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REPORT OF THE FIELD MANAGER
ENIWETOK FIELD OFFICE
TO THE
MANAGER, SANTA FE OPERATIONS, AEC

79177

July 1, 1950 to July 1, 1953

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RESUME

The inception of Pacific Proving Grounds, as an overseas testing site, was contained in the objectives of the Manager, Santa Fe Operations, as early as July 1947. Eniwetok Atoll was designated by the President of the United States on December 2, 1947, as an atomic proving ground entrusted to the Atomic Energy Commission for maintenance.

Selection of the site for test operations was based on many considerations. Continental locations could not safely be used for tests of an order which created such extensive radiological hazards. Physical condition of the Atoll and the island chain provided suitable combination of orientation, space, and cleared area (over water). Climate was satisfactory. Isolation contributed to radiological safety and overall security.

Subsequent selection of the Bikini Atoll for the Castle test series was an extension of the basic consideration, influenced by the need for more space within the proving grounds, and logistically within the proving ground capabilities of the base facilities of Parry and Eniwetok Islands at Eniwetok Atoll.

Selection of a contractor was made after careful investigation into capabilities, experience, and reliability. Holmes & Narver, Inc., Los Angeles, California, had previous experience in Pacific Ocean sites and the necessary nucleus of personnel for the work anticipated. A contract

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was entered into with this firm and their reconnaissance party reported to the Manager, SFOO, on January 9, 1949. On May 17, 1949, a definitive architect-engineer-construction-management contract was accomplished to implement construction of base facilities and erect scientific structures. Administration by SFO was effected through the ^{Office of} Engineering ^{and Construction} Division represented by a contract administrator.

The basis of the contract was an outgrowth of earlier experience by SFO and a recognition of the necessary flexibility required for the accomplishment of an undertaking without precedent, of such complex composition, and great variables as to recommend the architect-engineer-construction-management (by a single responsible entity) solution.

The interests of Los Alamos Scientific Laboratories and Department of Defense were determined and target dates for Operation Greenhouse were established at late winter 1950, and early spring 1951.

The Pacific Proving Ground consists at present of two atolls in an area within the Marshall Islands group and within the Trust Territory of the Pacific Islands. This area is 150 x 350 miles in extent and is bounded by latitudes $10^{\circ} 15' - 12^{\circ} - 45' N.$, and longitudes $160^{\circ} 35' - 166^{\circ} - 16' E.$

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It is located approximately 5000 statute miles from the west coast of the United States, and 2700 statute miles southwesterly of Honolulu. Eniwetok Atoll, located at latitude $11^{\circ} 30' N$ and longitude $162^{\circ} - 20' E.$ is a coral atoll, circular in shape and approximately 20 miles in diameter. The chain of islands and reef is broken by two navigable passages from Ocean to lagoon. Bikini Atoll, located at latitude $11^{\circ} - 30' N.$, and longitude $165^{\circ} - 30'$, is also a coral atoll, ovalar in shape, approximately 24 miles

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in length and 14 miles in width. The chain of islands and reef follows the usual atoll pattern.

General physical characteristics are similar in both Atolls. The land area is limited and careful control is necessary to avoid expending it through construction operations and wave action. The highest points are approximately 12 feet above high tide, with Bikini averaging out lower than Eniwetok. The waters within the lagoon at Bikini are not as calm as at Eniwetok due to ocean waves entering the wide passage, and the length of the lagoon running with the prevailing wind.

Climate is generally favorable with a range of temperatures from 77° F to 88° F tempered by the northeasterly trade winds. Humidity is high but is not ^a serious discomfort because of excellent circulation of the ocean-borne winds. Precipitation comes in tropical showers with seasonal maximum July thru November, and minimum January thru March, totalling 70 to 80 inches annually. Natural disasters from typhoon or seismic forces were known to be unlikely, since the area is out of the usual path of such forces.

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Possibility of hostile action in the form of attack on the area was recognized also as remote, but emergency plans were made to meet conditions of imminent disaster or hostile attack.

