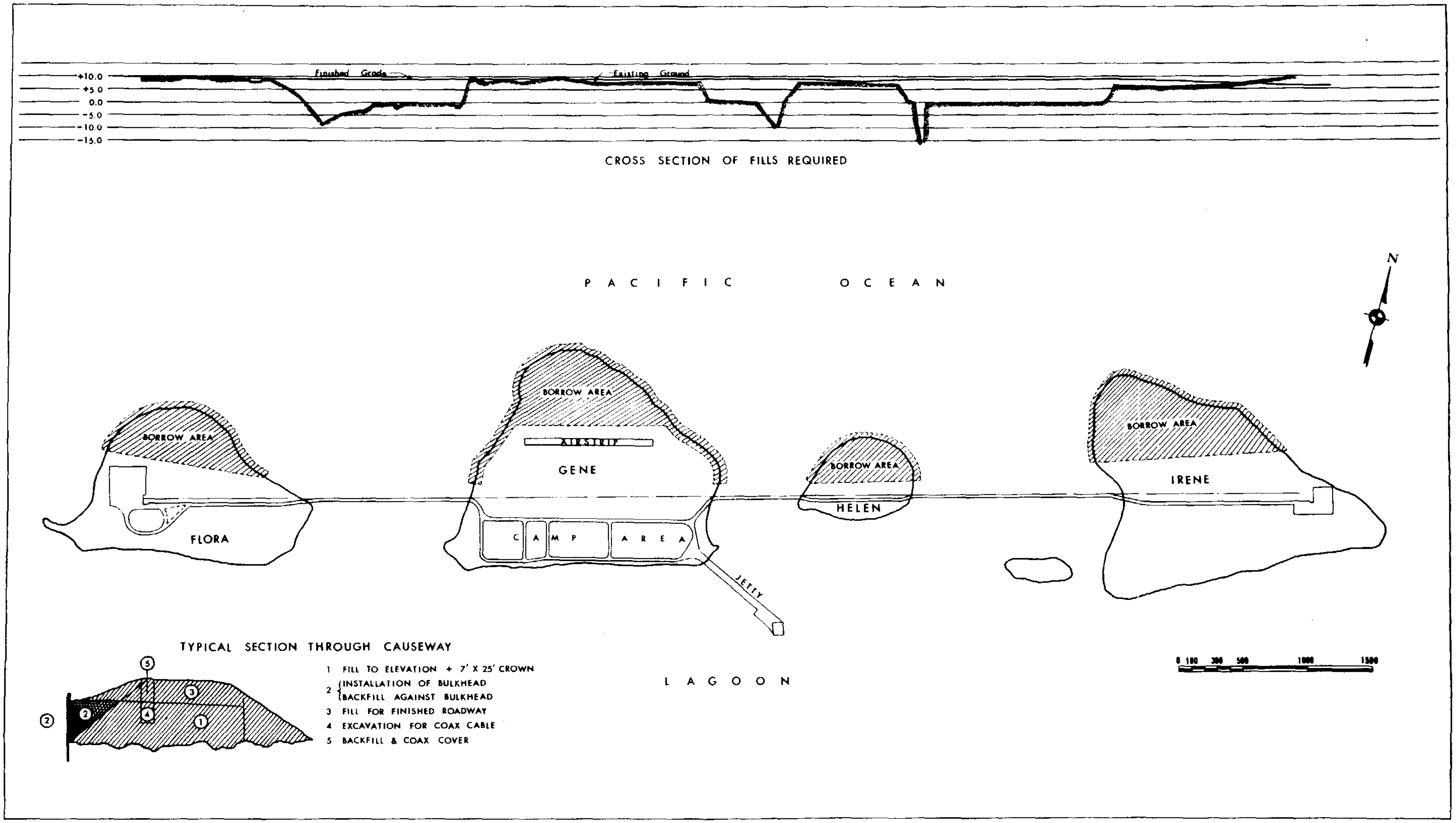


Figure 2-118. Causeway Flora to Irene

required to be removed sufficiently to prevent later shoaling of the basin, it was decided to waste this material in widening the causeway and thus provide additional construction operational area alongside Station 204. Accordingly the causeway was finally constructed as stated previously with a plus 9.0 feet above mean lower low water on the lagoon side and plus 10.5 feet on the ocean side with a width of 55 feet to 65 feet. Figure 2-119 is a photograph of a typical washout during construction on the Flora-Gene Causeway on 24 April 1952.

The final closing of the causeway gap between Gene and Helen was a race to complete the fill ahead of the rising tide, since the current through the opening was very swift. This condition is partially noted in Figure 2-120. At two-thirds full tide, with the gap closed, the water on the ocean side was one foot higher than on the lagoon side. During periods of high wind, combined with high tides, the water on the ocean side was more than two feet higher than the water on the lagoon side.

During the construction, sea action pounded the planking loose where it was not backed up by the fill, and it was therefore necessary to backfill as early as possible after the planking was placed. In driving the rail piles the jig holding the rails was completely submerged when low places in the reef were crossed at high tides. At these times it was necessary to continue the work from a raft. The depths to which the rails were driven varied widely in accordance with depth of water and subsurface conditions. In general, the rails were cut from 11 to 18 feet, but in some cases the full rail length of 30 feet was necessary.

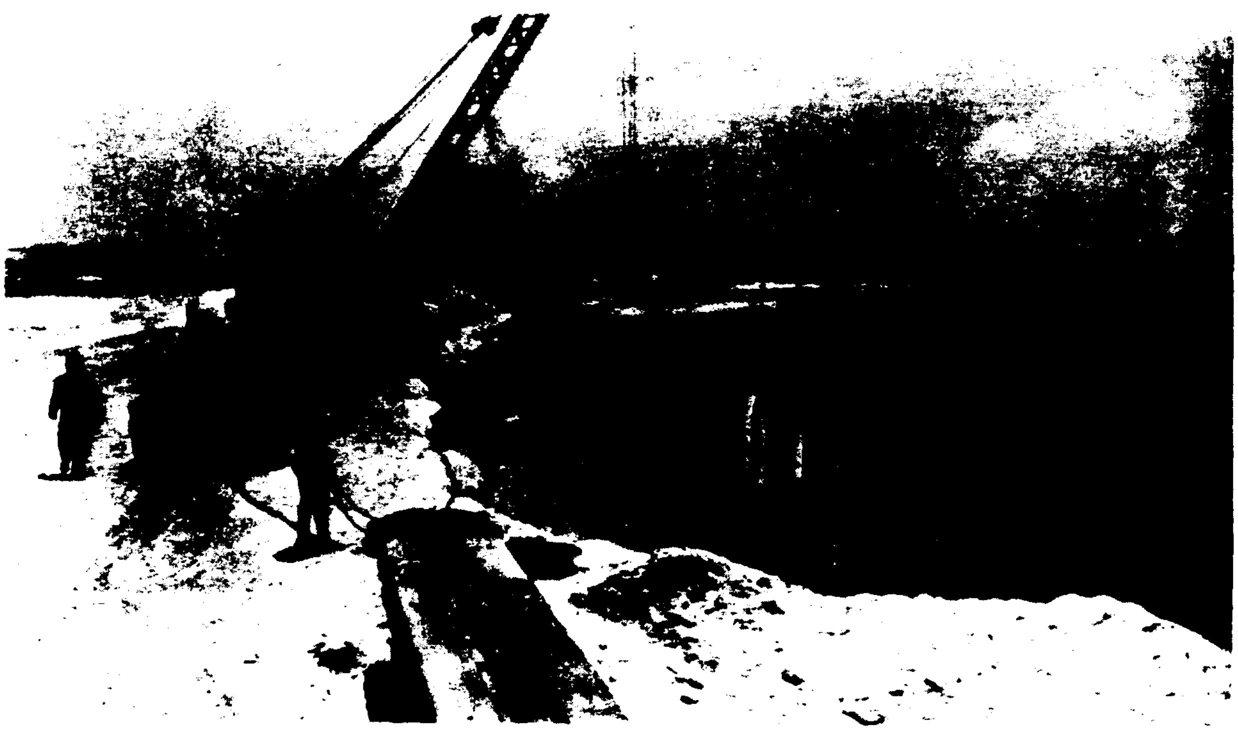


Figure 2-119. Typical Tidal Washout on Causeway

Figure 2-120. Closing Causeway Gap Between Flora and Gene

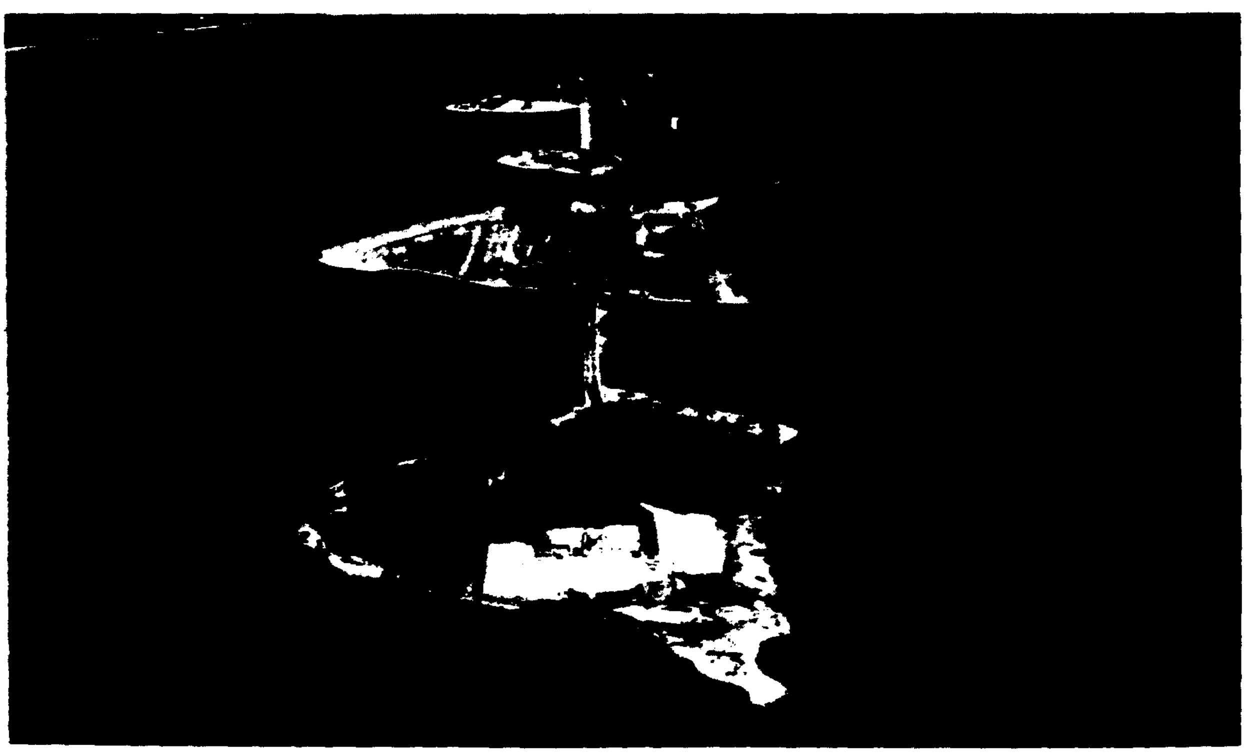


Figure 2-121. Aerial of Entire Causeway

The construction of the causeway was occasionally slowed by the necessity for using the roadway in support of early scientific activities.

All work associated with the causeway program was completed on 19 September; however, the causeway itself was usable by 25 April 1952. The Flora-Gene section of 1,350 feet was opened to traffic in eleven working days. Figure 2-121 shows the causeways as of 10 May 1952.

This causeway proved to be adequate for its purpose. The method of construction, although subject to a degree of continuing maintenance, is considered to have been the most effective solution, within economic limits, for inter-island connection under the conditions prevailing in this portion of the Atoll. Similar inter-island connections in other areas should be planned with regard to local wind, current and hydrographic conditions.

CHAPTER VII
INTER-ISLAND CABLES

SECTION 1. GENERAL

Prior to OPERATION IVY, there was approximately 1,800,000 feet of inter-island submarine cable installed for previous operations, which had established the need for reliable communications between the stations, islands, photo towers, and anchored ships with the center of the Atoll communications system located on Elmer. Decisions were made during previous tests in regard to type, number of systems and various individual installations. OPERATION IVY required 2,089,580 feet of cable, including that previously installed, to service all sites and stations. The Submarine Cable Block Chart, Figure 2-122, notes in detail the cable numbers, approximate length, cable type, test data, etc. of the existing cable as well as the new cable requirements.

In January 1952, tests and inspections were commenced on the adequacy of the then existing cables. The tests consisted primarily of opening the various terminal cans to test the cable for insulation resistances. Three tests were made as follows:

1. Copper resistance per pair (ohms)

2. Insulation resistance to ground per pair (megohms)

3. Insulation resistance to all conductors per pair (megohms)

For all work in connection with the lifting and inspection of cables, an M-Boat fitted with a special cable laying rig was used. This rig consisted primarily of two large sheaves, spaced approximately 20 feet apart, and which extended a few feet outboard. The cable, after being brought to the surface, was run across these sheaves. As the boat moved forward the cable was inspected for defects. In certain cases where cable was fouled around coral heads, it was necessary to use divers to free the cable, and where the depths exceeded 130 feet, the cable had to be cut, as divers were not permitted beyond this depth.

Telephone cable No. 104 between Elmer and Yvonne was examined and a bad break was found in its wrapping apparently due to chafing against coral formations. The cable was water-soaked and required partial replacement. In checking telephone cable No. 105 it was found fouled in approximately 200 feet of water, and it could not be freed by Jobsite divers. It was therefore cut so that two ends could be recovered and a new section was spliced to the cable to complete the circuit. Figures 2-123, 2-124 and 2-125 indicate methods used in splicing cables.

When submarine cables were first laid at the Proving Grounds, they were routed through relatively deep sections of the lagoon. Due to the difficulties experienced in the examination and repair of cables laid in deep water, it was decided that all future replacements be routed through shallow water. After repairs had been effected on cable No. 104, it again developed trouble and was completely replaced. This cable was then routed along the edge of the reef on the lagoon side and laid in approximately three to six fathoms of water.

For OPERATION IVY, 267,910 feet of cable was laid including 54,000 feet replacement of damaged submarine telephone cable. A total of 112,170 feet of signal cable and 155,740 feet of telephone cable was laid between islands and on causeways. This included the causeway between Flora and Irene on which was laid 10,900 feet for the signal system and 10,900 feet for the telephone connections.

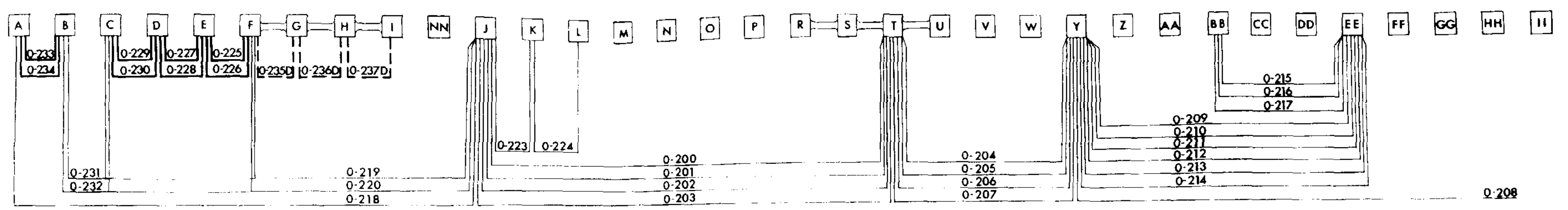
The estimated cost for this work was $315,395.00. The actual costs were $275,810.00.

The Telephone System Block is noted in Figure 2-126 and the Underground Electric System is noted in Figure 2-127. Terminals were established on each island and the type of terminal, i.e., Terminal House, Telephone Exchange, etc. is noted in Figure 2-122. From the terminal to the station, the cables were trenched as shown in Figure 2-128. Signal wire and cable from terminals were installed to 52 Scientific Stations and telephone service was rendered the Users to 26 Scientific Stations. Costs of cables from terminals to the various stations are not included in the above reported costs. These latter costs were prorated to the costs of the various stations.

In June and July 1952, the placement of new cables was approximately 50% behind schedule. This was due primarily to lack of material on hand and secondarily to changes in locations and functions of various Scientific Stations. The installation of the final 36,000 feet of new submarine cable was completed in early October.

DESIGNATION	ALICE	BELLE	CLARA	DAISY	EDNA	FLORA	GENE	HELEN	IRENE	NOAH	JANET	KATE	LUCY	MARY	NANCY	OLIVE	PEARL	RUBY	SALLY
ISLAND	BOGAL-LUA	BOGOM-BOGO	RUCHI	COCHITI	SANILDE-FENSO	ELUGE-LAB	TEITEIRI-PUCCHI	BOGA-IRIKK	BOGON		ENGEBI	MUZIN	KIRIN-IAN	BOKONA-ARAPPU	YEIRI	AITSU	RUJORO	EBERIRU	AOMON
TERMINAL HOUSE	1000.01 EXIST. STA 101	1000.02 EXIST. STA 101	NEW STA 1000.03	NEW STA 1000.04	NEW STA 1000.05	NEW STA 5	G 92	NEW STA 1000.10	NEW STA 1000.06		1001.01 EXIST. STA 69	1000.07 EXIST. STA 101	NEW STA 1000.08	1000.0 EXIST. STA 64					

DESIGNATION	TILDA	URSULA	VERA	WILMA	YVONNE	ZONA	ALVIN	BRUCE	CLYDE	DAVID	ELMER	FRED	GLENN	HENRY	IRWIN	JA
ISLAND	BIIJIRI	ROJOA	AARA-ANBIRU	PIIRAAI	RUNIT	"M"	CHINI-EERO	ANIYA-ANII	CHINIMI	JAPTAN	PARRY	ENIWE-TOK	IGURIN	MUI	POKON	RIB
TERMINAL HOUSE		1001.02 EXIST. STA 69	EXIST. STA 101	EXIST. STA 64	1001.03 EXIST. STA 69	STA. 101 RE-MOVED		STA. 804			EXIST. TEL. EXCH. BLDG 208	EXIST. TEL. EXCH.				



EXISTING SUBMARINE SIGNAL CABLE DATA PREVIOUS TO IVY

CABLE NO.	APPROX. LENGTH (IN FEET)	CABLE TYPE	CONDUCTOR QUANT.	CONDUCTOR SIZE	TEST DATA DATE	TEST DATA MIN. RESISTANCE (OHMS)	FROM	TO	REMARKS
O-200	47,000	115-P	10		1951	500,000	J	T	
O-201	47,500	115-P	10		1951	300,000	J	T	
O-202	46,800	115-P	10		1951	400,000	J	T	
O-203	48,400	115-P	10		1951	300,000	J	T	
O-204	42,000	115-P	10		1951	400,000	T	Y	
O-205	38,000	115-P	10		1951	19,000	T	Y	
O-206	38,500	115-P	10		1951	50,000	T	Y	
O-207	38,000	115-P	10		1951	400,000	T	Y	
O-208	44,000	115-P	10		1950		Y	MM	
O-209					1948		Y	EE	UNUSABLE
O-210					1949		Y	EE	UNUSABLE
O-211	61,000	115-P	10		1951	300,000	Y	EE	
O-212	58,000	115-P	10		1951	20,000	Y	EE	
O-213	57,750	115-P	10		1951	200,000	Y	EE	
O-214	57,000	115-P	10		1951	40,000	Y	EE	
O-215	30,800	113	3		1950		BB	EE	1 MEG OHM
O-216	41,900	104	3		1949		BB	EE	UNUSABLE
O-217	44,900	104	3		1949		BB	EE	UNUSABLE
O-218	39,000	115-P	10				A	J	
O-219	36,000	115-P	10				B	J	
O-220	36,000	115-P	10				B	J	
O-223	5,300	104	10				J	K	
O-224	5,500	104	10				K	L	

NEW SIGNAL CABLE REQUIRED FOR IVY

CABLE NO.	APPROX. LENGTH (IN FEET)	CABLE TYPE	CONDUCTOR QUANT.	CONDUCTOR SIZE	FROM	TO	REMARKS
O-219	31,000	115-P	10		F	J	ON REEF
O-220	31,000	115-P	10		F	J	ON REEF
O-225	4,730	115-P	10		E	F	ON REEF
O-226	4,730	115-P	10		E	F	ON REEF
O-227	2,420	115-P	10		D	E	ON REEF
O-228	2,420	115-P	10		D	E	ON REEF
O-229	2,200	115-P	10		C	D	ON REEF
O-230	2,200	115-P	10		C	D	ON REEF
O-231	5,720	115-P	10		B	C	ON REEF
O-232	5,720	115-P	10		B	C	ON REEF
O-233	4,565	115-P	10		A	B	ON REEF
O-234	4,565	115-P	10		A	B	ON REEF
O-235D	3,080	ROMEX	(10) 2/C	#14	F	G	**ON CAUSEWAY
O-236D	3,630	ROMEX	(10) 2/C	#14	G	H	**ON CAUSEWAY
O-237D	3,740	ROMEX	(10) 2/C	#14	H	I	**ON CAUSEWAY

SYMBOLS

- EXISTING SUBMARINE SIGNAL CABLE
- NEW SIGNAL CABLE 10/C TYPE 115-P
- NEW SIGNAL CABLE (10)2/C No.14 RC
- EXISTING SUBMARINE SIGNAL CABLE RE
- ISLANDS CONNECTED BY CAUSEWAY

Figure 2-122. Submarine Signal Cable Block Chart

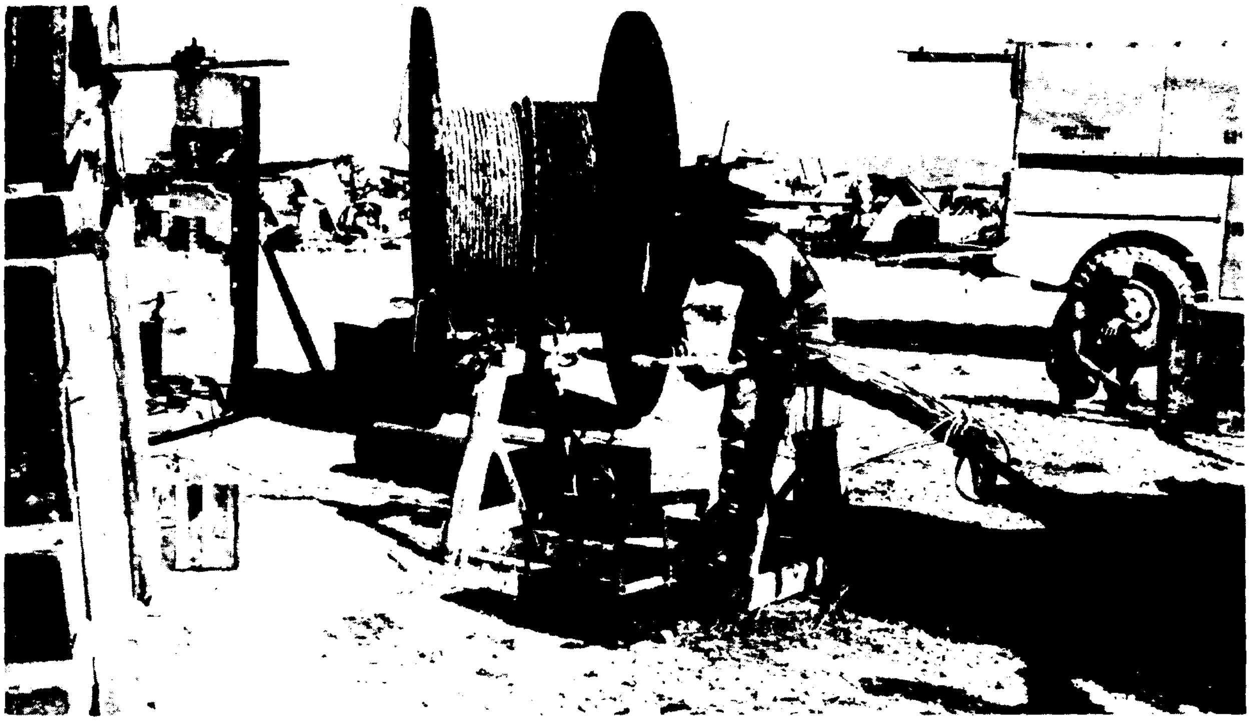


Figure 2-123. Splicing Submarine Communications Cable

Figure 2-124. Wiping Sleeve Joint After Splice

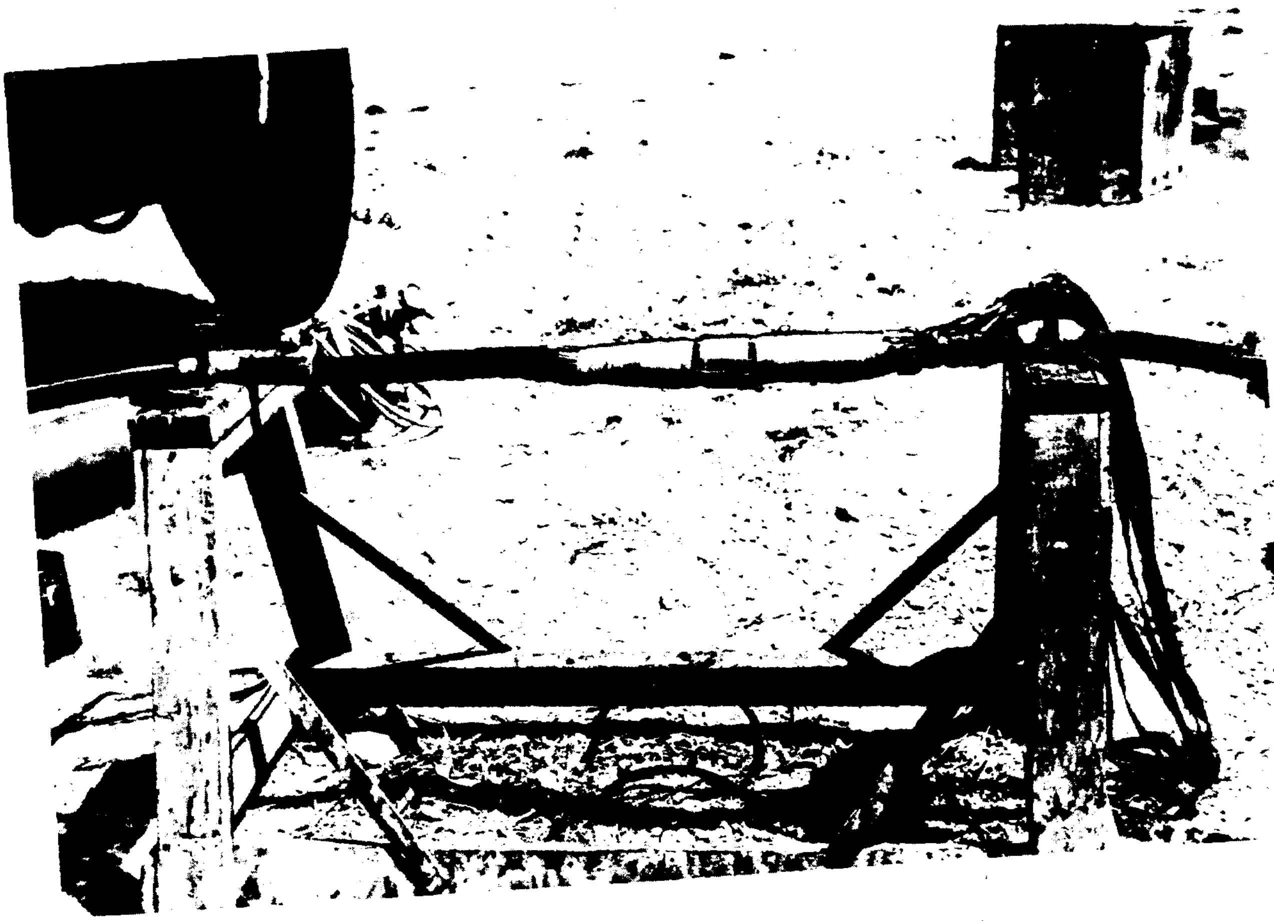
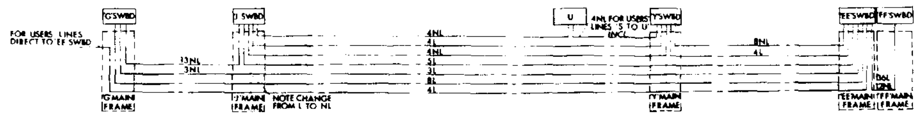


Figure 2-125. Splice Tested and Ready to Wrap

Figure 2-128. Trenching of Cables

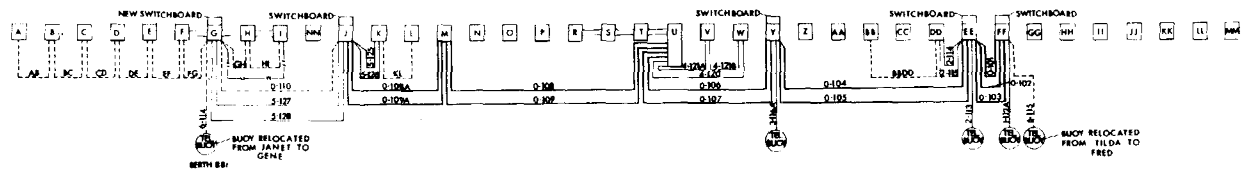


SWITCHBOARD TRUNKING

DESIGNATION	ALICE	BELLE	CLARA	DAISY	EDNA	FLORA	GENE	HELEN	IRENE	NOAH	JANET	KATE	LUCY	MARY
ISLAND	BOGALLUA	BOGOMBOGO	RUCHI	COCHITI	SANILDEFENSO	ELUGELAB	TEITERIPUCCHI	BOGAIRIKK	BOGON		ENGEBI	MUZIN	KIRINIAN	BOKONAARAPPU
GREENHOUSE DESIG	F	U					Q		W		E	S	T	P
TERMINAL HOUSE	1000.01 EXIST STA 101	1000.02 EXIST STA 101	NEW STA 1000.03	NEW STA 1000.04	NEW STA 1000.05		G 92	NEW STA 1000.10	NEW STA 1000.06		1001.01 EXIST STA 69	1000.07 EXIST STA 101	NEW STA 1000.08	1000.0 EXIST STA 64
SWITCHBOARD							G 92				SWBD STA [illegible] STA 23A			
REQ'D USERS TO EE	1					2			1					
H & N PHONES	1	1	1	1	1	2	12	1	2		2	1	1	1
REQ'D USERS LOCAL PHONES	3	1	2	1	1	14		1	8		5	2	1	2

DESIGNATION	NANCY	OLIVE	PEARL	RUBY	SALLY	TILDA	URSULA	VERA	WILMA	YVONNE	ZONA	ALVIN	BRUCE	CLYDE	DAVID
ISLAND	YEIRI	AITSU	RUJORO	EBERIRU	AOMON	BIIJIRI	ROJOA	AARAANBIRU	PIIRAAI	RUNIT	"M"	CHINIEERO	ANIYAANII	CHINIMI	JAPTAN
GREENHOUSE DESIG				V	D	D	D	R	N	C	M		K		L
TERMINAL HOUSE							1001.02 EXIST STA 69	EXIST STA 101	EXIST STA 64	1001.03 EXIST STA 69	STA 101 REMOVED		STA 804		
SWITCHBOARD										SWBD STA [illegible] STA 23A					
REQ'D USERS TO EE															
H & N PHONES					1	1				8			1		
REQ'D USERS LOCAL PHONES					1	2	1			4			1		

DESIGNATION	ELMER	FRED	GLENN	HENRY	IRWIN	JAMES	KEITH	LEROY	MACK
ISLAND	PARRY	ENIWETOK	IGURIN	MUI	POKON	RIBAION	GIRIINIEN	RIGILI	CORAL HEAD
GREENHOUSE DESIG	B	A	Z						
TERMINAL HOUSE	EXIST TELEXCH BLDG [illegible]	EXIST TELEXCH							
SWITCHBOARD	EXIST TELEXCH BLDG [illegible]	EXIST. TELEXCH							
REQ'D USERS TO EE									
H & N PHONES									
REQ'D USERS LOCAL PHONES									



PRIOR TO IVY

EXISTING SUBMARINE TELEPHONE CABLE DATA

CABLE NO	APPROX. LENGTH (IN FEET)	CABLE SIZE PRS	CABLE SIZE GA	LOADED PAIRS PR. CT.	LOADED PAIRS NO. PRS	NON LOADED PAIRS PR. CT	NON LOADED PAIRS NO. PRS	FROM	TO
0-101	23,640 FT	16	19	1-12	12	13-16	4	EE	FF
0-102	24,960 FT	16	19	1-12	12	13-16	4	EE	FF
0-103	22,980 FT	16	19	1-12	12	13-16	4	EE	FF
0-104	60,192 FT	16	19	1-12	12	13-16	4	Y	EE
0-105	58,608 FT	16	19	1, 5, 7, 10, 12, 14, [illegible]	12	6, 8, 9, 11	4	Y	EE
0-106	40,140 FT	16	19		12		4	T	Y
0-107	42,000 FT	16	19	1-12	12	13-16	4	T	Y
0-108	30,840 FT	16	19	1-12	12	13-16	4	M	T
0-108A	24,300 FT	16	19		12		4	J	M
0-109	30,540 FT	16	19	1-12	12	13-16	4	M	T
0-109A	22,260 FT	16	19	1-12	12	13-16	6	J	M
2-114	15,300 FT	6	19			1-6	6	DD	EE
2-115	15,180 FT	6	19			1-6	6	DD	EE
4-120	12,672 FT	6	19			1-6	6	T	W
4-121A	9,960 FT	6	19			1-6	6	T	V
4-121B	6,360 FT	6	19			1-6	6	V	W
5-125	6,960 FT	6	19			1-6	6	J	K
5-126	9,000 FT	6	19			1-6	6	J	K
5-127	16,720 FT	6	19			1-6	6	G	J
5-128	19,980 FT	6	19			1-6	6	G	J

NEW FOR IVY

NEW SUBMARINE TELEPHONE CABLE REQUIRED

CABLE NO.	APPROX. LENGTH (IN FEET)	CABLE SIZE PRS.	CABLE SIZE GA	LOADED PAIRS PR. CT.	LOADED PAIRS NO. PRS.	NON LOADED PAIRS PR. CT.	NON LOADED PAIRS NO. PRS.	FROM	TO	REMARKS
* 0-110	19,000 FT	16	19	1-12	12	13-16	4	J	G	IN LAGOON
AB	4,565 FT	6	19			1-6	6	A	B	ON REEF
BC	5,720 FT	6	19			1-6	6	B	C	ON REEF
CD	2,200 FT	16	19			1-16	16	C	D	ON REEF
DE	2,420 FT	16	19			1-16	16	D	E	ON REEF
EF	4,730 FT	16	19			1-16	16	E	F	ON REEF
FG	3,080 FT	51	19			1-51	51	F	G	ON CAUSEWAY
GH	3,430 FT	6	19			1-16	16	G	H	ON CAUSEWAY
HI	3,740 FT	6	19			1-16	16	H	I	ON CAUSEWAY
6-114	6,000 FT	6	19			1-6	6	G	BUOY	BERTH 88
KL	2,800 FT	6	19			1-6	6	K	L	ON REEF
6-115	10,000 FT	6	19			1-6	6	G	BUOY	SALVAGED CABLE
BBDD	12,000 FT	6	19			1-6	6	BB	DD	ON REEF

* LOADED CABLE – LOAD PAIRS 1-12 WITH 88 MILLIHENRY LOADING COIL EACH 3,000 FT

NEW TELEPHONE SWITCHBOARD
COMPLETE WITH COMMON BATTERY, POWER PACK, MAIN FRAME

LOCATION	DESCRIPTION	COMMON BATTERY POSITION	MAGNETO POSITION
GENE TEITERIPUCCHI	KELLOGG MASTER BUILT 2-1 POS SWBD	60	10

SYMBOLS

- 16PR-19GA SUBMARINE TELEPHONE CABLE 12 PR LOADED
- 6PR-19GA SUBMARINE TELEPHONE CABLE NOT LOADED
- NEW TELEPHONE CABLE SIZE & TYPE AS NOTED
- ISLANDS CONNECTED BY CAUSEWAY
- NL NOT LOADED
- L LOADED

Figure 2-126. Telephone System Block Diagram for Ivy

STATION NO.	SITE	USER	POWER SUPPLY — DEMAND — KVA	PHASE	VOLTAGE	SOURCE — PORT. GEN.	SUBSTA. NO.	TRANSF. SIZE	TIMING SIGNALS FROM STA. NO.	TELEPHONE LINES FROM STA. NO.	REMARKS
1	F	TU4	200	3	120/208	NONE	1	3-100	STA. 5	4 F-1	
2	F	TU4	45	3	220/240	NONE	2	2-10 1-25	NONE	3 F-1	
3	F	TU4	30	3	120/208	NONE	3	3-10	NONE	NONE	
4	F	TU4	50	3	120/208	NONE	1	3-100	-	1 F-1	
5	F	EGG	50	3	120/208	NONE	[illegible]	3-100	-	2 F-1	
6	F	EGG	.5	1	120	NONE	-	-	NONE	NONE	POWER FROM STA. 5
7	F	TU4	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
11	E	AFSWP	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
120	F	J-11	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
200	I	NRLK	200	3	120/208	NONE	200	3-75	NOTE 2	NOTE 3	
201	F	NRLK	5	3	208	NONE	-	-	NONE	NONE	POWER FROM STA. 1
202	I	NRLK	3.2 3.5	1 3	120 208	NONE	-	-	-	1 1000.06	POWER FROM STA. 200
203.01	CAUSE-WAY	NRLK	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
203.02	C	NRLK	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
203.03	CAUSE-WAY	NRLK	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
203.04 THRU 203.09	I	NRLK	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
204	F TO I	NRLK	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
300	A	J-15	25	3	120/208	25	NONE	NONE	5 1000.01	4 1000.01	
330	F	J-15	5	1	120	NONE	-	-	2 STA. 5	1 F-1	POWER FROM STA. 1
331.01	F	J-15	.5	1	120	NONE	-	-	NONE	NOTE 1	POWER FROM STA. 1
331.02	F	J-15	.5	1	120	NONE	-	-	NONE	NOTE 1	POWER FROM STA. 1
331.03	F	J-15	.5	1	120	NONE	-	-	NONE	NOTE 1	POWER FROM STA. 1
331.04	F	J-15	.5	1	120	NONE	-	-	NONE	NOTE 1	POWER FROM STA. 1
331.05	F	J-15	.5	1	120	NONE	-	-	NONE	NOTE 1	POWER FROM STA. 1
331.06	F	J-15	.5	1	120	NONE	-	-	NONE	NOTE 1	POWER FROM STA. 1
331.07	F	J-15	.5	1	120	NONE	-	-	NONE	NOTE 1	POWER FROM STA. 1
332	F	J-15	.5	1	120	NONE	-	-	NONE	NOTE 1	POWER FROM STA. 1
333.01 THRU 333.07	F	J-15	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
334	A	J-15	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
335	A	J-15	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
411.01	F	J-12	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
411.02 THRU 411.22	REEF	J-12	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
411.23 THRU 411.47	REEF	J-12	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
440	E	J-12	NONE	NONE	NONE	NONE	NONE	NONE	3 1000.05	NONE	
510.01 THRU 510.07	A	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
510.08 THRU 510.14	B	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
510.15 THRU 510.19	C	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
510.20 THRU 510.24	D	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
510.25 THRU 510.29	E	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	

STATION NO.	SITE	USER	POWER SUPPLY — DEMAND — KVA	PHASE	VOLTAGE	SOURCE — PORT. GEN.	SUBSTA. NO.	TRANSF. SIZE	TIMING SIGNALS FROM STA. NO.	TELEPHONE LINES FROM STA. NO.	REMARKS
510.30 THRU 510.35	G	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
510.36	CAUSE-WAY	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
510.37 THRU 510.40	H	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
510.41 THRU 510.45	CAUSE-WAY	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
510.46 THRU 510.51	I	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
520	C	J-13	25	3	120/208	25	NONE	NONE	2 1000.03	1 1000.03	
521.01	B	J-13	NONE	NONE	NONE	NONE	NONE	NONE	2 1000.01	NONE	
521.02	D	J-13	NONE	NONE	NONE	NONE	NONE	NONE	2 1000.04	NONE	
521.03	E	J-13	NONE	NONE	NONE	NONE	NONE	NONE	2 1000.05	NONE	
530.01	I	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	1 1000.06	SIGNAL TELEMETERED TO ELMER VIA TELEPHONE LINE
531.01	A	J-13	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	(ACC)
541.01	A	DOD	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	(ACC)
541.02	B	DOD	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	(ACC)
541.03	C	DOD	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	(ACC)
541.04	I	DOD	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
542.01	A	DOD	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	(BUSHIPS NRDL)
600	I	SANDIA	35	3	120/208	NONE	600	3-15	2 1000.06	1 1000.06	
610	NN	SANDIA	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	SIG. BY USER TO STA. 600
614	G	SANDIA	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	SIG. BY USER TO STA. 600
615.01	H	SANDIA	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	SIG. BY USER TO STA. 600
615.02	I	SANDIA	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	SIG. BY USER TO STA. 600
616.01	H	SANDIA	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	SIG. BY USER TO STA. 600
616.02	I	SANDIA	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	SIG. BY USER TO STA. 600
6104	A	SANDIA	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
620.01	REEF	J-10	NONE	NONE	NONE	NONE	NONE	NONE	1 G-92	NONE	
620.02	REEF	J-10	NONE	NONE	NONE	NONE	NONE	NONE	1 1000.10	NONE	
620.03	REEF	J-10	NONE	NONE	NONE	NONE	NONE	NONE	1 1000.06	NONE	
620.04	REEF	J-10	NONE	NONE	NONE	NONE	NONE	NONE	1 1000.06	NONE	
650.01	I	SANDIA	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
671	G	NRL	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
810.01	A	NRLS	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
810.02	I	NRLS	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
810.03	NN	NRLS	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
840	A	NRLS	NONE	NONE	NONE	NONE	NONE	NONE	NONE	1 1000.01	POWER FROM STA. 1
841	F	NRLS	1.5	1	120	NONE	NONE	NONE	NONE	1 F-1	
842	F	NRLS	1.5	1	120	1	842	15	NONE	1 F-1	
1000.01	A	EGG	1	1	120	1	NONE	NONE	ALL	1 G-92	POWER FROM PORT. GEN. WHEN REQ.
1000.02	B	EGG	1	1	120	1	NONE	NONE	ALL	1 G-92	POWER FROM PORT. GEN. WHEN REQ.
1000.03	C	EGG	1	1	120	1	NONE	NONE	ALL	1 G-92	POWER FROM PORT. GEN. WHEN REQ.
1000.04	D	EGG	1	1	120	1	NONE	NONE	ALL	1 G-92	POWER FROM PORT. GEN. WHEN REQ.
1000.05	E	EGG	1	1	120	1	NONE	NONE	ALL	1 G-92	POWER FROM PORT. GEN. WHEN REQ.
1000.06	I	EGG	1	1	120	1	NONE	NONE	ALL	1 G-92	POWER FROM PORT. GEN. WHEN REQ.
1000.10	H	EGG	1	1	120	1	NONE	NONE	ALL	1 G-92	POWER FROM PORT. GEN. WHEN REQ.
1130	F	DOD	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	
F-1	F	AEC	NONE	NONE	NONE	NONE	NONE	NONE	NONE	1 G-92	TELEPHONE STA.
G-92	G	EGG	14.9	3	120/208	NONE	TRANS ON POLE	3-10	ALL	ALL	TEL. AND SIGNAL STA.

Figure 2-127. Underground Electrical System Chart

COMPLETION REPORT
OPERATION IVY

VOLUME I
BOOK 3
CAMP OPERATION AND MANAGEMENT

BOOK 3
TABLE OF CONTENTS

BOOK 3

LIST OF ILLUSTRATIONS

CHAPTER I
ADMINISTRATION & MANAGEMENT

SECTION 1. SUPERVISION

Over-all supervision of the management of Contract AT-(29-2)-20 was the responsibility of the General Manager, which position was created on 1 November 1951. The General Manager was directly responsible to the President and Executive Vice President of the Company and exercised supervision over the conduct of Contract AT-(29-2)-20 through the Chief of Operations, the Director of Engineering, the Controller, the Contract Administrator, and the Chief Security Officer. The responsibilities and authority of each of these five Division Heads were clearly defined and each was authorized to maintain direct liaison with AEC officials and with Jobsite supervisors on matters involving his particular activity. In addition, two staff positions of Executive Assistants in Engineering and Administration were created, without direct operational responsibility, to assist the General Manager in examining and correcting any deficiencies which appeared in the conduct of any phase of the operation. This managerial arrangement assured a high degree of coordination and close supervisory control. All major decisions were coordinated with the President, the Executive Vice President, and the Division Heads concerned who were kept constantly advised by the General Manager on all aspects of the project by means of conferences and periodic reports.

The over-all supervision of the management and their exercised supervision is shown on the Home Office Management Chart, Figure 3-1.

Inherent in an operation of this type, in which a large part of the work was of an experimental nature and in which the operational site was isolated from all normal sources of supply of both personnel and material, were certain difficulties which were known and appreciated at the outset. It was realized that these difficulties could be minimized by the maintenance of close liaison between the Contractor and the AEC, between Home Office and the Jobsite, and between the Home Office and the various participating agencies including military and scientific agencies, and transportation agencies. All supervisory personnel at the Home Office were alert to the need for continuing liaison with the AEC and the immediate transmission of information to the Jobsite. Transmission was normally accomplished by teletype or written memoranda; however, it was found that personal discussions were essential to maintain complete understanding of developments and criteria which were constantly undergoing revision. In order to meet this need, a program of scheduled visits of Home Office supervisory personnel to the Jobsite was inaugurated.

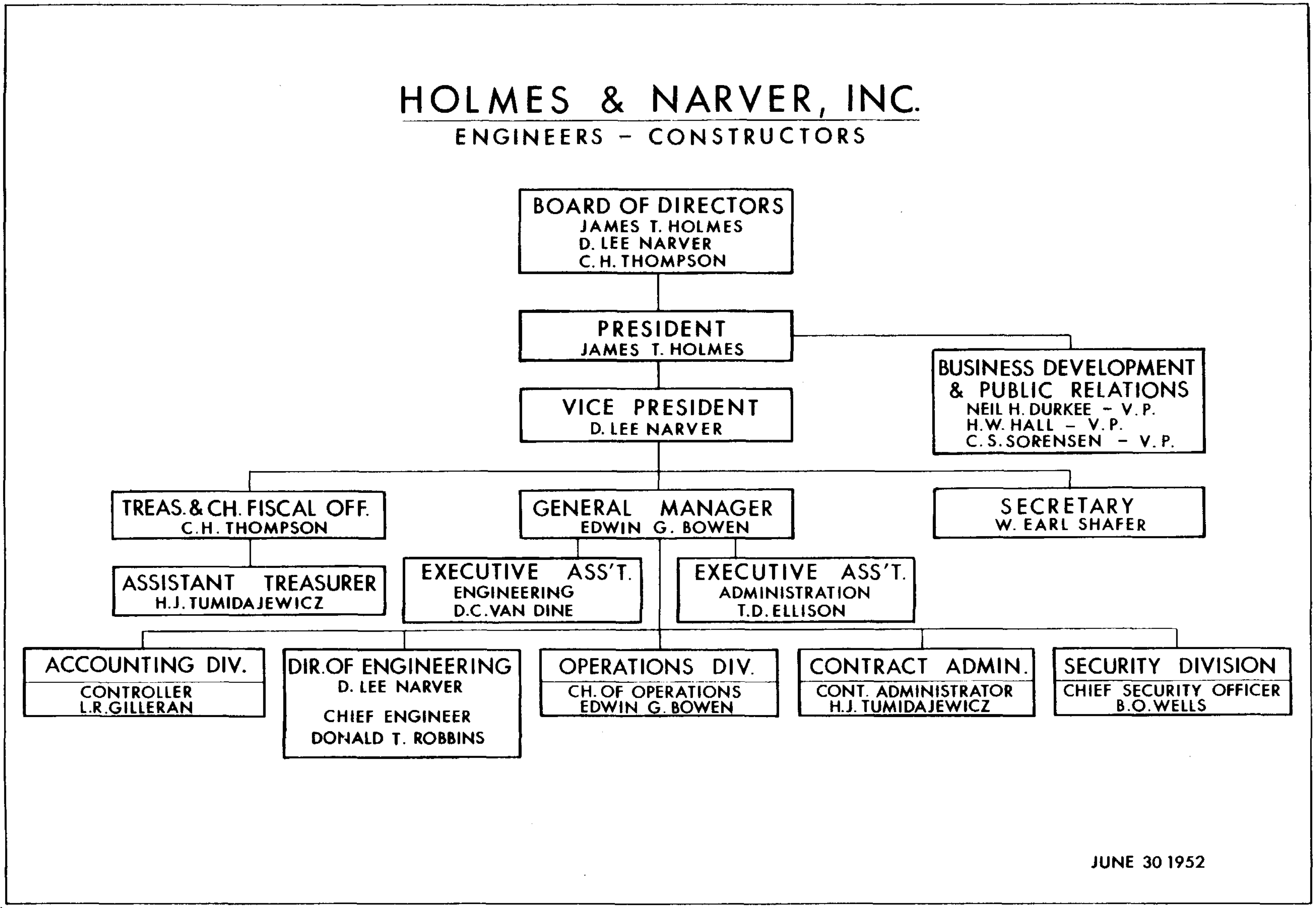


Figure 3-1. Home Office Management Chart.

The establishment of the position of Project Engineer on 31 October 1951, provided particularly close liaison on engineering matters. The Project Engineer reported directly to the Chief of Operations, and his office was located adjacent to the Engineering Division activities. He was thus enabled to maintain constant surveillance over the progress of design work on this project, and to keep the Chief of Operations and the Project Manager advised of revisions and of progress. The assignment to the Project Engineer of the responsibility for the supervision of engineering developments on Contract AT-(29-2)-20 permitted the Chief Engineer to devote his undivided attention to his primary responsibility for engineering design work. The Operations Division Organization Chart is shown in Figure 3-2.

Another change in organizational policy introduced near the close of OPERATION IVY was the establishment of rotational assignments among certain supervisory personnel at the Jobsite and the Home Office. Experience had indicated that an interchange of individuals in these categories at approximately three month intervals would serve to broaden their knowledge of all aspects of the job and would minimize fatigue which occurred after extended assignment at the Jobsite. This rotational program was applicable to the Project Manager, Resident Manager, and to the Division Heads at the Jobsite.

The Chief of Operations exercised supervision over the conduct of operations at the Jobsite through the Project Manager who was habitually at the site. In addition, the Chief of Operations supervised those activities at the Home Office which directly supported the Jobsite. These included: the negotiation of subcontracts; the procurement and shipment of supplies and equipment; the hiring and transportation of personnel; estimating; communications; and the management of the branch office at Honolulu. Each of these activities was under the direct control of Department Heads who were authorized to communicate directly with supervisory personnel at the Jobsite on matters pertaining to their particular activity. The Project Engineer of Contract AT-(29-2)-20 also reported to the Chief of Operations in order that the latter could be constantly informed of the progress of engineering features of the Contract and could exercise effective coordination between all activities concerned.

It was also found desirable to provide, at the Home Office, an Assistant to the Project Manager. Reporting to the Chief of Operations, this Assistant's primary responsibility was that of material control, including the processing of Jobsite material requisitions, and the inspection of material and equipment prior to shipment to the Jobsite.

The phraseology of Contract AT-(29-2)-20 was stated in broad terms in certain instances in order to provide the widest possible latitude to the AEC in the scope and location of future work. As the work progressed, various modifications to the Contract were received; new items were added, others were increased in scope, and still others were reduced or deleted. Modifications in

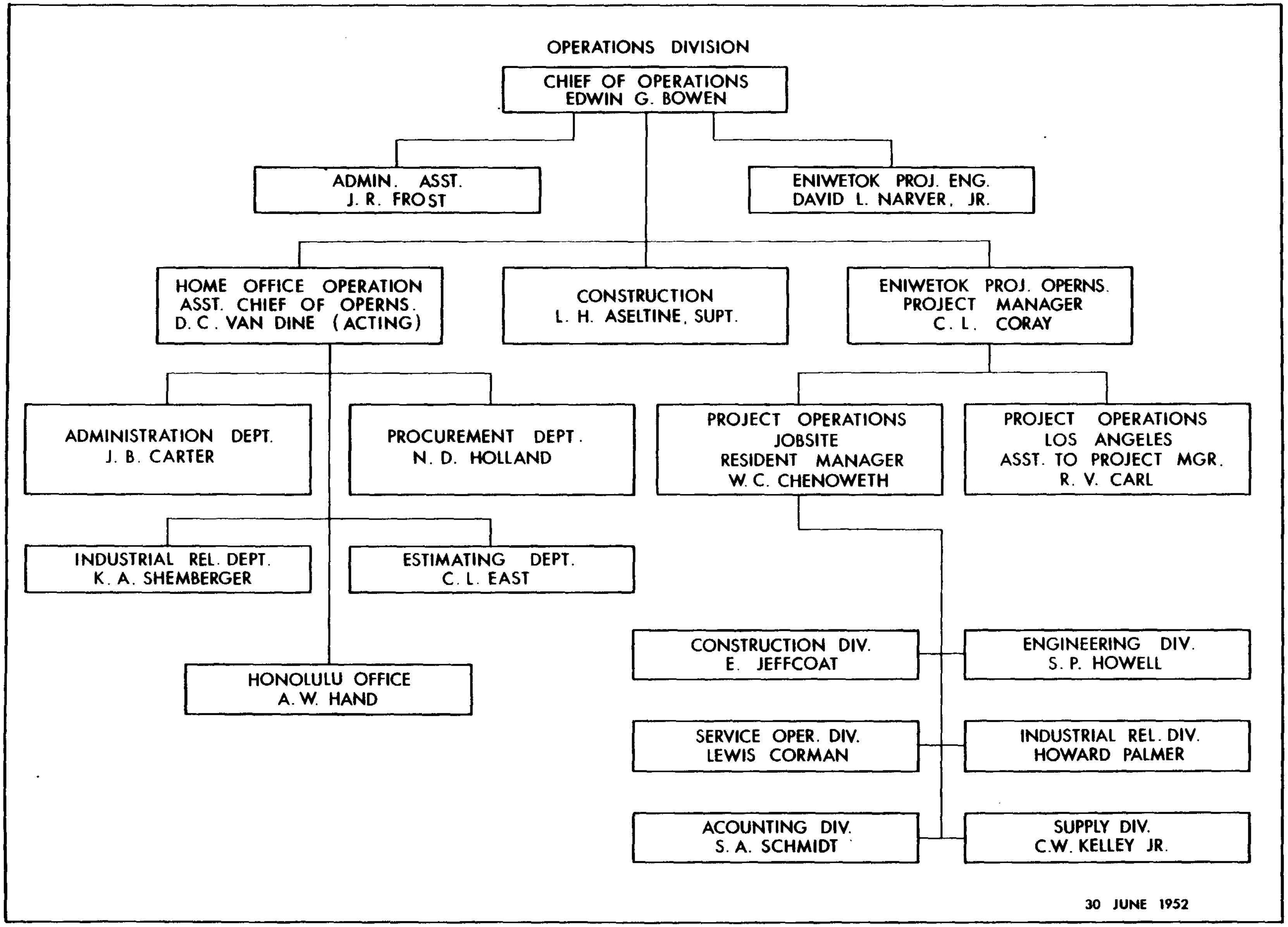


Figure 3-2. Operations Division Organization Chart.

certain Scientific Stations presented particular difficulties due to the short period of time allowed for completion of these items of work. While these modifications were not unexpected, they imposed frequent changes in the organizational distribution of personnel at the Jobsite. These modifications also entailed additional activity at the Home Office, particularly on the part of the Purchasing, Expediting and Transportation Sections.

Transportation of supplies, equipment and personnel were closely coordinated by the Commander of Task Force 132 through a system of advance estimates which were periodically revised. In addition, the Holmes & Narver representatives at Travis Air Force Base, at the Naval Supply Center, Oakland, and at Hickam Air Field, Honolulu, maintained close liaison with Task Force representatives and with shipping agency officials, keeping them informed at all times of changes in shipping requirements. Holmes & Narver representatives were, in turn, kept informed of changes in shipping schedules.

This closely integrated liaison arrangement greatly assisted in the orderly flow of air freight shipments which at times far exceeded advance estimates, particularly in those instances in which last-minute revisions in Scientific Stations required the expeditious supply of materials whose need had not previously been indicated.

Over-all supervision of the operations at the Jobsite was the responsibility of the Project Manager assisted by the Resident Manager. The Project Manager was directly responsible to the Chief of Operations of the Company and exercised supervision over the conduct of Contract AT-(29-2)-20 at the Jobsite through the General Superintendent of Construction, the Resident Engineer, the General Supervisor of Service Operations, the Resident Controller, the Jobsite Director of Industrial Relations and the Superintendent of Supply. The responsibilities and authority of these Division Heads were clearly defined. Each Division Head was authorized to maintain direct liaison with the AEC Resident Engineer on details involving his particular activity. However, the Project Manager retained the responsibility for all decisions involving policy or the expenditure of funds. With the exception of a short visit to the Home Office, the Project Manager was at the Jobsite during the entire period of the operations under this Contract and he thereby was able to maintain constant surveillance over all phases of the work. Coordination of the various Division Heads was effected by direct contact with them and through weekly staff conferences.

Prior to the commencement of OPERATION IVY, the Jobsite Organization was carefully analyzed and changes thereto were effected for better efficiency and simplification. These changes were as follows:

1. The Equipment Repair and Machine Shop, Communications, and Maintenance Departments, which had been components of the Service Operations Division, were placed in the Construction-Maintenance Division.

2. The Supply Division, which had operated as a department of the Administrative Division, was established as a Division and the Superintendent of Supply was designated as a member of the Jobsite Staff.

3. All services and activities relating to the handling of personnel were combined into an Industrial Relations Division and the Director of this Division was designated as a member of the Jobsite Staff.

In addition to the general organization as outlined above, an Area Superintendent was designated for Site Fred and for each experimental island site. He was directly responsible to the General Superintendent of Construction, but was charged with the responsibility of supervising and coordinating all activities on that site. In accomplishing this the Area Superintendent normally worked through the Division Heads, but in cases of urgency he could take such action as he deemed necessary to meet the immediate needs of the area to which he was assigned.

The formulation of a Jobsite Procedures Manual was a decided step forward in Administrative control. The Standard Operating Procedures became a guide for the conduct of each Division, and for indoctrinating new arrivals. They were extremely valuable in standardizing the methods and conduct of all operations. Figure 3-3 shows the over-all Jobsite Organization.

The mechanics of administrative control of the project are discussed hereafter under the following general headings:

Cost Estimating
Engineering Organization
Construction Organization
Accounting
Industrial Relations
Procurement
Exporting and Packing
Jobsite Supply and Warehousing
Service Operations
Intra-Atoll Transportation
Communications
Security
Records and Reports

SECTION 2. ESTIMATING

Since Holmes & Narver had just completed Contract AT-(29-1)-507, there was established within the Estimating Department an experienced organization prepared to take over the estimating responsibility of Contract AT-(29-2)-20.

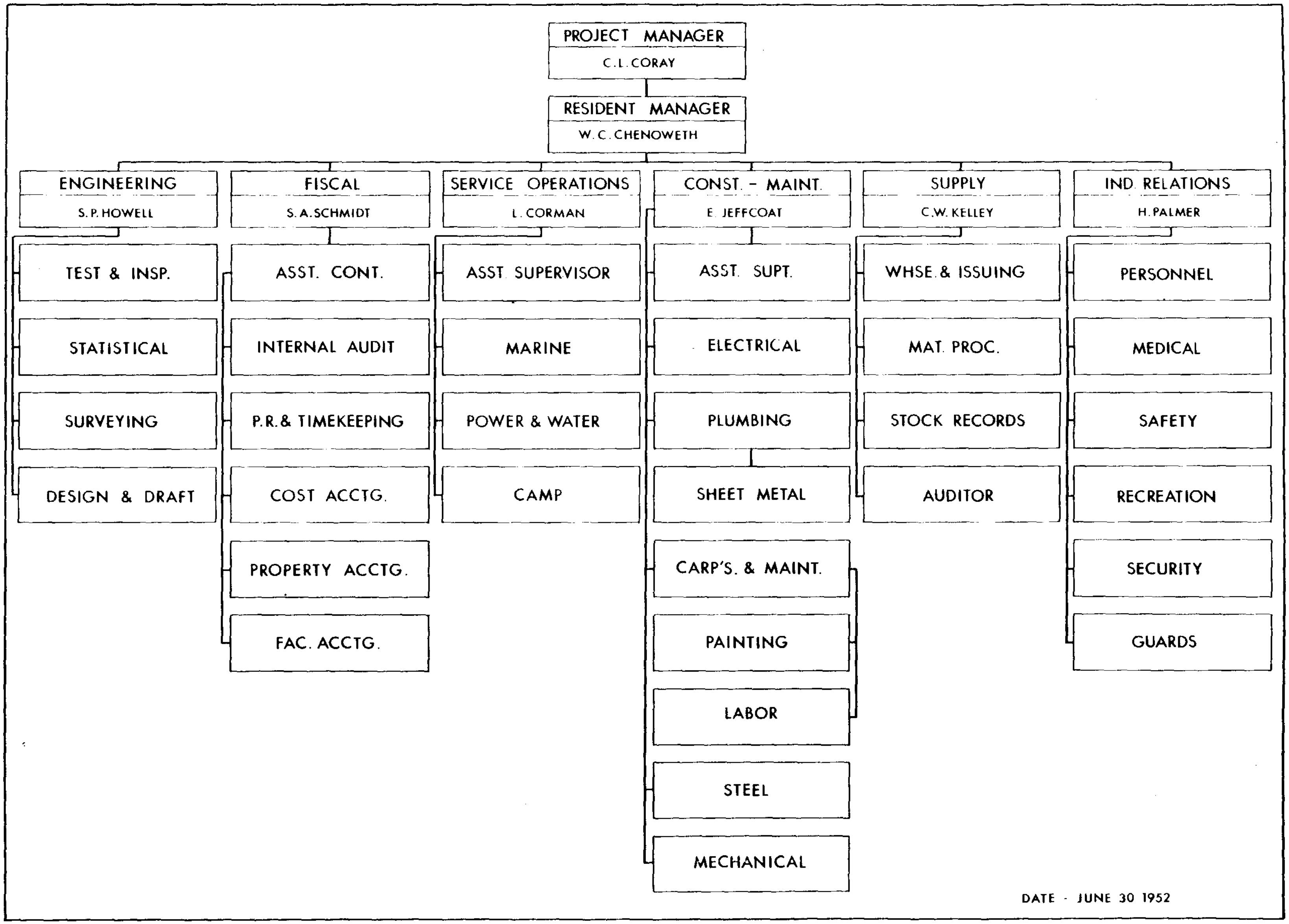


Figure 3-3. Jobsite Organization Chart.

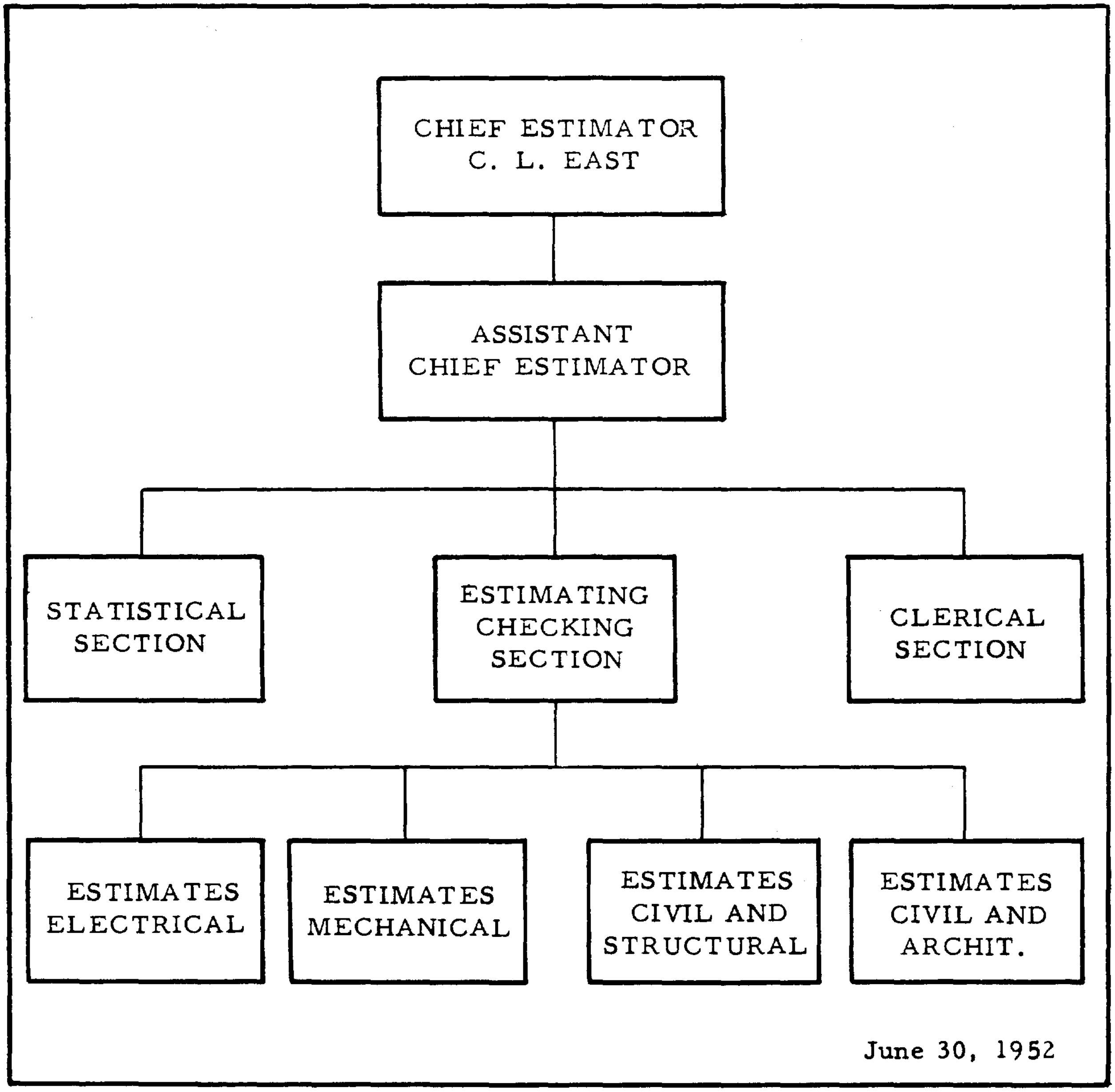


Figure 3-4. Estimating Department Organization Chart

Generally throughout the administration of Contract AT-(29-2)-20, this department was made up of seven cost estimates experienced in take-off, pricing, and the preparation of bills of material as well as two typist-clerks typing estimates and bills of material and maintaining related records. These employees, supervised by the Chief Estimator and an Assistant Chief Estimator, carried out the functions of the Estimating Department throughout this Contract. The Organization Chart for this Department is shown in Figure 3-4.

The general functions of the Estimating Department were as follows:

1. Preparation and assembly of preliminary cost estimates based upon undetermined scope of work, schematics, and letter directives.

2. Assembly and preparation of original cost estimates based upon preliminary drawings requiring an estimate of cost prior to AEC approval of design.

3. Assembly and preparation of current cost estimates prepared from AEC approved design drawings.

4. Assembly and preparation of estimates involving engineering changes from the approved design drawings.

5. To prepare from these estimates man power requirements, construction scheduling, bills of material, budget projections, and other studies that might be necessary for the efficient operation of Contract AT-(29-2)-20 through the various operational divisions of Holmes & Narver.

6. To establish the method of reporting progress upon each of the features of the Contract, which were assigned and scheduled in accordance with the estimates previously submitted.

7. To assemble, with the assistance of Jobsite engineering, the Continuing Property Record Completion Report on all facilities constructed under this Contract and to reflect on these continuing property record reports a full description of each feature of construction, together with the construction, engineering, and total incurred costs. This compilation neccessitated close coordination with Jobsite engineering to correlate the features and nomenclature of the continuing property record with "As-Built" drawings and incurred cost accounts.

METHODS AND PROCEDURES

Preliminary design drawings were prepared within the Engineering Division for the approval of the AEC Field Manager. These drawings, together with original cost estimates covering them, were submitted to the AEC for approval by the Estimating Department. In conjunction with the preparation of original cost estimates, a complete Bill of Material was prepared and transmitted to the Material Control Department for procurement action.

Upon receipt of the AEC approval of the preliminary drawings and related original cost estimate, signed drawings were issued by the Engineering Division, and a final or current cost estimate was prepared by the Estimating Department and submitted to the AEC. At this time revised Bills of Material were prepared to supplement those prepared from preliminary drawings.

The preliminary estimating work carried on during this Contract involved cost studies, comparative cost studies, construction schedules, budget forecasts, and man power forecasts amounting to approximately 115 such studies and involved in dollar value an amount of approximately $ 85,000,000. Subsequent to these preliminary studies there was formally submitted to the AEC approximately 145 original cost estimates, 320 current cost estimates, and 100 Engineering Change Order estimates, the value of this group formally submitted being approximately $ 15,000,000, all of which was supported by detailed bills of material required for the approved construction. An example of the original man power forecast in comparison with actual man power is shown in Figure 3-5.

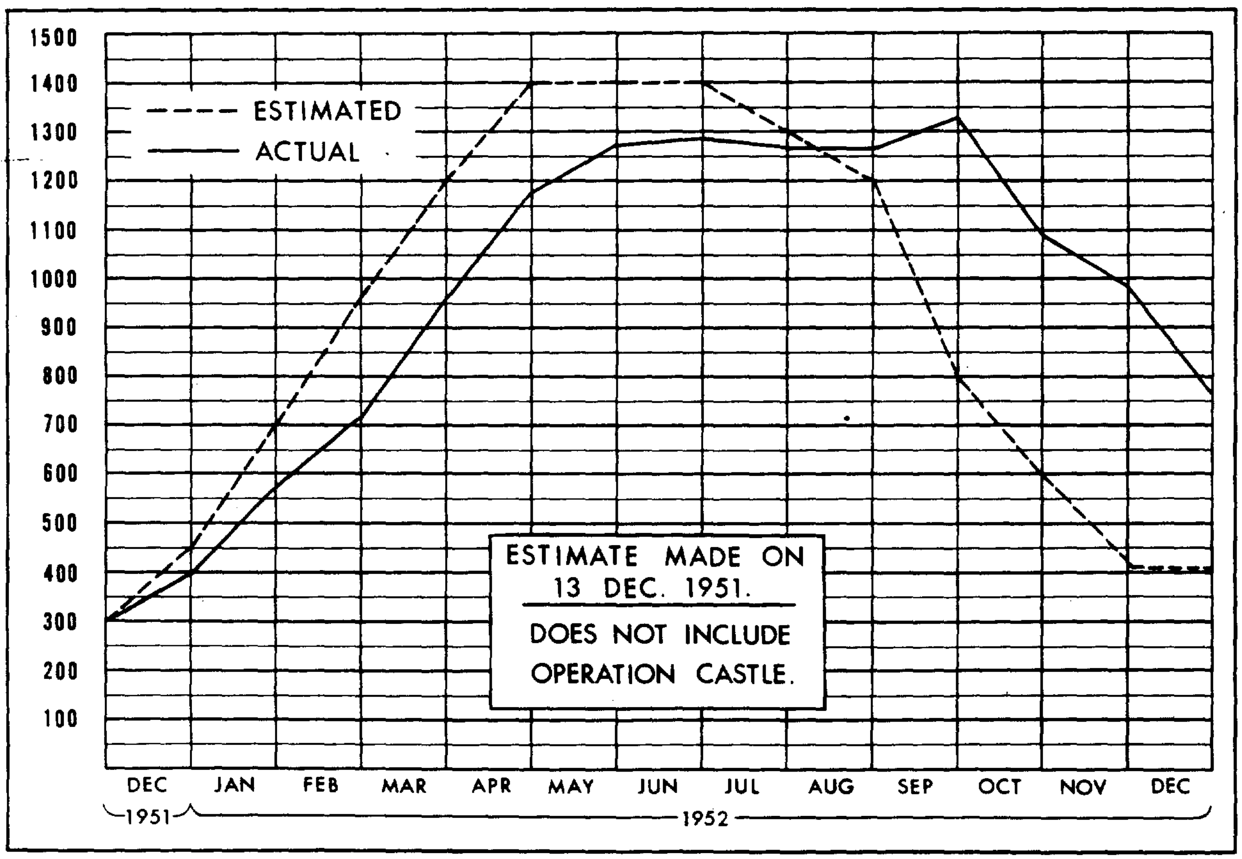


Figure 3-5. Estimated and Actual Jobsite Personnel

All cost estimates for this Contract were prepared on the same general basis and involved the same cost breakdown, shown as: Material; Labor; Equipment; and Transportation. All cost estimates reflected the known current On-Continent construction costs at the time they were prepared, and all discounts and multiple buying advantages were taken into consideration. Then added to these four features were overseas indirect and operational costs to compensate for the project location and the abnormal conditions which effect this type of construction project. These indirect and operational costs were the same, percentage-wise, as those applied on construction estimates submitted for OPERATION GREENHOUSE.

The following four paragraphs show the basic thinking used in the preparation of cost estimates.

MATERIAL COST. Estimated quantities were used in establishing the material required for a particular item of construction when schematic drawings or criteria were the basis for the estimate; actual take-off quantities were used when approved drawings were the basis. Material quantities were increased to cover cutting and waste in accordance with normal On-Continent estimating practices. Due to the location of this project and resultant abnormal shipping problems, estimated material quantities were generally increased by an experience factor of fifteen percent to cover loss by waste, breakage circumstances, long lead-time for delivery, or excessive transportation delays. Unit costs obtained from direct quotations, current catalogue prices, and/or recent actual job costs were then applied to these estimated quantities, establishing the total On-Continent material cost. All prices used were based on material delivered f.o.b. Naval Supply Center, Oakland, California.

LABOR COST. After material quantities had been established for each item of work, the estimated labor man hours necessary to complete the work were computed. To these man hours were added the labor man hours necessary to handle the material at the Jobsite from the central warehouse to the construction location. The labor rates applied to these man hours for all classes of construction labor were the rates effective within the Building and Construction Trades Council, American Federation of Labor, as applied in both the Los Angeles and San Francisco areas.

EQUIPMENT COST. Equipment cost was determined by making a detailed estimate of the equipment necessary to complete the construction of each feature of work, and computing the estimated time this equipment would be in operation. Costs applied to this operating time reflected an equipment rental rate which was established on a cost-per-day basis as set forth by the Associated General Contractors of America, Inc., combined with the equipment rental rates as set forth in Maximum Price Regulation No. 134. These rates included amortization, normal maintenance and repair, fuel, and lubricants. To these equipment costs a factor was added to provide for the variables of climatic conditions which from previous experience are known to exist at this location.

TRANSPORTATION COST. The transportation cost, applied against the estimated tonnage of all items of material and supplies, was computed on the basis of delivery by common carrier on both land and water from the On-Continent f.o.b. point to the Jobsite central warehouse. This represented the gross transportation cost from which a provisional deduction was made to arrive at the net transportation figure. This provisional deduction represented possible Government-furnished water transportation, and was based on an average estimated cost of twenty-seven dollars per ton.

All cost estimates were prepared to show the total net direct and indirect cost as required by the AEC. However, to provide a gross cost as required for contract negotiations, the allowance made for provisional Government-furnished water transportation was added to the net figure to give the total direct and indirect gross cost for each feature of work under the Contract.

SECTION 3. ENGINEERING ORGANIZATION

The Director of Engineering at the Home Office was charged with the responsibility and supervision of all functions of the Engineering Division. He reported directly to the General Manager. Within the Engineering Division, the Chief Engineer was responsible for all design work including the production of drawings, maps, charts, specifications, etc. Specialists in each engineering category headed the various departments within the Division. These included Architectural, Civil, Electrical, Mechanical, Mining, Sanitary, Structural and Surveying; in addition, there were Checking, Specifications, and Statistical Departments, and an Administrative Supervisor who was charged with the administrative and clerical details of the Division. This organization is illustrated in Figure 3-6.

Design and production work was assigned to the appropriate department for accomplishment under the supervision of the Department Head.

Project Engineers, assigned as the responsible supervisors of various engineering projects, were directly responsible to the Director of Engineering for the successful completion of their particular project. As such, their work was performed in close coordination with the design departments concerned. A Project Engineer for Contract AT-(29-2)-20 was designated on 31 October 1951, and was functioning in that capacity by the commencement of OPERATION IVY. In view of the fact that this Contract was predominantly concerned with construction, the Project Engineer reported directly to the Chief of Operations. He provided close liaison between the Engineering and Operations Divisions, keeping each informed at all times as to progress and development of the other; maintained close liaison on all engineering matters with the Eniwetok Field Manager at Albuquerque, and with various participating agencies connected with the Operation. He maintained close supervision over the progress of engineering work on the project by the various Design Departments, and kept in close touch with the engineering and construction work at the site. The designation of a Project Engineer for the Eniwetok Project constituted an important step in the

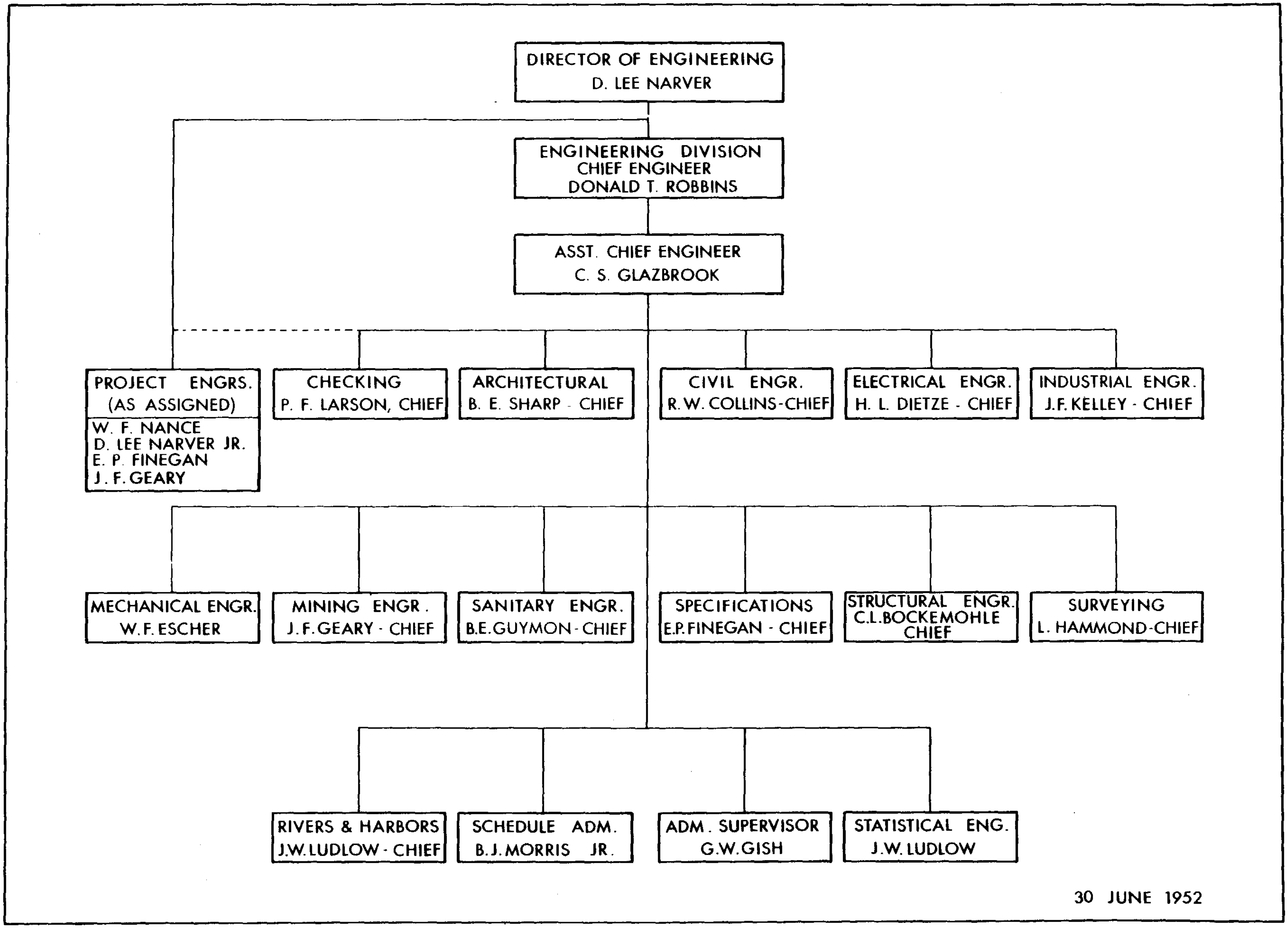


Figure 3-6. Home Office Engineering Organization

development of closer liaison between all interested activities both within and without the Holmes & Narver organization; it also served to release the Chief Engineer from this responsibility, and thus enabled him to devote his attention to design work.

Specialists from the Engineering Division were available for consultation with the Procurement Department on the purchase of special equipment items, and with the Inspection Section on the inspection of equipment requiring specialized knowledge.

Work within the Engineering Division for Contract AT-(29-2)-20 included the following:

1. Preparation of advance material estimates pertinent to prospective design requirements.
2. Preparation of specifications for specific items of equipment which were in some cases necessarily purchased prior to completion of design work for a particular facility.
3. Review of bids for equipment and materials obtained by the Procurement Department, including maintenance materials.
4. Preparation of all drawings and specifications for construction work.
5. Checking and approval of all shop drawings.
6. Preparation of Engineering Reports.

It was necessary to prepare advance material estimates and stockpile material prior to completion of the engineering drawings in order to eliminate the time required for purchase and delivery of material and equipment to Jobsite, and to meet the rigid construction schedule. Thus, when the engineering drawings were released, field forces could begin construction immediately.

All engineering information and criteria obtained by the Project Engineer was transmitted to the Engineering Division by inter-office memoranda, thereby maintaining a record of all information received.

By authorization of the Field Manager for the Eniwetok Proving Ground, J-6 of J-Division of the Los Alamos Scientific Laboratory was formulated to determine all design criteria for the Scientific Program. J-6 was, therefore, the source for nearly all of the information required by the Holmes & Narver Engineering Division. Design criteria covering engineering design work for projects, other than those included in the Scientific Program, were obtained from the Field Manager, or from recommendations submitted by Holmes & Narver and approved by the Field Manager.

On this project, the approval of drawings by the Field Manager of the Eniwetok Proving Ground was generally accomplished by letter or teletype, rather than by his signature on drawings, thus saving considerable time. Each drawing bore a stamp which showed the letter or teletype number and date of approval by the Field Manager. After the drawings were approved by the Field Manager, they were signed by the Chief Engineer and issued for construction.

JOBSITE ENGINEERING ORGANIZATION

The Jobsite Engineering Division consisted of a Resident Engineer and a staff of assistants organized into four departments operating under departmental heads. The Resident Engineer was responsible directly to the Resident Manager; the Department Heads were responsible directly to the Resident Engineer.

The four departments of the Resident Engineer's staff were namely: Test and Inspection, Survey, Design and Drafting, and Reports and Estimating. Included in the staff of the latter department was the Jobsite Historian, whose responsibility it was to furnish the Home Office with the data necessary for the preparation of reports as required by the AEC. This data was presented in the report forms of a Weekly Progress Report and a Jobsite Monthly Narrative Report.

The Engineering Division was responsible for furnishing complete Jobsite architect-engineer supervision and inspection of construction; for making topographic, hydrographic, control and construction surveys; for preparation of record and "As-Built" drawings; for interpretation of plans and specifications; for design and approval of alterations and substitutions; for preparation of designs and drawings for proposed work; for inspection of construction for compliance with plans and specifications; for inspection and testing of construction materials; for submission of reports and estimates; and for maintaining a complete file of all drawings and other engineering data.

Five types of Work Orders were used for controlling the work as shown in the following five paragraphs.

ENGINEERING WORK ORDERS (EWO). These were used for all new construction and were released by the Holmes & Narver Jobsite Resident Engineer as a means of initiating work which had been authorized by one of the following:

1. Authorizations by the Field Manager, Eniwetok Field Office, of approved plans, specifications, or specific work authorizations. These were covered either by the Contract, Modifications to the Contract, or by Letters of Instructions from the Field Manager, Eniwetok.

2. Authorizations by the Project Manager without the use of a separate Work Order, of requirements for temporary facilities as necessary for

the operation or shelter of power apparatus, batch plants, crusher plants, saw mill, and other equipment or materials, and walkways, scaffolds, railing, and similar items needed for executing the work or for safety of personnel.

ENGINEERING CHANGE ORDERS (ECO). These were used to cover construction or reconstruction (betterment) work involving a total cost of $ 100 or more and which was outside the scope of drawings, work authorizations or specifications, and required approval by the Field Manager, Eniwetok Field Office, either on the Change Order, on the drawings, or by a directive. A betterment was considered effected when the unit as a whole was rendered substantially more useful, durable, efficient, or productive than in its previous condition; and when the cost was of sufficient importance to be accounted for as a plant and/or equipment change.

A Change Order covered changes made to structures during the progress of construction or changes made to a structure after it had been completed and accepted. Where the construction involved both Additions and Retirements, they were handled by separate Change Orders so that a clear-out delineation of the work could be made.

The AEC Resident Engineer was responsible for approving field changes necessary to accommodate construction to field conditions and terrain, but any changes in scope desired by the agencies involved required approval of the Field Manager, Eniwetok Field Office, before execution in the field.

It was the responsibility of the Engineering Division to plan Change Orders by preparation of specifications, appropriate Field Sketches, Estimate Work Sheets and Bills of Material. The Bill of Material was made available to the Construction Division for planning purposes. The estimate of cost was computed from the basic data shown on Estimating Work Sheets, i.e., material value, labor man hours, equipment usage hours and transportation costs. The details or work sheets used to obtain the basic data became a part of the record. All buildings and structures were identified by proper numbering in accordance with AEC requirements.

After preliminary engineering work and advance planning had been completed, the Change Order (O/S Form 100) together with a folder containing all pertinent data, was presented to the Holmes & Narver Resident Engineer for submission to the Holmes & Narver Resident Manager for approval. Upon approval by the Resident Manager, the Change Order and drawings were removed from the folder and transmitted to the AEC Resident Engineer for final Jobsite approval. The folder and other pertinent data were returned to the office of the Holmes & Narver Resident Engineer. Upon approval by the AEC Resident Engineer, the Change Order was returned through the Resident Manager to the Holmes & Narver Resident Engineer who made distribution of copies as necessary.

MAINTENANCE WORK ORDERS (M WO). These were used if the value of the maintenance work exceeded a total of $ 1,000 or was of a technical nature. Requests were submitted to the Engineering Division for preparation of the Work Order. The Work Order was then forwarded to the Resident Manager for approval. In general, routine maintenance work did not require approval of the Holmes & Narver Resident Engineer, but was performed on the authority of the General Superintendent, Construction-Maintenance Division. The Maintenance Work Order in some instances covered an individual maintenance job; in others it was blanket authority covering, for example, repairs to the distillation units.

DAMAGE REPAIR WORK ORDERS. These were used to cover work done to repair damage by storm, high winds, rough seas, blast damage, Acts of God, fire, accidents, or any major damage which was unforeseen and which, therefore, could not have been included for budget purposes in any estimate of maintenance. Work of this nature exceeding the total cost of $ 100 required the prior approval of the AEC Resident Engineer except in cases of emergency where immediate action was required to protect personnel or property.

JOB 4 AND 5 WORK ORDERS. These normally originated with the AEC, Scientific Using Agency, or some element of Task Force 132. These orders could cover labor, equipment, materials, or supplies as required to assist the User in the accomplishment of an operations program. These extra services (beyond those normally furnished under Job II in the way of housing, messing, laundry, land, and water transportation and the Engineering and Construction services under Job I) required the prior approval of the AEC Resident Engineer or Field Manager, Eniwetok Field Office, regardless of scope or value of the individual Work Order.

SECTION 4. JOBSITE CONSTRUCTION ORGANIZATION

The Construction-Maintenance Division at the Jobsite was under the overall supervision of the General Superintendent of Construction and consisted of the following Departments: Mechanical and Heavy Equipment; Electrical; Plumbing and Utilities; Carpenter and Maintenance; and Steel. During the construction phases, Area Superintendents were delegated the On-Site responsibilities for all construction work in the areas of Gene and Yvonne, and for all construction and maintenance on Fred.

The General Superintendent of Construction was responsible for all construction activities and the maintenance of all base facilities, except those in connection with Marine, Stationary Power Plants and Water Distillation Plants. The installation, operation and maintenance of portable power units was a function of the Construction-Maintenance Division. All authorizations for construction and/or maintenance projects were routed to the General Superintendent of Construction. These authorizations were issued in the form of Engineering Work Orders, Engineering Change Orders, Maintenance Work Orders, AEC Support Work Orders (Job V), and Interdepartmental Work Orders. The work was scheduled by the Project Manager with the advice of the General Superintendent of Construction to meet the required completion dates. The work was planned by the General Superintendent of Construction who assigned the task to the appropriate Department for accomplishment by furnishing the Departmental Head with the necessary copies of the work authorizations. The General Superintendent of Construction maintained close surveillance over the progress of the work and coordinated the activities of all Departments concerned through direct contact with the Departmental Heads. A consistent level of employment for the critical months of construction was attained as may be noted from the following man power table for this Division for the year:

14 January	-	219	14 July	-	582
14 February	-	325	14 August	-	578
14 March	-	411	14 September	-	599
14 April	-	544	14 October	-	592
14 May	-	587	14 November	-	288
14 June	-	595	14 December	-	113

The General Superintendent of Construction maintained direct operational and supervisory control of each of the Departments within the Division, and of each of the Area Superintendent in Charge of the various test sites. The mechanics of the administration of personnel in the Construction Division was centralized under the General Superintendent of Construction. The functions of each department of this Division were as follows:

MECHANICAL AND HEAVY EQUIPMENT. The Mechanical Section was responsible for the operation of the Machine, Equipment Repair, Tire and Lubrication, Auto-Electric and Welding Shops. The Heavy Equipment Section was responsible for the movement of heavy equipment, excavation, rigging of land equipment, paving and stabilizing, rock crushing, heavy duty hauling, construction and maintenance of piers, pile driving, and operation of the motor pool.

ELECTRICAL. This department was responsible for the construction, installation and maintenance of power distribution lines, land and ship-to-shore communication facilities, interior and exterior lighting systems; and the installation and maintenance of dehumidification units, refrigeration units and office machines.

The maintenance of the electrical and of the Power Generation units, including switchboards and panels was the responsibility of the Electrical Superintendent. In general, the maintenance of all apparatus requiring the use of electricity for all Using Agencies was the responsibility of the Electrical Superintendent.

PLUMBING AND SHEET METAL. This department was responsible for the fabrication, installation and maintenance of steam systems, of water distribution systems, POL tanks and piping and for all plumbing fixtures and sheet metal work.

CARPENTER AND MAINTENANCE. This department was organized in three sections; Labor, Carpenter and Paint Sections. The Labor Section was responsible for camp clean-up, collection and disposal of rubbish and garbage, insect and pest control, minor construction work and for the furnishing of laborers as required by other departments. The Carpenter Section was responsible for the operation of the Carpenter Shop and Saw Mill, for the fabrication of all items of wood work including concrete forms, and for repair of furniture or other wooden equipment. The Paint Section was responsible for all painting of structures and equipment.

STEEL. This department was responsible for the fabrication, erection and placing of reinforcing steel, structural steel and miscellaneous iron work.

Liaison was closely maintained with other Divisions, particularly the Supply, Engineering, and Service Operations Divisions. A Material Expediter in the office of the General Superintendent of Construction analyzed material and equipment requirements, and kept the Supply Division informed of the needs of construction. The work of the construction crews had to be coordinated with survey and inspection crews, who, under the supervision of the Resident Engineer were responsible for staking out work to be done and for insuring that work accomplished was in accordance with design and specifications. As the Service Operations Division was responsible for the generation of power and distillation of fresh water, it was vital that close coordination between that Division and the Construction-Maintenance Division be maintained. This was of particular importance to prevent outages of power and heavy losses of fresh and salt water when leaks developed in the distribution lines. Service Operations kept the Plumbing Department informed of daily usage of water, and any unusual rise in water consumption was investigated and corrected.

SECTION 5. ACCOUNTING

GENERAL

On notification that a Letter of Intent, dated 18 October 1952, covering Contract AT-(29-2)-20, had been received from the Atomic Energy Commission, the Accounting Division examined the problems connected with segregation of costs pertaining to Contract AT-(29-1)-507 and the new Contract. Concurrent operations under the two Contracts presented problems affecting most phases of the Company. In this respect, after conferences with Company Division Heads and AEC Finance Representatives, the General Manager issued bulletins governing allocation of charges during the remainder of calendar year 1951.

A bulletin dated 3 December 1951 clarified AEC requirements in connection with the accounting function of closing out final costs to Contract AT-(29-1)-507 and continuance of operations under Contract AT-(29-2)-20. A further bulletin, dated 20 April 1952, was issued after approval by the AEC Field Manager detailing the closing of the books on the old Contract on 31 December 1951. This bulletin also specified that most of the costs after that date would be chargeable against the new Contract.

Under the terms and conditions of Contract AT-(29-2)-20, special accounting requirements and responsibilities were set forth therein as follows:

> "1. The Contractor shall establish and maintain a separate and distinct set of accounting records and books of account covering work performed under this Contract. Such records and books of account shall be kept at a place mutually agreeable and shall show any and all accounting transactions of whatever nature that are applicable to the Contract. These books, records and supporting data are the property of the Commission. Upon expiration or termination of this Contract, the Contractor will deliver to the Commission at the Commission's expense all of the books, records, correspondence and other data pertaining to the work except as provided in Article XX, paragraph 3, provided, however, that the records may be retained by the Contractor for a period agreed upon in writing, at the Contractor's own expense, subject to inspection at any time by the Commission, its authorized representative, or by the General Accounting Office. At the expiration of such period, the Contractor will deliver all such documents to the Commission at the Commission's expense."
>
> "2. The system of accounting and internal control established and maintained by the Contractor shall conform to generally accepted accounting principles and shall be such as is satisfactory to the Commission. Proposed changes in the accounting system shall be submitted in writing to the Commission and adopted upon receiving the consent of the Commission."
>
> "3. The internal auditing procedures adopted by the Contractor shall conform to generally accepted auditing principles and shall be such as are satisfactory to the Commission."
>
> "4. The Commission shall at all reasonable times be afforded proper facilities for inspection of the work and audit of the records, shall at all reasonable times have access to

the premises, work and materials, to all books, records, correspondence, instructions, plans, drawings, receipts, vouchers, and memoranda of every description pertaining to said work."

"5. The Contractor shall furnish progress reports and schedules, financial and cost reports and other reports to the Commission with respect to activities under this Contract as the Commission may require from time to time, such reports to be in the form prescribed by the Commission."

The Controller, for this Project, reported to the General Manager for direction on all matters pertaining to major fiscal policies, exception to established procedures, or contract fiscal relationship between the AEC and others concerned.

The Jobsite Controller, who reported to the Project Manager as a Staff Officer, administered the coordinated functional responsibility and control over the various accounting operations. However, the Project Manager and the Jobsite Controller acted in conformity with the standard operating procedures and basic accounting policies established and issued through the coordinating office of the On-Continent Controller.

The Accounting Division audited, recorded and processed for disbursement, or entry and reimbursement, all purchases or charges, payrolls, taxes, petty cash, per diem, transportation and other authorized expenses for recording on the permanent Books of Account and Record for the compilation of Statements and reports, etc. as required by the AEC and Holmes & Narver management.

In accordance with standard procedures, the Jobsite Office audited and prepared for transmittal to the On-Continent Accounting Office basic timekeeping and cost distribution data, material issues, token payments, travel advances, cashiering, inventory records, etc. All such accounting data was audited, recorded and processed for disbursement and entry on the permanent Books of Account and Record at the On-Continent Accounting Office. Figure 3-7 shows the organization of this Division.

A decision was arrived at, after a review and study of problems experienced under operation of Contract AT-(29-1)-507, to place as many accounting operations as economically sound on accounting machines. The acquisition of two Multiple-Duty Accounting Machines proved economically sound, as later reflected by a high of only 45 accounting personnel during the peak load under Contract AT-(29-2)-20 as comparable to 59 people under the same conditions for Contract AT-(29-1)-507.

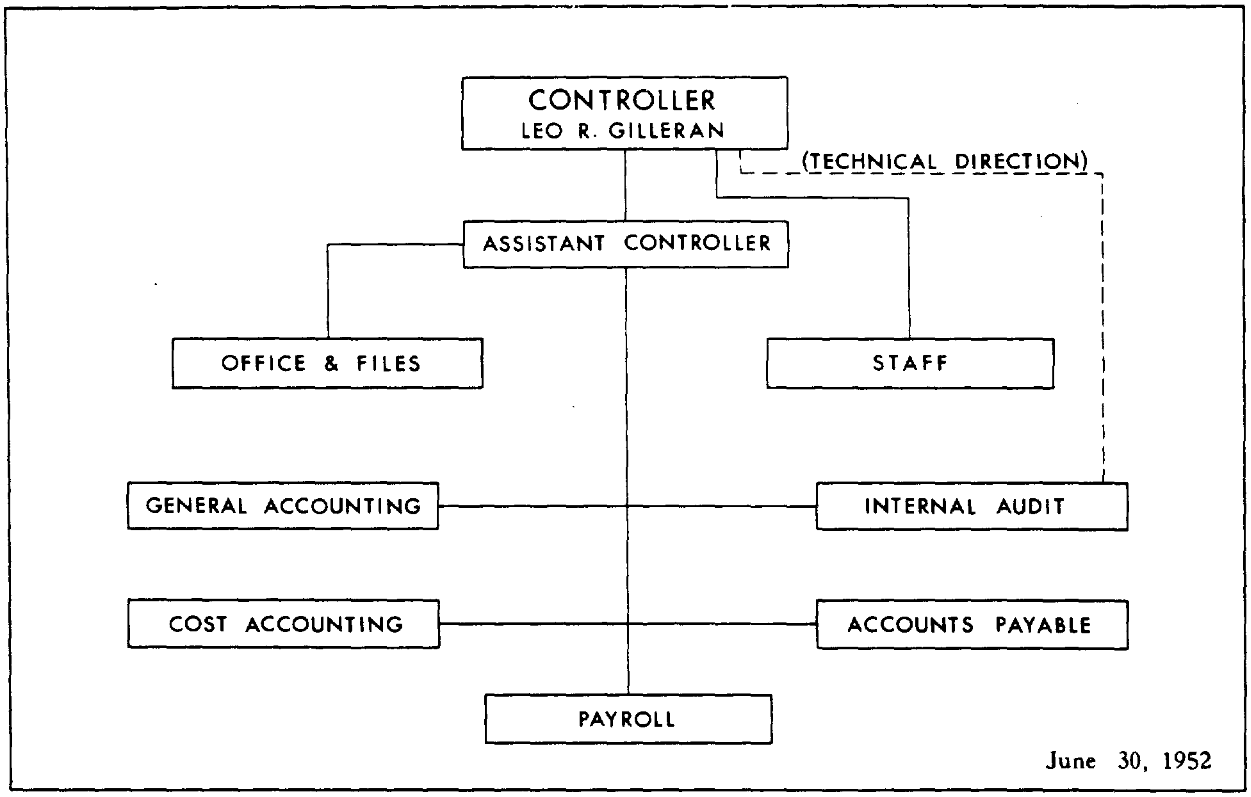


Figure 3-7. On-Continent Accounting Division Organization

On 27 April 1952 the Controller participated in a conference with the Corporate Legal Counsel, Commission Assistant General Counsel, and officials of the California State Board of Equalization in Sacramento, California. The meeting was held to discuss the pending petition for redetermination regarding the California Sales and Use Tax paid under OPERATION GREENHOUSE, and also the problem of determining the propriety of the State's tax assessment against vendors who in turn are compelled to charge such taxes to the Contractor. The solution to the problem is expected early in 1953.

At the direction of AEC in April 1952, Holmes & Narver prepared a detailed budget covering the fiscal years 1953 and 1954.

During the period 27 April through 15 May 1952, the Holmes & Narver Controller accompanied the AEC Chief Test Accountant and Auditor-in-Charge to Honolulu and to the Jobsite for the purpose of resolving various accounting and auditing problems, and generally to coordinate the Jobsite Accounting with Home Office Accounting. Items covered during the trip were the following:

1. Discussions were held in Honolulu with representatives of CINCPAC and JTF-132 as to the position of Pearl Harbor in supplying parts and POL products with special emphasis on paper work and funds to be used. It was agreed that Pearl Harbor would supply Company requests and invoices, applicable charges to be recorded against the Naval Working Funds in custody of Pearl Harbor Shipyards. The Commander of the Naval Shipyard in Pearl Harbor agreed to accept the charges from the Naval Supply Center and apply them against the holding Commission Funds.

   Jobsite excess stock of Marine Parts was discussed, and the Naval Supply Center agreed to issue credit at time of return and receipt.

2. The various Jobsite warehouses were visited for the purpose of inspecting operations and housekeeping.

3. Discussions were held with the AEC Supply Division Representative in regard to certain deficiencies within supply. These discussions resulted in plans and procedures for corrective action.

4. Procedures covering Over, Short and Damage Reports, and Reports of Survey were reviewed and revised to conform to AEC Supply and Finance Division desires.

5. Conferences were held with Military Officials at Eniwetok Atoll in regard to paper work which concerned Work Orders issued by ATCOM and in regard to JTF-132 Cost Report. Also covered was the Contractor's responsibility for maintenance on Navy Crash Boats, unloading cargo, etc. Temporary solutions to these problems were concluded. A new over-all agreement between AEC and the Department of Defense concerning these conditions was to be reached later.

6. Discussion of the Work Order Procedure resulted in revising and rewriting them for the approval of the AEC Eniwetok Field Manager.

7. Problems encountered by converting the Contractor's accounting methods to the current Commission bases with respect to Plant and Equipment and Construction Cost were discussed.