The services outlined in the contract comprised five major contract conditions

Job One - Reconnaissance and Preliminary Study.

Job Two - Formal report setting forth a construction program and presenting design.

Job Three - To build base facilities and to design and construct scientific structures. ~~SECRET~~

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- Job Four - To operate, maintain and manage camps.
- Job Five - To provide skilled support to scientific personnel, rehabilitate structures and facilities, perform salvage, storage and demolition.

Activities, prior to July 1950 (Greenhouse), were under way in the preparation of detailed construction plans when on March 24, 1949, the Military Liaison Committee listed the tests proposed for inclusion in the 1951 program. This was followed by meetings sponsored by Los Alamos Scientific Laboratory, and attended by Army, Navy, Division of Military Application, U. S. Air Force, Armed Forces Special Weapons Project, and Military Liaison Committee representatives. AEC plans were briefed to these representatives. On May 6, 1950, the Joint Chiefs of Staff approved General Vandenberg's recommendation, and General Quesada was designated Task Force Commander, JTF-3. Organization and financing problems were worked out and the Greenhouse constructional phase was well under way.

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Task Group 3.1 was organized March 17, 1950, composed of personnel from AEC, the military services, and several civilian contract firms. This Task Group was commanded by Dr. Alvin C. Graves. Conferences were held in November to discuss with Holmes & Narver the Eniwetok Island construction program and relationships between the contractor and the Construction Battalion which was to accomplish a part of the construction work. Command relationships were subject of further conferences. It was decided that an AEC representative should be appointed as Resident Engineer, responsible for coordinating operations of Holmes and Narver and the Army Construction

Battalion, and for inspection throughout the Atoll.

Impact of the Korean War was felt in the Summer of 1950 by Joint Task Force 3. AEC recognized the possible effects on prosecution of the tests, and Chairman Gordon Dean made known to the Department of Defense the strong feeling that there should be no delay in scheduled tests. Some consideration was given to the transfer of the 1951 tests to the Zone of Interior, and an unsettled period existed until, after extensive study and consultation, on September 1, 1950, JCS 1998/30 was published rendering a decision in favor of the conduct of the weapons tests at Eniwetok. The Commander, JTF-3 assumed overall responsibility for the Eniwetok area on February 1, 1951. About this time it was decided that the proving ground would be held in a standby status for possible future tests of atomic weapons. It was agreed that the test would be held April 15, 1951, or the earliest practicable date thereafter. By June 1950, the planning of Greenhouse had progressed to permit detailed considerations. By the autumn of 1950, JTF-3 was well advanced in plans for the operational phase. The last half of 1950 saw completion of base facilities at the Atoll, construction of more than one hundred scientific stations, substantial completion of the military structures; and, over three hundred changes affecting construction in the program. Extensive exploration in the field of soil behavior, and foundation investigations leading to a large grouting program for a large military test structure ^{were} ~~was~~ accomplished. Increasing tonnage of cargo received at the proving grounds overtaxed warehousing and storage facilities, cargo lightering and stevedoring equipment and crews.

Projections of manpower requirements were continuously under study and

adjustments were frequently made. The population peaks mounted over estimates posing problems of expanded facilities.

By the beginning of November the shot island camps were complete and occupied by construction personnel. Considerable progress had been made on scientific structures. Still re-design had its effect on progress.

By the end of 1950 an increasing number of items had reached a "Punch List" stage. Occupancy by the AEC and users had started. Security controls in exclusion areas now limited such areas to "Q" cleared personnel and necessitated reassignments of the contractor's workers. The military structures program was on schedule. The Navy structures had been completed in December. The Air Forces structures were delayed by material difficulties; later overcome. The status of many scientific stations was satisfactory.

With the beginning of 1951 user occupancy was on the increase. Contractor activities were shifting from ~~Job Three~~ construction to ~~Job Five~~ ¹⁶ Support of scientific users ~~and roll-up~~. Of the entire construction program, comprising more than a thousand buildings, stations, and installations, the laying of coaxial cables caused the most concern. However, the assembly of the 2,476,000 feet of this cable was accomplished in time and checked out satisfactorily. Protective berms over the cable and repair to causeways made last-moment earth movement a heavy job. The last of the major construction features was completed in the period April 23 to May 25, 1951. Dismantling of experiment island camps prior to each shot was accomplished and materials were placed in storage.