8. Other problems and procedures examined and discussed were:

   a. Timekeeping Procedure

   b. Physical Inventory

   c. Heavy Equipment Usage Cost related to Work Order problems

d. Property Cards

e. Kardex Allocation Card Records

f. Proper tagging of installed equipment

g. Issuance of Contractor monthly requisitions for POL products

h. Use of cost records by Jobsite Division Heads and cooperation for improvement thereof.

i. Los Alamos and Commission Property not covered by Contractor Property Records.

9. Discussion of the definitions of Job III and Job IV, relative to the incurred Contractor Costs on jobs performed for ATCOM at Site Fred, prompted a request to the Field Manager for approval to rewrite the definitions for clarity.

10. The problem of proper cost coding for compiling JTF-132 Cost Reports was discussed at Jobsite level for further coordination at the On-Continent level.

The Controller attended a two-day Property Management meeting held by the Commission in Albuquerque, New Mexico, 17 and 18 July. The purpose was a general discussion of the property record and disposal requirements for AEC and the beginning of a category known as "Long Supply". Other items emphasized were Inventory Levels, Cataloguing, and Reduction of Inventory by interchangeability and substitution. These points were subsequently followed through to On-Continent and Jobsite management by the Controller, and necessary procedures developed.

Many changes in Cost and Budget Reporting and in some Financial Statements were put into effect beginning with fiscal year 1953 on instructions from AEC. During September 1952, a further revision of Operations Expenses in a manner that would have been very costly to ascertain was proposed by AEC but subsequently modified. Beginning with the September statements, the Work in Progress Cost Reports were expanded to include Supporting Schedules to provide more information for both AEC and Holmes & Narver management.

In December 1952, a midyear review of the 1953 Fiscal Budget was prepared and, to meet the requirements of detailed information for this and expected future requests, a Budget Section was set up in the Accounting Division.

Problems or requirements in the form of statements, reports, analysis, procedures, methods, adjustments or recommendations, etc., were at all times consistently resolved and administered on a high plane of coordination and constructive cooperation between the Commission and the Contractor representatives.

Revisions and additional reports as required by the Commission and in accordance with various directives in the form of Controller's Releases, G.M. Bulletins, SF Bulletins, etc., the Accounting Statements and Reports were submitted and the records maintained in compliance with instructions.

METHODS AND PROCEDURES

In compliance with the terms and conditions of Contract AT-(29-2)-20, and through consultation and directives from the Commission's Director of Finance and the Local Auditor-in-Charge, accounting methods and procedures in effect under OPERATION GREENHOUSE were revised and rewritten to effect desired functioning under OPERATION IVY.

PAYROLL

All employee payrolls were prepared and paid by the On-Continent Accounting Division on a weekly basis in accordance with classifications and rates as contained in the Definitive Contract. Overseas employees worked under Employee Agreement terms which guaranteed a 48-hour work week, except for failure to work by reason of illness or accident, and provided for a Contract Completion Bonus.

Payroll functions were divided into two separate operations; On-Continent and Overseas. The On-Continent payroll, supported by employees' Time Cards, was prepared immediately following the close of the pay period. For the Overseas payroll, the pay checks were issued within five days after the close of the weekly pay period. To accomplish this, the guaranteed wage for the regularly scheduled work week was paid currently. The time lag between the close of the pay period at Jobsite and receipt of the Time Cards in the Los Angeles Office covered approximately ten days. Upon receipt at the On-Continent Office, the Time Cards were tallied with previously paid wages, and the necessary adjustments were made for irregular or overtime hours worked. These adjustments were effected on pay checks covering the current weekly wages.

In addition to the normal payroll deductions and records, special deductions were made for Return Travel Fund, Subsistence and Quarters, Token Payments, etc. Other than cash token payments made to the employees at Jobsite, the net payroll earnings bearing the name of the employee were forwarded by check to the designated allottee. Pay check vouchers, reflecting regular and overtime hours credited, specific deductions and amounts, and the net amount of allottee checks, were transmitted to Jobsite for distribution to the respective employee.

The payroll function as of October 1952 served a peak of 335 employees On-Continent and 1,352 overseas. The total number of pay checks processed for the period 6 January 1952 through 30 November 1952 were 69,247 amounting to $ 9,533,095.00.

PAYROLL WITHHOLDING AND SOCIAL SECURITY TAXES

In accordance with Treasury Department determinations, Withholding Taxes were deducted from Jobsite employee earnings. Eniwetok Atoll, which is a part of the Marshall Islands, is included in what is known as the Territory of the Pacific Islands, administered by the United States under a trusteeship agreement effective 18 July 1947 between the United States and the Security Council of the United Nations, and in some instances Jobsite employees could claim refunds. Such refunds were not sponsored by the Contractor but were initiated independently by the employees who believed they could qualify under various Internal Revenue Code Sections.

The Amended Revenue Act, effective 1 January 1951, set forth certain requirements on Withholding Taxes for employment outside the United States and Territorial Possessions. Publishing this amendment resulted in numerous requests from Jobsite Contractor employees for clarification regarding continued deduction of Withholding Tax on earned wages.

A memorandum sent 4 April 1952 from the Controller to the Project Manager reflected partial revision of the Holmes & Narver policy relative to discontinuing Withholding Tax deductions from Jobsite payroll checks due to rulings by the office of the Commissioner of Internal Revenue.

The Company received an official communication 19 December 1952 from the head of the Technical Ruling Division, Washington, D. C., stating employer-employee responsibilities and liabilities relative to the applicability of Income Tax Withholding under Section 1622 of the Internal Revenue Code to remuneration paid Contractor employees for services performed on Eniwetok and other Marshall Island locations. Receipt of these rulings enabled the Controller to issue final instructions on withholding taxes. These rulings stated in part that before the end of 1953 the employee must have been physically present in a foreign country for a minimum of 510 days in eighteen consecutive months. Commencing with pay period ending 4 January 1953, for those employees requesting and able to submit Statement of Claim, Benefit of Section 116 (1) (2), such deductions were discontinued.

WORK AUTHORIZATIONS

Formal Work Authorization letters were issued by the Commission's Contracting Officer, by which the Contractor was directed to proceed with all Engineering, Design, Inspection and Construction. These Work Authorizations set forth the specific scope of the work performed, and made reference to Job No. 1, Appendix "A" of the Definitive Contract, and subsequent modifications in addition to official directives covering additional work or facilities required by the Commission.

Further Work Authorizations were issued by the Contracting Officer to proceed with Appendix "A", Job No. 2, Camp Operation and Management, and Job No. 3, Maintenance, on the scale which was necessary to support construction activities at all times and properly preserve and maintain all facilities and structures. Due to the complete isolation and remoteness of the Project location, it was necessary to provide basic living quarters, facilities and services to efficiently house and sustain an organization or workers, military and scientific personnel, and the Commission's Staff and Representatives. Such facilities and services required proper accounting and auditing systems. The facilities and services consisted of Mess Halls, Billets, Commissaries, P.X. Stores, Barber Shops, Bars, Clubs, Chapels, Movies, Libraries, Post Offices, Dispensaries and Recreational Activities.

Work or Change Orders, in addition to the aforementioned basic Work Authorization Letters originated by the Commission's Contracting Officers, were issued by the Contractor's Resident Engineer.

ENGINEERING WORK ORDERS (EWO)

These were used for all new construction which had been authorized either by approved plans, specifications, or specific Eniwetok Field Manager authorization. These were covered either by the Contract, modifications to the Contract, or by Field Manager instruction letters. Items needed for executing the work or for safety of personnel were also authorized by the Project Manager without the use of a separate Work Order.

ENGINEERING CHANGE ORDERS (ECO)

These were issued to cover construction or reconstruction jobs involving a total cost of $100 or more, which were outside the scope of drawings, work authorizations or specifications. These were approved by the Field Manager, Eniwetok Field Office, either on the Change Order and the drawings, or by an independent directive.

MAINTENANCE WORK ORDERS (MWO)

These were used if the value of maintenance work exceeded $1,000 or was of a technical nature. Requests were submitted to the Engineering Division for preparation of the Work Order and to the Contractor's Resident Manager before they were issued by the AEC Resident Engineer.

DAMAGE REPAIR WORK ORDERS

These were used to cover work accomplished to repair major damage which could not have been foreseen and which, therefore, had not been included for budget purposes in any estimate of maintenance. Request was submitted to the Engineering Division for preparation and to the Resident Manager for approval. Work of this nature, exceeding the total cost of $100, required prior approval of the Commission's Resident Engineer, except in emergency cases where immediate action was taken to protect personnel or property.

JOB 4 AND 5 WORK ORDERS

These normally originated with representatives of the Commission, Scientific Using Agency, or some element of Task Force 132, and covered labor, equipment, materials or supplies as required to assist the User in his operations program accomplishment. These extra services required prior approval of the Commission Resident Engineer or Field Manager, regardless of scope or value of the Work Order. In all cases, these basic documents of Work Order Authority were utilized by the Jobsite Accounting Division or others concerned, for the proper accounting, audit and control of costs, preparatory for final entry in the On-Continent Books of Account and Records, and the appropriate Financial Statements rendered monthly to the Commission and the Contractor's Management.

ACCOUNTS PAYABLE, VENDORS

The Accounts Payable Section continued the procedures which had been in effect during OPERATION GREENHOUSE, with minor modifications from time to time as required by changing conditions.

Accounting machines were adopted in May 1952 to the functions of the Accounts Payable Section. This action, combined with further simplification of procedure and operation, proved very effective.

Problems arising were not abnormal to those usually encountered in processing vendor payments for materials and services under CPFF Contracts. With the exception of a small number of invoices requiring adjustment, or justification, on the part of the vendors, all payments were made promptly and no cash discounts were lost. Minor difficulties, arising from delayed receiving documents, were soon resolved through Supply Division cooperation.

From 18 October 1951 through November 1952, this Section processed and paid vendor invoices totaling approximately $6,162,808 (after deduction of discounts in excess of $31,730) by issuance of 9,900 checks.

PROPERTY AND MATERIALS ACCOUNTABILITY

Functions of Property and Materials were carefully synchronized with receiving and warehousing operations and accountability procedures were developed in conjunction with representatives of the Jobsite and On-Continent warehousing organizations. Jobsite Receiving and Warehouse procedures were drafted concurrently with the Jobsite Property and Material Accounting procedures in order that adequate accounting controls be maintained at all times.

In order to process vendor's invoices for payment, it was necessary that the On-Continent Accounting Division be furnished Receiving Reports from Pacific Ports Industries at Oakland in a timely manner. On receipt of materials at this point of transshipment overseas, receiving reports were immediately prepared and transmitted to the Los Angeles Office for processing.

Accounting control was maintained through the "Inventory in Transit" Account for items in transit overseas. Upon receipt at Jobsite, the procedure provided that the items be cleared from the "Inventory in Transit" Account by appropriate charge to either the applicable warehouse inventory account, or the Work Order number applicable to the feature of work.

During the Spring of 1952, a representative of the SFOO Supply Division performed an audit of Jobsite receiving, handling and accounting methods of supply. The subsequent report reflected certain deficiencies in the supply handling and warehousing of equipment and material. Following receipt of this report, a representative of the Home Office Accounting Division visited the Jobsite for the purpose of reviewing and studying the problems which had been encountered. As a result of this study, a formal proposal was transmitted to the Eniwetok Field Manager, SFOO Albuquerque, recommending corrective measures which included the adoption of revised stock record cards, the acquisition of improved equipment, and the adoption of certain revisions in procedure.

INSURANCE

On receipt of the Letter of Intent covering Contract AT-(29-2)-20, Contractor's Broker of Record was notified, resulting in endorsement of the insurance policies in effect covering operations under Contract AT-(29-1)-507, to include operations under the new Contract. During the period the two contracts operated concurrently, wages reported for purpose of computing earned premiums were segregated, allowing for recording of incurred costs to applicable contracts.

In effect on 1 January 1952, with the Commission's approval for reimbursement of costs thereof, a Blanket Position Bond, for a three year period, was secured from the Glen Falls Indemnity Company covering all employees of Holmes & Narver, Inc., in the amount of $25,000 each. Inasmuch as this bond covered other than Contract AT-(29-2)-20 employees, the Contractor reimbursed the Contract Funds for that portion expended to cover other than Contract employees. From the inception of Contract AT-(29-1)-507 through 31 December 1951, Fidelity Bond Coverage was procured by the Contractor and paid for from Corporate Funds as a non-reimburseable item.

Insurance and bond coverage, as required by the Definitive Contract, was continued throughout the life of the project, and as of 30 November 1952, the claim ratio was extremely low for a project of this nature, On-Continent or elsewhere.

OVERHEAD METHOD OF PAYMENT

In accordance with the terms of the Contract, Article III, Sections 3(u) and 3(v), provision was made for a semi-annual determination and payment of the Contractor's Allowable Overhead. Such allowance is based on the ratio which the total basic wages, as defined under the Contract, bears to the total basic wages in all the Contractor's Operational activities.

The Contractor's Adjusted Allowable Overhead is limited to the category "General Expense" and does not include General or Special Promotional Expense. In addition, certain categories in the General Expense were also excluded from Allowable Overhead.

AUDIT AND CONTROL

The Internal Audit Sections, On-Continent and Jobsite, operated under the direct supervision of the Assistant Controller, but reported to the Controller on all technical matters. The functions of this Section normally consisted of internal audits and checks to assure adequate control over the volume of financial and business transactions under the Contract following a detailed Audit Program.

In addition to the normal internal duties of this Section, necessary audits of vendors performing time and material services for materials on pre-shipment to Jobsite were conducted. Records of subcontractors performing technical services on a cost-plus basis were also audited. This Section also had the responsibility of determining that all expenditures under the Contract conformed to the reimbursement and documentary audit requirements of the Commission and General Accounting Office.

GENERAL ACCOUNTING

The General Accounting Section was responsible for the maintenance of complete accounting records, including all books of original entry except the cost ledger, and monthly preparation of financial statements, except cost reports, as required by Contractor's Management and the AEC in accord with the Definitive Contract terms.

Regularly scheduled statements and reports were supplied to the Eniwetok Field Manager, SFOO Albuquerque, as follows:

1. Status of Obligated Funds

2. Financial Statements and Supporting Schedules

   A Balance Sheet

   A-8 Payments and Deferred Charges

   A-10 Deferred Credits

   A-13 Collateral Funds and Other Deposits and Related Income

   A-14 Employee and Other Funds on Deposit

   B-2 Miscellaneous Other Expenses

   C Analysis of AEC Equity

   C-1 Prior Year Adjustments

   D Statement of Source and Application of Funds
   Commitment Report
   Cash Requirements

   A-1 Analysis of Store Inventory

   A-2 Summary of Stores Transactions

   A-3 Inventories of Reactor and Other Special Materials

   A-4 Spare Equipment in Storage by Location

   A-5 Excess Plant and Equipment by Location

   A-6 Summary of Plant and Equipment Changes in Progress

   A-7 Changes in Reserve for Losses on Stores Inventory

   A-9 Analysis of Changes in Completed Plant and Related Reserves

A-11 Completed Plant and Related Reserves by Type

A-12 Completed Plant and Related reserves by Location
Report of Motor Vehicle Additions and Disposals
Report of Motor Vehicle Operations
AEC-302 AEC Owned Construction Equipment Inventory
Machine Tool Inventory
Report of Excess and Surplus Property Activity

COST ACCOUNTING

The Cost Accounting Section was responsible for the cost distribution of all expenditures incurred in connection with Contract AT-(29-2)-20.

Cost Accounting Procedures and Policies established for cost distribution of expenditures are listed below:

1. Establish and provide cost accounting and reporting procedures for AEC contracts to provide AEC Cost Reports, JTF Cost Reports and Management Cost Reports.

2. Establish and maintain, insofar as practicable, uniform cost accounting procedures following a complete Chart of Accounts.

3. Maintain and control such detailed subsidiary ledgers as required to permit complete analysis of each contract item and/or feature covered in the Scope of Work of applicable contract.

4. Furnish sufficient and accurate data on completion of all contract items and/or features for Completion Report purposes, Completed Plant Assets and Expendable Construction.

On 17 March 1952, Revision No. 2 to the Chart of Accounts was initiated and formalized; this revision superseded Controller's Bulletin Nos. 5 and 7, and revised Controller's Bulletin No. 25, and Revision No. 1 thereof.

The revision to Controller's Bulletin No. 25 incorporated a Chart of General Ledger Control Accounts and detail subsidiary accounts applicable thereto.

Included in the Work in Process subsidiary accounts for Job I - Engineering and Construction Services, was the Scientific Structures Program (Contract Item No. 28). The Scientific Structures Program included a detail account for each Scientific Station or joint User together with the appropriate JTF Cost Code by Program Number and Project Number.

Included in the Work in Process subsidiary accounts for Job IV - Support Services, were the series of detail accounts for support services rendered to the various Governmental Agencies. Within the service, support was rendered to ten different programs, 50 projects and 11 task groups. As of 1 December 1952 there were 544 AEC Work Orders approved by the AEC Field Manager or AEC Resident Engineer authorizing the above service to be accomplished by Contractor Personnel.

The Cost Accounting Section was responsible for the preparation of certain Cost Reports and Supporting Schedules applicable thereto, as required by AEC and provided for in certain AEC Directives and Bulletins, or required by Company Management.

The Joint Task Force Cost Reports were for the Cumulative Cost Distribution and the Monthly Cost Distribution. These reports not only required a great amount of detail cost accounting (in order to segregate all costs incurred and classified by the AEC Chart of Accounts as either AEC or Department of Defense scope of work) but in many instances required a distribution of costs between the AEC and the Department of Defense. This distribution was determined on the basis of proportionate participation, in accordance with schedules promulgated by the AEC. This same procedure was followed in connection with the Support Services rendered to certain Users normally classified as AEC and DOD participating in the over-all program costs.

BUDGETS

A policy decision by AEC relative to the budgeting of expenditures, prompted the establishment of a Budgetary Control Section in the Holmes & Narver Accounting Division during the latter part of 1952. Experience factors accumulated during OPERATION GREENHOUSE and OPERATION IVY having now permitted a closer approximation of funds required for specific types of construction, it has become possible to set up budgeted schedules for OPERATION CASTLE, and records of costs in relation to budgets are being maintained.

JOBSITE ACCOUNTING

The activities of the Jobsite Accounting Division were under the direction of the Resident Controller. The fifteen men in the division were organized into five sections; Payroll and Timekeeping, Material and Property, Cost Accounting, Facilities, and Internal Audit.

On 1 January 1952 the cash on hand and in the bank was transferred from Contract AT-(29-1)-507 to Contract AT-(29-2)-20. Inventories, completed plants and equipment, and prepaid expenses were also transferred at this time. As income and expense arose subsequent to 1 January 1952, it was considered to be applicable to OPERATION IVY.

During the first four months of the year, the acceleration of activities necessitated increases in Accounting personnel and on 30 April 1952 a peak of 36 employees was reached. Personnel strength was maintained at approximately this figure until after the tests.

DIVISION OF RESPONSIBILITY

The Accounting Division at the Jobsite was responsible for the accumulation of time and material costs, distribution of these costs to accounts, and for the accounting in connection with the income from facilities. It was also responsible for the internal audit work required by the Contract. There were no modifications to the contractual requirements pertaining to accounting and auditing procedures which stated in part:

> "The system of accounting and internal control established and maintained by the Contractor shall conform to generally accepted accounting principles, and shall be such as is satisfactory to the Commission. Proposed changes in the accounting system shall be submitted in writing to the Commission and adopted upon receiving the consent of the Commission."

> "The internal auditing procedures adopted by the Contractor shall conform to generally accepted auditing principles and shall be such as are satisfactory to the Commission."

All Section Heads within the Division were responsible for the proper operation of their Sections and were accountable to the Jobsite Controller. Functions of the five sections were as follows:

1. PAYROLL AND TIMEKEEPING. Maintained brass-check system of Timekeeping, kept records and reported to the Home Office on all matters pertaining to time worked, wages (or salaries) earned, and accounts to be charged. Disbursed weekly Token Payroll.

2. MATERIAL AND PROPERTY. Kept records and reported to the Home Office on all matters pertaining to the receipt of materials and equipment.

3. COST ACCOUNTING. Kept records and reported to the Home Office on all matters pertaining to the accumulation of job costs. Prepared special cost reports as necessary.

4. FACILITIES. Kept records and reported to the Home Office on all matters pertaining to Jobsite income producing activities and those transactions which involved Jobsite cash receipts and expenditures.

5. INTERNAL AUDIT. Made sufficient tests of Jobsite activities to report monthly to Management regarding the adequacy of all Jobsite controls having any material effect on financial statements; these included controls governing accounting, reporting, prices, salaries and wages, and commitments.

PAYROLL AND TIMEKEEPING

The Payroll Section consisted of one Poster for approximately every four hundred employees at Jobsite. The Posters had the responsibility of transcribing time by the following operations:

1. Checked time reported on the daily time sheets for overtime hours, reported over the normal work-day period, for overtime authorization. Time not covered by overtime authorizations or which was improperly reported was listed on a discrepancy sheet and submitted to the Assistant Chief Timekeeper for further action.

2. Transcribed the time from daily time sheets to individual Time Cards by recording hours reported by job, straight time, overtime and total hours worked by employees.

3. Divided payroll cards into groups for posting purposes by department or crew arrangement. After all cards were posted in the individual groups, Posters totaled the cards by department and balanced this summation of hours against total hours shown on pertinent time sheets. This method insured the elimination of any posting errors which may have occurred. After a balance had been reached, the total hours posted for the day were entered on a Group Control Card. Upon completion on Tuesday of each week of the previous week's posting (Monday through Sunday), the hours were totaled on each Time Card for the week. The totals of the cards were then balanced by groups with the total resume of the daily balance reflected on the Group Control Cards.

4. All hours reported by day, less than the scheduled 9-hour working day, were accompanied by an appropriate symbol on the Time Card.

5. Upon completion of alphabetizing and card count, Time Cards were submitted to the Chief Timekeeper for routing. Originals were forwarded to the Home Office. Duplicates were turned over to the Jobsite Cost Department for recapitulation and filing in the Accounting Division vault to be retained as a Jobsite record.

TRANSFERS AND FILES. This group maintained control of records pertaining to an employees' location and his classification, maintained a aster ontrol

Sheet with daily entries showing personnel movement authorizations or departmental transfers and termination papers, transferred any changes or alterations from the Time Sheets to the Master Control Sheets, and transcribed changes or alterations to the following day's Time Sheets, including any notation of terminations received from the Record Clerk.

RECORDS. This group maintained records of Jobsite personnel by site; Token Payroll record; arrival and departure book; and records pertinent to employees' classification status. In addition, with each termination other than a completed contract, a Statement of Subsistence and Transportation Form was initiated which reflected the charges incurred by the terminating employees during the period between termination and departure from Jobsite.

ADDRESSOGRAPH CLERK. This person was charged with the responsibility of originating all Time Sheets, Time Cards, Token Payroll, Field Check Sheets, and plates (masters) prepared on the Graphotype machine for use on the Addressograph machine.

TIMEKEEPING. The Timekeeping Section utilized the "brass" system of "check in and out". This system was handled by two to six employees (depending on the number of personnel). These men performed the following:

1. Checked brass in and out
2. Distributed current day's Time Sheets
3. Picked up previous day's Time Sheets and checked them for proper distribution of hours
4. Checked Time Sheets for clear and complete description of work performed
5. Cost coded labor distribution
6. Made daily field check of employees by assigned groups, and recorded same on Field Check sheets
7. Cost coded heavy equipment usage
8. Insured through personal contact with foremen, clerks and supervisors that established timekeeping and payroll policies were understood and adhered to
9. Made additional field checks at temporary camp sites at least once a week or whenever so designated by immediate supervisors

Direct supervision and coordination of the Payroll and Timekeeping Section at Site Elmer was performed by the assistant to the Chief Timekeeper as well indirect supervision of outlying time offices, insofar as their conformance to policy and procedure affected the Payroll Section. He also performed the following duties:

1. Maintained current record of accumulated sick time of all employees.

2. Prepared payroll notification to Home Office pertaining to departures of personnel, showing the hours which had been worked and token payment disbursed within the applicable payroll period.

TOKEN PAYROLL. Disbursement of weekly token payment was the same throughout the Jobsite. It was directly operated and supervised by the Chief Timekeeper. By Friday of each week he received the prepared payroll from the Addressograph Section, which was divided according to sites of payment. Cash was drawn, for which he became accountable to the Accounting Cashier, equal to the total payroll amount, plus approximately 15%. On Saturday morning of each week, a courier mail pouch service delivered the pertinent section of the payroll (check stubs and per diem checks) and funds equaling the payroll section total, plus approximately 15%. The Chief Timekeeper then obtained sub-accountability from each of the area paymasters upon delivery of said funds. The additional 15% funds drawn allowed sufficient funds for payment of personnel who transferred to the site during or after preparation of the initial payroll.

The area paymasters obtained sub-accountability for funds from payees as required. The Chief Timekeeper obtained sub-accountability directly from all payees at Site Fred and Site Elmer.

Each Monday morning the area paymasters sent their section of the payroll, listing of all unpaid and added employees pertinent to their individual sites, and unused funds to the Chief Timekeeper.

CHIEF TIMEKEEPER. The Chief Timekeeper was directly responsible for performance of the following:

1. The direct supervision and coordination of all timekeeping functions.

2. Execution of the established payroll procedure.

DAILY TIME SHEETS. The Timekeeping Section forwarded the Daily Time Sheets to the Cost Accounting Section for audit of the cost code applied. It checked the name, employee's classification, hourly rate, and hours worked.

A preliminary audit of cost codes was made by the Timekeeping Section, and obvious errors were corrected prior to submission to the Cost Accounting Section.

WEEKLY TIME CARDS. Employees' weekly Time Cards were prepared from the Daily Time Sheets by the Timekeeping Section. As soon as possible after Sunday work was posted to the Time Cards, they were forwarded to the Cost Accounting Section for money distribution to the various cost accounts. Upon receipt in Cost Accounting Section, the following steps took place:

1. From the hourly rates shown on the Time Card, the total regular and overtime earnings were computed and noted on the Time Card.

2. Pro-rating of the weekly earnings to the various cost codes reflected on the Time Cards.

3. To expedite distribution, separation of the Time Cards into those containing more than one account number.

4. From the Time Cards, transcribing the account number, hours worked and cost to a separate sheet. (Each cost account affected had an individual distribution sheet.)

5. When all cost accounts were distributed, the distribution sheets were totaled as to hours and money distributed thereon. An adding machine tape was then run on the distribution sheets and balanced against the total manhours and costs on the weekly Time Cards.

MATERIAL AND PROPERTY

Procedures for the Material and Property Section (MPA), were divided primarily, as follows:

Processing of Purchase Orders, Receiving Reports and paid invoices.

Processing of Stores Issue Slips from the Jobsite Warehouse Department.

Maintaining Equipment Records at the Jobsite.

PURCHASE ORDERS. Adequate copies of Purchase Orders were forwarded to the Jobsite from the Home Office. Upon receipt in the Accounting Division, MPA performed the following:

1. All Purchase Orders were entered in the Purchase Order Register to verify receipt at the Jobsite.

2. A file folder was prepared which listed on the tab the Purchase Order number, and this was placed in the active Purchase Order file, in order to account for the receipt of material, equipment and supplies. If the Purchase Order applied to one of the retail facilities, the MPA copy was forwarded to the Facilities Accounting Section which maintained a Purchase Order file for each retail facility.

3. Upon receipt of all data relating to the Purchase Order, such as invoices, receiving reports, or O.S. & D. Reports, the Purchase Order was considered complete and filed.

RECEIVING REPORTS. Receiving Reports were forwarded from the Material Stock Records Section (MSRS), and materials were checked into the various Warehouse Departments from the packing lists. These packing lists were also the source of information for posting to Kardex Records wherever such records were maintained. The warehouse then forwarded the packing lists with a Receiving Report transmittal to the Supply Division, where a Receiving Report was prepared for each shipment. After preparation, the Receiving Report was forwarded to MPA by MSRS on a letter of transmittal which listed each Receiving Report by Purchase Order and amount. The total amount of the Receiving Reports was also shown on the transmittal. Upon receipt in the Accounting Division, MPA took the following action:

1. The Receiving Reports were listed in a Receiving Report Register showing in numerical order the Receiving Report number with applicable Purchase Order number and date received.

2. After verification of the amount shown on each Receiving Report with the same amount as listed on the Receiving Report transmittal, the Receiving Reports were stamped with the date of transmittal from MSRS. The original (white) copy of the Receiving Report was forwarded by MPA to the Traffic Section of the Home Office Purchasing Department, with a letter of transmittal. The duplicate copy was retained by MPA, Jobsite Accounting Division, and filed with the Purchase Order folder to which it pertained in the Purchase Order files - except in the case of Receiving Reports applying to any of the retail facilities, in which case, MPA forwarded them to the Facilities Accounting Section.

INVOICES. Paid invoices were forwarded to the Jobsite from the Home Office. These were attached to a jacket bearing a transmittal number. These numbers represented the calendar year, month and the numerical sequence of the transmittal for the month. Example: 52-6-30 means Transmittal No. 30 for the month of June, 1952.

Upon receipt of the invoice in MPA, it was entered in the invoice register, showing the transmittal number, Purchase Order number, and the amount of the invoice. This constituted the set-up of the materials in transit account. All invoices were posted in this register, including those pertaining to supplies for a retail facility, in order to retain a reconciliation between the detail and the general ledger control. However, if the invoice pertained to supplies for a retail facility, it was forwarded to Facilities Accounting Section. All other invoices were filed in the file folder of the applicable Purchase Order.

STORES ISSUE SLIPS. Store Issue Slips (SIS) were forwarded from MSRS to MPA on a letter of transmittal. There were thirteen divisions of MSRS which originated transmittals, and had own numerical sequence of transmittals and SIS. These divisions are as follows:

1. Construction
2. Special Structures
3. Paints
4. Tools
5. Metals and Machine Shop Steel
6. Electrical
7. Plumbing
8. POL Products
9. Automotive Parts
10. Marine Parts
11. Camp Supplies
12. Subsistence
13. Liquor and Beer

The transmittals forwarded by any of the above divisions showed the number, the division originating, the total amount transmitted, the individual SIS number and the amount of each SIS listed. All SIS for subsistence and liquors were forwarded by MPA to the Facilities Accounting Section which handled the accounting for these commodities.

Upon receipt of the transmittal in MPA, entry was made in the SIS Register, showing:

Transmittal Number

Date of Receipt

Total Amount

Classification of materials by money value as to warehouse departments

After checking the accuracy of extensions and additions, a rubber stamp impression was made on each SIS showing credit to the proper inventory account, and a blank space for insertion of the cost account to which the material was to be charged. The SIS's were then forwarded to the Cost Accounting Section for the insertion of the proper cost distribution to which the material was to be charged. Upon return to MPA, a recapitulation of the cost accounts was prepared and reconciled with the amounts entered in the SIS Register before a journal was prepared. This journal, recording the amount of materials issued by the various warehouse departments, was prepared weekly. The SIS was then filed under the journal voucher number, and in the order by account number charged as set up in the Chart of Accounts. The SIS transmittals were stamped with the same date as the SIS pertaining thereto, and opposite each SIS number listed on the transmittal the cost code was appended. The transmittals were then filed in the applicable folder provided therefor in MPA files.

EQUIPMENT RECORDS. The MPA's Equipment Register contained the following information:

1. The AEC number affixed to the piece of equipment
2. Description of the item
3. Purchase Order number
4. Receiving report number
5. Vendor's name
6. Make
7. Model
8. Maker's serial number, if any
9. Holmes & Narver number affixed
10. Account to which the item is charged
11. Value of the item

The original entry to this register was made from the Receiving Reports forwarded to MPA from MSRS. The only information not furnished at that time was the cost account to which the item was charged. This information was covered previously in this section.

Property Cards were prepared on all equipment charged to fixed assets, indirect expense, or work in process. A card was made at the time the Receiving Report was transmitted to MPA. It contained the same information as the Equipment Register, plus the date and journal voucher number on which the charge was made. These cards were generally filed in three categories, namely:

a. Completed Plant and Equipment (charged to fixed assets)

b. Work in Process (charged to special job feature)

c. Minor Movable Equipment (charged to indirect expense)

The cards in the Completed Plant and Equipment file served as a detail of the Fixed Asset Account in the General Ledger, and a reconciliation was effected monthly. Any additions or deductions in the Fixed Asset Account were reflected in this completed plant and equipment detail.

COST ACCOUNTING

The primary functions of the Cost Accounting Section were:

Maintenance of a Job Cost Ledger

Distribution of Labor Costs

Report Heavy Equipment Usage

Maintain Chart of Accounts

Reports from the Material and Property Accounting Section, Facilities Accounting Section, and Timekeeping Sections formed the basic entries for the Cost Ledger. Daily Time Sheets and Weekly Time Cards from the Timekeeping Section provided the material for labor distribution. Basic material for performing analyses necessarily depended upon the type of analysis requested; but, primarily, Time Cards and Stores Issue Slips formed the basis from which to start.

The Cost Accounting Section was charged with the responsibility of maintaining a current chart of accounts for cost coding. This chart of accounts was furnished by the Home Office on all indirect and construction expense with the exception of engineering change orders and extraordinary maintenance work orders. Assignment of these code numbers was made by the Jobsite Engineering Division, and they furnished the Jobsite and Home Office Fiscal Departments with copies of such orders.

COST LEDGER. In the Job Cost Ledger were posted all direct and indirect labor charges and all direct and indirect material and supplies charges. All postings were made from Journal Vouchers to the ledger by individual account, and the total amount of the voucher was posted to the control, or balance, card. The ledger cards reflect material and labor costs.

The total cost column on the ledger normally was used only when the account was completed, or closed. The Cost Ledger was broken down into five sections:

1. Miscellaneous
2. Indirect Expense
3. Construction Costs
4. Engineering Costs
5. Job No. 5

LABOR DISTRIBUTION. The Cost Accounting Section had the responsibility of extending the weekly time cards, hours times rate of pay, and distributing such costs on the Time Cards. The section furnished the coding information to all Departments and foremen therein, as well as the Timekeeping Section within the Fiscal Department. The Cost Accounting Section was accountable for the accuracy of code use. Labor distributions were broken down into the following functions:

Checking Cost Codes on Daily Time Sheets

Extending and Distributing Costs on Weekly Time Cards

Preparing and Posting Journal Vouchers

Journal Voucher. Once each month, a journal voucher was prepared which listed charges to the various accounts shown on the distribution sheets, and credited to A/C 1609, Payroll Clearing Account. The duplicate of the journal voucher was forwarded to the Home Office, the original copy, after posting to the Cost Ledger, was filed in the journal voucher file.

HEAVY EQUIPMENT USAGE. The Cost Accounting Section made a weekly report to the Home Office of all heavy equipment usage by cost account number. The weekly report was compiled from reports submitted daily from any Department using the equipment.

Daily Reports. Daily reports of equipment usage were presented on mimeographed forms O/S 190 and O/S 195. If the piece of equipment was not used, the Heavy Equipment Foreman reported the piece as being on "Stand-by", or if it was in the repair shop, as being on "Deadline."

Weekly Accumulations. Mimeographed form O/S 284 was prepared for each piece of classified heavy equipment at the Jobsite. To this form was posted the daily usage reports covering all cost accounts charged for that particular piece of equipment. This report was accumulated over a seven-day period, and was the source of information for the typewritten weekly report sent to the Home Office.

CHART OF ACCOUNTS. A primary Chart of Accounts was furnished by the Home Office, broken down into the several divisions as cited in "Cost Ledger." Subsequent to the original issue, there were numerous changes, additions, deletions, as well as originations from the Jobsite Engineering Division on engineering change orders and extraordinary maintenance work orders. It was the responsibility of the Cost Accounting Section to revise and maintain the Chart of Accounts in such a manner that current account numbers were always available for ready dissemination of information for coding purposes.

As stated, the Cost Accounting Section was charged with the responsibility of furnishing the cost account chargeable for distributing labor costs, and of posting the proper cost accounts to Stores Issue Slips. The Material and Property Section, upon receipt from the Material Stock Record Section of the Supply Division, forwarded the Stores Issue Slips to the Cost Accounting Section for insertion of the cost account applicable. The Stores Issue Slip indicated the item, unit cost, extension, department requisitioning, and the job on which it was used. From this information, the Cost Accounting Section inserted the cost account applicable and returned the Stores Issue Slips to Material and Property Accounting Section. Journal vouchers prepared by Material and Property Accounting Section from these Stores Issue Slips then became the media for posting costs of materials and supplies to the proper cost account in the Cost Ledger.

FACILITIES

The Facilities Section was responsible for the accounting of:

1. Funds advanced to the Facilities Cashiers.

2. Revenue accrued from the operation of the various facilities.

REVOLVING FUND. A revolving fund was maintained by the Jobsite Accounting Department for the purpose of making payroll token payments, payroll advances, cash purchases, subsistence payments, and check and money order cashing. The Accounting Department Cashier was the custodian of the fund.

Checks drawn on this fund were signed by the Controller, or Assistant Controller, and by the Resident Manager or Project Manager. A petty cash voucher was prepared for each transaction involving expenditures from the fund, with the exception of transmittals of revenue from sales facilities and subsistence and quarters. Checks or money orders cashed were listed on a from entitled: "List of Checks for Deposit in the Bank of America, Contract AT-(29-2)-20, Revolving Fund Account." Upon receipt in the Home Office of a petty cash voucher, or a check list, a deposit was made replenishing the Revolving Fund in the amount of the petty cash voucher or check list.

The Chief Auditor, or the Senior Accountant in charge of Facilities Accounting Section (FAS), counted and supervised daily the balancing of the cash on hand with the Cash Book. Cash and check disbursements were made by the Cashier who prepared the petty cash voucher.

Cash receipts derived from sales facilities, subsistence and quarters, and miscellaneous collections, were transmitted to the Home Office by check.

Operating funds were provided where needed for the purpose of making change at sales facilities, Post Offices, and for cashing checks and Money Orders. A periodic audit of these funds was made by FAS.

CASH RECEIPTS. FAS was responsible for the collection of revenue from all sales facilities, and from individuals for subsistence and quarters for which collections were not made by payroll deductions. FAS prepared a Cashier's Receipt Slip and a Cashier's Deposit Slip for submission of the receipts to the Cashier. The Cashier signed the Cashier's Receipt Slip to FAS for entry in the Cash Book and for use in sales accountability reports.

COMMISSARY STORE REVENUE. At the Elmer Post Exchange, a Facility Cashier handled all cash from sales. Pre-numbered sales slips were prepared, in duplicate, by the Post Exchange employees, and the original was given to the customer for presentation to the PX Cashier. Daily cash register records were maintained.

Post Exchange Managers at other sites handled their own receipts, and turned in the cash each day to a designated representative of the Accounting Department, generally the site Timekeeper. The PX Manager prepared a Personnel Facilities Revenue Receipt, in triplicate, showing beginning and ending totals on the form, and the amount of cash submitted. The Accounting Department representative receipted for the funds, on all copies, and the triplicate was given to the Store Manager.

On sites where no Accounting Department representative was stationed, FAS checked the PX Manager's accountability twice weekly at the PX and submitted the cash receipts to the Accounting Department Cashier. Duplicate copies of the Personnel Facility Revenue Receipt were prepared by the PX Manager, and the duplicate copy was signed by FAS, the original being submitted to the Accounting Department with a Cashier's Deposit Slip and cash receipts.

BEER HALL REVENUE. At Site Elmer, Facility Cashiers provided by the Accounting Department handled cash receipts at the Beer Hall. Cash register totals were taken and tapes submitted to the Accounting Department Cashier. The Head Cashier furnished information as to liquor, beer, and miscellaneous sales by receipts in order that such information could be used to check the Daily Accountability Sheet for the facility. The Accounting Department Cashier signed the form and returned it to FAS for entry in the Cash Book for sales accountability reports.

Beer Hall Managers at other sites handled their own cash receipts and prepared the Daily Accountability Report in duplicate. These forms and funds were presented daily to the Accounting Department representative who signed both copies, then returned the duplicate to the Beer Hall Manager and the original, along with the cash receipts, to the Accounting Department Cashier via locked pouch.

On sites where no Accounting Department representative was stationed, FAS checked the Beer Hall Manager's accountability twice weekly and submitted the cash receipts to the Accounting Department Cashier.

SNACK BAR. The Snack Bar Manager handled his own cash receipts and the receipts were picked up daily, along with the cash register tapes and readings.

SUBSISTENCE AND QUARTERS COLLECTIONS. A Kardex file was maintained in FAS on each individual subject to quarters and subsistence collection, and a receipt issued to the individual when the collection was made. These funds were turned in to the Accounting Department Cashier for entry in the Cash Book.

INTERNAL AUDIT

A complete Internal Audit Program was followed with regular and special audit reports to management. The Jobsite Program covered such items as Cash Accountability, Payrolls, Materials, Equipment and Revenue Producing Facilities and is generally more inclusive than the AEC Questionnaire on Internal Control.

SECTION 6. INDUSTRIAL RELATIONS

The Chief of Industrial Relations was responsible to the Chief of Operations for all personnel matters involving On-Continent and Off-Continent operations, including: procurement, employment and termination of personnel; transportation; maintenance of personnel records; administration of wages and salaries; insurance; and formulation of industrial relations policies. The Personnel Manager was the principal assistant of the Chief of Industrial Relations, and as such, exercised direct supervision over all of these personnel functions. Section Heads were designated to supervise each of the functions of the department.

During the period immediately following OPERATION GREENHOUSE, the work load of the Industrial Relations Department had decreased to such an extent that the entire staff numbered only ten individuals. As requirements for overseas employees increased with the development of work on OPERATION IVY, it was found necessary to establish a regular procedure of processing approximately fifty men per day. This work load generated an increase in the staff of the Industrial Relations Department to 38 individuals by 15 January 1952, and necessitated the use of additional office space for the interviewing and processing of applicants for employment. Offices were arranged at the Holmes & Narver warehouse at 244 West 15th Street, Los Angeles. All overseas applicants, except those seeking top supervisory positions, were screened and processed by representatives of the Industrial Relations Department and of the Security Division at that location. An outline of the Departmental Organization is shown in Figure 3-8.

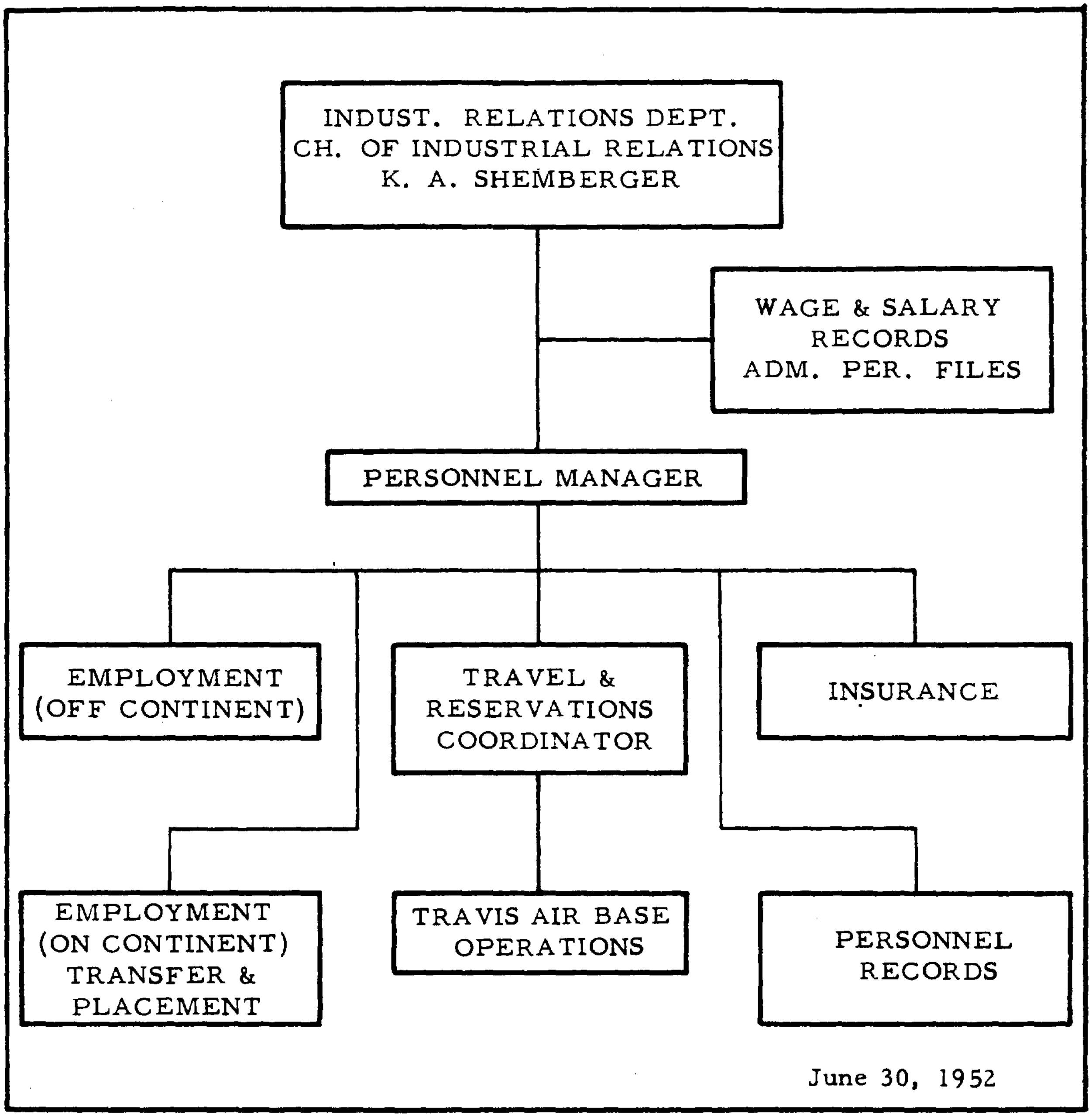


Figure 3-8 Industrial Relations Department Organization Chart

In February, a new Records procedure was instituted to maintain detailed Kardex Record Forms for both Home Office and Jobsite personnel in order to permit rapid reference and to provide a more complete system for maintaining personnel records. From these records, a complete history of the individual employee was continuously and readily available.

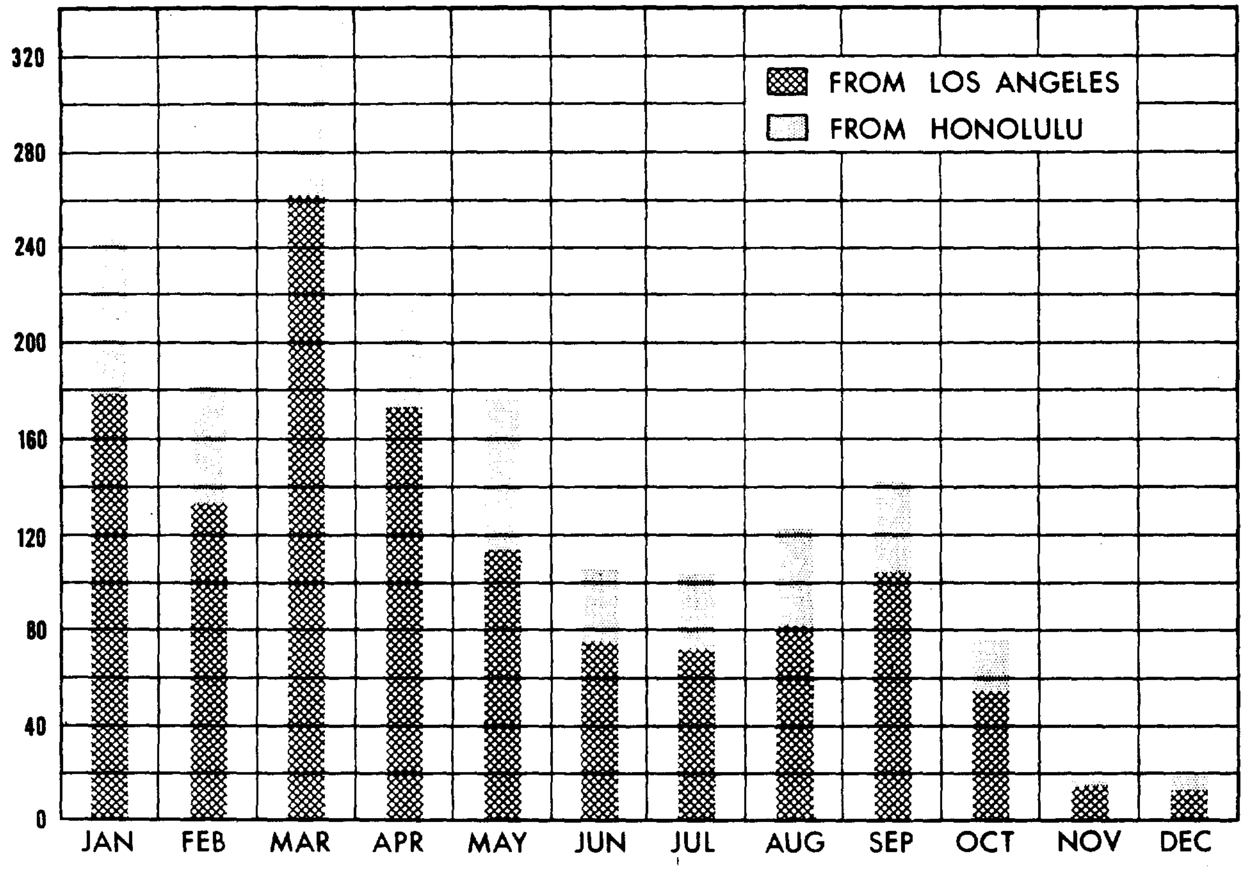


Figure 3-9. Holmes & Narver Personnel Movement to the Jobsite

Overseas shipments of personnel were at their height in March 1952, during which month, more than 260 employees were transported to the Jobsite. This is noted in Figure 3-9. This Chart also includes the employees that were recruited and transported from Honolulu to the Jobsite. For March it will be noted that the total was in excess of 320. The organization of the Honolulu Office is shown in Figure 3-10. By May 1952, the peak of recruiting had passed, and the work load had stabilized to such degree that the Off-Continent recruiting branch of the Personnel Section was moved from the detached hiring hall at the warehouse location and consolidated with the Home Office Personnel Section. Recruitment in other outlying localities was suspended, and advertising for new employees was temporarily discontinued. The Personnel Section then initiated an intensive review of applications on hand. Contact letters were mailed to applicants, many of whom replied that they were available for immediate Off-Continent employment. This provided a reserve employment pool from which many replacement requisitions were filled during the ensuing months. Effective the first of September 1952, only men with "Q" Clearances could be sent to Jobsite. Availability lists were screened and revised to meet this requirement.