The roll-up operation for Greenhouse was scheduled to begin as soon after the completion of experiments as safety considerations permitted. Basic specifications were prepared under date of April 19, 1951, covering four major headings:

1. Structures on experiment islands.
2. Structures on support islands.
3. Equipment.
4. Furniture and fixtures.

In retrospect, Operation Greenhouse would be inadequately reported if mention should not be made of collateral operations involved. Success of the test series depended heavily on these important though briefly mentioned functions:

Security with its large job of personnel clearance and indoctrination; its physical security phase with safeguards of all locations associated with the operation; information security covering control and accountability of classified documents and material and handling of Restricted Data and other classified information; and, the extensive liaison with all services and agencies associated with the Operation.

Procurement of personnel is indicated on the following table:

Personnel at Peak (Greenhouse)

Scientific	553
Military	6707
*AEC Administrative	7
Contractor	<u>1841</u>
Total	9108

*Included H&N assigned to AEC but not AEC observers.

Procurement of material by Holmes & Narver has been a major function of the home office at Los Angeles. Changes in requirements for Greenhouse contributed much to the soaring costs of procurement. The national security required some precedence of time over cost.

Transportation of materials and personnel by air and surface craft was logistically much like the problem of any small expeditionary force. The 9000 men of JTF-3 acted as a multiplier of all usual functions. However, an unusual factor existed in that Eniwetok possessed no local resources. The total of personal necessities and construction materials was disproportionate with this number of men. Therefore, base facilities and test facilities, under contract operation, became the basic element in overall cost of the operation.

<u>Transportation:</u>	<u>Westbound</u>	<u>Eastbound</u>
Water - Cargo	222,226 M/T	51,266 M/T
Passengers	6,558	7,017
Air - Cargo	1,208 Tons	642 Tons
Passengers	6,440	6,631

Intra-Atoll transportation by boat pool and liaison aircraft likewise assumed great importance in the logistics of the operation. The Air Force Task Group using L-13 single-engine aircraft and airstrips at Eniwetok, Parry, Runit, Biijiri, Engebi, Teiteirpucchi, ^{and} Bogallua carried a valuable share of inter-island requirements. In addition, helicopters were operated extensively in access to islands lacking airstrips. The Holmes & Narver boat pool consisting of LCM, LCU, DUKW, ATF tugs, water-taxis, and ~~the~~ ^{barges} ~~floating drydock~~ was, during the operational period, augmented by the Navy

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boat pool of Task Group ³³132.3 in the large requirement of surface inter-island transportation.

Other collateral operations including maintenance, special and personnel services, medical care, and sanitation were all carried ^{out} ~~forth~~ to the successful conclusion of Operation Greenhouse.

Budgeting for Pacific Proving Grounds was necessarily based on a philosophy of estimating the earlier cost experience (by comparison with the order of magnitude of the test operation to follow.

The use of Kwajalein as an air-base for anti-submarine ^{weather,} and evacuation aircraft cut down construction requirements for Eniwetok, but necessitated some construction on Kwajalein ^{by the military.}

Construction of scientific and military test structures for Greenhouse was technically unprecedented. The proportionate share of each program in the overall plans is shown by type:

Base facilities on Eniwetok	25%
Base facilities on other islands	40%
Military test structures	15%
Scientific test structures	<u>20%</u>
Total	100%

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With a total of 35% for test structures subject to frequent changes in requirement and constantly arising new problems, it is noteworthy that final test schedules were met.