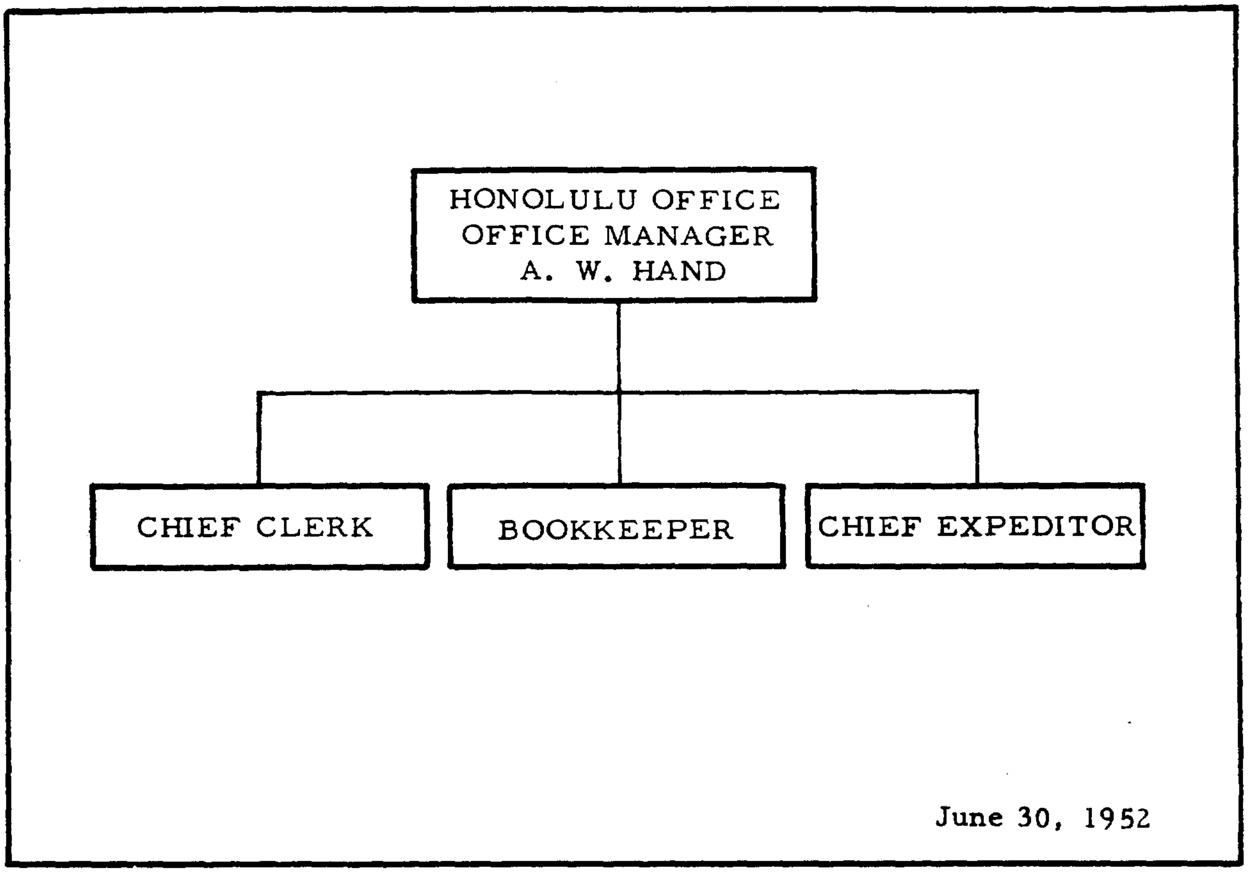


Figure 3-10. Honolulu Office Organization Chart

Beginning in October 1952, as the Jobsite Program drew to a close, the release of Jobsite employees caused one of the most active months for the Personnel Section with some 215 terminations being handled during a three week period.

The total number of personnel hired for this Contract for the period from February through December 1952, is indicated on Figure 3-11. The total manual, non-manual and professional personnel hired for both On and Off-Continent was 1,958. Of this total, 1,174 were manual, 754 were non-manual and 30 were professional.

During the entire course of this operation, five deaths occurred at the Jobsite as follows:

On 24 February 1952, Williams, D. (Heavy Equipment Operator) was drowned while crossing the reef on foot between Sites Gene and Flora, during off-duty hours.

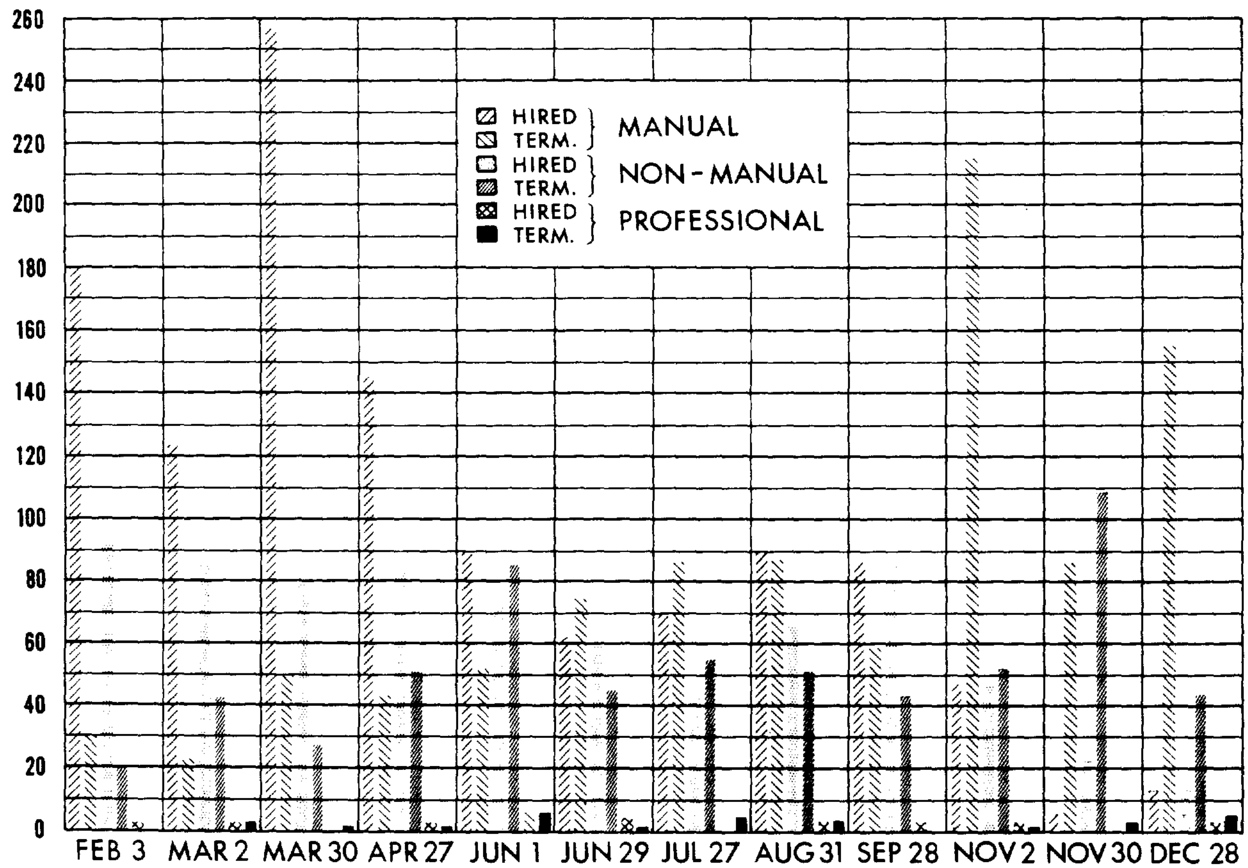


Figure 3-11. On and Off Continent Personnel, All Categories

On 27 March 1952, Boehler, O. C. (Heavy Equipment Foreman) was fatally injured by a crane which was being loaded on a boat at the pier at Site Elmer.

On 11 August 1952, Tyson, H. L. (Marine Mechanic) was electrocuted while working with a motor in the water off Site Elmer.

On 6 September 1952, Shishida, T. (Second Cook) died of a gastric hemorrhage while en route from the Jobsite to Honolulu.

On 26 October 1952, Fiedler, M. (Ass't. Recreation Director) died of coronary occlusion at Site Elmer.

In each case the circumstances were thoroughly investigated, next of kin were immediately consulted, and the remains were expeditiously transported to such location as was specified by the next of kin.

One other casualty occurred on 12 June 1952 when Cromwell, D. F. (Procurement Clerk) was found to be missing. A search of the entire Atoll, and a combined air and surface search of the lagoon and surrounding sea area was made without revealing any evidence as to his whereabouts.

In a Report of Investigation dated 23 June 1952, the Commander of Task Group 132.2 concluded that D. F. Cromwell had been lost at sea.

RECRUITING

With the great increase in personnel necessary for the fulfillment of Jobsite requirements, recruiting activity came rapidly to a peak. The California State Employment Service cooperated in an excellent manner and allocated space in their Industrial and Labor Office at 11th and Flower Streets in Los Angeles for preliminary screening of our applicants. These services were utilized starting 10 December 1951 with C. S. E. S. representatives doing preliminary screening and three Holmes & Narver interviewers handling the final interviewing. This arrangement was continued until the hiring hall for overseas employment was established at the Holmes & Narver warehouse during the latter part of January 1952. However, the C. S. E. S. continued to refer applicants to Holmes & Narver. An estimated 3,000 men appeared at the C. S. E. S. for employment interviews by the first of the year; about 1,800 were screened out by the California State Employment Service, the remaining 1,200 were interviewed by the Holmes & Narver staff. Approximately 650 of the 1,200 men were considered for further processing and completed their Security and Medical Questionnaires. About 500 of this group were given medical examinations, their references were checked, and Security Applications were filed.

The number of Home Office personnel interviewed from January through December 1952, totaled 1,432 which resulted in the hiring of a total of 241 for Home Office employment.

By January 1952, advertising in local newspapers was at its peak with advertisements appearing daily. The Holmes & Narver hiring hall was open six days a week for a limited time and interviewers remained until eight o'clock in the evening when necessary. Jobsite requisitions were met, and by the latter part of January reserve pools of prospective construction laborers, marine deckhands, and apprentice engineers had been established.

A high level of recruiting activity was maintained until the first of April when the number of applicants for overseas employment showed a marked decrease. This was apparently due to the seasonal spring pick-up of other construction work in the United States, and to the normal decline of applicants which occurs after several months of repeated advertising. At this time considerable difficulty arose in obtaining certain highly specialized personnel. In order to secure these necessary personnel, recruiters were dispatched to the California State Employment Service Offices located throughout California and advertisements were placed in newspapers in areas adjacent to Los Angeles. This recruiting effort resulted in obtaining a sufficient number of the required specialized personnel to meet Jobsite needs. During the latter months, personnel requirements were supplied from reserve pools which had been developed, and from those former employees who had expressed a desire for re-employment.

WAGE AND SALARY ADMINISTRATION. At the inception of OPERATION IVY, it was realized that an adjustment in Wage and Salary schedules would be necessary for both On-Continent and Off-Continent personnel, in order to meet local competition in the procurement of necessary help. It was determined that sufficient allowable adjustment could be effected within the framework of Wage Stabilization regulations without the necessity of applying to the Wage and Salary Stabilization Boards in Washington for approval.

For On-Continent operations, satisfactory adjustment was made by taking advantage of the 10% Catch-Up formula allowed under Wage regulations, and such cost of living increases as were applicable in the Los Angeles area. The new rates which were placed in effect did not result in immediate automatic increases for any of the incumbent personnel, but instead, the permissible increase in rates was added to the present top of existing rate ranges. Such individual increases as were necessary then were effected by means of merit increases.

For Off-Continent operations, the same principle (as required to bring rate in line) was applied to all non-manual and supervisory rates of pay. In the non-manual, non-supervisory category, however, additional adjustment was effected by a change in the payment of bonus. It was in this group that the Wage schedule was deemed mostly out of line, and by converting a portion of the weekly bonus to the hourly rate, these rates were brought into better comparison with the revised manual rates.

After a thorough review by the Industrial Relations Department of Holmes & Narver and the Industrial Relations Division of the AEC, it was decided that it would be necessary for Holmes & Narver to equal the going Southern California area rates of pay in all construction crafts, in order to be in a competitive position for recruiting. The survey revealed that only a portion of manual rates of pay required changes in order to coincide with the current area rates. These changes were effected and an agreement was reached between Holmes & Narver and the AEC to the effect that Holmes & Narver would make whatever periodic changes were necessary in order to keep craft rates in line with the going Southern California area rates as approved by the Construction Industry Stabilization Commission and as agreed to by the local Association of General Contractors.

Since all of the changes which were effected were allowable within the framework of Wage Stabilization regulations and did not need prior approval, it was practicable to effect the On-Continent changes immediately. However, due to the fact that Off-Continent employment was all on a contract basis, a later effective date was necessary in order that new Employment Agreements could be executed by all personnel. A representative of the Industrial Relations Department was sent to the Jobsite on 22 January 1952, to supervise the installation of the new Wage schedules for both manual and non-manual Off-Continent employees and the change was effected 25 January 1952. At this time the entire supervisory structure was reviewed and changes effected to streamline the supervisory and administrative organizational set-up. The changes effected were very helpful in the over-all Wage and Salary Administration. At the same time, a Wage and Salary representative was installed in the Jobsite Industrial Relations Division. The primary functions of this representative were to review all Changes of Status, to insure that all personnel were working within their proper classification, and thus further insure compliance with all existing regulations.

At this time, the Employment Agreement was revised somewhat to clarify certain paragraphs pertaining to holiday work and the rate of pay therefor; also to allow management more discretionary rights in the movement of personnel while located at the Jobsite. Thereafter, during the period of OPERATION IVY, a number of craft rates were changed to comply with changes effected in the Los Angeles area. Also some new job classifications were added and some titles were changed to agree more closely with those approved for use in the Southern California area by AEC.

EMPLOYMENT PROCEDURE. A complete procedure covering the hiring of both On-Continent and Off-Continent personnel is set forth in detail in the company's Standard Operating Procedure. A review is made herein of some of the problems most pertinent to this particular operation. The preliminary screening consisted of: determining the applicant's qualifications, and the availability of the type of work for which the applicant was qualified; determining satisfactory citizenship (Security requirements precluded the employment of all other than U. S. citizens); and the elimination of those applicants obviously physically unqualified.

Those applicants who were determined eligible for further consideration after preliminary screening were then referred to the final interviewers for more definite examination. The final interview culled out all those applicants not definitely determined eligible upon an ability basis. Then followed the preparation of all the necessary forms and a subsequent referral to the examining physician for a physical examination. The physical examination removed another percentage of applicants, however, by far the largest applicant loss was due to the length of time involved in conducting the Security investigation and determining eligibility for Clearance. During the height of recruiting, Clearances were taking three months or longer, and as a result, a large number of the applicants found it necessary to procure employment elsewhere and were not available when final Clearance was obtained. Despite these many difficulties, some of which were inherent in this particular operation, Jobsite requirements for personnel were met, as were the resultant needs for the Home Office staff.

When overseas employees completed their tour of duty, or for other reasons were returned to the United States, processing was required. This included termination for purposes of determining final salary settlement, physical examination to determine the employee's health condition as compared to his condition at time of hire, and finally, a Security lecture to inform him of Security restrictions applicable to his future activities.

TRANSPORTATION

The Industrial Relations Department was responsible for handling all transportation arrangements for Holmes & Narver employees on official business. Personnel were transported by commercial air line or by MATS from the Continent to Honolulu and by MATS from Honolulu to the Jobsite. Transportation from Los Angeles to Oakland was normally arranged over one of the regular commercial air lines. In the case of groups of personnel of seven or more, the Vaca Valley Bus was chartered for transportation from Oakland to Travis Air Force Base. The Transportation Section of the Industrial Relations Department coordinated all personnel travel advising the Holmes & Narver Travis Air Force Base representative, the Honolulu Office and the Jobsite regarding men in transit. Return transportation from the Jobsite to Honolulu was via MATS for all personnel. From Honolulu to the U. S. Continent transportation was arranged either via MATS or by commercial air line facilities. In the event that a MATS flight from Honolulu to Travis Air Force Base could not be arranged within 48 hours after arrival in Hawaii from the Jobsite, personnel were transported via commercial air lines, this being deemed more economical than accumulation of unproductive wage costs through excessive stand-by time.

The Industrial Relations Transportation Section arranged for hotel reservations and made other arrangements for all On-Continent travelers as required. When a lay-over in Honolulu was necessary, all required arrangements were made by the Honolulu representative.

Prior to April, group personnel en route to the Jobsite were given advance checks which totaled the individual traveler's three-day pay. However, beginning in April 1952, all group personnel en route to the Jobsite were given Travel Advance Checks in the amount of $25.00 only. Personnel traveling via commercial flights to Honolulu were given travel advances (if required) as authorized by the Treasurer. All travel advances to Contract personnel were recovered by being deducted from their first earnings.

Of a total of 1,785 personnel transported to Jobsite during Contract AT-(29-2)-20, 1,261 were shipped from the Home Office, 447 were hired and shipped to Jobsite from Honolulu and 47 were transported from the Home Office to Jobsite on Temporary Duty.

JOBSITE INDUSTRIAL RELATIONS

The Jobsite Industrial Relations Division, headed by a Director of Industrial Relations, and comprising the following Departments, was established in January 1952:

Medical Department

Personnel Department

Recreation Department

Safety & Fire Departments

Security Department

Guard Department

The Director of Industrial Relations was responsible for the effective and intelligent direction of the Division in conformance with established company policy and procedure, and for the effective organization, planning, direction and control of the Departments within the Division. He was a member of the Jobsite Staff, and reported directly to the Project Manager.

Department Heads within the Division were members of the staff of the Director of Industrial Relations, and reported directly to him.

Close liaison was maintained between Personnel and all Jobsite Departments. The addition of a Wage and Salary Section afforded a closer control of classifications and merit increases.

Recreational facilities were utilized to the utmost, and employee interest was high in all undertakings. The library was used extensively.

The Safety and Fire Department was responsible for the enforcement of safe operating procedures.

The Security Department effectively maintained its program, and minor difficulties encountered by the institution of the badge system were quickly overcome.

Jobsite procedures were published, which outlined departmental operating procedures, and included certain continuing and permanent company policies and procedures.

PERSONNEL

Effective midnight, 20 January 1952, new wage schedules and rates of pay for Off-Continent employees were put into effect. The general classifications of Sub-Foremen and General Foreman were also discontinued on 21 January, except in those few instances in which individuals in those classifications refused to sign contract modifications and were permitted to complete their current contracts under the old contract titles and rates.

Wage rates for manual and non-manual employees were again revised as approved by AEC on 15 September 1952, based on approved rates in the Los Angeles area by the Construction Industry Stabilization Commission, and 10% Catch-Up formula and 5.8% Cost of Living formula, all of which fell under rulings of the Wage Stabilization Act.

New contract forms were also published in September 1952; and, although the content of the Contract changed in no major fashion, some points were clarified. The form was executed where applicable.

Considerable time was devoted to a complete file of job descriptions for non-manual, supervisory and administrative classification, and certain manual classifications. Such descriptions became helpful in the proper determination of classifications for individuals, particularly in clerical jobs. The writing of job descriptions also served the very useful purpose of coordination between the Personnel Department and the various Divisions and Departments which were affected by the new descriptions, and tended to improve Change of Status procedures on the part of supervisory personnel.

Procedure bulletins covering activities of the Industrial Relations Division were issued as follows:

- B-2 Personnel Transfers
- B-4 Personnel Requisitions
- B-10 Instruction Concerning Jobsite Terminations Policy
- B-11 Personnel Contracts Completed, and Departure from Jobsite
- B-14 Letters of Recommendation and Commendation
- B-15 Instructions Concerning Employees Declared Surplus to Jobsite Requirements
- B-17 Interim Procedure for Granting Merit Increases

B-18 Sick Leave Policy - Off-Continent Employees

B-19 Jobsite Transportation Regulations

B-21 Request for Salary Adjustment and/or Reclassification

B-22 Access to Jobsite Personnel Files

B-25 Letters of Commendation from AEC, Military and User Groups

Additions and modifications to the above procedures were written as necessary.

A problem which became of increasing concern at Jobsite, in May 1952, was the comparatively large number of voluntary terminating employees. A peak was reached in May and June, when approximately fifty employees voluntarily terminated each month. A study of the situation gave no clue for the possible cause of these actions, since there seemed to be no particular pattern to the terminations, either by Department or by association. However, as the construction phase of the job began to near completion, there was a noticeable decrease in the number of employees who terminated voluntarily, and by the month of August the situation was considered normal, and remained at a comparatively low figure thereafter.

Close liaison was maintained throughout the year between the Jobsite and the Home Office, and required personnel arrived at Jobsite in the number, classification, and at the time required. The major deviation from standard requisitions procedure occurred in September, when approximately twelve carpenters were dispatched to Jobsite on 6-week contracts for the completion of a Special Structures Program of short duration.

The Wage and Salary Section of the Personnel Department was established to analyze, investigate and report on problems involving job classifications, wages, salaries, and merit increases. It was through this Section that verification of all changes in classification and requests for increases were made.

A weekly average of forty Change of Status forms was processed and submitted to the Home Office. All reclassifications and merit increases were analyzed so as to conform to existing company policy and government regulations. The Wage and Salary Section also held a weekly meeting with the Project Manager to discuss problems related to Wage and Salary administration.

This Section was also charged with the proper handling of all employee claims arising out of wage disputes and performance of work out of proper classification. Data concerning these claims were compiled and sent to the Home Office for final decision.

Proposed new job classifications were analyzed, and descriptions written, as well as job descriptions for established positions.

MEDICAL

The Medical Department operated administratively as a part of the Industrial Relations Division, under the supervision of the Director of Industrial Relations, to whom all correspondence and reports were submitted.

The Medical Department Head was the doctor. His assistant, the supervisor of routine departmental functions, was a head nurse or hospital administrator. One senior clerk and eight or nine first aid men were usually assigned to the Department. One of the latter served as assistant to the dentist. The dental clinic operated independently from the infirmary, except administratively, although the doctor was available for consultation.

Prior to the arrival of a dentist on 28 June 1952, employees requiring emergency dental treatment were sent to the Army base dispensary at Fred by the Holmes & Narver Medical Officer. Due to the normal work load at that office it was necessary to limit the number of employees and the work that would be undertaken. On arrival of the Holmes & Narver dentist, a maximum coverage of necessary dental work was provided.

The doctor and dentist worked a 48-hour contractual week, although they were always on call. Other personnel normally worked 54 hours. Occasional overtime was necessary for first aid men to work at night, because the number of aid men did not permit the operation of a 24-hour schedule in the infirmary.

The facilities of the Medical Department were centralized in the infirmary at Elmer. Its treatment room was equipped to handle all routine cases. Ward space consisted of six beds, but could have been expanded to fifteen by the absorption of the adjoining quarters of the aid men.

Surgical facilities were of a strictly emergency nature, due to limited space in the operating room, and its exposure to dust and other contaminating elements. For procedures other than minor, it was necessary to transfer patients to the U. S. Army Hospital at Fred, or to Honolulu. Contagious diseases fell into this category also, because of the lack of proper isolation space.

Adequate X-ray facilities were available. Laboratory facilities were sufficient for emergency measures only, but were increased by the installation of a microscope and other incidental equipment. Diathermy and infra-red therapy were also available.

A standard Army-type ambulance was used for emergency calls and for the transportation of patients to the hospital at Fred. It was equipped with first aid supplies sufficient for any foreseeable emergency.

First aid stations were maintained on outlying locations wherever groups of employees were stationed. The treatment rendered at these stations was limited to treatment of routine complaints and emergency first aid. The doctor visited each site semi-weekly. Any patient requiring extended hospitalization, intensive treatment, X-ray or laboratory analysis, was moved to the infirmary at Elmer.

At Gene, an emergency first aid station was established on 21 January 1952, with one first aid man. As the operation there progressed, an additional man was assigned. One man operated a station at Yvonne from 20 May until the last of October.

On 15 October 1952, an aid station was established at Bikini Atoll, operated by one man, later increased to two men, thus providing adequate emergency protection. As further temporary protection, the doctor from Elmer visited Bikini Atoll weekly.

First aid kits were furnished to all boats and small working parties which were isolated from the established aid stations. They were also placed in the various shops, plants and recreation areas. Litters were placed in strategic locations throughout the Atoll, such as at each airstrip.

Sick call was held daily from 0700 hours to 0830 hours, and 1800 to 2000 hours. In these periods, treatment was furnished for all complaints of a routine nature, such as colds, fungus, gastritus, and old injuries. Injuries and all other emergencies were taken at any hour, and the aid men were quartered in a building adjoining the infirmary in order to be readily available at night. Personnel of participating agencies other than Holmes & Narver were served by the Holmes & Narver Medical Department until the arrival of the Task Force Surgeon.

The Army medical officers at the garrison cooperated generously with the Holmes & Narver Medical Department. They were always available for consultations, and performed surgery and laboratory work for which the Holmes & Narver Infirmary was not adequately equipped. During brief periods when no physician was on Elmer, one of the Army doctors visited the infirmary for daily sick call. At the height of the operation, a USAF medical officer was assigned to Elmer for approximately a month. Facilities were furnished for him and an Army aid man to treat military patients in the infirmary.

Permanent records were maintained on medical service to all personnel. An entry was made upon each individual's treatment record card at the time of treatment. At the end of each day, pertinent information was transcribed from each card upon which an entry was made, to a clinic register, which was the permanent chronological record used as the source of statistical information. The U. S. Army Hospital at Fred sent a report on each Holmes & Narver patient who was treated there, and this was attached to his treatment record card. Aid stations away from Elmer made the same kind of records, and submitted to the Medical Department a daily summary, which was incorporated into its periodic reports.

A morning sick report was made daily, listing those patients who were off duty, and stating their diagnoses. Copies of this report were sent for information to the Project Manager and the Timekeeping, Safety and Personnel Departments.

A Daily Time Sheet was submitted to the Timekeeping Department for off-duty patients. Compensable sick time could not exceed 8 hours per day, 40 hours per week, or a total of 80 hours, except with specific approval of the Project Manager.

Accident reports were made of each patient reporting for treatment of an injury, compensable or non-compensable. These reports were used for information necessary in the preparation of reports to the Bureau of Employees' Compensation, then were forwarded to the Safety Department.

The Medical Department, in coordination with the Jobsite representative of American International Underwriters, Inc., prepared and distributed the insurance reports listed below. Distribution was: Two to Deputy Commissioner, Bureau of Employees' Compensation; two to Holmes & Narver Home Office; two to Holmes & Narver Medical Department; and two to American International Underwriters. One extra form, No. 202, was made for Safety Department files. Distribution varied in those reports prepared for other agencies.

Form US No.	Name of Report
202	Employer's First Report to Deputy Commissioner of Accident or Occupational Disease
204	Attending Physician's Report
210	Employer's Supplementary Report of Subsequent Disability
211	Employer's Supplementary Report of Accident or Occupational Disease
227	Attending Physician's Supplementary Report
261	Supplemental Report of Employer in Death Case

Terminations classified as "Completed Contract - Injury" and "Physically Unqualified - (cause stated)" originated with the medical officer. His statement to the Director of Industrial Relations included a description of employee's complaint and examination findings, history of treatment, diagnosis and prognosis, and a recommendation concerning further treatment.

The medical officer maintained and was responsible for a program of health and sanitation in accordance with good housekeeping policy and procedures. In coordination with the Safety Engineer, he made periodic inspections of the kitchen, mess facilities, restaurant, beer hall, barber shop, quarters, water supply and insect control to insure that established standards of health and sanitation were being maintained, and submitted weekly reports of these inspections to the Director of Industrial Relations.

A historical report was prepared monthly to outline general activities, changes in personnel and location of aid stations, and to present statistical information concerning treatments.

A card inventory of supplies and equipment was maintained for the primary purpose of controlling replacement orders. Efforts were made to keep on hand a three-month supply of all expendables. This proved to be the principal supply problem, because of unforeseeable population shifts, and the sometimes uncertain time interval between the order and receipt of goods. Another aspect of this problem was the frequent change in medical officers, which resulted in the accumulation of several non-standard items of drugs. A separate supply register of narcotics was kept by the medical officer.

STATISTICS

Total Number of Fatalities: 5

Nature of Fatalities:
1 Drowning
1 Electrocution
1 Direct Injury
1 Abdominal Hemorrhage
1 Coronary

Total Number of Immunizations Completed: 1,487

Full Working Days Lost Due to Sickness or Injury: 1,024

Medical Terminations

Month	Completed Contract-Injury	Physically Unqualified
January	0	0
February	0	0
March	1	1
April	2	7

Medical Terminations (Cont.)

Month	Completed Contract-Injury	Physically Unqualified
May	1	2
June	5	14
July	1	5
August	3	4
September	5	8
October	5	7
to November 10	0	0
Total	23	48

Number of X-Rays Made: 569

Total Number of Out Patient Treatments: 18,471

Incidence of Treatments

Injuries	Percent	Diseases	Percent
Lacerations & Puncture Wounds	6.5	Upper Respiratory Infection	22.0
Contusions	6.2	Fungus	3.5
Sprains	5.5	Other Otitis (Athlete's Foot, etc.)	10.6
Fractures	.2	Gastritis	4.2
Sunburn	3.8	Conjuctivitis	4.5
Flashburn	.8	Other Diseases	16.2
Foreign Body in Eye	2.2		
Other Injuries	3.8		

A total of 238 AEC and User personnel were treated for 204 injuries and 380 diseases. 129 military personnel were treated for 196 injuries and 204 diseases.

SAFETY

GENERAL. It was the policy of Jobsite management to have a continuous safety program which would maintain the health of employees and the affected User groups, and to prevent accidents through the elimination or control of conditions or procedures capable of causing personal injuries, occupational disease, fire, damage to equipment or property and material.

It was a basic responsibility of supervisory personnel to be constantly alert for any action or condition which might endanger the physical or mental well being of any employee, or that might involve loss or damage to property, and to initiate the necessary corrective action. The activities of the safety department were broken down into three major categories, namely, accident prevention, fire protection, and camp sanitation. They will be discussed in that order.

ACCIDENT PREVENTION

The "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., was the accepted basis for Jobsite safety requirements, with further guidance from applicable bulletins issued by the AEC Santa Fe Operations Office. Additional and specific safety rules and regulations as set forth by Jobsite management were published in the form of Jobsite procedures, numbered and unnumbered safety bulletins, and included in subject material, such items as camp health and sanitation, restrictions, warnings or controls of recreational activities, work area housekeeping, motor vehicle operation, licensing of drivers, traffic control, fire prevention, disaster and emergency action thereto, detailed storage handling and construction practices or procedures. Distribution of above publications was made to personnel or organizations, according to the subject matter.

Continuous studies were made of Jobsite activities to detect and promote action of appropriate nature to eliminate conditions and practices which might cause illness, injury or property damage. All injury cases were reviewed and investigated as necessary in order to determine the cause factors and recommendations which would minimize the possibility of recurrence. Jobsite engineering plans and designs were reviewed to effect maximum application of safety engineering standards and practices.

All new arrivals at the Jobsite attended safety orientation discussions which outline established precautions with regard to swimming, shell hunting, exposure to the sun, transportation, personal hygiene, protective equipment and clothing. Meetings for discussion of safety problems or safety educational programs were held between individuals or by groups as the urgency of safety problems necessitated. Supply of personal protective equipment was maintained at Supply warehouses for withdrawal by respective User organizations. This informational program and protective equipment provision conforms with minimums as set forth in the ASA codes.

Continuous safety education was promoted by utilization of signs and posters, and entries published in the daily news publication, designating hazardous locations, speed limitations, off-the-job safety, use of protective equipment and such other subject material to effect optimum results.

Routine safety surveys of operations were performed with supervision normally in attendance. Hazardous conditions found were discussed, recommendations made, and corrective action initiated.

Necessary reports required by the AEC regulations were prepared and submitted through routine channels, together with any supporting data pertinent thereto. The weekly activities report formerly in use was replaced by a monthly narrative report to the AEC and management.

Injury experience figures shown were based on the American Standards Association Z-16.1 code, titled "Method of Compiling Industrial Injury Rates", and as amended by applicable AEC Bulletins. The statistics shown reflect the experience of the first ten months of 1952:

Average Number of Employees (Jan. - Oct., incl.)	1,038
Man Hours Worked (total)	2,471,674
Number Lost Time Injuries	37*
Frequency Rate	14.97*
Number of Days Lost	12,459**
Severity Rate	5.04

*Cases reported in these figures are under review, and are subject to later modification.

**This figure reflects two fatalities, each bearing the standard lost time charge of 6,000 days, each.

During the operation, through 1952, there were no accidents resulting in loss of limb or permanent partial disability. There were, however, two fatal accidents. The first case involved the death of a heavy equipment foreman, who attempted to push a block under the tread of a free rolling crane with his foot. His foot was caught, and the crane rolled over his lower extremities, resulting in immediate death.

The basic operation of using a crane to lift M-Boats and other craft has virtually been eliminated since Jobsite obtained the use of a Gilhoist unit, which is rigged to handle such operations efficiently. Proper blocking of any crane on an incline has been made a stringent requirement.

A second fatal case involved the death of a mechanic who suffered electrical shock. Resuscitation was promptly attempted, and the resident physician was in attendance within five minutes, but no response from the victim was attained. This employee was using an electric pump at the water's edge while it was running, when he received the shock.

The principal corrective measure was a project-wide program initiated to equip all power tools, not already thus equipped, with three-conductor cords, cord grip clamps and wired to proper ground. Availability of the previously mentioned Gilhoist after this accident has enabled the movement of boats to a location with more adequate facilities for repair and service.

In matters of safety, fire protection and health, extensive liaison with the AEC and Task Group officials was necessary in the coordination of test site activities concerning Holmes & Narver operations. A few of the operations so coordinated were Dewar movements, mortar, rocket and explosives operations, and emergency alarms. The cooperation of the military was obtained for demolition or disposal of unexploded missiles and projectiles of various types, which are war remnants frequently found throughout the Jobsite.

FIRE PROTECTION AND PREVENTION

From January through August, in 1952, the fire department operated with two 1942, 1-1/2 ton Chevrolet fire trucks, with a combined pumping capacity of 800 gpm. These trucks were adequately equipped with sufficient hose in service, and in reserve, together with all fittings and auxillary equipment to operate efficiently.

In the first week of September, the department received two additional fire trucks. One is a 1942 Maxim, equipped with a series-parallel centrifugal pump of 750 gpm capacity; the other is a 1-1/2 ton Chevrolet, with a 500 gpm pump.

During the construction phase of the operation, the fire department operated with a varying number of full-time firemen, ranging from two to four. The department was augmented, at all times, by a group of volunteer firemen who were quartered in the Fire Station. They received an average of four hours intensive training per month.

Site Gene was furnished, on 16 May, with an organized fire department. Personnel consisted of one professionally trained fire chief, and four volunteers. A building was provided to house a fire truck with a 300 gpm pump. All necessary adjuncts for fire fighting were provided.

At a somewhat later date, Yvonne was first provided with first aid fire fighting equipment, and as operations developed, a fire truck was provided, with a non-professional manning the apparatus.

Throughout the operation, supervisory and other personnel were instructed in the use of emergency fire fighting facilities which were available and in ample supply. Precautions against fire and the use of emergency equipment were taught and demonstrated wherever unusual fire hazards prevailed in test site operations.

The water supply for fire fighting was adequate for normal expectation demands, and fire hydrants were constantly tested. Because the Marine Department had fire hazards peculiar to their operations, a close liaison was maintained to insure safe operations of sea craft at all times.

Fire protection was afforded operation at airstrips by stationing at each strip, "crash jeeps" and trailers equipped for first aid and fire fighting. Special training was given to the men stationed at the airstrips, in the use of the fire fighting and first aid equipment.

In view of the large valuation of equipment and material which was involved in the test site operations, above and beyond that of Holmes & Narver equipment, it is felt that an exceptionally small fire loss has been experienced. Through ten months, a total loss of $ 1,006.00 accrued, of which $ 891.00 was charged to one fire.

SANITATION

The insect control problem throughout the Atoll was a continuing program, and necessitated concentrated efforts on the part of the organization to attain relative freedom from serious insect infestations. A daily DDT spray was used at Elmer to control flies during most of the operation. During the period when Gene and Yvonne were established camp sites, the spray equipment was scheduled to cover them once weekly. A liquid residual spray was applied once a week to applicable areas of the Jobsite. Hand spraying was routine performance in the mess halls and other buildings, and was centralized about baseboards. Small rodent problems were adequately controlled through use of traps, and by the presence of cats and dogs.

Routine weekly inspections of conditions relative to sanitation and health were made in conjunction with the Medical Department, of all facilities where personnel were housed and fed. Coverage was given to mess halls, reefers, food storage, galleys, beer halls, snack bars, barracks, tents, latrines and recreational areas. Discrepancies were immediately referred to management, with recommendations as to corrective action.

The continuous attention given to food handling was reflected by the fact that no sickness was experienced which could be traced to unsanitary food handling.

Through close coordination with the water distillation organization, and by means of regular checks with the Wallace & Tiernan Comparator, the residual chlorine in fresh water was normally maintained at .4 parts per million or above.

RECREATION

Recreation facilities were available on the occupied sites as follows:

Elmer - A recreation building containing billiard, tennis and card tables. This building was in use continually from early morning until 2300 hours, so that it was available for men working odd shifts; a gymnasium containing boxing, wrestling and weight lifting equipment; a day room containing a library, tables for small games and lounge chairs; motion picture theater; three beach clubs, with designated swimming areas; softball diamond, volleyball and horseshoe courts; a barbecue pit with tables and benches for organized parties; beer hall and snack bar.

Gene - A recreation building containing tennis tables, small game tables and a library; a gymnasium; motion picture theater; beer hall; softball diamond, horseshoe and volleyball courts; a barbecue pit; swimming areas were designated and staked.

Yvonne - A library; motion picture theater; volleyball and horseshoe courts; beer hall.

In addition to the established recreational facilities various group activities were organized for the purpose of occupying leisure hours.

The Coral Island Breeze, a local mimeographed newspaper containing briefs of world news, announcements and other items of interest, was published daily, except Sunday. Rebroadcasts of sports events were made through the public address system in the recreation building on Elmer.

A Chapel on Elmer, and improvised facilities on Gene and Yvonne, were made available for Protestant and Catholic Church services which were conducted each Sunday by Army Chaplains.

Evening classes in modern languages were conducted during the week in the Chapel on Elmer.

SECTION 7. PROCUREMENT

All procurement activities were accomplished through standard purchasing practices under U. S. Government regulations. Departmental procedures for these practices were in accord with approved AEC standards per Article II, Job I, Title 2, Paragraph 6; Title IV, Paragraphs 1 and 2; Article XV, Paragraphs 1, 2 and 3 of Contract AT-(29-2)-20.

At the time of inception of the Contract, the Purchasing Department consisted of a limited staff remaining from the previous operation. In order to properly execute the anticipated increase in volume of the new operation, it became necessary to immediately expand the department with experienced personnel.

The organization of key personnel and inter-departmental sections of procurement consisted of a Chief Purchasing Agent who was responsible for all procurement activity and the delivery of food, materials, equipment and supplies. He was supported by two assistants as shown in Figure 3-12. One of these supervised the Buying and Audit Sections; the other was in charge of the Priorities and the Control Sections. These Assistant Purchasing Agents reported directly to the Chief Purchasing Agent.

The Traffic Section handled all routing, expediting and transportation of materials and equipment from the point of supply to the point of embarkation. Operating under the direction of the Traffic Section was a fully staffed Expediting Section. In addition, the Traffic Section assumed responsibility for Warehouse activity at the Naval Supply Center, Oakland, and at Travis Air Base.

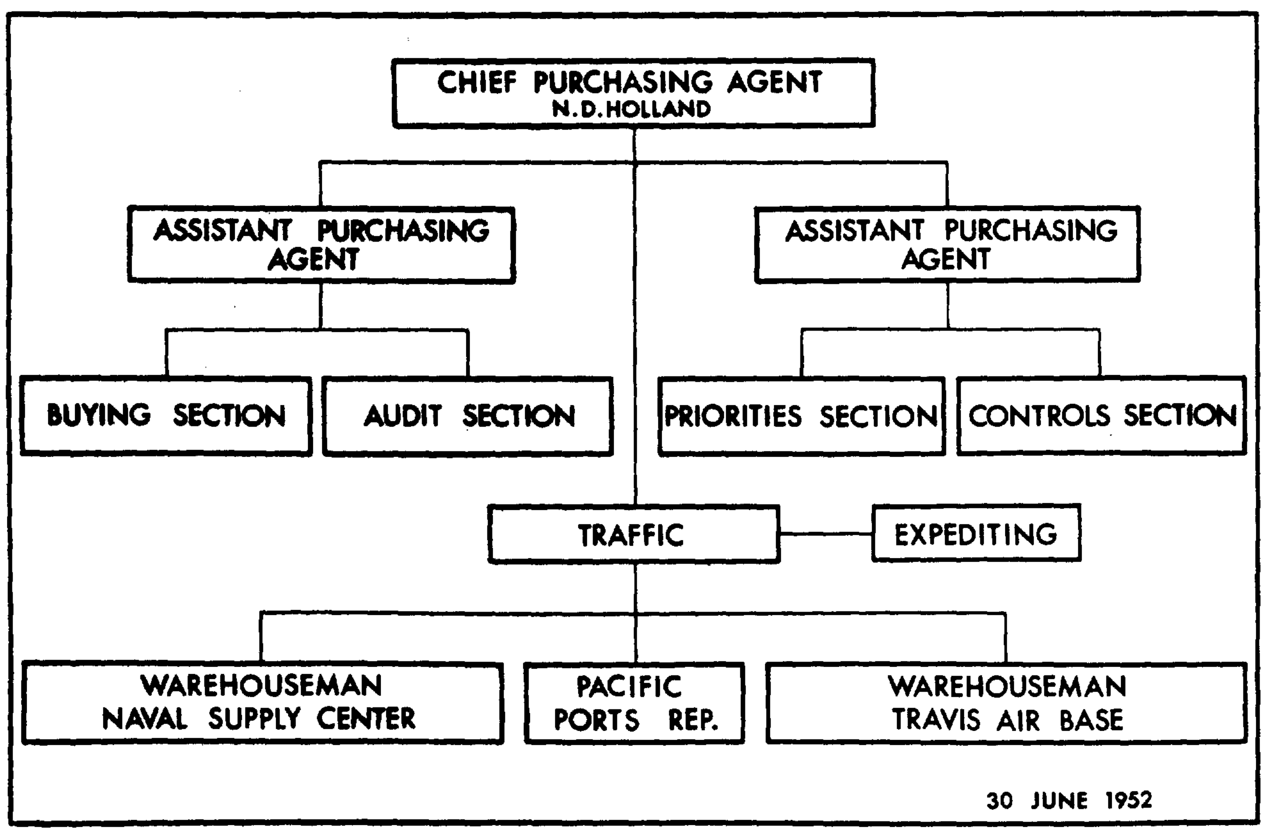


Figure 3-12. Purchasing Department Organization Chart

Operations at these two points were handled by a Chief Warehouseman who received and checked materials for proper packing and marking for shipment to Jobsite, and who handled all related paper work.

Coincident with these activities, the procurement program was faced with shortages in steel, copper and aluminum. The National Production Authority was attempting to grant all allotment requests from defense industries, yet maintain essential civilian manufacturing. While Holmes & Narver operated under the category of a defense industry, as an agent of the AEC, accurate scheduling was necessary to maintain Home Office delivery dates that would meet Jobsite construction schedules.

In January 1952, several improvements were put into effect which reduced the amount of typing work required in preparing Purchase Orders. A new Purchase Order form was inaugurated which eliminated the Advance Receiving Report, and a ditto-type material requisition form. These changes accelerated interdepartmental work-flow and enabled the Department to complete and mail orders within two days after an award was made. These new procedures advanced shipping dates and assisted in the delivery of needed materials to the Jobsite.

Several times during this Contract, labor difficulties throughout the nation seriously hampered required delivery dates. Among these were: New York Central Railroad, Brown and Sharpe Company, Bell Telephone Company, Western Union Telegraph Company, the midwest oil industries, steel mills, local ironworkers, copper wire mills and West Coast Longshoremen. In addition, floods in the midwest caused considerable hardship in routing transcontinental shipments. Surface shipments had to be re-routed during this period, and in some cases air freight was utilized to maintain delivery schedules.

Prior to the sailing time of each monthly refrigerated ship, an expediter was dispatched to the San Francisco-Oakland area to inspect and check all subsistence items (i.e. meat, fowl, poultry, fresh fruits, fresh vegetables and dairy products.) All expediting action in this connection was coordinated with the United States Department of Agriculture Inspection, thus enabling much closer control, especially with seasonable products which required speedy handling between the grower and the various produce warehouses.

In June 1952, because of emergency military requirements, air freight allocations were curtailed to such an extent that items carrying a Priority "One" rating only were transported. Hence, a considerable backlog developed as the Jobsite requests for critical items increased. The problem was cleared through the cooperation of the Officer-in-Charge of MATS, Travis Air Force Base, California, who authorized the release of additional planes.

Immediately prior to the test operation, Holmes & Narver received requests for new items required for this particular phase of the Contract, and advanced the scheduled dates for materials which had been previously committed. With the tempo of the entire operations greatly increased, authorizations were issued at this time for overtime services, courier handling, and practically exclusive use of air shipments.

PURCHASING

Procurement action on Contract AT-(29-2)-20 formally commenced on 31 October 1951, with the award of Purchase Order No. 20,001. This and subsequent orders issued until 31 December 1952 were in response to Engineering and Service Requisitions, the first of which were received on 21 October and 29 October 1951 respectively. The first Field Requisition pertinent to this Contract was dated 31 October 1951, and resulted in the award of Purchase Order No. 20,074 on 19 November 1951.

Field, Engineering and Service Requisitions received at both the Home Office and the Honolulu Office during the Contract are listed in the following table. This table also shows the number of Purchase Orders written during each period and the respective dollar value.

REQUISITIONS

Month	Field	Service	Engineering	Total	P.O.'s	Value
1951						
Oct.	2	17	9	28	-	-
Nov.	94	53	73	220	47	$ 55,777.86
Dec.	29	60	81	170	139	417,357.28
1952						
Jan.	241	123	138	502	574	1,282,659.99
Feb.	169	89	80	338	642	516,254.25
Mar.	209	74	104	387	512	459,147.71
Apr.	236	60	141	437	595	320,118.13
May	198	54	162	414	514	431,898.87
June	173	75	113	361	520	362,565.57
July	242	88	126	456	502	511,684.70

REQUISITIONS (Cont.)

Month	Field	Service	Engineering	Total	P.O.'s	Value
1952						
Aug.	181	73	111	365	474	$ 443,292.50
Sept.	240	56	97	393	515	275,760.37
Oct.	171	91	21	283	454	299,588.35
Nov.	136	32	29	197	296	415,877.93
Dec.	154	56	21	231	341	252,223.25
	2475	1001	1306	4782	6125	$ 6,044,206.76

Certain emergency purchases were made by the Honolulu Office, such as pharmaceutal supplies, yeast, and equipment or plant repair parts. All such purchases were cleared and approved through the Holmes & Narver Home Office Purchasing Department.

A complete Control Register was maintained of all Purchase Orders and requisitions. This register listed the requisition number, date received, buyer assigned, vendor, and the Purchase Order number and date. A similar register was also maintained by Purchase Order number, which was a cross-reference between requisition and Purchase Order numbers.

Additional records were kept which showed the total dollar value of each Purchase Order issued, priorities extended, cost paid for premium transportation and other explicit details. A complete record was also kept on all controlled materials for which an allocation had been made.

All commodities and materials were assigned priority ratings by the Procurement Department. A close relation was maintained with the AEC, Defense Requirements Branch, SFOO, in the extension of all priorities. This AEC branch was very cooperative in lending assistance on various long-delivery items. Since the beginning of procurement action on Contract 20, 16 requests for Directives were initiated through this branch; action was completed on 14. A monthly report was furnished to the Defense Requirements Branch which reflected Holmes & Narver's total allocated materials on hand and also those materials which were extended to the previous month.

EXPEDITING

Expediting activity originated at the Holmes & Narver Home Office on all materials except items purchased from San Francisco Bay District Vendors.

Such Purchase Orders were followed up by the Holmes & Narver representatives at Pacific Ports Industries, Oakland, California. At least one direct contact with the Vendor was made by the expediter on each Purchase Order; future calls being dependent upon promptness of delivery. Occasionally, due to unforeseen circumstances such as labor difficulty in industry, material was difficult to obtain. At such times, intensified expediting activity took place and daily contact was maintained with the Vendors in order to fill Jobsite Requisitions.

In some instances where critical material was scheduled to meet a sailing date, information was requested from the Vendor concerning means of shipping. This resulted in close follow-up on the shipment to the port of embarkation. In addition, considerable expediting was necessary to help a prime Vendor procure material from other sources, such as steel, brass, castings, electrical equipment and electric motors. For the period 18 November 1951 through 31 December 1952 approximately 450 Purchase Orders per month were received by the Expediting Department. An average of 95 percent of these orders were processed and completed each month.

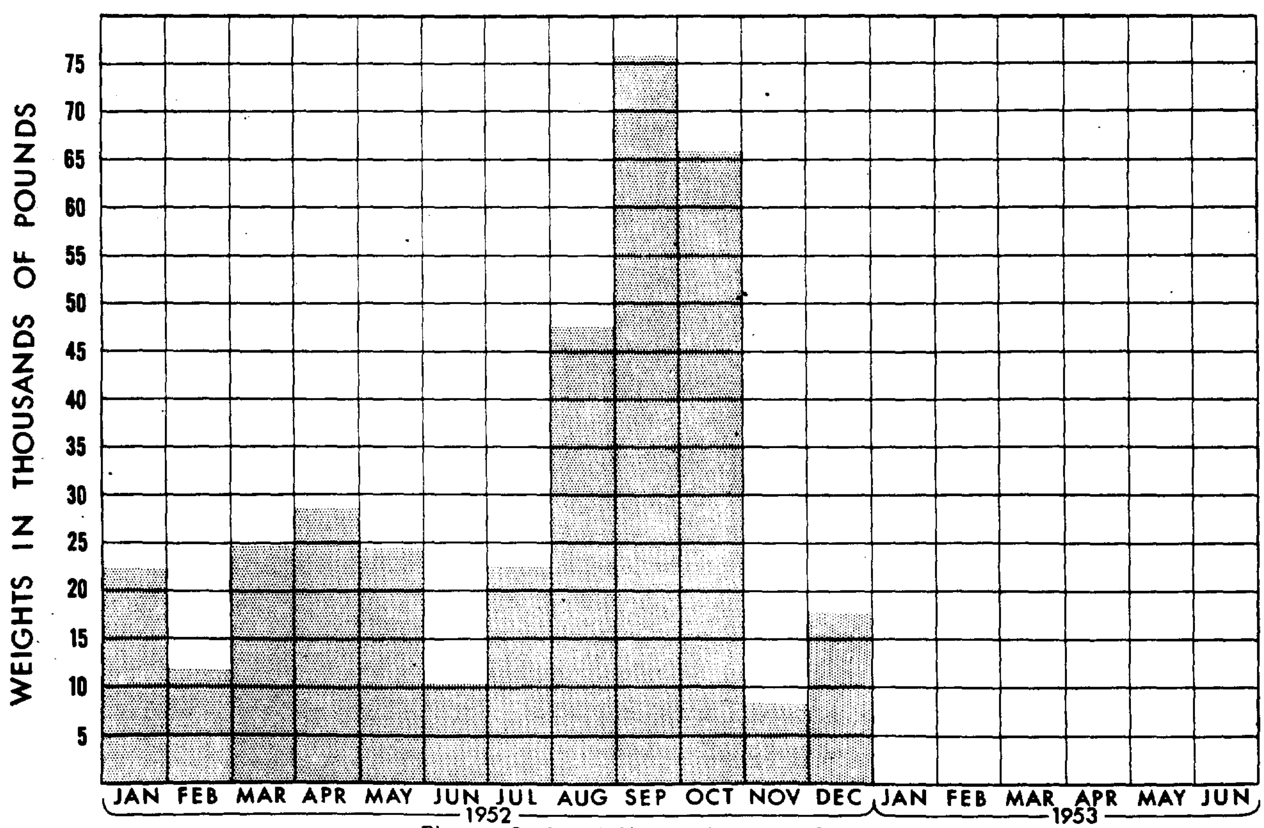


Figure 3-13. Airlift Shipment Chart

TRANSPORTATION

AIR SHIPMENTS. During the period from 1 January 1952 to 31 December 1952, Holmes & Narver shipped via air freight 361,391 lbs. The two high months were September 1952 and October 1952, with air freight shipments of 75,683 and 65,831 lbs. respectively (see Figure 3-13).

WATER SHIPMENTS. During the period from 1 January 1952 to 31 December 1952 Holmes & Narver shipped via water 29,898,017 lbs. The two high months were March 1952 and April 1952 with shipments of 5,042,236 and 4,468,874 lbs. respectively (see Figure 3-14).

SCHEDULING. Cargo for transshipment via water was allocated space aboard a cargo vessel or refrigerated ship (reefer) by Naval Authorities at Oakland. On receipt of notification concerning vessel availability, preparations were made for receiving as much material as possible for loading purposes. In the case of perishable commodities for loading aboard reefer ships, Jobsite requirements for the particular month determined the amount of space allocated. As a general rule, space for Holmes & Narver's use was set aside aboard one cargo vessel and one reefer per month. During some peak periods two cargo vessels a month were assigned.

Material was scheduled for air freight when the Jobsite requirements were such that the faster method of transshipment was essential. Figure 3-15 notes the combined Water and Air Shipments by monthly periods from January 1952 to December 1952.

HANDLING OF RECORDS, INVOICES, CLAIMS

Records covering the transportation of materials to Jobsite included the U. S. Navy Ship's Manifest, prepared by Naval Agencies and forwarded to the Holmes & Narver Home Office, and the Air Manifest. The latter was prepared by the Holmes & Narver representative at Travis Air Force Base, California, and forwarded daily to the Home Office. These documents were received by the Traffic Department and processed and filed for future reference. Copies of all manifests and supporting documents were dispatched to the Jobsite for advance information.

Claims for damaged and lost material were initiated and processed by the Traffic Department and referred to the Accounting Division.

MATERIAL AND EQUIPMENT INSPECTION

For the execution of Contract AT-(29-2)-20, the Holmes & Narver Home Office Inspection Section was set up under the direction of the Assistant to the Project Manager. The activities, methods of reporting, and procedures initiated

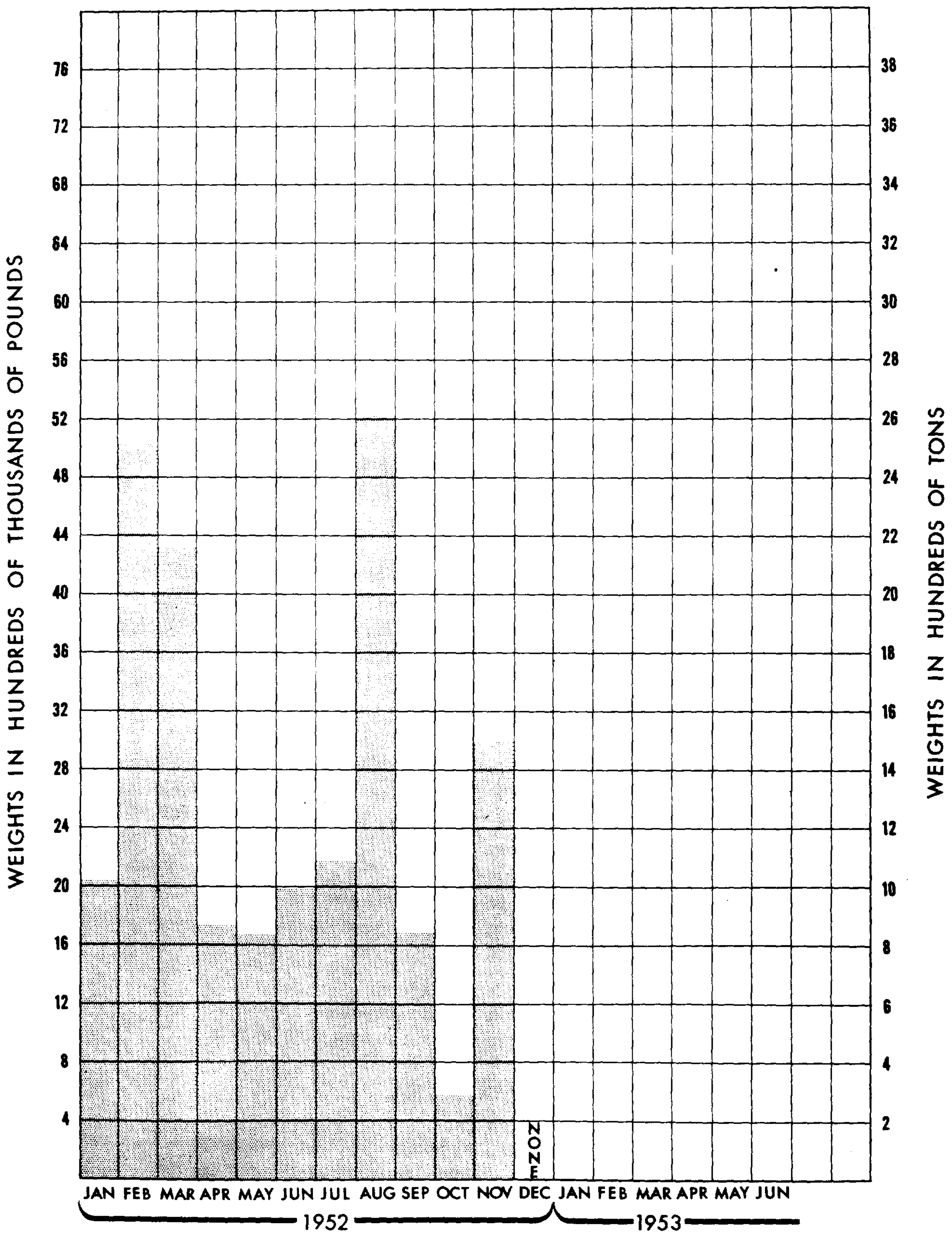


Figure 3-14. Water Shipment Chart

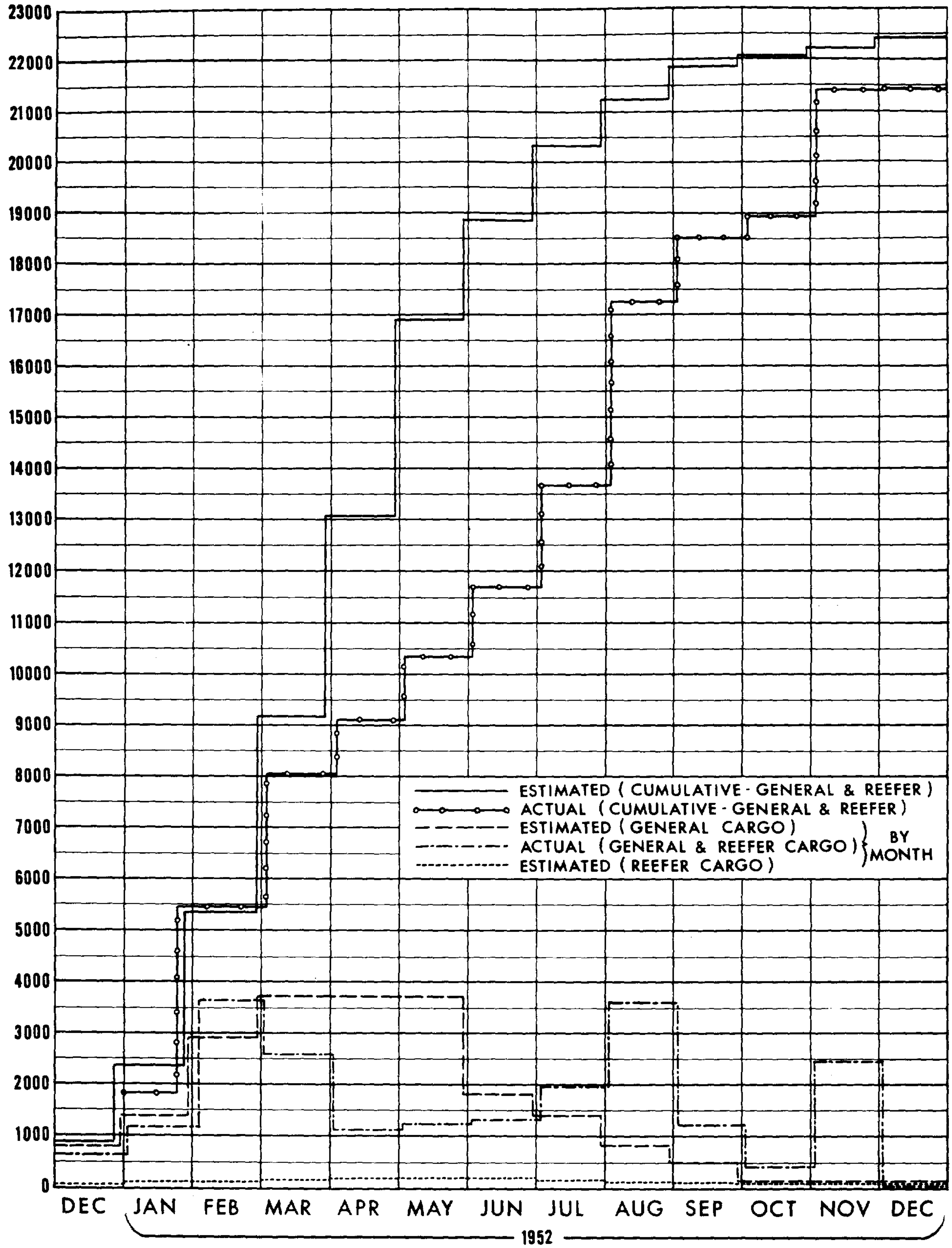


Figure 3-15. Combined Water and Air Shipments in Measurement Tons

by the Inspection Section were submitted to him for approval and clearance. Inspection procedures were divided into two categories; technical inspection to cover all fabricated materials and special equipment, and inspection to verify the condition and genuineness of standard parts and materials.

Procurement inspection was limited to "shelf goods" to ascertain that materials of this type were as specified. Inspection of these items were performed by the Expediters and by Holmes & Narver representatives at Pacific Ports Industries.

For inspection of fabricated and special equipment the Inspector was furnished with a copy of the Material Requisition, a Preliminary Drawing, and a copy of the Specifications (if issued). Pending the selection of a vendor, an Inspector reviewed the conditions of the Material Requisition and studied the Drawing and Specifications. If any part of this data was not clear and understandable, it was taken up with the department concerned for clarification. When a Purchase Order was issued, a file was set up containing a copy of the Material Requisition, the Drawings and Specifications. The Inspector made an initial visit to the vendor's plant and reviewed the Drawings and Specifications with the vendor and endeavored to establish a definite fabrication and inspection schedule. The facts obtained by the Inspector were then set forth in a written report.

The Inspector was then required to follow the material and all phases of fabrication in the vendor's shop, up to and including final acceptance, and was responsible for ascertaining that the vendor met all the requirements of the Specifications, Drawings, and conditions of the Purchase Order.

All revisions in design, fabrication, or delivery schedule which were presented to the Inspector by the vendor during plant inspection were referred directly to the Assistant to the Project Manager. Subjects so referred were either cleared directly by him through the proper Department Head concerned, or were taken up by the Inspector if so directed.

Inspection records and reports were executed and filed by the Inspector after each visit to the vendor's plant. Inspection reports were both factual and accurate. While fabrication was in process, and prior to completion of the purchased item, these reports were made out on an Interim Form. Distribution of these reports were made to the Construction Department, to the Holmes & Narver receiver at Pacific Ports Industries, and to the Traffic and Inspection Sections of the Procurement Department. When inspection was completed, a final report was issued showing either acceptance or rejection. Distribution of these final reports were made to Construction, Purchasing, Traffic, Jobsite (2), Inspection and Accounting.

The master inspection file contained all information pertinent to the equipment or the fabrication of materials, and this file was not marked completed until the material or equipment had been accepted and shipped.

In some cases the equipment purchased was manufactured in a plant located in the middle west or eastern seaboard; the vendor was then required to ship directly to the Naval Supply Center, Oakland. In such instances, inspection at the source was not practical and the vendor was required to furnish Holmes & Narver with not less than three copies of a certificate stating that equipment met all requirements of the Purchase Order. In cases involving mechanical or electrical equipment three copies of test reports were required from the manufacturer.

In cases where Certificates of Compliance or Certified Test Reports were required in lieu of Inspection at Source, the file was held open until such Certificates were received.

Effective 1 December 1952 the Inspection Section was transferred to the Procurement Department, in order to provide more effective coordination of this activity.

EXCESS PERSONAL PROPERTY

A "Special Assignments" Section was installed on 19 May 1952 within the Supply Division at the Jobsite for the primary purpose of setting up a complete stock analysis to obtain the monthly usage factors of that class of material and equipment which is not fixed in place and therefore which is classified as Personal Property. This analysis was based on an eighteen-month period covering the stock activities from 1 January 1951 through 30 June 1952. The figures obtained in this analysis were then used as a guide in determining the amounts of each individual item of stock that would be required for the following twelve-month period. The balance of the stock over and above the twelve-month requirement was then deemed to be in excess and, with the exception of inconsequential items, was reported on a "Report of Excess Personal Property". The finalized reports accompanied by the Jobsite Journal Vouchers were approved by the Superintendent of Supply and the Project Manager and were then forwarded by the Jobsite Controller to the Home Office Controller for necessary accounting entries. Reports of excess were then directed to the Material Control Section for their review against existing and subsequent requisitions.

Jobsite Procedure D-2, "Excess Personal Property", was originated to comply with the requirements established by the AEC Property Management Branch. (Bulletin SF-S&S-3, Serial No. 73 entitled "Reporting and Classification of Excess Personal Property".) The reports were sent in on O/S Form 324 and O/S Form 325 (Continuation Sheet).

Following is a compilation of all reports of Excess Personal Property and withdrawals reported from 6 June 1952 thru 30 September 1952:

	EXCESS REPORTS		WITHDRAWALS	
NUMBER	AMOUNT	ITEM	AMOUNT	ITEM
1	$ 2,943.67	Beer Hall Beverages		
2	13,600.93	Dining Hall Food		
3	122,902.26	Construction		
4	3,480.00	Marine Parts		
5	14,261.68	Plumbing		
6	5,693.16	Construction		
7			$ 667.62	Dining Hall Food
8	270,356.42	Special Structures		
9	28,413.93	Plumbing		
10			24,940.98	Special Structures
11	Excess Marine Parts (Navy)			
12	42,642.24	Paint		
13	24,705.00	Camp Supplies		
14	4,778.48	POL		
15			1,931.29	Plumbing
16	99,060.30	Electrical		
17	52,349.79	Marine Parts		
18			245,415.44	Special Structures

	EXCESS REPORTS		WITHDRAWALS	
NUMBER	AMOUNT	ITEM	AMOUNT	ITEM
19			$91,795.75	Construction
20	$93,185.87	Construction Amended		
21			11,489.45	Marine Parts
22			7,164.99	Electrical
23			57.79	Beer Hall Beverages
24			614.30	Paint
25			886.88	Camp Supplies
26			148.10	Marine Parts
27			1,213.58	Electrical
28			1,939.34	Plumbing
29			23,818.12	Camp Supplies
30			44,192.24	Marine Parts
31			32,667.47	Paint
32			12,933.31	Dining Hall Food
33			2,885.88	Beer Hall Beverages
34			90,681.73	Electrical
35			38,804.98	Plumbing
36			129,985.54	Construction

	EXCESS REPORTS		WITHDRAWALS	
NUMBER	AMOUNT	ITEM	AMOUNT	ITEM
37			$ 4,778.48	POL
38			9,360.47	Paint
	$778,373.73		$778,373.73	

PERSONAL PROPERTY IN LONG SUPPLY

It was decided in the Property Management Meeting held in Albuquerque, New Mexico on 17 July 1952 that the bulk of reporting excess materials by Holmes & Narver would fall under the category of "Personal Property in Long Supply" rather than "Excess Personal Property". Jobsite Procedure D-2.1 was originated to cover this phase of reporting and plans were made to revise immediately all previous reports of "Excess Personal Property" and initiate reports of "Personal Property in Long Supply".

On 15 October 1952, the Special Assignment Section began an analysis of each individual Kardex card at Jobsite, using as a basis the former comprehensive analysis sheets compiled for the orignal reports of excess, plus the usage of all items from 1 June 1952 thru the dates appearing on each successive report of Long Supply.

Through 15 November 1952, six Reports of Personal Property in Long Supply on O/S Form 360 and O/S Form 361 (Continuation Sheet) have been completed, and reported as follows:

NUMBER	ITEM	AMOUNT	DATE
1	Camp Supplies	$ 16,314.84	15 October 1952
2	Dining Hall Food	8,619.87	15 October 1952
3	Plumbing	139,765.11	5 November 1952
4	Paint	33,322.79	5 November 1952
5	Metals & Shop Steel	26,725.31	10 November 1952
6	Electrical Construction	189,252.28	15 November 1952
	TOTAL	$414,000.20	As of 15 November 1952

PRINCIPAL VENDORS

FABRICATED MATERIALS AND SPECIAL EQUIPMENT

Norton Wholesale Electric Co.
Mullenback Electrical Mfg. Co.
Square D Co.
Trumbull Electric Co.
Westinghouse M & R Shop
Westinghouse Electric Corp.
American Wholesale Electric Co.
Associated Wholesale Electric Co.
General Electric Supply Corp.

STRUCTURAL AND MECHANICAL

Butler Manufacturing Co.
Preferred Equipment Co.
American Construction Co.
Canvas Specialty Mfg. Co.
The Cookson Co.
Cutting Engineering Works
Electric Tool & Supply
Hoertig Iron Works
National Metal & Steel Corp.
Mac Callum Steel Corp.
Crane Hoist Engineering Co.
Kyle Steel Construction Co.
Kimball Elevator Co., Ltd.
Kilpatrick & Co.
Industrial Air Conditioning
Weldors Co.
The Robson Co.
Pacific Iron & Steel
Otto K. Olsen
National Steel & Ship Building
Consolidated Western Steel

CONSTRUCTION AND MAINTENANCE SUPPLIES

California Industrial Supplies Co.
California Metals Co.
Cleaver-Brooks Co.
Cleveland Diesel Eng. Div. GMC
Columbia-Geneva Steel Div.
Garlinghouse Brothers
The General Fireproofing Co.
Gilmore Steel & Supply Co., Inc.
Harbor Plywood Corp.
Hercules Powder Co., Inc.
Hollywood Wholesale Electric Co.
Keenan Pipe & Supply Co.
E. C. Livingstone & Co.
Monarch Lumber Corp.
Naval Supply Center
Owen Bucket Co.
Peterson Tractor & Equipment Co.
H. H. Robinson Co.
Simonds Machinery Co.
Sutorbuilt Corp.
Crane Co.
Crofton Diesel Engine Co.
Cummins Service & Sales
Ducommun Metals & Supply Co.
Fairbanks Morse & Co.
General Chemical Div.
General Services Administration
Graybar Electric Co., Inc.
C. H. Hendry Co.
Highland Park Auto & Truck Supply
Hyster Co.
Kellogg Switchboard & Supply Co.
Mack Motor Truck Corp.
Narragansett Wire Co.
Oakland Aluminum, Inc.
Permanent Cement Co.
Republic Supply Co.
Santa Cruz Portland Cement
Sinclair Paint Co.
Triangle Steel & Supply Co.

CONSTRUCTION AND MAINTENANCE SUPPLIES
(Continued)

U. S. Plywood Corp.
Westinghouse Electric Supply Co.
Westinghouse Electric Corp.
Wooldridge Mfg. Co.

SUBSISTANCE SUPPLIES

Brown & Williamson Tobacco Corp.
California Poultry Co.
Caraco Ship Supply
O. Casperson & Sons
Virg-Davidson-Chudacoff Co.
John DeMartini Co.
Fredericks & Co.
Haas Brothers
Ed Heuck Co.
Holly Meat Packing Co.
Nat Jolton Co.
G. M. Lawless & Co.
A. Levy & J. Zentner Co.
Luce & Co.
Miller Brewing Co.
O'Brien, Spotorno, Mitchell & Compagno Bros.
Prairie Kist Foods
S. & W. Meat Co.
Schenley International Corp.
Schweitzer & Co.
Sunshine Specialty Products
Tiedemann & McMorran, Inc.
Western Dairy Products

SECTION 8. EXPORTING AND PACKING

GENERAL

The Exporting and Packing of material and equipment was a function of the Traffic Section of the Holmes & Narver Purchasing Department. Where export packing was not provided by the vendor, it was accomplished under a contract with the Pacific Ports Industries, Oakland, California.

Temporary delays of Air Shipments from Travis Air Force Base occurred in a few instances due to priority of shipment for military materials. Air freight was very heavy during the months of September and October, the total amounting to over 140,000 lbs. The shipment of such a large quantity of air freight was accomplished through close cooperation of Holmes & Narver representatives with the Air Force Base personnel.

METHODS AND PROCEDURES

The methods and procedures used by Holmes & Narver in handling exporting and packing coincided as nearly as possible with methods set forth in Bureau of Foreign and Domestic Commerce - U. S. Department of Commerce. As an example, the following is quoted to cover type of packing cases. "Nailed wooden boxes, reinforced with cleats and battens and reinforced with metal straps or wires, have been the common shipping cases used in export service for many years in all the leading markets. When properly designed and constructed and used for the commodities for which it is best adapted, this standard export shipping case is generally a very satisfactory package for all-round use. It will resist the roughest sort of handling, is proof against the ordinary hazards of puncturing, and the use of straps and sealing devices minimizes pilfering. Such cases can be made so as to require little storage space; knocked-down boxes are delivered in compact bundles, and many types of set-up boxes 'nest' while in storage prior to use."

In the following paragraphs are detailed descriptions of the scheduling of materials both On-Continent and Off-Continent, storage involved, and packing and shipping of these materials.

SCHEDULING

Scheduling of all shipments began with the receipt of a Jobsite requisition. The requisition received from the Jobsite by the Holmes & Narver Home Office was first directed to the Material Control Section of the Operations Division to determine the feasibility of the means of transportation requested on the requisition from the standpoint of the over-all program. The Purchase Order was then written as determined by this Section. In many cases during the program in which the Purchase Order called for water shipment, the shipment had to be changed to air freight due to delay in delivery of material caused by labor difficulties in the supplier's factories, or in certain carrier's lines, and by floods in the Midwest.

Material scheduled for transshipment to the Jobsite via water was delivered to the Naval Supply Center, Oakland, where it was manifested and held for loading aboard cargo vessels. The Western Sea Frontier allocated space aboard the vessels according to the amount of Holmes & Narver material to be shipped. A Holmes & Narver representative was stationed at the Naval Supply Center, Oakland, for the purpose of receiving and scheduling all water shipments. In the case of material being shipped to the Jobsite via air freight a priority permit was required.

STORAGE

When non-perishable material and equipment was received at either the Pacific Ports Industries warehouse in Oakland, or the Holmes & Narver warehouse in Los Angeles, it was immediately checked and inspected for quantity and description as set forth in the applicable Purchase Order. The necessary papers, the Receiving and Inspection Report and the Short or Damage Report were executed by the receiving warehouse. In most cases, the material was immediately processed for export packing and shipping. Very little storage was required in either the Holmes & Narver or the export packers warehouse during this Contract, as the received material was loaded on carriers for transfer to the Naval Supply Center or Travis Air Force Base within a few days.

All perishable goods were delivered directly by the vendor to the Haslett Warehouse Company, Oakland, which firm was under contract with Holmes & Narver for receiving, storing and delivering this type of cargo to Naval Supply Center, Oakland. This material was stored in either refrigerated or ventilated rooms as required. The storage period was brief and material was held only until the day it was to be loaded aboard a refrigerated vessel at the Naval Supply Center.

PACKING AND SHIPPING

The packing of all non-perishable materials and equipment for transshipment overseas was made in cases, or on skids, as required. Packages were standardized as nearly as possible and with the exception of small shipments received at the Holmes & Narver Los Angeles warehouse, the bulk of the packing was done by Pacific Ports Industries, Oakland, California. The loss due to packing during this Contract was slight.

The bulk of materials and supplies requisitioned by the Jobsite were purchased from Los Angeles or San Francisco Bay area vendors and shipment to the export packers or the Naval Supply Center was usually accomplished by truck lines. In a great many instances our prime vendor reordered from a subvendor and the material had to be shipped from the East or Midwest. This caused many and varied expediting and transportation problems in meeting transshipment schedules. Material being shipped from inland and East Coast States was made by fast truck, rail or air, depending upon the urgency of the items. With packages of little weight and small content, the U. S. Mails were used, when this method of transportation was the most expeditious. Shipment of material from the Pacific Ports Industries to the point of loading was made by truck lines. For perishable commodities, shipment was made to the point of loading by either refrigerated truck or refrigerated rail car, depending upon the size of shipment.

MARKINGS

All packages were stencilled on at least two surfaces with the Consignee designator such as FOGS-H&N-AP-304-EE. Added to this was the Requisition Number, Purchase Order Number and Lot Number. A blue "X" indicating Holmes & Narver cargo was placed on all visible surfaces. Labels were attached as cargo designators as follows: blue for general cargo; red for inflammable liquids; white for acids and corrosives and yellow for inflammable solids and oxidizing materials. The gross weight, gross cube and dimensions of each container were indicated. One packing list in a waterproof container was stapled to the outside of the container and one packing list placed inside the container.

RECORDS

Papers and records concerning all types of shipments were directed to the Traffic Department of the Holmes & Narver Home Office, Los Angeles. Upon receipt of these documents, processing, distribution and filing was accomplished. All documents pertaining to Purchase Orders (including receiving reports, inspection reports, vendor packing lists, Jobsite receiving reports) were kept in a numerical Purchase Order file in the Traffic Department. Additional files containing documents pertaining to the transportation of materials were also maintained in the Traffic Department.

After all documents, including Jobsite receiving reports, were received, they were checked to determine if the applicable Purchase Order had been completed. If completed, all documents relating to the Purchase Order were consolidated in one file so that it contained a complete record of activity from the requisition through the Jobsite receiving report.

SECTION 9. JOBSITE SUPPLY AND WAREHOUSING

GENERAL

The Supply Division at the Jobsite, under the direction of the Superintendent of Supply, was comprised of three departments; Material Records, Material Procurement, and Warehousing. The Material Records Department was responsible for maintaining records and control of all Supply Items; the Procurement Department was responsible for all Jobsite requisitioning and the flow of material to the Jobsite; the Warehouse Department was responsible for the physical handling of material which included receiving, storing, protecting, dispersing and shipping.

MATERIAL RECORDS

This Department was comprised of three sections; namely, Kardex, Property, and Inventory. The Kardex Section maintained a current inventory of all warehoused items and maintained control of allocated items. The Property Section recorded all property and equipment, conducted periodic inventories of these items, maintained a record of Memorandum Receipts for all items on loan from Department of Defense Agencies and conducted surveys of damaged or expended materials, property or equipment. The Inventory Section conducted physical inventories of all materials in the custody of the Supply Division.

At the commencement of OPERATION IVY, Kardex records were being maintained in each warehouse for the specific items stored therein. In July 1952, centralization of all Kardex operations was effected by the transfer of all Kardex files to the Supply Division office. Lack of personnel experienced in Kardex operations, prompted the inauguaration of a training program for the purpose of providing adequate trained operators. A Standard Operating Procedure was also developed and distributed. The cards were maintained by Commodity Groups. Each Kardex Commodity Group was "taped" once a month so that a comparison could be made with the Material Control Ledger. A month end closing report was compiled and this was balanced with the Accounting Division Records.

During 1952, all Kardex cards were revised in accordance with the request of the Atomic Energy Commission in order to expand identification of material as to its classification as construction or maintenance material, and to include other information which would assist in the determination of proper stock levels, and in the allocation of materials by structures. This revision had reached 90% completion by November 1952.

Allocation of materials was on a strict control basis on 20 May 1952. At that time all Bills of Materials were analyzed against Stores Issue Slips and the amount of material to be frozen for particular jobs was determined. As of 1 June 1952 all allocations were on a current basis. Close liaison between the material expediter and the allocation clerk was necessary to assure availability of material when needed.

In March 1952, a Kardex Section was established on Gene to control the flow of materials at that site. All materials were shipped to Gene from Elmer on Stores Transfers Slips. The monetary value of materials, except Tool Crib Items, were entered as "debit", the Transfer Slip having been priced at Elmer.

The Property Section of the Material Records Department was activated on 8 February 1952. Records were brought up to date, untagged property was identified and accumulated unserviceable items were surveyed. This section recorded all receipts, marked all property items and inventoried fixed assets. The following major reports were made as shown:

April	AEC-owned Construction Equipment Inventory
June	Machinery and Equipment Physical Inventory
October	AEC-owned Construction Equipment Inventory

The following records were maintained:

All Item Inventory by Holmes & Narver number
All Item Inventory by nomenclature
Memorandum Receipts
Bikini Property

The total number of property items acquired during the first eleven months of 1952 were 1,755. During this period 493 items were surveyed, having a total book value of $221,487.92.

On 15 February 1952 the Inventory Section was established to check the actual materials against Kardex records, and to conduct special inventories as the need developed. Inventories were required by 30 June for Accounting purposes and the following were made:

DATE	ITEM	VALUE	
2 March 1952	POL	$ 37,793.43	
17 March 1952	Steel and Metals	29,267.71	
19-20 March 1952	Paints	74,332.12	
25-26 March 1952	Camp Supplies	71,290.14	
2-11 April 1952	Plumbing Materials	245,185.03	Elmer
	Plumbing Materials	19,749.60	Fred
	Plumbing Materials	6,288.92	Gene
15-18 April 1952	Tool Crib	73,662.61	
18-30 April 1952	Electrical	651,872.37	Elmer
	Electrical	14,045.46	Fred
	Electrical	3,414.78	Gene
1-9 May 1952	Construction Materials	485,748.82	
12-19 May 1952	Marine Parts	381,063.51	
19-27 May 1952	Automotive Parts	546,137.45	
3-16 June 1952	Special Structures	298,272.62	

Cycle Inventories of all categories were commenced in August. An inventory, which covered 2,730 items with a total value of $297,261.27, was taken of the Plumbing Warehouse and its outside storage area during this month. The inventory crew was also engaged in identifying and computing footage of partial and full reels of electric wire cable. These were tagged with proper nomenclature and numbered. The material involved had a total value of $ 187,568.90. An inventory of Tool Crib items was made during the same period. As Site David was rolled up the Inventory Crew was engaged in accounting and preparing for shipment of animal colony equipment and supplies. During September, material for Special Structures was inventoried; all aluminum building parts were measured and re-marked with correct part number; a crew was engaged in taking inventory of all Steel and Shop Metals; and an inventory of Paints was conducted. At the same time a crew was engaged in the preparation and packing of Excess Navy procured marine parts, and all materials in outside storage areas containing General Stores and Construction items were inventoried. An inventory of Camp Supplies was completed in October. For this inventory all boxes or other containers were opened and contents checked, identified and the boxes and containers properly marked. The Refrigeration, Marine and Power Warehouses were inventoried over an extended period as this particular operation was used to utilize man power not required on regular scheduled inventories. This inventory involved checking materials against bin tags and placing of bin tags where found necessary.

In addition to regularly scheduled cycle inventories of equipment and materials, the Inventory Section was engaged in such work as bi-monthly inventory of critical items as blasting caps, bottled gases, welding rods and the monthly inventories of dry and frozen foods, beer and liquors.

MATERIAL PROCUREMENT

The functions of the Material Procurement Department were as follows:

1. Preparation of Field Requisitions for all equipment, material, tools, supplies and subsistence required for Operations, Maintenance, and for Construction when not otherwise provided.

2. Expediting: This group maintained close association with superintendents all during the construction period; and, together, they anticipated as far as possible the materials needed to avoid construction delays. Teletypes and memoranda were sent to the Home Office placing emphasis on expediting those items which gave evidence of causing delays in schedules. This group received copies of Advance Material Estimates and Bills of Materials and checked them against unallocated warehouse stock. These Advance Material Estimates and Bills of Materials were filed by "Project" or "Use Feature", in which all procurement and shipping information was posted as received from the Los Angeles Office, from Purchase Orders, Los Angeles Warehouse receiving reports, teletypes, memoranda or other source, which resulted in having a concise, up-to-date record at all times on material by project. From this record, periodic reports were prepared and distributed to

superintendents and other interested personnel. At first, this report was issued twice monthly, but as construction schedules became tighter it was issued weekly. Air freight shipments, upon arrival at the receiving station, were checked, routed to the proper warehouse, and the intended User was notified.

3. Preparation of a Cargo Breakdown on all incoming carriers, listing description, warehouse routing and use feature. This breakdown was prepared on stencils and printed in sufficient copies for distribution to supply personnel who handled off-loading or warehousing, and to all interested parties, including Area Superintendents and other supervisory personnel, as notice to them of the arrival of supplies, and for their information in planning work schedules.

4. Preparation of Jobsite receiving reports and Over, Short and Damage Reports, when applicable, on all incoming material, performing the necessary follow up, and maintaining the necessary controls, to verify receipt of all material manifested on all incoming carriers.

5. Preparation of shipping documents on outgoing shipments for both Holmes & Narver and Users.

6. Comparison of Jobsite receiving reports with applicable Requisitions and Purchase Orders to determine that all items thereon had been received and accounted for.

In the accomplishment of the foregoing functions the following documents were processed:

Field Requisitions	2510
Teletype Requests (Emergency Procurement)	415
Receiving Reports	6230
Over, Short & Damage Reports	200
Air Freight AEC B/Ls	43
Air Freight H&N B/Ls	41
Water Freight AEC B/Ls	296
Water Freight H&N B/Ls	101

WAREHOUSING

During the "Roll-Up" period of OPERATION GREENHOUSE the warehouses, including the POL Storage Area, were operated only on call. At the commencement of OPERATION IVY the warehouses were reopened and operated on a 54 hour week basis, stocks of materials were removed from temporary storage areas and placed in ready condition. Suitable stabilized areas were established for outside storage to accommodate such items as lumber, steel, ore, pipe and generally rough materials.

A Shipping Office was established which handled all inter-island shipments, including heavy equipment and food supplies.

A classification area was established adjacent to the freight pier to which all cargo off-loaded from ships was routed. As the cargo was identified and checked it was sent to the proper warehouse or in some cases direct to the job.

Prior to M-Day all materials and equipment returned from temporary camp sites were checked and stored. Storage of critical materials was given careful consideration and all materials were stored insofar as practicable to decrease possible blast damage.

SECTION 10. SERVICE OPERATIONS MANAGEMENT

The Service Operations Division at the Jobsite, under the direction of the General Supervisor of Service Operations, comprised the Camp, Marine, and Power and Water Departments. The organization with the channels of supervision is illustrated in Figure 3-16. Standard Operating Procedures were published for the guidance of all personnel. These procedures were of particular importance in indoctrination of new personnel of the Division and as a source of information for the Military and Scientific personnel as to the methods and procedures used for service support to them during their stay at the Proving Ground.

During OPERATION GREENHOUSE, the Communication and Maintenance Departments and the Mechanical and Machine Shops were included in the Service Operations Division. During the "Roll-Up" phase of that operation, these activities were transferred to the Construction-Maintenance Division and were operated as a part of that Division during OPERATION IVY. This change in organization was effected in order to place under one directing head, insofar as was practicable, all those employees having like trade classifications. This permitted more flexible use of available man power, eliminated duplication of effort, and provided better supervision.

The factual report of the operations of this Division is found in Section 11 of this Chapter (Intra-Atoll Transportation) and in Chapter II of this Book which details the actual operations of all Camp Facilities and Power Generation and Water Distillation Plants.

The General Supervisor of Service Operations was a member of the Jobsite Staff and reported directly to the Resident Manager and Project Manager. In

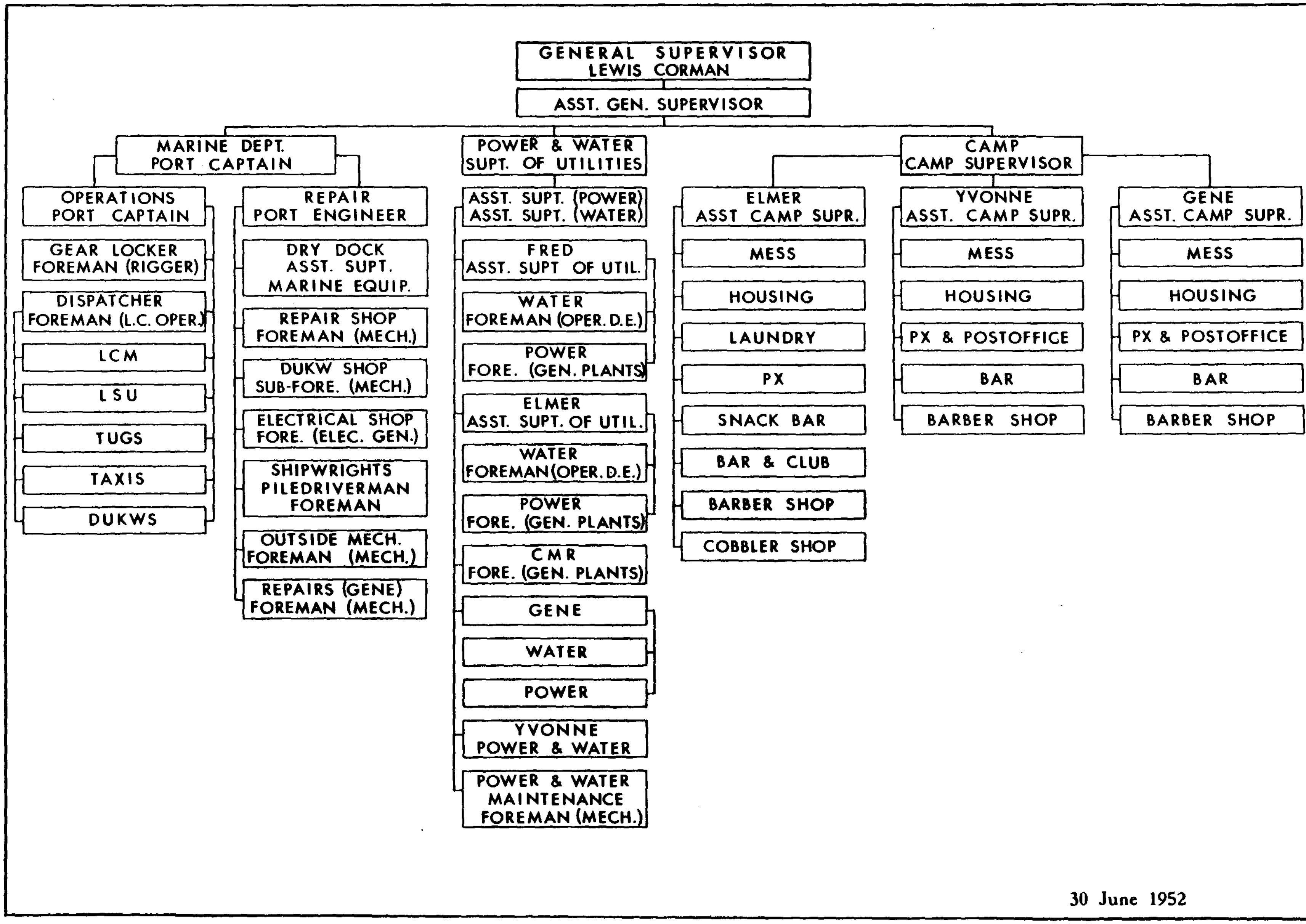


Figure 3-16. Service Operations

connection with the operation of camp facilities, and in matters of service to the Military and Scientific personnel of the Task Force, he conferred frequently with the AEC Resident Engineer and was guided by his advice in these matters. He worked closely with the Headquarters Commandants of the Joint Task Force and of Task Group 132.1. The degree of success which was attained in providing camp services can be attributed to the high degree of cooperation exercised by the diverse elements engaged in the operation.

The General Supervisor of Service Operations was directly responsible for the determination of man power requirements for his Division and the requisitioning of necessary personnel. He maintained administrative control over all personnel matters within the Service Operations Division and such items as changes in classifications, merit increases, discharges, interdepartmental transfers and personnel movements required his prior approval for accomplishment. He initiated all operating schedules for camp facilities, as: mess hall, PX, bar and Post Office hours. He maintained close surveillance over the activities of the Marine Department and kept the Project Manager informed as to the number of active marine craft required. In this connection he advised the Project Manager as to when marine craft on loan from the Navy should be returned or exchanged. When this was effected he designated Holmes & Narver personnel for the Joint Inspection of the craft with representatives of the U. S. Navy in accordance with the terms and conditions for loan of vessels by the Navy Department to the Atomic Energy Commission as contained in OPNAV 4000.10, Serial 1623 P43 dated 29 October 1951. A copy of all reports of these joint inspections were furnished the AEC Resident Engineer for use in final accounting with the U. S. Navy. The General Supervisor of Service Operations compiled statistics concerning power production and fresh water consumption, and determined therefrom the adequacy of the facilities provided. By closely checking daily water consumption the number of stills installed on Gene was kept to a minimum. The functions of the Marine Department and the Power and Water Distillation Department are outlined in the following paragraphs.

MARINE DEPARTMENT. The Port Captain was responsible to the General Supervisor of Service Operations for the conduct of the activities of the Marine Department. He assigned crews to craft and supervised their operation. He was required to conduct frequent inspections of all craft to determine their seaworthiness, adequacy of fire protection devices, sufficiency of life preservers, and to insure compliance with the Safety Regulations issued by the Safety Engineer. He was required to coordinate all requests for marine transportation and to schedule trips so as to make full use of available craft. He was responsible for marking all channels, and for planting and overhaul of mooring buoys. He acted as liaison officer between the Army Port Commander and Commanding Officers or Masters of vessels in the harbor in matters requiring coordinated marine effort involving Holmes & Narver operated craft. He was responsible for all deep sea diving operations. Prior to permitting any deep sea diving operations, which were limited to depths of 130 ft., he was required to have all divers examined by the Jobsite physician.

The Port Engineer was the assistant to the Port Captain for the maintenance and repair of all marine craft and equipment. He directly supervised the operation of the shops, dry dock and Gilhoist. He maintained a boat history for each craft in which was entered all items of maintenance or repair. He maintained fuel consumption and engine operating hour records. He was responsible for ordering supplies and spare parts and was required to maintain a four months' supply based on the number of craft in active operation.

POWER AND WATER DISTILLATION DEPARTMENT. The Superintendent of Utilities was responsible for the proper operation and maintenance of all Power and Water Distillation Plants. He made assignments of personnel to the plants. He was required to maintain operating logs and to check these logs for variations from normal operations which might disclose malfunctioning of equipment. He was required to maintain a machinery history for each engine detailing all items of repair. He was required to submit requisitions for spare parts and supplies so that a six-month level was maintained. He submitted the following reports to the General Supervisor of Service Operations:

DAILY

1. Power Plant operations containing KW hours, operating hours, plant utilization factor, fuel oil and lube oil used.

2. Distillation Plant operation containing water in storage, produced, consumed, gained or lost, operating hours, and consumption between the hours of 2400 to 0400.

WEEKLY

A report summarizing all items of major maintenance performed during the week.

CAMP

The Camp Supervisor was responsible for the operation of all camp facilities. These facilities were Housing, Messing, Laundry, Post Exchange, Snack Bar, Bars and Clubs, Post Office, Barber Shops and Cobbler Shop.

HOUSING

Assignments to quarters were made by a housing clerk acting for the Camp Supervisor, who maintained a complete record of these assignments. A file was also kept of all Holmes & Narver personnel on the Jobsite, indicating name, payroll number, barracks, room or tent number and camp in which the man was located. The housing clerk kept the Post Office and laundry informed of all inter-island personnel movements. Janitorial service was provided for barracks, tents, latrines, recreation hall, bars and clubs, library and all offices within the Administration Compound.

MESS

The Camp Supervisor prepared monthly menus for the approval of the General Supervisor of Service Operations. At each camp a chef was designated in charge of the operation of the Messing Facilities. He was required to check the preparation of each meal, maintain records of receipts from warehouse and reefers, and maintain spoilage records. Every effort was made to keep waste to a minimum. The chef was furnished a list of employees who required feeding at hours other than those scheduled and was instructed to refuse service to those not so listed. Take-out meals were normally prepared and packaged on the midnight shift. All visitors to the mess hall not on Holmes & Narver subsistence rolls were required to register, and if officers or civilians of officer status, were required to pay forty cents in cash for each meal. The register and the cash collected were submitted to the Controller. The Controller then made the necessary exchange of funds with the Army to compensate for meals obtained by enlisted men from the Holmes & Narver mess and meals obtained by Holmes & Narver personnel at Army messes. Monthly requisitions for food were prepared 90 days in advance of requirements. Food requirements were estimated on a basis of man power forecasts, with the intent of maintaining a 60 day supply of dry stores, and a 30 day supply of frozen stores on hand at all times. Chilled stores, subject to spoilage, were ordered only on a monthly basis.

LAUNDRY

The laundry on Elmer was operated under a Laundry Foreman servicing all sites. Weekly service was provided and schedules of pick up and delivery were published by bulletins. A definite procedure for making up laundry bundles, and their markings, was issued. The Foreman was kept informed of the movement of all employees between sites in order that laundry could be delivered to the proper site. Finished laundry for this operation was limited each week to three shirts and three pair of trousers. Other laundry was not limited but was not ironed. A complete record of laundry production was kept.

POST EXCHANGE

The PX stores were operated to provide the employees with articles of ordinary use, wear or consumption at reasonable prices. Merchandise normally classed as luxury items was not carried. Prices were established by the

Resident Controller to operate on a break-even basis; that is, items were marked up to cover cost, salaries, and an estimated amount to cover cost of purchasing and export packing. With the approval of the General Supervisor of Service Operations and Resident Controller, reduction in retail prices was permitted for merchandise which was slow moving, inferior in quality or damaged or subject to spoilage. A three months' supply on hand was the minimum stock level and a three months' supply was the maximum order allowable. All receipts of merchandise were carefully checked against requisitions and packing lists. A copy of the packing list, together with Over, Short and Damage Report was transmitted to the Accounting Division. Stock record cards were maintained of all Post Exchange merchandise in the warehouse.

Physical inventories of all stores were taken at the end of each accounting period, or when a change in Store Managers occurred. The taking of the inventory was witnessed by representatives of the Accounting Division. A record of sales of each item was maintained throughout the operation, and usage factors thereby established for ordering purposes.

SNACK BAR

A snack bar was operated on Elmer for the sale of sandwiches, soft drinks, and popcorn. Retail prices were established by mutual agreement of the General Supervisor of Service Operations and the Resident Controller, and a price list was kept posted on the premises. Stores for the snack bar were drawn from mess hall stock. Physical inventories of stock were taken at the close of each accounting period, and audit of the snack bar was accomplished by the Audit Section of the Accounting Division.

BARS AND CLUBS

The Club Manager, under the direction of the Camp Supervisor was in charge of all liquor and beer sales. Liquor was only sold across the bar by the drink. The following abuses were sufficient cause to deny the privileges of the bar to any employee:

1. Removal of liquor or beer from the bar premises.

2. Creation of a disturbance on the bar premises.

3. Intoxication to such a degree as to become a nuisance and annoyance to others.

4. Unauthorized possession of liquor and/or beer in quarters.

A daily inventory was taken of all bar stocks on hand, which inventory was subject to frequent audits by the Accounting Division. A monthly inventory of bar and warehouse stocks was required. A three months' supply on hand was the minimum stock level and a three months' supply was the maximum order allowable.

POST OFFICE

The Post Office was under the direct supervision of the Camp Supervisor. The Post Office was operated in accordance with postal regulations as contained in the Departments of the Army and Air Force special regulations SR 65-220-1 AFM 182-3 for Unit Mail Service. One postal clerk was placed in charge and he was allowed a working fund of $650.00 to transact cash business. The Accounting Division made frequent audits, without advance notice, of this account. The Post Office maintained a corrected list of all employees and their location by sites. All employees assigned to postal duties were bonded.

BARBER SHOPS

The barber shops were under the direct supervision of the Camp Supervisor. Barbers were recruited from among Jobsite employees for work during their off hours. The price of haircuts was established at sixty-five cents. With the provision that barbers furnish expendable supplies under this arrangement the barbers retained all revenue as their compensation.

COBBLER SHOP

The cobbler shop was under the direct supervision of the Camp Supervisor. Cobblers were recruited from among Jobsite employees for work during their off hours. A small stock of needed materials was maintained by Holmes & Narver for sale to the cobblers. The price for work was established as follows: heels only sixty-five cents; half soles one dollar and sixty-five cents; heels and half soles two dollars. As a fair return for his labor and the materials he the cobbler was permitted to retain all monies received by him.

SECTION 11. INTRA-ATOLL TRANSPORTATION

GENERAL

Jobsite transportation requirements for personnel and cargo were met during the construction phase of the operation by the Holmes & Narver Marine Department for water transportation, by the U. S. Air Force Detachment for air transportation, and by the Holmes & Narver motor pool for land transportation. During the operational phase TG 132.3 provided additional marine craft, air transportation was bolstered by Army and Navy air elements, and TG 132.1 and Headquarters of JTF 132 augmented the land vehicles and established motor pools primarily to provide service for the personnel of their respective organizations.

Central dispatchers for each type of transportation were established on Elmer who were responsible for the maximum utilization of the craft or vehicles. During the accelerated phase of the operations, assistant dispatchers were set up on Gene and Yvonne for marine and on Gene for air transportation.

MARINE TRANSPORTATION

The Marine Department functioned as a component of the Service Operations Division. The Port Captain was held directly responsible for the operational control of this Department. The Marine Craft available at the Jobsite at the commencement of the operation consisted of 19 LCMs, seven LCUs, two YTLs, three Seacraft, three DUKWs, four YC barges, one Sea Mule and one Floating Dry Dock. Prior to the operational phase two LCUs were returned to the U. S. Navy, two YC steel barges and six DUKWs were acquired and the Sea Mule was replaced by one built at the Jobsite. After completion of this operation one LCU and six LCMs in the custody of Holmes & Narver were exchanged for similar craft with the U. S. Navy.

The volume of traffic and the general over-all type of cargo carried were closely watched and regular boat schedules were established and published so as to make maximum use of available operating craft. The assignment of craft to meet the varying daily needs of the Construction and Service personnel was the responsibility of the Port Captain. In order that he could coordinate the use of all craft, requests for their use was normally required by 1700 of the day previous to that in which required. This was of particular importance in the early stages of the construction on Gene, when marine craft could beach only during certain periods of high tides. Weekly schedules of times during which boats could remain on the beach at this site were published in advance. This was invaluable in planning the cargo to be landed at the scheduled beaching periods.

The stevedoring and off or back loading of cargo vessels was the responsibility of the Army Port Commander. Holmes & Narver provided the barges or other craft for this work and the number so furnished was determined by mutual agreement of the Army Port Commander and the Holmes & Narver Port Captain.