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FULL SCALE WEAPONS TEST COSTS

(Holmes & Narver, Inc. & EFO)

OPERATION GREENHOUSE

Permanent Construction

Parry Island	\$6,449,120
Eniwetok Island	3,108,078
Miscellaneous	<u>1,600,394</u>
Total	\$11,157,592

Expendable Construction

Shot Island Camps	\$1,591,760
Scientific Structures & Related Construction	<u>\$12,645,858</u>
Total	\$14,237,618

Other Costs

Camp Operation, Maintenance & Management	\$ 7,011,874
Support & Roll Up	\$ 3,797,514
Eniwetok Field Office	<u>\$ 49,665</u>
Total -	
Grand Total Costs	\$36,254,263

Work Funded by DOD Included in Above	\$ 5,966,187
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Upon completion of Greenhouse during the spring and summer of 1951, the proving grounds was put in standby condition. Joint Task Force 132 was established with Major General Percy W. Clarkson designated Commander. AEC, Holmes & Narver, and the scientific users were integrated under Task Group 132.1.

On October 1, 1951, the next series of tests was announced. The cryogenics facilities were to be enlarged. Islands in the Atoll chain were to be connected by causeways. Additional air-strips and helicopter landing mats were required. Marine transportation indicated the clearance of channels and construction of piers. A new 400-man shot island camp and the reactivation of the Runit camp were additional requirements. With these basic criteria established various assumptions could be made for the engineering and construction program. Surveys were to be expanded to include all islands of Eniwetok Atoll in a primary network.

On October 18, 1951, a letter order contract was accomplished for the new work on an architect-engineer-construction management CPFF basis. By mid-December preliminary cost estimates were assembled.

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Organization of Eniwetok Field Office and the appointment of a Field Manager was accomplished within SFO on November 15, 1951, for administration of the Pacific Proving Grounds for AEC. Organization of Holmes & Narver was tailored to the changes affecting performance of their contract with AEC. Close liaison between EFO and Holmes & Narver ~~on organization~~ is consistently maintained with respect to effective organization.

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Succeeding substantial changes in test requirements with corresponding contract modifications finally resolved to the new definitive contract of April 1952. This contract set forth five basic jobs:

- Job No. I. Engineering, Design, Inspection and Construction.
- Job No. II. Camp Operation and Management.
- Job No. III. Maintenance.
- Job No. IV. Support Services.
- Job No. V. Roll-Up Services.

With the scope of work known, and benefits of past experience in mind, the contractor reorganized his staff. Rotation of key personnel with alternate duties at the home office and at Eniwetok was scheduled to bring about close liaison and to enable the contractor to keep down turn-over in his key personnel. From a low point of 300 employees, the contractor's strength went to a peak of 1300 with about half of this number being re-hires.

The new concept of future operations lead to implementing a long range plan. A report was prepared and submitted on October 8, 1952, outlining general site planning, utilities, and facilities essential to the orderly development of the site. It appeared that the base facilities were generally adequate to meet the requirements of the operation, with the addition of a 500-man camp at Gene, and reactivation of the 250-man camp at Runit.

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The test schedules were extended to a concept of the operation to follow Ivy, and the use of Bikini Atoll was planned. A beachhead camp was established on Eninman Island October 1952. The temporary camp, together with construction of a 4500-foot airstrip, was carried forward coincidentally

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with the work at Eniwetok.

Going along with construction activities, maintenance required a continuous preventive program. Rapid corrosion and deterioration of substantially all materials (except that of the aluminum buildings) occurred in the tropical atmosphere and salt spray prevalent at the Pacific Proving Grounds. Many experiments were carried along to help solve various maintenance problems. The marine equipment was particularly a heavy maintenance operation. The acquisition of a floating drydock (in August 1951) and a Gilhoist (in August 1952) permitted handling heavier craft more expeditiously. Deep sea diving operations were necessary to the maintenance of POL lines, submarine cables, and post-shot recovery of samples and scientific instruments. Heavy equipment and vehicles constituted a large measure of maintenance. Scientific stations involved sandblasting of exposed metals to remove rust and preservative "moth-balling", as well as, in some cases, the continuation of dehumidification.