On 15 September Commander Task Group 132.1 assumed operational control of the Holmes & Narver boat pool and retained this control until 14 November. For this period a representative of Commander Task Group 132.1, generally stationed during working hours in the Port Captain's Office, detailed the craft for the various tasks required. The proper operation of the craft remained a responsibility of the Port Captain, particularly in matters of safety and proper loading of cargo in the craft. This arrangement interjected a problem of management as Holmes & Narver was held responsible for keeping overtime hours to a minimum without having control of the working hours of the boat crews.

During the period of the operational phase, the marine craft at the Jobsite were augmented by those provided by Commander Task Group 132.3 and Commander Task Group 132.2. Task Group 132.3 furnished 5 LCUs on a full time basis and LCMs as requested daily. The number of LCMs of TG 132.3 so used, varied from four to eight, depending on the daily need for boats. In addition to the craft provided by TF 132.3, Army manned DUKWs were provided by Commander Task Group 132.2.

All Holmes & Narver marine craft except DUKWs were equipped with ship to shore radios. This facilitated control of the craft when out of sight and permitted diverting of craft to other than their designated destinations as need for such diversion arose. With this radio network, the marine dispatcher could always maintain contact with all boats. All operators were required to report their departures from a site and their estimated time of arrival at their destination with information as to the need for assistance in loading or unloading their cargo, by riggers, heavy equipment personnel, or others. The dispatcher therefore could make advance arrangements for this assistance and thereby reduce the time of the boat on the beach or at the dock. This radio network was of invaluable assistance in providing safe and efficient operation. In general, marine operations differed little from those of the previous operations.

The number of operating craft by type as of the last day of each month is indicated in the following table:

SUMMARY OF OPERATING MARINE CRAFT

MONTH ENDING	LCMs	LCUs	TUGs	DUKWs	TAXIS
1952					
31 January	8	7	1	4	2
29 February	9	4	1	4	2
31 March	9	4	1	4	2
30 April	10	5	1	7	2
31 May	10	5	1	9	2
30 June	10	5	1	9	2
31 July	11	5	2	8	3
31 August	11	5	2	14	2
30 September	12	5	2	16	2

SUMMARY OF OPERATING MARINE CRAFT - Continued

MONTH ENDING	LCMs	LCUs	TUGs	DUKWs	TAXIS
1952					
31 October	13	5	2	3	2
30 November	10	2	2	3	2
31 December	5	2	1	3	1

The number of passengers and the amont of cargo carried with the total number of beach or pier landings for each month are shown in the following table:

MONTH ENDING	BEACH & PIER LANDINGS	PASSENGERS CARRIED	MEASUREMENT TONS HANDLED
1952			
31 January	1807	7,990	26,580
29 February	1453	7,045	27,644½
31 March	2306	7,921	31,956
30 April	2553	10,109	37,346½
31 May	2059	9,904	38,622
30 June	2829	11,264	66,026
31 July	2557	11,189	65,677
31 August	3872	16,583	63,212
30 September	5036	15,095	76,466
31 October	4775	12,301	62,735
30 November	1469	8,267	46,677½
31 December	1528	7,707	29,793

AIR TRANSPORTATION

Intra-Atoll air transportation was provided to Holmes & Narver during the early construction stages of OPERATION IVY by Task Group 132.4 through its facilities at Fred. During this time, air transport requirements were relatively small and the utilization of two or three L-13s daily, satisfied the requirements of Holmes & Narver for movement of personnel, mail and urgently needed construction materials and supplies. Air dispatching was handled through the Project Manager's Office on Site Elmer by the Office Manager, who placed all requests for air transportation direct with Liaison Aircraft Operations at Fred. This system worked satisfactorily until summer when increased demands for air support due to the arrival of scientific and other participating personnel necessitated the placing of an air dispatcher at the Site Elmer Airport on 11 August 1952 to process requests for air travel. Seven principal airfields were used; Figure 3-17 shows their locations.

For the Operational Phase a flight schedule was maintained with planes departing from Elmer for Gene each morning at 0745, 0900, 1000 and 1100 hours, and returning from Gene to Elmer at 0815, 0930, 1030 and 1130 hours. Afternoon flights commenced at 1330 hours from Elmer and were made at 1430 and 1530 hours, whereas return flights from Gene started at 1400 hours, and were made at 1500 and 1600 hours. Routine stops were also made for passengers at other island locations within the Atoll. Traveling time from Elmer to Gene was approximately 22 minutes by L-13. Emergency air lift service for spare parts was available in case of equipment breakdown.

With the arrival of the Joint Task Force at the Jobsite, the J-3 Division of the staff of JTF 132 acted as the coordinating agency between Task Group 132.1 and 132.4. Prior to M -5 Day, the Holmes & Narver dispatcher exercised operational control under the guidance of these Task Group Representatives. This operational control was assumed by the J-3 Division of the staff of JTF 132 for the period M -5 Day through M -1 Day and by Rad-Safe for the period M -1 Day through M +9 Day.

During the operational period there were seven L-13s made available by the Air Force for scheduled trips (0730 to 1130 hours and 1330 to 1630 hours), augmented by two H-13s and two H-19s. The Navy, during critical stages, provided four H-19s. The following table indicates the number of air passengers during a typical week of the operational period of 6 October through 12 October 1952:

See page 3-102 for above table.

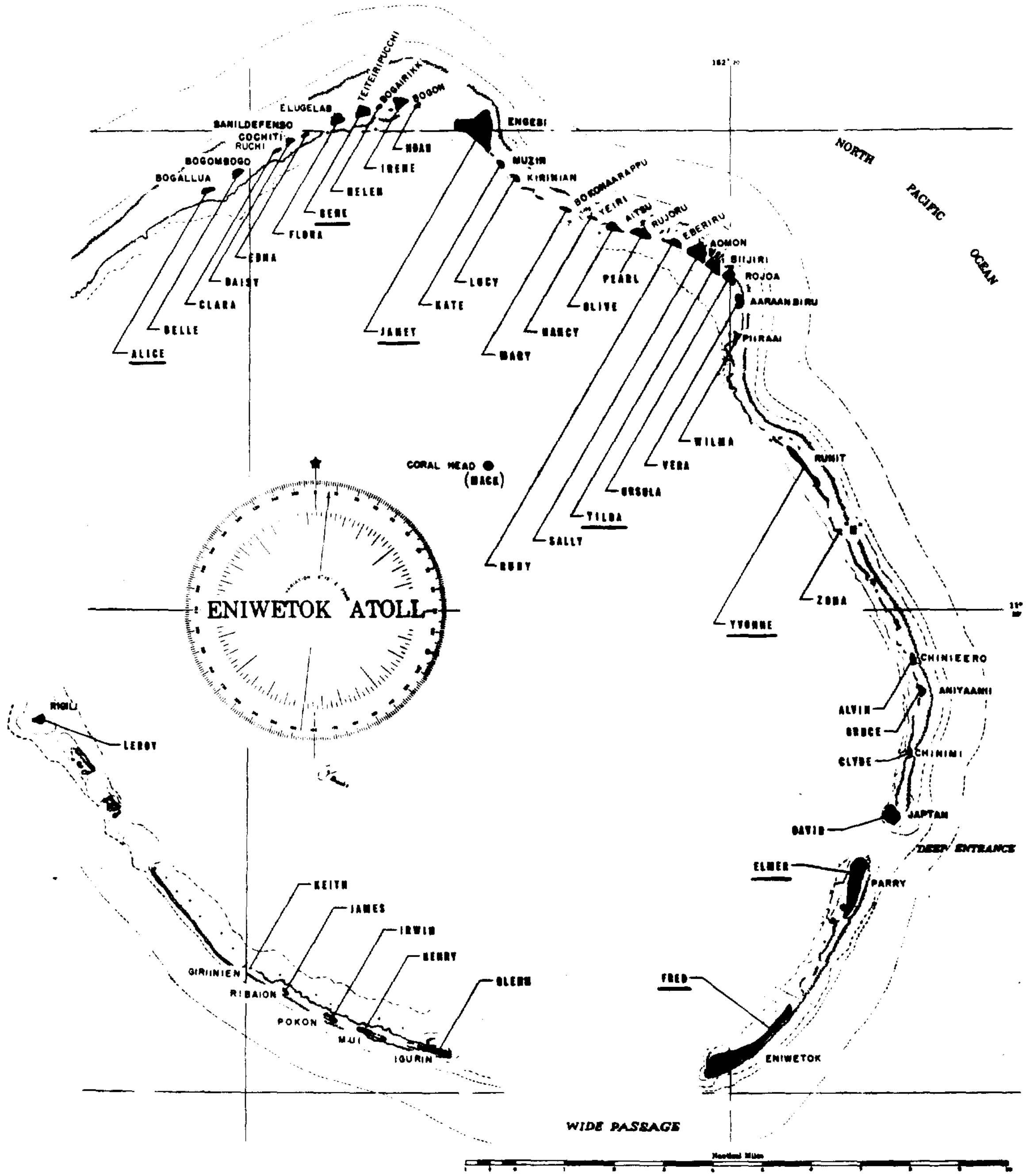


Figure 3-17. Sites Underlined Indicate Airfield Location

USING AGCY.	OCT. 6	OCT. 7	OCT. 8	OCT. 9	OCT. 10	OCT. 11	OCT. 12	USING TOTALS
132	11	0	6	12	12	12	6	59
132.1	154	185	144	153	141	141	73	991
132.2	6	12	14	7	15	18	7	79
132.3	4	4	9	5	6	6	3	37
132.4	3	0	12	10	13	2	0	40
Daily Total	178	201	185	187	187	179	89	1206

Cumulative work load totals for the same week were as follows:

Number of passengers flown	1,206
Passenger miles flown	23,708
Air lift pilot hours flown	311:55
Landings	1,345
Cargo pounds carried	8,639

The following table is a basic comparison of aircraft schedules between the early Construction and Operational phases:

AIRCRAFT SCHEDULES DURING OPERATION IVY

EARLY CONSTRUCTION PHASE		OPERATION PHASE	
Leave ELMER	Leave GENE	Leave ELMER	Leave GENE
(Daily except Sunday)		(Daily)	
0745	0815	0730	0800
0900	0930	0800	0830
1000	1030	0830	0900
1100	1130	0900	0930
1330	1400	0930	1000
1430	1500	1000	1030
1530	1600	1030	1100
		1100	1130
		1330	1400
		1400	1430
		1430	1500
		1500	1530
		1600	1630

Number and type of aircraft available during OPERATION IVY:

EARLY CONSTRUCTION PHASE

NO. OF CRAFT (DAILY AVERAGE)	TYPE	CARRYING CAPACITY	NORMAL INDICATED AIR SPEED
2	L-13	3 Passengers & 100# Cargo	90 mph

OPERATIONAL PHASE

NO. OF CRAFT (DAILY AVERAGE)	TYPE	CARRYING CAPACITY	NORMAL INDICATED AIR SPEED
7	L-13	3 Passengers & 100# Cargo	90 mph
2	H-13	345# Total Passenger and Cargo Weight	75 mph
2	H-19	1200# Total Passenger and Cargo Weight	75 mph

LAND TRANSPORTATION

Land transportation during the construction phase was provided through a motor pool operated by Holmes & Narver. Generally jeeps, pickups, scooters and trucks were assigned to individuals, usually heads of departments, for daily use. With the exception of a few vehicles which were retained by them to meet emergencies, all these vehicles were required to be returned to the motor pool after the day's work was completed. In addition to the regularly assigned vehicles a number were retained in the pool which could be obtained for short periods. Limited bus service was maintained on Elmer between the CMR Area and the Administration Building, and for a short period a taxi service was made available.

With the arrival of the Military and Scientific personnel of the Task Force the number of vehicles was greatly augmented. In September Task Group 132.2 assumed control of the motor pool. This pool not only provided transportation for the Military and Scientific groups but also met the increased need for vehicles by Holmes & Narver. Routine servicing and minor trouble shooting of all vehicles was performed on all islands except Fred by the Holmes & Narver service groups.

The following table indicates the distribution of vehicles in the custody of Holmes & Narver as of 10 September, a date of approximate maximum use prior to the assumption of control of the motor pool by TG 132.2.

SITE	JEEPS	PICKUPS	WEAPONS CARRIERS	TRUCKS	SCOOTERS
Elmer	12	17	16	44	9
Gene	10	0	5	35	2
Yvonne	1	2	0	10	0
Fred	4	1	1	1	1
Janet	2	0	0	0	0
Tilda	1	0	0	0	0
Totals	30	20	22	90	12

SECTION 12. COMMUNICATIONS

GENERAL

The location of the construction project at Eniwetok, as in all overseas work, imposed a severe communications problem. The difficulties inherent in the lack of direct telephone or other type of communication between the Holmes & Narver Home Office and Jobiste were offset through the maintenance of efficient radio-teletype facilities via the AEC and military establishments. This was augmented by the expeditious handling of mail. It was through these means of communication that effective liaison in respect to the many changes which occurred in details of design, construction, requisitioning, hiring and transportation originating at the AEC, Holmes & Narver Home Office and Jobsite locations were maintained. While the radio-teletype system lacked the speed of oral communication, the teletype system had the distinct advantage of furnishing a permanent written record of all instructions and developments, both to and from the AEC, the Holmes & Narver Home Office and Jobsite. This system also expedited the channeling of all messages directly from the teletype machines to specific individuals or departments for action or information with a resultant saving in time and man power.

Effective use was made of commercial telephone services, particularly for the rapid dissemination of information from AEC On-Continent offices and for the procurement and delivery of material and equipment both by the Holmes & Narver Home Office and the Holmes & Narver Honolulu Office. Information or instructions obtained by this means were habitually confirmed by radio-teletype or mail.

TELEPHONE

On-Continent telephone facilities were invaluable in maintaining direct liaison between the Holmes & Narver Home Office at Los Angeles, California, and the Santa Fe Operations Offices at Albuquerque and Los Alamos, New Mexico. These facilities were also used between the Holmes & Narver Home Office and the Holmes & Narver representative at the Naval Supply Center, Oakland and Travis Air Force Base, California for all unclassified matter pertaining to the Program. Transoceanic telephone services were also utilized between the Home Office and the Holmes & Narver Office at Honolulu, T. H. Through the use of these facilities priority demands for the procurement and delivery of equipment and material to meet critical construction schedules were accomplished. This was particularly true during the latter stages of the Program when unforseeable conditions arose which required changes in design and construction.

TELETYPE

Dependable teletype facilities providing direct communications between Los Alamos and the Army Communication Center at Eniwetok Atoll had been established prior to commencement of OPERATION IVY. This facility was available to Holmes & Narver through the use of the teletypewriter and cryptographic machine already installed at the Home Office. This system comprised the primary means of communication between SFOO Albuquerque, New Mexico and between the Holmes & Narver Home Office, Honolulu Office, and Jobsite. Despite difficulties of radio reception between Eniwetok and Los Alamos, due to atmospheric conditions during certain periods of the day, our communications were both rapid and dependable.

A "back-up" teletype facility was available in the event of failure of the primary system. The "back-up" channel operated through the 2nd Army Headquarters at San Antonio, Texas, thence through the Oahu Joint Communication Center, T. H. to Eniwetok. This system was utilized on at least two occasions wherein priority teletype dispatches were received by the 2nd Army, transmitted by telephone to Los Alamos, and thence to Holmes & Narver within a few hours of the dispatch time at Eniwetok.

From the commencement of the construction program until the end of the operational period outgoing SECRET and CONFIDENTIAL classified teletypes addressed to the Jobsite were encrypted in the Holmes & Narver communications office, then transmitted to Los Alamos. At Los Alamos it was necessary to decrypt and re-encrypt them for transmission to the Jobsite. This system imposed an additional load on the Los Alamos communication center and resulted in some delay in transmission time.

As a result, in October 1952, it was decided that a special one-time cryptographic tape would be issued for the exclusive use of Holmes & Narver and the Task Force Headquarters at Eniwetok, thus eliminating the delay and the extra labor required by re-encryption at Los Alamos. This special tape was received by Holmes & Narver on 10 November 1952 and was placed in effect shortly thereafter.

Teletype communications were also available between the Home Office and the Holmes & Narver Honolulu Office. The normal channel for this service was through the Army Communication Center, Los Angeles, thence through the 6th Army Headquarters, San Francisco, and finally through the Joint Communication Center, Oahu. While this channel was somewhat slower than the channel to Eniwetok, it served as a valuable communication link between Los Angeles and Honolulu. In the few instances in which particularly rapid communication to Honolulu was required commercial cable or telephone facilities were employed.

Teletype facilities were also frequently employed between Holmes & Narver and other industrial agencies within the United States, particularly in connection with purchasing and expediting activities.

The peak radio-teletype traffic occurred during the months of July, August and September. The average total number of messages received and transmitted per month for the period 1 January through 31 December 1952 was 748. Of this the average number per month received and transmitted was 251 and 496 respectively. A monthly breakdown of the teletype traffic transmitted and received for the above period follows:

1952	TRANSMITTED	RECEIVED	TOTAL
January	277	409	686
February	286	409	695
March	308	565	873
April	296	670	966
May	293	597	890
June	315	642	957
July	328	700	1,028
August	345	705	1,050

1952		TRANSMITTED	RECEIVED	TOTAL
September		338	739	1,077
October		234	521	755
November		134	332	466
December		213	501	714
	Totals	3,367	6,790	10,157

In conjunction with the necessity for rapid communication was the need for complete and rapid coordination of all the diversified Home Office activities. This required that all incoming and outgoing teletypes be distributed to the various interested departments with a minimum of delay.

Since the number of copies required for distribution exceeded that obtainable on the ordinary 3-ply teletype roll, all incoming and outgoing teletypes were promptly retyped on ditto masters and copies produced in sufficient number to effect simultaneous delivery.. At the time of retyping, it was also found advantageous to translate many of the communication symbols into a more readable form. Hence, the retyped copies provided were more readily understood by the recipients. The slight additional cost of material and labor involved in retyping was considered more than offset by the increased efficiency obtained from this method of operation.

MAIL

While most of the communications requiring rapid transmittal were handled by either teletype or telephone, the volume of mail received in connection with this project was considerable. Mail of a routine nature such as confirming data and correspondence containing information and instructions in which time was not considered essential, was handled through this medium.

The handling of all outgoing and incoming mail was in accordance with AEC instructions and Security regulations. All mail was delivered to the Holmes & Narver central mail room where it was routed and delivered by messengers to the recipients.

The initial method of logging, filing and accountability of mail in force during the first half of 1952 proved cumbersome and in June 1952, the standard method employed by the AEC Santa Fe Operations Office was adopted. This method utilizes Mail Record Cards and Classified Record Control forms for all incoming AEC correspondence. The adoption of this procedure effected a reduction in labor and improved the efficiency of distribution and accountability of correspondence.

An additional improvement in the mail facilities between the Holmes & Narver Home Office and Jobsite was made in May 1952, with the inauguration of a pouch system between Honolulu and Eniwetok. The pouch system was utilized for both Westbound and Eastbound mail and was available for use by AEC and Task Force Agencies as well as Holmes & Narver. Using this system, Westbound communications, for example, were air mailed commercially to "Holmes & Narver, P. O. Box 6, Honolulu, T. H." and marked "Jobsite Mail". Such mail was immediately placed in a special locked pouch at the MATS Terminal, Hickam Field, Honolulu. Normally this mail left Honolulu on the same day it arrived. Eastbound mail followed the reverse procedure.

Mail records were maintained at the Home Office, at Eniwetok and Honolulu on each item of mail transmitted by the pouch system, whereby adequate accountability was provided. The system was approved by Security representatives of the AEC and the Task Force for practically all classified as well as unclassified documents. The lone exception being that no RESTRICTED DATA be sent by this method. The use of this system frequently resulted in documents from the Jobsite being received at the Holmes & Narver Home Office the day following the originating date. The average time of transmission was about two and one-half days, reducing by about one-half the time formerly required by normal air mail postal facilities.

The communications system utilized during this program was considered adequate and satisfactory. Communications of all types were improved over those of previous operations. Improvements which were effected are recommended for retention in future operations.

JOBSITE COMMUNICATIONS

Jobsite communication media consisted of telephone, teletype, radio, public address system and mail services. The control center for Holmes & Narver for all cummunications services during OPERATION IVY was maintained at Elmer, although during the accelerated stage of the operation, elements of control such as additional telephone switchboards and marine and air dispatchers' radio control units, were set up on temporary camp sites in order to provide more effective communications for particular activities.

Telephone and radio installation and maintenance on all sites except Fred was the responsibility of the Holmes & Narver Electrical Department. Over-all operational control of the communications services was a function of the office of the Resident Manager. Coordination and liaison with the JTF 132 Communication Center and other agencies of the Task Force were effectively maintained.

TELEPHONE

During the early stages of construction for OPERATION IVY, telephone control equipment consisted of a two-position Kellog Masterbuilt switchboard on Elmer. This equipment included 230 common battery lines and 40 magneto lines, and was operated daily, except Sundays, from 0700 to 1900 hours. During this period contact with temporary camp site telephones was made through the Elmer exchange. Four telephones at Gene were located one each in the offices of the Construction-Maintenance Division, Heavy Equipment Department, Time-keeping Department, and mess hall. Alice, Vera, Yvonne, Janet, Belle, Irene, Kate, Wilma, David and Bruce were each provided with one telephone.

In August 1952, service at Elmer was extended to a full 24-hour continuous schedule, with trunks to switchboards at other locations and operated with 335 instruments on 222 battery lines and 30 trunks, including radio AN/TRX trunks. A one-position switchboard was placed in operation at Gene, equipped with 60 battery lines and 10 magneto trunks serving Gene, Irene, Helen, Flora, Edna, Daisy, Clara, Belle and Alice. At these sites, 47 battery lines were used, and 58 instruments installed. Service was provided from 0700 to 1900 hours daily except Sunday, during the initial period, but this was soon extended to continuous 24-hour service, seven days a week.

A one-position board was installed at Yvonne during the first week of September 1952, equipped with 60 common battery lines and 10 magneto trunk lines serving Yvonne, Wilma, Ursula, Tilda and Sally. A total of 19 battery lines and 22 telephone instruments were in use at these sites. Two telephone operators were placed on this board to provide service from 0700 to 2400 hours daily, seven days a week.

On Monday, 29 September 1952, a one-position switchboard, equipped with 60 common battery lines and 10 magneto lines, and serving Janet, Kate, Lucy and Mary, was opened at Janet. A total of 13 battery lines and 17 telephone instruments were installed at these sites. An operator commuted daily from Gene, since living accommodations were not available on Janet.

In addition to service to off-island locations, telephone connections were provided to the USS ESTES via six lines connected to a telephone buoy. Two of the lines were used for teletype receiving and sending, and the remaining four for telephone service. A telephone buoy was also located off Gene providing telephone service to the USS CURTISS.

Initially, communications between the Elmer airstrip and Fred were conducted over a direct line telephone. During the critical period of operations an additional phone to Fred and direct lines to Rad-Safe and Yvonne were installed. A six-station inter-communication system at Elmer was also placed in operation.

In the interim between MIKE and KING-Shots, telephone service was provided at Yvonne during the regular work day period only.

It was apparent during OPERATION IVY that switchboard facilities on Elmer were inadequate during the operational period, resulting in answering delays in excess of the standard maximum of 10 seconds. Approximately 20 additional lines could have been used to good advantage, if they had been available. The peg counts, as indicated below, reflect hourly calls, including extension to extension, extension to trunk, and calls for information, for a representative 2-day period during the height of the Program. By comparison, an average of 1,500 calls daily was normal during the early construction phase. Hourly peg count on PBX - Elmer:

TIME	15 OCTOBER	16 OCTOBER
0730-0830	543	520
0830-0930	563	484
0930-1030	407	370
1030-1130	395	427
1130-1230	208	234
1230-1330	249	351
1330-1430	374	519
1430-1530	447	432
1530-1630	427	351
1630-1730	403	376
Totals	4,016	4,044

The total number of lines and trunks available and in service during OPERATION IVY, together with the number of instruments in service, are listed below:

Total Lines Available	230 (including 10 added during IVY)
Total Lines in Service	222
Total Telephone Instruments in Service	331 (main lines and extensions)
Total Trunks Available	40
Total Trunks in Service	30

TELETYPE

During the construction and post-operation periods, teletype service was maintained at Elmer through the use of two teletype machines in the Administration Building. With a few exceptions messages were received and sent via the Eniwetok - Los Alamos circuit.

On the activation of the JTF Headquarters Communications Center, the Holmes & Narver teletype equipment was not used. Holmes & Narver teletypes were logged in and prepared for transmission by Holmes & Narver's own message center, but the actual receiving and sending of messages was processed by the JTF Communications Center. This system continued until the departure of the Joint Task Force, when the operation of the teletype by Holmes & Narver was resumed.

RADIO

Communications to various ships of the Task Force were provided by means of AN/TRX circuits (radio) to the USS CURTISS, USS ESTES and the RENDOVA, through the Army Communications Center on Elmer.

Marine radio communications were maintained between the dispatching offices at Elmer, Yvonne and Gene, and the Holmes & Narver craft. This network consisted of 33 type SCR-508 radio sets. Additional sets of this type were added immediately prior to and during operations for scientific program support such as Dewar transport, backup for telephone service between Alice and Gene and Rad-Safe office for monitoring recovery parties.

A liaison network was also maintained for aircraft dispatching through the airstrip offices at Elmer, Fred and Gene using low frequency Navy TCS-12 radios. During the critical period, aircraft control moved from Fred to the airport at Elmer. A high frequency radio receiver and transmitter for TG 132.4 aircraft liaison control was also established at the Elmer Airport.

Forty-three SCR-300 radio sets were issued for short range walkie-talkie use to scientific organizations. These sets were installed and maintained by Holmes & Narver radio technicians. In addition, a six-station RCA intercommunication system, a six-station Stromberg-Carlson inter-phone system, and a public address system were installed and maintained at Station 1 on Flora.

MAIL

Official Jobsite mail for transmission to the Home Office was processed through the Holmes & Narver central files and mail room. This pouch was picked up each morning by the mail clerk, and transported to Fred where it was delivered to the MATS Terminal marked "XXX Classified Cargo" and placed on the MATS aircraft departing about noon, daily, when flights were scheduled. At Honolulu, the Jobsite mail pouch was obtained by Holmes & Narver personnel from the MATS cargo office on arrival of the Eniwetok aircraft, mail sorted, and taken to the Honolulu Post Office for air mail to destination.

SECTION 13. SECURITY

To the Security Division of Holmes & Narver was assigned the task of administering the many phases of the security program. The security requirements as specified in Contract AT-(29-2)-20 for OPERATION IVY were similar to those required for OPERATION GREENHOUSE. In meeting these requirements the Security Division issued security procedures; processed personnel Clearances; governed the dissemination of information and documentary control; maintained the necessary Home Office physical security measures and conducted the security education program.

At the beginning of the program the Security Division consisted of the Chief Security Officer and a secretary. An Assistant Security Officer and four clerks were added to the Home Office Staff and a Jobsite Security Officer and an assistant were added to handle security at the overseas location early in 1952.

Under this arrangement the Chief Security Officer, reporting to the General Manager, assumed the over-all security responsibilities for the Home Office, Honolulu Office and Jobsite.

The Jobsite Security Officer and his staff operated under the technical guidance of the Chief Security Officer and under the administrative control of the Jobsite Project Manager. The handling of security matters in the Holmes & Narver Honolulu Office was assigned to various cleared personnel by the Honolulu Office Manager as the necessity arose. As in the case of Jobsite Security, the Honolulu Office was issued the necessary security instructions by the Chief Security Officer to whom it was responsible for all matters pertaining to Security.

The organization of the Security Division is shown in Figure 3-18. The four sections comprising the Division reported directly to the Assistant Chief Security Officer.

The pre-employment section interviewed all applicants for employment from the security standpoint and obtained information for use in conducting a preliminary investigation prior to requesting a costly governmental investigation.

The photograph and fingerprint section handled the photographing and fingerprinting of the applicant for identification purposes and worked in conjunction with the identification section in processing Identification Cards and badges. The identification section prepared the necessary identification forms,

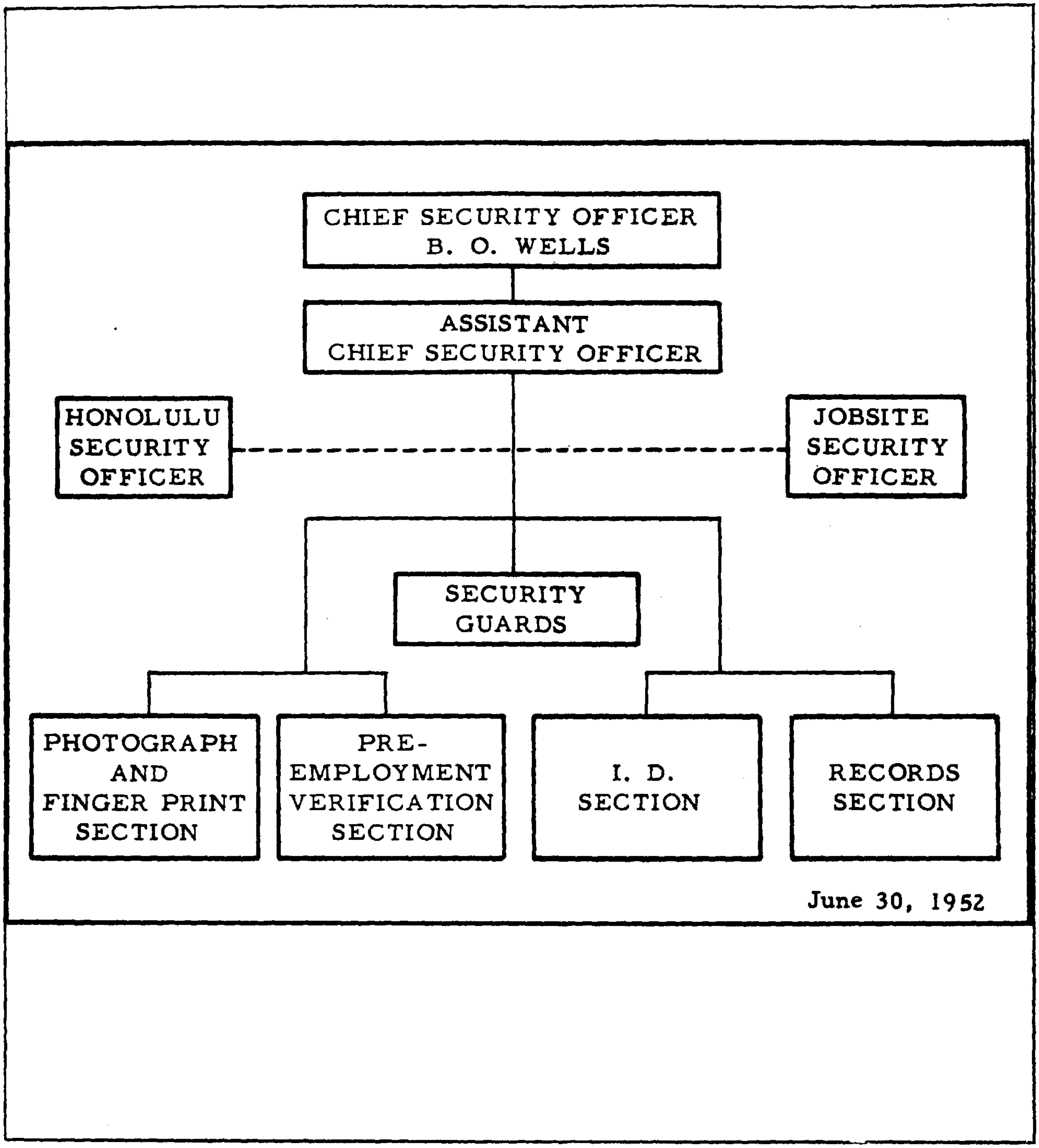


Figure 3-18. Security Division Organization Chart

requested Travel Orders, and issued the applicant his I.D. Card on receiving notification that the applicant was eligible and had been hired.

The records section maintained a complete and comprehensive file on all employees processed by the Security Division. The contents of this file included a Clearance progress record and information on any Security violations or misconduct during employment.

PHYSICAL SECURITY

Procedures established during OPERATION GREENHOUSE and the experience gained from that operation did much to alleviate the problems incident to the maintenance of adequate physical security measures during OPERATION IVY. Basically, the same fundamental security measures were adopted for the Home Office, Honolulu and Jobsite.

The physical security measures supervised and maintained by the Security Division included: control of access to all classified information and data; adequate guard forces; protective lighting and identification systems; restricting of limited areas to cleared personnel; proper use of repositories; and other measures which would deny physical access to unauthorized personnel. All of the measures taken were in accordance with the AEC's General Manager's Bulletin Nos. 153 and 37.

One of the main provisions for physical security control at the Home Office was the Guard Force employed on a 24-hour-per-day basis. All guards subcontracted from the General Plant Protection Company, were "Q" Cleared, uniformed, armed and trained in fire prevention, detection and all other physical Security requisites. Guards were stationed at both Home Office locations. The guard at 828 S. Figueroa St. controlled access to all offices where Contract work was being performed and provided additional control for the "limited area" occupied by the Engineering Division. The guard stationed at the entrance to the 816 S. Figueroa St. Office also furnished information for all visitors to the building.

Inspection of all repositories containing classified material was made during the Company's non-working hours on an hourly basis and required the punching of a disc type watch clock by the inspecting guard. Inspection of safes, doors, windows, etc., by the armed guards began at the close of the normal working day. In addition, one inspection was made by the guards' supervisors at an unscheduled time during each shift.

The communication network of the guard system included a Central Control Station. The guards were required to telephone this station every hour during the Company's non-working hours. In the event hourly report calls were not received by the Control Station, the General Plant Protection Company's Officer of the Day, patrolling the vicinity in a radio-controlled automobile, was dispatched for an immediate inspection of Holmes & Narver's premises.

At the Home Office it was determined that, due to classification of the documents involved, certain areas would be subject to Security restrictions and controls. Accordingly, "limited areas" were established. These areas were conspicuously posted and access was limited to authorized personnel. A total of three "limited areas" were established in the two buildings occupied by the Home Office. Access to the second floor of 828 S. Figueroa St., accommodating the Engineering Division, was controlled both at the ground floor level by an armed guard, and at the actual entrance to the "limited area" by a "Q" Cleared employee. Personnel entering this "limited area" were required to wear a tamper-proof, AEC approved identification badge.

Visitors to the "limited areas", who were certified by the AEC Los Angeles Security Branch, were required to sign a visitors logbook and were issued a temporary tamper-proof badge.

Two other limited areas were established on the fourth floor of 816 S. Figueroa St. to provide adequate safeguards for the central file and teletype rooms. Ingress to the central file room was controlled by "Q" Cleared clerks and was restricted to cleared employees requiring entrance in the performance of their duties. Entrance to the teletype code room was restricted to "Q" Cleared teletype operators and the management. Other personnel requiring admission to this area were required to obtain the written approval of the Chief Administrative Officer.

During the Company's non-working hours classified documents were stored in repositories meeting Atomic Energy Commission's specifications for the storage of classified matter. The majority of these repositories were either fire resistant safes or safe-files possessing integral three-way locks. The Security Division assigned all lock combinations and was responsible for changing lock combinations at least every six months under normal conditions. Combinations were immediately changed when an employee possessing the combination to any safe or safe-file terminated. All lock combinations were maintained in the control and custody of the Security Division and were classified in accordance with the material contained in the specific repository.

Due to the small quantity of classified material handled by the Honolulu Office, an adequate repository was deemed sufficient for the physical security requirements. In this, AEC concurred, since all classified material was under the control of "Q" Cleared personnel.

PERSONNEL CLEARANCES

Due to the nature of the operation, exacting requirements were established by the AEC as to the security criteria for Holmes & Narver personnel. The problems of the critical need for certain types of personnel versus the security requirements of the Contract were agreeably resolved through the excellent liaison which had been established with the local office of the AEC and the Security Section of the AEC Field Manager's Office, Eniwetok.

The basic security criteria consisted of two types of authorizations, the "P" Approval and the "Q" Clearance. Access to RESTRICTED DATA, either in the Home Office or Jobsite, required a "Q" Clearance. Access to other classified information, including SECRET - Security Information, Non-Restricted Data, was permitted to persons having a "P" Approval only. At the Jobsite all persons were required to have a "Q" Clearance regardless of their access to classified information after a so-called "Limiting Date". This date was first established as 1 August 1952 and was later extended to 1 September 1952.

To satisfy the requirements from an administrative point of view, an organization was established in the Holmes & Narver Security Division to process all Clearances at the Home Office. This applied to personnel hired for Jobsite employment by the Honolulu and the Home Offices, as well as for those people hired for the Honolulu and Home Office. The granting of the "P" Approval Clearance was based upon the results of a name and fingerprint check of the Federal Bureau of Investigation files in Washington, D. C. A "Q" Clearance authorized access to material classified as high as RESTRICTED DATA, when necessary to the individual's work, and was based on both a name and fingerprint check and an extensive background investigation. Results of the reports of the investigations on each applicant were screened and a decision rendered by the Los Angeles Security Branch of the AEC, which was assigned as the Security Servicing Agency.

Applicants for employment on Contract AT-(29-2)-20 who would have access to classified information were required to execute a Personnel Security Questionnaire. In the case of personnel requiring access to material classified as high as RESTRICTED DATA, Personnel Security Questionnaire, Form AEC-1 was used, and Form AEC-150 was used for personnel needing access to Non-Restricted Data. In addition, each applicant executed the Atomic Energy Commission Security Acknowledgement Form AEC-15, acknowledging: Sections 10 (b) of the Atomic Energy Act of 1946; and Sections 31, 32, 105 and 106 of Title 50, United States Code Annotated, which concern the Espionage and Sabotage Act. Section 123, Title 18, United States Code Annotated pertaining to the misuse of Naval and/or official passes was also acknowledged by all applicants.

Prior to May of 1952, the initial security interview and preparation of Security forms were handled by the Security Division. In order to consolidate and execute the Security forms and various Holmes & Narver papers in the Industrial Relations Division, a manual was prepared by the Security Division for Industrial Relations Division interviewers. This manual set forth the proper procedures to be used in filling out the Security forms and contained a rudimentary orientation as to the possible ecurity risks that could be discovered during the initial interview.

After completing the required forms and initial interview in the Industrial Relations Division, the applicant was screened by experienced Security Division interviewers to obtain data and information for use in an investigation conducted by one of two national commercial investigation agencies. Selected by mutual assent of AEC and Holmes & Narver, these agencies served to assure that each applicant was qualified for employment from a personnel standpoint. The investigation provided verification of the applicant's employment record, professional ability and general character, and in many instances included the searching of law enforcement agency files. This procedure was found to be productive in that approximately 9% of all applicants were removed from processing upon receipt of information obtained through these sources.

In the case of doubtful or questionable applicants, the Security Division conducted their own survey of government agencies located in the Southern California area. The cooperation received from these agencies was gratifying and served in many instances to eliminate considerable AEC investigation expense.

Satisfactory completion of the applicant's interview by the pre-employment section was followed by photographing and fingerprinting in the photograph and fingerprint section. Fingerprints were taken in accordance with AEC specifications for transmittal to the Federal Bureau of Investigation for the name and fingerprint check. The initial steps in preparing the Identification Card were also taken at this time.

Following photographing and fingerprinting, the applicant was processed through the identification section where he signed the I. D. Card, and in the case of overseas applicants, a Navy Identification Data Sheet was prepared. The Data Sheet set forth the subject's description, occupation and his I. D. Card number.

At the time the applicant for Jobsite employment was considered eligible for hire from the personnel and security standpoint, the I. D. Card, along with the travel request, was transmitted to the Port Director, Long Beach Naval Station for countersignature. A copy of each applicant's Security Clearance was also forwarded to the Port Director with the Travel Order request. On receipt of the signed orders and I. D. Card, the identification section prepared the tamper-proof card and badge which were then issued to the new employee.

The Port Director also issued a Clearance notification to clear each employee through Travis Air Force Base, California; Hickam Air Force Base, Honolulu, T. H.; Johnston Island; Kwajalein Island and Eniwetok. This procedure satisfied the requirements as set forth in CINCPAC Serial 020, the controlling directive concerning admittance to the forward area.

The Clearance notification procedure was inaugurated during January 1952, and was authorized by the Commander-in-Chief, Pacific area. The issuance of Clearance notification by the Port Director replaced the previous practice in which employees hand-carried Clearance letters to Honolulu for transmittal to CINCPAC which had resulted in employees being delayed for two or three days in Honolulu while awaiting a Clearance dispatch.

A total of 1,595 "P" Approvals were granted during the period December 1951 through December 1952. Jobsite employment accounted for 1,400 of this total; the Home Office and Honolulu Office employees were granted the remaining 195. The total average time required to obtain a "P" Approval was 28.73 days, Jobsite "P" Approvals being received in an average time of 28.13 days and the Home Office and Honolulu Office approvals being granted in an average of 33.04 days.

In order to later avoid requesting a "Q" Clearance for "P" Approval Cleared personnel who would be required to work in Jobsite Security areas after the limiting date, a "QP" Clearance was requested at the time these personnel were hired. Since after the limiting date only "Q" Cleared personnel were permitted to work at Jobsite, the "QP" Clearance request expedited the transporting to Jobsite of "P" Approval leared personnel prior to the granting of a "Q" Clearance. This method proved to be of extreme benefit in filling the needs of Jobsite personnel since the time required to obtain a "P" Approval averaged about 29 days as compared to an average time of 93 days for a "Q" Clearance.

During the period of this report, there was a total of 1,876 "Q" Clearances received for Jobsite employees. Of this number, 1,358 were initial "Q" Clearances and 518 were "Q" Reinstatements. The average time for obtaining initial "Q" Clearances was 93.24 days and "Q" Reinstatement Clearances required an average time of 8.07 days.

In an effort to reduce the time required to obtain Clearances, and the cost involved, Holmes & Narver recruited as many previously cleared personnel as possible. Accordingly, individual Clearances which had lapsed were reactivated upon bringing the original Personnel Security Questionnaire up to date and submitting AEC Security Acknowledgement Form AEC-15. This procedure reduced the work on the part of AEC and also permitted the granting of a "Q" Clearance in these cases, in approximately eight days after submission.

Of a total of 158 "Q" Clearances obtained for Home Office and Honolulu Office employees during the period covered, 124 were initial "Q" Clearances and 34 were "Q" Reinstatements. The average time required to obtain an initial "Q" Clearance was 89.89 days and for receiving a "Q" Reinstatement required an average of 14.62 days.

In all, there were a total of 2,034 "Q" Clearances granted during this operation. Of these, 1,876 were for Jobsite and 158 were for Home Office and Honolulu Office employees. The number of initial "Q" Clearances obtained totaled 1,482 and a total of 552 "Q" Reinstatement Clearances were received. The over-all average time required to obtain an initial "Q" Clearance was 92.96 days, and an average over-all time of 8.47 days was necessary in order to obtain "Q" Reinstatement Clearances.

A "QE" ("Q" Emergency Clearance) was also provided for in the planning for OPERATION IVY. This type of Clearance facilitated clearing those individuals whose services it was mandatory to procure prior to the time that a formal investigation could be conducted and a report submitted to the AEC. The "Q" Emergency Clearance was granted by the Manager, Santa Fe Operations Office, and was based on all available information from local and national sources. It was necessary to request this type of Clearance during the middle of the operation in order to procure some specialized personnel. This type of Clearance was obtained in approximately thirty days and was strictly temporary, being conditional upon information developed during a thorough subsequent background investigation.

Comparable in necessity to the "QE" Clearance was the "P" Approval granted on the basis of a local agency check. This type of Approval was requested when the need for critically required personnel could not be reconciled with the time required for a formal "P" Approval. Approvals in this category were temporary and subject to a final decision when results of formal "P" Approval national agency checks were received by the local AEC Security Branch.

INFORMATION CONTROL

All classified information and material was disseminated through a comprehensive control program established and supervised by the Security Division. This program consisted principally of: a document control system, for ensuring proper classification of documents and other matter; a system for the destruction of classified material; and an educational program.

The document control system was revised during the program in order to incorporate a triplicate copy system wherein the original and a carbon copy of the receipt were transmitted to the recipient of the classified matter and the third carbon copy retained in suspense in central files until receipt of the signed original.

All of the instructions, procedures and mechanics pertaining to documentation were executed in accordance with existing AEC directives. On receipt of classification guides and criteria, the Security Division relayed this information to the "Q" Cleared personnel who were responsible for the proper classification of documents that originated under their control. When borderline or questionable cases arose the Security Division was consulted and a decision rendered. Where insufficient information was possessed by the Security Division to render a decision, the document in question was transmitted to the Classification Board at Los Alamos, New Mexico for proper classification.

During the latter part of the Program the Security Division prepared a comprehensive set of instructions based on the AEC Manager's Bulletin GM-SEC-5, revised 20 October 1952. These instructions covered the documentation and processing of classified information and material and were, for the most part, taken directly from GM-SEC-5, edited to remove instructions not ordinarily required by Contractors. Additional detailed information was included relative to specific Holmes & Narver procedures.

A document destruction procedure and system was also maintained by the Security Division to assure proper destruction of all classified matter in accordance with AEC directives.

All undocumented matter was shredded and placed in conspicuously marked "Burn" receptacles, the contents of which were collected by the guard force at the end of each working day. The collected material was stored in an approved repository until a sufficient quantity was accumulated to warrant burning in accordance with existing regulations.

All documented classified material was collected by the Security Division on notification and receipts prepared prior to shredding the material. The shredded documented material was then transported to an approved incinerator where it was burned, and the ashes stirred to assure complete destruction.

The Information Control Program was further implemented by strict adherence to the procedures set forth in the Atomic Energy Commission directive relative to the procuring and accounting of all documents from terminating employees. This procedure was established as an integral part of the personnel terminating process.

In the Security Education Program, each cleared personnel was given a basic lecture outlining the fundamental security requirements. Included in the subjects covered by this lecture were: the meaning of security as it related to the operation as a whole; the structure of security classifications and their application; the avoidance of certain security pitfalls; and a question and answer period. All cleared Home Office employees were instructed in security requirements as specifically applied to Home Office operations in connection with the Contract.

Jobsite employees were also given a comprehensive security lecture by the Jobsite Security Officer on arrival at Jobsite, and security reminders were brought to the employees' attention in the form of bulletins, directives, and notices in the Holmes & Narver daily newspaper.

When terminating, each employee was required to read and sign the AEC Security Termination Statement, AEC Form 136, and was again advised of the existing security regulations.

On arrival at Hickam Field, Honolulu, each employee was again briefed on the security regulations and cautioned against their violation during his stay in Honolulu.

A final security lecture was given Jobsite employees who were processed through the Home Office. These employees again read and signed AEC Form 136 and important provisions were verbally brought to each employees' attention. The employee was again warned against discussing classified information and it was strongly recommended that the terminating employee refrain from participating in any discussion concerning the activities of JTF 132.

All terminating Home Office employees were cleared through the Security Division prior to receipt of their final pay check. This assured that each terminating employee had read and signed the AEC Security Termination Statement and was advised of the security regulations.

JOBSITE SECURITY

The Project Manager at the Jobsite was responsible for the security of all activities within the area of his administrative jurisdiction including all installations, operations, personnel, documents and related facilities and information, involving Restricted Data or other classified matters. In the discharge of his security responsibilities the Project Manager was responsible for the effective administration of the policies, standards, procedures and instructions promulgated by or through the Chief Security Officer, Home Office, or received directly from or through the office of the Eniwetok Field Manager at the Jobsite. The Project Manager was authorized and directed to prescribe such additional security standards and procedures as he considered necessary in the interests of security.

The Jobsite Security Section was organized as a unit under the administrative and operational control of the Director of Industrial Relations at the Jobsite, but the technical work of the Section was closely coordinated with the policies and directives issued by the Chief Security Officer at the Home Office. Due to the nature of the work, the head of the Section had direct access to the Project Manager at all times on matters involving personnel Clearances and security records.

This Section consisted of a Security Officer, and one assistant; clerical assistance was made available as required, and the personnel of the guard force were available for the supervision of certain aspects of physical security.

The Security Officer was charged with the responsibility of insuring that all Holmes & Narver employees arriving at the Jobsite had received the required Security Clearance, and of maintaining security records on all personnel; supervising the maintenance of the physical security of all buildings equipment and material; insuring the security of all classified documents and records; supervising the proper classification of documents; and supervising the use of security badges by all Holmes & Narver employees. These responsibilities required close coordination with the Home Office Security Division and with the Security Officers of the AEC and the Task Force at the Jobsite, as well as close coordination with the various supervisory Holmes & Narver personnel at the Jobsite.

SECURITY EDUCATION

Education of employees in security matters was carried out by lectures, by the display of security posters, by the insertion of frequent editorials, and news items in the Project newspaper, and by security motion pictures. In addition, by constant circulation among the employees, by personal interviews, and by generating discussions on security subjects, the Security Officer was able to establish and maintain a high degree of security consciousness in the minds of all employees. All new employees received an indoctrination lecture upon their arrival at the Jobsite, and periodic lectures were given during the course of the operation; these covered such subjects as "Preparation, Distribution, Classification, Downgrading and Storage of Classified Documents", "Use of Security Badges", "Limitations of Security Areas", "Loose Talk", "Observation of Security Limitations in Personal Correspondence", "Task Force Security Directives" and other related subjects. All personnel were again instructed in security restrictions immediately prior to their departure, and all were required to read and sign AEC Form 136 "Security Termination Statement".

PHYSICAL SECURITY

One important aspect of the maintenance of physical security was that of supervising the use of safe-files in Holmes & Narver offices. This included periodic inspection of all safe-files to insure that they were properly locked when not in use, and maintaining records of all combinations, effecting changes in safe combinations as required, and repairing combination locks as necessary.

While the maintenance of security barriers and security lighting was not a direct responsibility of the Holmes & Narver Security Officer, he cooperated with the Task Force and AEC Security Officers in their supervision of this function, and provided necessary liaison between these officers and the Project Manager in connection with any construction or maintenance work required.

PERSONNEL CLEARANCES

Holmes & Narver employees were processed for "QP" Clearance prior to their departure from the point of hire, therefore no processing of this nature was required by the Jobsite Security Officer. It was frequently necessary, however, to obtain additional information for the correction of deficiencies or omissions in Clearance information, or for the correction of Identification Cards. Records of the Security Clearance status of all Jobsite employees were maintained.

INFORMATION CONTROL

In addition to the Security Educational Program, various control measures were made a part of the Security Officer's routine. These included the provision of "Burn" wastebaskets, the collection and destruction of classified waste, and the designation and supervision of incinerators for waste disposal. The Security Officer also maintained the required records of the receipt, disposition, or transmission of classified documents. Following is a list of the principal security directives which were issued.

Repository Survey: (A notice requiring proper marking on safes).

Security Termination Clearance Check List.

Emergency Classified Document and Material Destruction Plan.

Discussion of JTF 132 Activities Outside of the Task Force (Specific topics which could and could not be discussed).

Discussion of JTF 132 and Holmes & Narver Jobsite Activities.

Security Indoctrination for "KING".

Task Group 132.1 Security Indoctrination for IVY.

Instructions for Personal Mail Censorship.

Special Security Termination Statement.

Security Indoctrination for IVY.

List of Contraband Items.

Excerpts from Classification Guides.

Special Instructions re-use of Code Words.

Proper Disposal of Classified Material.

Instructions to New Arrivals at BIKINI.