On December 29, 1952, Typhoon "Hester" approached the site. The emergency disaster plan was effected. Preventive and protective measures were taken to protect plant and equipment. Winds developed to an intensity of 70 knots, accompanied by rain and high tides. Ocean waves drove 100 to 300 feet beyond the normal tide-line on Eniwetok Island. On December 30, 1952, all personnel were accounted for, and a preliminary survey was made to ascertain extent of property damage. Damage on Parry Island was not extensive, but considerable damage was found at Eniwetok Island. Roads were obliterated, tents destroyed, three buildings were partly collapsed, the freight pier was badly damaged, and the weather station and salt-water well were inoperative.

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Debris was scattered over large areas and a loss of shore-line extended virtually around the island. Immediate steps were taken to make the necessary repairs which extended into 1953, and beyond the period of this report. This work added to the roll-up of Ivy and compelled the contractor to maintain a somewhat higher strength than would have been necessary except for the typhoon.

FULL SCALE WEAPONS TEST COSTS
(Holmes & Narver, Inc. + EFO)

OPERATION IVY

Permanent Construction

Parry Island	\$ 2,936,498
Eniwetok Island	75,510
Miscellaneous	<u>131,213</u>
Total	\$ 3,143,221

Expendable Construction

Shot Island Camps	\$ 1,051,635
Scientific Structures & Related Construction	<u>\$ 5,568,923</u>
Total	\$ 6,620,558

Other Costs

Camp Operation, Maintenance & Management	\$ 3,085,971
Support & Roll Up	3,060,834
Eniwetok Field Office	<u>269,082</u>

Grand Total Costs \$16,179,666

Work funded by DOD
Included in Above \$ 2,088,527

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Subsequently, ^{has been} Operation Order No. 1-53 ~~was~~ issued, together with the concept of Operation Castle. Upon the date when the Joint Task Force becomes operational, responsibility for the execution of the approved operation plan passes to the Commander, JTF. Activities not related to, nor covered by, the Operation Plan remain at all times the responsibility of the Manager, SFO.

Scientific criteria for Operation Castle were delayed in the making, and test schedules underwent changes, all resulting in late receipt of much of the criteria basic to engineering and planning. However, good use of the interim time was made by the undertaking of basic surveys at Bikini Atoll and as-built surveys and plans at Eniwetok Atoll. In addition to this the Typhoon Hester damage repair acted favorably to maintain efficient levels of contractor personnel.

Plans for Castle required the reactivation of Camp Rojoa (200-man camp) with coincidental decontamination of the camp area and the Eberiru-Rojoa group. The Eberiru crater was back-filled in preparation for this Operation. Expansion of facilities at Parry and Eniwetok progressed within budgetary limitations. The long-term plan was a useful guide to this work.

Work of establishing the Bikini camp at Eninman Island continued and plans were expanded through shifts in test planning. The Eninman Camp was set up to a 1000-man capacity. Outlying camps with capacities of 400, 200, and 100, respectively, were established. The 4500-ft. airstrip near the Eninman Camp was essentially completed, together with air operations buildings and facilities. Causeways for inter-island access were substantially

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completed. In addition, causeways for scientific stations were well along by June 30, 1953. Inter-island airlift was established at Bikini Atoll and stepped up at Eniwetok Atoll to augment the slower travel by surface craft.

The shift of the air base for Castle from Kwajalein to Eniwetok brought about an improvement of the Eniwetok airstrip and facilities. This also created a heavy surface lift of pre-fab^{ricated} buildings and ^{other} Air Force equipment. The movement of cargo from the Zone of the Interior accelerated, and direct routing of cargo and reefer ships to Bikini ^{is} believed the overburden of trans^{shipment} from Eniwetok to Bikini by IST.

Production of aggregate for stabiliz^{ation}~~ing~~, concrete, and pavement assumed large proportions. Expanded facilities for POL were planned for at Eniwetok and Bikini.

The estimated population continued to grow, and the problem of support and facilities ^{was} ~~were~~ met with revised planning.

Submarine cable for the system at Bikini became a critical case of late supply with construction slated late in 1953. Rehabilitation of the system at Eniwetok was included in the problem. **ALOO**

Communications as established, and as planned for Castle, consist of telephone, radio, teletype, inter-communications, and paging.