LIAISON

Liaison as it applied to Jobsite Security was an all-inclusive term which encompassed all varieties of services to agencies of the Task Force other than Holmes & Narver. In view of the Holmes & Narver contractual relation with the Atomic Energy Commission, the sole direct official contact with the Task Force was with the AEC Security Office. However, close personal contact was maintained with all security and related activities. All reports of incidents of interest to Task Force Security units were made via the AEC Security Office.

GUARD FORCE

Although not directly under the Jobsite Security Section, the Holmes & Narver Guard Force was constantly available for any security activities including repository and other periodic inspections, collection and destruction of classified waste, perimeter patrols, furnishing of information regarding unusual incidents, and making investigations.

Other activities of the Guard Force included normal camp police duties such as: enforcing camp rules; warning and/or reporting of offenders; maintaining an alert night patrol; reporting safety and fire hazards; rendering assistance to the safety engineer or fire department, and carrying out general and specific orders as required.

Satisfactory liaison was maintained with military police and other Task Force enforcement or security units, and full cooperation was given those agencies at all times.

The guard force captain was directly responsible to the Director of Industrial Relations. Guard sergeants, under the supervision of the captain, performed relief duties and instructed the guards on duty. One sergeant was delegated as acting captain in the appointed captain's absence from Elmer, which was the base for all Holmes & Narver guard operations.

	Elmer	Gene	Yvonne
Captain	1	*	*
Sergeants	2	1	0
Guards	3	1	1

(*The Captain's responsibility included guard activities on Gene and Yvonne.)

During the peak period, one captain, three sergeants and five guards were employed. At the close of operations, guard strength consisted of one captain, one sergeant, and four guards, all at Elmer. Another guard was stationed at Bikini.

No problems of consequence faced the Holmes & Narver guards during OPERATION IVY, and no major crimes were committed during the year. Due to careful screening of employees prior to hiring, a generally stable type of employee appeared at Jobsite, which helped to simplify guard operations. A significant fact is that at no time during the operation did Holmes & Narver guards carry firearms.

SECTION 14. RECORDS AND REPORTS

Records, reports, central files, mail, communications and special services are under the Chief Administrative Officer. The Administrative Organization Chart is shown in Figure 3-19.

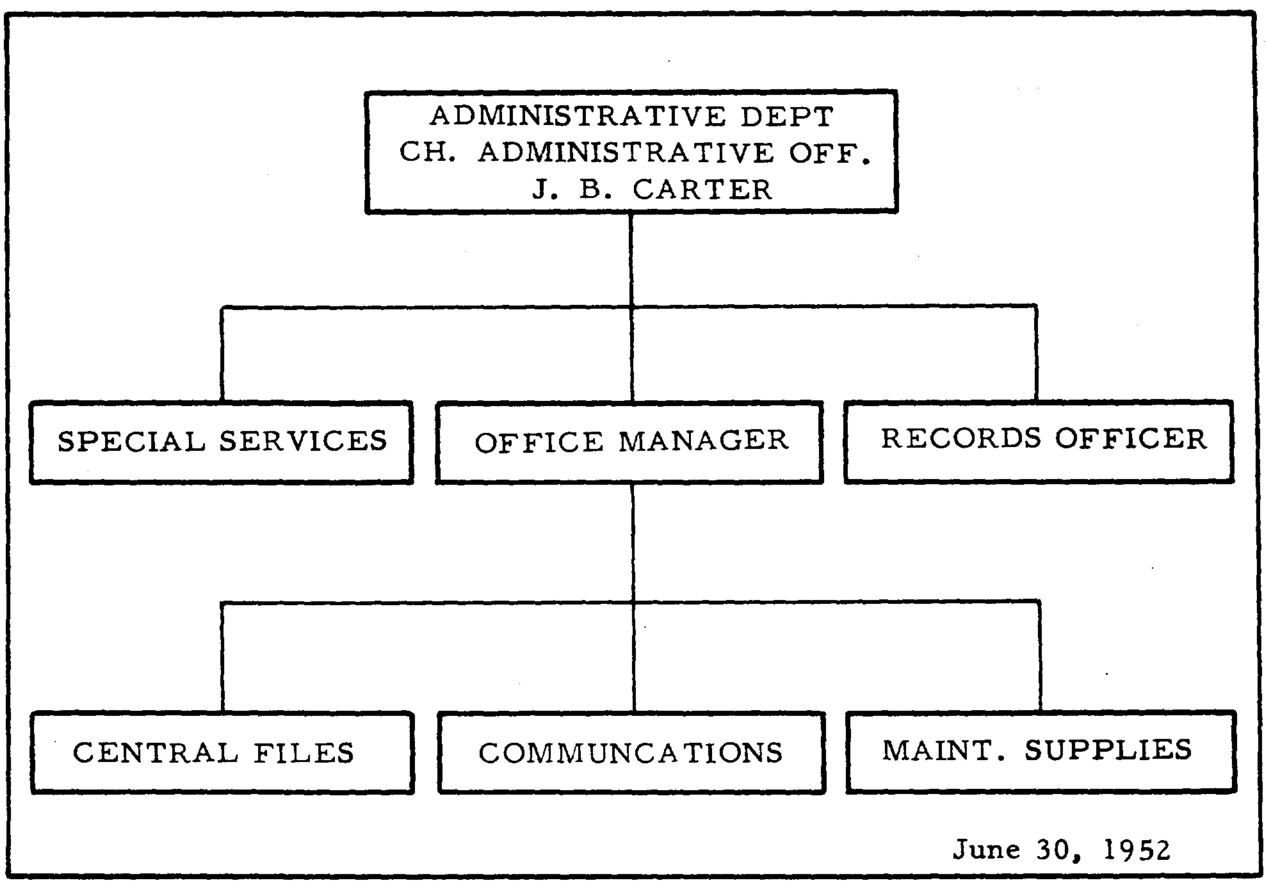


Figure 3-19. Administrative Department Organization Chart

All mail coming into the Holmes & Narver Home Office was received in the central mail room and was immediately stamped with the date and the hour of of receipt. It was then sorted and routed to individuals concerned within the organization in accordance with specified routing procedures, which were based on the identity of the originator and on the subject matter of the correspondence. The individual designated for "Action" was specified on all copies of the correspondence, and any reply or action required, became his responsibility.

Files of all incoming and outgoing correspondence were maintained in the central files section. These were available for use by any office of the firm, although each activity maintained its own current working files.

Prior to February 1951 the correspondence files in the central file room were kept chronologically by addressee or in some cases by subjects without reference to any standard filing system. After that date, the AEC Standard Subject File System was adopted and placed in effect in the central file room. (This system is progressively being instituted in the various division and department files within the organization). It has the advantage of simplicity and ease of identification since the file designation appearing on the correspondence is identical within the AEC organization and the Holmes & Narver Home Office.

As files became inactive they were transferred to the Holmes & Narver warehouse for analysis by the Records Officer as to disposal or specified retention in accordance with current AEC policies.

RECORDS

CONTROL AND ACCOUNTABILITY. As a result of the annual meeting of the AEC Records Management in May 1952, a Records Officer was designated and a progressive program of record analysis was initiated. By the end of 1952, considerable progress had been made in the analysis and disposal of records.

Retired records awaiting disposal were stored in boxes in the Home Office warehouse or in the Records Center at Los Alamos depending upon requirements for future availability. This procedure resulted in the release of numerous filing cabinets which were made available for reuse, thus accomplishing a saving in funds which otherwise would have been expended for additional filing cabinets, and also a saving in valuable floor space.

Early in 1952 an analysis was made of the methods then used for filing, routing and accounting for mail in the Home Office. It was found that, while adequate measures of accountability were in effect, the methods could be expedited. In June 1952 the system employed by the Santa Fe Operations Office was adopted, including the use of Mail Record Cards and Classified Record Control forms. With this system, a receipt is obtained by the recipient of each classified document (confidential or higher). This receipt is retained in the central file room and provides a positive check on the location and accountability of each such document. The system also provides a simple means of checking to insure that action was taken by the specified date on each incoming document.

Each office holding classified documents was provided with a safe file which was checked daily by the Security guards in accordance with current Security procedures.

All Restricted Data was delivered by hand to a specified custodian who maintained this file in a special combination safe in the Engineering Division. (Restricted Data was transferred from one custodian to another only by hand, and written receipts were required in each instance.)

In many cases, it was found that an insufficient number of copies of the correspondence received did not allow the necessary distribution to the various units of Holmes & Narver's organization. In order to reduce the cost of reproducing adequate copies of this correspondence by hand, an autostat machine was purchased at a nominal cost and placed in operation in October 1952. This facility proved to be invaluable in providing rapid duplication of certain records required for official use, and in expediting the distribution of important documents. Its use was carefully supervised and as a result it was found to effect considerable saving in clerical labor, as well as an increase in efficiency.

In all instances in which documented records were duplicated by the autostat machine, or other means, prescribed reports were submitted to the originator in accordance with established procedures.

REPORTS

Many periodic reports were required by both the Santa Fe Operations Office and by Task Force Agencies. The responsibility for furnishing each of these reports was assigned to a specific Division or Department within the Holmes & Narver organization. While Jobsite units normally made no direct reports to these agencies, they did furnish the following reports to the Home Office. These Jobsite reports were, in effect, the source of information in many instances for the reports compiled by the Home Office for the AEC.

ACCOUNTING
- General and Cost Accounting
- Property and Material Accounting
- Payroll, Timekeeping and Personnel
- Internal Auditing

ENGINEERING
- Engineering Work Orders
- Engineering Change Orders

ENGINEERING - continued
- Maintenance Work Orders
- AEC Work Orders
- Field Sketches
- Preliminary Drawings
- As-Built Drawings
- Bills of Materials
- Cost Estimates

ENGINEERING REPORTS
- Daily Inspection Report
- Weekly Test Lab. Narrative Report
- Weekly Survey Report
- Semi-Monthly Construction Progress Report
- Operation Completion Reports on Construction Items
- Concrete Test Reports
- Special Engineering Reports

INDUSTRIAL RELATIONS - PERSONNEL
- Security Reports
- Requisition Progress and Status Reports
- Monthly Flight Report
- Arrival and Departure Notices
- Weekly and Monthly Strength Reports
- Termination Reports
- Transportation Request Reports
- Sickness, Accident and Hospitalization Reports
- Insurance Reports
- Recreation Reports

SERVICE OPERATIONS
- Marine Operations (Monthly)
- Fresh Water Distillation Reports
- Power Production Reports
- Dining Hall Reports

In the following tables are listed the reports Holmes & Narver was required to furnish, their frequency of presentation, the recipient, due date, and the type of presentation.

TITLE OF REPORT		REPORT PERIOD	ORIGINAL	DUE DATE BY RECPNT.	FORM NO.
Financial Statements & Supporting Schedules:					
A-1	Analysis of Stores Inventory	Quarterly	AEC	15th	Letter Head
A-2	Summary of Stores Transactions	Quarterly	AEC	15th	Letter Head
A-3	Inventories of Reactor & Other Special Materials	Quarterly	AEC	15th	Letter Head
A-4	Spare Equipment in Storage by Location	Quarterly	AEC	15th	Letter Head
A-5	Excess Plant & Equipment by Location	Quarterly	AEC	15th	Letter Head
A-6	Summary of Plant & Equipment Changes in Progress	Quarterly	AEC	15th	Letter Head
A-7	Changes in Reserve for Losses on Stores Inventory	Semi-Annually	AEC	15th	Letter Head
Status Obligated Funds Report		As Req'd.	AEC Albuq.		Letter Head
A	Balance Sheet	Monthly	AEC	12th	Letter Head
A-8	Prepayments & Deferred Charges	Semi-Annually	AEC	12th	Letter Head
A-10	Deferred Credits	Semi-Annually	AEC	12th	Letter Head

TITLE OF REPORT	REPORT PERIOD	ORIGINAL	DUE DATE BY RECPNT.	FORM NO.
A-13 Collateral Funds & Other Deposits & Related Income	Annual	AEC	12th	Letter Head
A-14 Employee & Other Funds on Deposit	Annual	AEC	12th	Letter Head
Financial Statements & Supporting Schedules:				
A-9 Analysis of Changes in Completed Plant & Related Reserves	Semi-Annually	AEC	12th	Letter Head
A-11 Completed Plant & Related Reserves by Type	Annual	AEC	12th	Letter Head
A-12 Completed Plant & Related Reserves by Location	Annual	AEC	12th	Letter Head
B Statement of Operations	Monthly	AEC	12th	Letter Head
B-1 Projects Abandoned	Quarterly	AEC	15th	Letter Head
Motor Vehicle Operations	Quarterly	AEC	15th	SFY-13
Annual Motor Vehicle	Annual	AEC	20th	82
Annual Motor Vehicle (Tabulation by States, U. S. Territories & Foreign Countries)	Annual	AEC	20th	82A

TITLE OF REPORT		REPORT PERIOD	ORIGINAL	DATE DUE BY RECPNT.	FORM NO.
	Inventory Construction Equipment	Semi-Annually	AEC	25th	302 303
B-2	Miscellaneous Other Expenses	Quarterly	AEC	15th	Letter Head
C	Analysis of AEC Equity	Monthly	AEC	12th	Letter Head
C-1	Prior Year Adjustments	Monthly	AEC	12th	Letter Head
D	Statement of Source & Application of Funds	Semi-Annually	AEC	15th	Letter Head
Cash Requirements		Monthly	AEC	20th	1034
Cost Report of Changes in Plant & Equipment (CR-9)		Monthly	AEC	12th	
Cost & Budget Report (CR-14)		Monthly	AEC	12th	
Joint Task Force Cost Report		Monthly & Cumulative	AEC	12th	
Budget Mid-Year Review Report		Semi-Annually	AEC	6/1 12/1	Form SFO-157, 157A, 158, 159 and 216
Cost & Budget Reports		Quarterly	AEC	5/25 8/25 11/25 2/25	Letter Head
Financial Statements:					
Cost Report - Work In Progress		Monthly	AEC	12th	

TITLE OF REPORT	REPORT PERIOD	ORIGINAL	DUE DATE BY RECPNT.	FORM NO.
Supporting Schedules:	Monthly	AEC	12th	
Indirect Expenses-O/S				
Indirect Expenses-O/C				
Scientific Stations				
Contract Item #35				
Heavy Equipment				
Aggregate Plant Operations				
Batch Plant Operations				
Camp Operations				
Maintenance Costs				
Support Services				
Personnel Status	Monthly	AEC	10th	SFO-58
Personnel Status	Quarterly	AEC	10th	SFO-59
H&N Transportation Utilization	Calendar Month	CTG 132.1	6th	Form Designed by AEC Albuq. (No Number)
H&N Airlift Requirements	3 Months in Advance	CTG 132.1	27th	Teletype Ref. RCS-JTF-132-MD-E3 JTF-132 SOP 76-3 dtd 5 Dec. 1951

TITLE OF REPORT	REPORT PERIOD	ORIGINAL	DUE DATE BY RECPNT.	FORM NO.
Procurement Actions of $10,000 or more Prime Contractors	Calendar Month	Manager SFOO Albuq.	15th following	AEC-328
Procurement Actions of $10,000 or more Sub-Contractor	Calendar Month	Manager SFOO Albuq.	15th following	AEC-329
Summary of Procurement Actions	Calendar Month	Manager SFOO Albuq.	5th following	AEC-330
Cumulative Report of Allotments made & of Sub-Allotment used by AEC	Calendar Month	Manager SFOO Albuq.	1st following	Form C-1 AEC-304
Transportation Activity Report	Semi-Monthly in Advance	CTG 132.1	17th & 2nd	Narrative
Cargo & Personnel via Water	6 Months in Advance	CTG 132.1	27th	Symbol JTF-132 MD-E7
Monthly Summary Accident, Occupational Disease & Fire Experience	Monthly	Manager SFOO Albuq.	20th	AEC-13
Planned Personnel Movement	1 Month in Advance	CTG 132.1	27th	Symbol JTF-132 MD-E6
Report of Selective Service Deferment Action	Quarterly 5th of Month Following Quarter	Field Manager Eniwetok Field Office	5th	SFO-94
Report of Military Reservists Delay Action	Quarterly 5th of Month Following Quarter	Field Manager Eniwetok Field Office	5th	SFO-95

TITLE OF REPORT	REPORT PERIOD	ORIGINAL	DUE DATE BY RECPNT.	FORM NO.
Monthly Design Progress (Completed Oct. 21, 1952)	Monthly-the 20th	AEC	25th	AEC-141
Scrap Iron & Steel Salvage	Quarterly	SFOO Albuq.	2nd	SF-S&S-21 Narrative
Monthly Status Report	Monthly	CTG 132.1	22nd	
Monthly Narrative Report	15th to 15th of Month	AEC - 6 Copies	Mailed on 25th	Letter Head
Estimate of Quarterly Requirements of Controlled Materials - Bulletin 17	Quarterly	AEC - 3 Copies	*	AEC-294, 295, 295A, 296, 297A, 297
Estimated Requirements for Selected Materials Bulletin 12	Quarterly	AEC - 3 Copies	*	AEC-309
Next of Kin Report Overseas Personnel	Weekly	AEC	Tuesday following	Letter Head
Weekly Security Processing Report	Weekly	Field Manager	Monday	Letter Head

*As Directed for Each Report

CHAPTER II
CAMP OPERATION AND MANAGEMENT

SECTION 1. GENERAL

Quarters, facilities and services were provided to house and sustain the personnel of Holmes & Narver, Inc., the Military and Scientific groups, and the representatives of the Atomic Energy Commission. A total peak population of 2,196 was reached on 13 October 1952. The facilities provided were messing, housing, PX store, barber shop, bars and clubs, snack bar, mail, cobbler shop and necessary utilities. Since the Atoll was restrictive compared with normal working areas, it was deemed essential that the morale of the employees be maintained, insofar as possible, by the provision of compensating housing and messing standards. Based on termination interviews with departing Holmes & Narver and other Task Force personnel, it may be stated that this was, in general, accomplished.

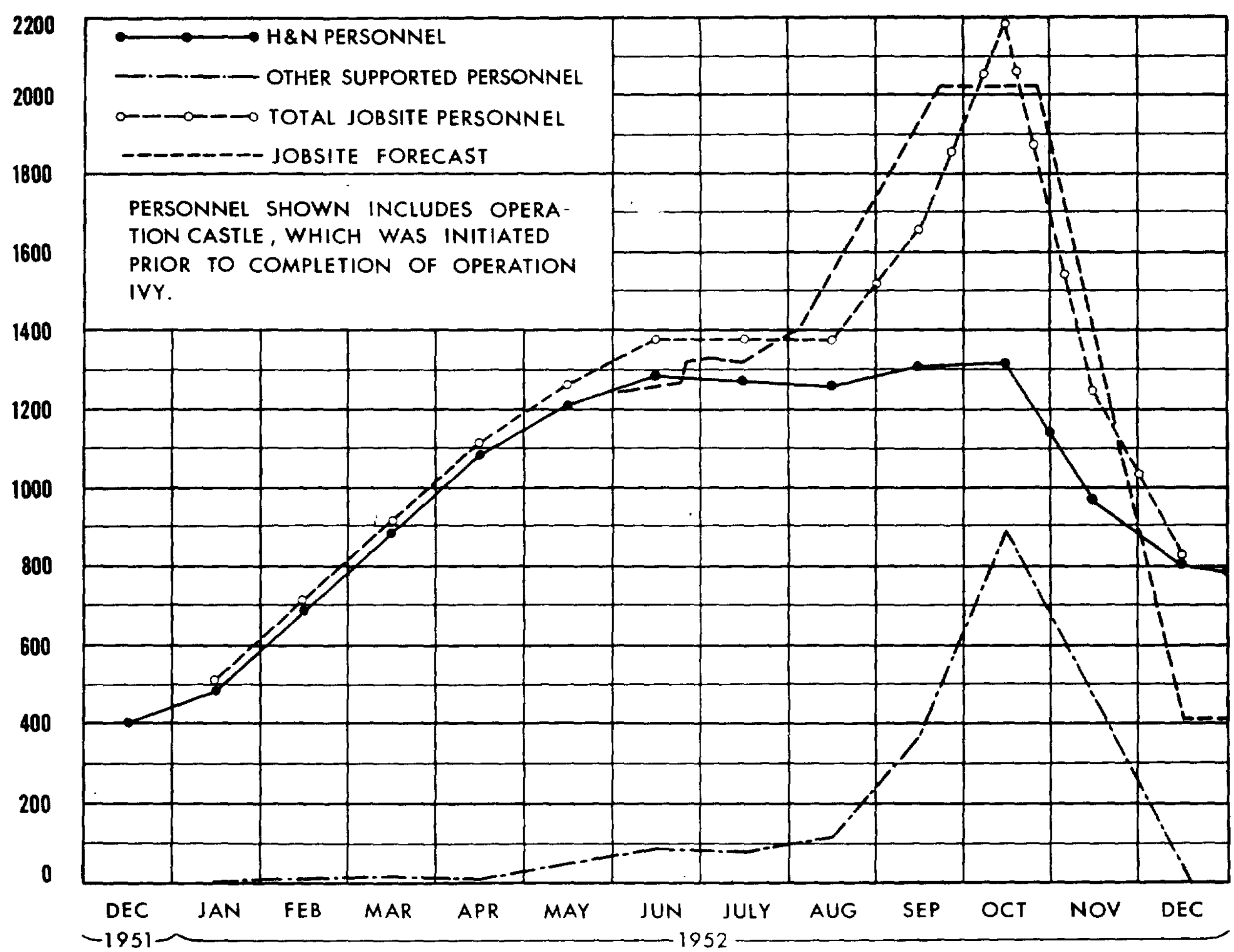


Figure 3-20. Jobsite Personnel Chart

Figure 3-20 shows the predicted population provided the Jobsite prior to the large influx of the personnel for the Operational Phase, and the actual number of personnel to whom Holmes & Narver provided camp services. Although this was considered to have been a close estimate of over-all population, it should be noted that in the Service Operations Division, particularly, any discrepancy in predicted population resulted in a work-load which is disproportionate to the working force, and one which is difficult to adjust on short notice.

At the commencement of OPERATION IVY, the camp on Site Elmer was being maintained in an active status to house and sustain approximately 300 Holmes & Narver personnel. It was therefore necessary to expand the existing facilities at this camp to provide for the influx of personnel. This work consisted primarily of removal of supplies and equipment stored in barracks and mess halls, and the reactivation of the "tent area". An entirely new camp had to be provided on Gene. This was accomplished in three successive steps as follows: by the use of an LCU as a houseboat for the beachhead landing; the establishment of a temporary camp; and finally, the erection of the permanent camp. Approximately 50 employees were supported on the LCU until the week of 22 January 1952, when the temporary camp was established. This camp was used until about 1 March 1952. At Yvonne, camp facilities were provided by reactivation of the power and distillation plants, sewer and water piping, and erection of buildings and tents on concrete slabs remaining from OPERATION GREENHOUSE. Camp operations on Yvonne were first started in May. Toward the end of June the work load had so decreased that it was not economical to continue camp operations for service to the few workers required. Consequently, the camp was closed down and until its reopening in late July the employees required to work on this site were supported from the camp on Elmer.

The responsibility for the operation of camp facilities on all sites devolved on the Camp Supervisor who was under the direction of the General Supervisor of Service Operations. An Assistant Camp Supervisor was responsible for the on-site operations of the camps at Gene and Yvonne. The Administration of the camp operations presented unusual difficulties due to the fact that the number of employees required varied radically with the population, and personnel with the necessary qualifications and experience could not always be hired and cleared in time to fill requirements. The working schedule of the employees engaged in messing activities was also difficult to administer since it was necessary to commence work earlier than the beginning and continue later than the end of the normal working day. In order to avoid excessive overtime on this schedule, it was necessary to work split shifts. Thus the recreation periods of these employees did not coincide with those of the employees in general.

SECTION 2. HOUSING

Housing throughout the Jobsite was generally adequate, though for relatively short periods there was some crowding. On Elmer, Barracks 100 to 104 inclusive, each designed to house 36 men, were used to billet 72 men. On Gene, during the latter stages of the Operation, 9 and 10 men were billeted in 8-man tents. There were cases in which it was necessary to provide berths for certain personnel at more than one camp. Added to this was the problem of housing of personnel whose work required them to be away from their base camp for overnight or short periods.

Housing facilities on Elmer consisted of aluminum barracks, augmented as needed by 4- and 8-man tents. Berthing assignments were made by the Camp Supervisor for all Holmes & Narver personnel. The Headquarters Commandants of JTF 132 and TG 132.1 assigned personnel of their respective organizations to quarters which were designated for their use. This designation was made at the commencement of the operational phase and was as follows:

HOLMES & NARVER

BARRACKS NOS.			CAPACITY
100 - 104 Inclusive	32 berths each		360
105			54
112, 114			36
113			12
TENTS			
31-50	4-man each		80
51-100	8-man each		400
		Total	942

TASK GROUP 132.1

BARRACKS NOS.			CAPACITY
106 - 110	54 berths each		270
111			27
119			8
121			18
123			25
125, 127, 129, 130	27 berths each		108
TENTS			
1 - 15	4-man each		60
		Total	516

JTF 132 HEADQUARTERS

BARRACKS NOS.			CAPACITY
120			8
122, 124, 126, 128	18 berths each		72
TENTS			
15 - 30	4-man each		60
99A - 99G	8-man each		56
		Total	196

MILITARY POLICE

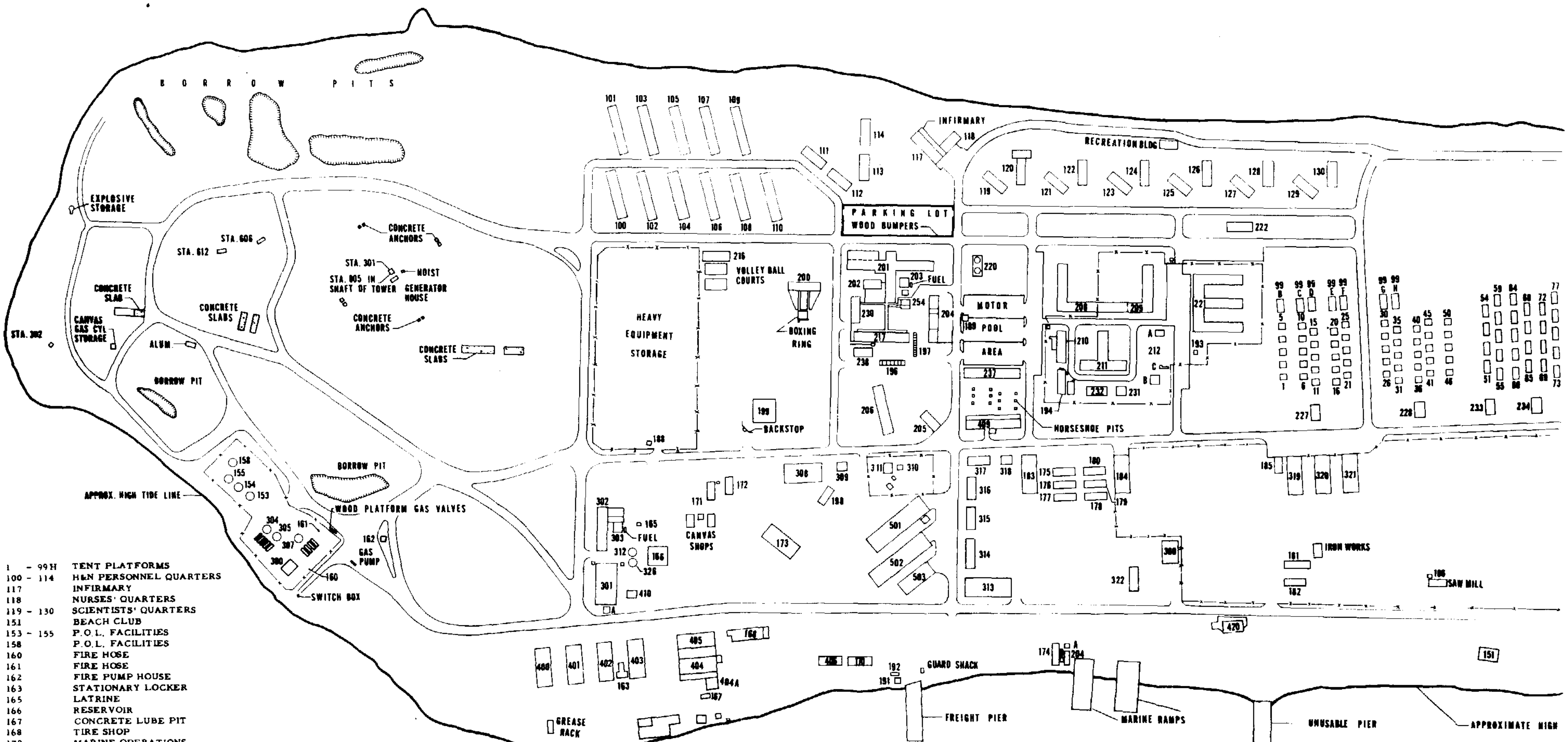
BARRACKS NO.		CAPACITY
206		65
	Grand Total	1,719

Camp site plan, as of 1 December 1952, is shown in Figure 3-21. The work undertaken in the CMR Area is shown in Figures 3-22 and 3-23.

For the beachhead operations on Site Gene, an LCU was fitted out as a houseboat until camp facilities could be provided ashore. This was accomplished by covering the after portion of the boat with wood and canvas, by the addition of cots, mess tables, chairs, a 650 cubic foot reefer, and one portable 50 KVA generator. Two "Navy Cubes" were provided to augment the fresh water storage. Approximately 50 employees were supported at one time on this boat. During the week of 22 January the employees were moved from the houseboat to a temporary camp established ashore. For housing purposes, 8-man tents were erected only as needed to meet the immediate demands. These tents were so erected that they could be picked up as a whole and moved to the permanent camp. The permanent camp was first occupied in early March. Four 4-man tents were provided for certain administrative and supervisory personnel, and sixty-five 8-man tents for all other housing purposes. The erection of these was a continuing project and tents were erected only as required. The work undertaken is shown on the Site Plan, Figure 3-24. The water and sewer systems that were installed are shown in Figure 3-25.

The original planning for Site Yvonne contemplated a 250-man camp. As work progressed, it became apparent this population would not be reached. Accordingly all the facilities provided were kept at a minimum. Housing was provided by the erection of thirty-seven 4-man tents on the existing concrete slabs. As was the case for housing facilities on Gene, the erection of tents was a continuing project; the tents being erected only as required. The work that was undertaken to reactivate Yvonne is shown in Figure 3-26.

Assignments to berths for all personnel at both Gene and Yvonne were made by the Assistant Camp Supervisor. Although housing tents were not definitely designated for occupancy by units, personnel of task units or project groups



1 - 99H TENT PLATFORMS
100 - 114 H&N PERSONNEL QUARTERS
117 INFIRMARY
118 NURSES' QUARTERS
119 - 130 SCIENTISTS' QUARTERS
151 BEACH CLUB
153 - 155 P.O.L. FACILITIES
158 P.O.L. FACILITIES
160 FIRE HOSE
161 FIRE HOSE
162 FIRE PUMP HOUSE
163 STATIONARY LOCKER
165 LATRINE
166 RESERVOIR
167 CONCRETE LUBE PIT
168 TIRE SHOP
170 MARINE OPERATIONS
171 DIST. REPAIR
172 POWER PLANT REPAIR SHOP
173 WAREHOUSE PLUMBING
174 MARINE RIGGING LOFT & MARINE "WAYS" OFFICES (A & B)
175 CHAPEL
176 PERSONNEL OFFICE
177 BLDG. MAINT. & GUARDS' OFFICE
178 CAMP OFFICE
179 GYM
180 RADIO SHOP
181 GENERAL STORES WAREHOUSE
182 HEAVY EQUIPMENT RIGGING LOFT
183 WAREHOUSE
184 WAREHOUSE
185 A.E.C. SUPPLY
186 SAW SHED
188 H&N DISPATCH
189 DISPATCHER'S OFFICE
190 BEACH CLUB
191 STORAGE ROOM
192 FUEL TANK
193 GENERAL LAB
194 SHOP
196 REEFER BANKS
197 REEFER BANKS
198 MARINE REPAIR SHOP
199 SOFTBALL DIAMOND
200 MOVIE
201 MESSHALL
202 BAKERY
203 BOILER
204 P.O. B.S. P.X. S.B.
205 FIRE STATION
206 SECURITY QUARTERS
208 H&N ADMINISTRATION
209 SCIENCE ADMIN
210 PHOTO LAB
211 INSTRUMENT LAB
212 A, B & C COUNTING & SAMPLING
216 DAY ROOM
217 REEFER
220 FRESH & SALT WATER ELEVATED TANKS
221 TASK FORCE ADMINISTRATION
222 A.E.C. SECURITY BLDG.
227 LATRINES & SHOWERS
228 LATRINES & SHOWERS
230 COMMISSARY
233 - 236 LATRINES & SHOWERS
237 RECREATION
238 CHILL STORAGE BUILDING
254 GARBAGE CAN BUILDINGS
300 ALUM. PUMP HOUSE
301 POWER & STILLS
302 LAUNDRY
303 BOILER
304 305 & 307 P.O.L. FACILITIES
308 WAREHOUSE & SUB STORES
309 MATERIAL TEST LAB
310 PRES. TOWER
311 CONTROL BUILDING
312 & 326 SALT WATER TANKS
313 WAREHOUSE MAINTENANCE
314 PLUMBING & MACHINE SHOP
315 ELECTRIC SHOP
316 SHEET METAL SHOP
317 CARPENTER SHOP
318 OFFICE MACHINE REPAIR SHOP
319 - 321 WAREHOUSES
322 MARINE REPAIR SHOP
360 WATER TAXI SHELTER
400 - 403 WAREHOUSES
404 WELDING SHOP
404A WELDING SH
405 MACHINE RE
406 WAREHOUSE
409 RECREATION
410 SALT WATEI
420 CEMENT WA
501, 502, 503 WAREHOUSE

Figure 3-21 Site Plan

15 DEC. 1952

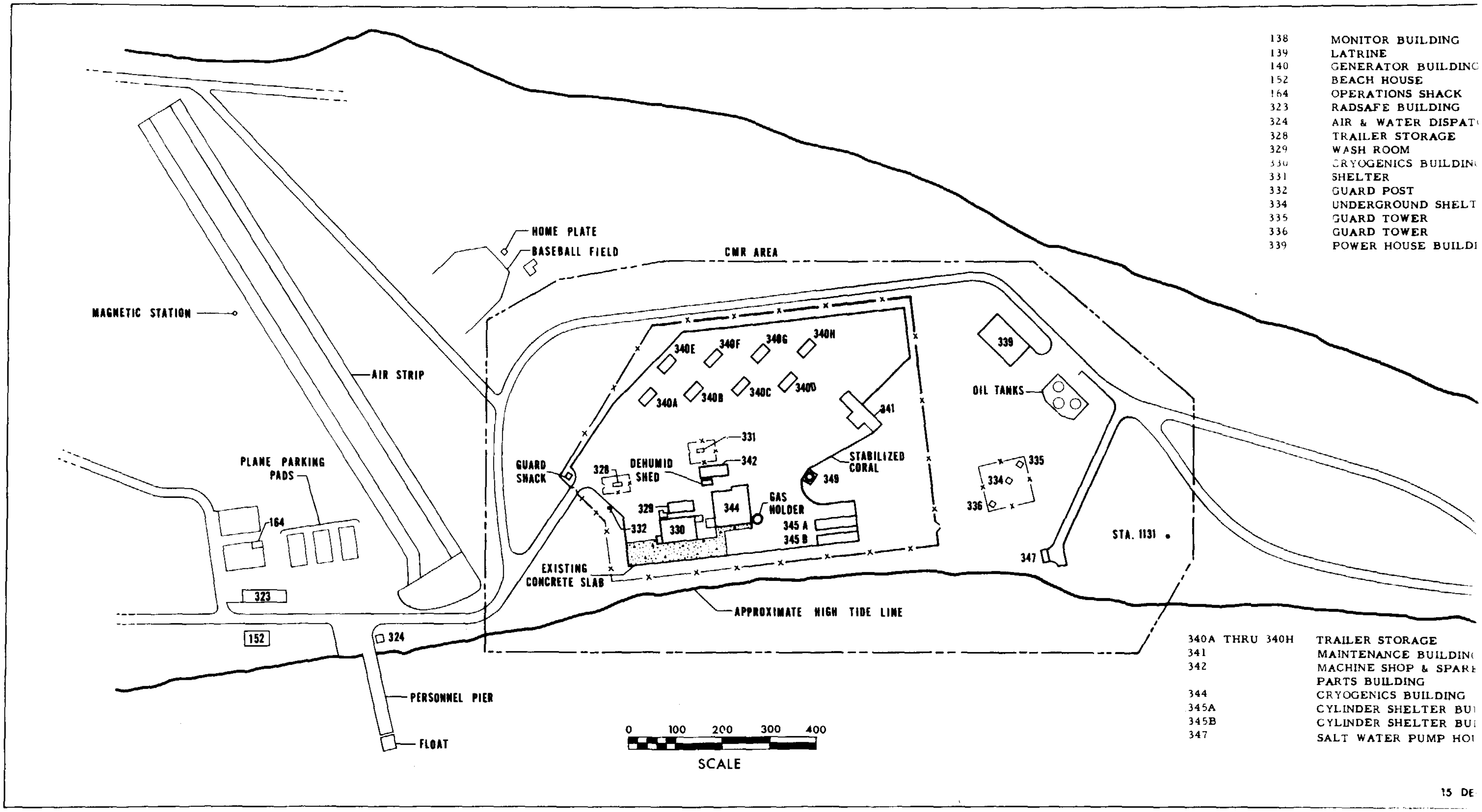


Figure 3-22. CMR Area - Site Plan.

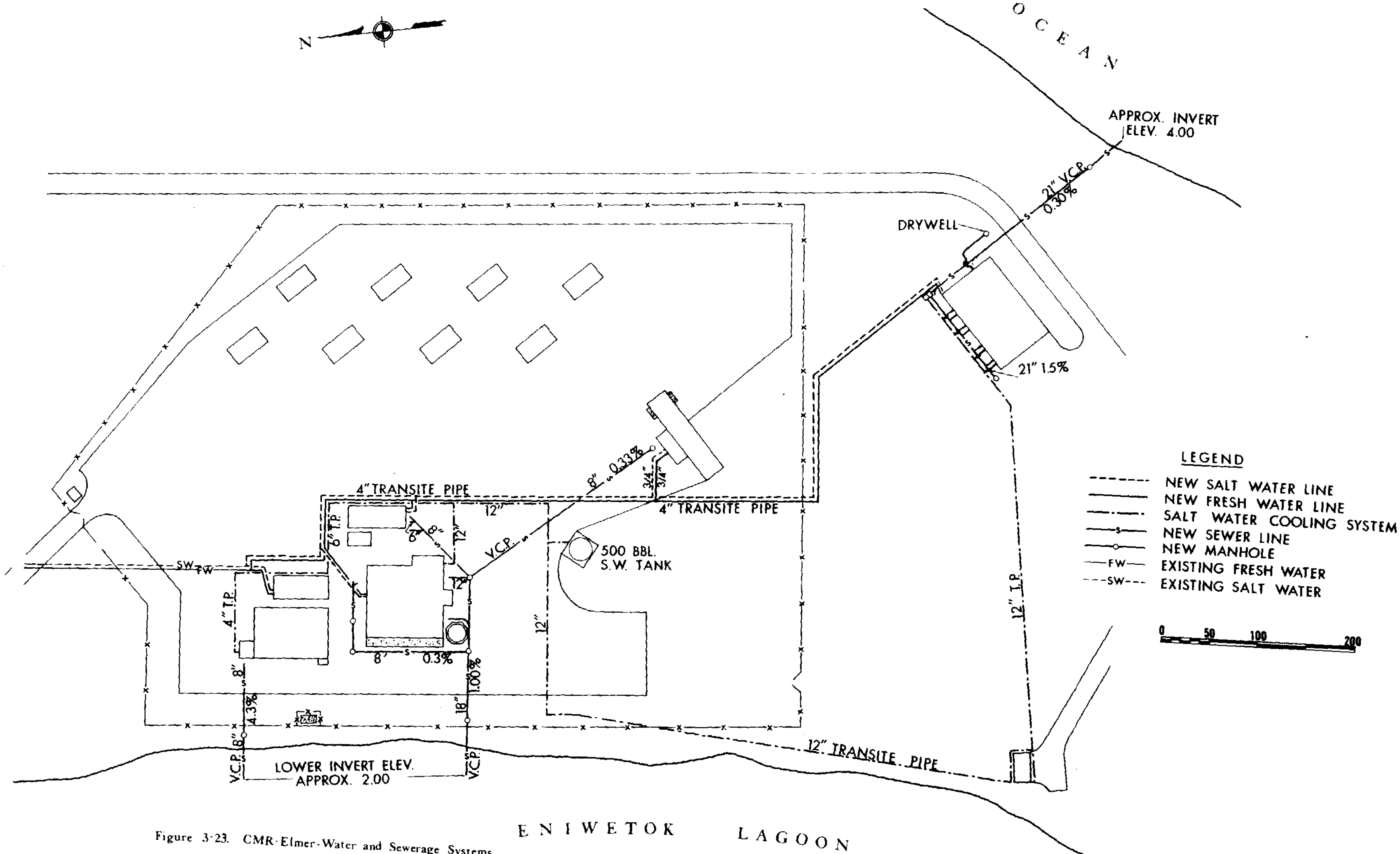


Figure 3-23. CMR-Elmer-Water and Sewerage Systems

15 DEC. 1952

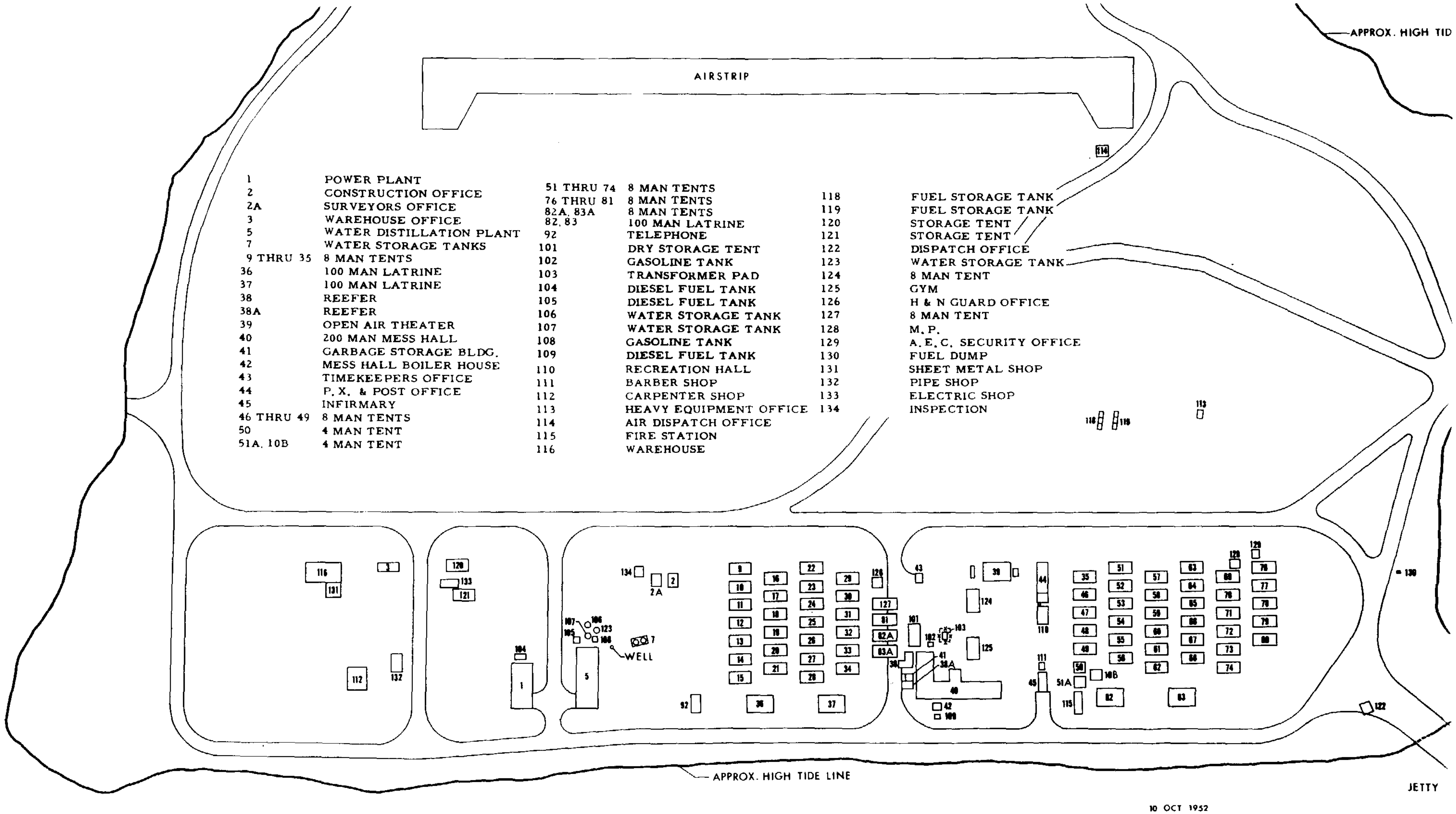
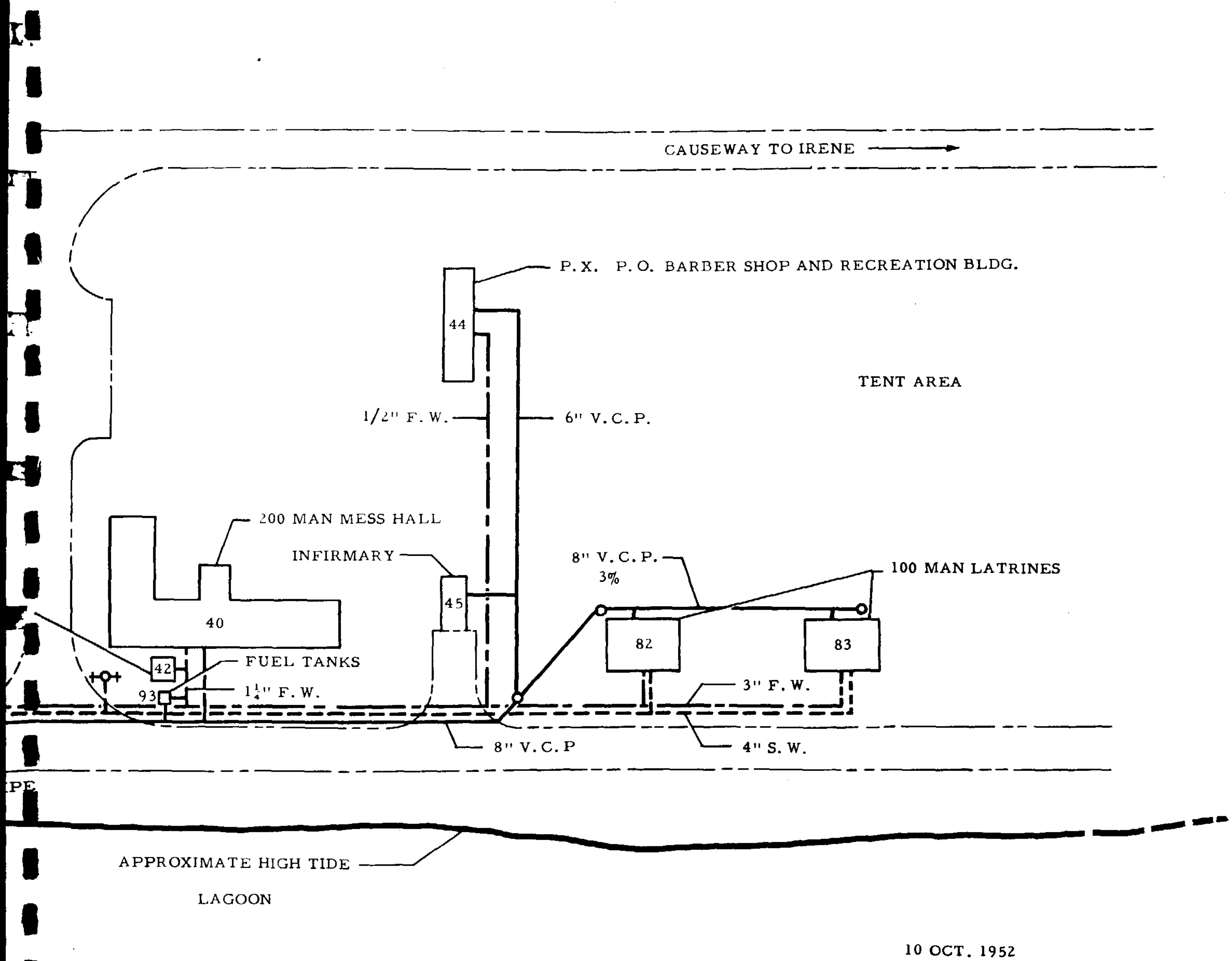


Figure 3-24. Site Plan, Gene


CAUSEWAY TO IRENE
P.X. P.O. BARBER SHOP AND RECREATION BLDG.
44
TENT AREA
1/2" F.W.
6" V.C.P.
200 MAN MESS HALL
INFIRMARY
8" V.C.P.
3%
100 MAN LATRINES
45
40
82
83
42
FUEL TANKS
93
1¼" F.W.
3" F.W.
8" V.C.P
4" S.W.
APPROXIMATE HIGH TIDE
LAGOON
10 OCT. 1952

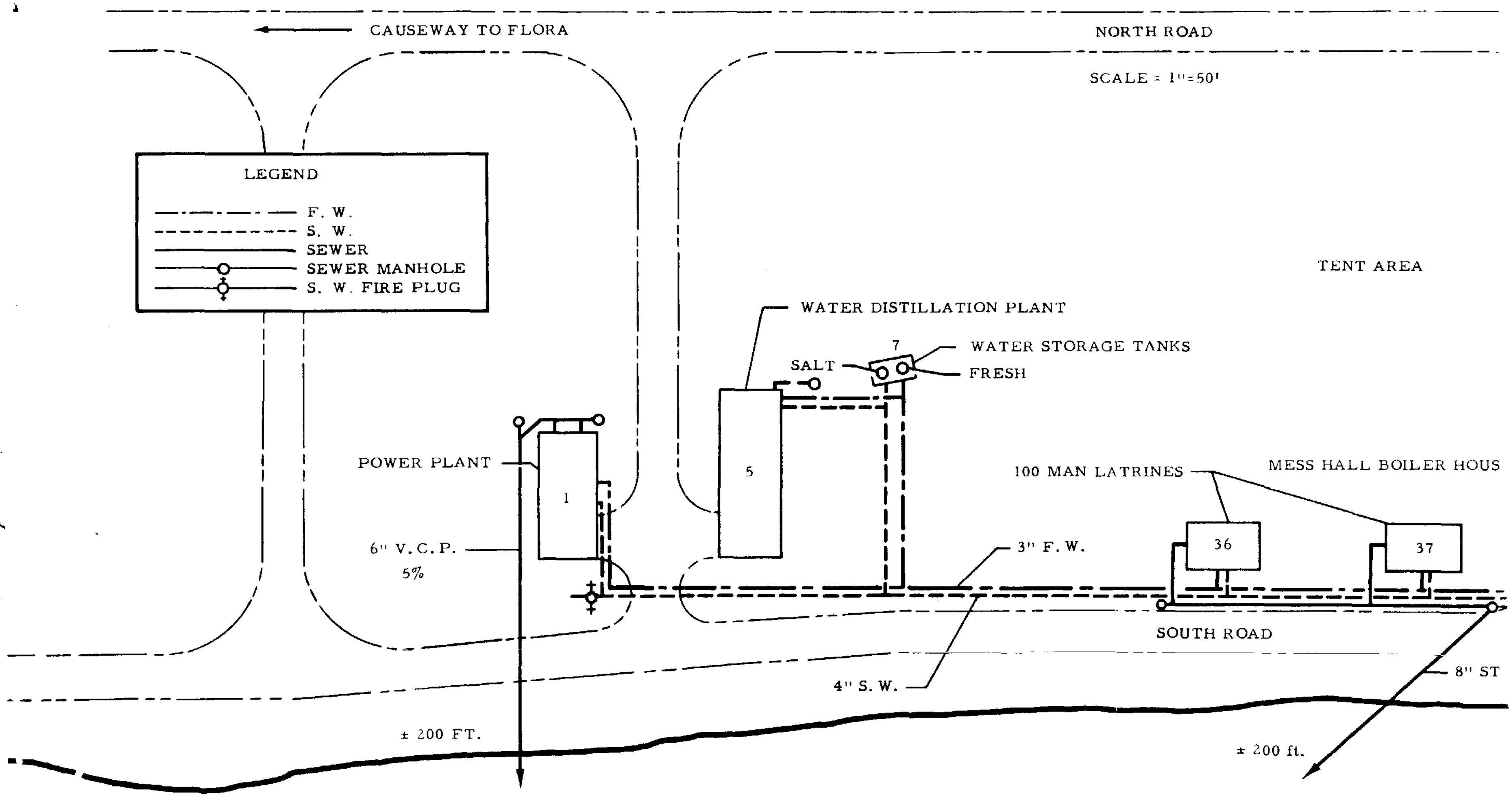


Figure 3-25. Gene Camp Site. Fresh and Salt Water Systems, Sewerage Layout.