Eniwetok and Parry Islands are provided with permanent-type telephone exchanges; the Eniwetok Island exchange is a 400-line, dial system, and Parry Island exchange is a 260-line, common battery system. Sixty-line, common battery exchanges are activated on other islands to facilitate

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communications during test periods as required. The exchanges are connected by a submarine cable system. At Eniwetok Atoll a separate submarine cable system has been installed over which timing signals, telemetering, etc., are transmitted. At Bikini Atoll one submarine cable system is utilized for both telephone and signaling requirements.

The boat pool (marine craft) has installed military tactical-type radio equipment consisting of 46 units for communications between boats and with marine dispatchers. During test operations radio equipment is installed at airstrips to expedite the dispatching of liaison type airplanes and helicopters. Commercial VHF type radio equipment is utilized for communications between construction, administrative, and maintenance forces.

External communications consist of radio-teletype circuit with voice capabilities between Eniwetok and Bikini, radio-teletype circuit between Eniwetok and Los Alamos, and radio-teletype circuit between Eniwetok and Oahu, T. H.

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During Ivy inadequacies of switchboard facilities at Parry Island became apparent. At the close of Ivy an additional switchboard position was added to the exchange, increasing the answering capability and adding forty new lines. Also, communications center at Eniwetok Island underwent planning for expansion indicated for Operation Castle. Close liaison on communications matters is effected through a staff member who is regularly attached to the Office of Engineering and Construction at SFO. Late changes in program requirements have affected communications as well as other phases of the Operations.

Warehousing and storage requirements became acute. Plans for construction of warehouse buildings at Parry and Eniwetok indicated some relief in the Fiscal Year 1954.

Joint Task Force SEVEN organization progressed, and Task Group 7.5 was established and staffed from personnel within SFO, Office of Test Operations, and the Eniwetok Field Office. The organization of Eniwetok Field Office was strengthened, and rotation of personnel between the PPG and Albuquerque was scheduled.

Progress on scientific stations was, by June 30, 1953, fairly well along in engineering and planning and with basic work started at the sites for Castle.

SUMMARY

The period of this report has touched on three major overseas Operations with participating agencies as indicated below:

	<u>Greenhouse</u>	<u>Ivy</u>	<u>*Castle</u>
Scientific	553	931	1200
Military	6707	9235	7600
**AEC Administrative	7	11	15
Contractor	1841	1320	2200
Totals	9108	11497	11015
Number of Test Stations	746	465	416

*Estimate

**Included H&N assigned to AEC. Does not include AEC observers.

The accomplishments of each Operation were considerable, and the aggregate is impressive.

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Eniwetok Field Office has operated with a minimum of AEC personnel, augmented by support from SFO offices, and the contractor. It is evident that progress has been made in effecting administrative controls with ~~minimum~~ economy under the circumstances. Great benefits have been derived from close liaison with the A-E-C-M contractor through the experience to date, and more will accrue with future activities.

Agreements between AEC and DOD on responsibilities and fiscal accounting principles for operations at Pacific Proving Grounds have been important management aids to the test programs. The most recent of these agreements, dating at January 1, 1953, provided for "a mutually satisfactory, general framework within which the AEC and DOD may, on an equitable basis, delineate primary responsibilities of each agency and budget and fund costs for joint AEC-DOD operations at the Pacific Proving Grounds."

With the closing of this report conditions now exist which are favorable to future test operations:

1. Eniwetok Field Office is staffed and scheduled for ensuing operations.
2. Holmes & Narver is staffed, scheduled, and has developed a manpower reservoir to fulfill operational requirements. Improved administrative and operational procedures have effected many economies over earlier Greenhouse experience.
3. Base facilities ^{and} Scientific Stations are well along with scheduled completion contemplated.
4. Joint Task Force SEVEN, as a continuing task force organization will contribute to efficiency in future test operations.

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All things considered, the effectiveness of organization, personnel, plant ⁵⁰ and equipment, and cooperative working relationships is well assured in future large-scale overseas tests at the Pacific Proving Grounds. ~~SECRET~~