BUILDINGS REACTIVATED

1-20. 4 MAN TENTS
41-56. 4 MAN TENTS
63. 4 MAN TENT
101. 100 MAN LATRINE & SHOWERS
102. MESSHALL & BOILER ROOM
103. THEATER
104. WATER TOWER
105. M.P. RECREATION ROOM
106. POWER HOUSE & DIST'N. (NOT USED EXCEPT GAS ENGINE & SW TANK)
108. 100 MAN LATRINE & SHOWERS
109. FIRST AID & FIRE STATION
111. GREASE RACK
122. GARBAGE HOUSE & RAMP
125. REEFER BUILDING
G. TWO 50 KVA PORTABLE GENERATORS
R. REFRESHMENT BUILDING & TENT

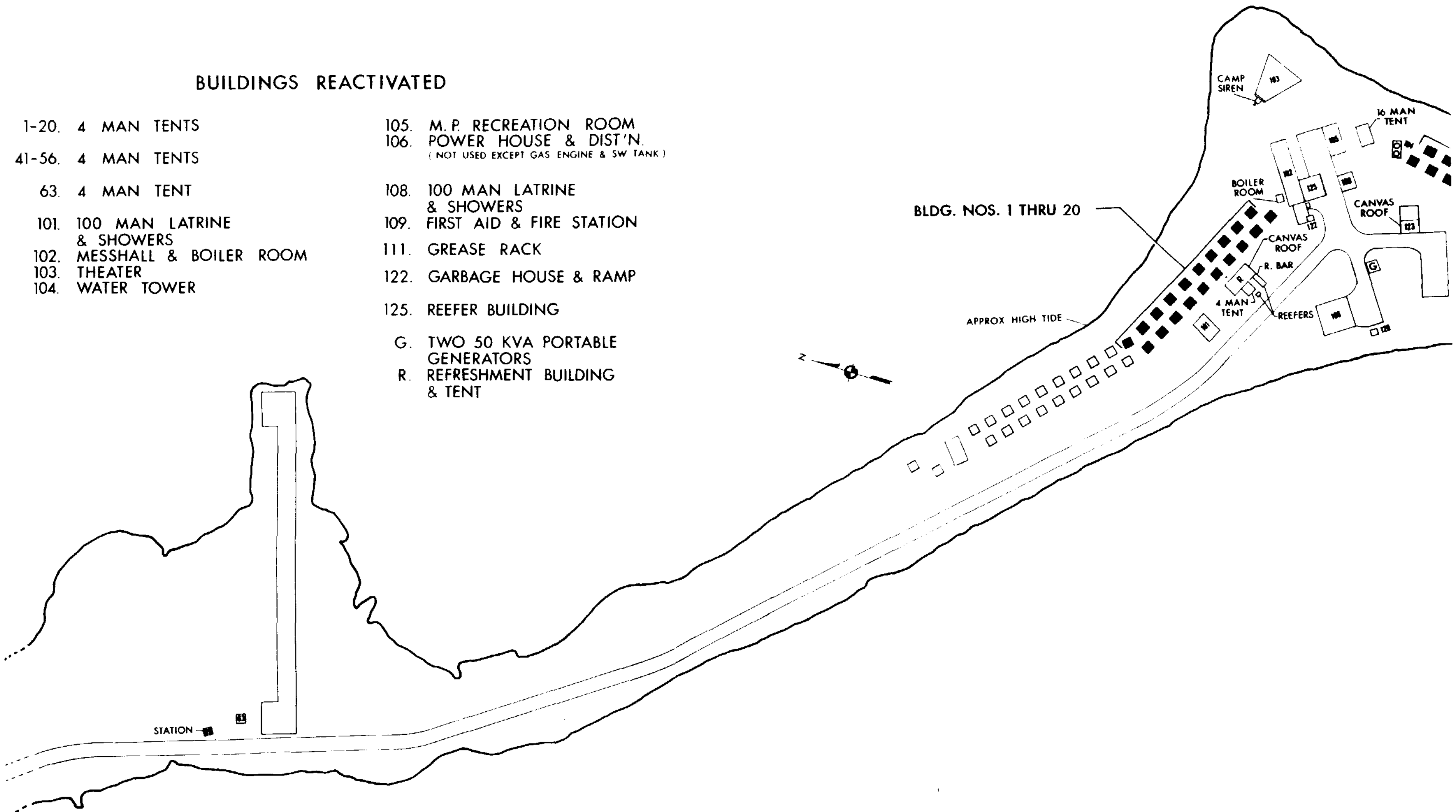


Figure 3-26. Yvonne-Site Plan

were generally housed together. In order that this could be accomplished during the latter stages of the Operations on Gene without erecting additional tents, frequent shifting of personnel was necessary. The personnel housed and messed by bases from 1 January 1952 through 31 December 1952 is shown in Figure 3-27. This figure includes all Jobsite personnel including supported personnel.

SECTION 3. MESSING

Messing facilities were operated at the established camps at Elmer, Gene, and Yvonne. For short periods, mess facilities were provided at Alice, Gene, and Yvonne by the use of a portable galley, and during the beachhead landing on Gene by the use of the facilities of an LCU fitted as a houseboat.

Menus were prepared monthly with emphasis placed on the avoidance of frequent repetitions. All camps were furnished the same menus and insofar as was practicable the meals served at all camps were uniform. Sample menus are shown herewith.

SUNDAY

Chilled Blended Orange-Grapefruit Juice	Relish Dish	Salad
Puffed Rice	Chicken Noodle Soup	Roast Prime Rib of Beef Au Jus
Oatmeal Mush	Potato Salad	Mashed Potatoes
Ham & Fried Eggs	Cold Solid Packed Tomatoes	Buttered Fresh Sweet Peas
Danish Pastry	Cold Cuts, Sliced Cheese	White Bread
Coffee, Fresh Milk	Tamales, Chili & Beans	Strawberry Shortcake
	French Bread	Coffee, Tea
	Chocolate Milk, Coffee, Tea	

MONDAY

Chilled Grape Juice	Salad	Salad
Fresh Grapes	Split Pea Puree	Breaded Veal Cutlets
Cream of Wheat	Corned Beef	Tomato Sauce
Shredded Wheat	Prepared Mustard	Oven Brown Potatoes
Minced Ham & Scrambled Eggs	Boiled Potatoes	Buttered Fresh Broccoli
Raised Doughnuts	Boiled Cabbage	White Bread
Toast and Jelly	Whole Wheat Bread	Cookies & Ice Cream
Coffee, Fresh Milk	Apple Pie Ala Mode	Coffee, Tea
	Coffee, Tea, Cold Drink	

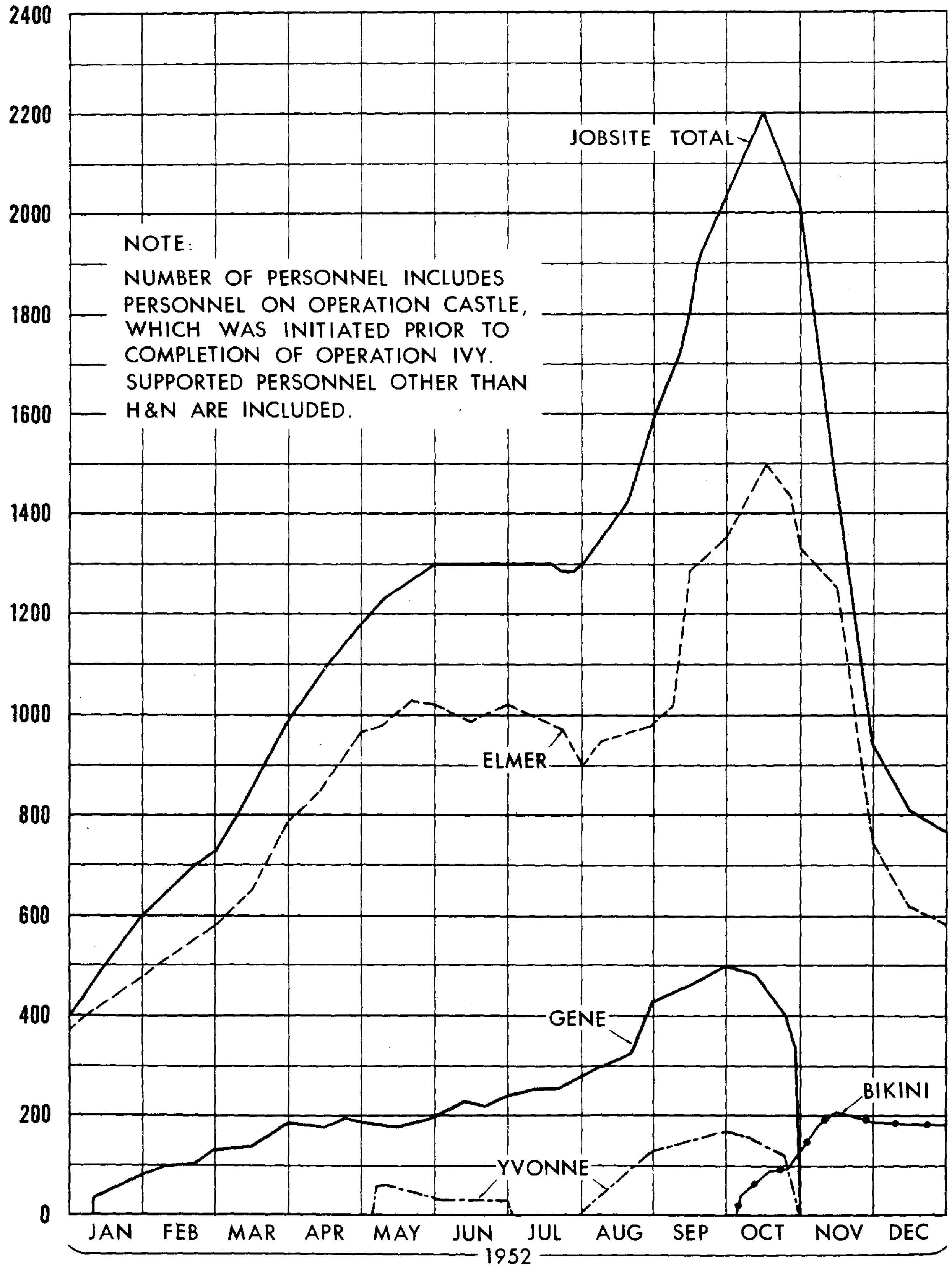


Figure 3-27. Personnel Housing and Messing, by Bases

TUESDAY

Chilled Grapefruit Juice	Relish Dish	Salad
Bartlett Pears	Scotch Soup with Barley	Roast Sirloin of Beef
Corn Flakes	Barbecued Pork Spare Ribs	Brown Gravy
Oatmeal Mush	Mashed Potatoes	Harvard Beets
Bacon and Fried Eggs	Whole Kernel Corn	White Bread
Cinnamon Rolls	Rye Bread	Cake and Ice Cream
Coffee, Fresh Milk	Custard Pie	Coffee, Tea
	Chocolate Milk, Tea, Coffee	

WEDNESDAY

Chilled Vegetable Juice	Salad	Salad
Canned Prunes	Cream of Tomato Soup	Roast Tom Turkey
Puffed Wheat	Barbecued Pork Spare Ribs, Mashed Potaotes	Cranberry Sauce
Cream of Wheat	Buttered Fresh Lima Beans	Savory Dressing
Creamed Hamburger	Dinner Rolls	Buttered Fresh Sweet Peas
Cheese Omelet	Vanilla Pudding	Mashed Potatoes
Butter Horns	Coffee, Tea, Cold Drink	White Bread
Toast and Jelly		Cookies & Ice Cream
Coffee, Fresh Milk		Coffee, Tea

THURSDAY

Chilled Orange Juice	Relish Dish	Salad
Sliced Pineapple	Milanis Vegetable Soup	Roast Leg of Lamb
Bran Flakes	Grilled Beef Liver and Onions	Mint Jelly
Oatmeal Mush	Lyonnaise Potatoes	Brown Gravy
Chipped Beef on Toast	Saute Spinach	Buttered Fresh Broccoli
Fried Eggs	White Bread	White Bread
Pecan Rolls	Cream Puffs	Cake & Ice Cream
Coffee, Fresh Milk	Coffee, Tea, Cold Drink	Coffee, Tea

FRIDAY

Chilled Tomato Juice	Salad	Salad
Fresh Pears	Oyster Stew	Grilled Breaded Pork Chops
Puffed Rice	Grilled Salmon Steaks	Apple Sauce
Cream of Wheat	Tartar Sauce	Country Gravy
Pork Link Sausages	Southern Hash	

FRIDAY - Continued

Fried Eggs	Macaroni Cheese	Buttered Fresh Asparagus
Hot Cross Buns	Whole Kernel Corn	Mashed Potatoes
Coffee, Fresh Milk	White Bread	White Bread
	Cherry Pie	Cake & Ice Cream
	Coffee, Tea, Cold Drink	Coffee, Tea

SATURDAY

Chilled Pineapple Juice	Relish Dish	Salad
Peach Halves	Potage Ala Andalouse	Grilled New York Cut Steaks
Shredded Wheat	Spaghetti & Meat Balls	Mushroom Sauce
Hot Cakes and Syrup	Meat Sauce	French Fried Potatoes
Bacon	Saute String Beans	Corn on the Cob
Cinnamon Rolls	Dinner Rolls	White Bread
Coffee, Fresh Milk	Blueberry Pie	Cookies & Ice Cream
	Coffee, Tea, Cold Drink	Coffee, Tea

Monthly requisitions for food were prepared 90 days in advance of requirements. The food requirements were estimated on the basis of man power forecasts, with the intent of maintaining a 60-day maximum supply of dry stores and a 30-day supply of forzen stores on hand at all times. Chill stores, which were liable to spoilage after three or four weeks, were ordered only on a monthly basis. For the Evacuation Period, the reefers had to operate unattended. Since there were a number of reefers that could not be left unattended as they were not self-defrosting, it became necessary to have at the Jobsite for this period only those provisions which could be stored in reefers that were self-defrosting. The available reefer space was reduced by approximately one-half the Jobsite total and resulted in storage of certain items for a limited time.

No major difficulties in food handling and storage were experienced other than indicated above. All provisions on Elmer were stored in the Supply Division warehouses or cold storage spaces and were drawn as needed by the chef. A small provision breakout room was operated as a part of the kitchen. The following table lists the cold storage available at this site.

LOCATION	QUANTITY	DESCRIPTION	CU. FT. CAPACITY	TOTAL
Reefer Bank	2	Hill	650	1,300
Reefer Bank	4	Barr	675	2,700
Reefer Bank	4	Econocold	825	3,300
Reefer Bank	9	Hussman	150	1,350
Reefer Bank	17	GRC	675	11,475
Galley	3	Econocold	300	900
Bakery	2	Hussman	150	300
Chill House	1	Jobsite Built	10,560	10,560

On Gene an 8-man tent was provided for dry provision storage. Four 675 cubic foot reefers and one 525 cubic foot mobile reefer were used for cold storage. On Yvonne, dry provisions were stored in the lean-to forming a part of the mess hall and cold storage was provided by four 675 cubic foot reefers.

All mess hall provisions and supplies were furnished to off-island camps from Elmer on a weekly schedule. Two portable reefers mounted on a standard trailer were used for transporting chilled and frozen foods. Although these reefers were not operated while in transit, no spoilage occurred.

At Elmer the mess facilities provided for OPERATION GREENHOUSE were used and in general these facilities were adequate. The peak in population on this site was 1,506 which was reached on 14 October 1952. The three wings of the dinning room accommodated 624 men in one seating. Two seatings, combined with the early and late messes, made it possible to serve all with little delay, except for a short time during the peak period when resetting a few tables a third time was necessary. Meal schedules were published and rigidly maintained. Due to a shortage of mess hall personnel, it was necessary to allow 30 minutes between seatings for resetting of tables.

The mess hall on Gene was a wooden structure designed and constructed to meet the needs of a 250-man camp. The original planning for this facility contemplated an additional dining hall wing to this building should the camp population exceed 250 men. Since it was known that all facilities on this site would be removed or expended and since the need for the increased facilities was for a limited period, the additional wing was not built. During the peak population period more than 500 persons were accommodated in this mess hall by the adoption of the cafeteria system of service.

On Site Yvonne the mess hall was a standard prefabricated aluminum building with a wooden lean-to which was used for provision storage and to house four 650 cubic foot reefers. As the peak population on this island was approximately 160 men, the facilities provided for messing were more than adequate, and no unusual difficulties were encountered.

Two portable kitchens were designed and constructed at the Jobsite. These were complete with all the necessary equipment and fitted with a radio which was adjusted to the marine radio network. Water and fuel were provided for these galleys by the use of "Navy Cubes" mounted on a standard trailer as shown in the accompanying photograph, Figure 3-28

Figure 3-28. Portable Galley Used on Site Yvonne

One portable kitchen was used for a 15-man camp established on Alice for a short period. After breakfast on M -3 Day, this kitchen was moved to Gene to service that camp so that the regular kitchen could be dismantled and moved off the site. A second portable kitchen was similarly used on Yvonne, and was also used later to provide hot lunches to those required to work on Yvonne in preparing for the KING-Shot. In operations on islands not having an established camp, the use of the portable kitchens eliminated the non-productive time of the employees in transportation and provided employees with hot lunches which could not be furnished otherwise.

The following table indicates the average of the daily population for each month of the year at each camp and the average daily number of mess personnel employed:

AVERAGE DAILY POPULATION AND MESS PERSONNEL

	ELMER		GENE		YVONNE	
	Pop.	Mess	Pop.	Mess	Pop.	Mess
Jan	426	32	51	6	0	0
Feb	523	42	108	7	0	0
Mar	673	61	158	12	0	0
Apr	853	71	188	18	0	0
May	991	98	186	21	41	6
Jun	972	97	218	21	36	6
Jul	983	94	252	22	9	0
Aug	967	88	328	25	73	9
Sep	1207	93	468	28	142	12
Oct	1384	89	427*	28	124*	11
Nov	1050	79	0	0	0	0
Dec	597	70	0	0	0	0

*Evacuation M -3 Day

A snack bar was operated on Elmer as an adjunct of the messing facilities. The accounting of this facility is therefore included in the mess account. The cost accounting of all mess facilities was accomplished on a Jobsite basis, rather than a camp basis. The extent of the activities involved may be noted from the fact that 1,264,497 meals were served. One dollar and fifty cents per day was collected for this subsistence. This money and the snack bar revenue totaled $657,745.70 and was deposited to the Contract Advance Fund Account. The statement of meal costs for the year 1952 follows:

STATEMENT OF MEAL COSTS
1952

Opening Inventory	$180,499.04	
Food Stores Received	978,343.97	
Transfers From Other Departments	1,330.93	
Transfers From Interdepartments		
Invoice Adjustments	325.63	
		$1,160,499.57
Less: Cost of Food Sold - Snack Bar	5,291.45	
Sales to Military	401.97	
Transfers to Interdepartments		
Closing Inventory	242,611.98	
		248,305.40
Gross Cost of Food	912,194.17	
Add: Cost of Food Sold - Snack Bar	5,291.45	
		917,485.62
Less: Food Surveyed	8,264.37	
Snack Bar Revenue	21,675.00	
		29,939.37
Net Cost of Food		887,546.25
Total Labor Cost		602,018.17

Total Meals Served	1,264,497
Food - Gross Cost Per Meal	.7214
Net Cost Per Meal	.7019
Labor - Cost Per Meal	.4761
Labor and Net Cost of Food:	
Cost Per Meal (2 & 3)	1.178

The subsistence cost for food and labor for each month of 1952 was as follows:

MONTH	FOOD COST PER MEAL	LABOR COST PER MEAL
January	.7690	.4584
February	.7253	.4624
March	.7351	.4553
April	.7362	.4329
May	.6777	.4539
June	.6776	.5010
July	.6879	.5164
August	.7327	.4609
September	.6732	.4555
October	.6859	.4572
November	.6544	.4903
December	.8111	.6088

Food inventories for each month were as follows:

INVENTORY DATE	TOTAL MAN POWER ON INVT. DATE	FOOD INVENTORY	
		TOTAL	AVERAGE PER MAN
31 Dec	402	$182,321.92	$453.54
27 Jan	567	184,207.71	324.88
2 Mar	742	188,966.10	254.67
30 Mar	978	238,637.62	244.01
27 Apr	1117	251,883.51	225.50

INVENTORY DATE	TOTAL MAN POWER ON INVT. DATE	FOOD INVENTORY TOTAL	FOOD INVENTORY AVERAGE PER MAN
1 Jun	1303	$198,979.56	$152.70
29 Jun	1292	174,421.91	135.00
27 Jul	1293	225,801.56	174.63
31 Aug	1643	238,303.13	145.04
28 Sep	1997	240,125.00	120.24
26 Oct	1948	198,428.11	101.86
30 Nov	939	111,213.34	118.43
28 Dec	772	242,611.98	314.26

SECTION 4. REVENUE PRODUCING FACILITIES

GENERAL

In accordance with the requirements of the Contract, Holmes & Narver operated such revenue producing facilities as mess, snack bar, post exchange, and bars and clubs. All revenues derived from these facilities were applied as credits to the cost of the work under the Contract. They were deposited regularly to the Contract Advance Fund Account and thus reverted to the Atomic Energy Commission. As of 28 December 1952, recorded revenues from all facilities on all sites totaled $1,105,348.03. Rigid controls were exercised over all stocks and revenues; as a consequence no significant shortages occurred.

MESS

The operation of mess facilities was discussed in Section 3 of this Chapter, in which an Operating Statement for the year was shown. One dollar and fifty cents per day from each person was collected for this subsistence and a total of $657,745.70 was deposited to the Contract Advance Fund Account.

POST EXCHANGE

The main post exchange was located on Elmer and branches were located on Gene and Yvonne. Only those items of merchandise considered essential for Jobsite use or recreation were stocked. Luxury items were not carried. All sales were for cash. Exchanges were not permitted unless they could be accomplished without loss to the store. On Elmer a cashier, under the direct supervision of the Resident Controller, was responsible for all cash receipts. Post exchange clerks were not permitted to receive cash. The clerks were required to make out a sales slip in duplicate, the original of which was given to the purchaser for presentation to the cashier when making payment. The duplicate of this sales slip was retained by the clerk and at the end of the day's work all duplicates were totaled and this total compared with the cash received by the cashier.

The post exchange on Yvonne was established in a 4-man tent, and only limited quantities of essential items were carried. Orders were taken for those items of merchandise stocked at Elmer but not at Yvonne, which were phoned in and generally delivered the following day. As the work involved in the operation of this store was not sufficient to keep the clerk fully occupied he was also assigned to postal and camp clerical duties.

The post exchange on Gene was established in a wooden building which was also used to house the bar and Post Office.

Physical inventories of all items of merchandise were taken at the end of each accounting period, or when a change in store managers occurred. The inventories were in all cases witnessed and audited by representatives of the Resident Controller. On completion of OPERATION GREENHOUSE, the post exchange was overstocked in certain items due to the radical reduction in personnel that occurred. Operations throughout 1952 were designed toward the reduction in this inventory, with the following results:

INVENTORY DATE	TOTAL MAN POWER ON INVT. DATE	POST EXCHANGE INVENTORY	
		TOTAL	AVERAGE PER MAN
31 Dec	402	$95,393.12	$237.29
27 Jan	567	88,965.19	156.90
2 Mar	742	79,857.81	107.62
30 Mar	978	72,286.51	73.91
27 Apr	1117	74,555.30	66.74
1 Jun	1303	64,786.86	49.72
29 Jun	1292	67,925.60	52.57

INVENTORY DATE	TOTAL MAN POWER ON INVT. DATE	POST EXCHANGE INVENTORY TOTAL	POST EXCHANGE INVENTORY AVERAGE PER MAN
27 Jul	1293	$70,616.51	$ 54.61
31 Aug	1643	58,762.86	35.77
28 Sep	1997	45,284.90	22.68
26 Oct	1948	43,994.04	22.58
30 Nov	939	32,643.51	34.76
28 Dec	772	48,841.55	60.64

The Operating Report for the post exchange for the year 1952 to date follows:

OPERATING REPORT
POST EXCHANGE

Gross Sales		$206,530.38
Cost of Sales		
Opening Inventory	$ 95,393.12	
Mdse. Received at Jobsite	142,728.18	
Invoice Clearance Adjustments	81.40	
		238,202.70
Less: Mdse. Returned to Vendor - Net	5,497.88	
Mdse. Transferred to Other Department - Net	3,603.59	
Invoice Clearance Adjustments	275.11	
Ending Inventory	48,841.55	
		58,218.13
Net Cost of Sales		179,984.57
Gross Operating Profit		26,545.81
Less: Labor - Operating		31,229.81
Net Operating Loss		4,684.00

The Profit and Loss Statement for each month of the year of 1952 follows:

	POST EXCHANGE		
MONTH	GROSS	LABOR	NET
Jan	$ 1,095.79	$ 950.09	$ 145.70
Feb	1,042.26	2,052.15	⟨1,009.89⟩
Mar	965.13	1,840.97	⟨875.84⟩
Apr	369.56	2,031.99	⟨1,662.43⟩
May	3,328.22	3,052.93	275.29
Jun	761.87	2,440.61	⟨1,678.74⟩
Jul	2,535.97	3,361.82	⟨825.85⟩
Aug	3,517.61	4,012.10	⟨494.49⟩
Sep	3,782.52	3,485.22	297.30
Oct	4,922.17	3,448.33	1,473.84
Nov	1,706.75	2,539.75	⟨833.00⟩
Dec	2,517.96	2,013.85	504.11
TOTALS	$26,545.81	$31,229.81	⟨$4,684.00⟩

BARS AND CLUBS

Bars were operated on the Islands of Elmer, Gene and Yvonne. In order that the privileges for the sale of beer and liquor would not be abused, stringent controls were established governing the handling and sale of these beverages. Liquor and beer were sold across the bars only at scheduled hours.

A daily inventory of all bar stock was taken by the bar manager, and frequently audited by representatives of the Controller. All cash derived from the sale of liquor was daily checked against the actual sales as indicated by daily inventories. At the end of each accounting period an inventory of all bar and warehouse stocks was taken.

The "Laguna" and "Miramar" beach clubs were opened for the sale of liquor and beer on weekends during the operational phase. All stocks for these clubs were drawn from the bar stock on Elmer and accounted for under that facility.

The Operating Report of the bars and clubs follows:

OPERATING REPORT
BARS AND CLUBS

Gross Revenue		$ 251,884.26
Cost of Sales		
Opening Inventory	$ 1,557.69	
Receipts from Warehouse	148,945.06	
Invoice Adjustments	74.59	
Transfers from Other Departments	222.72	
		150,800.06
Less: Transfers to Army - Loan Repaid	1,127.51	
Transfers to Other Departments	130.55	
Mdse. Received - No Cost	50.40	
Ending Inventory	4,924.04	
		6,232.50
Net Cost of Sales		144,567.56
Gross Operating Profit		107,316.70
Less: Labor - Operating	39,974.06	
Material - Operating Supplies - Jobsite	833.29	
Net Operating Profit		66,509.35

The Profit and Loss Statement for each month of the year of 1952 follows:

MONTH	BEER HALL GROSS	BEER HALL LABOR	BEER HALL NET
Jan	$ 3,105.48	$ 1,267.86	$ 1,837.62
Feb	5,641.91	1,966.25	3,675.66
Mar	6,542.23	1,901.75	4,640.48

MONTH	BEER HALL GROSS	LABOR	NET
Apr	$ 7,052.90	$ 2,226.78	$ 4,826.12
May	10,407.03	3,817.87	6,589.16
Jun	8,978.07	3,265.44	5,712.63
Jul	9,026.50	2,901.10	6,125.40
Aug	12,880.39	5,162.00	7,718.39
Sep	12,013.35	5,250.93	6,762.42
Oct	13,312.39	5,611.75	7,700.64
Nov	11,244.96	3,823.17	7,421.79
Dec	7,111.49	2,779.16	4,332.33
TOTALS	$107,316.70	$39,974.06	$67,342.64
Less: Operating Supplies			833.29
			$66,509.35

SECTION 5. LAUNDRY

The laundry facility on Parry was operated to serve all sites. Regular days for pick up and delivery of laundry were established and the entire operation was on a schedule basis, except for special services for personnel arriving or departing from the Jobsite. Specific instructions as to the method of preparing laundry bags were published which facilitated the processing of and accounting for the laundry. During the construction phase of the operation, fresh water was used for all washing purposes. Due to the relatively large influx of personnel for the operational phase, with the resultant need for conservation of fresh water, it became necessary to shift to the use of salt water for all laundering, except for a limited number of items. During peak loads the laundry was operated with two shifts and only on a few occasions were work hours in excess of the scheduled 54-hour week required to provide adequate service. A table of laundry production through October 1952 follows:

Month	No. of Rough Dry Bundles	No. of Finished Bundles	No. of Shirts Pressed Etc.	No. of Trousers Pressed Etc.	Sheets Ea.	Pillow Cases Ea.	No. Pcs. Laundry Hospital Bar Galley	No. Pcs. Rad-Safe Finished Clothing	No. Lbs. Marine Paint Shop Power (Rough, Lb.)
Jan	1653	1660	2730	3328	4436	2306	1422	215	510
Feb	2197	2041	3205	3825	5784	2988	1515	54	625
Mar	3448	3405	5186	6488	10490	5240	2138	9	1500
Apr	3670	3554	5065		12843	6190	1600	0	1275
May	5347	5256	7267	9177	18276	9113	2114	0	400
Jun	4460	4325	6024	7510	15020	7571	1740	50	475
Jul	3997	3870	5067	6936	15262	7536		0	530
Aug	5205	4997	8080	8406	20126	10245	2130	0	680
Sep	5160	5150	7850	9275	20092	9921	*2514	0	1160
Oct	5146	5141	8112	9996	22555	11140	*2970	34	1460

*Includes General's Quarters

SECTION 6. POST OFFICE

The Post Office facilities were operated as branches of APO 187 in accordance with the postal regulations as contained in the Departments of the Army and Air Force special regulations SR 65-220-1 AFM 182-3 for Unit Mail Service. A central Holmes & Narver postal facility was located on Elmer and it served those located on Gene and Yvonne. The postal clerk in charge on Elmer was allowed a working fund of $650.00 for the transaction of cash business. Frequent audits of this account, were made by the representatives of the Resident Controller.

The Post Office on Elmer maintained a complete record of the site location of all employees and a record of forwarding addresses of those employees who had departed from the Jobsite. All mail arriving at Jobsite was first processed through APO 187 and then delivered to the Post Office on Elmer where it was sorted and distributed to other sites.

Considerable improvement in sorting and delivery of mail was effected by the installation of individual mail boxes in the Post Office on Elmer. Each person was assigned a box number and was requested to inform his correspondents to use the mail box number as part of his address. Approximately 75% of the mail received contained box numbers. A system of colored thumb tacks was used for those boxes assigned to employees living on other islands or for those employees who had left the Jobsite.. This system facilitated the sorting and delivery of the mail and reduced the man hours required for this work.

SECTION 7. BARBER AND COBBLER SHOPS

A three-chair barber shop was operated at Elmer, and one-chair barber shops at each of the camps on Gene and Yvonne. All barbering was accomplished by qualified volunteer personnel working during their off hours. With the approval of the AEC Resident Engineer the price of haircuts was established at sixty-five cents, with the provision that the barbers furnish expendable supplies. Under this arrangement the barbers retained the revenue as their compensation.

A cobbler shop was established on Elmer operated by volunteer cobblers working during their off hours. A limited supply of material was kept available for purchase by the cobblers. The price set for this work was as follows: heels only, sixty-five cents; half soles one dollar and sixty-five cents; heels and half soles two dollars. All monies taken in under the above conditions were retained by the cobbler as his compensation.

SECTION 8. UTILITIES

ELECTRIC POWER

Stationary power plants for the generation of electrical energy were operated on Elmer, Fred, Gene, Janet and Yvonne. Portable power plants were installed on other islands for supplying the needs of the various users.

The following changes in power plants were effected during this operation:

(a) Installation of the CMR Power Plant on Elmer

(b) Removal of the generating units from Ursula for installation on Gene

(c) Dismantling of the plant on David and the installation of the 118 KW unit on Gene

The following is a recapitulation of the power plant capacities:

		TOTAL
FRED		
5 Units	142 KW each	
1 Unit	195 KW	905 KW
ELMER (OLD PLANT)		
6 Units	142 KW each	852 KW
ELMER (CMR)		
3 Units	1000 KW each	3000 KW
YVONNE		
3 Units	118 KW each	354 KW
JANET		
2 Units	118 KW each	
1 Unit	195 KW	431 KW
GENE		
3 Units	118 KW each	
1 Unit	195 KW	549 KW

The power plant capacities were adequate for this operation. No unusual operating difficulties were experienced with the exception of those occasioned by the presence of sea moss in the salt water cooling systems for the CMR and Fred Plants, both of which received the cooling water directly from the lagoon. This moss collected on the pump suction grids and the intake tube sheets of the heat exchangers and thereby restricted the flow of water. This condition was rectified by the addition of 115 feet of 36" pipe to the salt water intake pipe to clear the moss beds in the lagoon and by the installation of strainers in the system.

Complete operating and production records of all plants were maintained and reported monthly. Power consumption for the year is shown graphically in Figure 3-29. Typical daily production curves are shown in Figure 3-30.

The maintenance work load for the plants at Fred and Elmer was heavier than normal. The engines at these plants had reached operating ages where piston clearances exceeded allowed tolerances and the replacement of piston liners became necessary.

Electric power was distributed over 2400 volt lines and was reduced to operating voltages by transformers located in sub stations adjacent to the end users. The distribution system for the CMR Plant was tied into the system of the old plant on Elmer so that either plant could be used to supply the needs of this island.

WATER DISTILLATION, STORAGE AND DISTRIBUTION

Water distillation plants were operated on Elmer, Fred, Gene and Yvonne. The changes effected in water distillation plants during this operation were as follows:

1. Removal of one 600 gph unit from both Janet and Ursula for installation in the plant on Elmer

2. Installation of a 30 HP boiler to augment the steam supply for the plant on Elmer

3. Installation of a plant on Gene having at the peak seven 150 gph Badger-type units with all necessary auxiliaries

For a short period, prior to placing the two additional units on Elmer in operation, a temporary installation of six 150 gph Badger-type units was used to augment the capacity of that plant.

During OPERATION GREENHOUSE considerable operating difficulties were experienced with the 150 gph Badger-type stills. Accordingly all Badger units were modified and reconditioned at the Jobsite before being used for this operation. As a result of this, only seven units were required on Gene during peak demands for fresh water, though original planning contemplated the use of 12 units at this site.

Figure 3-31 shows the number of gallons of water used at each site by months. The following table shows the average daily water consumption in gallons per man on a monthly basis at each camp site:

MONTH	FRED	ELMER	GENE	YVONNE
Jan	64.9	87.3	-	-
Feb	63.9	60.2	-	-
Mar	70.7	50.6	25.2	-
Apr	64.4	47.4	32.9	-
May	60.5	44.3	37.0	-
Jun	56.2	51.0	40.2	-
Jul	55.0	44.7	35.5	-
Aug	42.5	54.0	35.7	53.8
Sep	40.3	49.5	27.0	35.5
Oct	38.2	40.2	25.3	32.8
Nov	42.3	52.0	-	-
Dec	46.6	57.3	-	-
Year	53.8	53.2	32.3	40.7

Fresh and salt water distribution systems were established and maintained on Sites Elmer, Fred, Gene, and Yvonne. All potable water was chlorinated and was free of bacterial contamination. Elevated water tanks, towers and accessories of these structures required periodic cleaning, rust removal and painting. Fresh water consumption was closely watched for unusual rises and any signs of leakage were immediately investigated. The western half of the fresh water concrete reservoir on Elmer developed leaks and had to be emptied for repairs. The pipe lines of the water systems had to be constantly checked; outlets, hydrants and lines required continuous testing because leaks developed through deterioration of metal and breakage of transite pipe.

This situation is attributable to the following factors:

1. Copper service lines have progressively deteriorated through electrolytic action.

2. Transite pipes are subject to unusual stresses due to the irregular supporting value of the soil over which it is laid, with normal sandy soil interrupted occasionally by hard coral sections,

3. Transite pipes could not be laid at normal depths due to the general low elevation of the Atoll.

4. Occasional movement of heavy construction equipment imposed unusual loads on the installation.

These conditions are being improved by:

1. Replacing copper with plastic service lines whenever weakness develops in this part of the installation.

2. Improving the bedding of transite pipes in sections which require removal and replacement.

3. Installing traffic signs to warn equipment operators of areas which must be avoided.

SEWAGE DISPOSAL

Underground sewage disposal systems were established and maintained on Sites Elmer, Fred, Gene, and Yvonne, with proper outfall lines leading into the lagoon or the ocean. Because of the flat terrain of the entire Atoll and the consequent low gradients of the sewer systems, it was necessary that they be closely watched for clogging. Periodic flushing of the systems was required to maintain free flow through the outfalls.

FUEL HANDLING AND STORAGE

Fuel handling and storage facilities for POL products were maintained at Sites Elmer and Fred. The requirements of all other islands were supplied from Elmer by tank trucks. Three 42,000 gallon fuel oil storage tanks and two 1,000 gallon lube oil tanks were erected to the southwest of the CMR Plant to supply the needs of that plant. The fuel oil for these storage tanks was supplied from the main tank farm on Elmer by tank trucks. Difficulties which were experienced with leakage in the flexible submarine gasoline and diesel hoses leading from the tank farms on Sites Elmer and Fred to the POL buoys in the lagoon, are described in Section 4, Chapter I, Book 4.

At the tank farms on Sites Elmer and Fred cross connections between the diesel and fuel oil intake lines were installed, so they could be used interchangeably if required. Changes in the method used in receiving oil from tankers were effected which lessened the possibilities of leakage in the systems. The pump house containing the de-aeraters and meters was by-passed and all oil pumped direct to the storage tanks. The pick-up and handling of the hose when it is taken on board the tankers and the return of the hose on completion of the operation was all accomplished by Holmes & Narver personnel. The tanker crew was only obligated to make up the final connections.

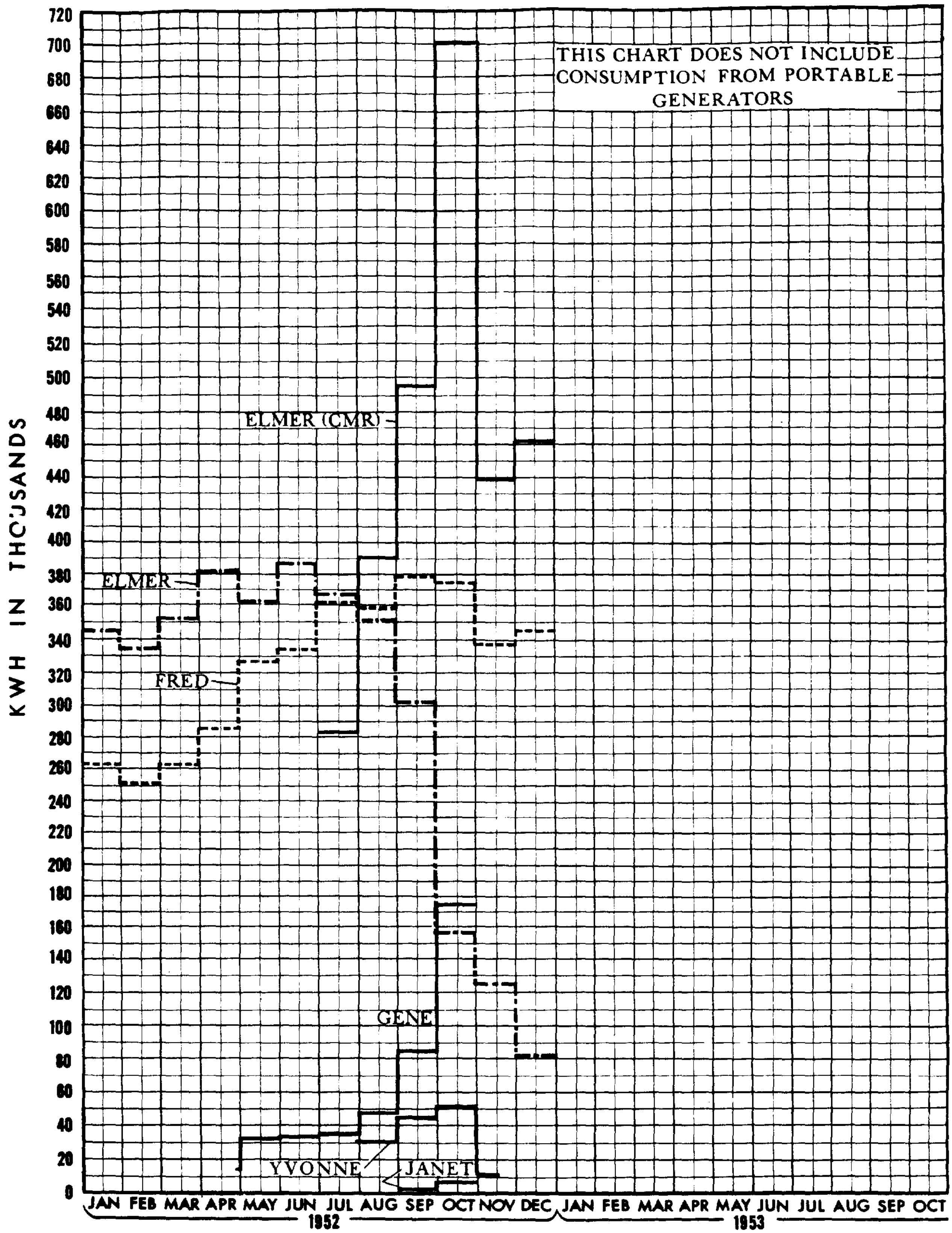


Figure 3-29. Power Consumption Chart

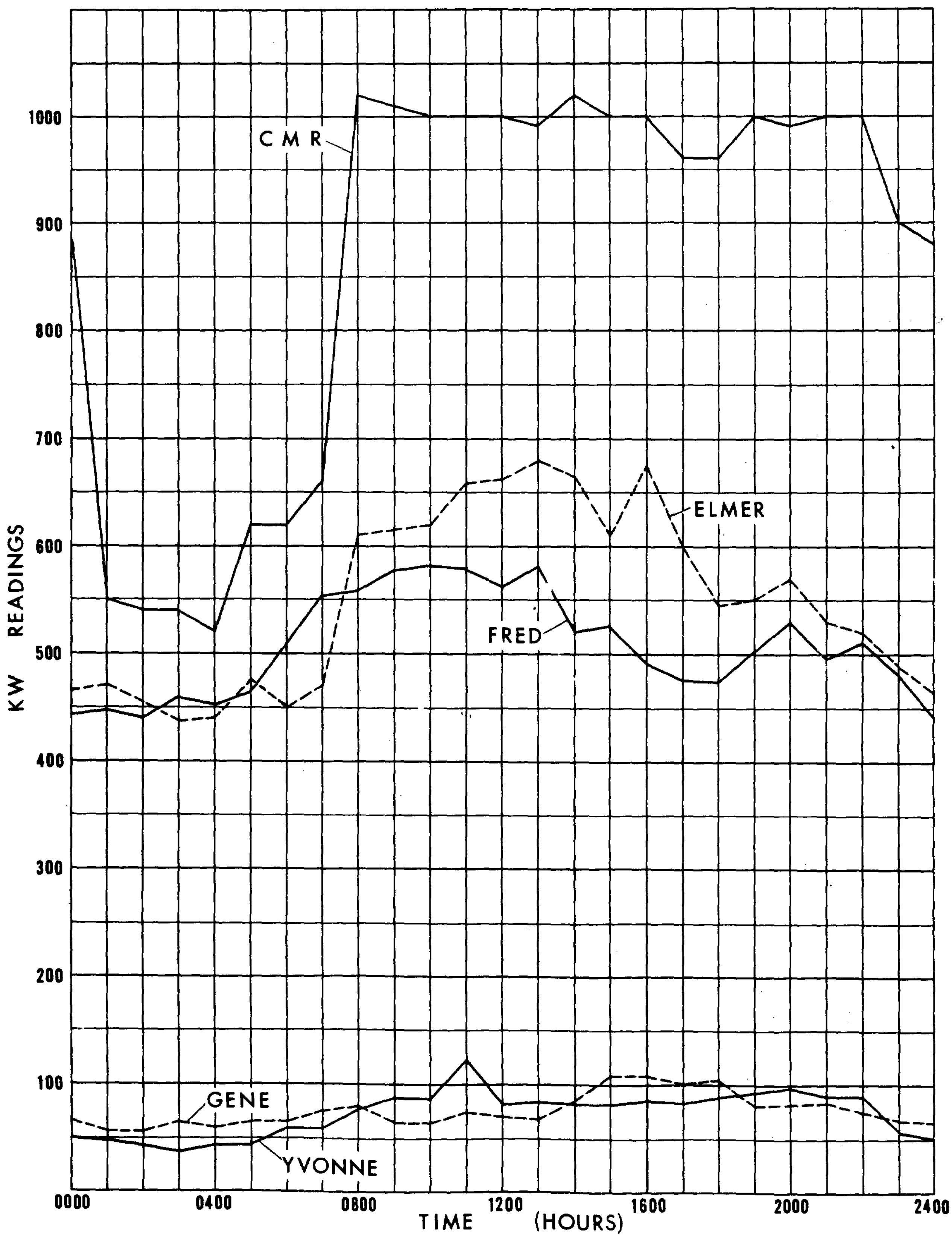


Figure 3-30. Power Plant Production in KW's-Typical 24-Hour Operation

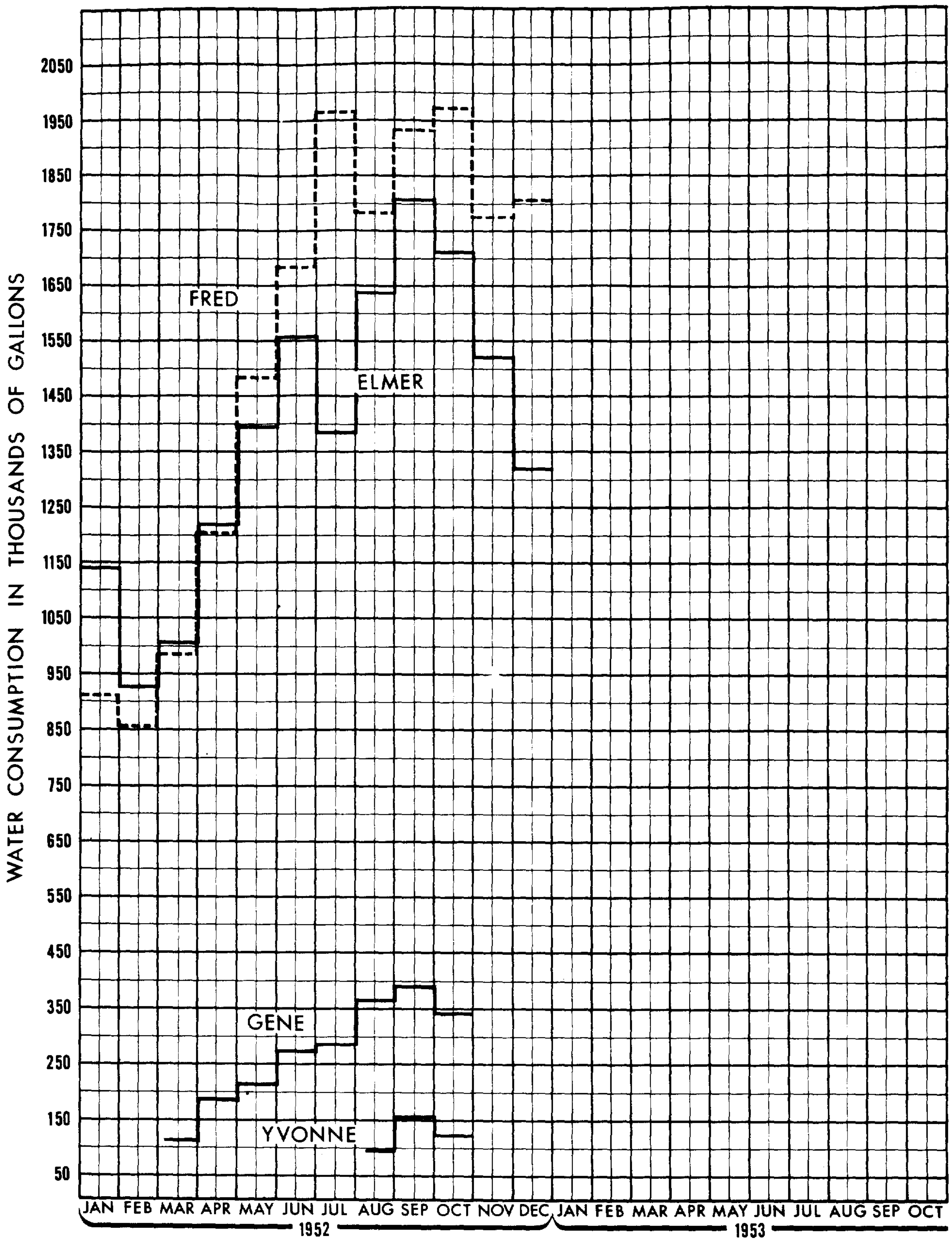


Figure 3-31. Water Consumption Chart