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MANHATTAN DISTRICT HISTORY
BOOK VIII, LOS ALAMOS PROJECT (Y)
VOLUME 3, AUXILIARY ACTIVITIES
CHAPTER 5, NAVY PARTICIPATION
CHAPTER 6, SANDIA

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MANHATTAN DISTRICT HISTORY
BOOK VIII, LOS ALAMOS PROJECT (Y)
VOLUME 3, AUXILIARY ACTIVITIES
CHAPTER 5, NAVY PARTICIPATION

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FOREWORD

The most important contribution made by the Navy to the activities of the Los Alamos Project consisted of assignment of key personnel, who were of invaluable assistance in the successful attainment of the Project's objective. The services of these personnel, foremost of whom were Rear Admiral (then Captain) W. S. Parsons, Commanders F. L. Ashworth, H. E. Bradbury and A. F. Birch, and (later) Captain R. A. Larkin, are described in Volume 2 of this Book of the History.

Further important contributions were made by the Navy through the participation of various Navy agencies in certain parts of the project's activities, and these are impressively indicated by numerous references in Volume 2, and also in Chapter 2 of Volume 3, of this Book. The assistance of the Naval agencies was usually obtained by Admiral Parsons, in his capacity as Ordnance Division Leader (after September 1944 also associate Director) of the project, through the cooperation of Rear Admiral W. E. Farnell, assistant to the Chief of Naval Operations for Materiel, and Rear Admiral G. F. Hussey, Chief of the Bureau of Ordnance. Principally because of security considerations, the requirements of the Los Alamos Project were made known to the Naval installations only through the Chief of the Bureau of Ordnance.

It is the purpose of this chapter to describe very briefly the most important contributions which were made by the various Naval agencies, supplementing the information previously furnished elsewhere in Book VIII. Because most of the work was arranged in conferences and by personal contacts, records of administrative actions are extremely

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scarce or non-existent and this fact is in part responsible for the brevity and incompleteness of the descriptions herein.

The important contributions to the project which were made by the Naval Ordnance Testing Station, Inyokern, California, have been described previously in some detail, in Chapter 2 of this volume, "Project Camel", and are not repeated in this chapter.

(Contributions of the Navy to Manhattan District installations other than Los Alamos may be found in other books of the History; reference should be made particularly to Book VI, Liquid Thermal Diffusion (S-50) Project, wherein the contributions of the Naval Research Laboratory are described, and to Book I, Volume 8, Personnel, in which, in Section 5, the assignment to the District of trained junior officers of the Navy is described.)

January, 1949

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SECTION 1 - NAVAL MINE DEPOT, YORKTOWN, VIRGINIA

1-1. The Naval Mine Depot, Yorktown, Virginia, gave assistance to the Los Alamos Project in the development and production of explosives.

1-2. During the early stages of the research and development of explosive charges required for the atomic bomb, at Los Alamos, it became apparent that a considerable amount of outside assistance would be required. Rear Admiral W. S. Parsons, Ordnance Division Leader, arranged through the Chief of the Bureau of Ordnance to make available to the project the assistance of Lieutenant Hudson Bullard, USNR, engineer officer of the Naval Mine Depot, Yorktown, Virginia. The services of Lieutenant Bullard were particularly desired in connection with the design and construction of the explosives casting plant at Los Alamos, which had been begun in the winter of 1943-1944. Bullard visited Los Alamos and contributed valuable advice in setting up and operating the specialized explosives casting plant at S-Site. (See Ek. VIII, Vol. 2, par. 7.72ff, where the difficulties of this part of the project are described.)

1-3. Through Lieutenant Bullard it was learned that the facilities of the newly constructed pilot plant at the Naval Mine Depot, Yorktown, might be adapted to the needs of the project, and on 17 August 1944 Admiral Parsons requested that these special facilities be made available, for limited assistance to the Los Alamos Project.

1-4. The work undertaken at Yorktown was concerned with the following four specific problems:

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a. Production of highly aluminized TNT for use at Los Alamos in the manufacture of terpex.

b. Production of about 240 shaped castings per day, weighing up to one hundred pounds each, using molds furnished by Los Alamos. (For this problem, it was suggested that experience might indicate the desirability of transferring the major part of the work to the Naval Ammunition Depot, McAlester, Oklahoma, or other casting activity.)

c. Investigation of quality control of castings by the then existing technique, and vacuum pressure molding, using the facilities of the pilot loading plant at Yorktown. (This work would parallel similar activity at Los Alamos and at the Explosives Research Laboratory at Brunston.)

d. Preparation of explosives having slow detonation rates, in coordination with work in progress at Brunston.

1-5. By November, 1944, molds had been shipped to Yorktown, and preparations for production had been started. On 11 December 1944, the Chief of the Bureau of Ordnance authorized the Naval Mine Depot, Yorktown, to cast 70,000 pounds of HBX blocks, 6,000 pounds to be cast immediately in molds furnished from Los Alamos, and the balance to be cast after completion of field tests. By February, 1945, this production was in full swing, but difficulties in the assembly of the explosive blocks developed, and all HBX production was abruptly halted until the difficulties could be eliminated.

1-6. In February, 1945, it was decided to abandon the use of HBX and substitute "Composition B" in the explosives casting program, and on 3 March 1945 Admiral Parsons requested the Chief of the Bureau of

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Ordnance to make the facilities at Yorktown available again, for the production of castings of Composition B, of each of two types required, called "quality" and "non-quality" castings respectively.

1-7. Meanwhile, the construction of a special pilot plant at the Naval Ordnance Test Station, Inyokern, designed for experimental development work on shaped charges, had been authorized and was under construction, under a development contract between the Bureau of Ordnance and the California Institute of Technology. It was expected that this pilot plant would be completed by 30 May 1945 and would be able to produce quality castings by 15 June 1945. (See Chapter 2 of this Volume, Section 7.)

1-8. At the time of Admiral Parsons' request (3 March 1945) the only plant capable of producing quality castings was located at S-Site, at Los Alamos, and there was then no prospect of production elsewhere until the following June. An extremely critical situation would have arisen, therefore, if any accident had occurred to interrupt the production at S-Site. For this reason, Admiral Parsons requested that the Naval Mine Depot commence, as soon as possible, production of 25 quality castings of Composition B per day, to continue until 15 June 1945, and that a suitable plant be made available for the production of non-quality castings of Composition B, to be supervised by the NMD, Yorktown, employing the technique developed at S-Site, Los Alamos.

1-9. As of 1 May 1945, 760 non-quality Composition B blocks had been cast at Yorktown; additional production of half scale non-quality blocks was being started, and development of satisfactory techniques for casting quality blocks was being actively pursued.

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1-10. When production of explosives was curtailed at the end of hostilities, both the Naval Mine Depot, Yorktown, and the still incomplete Salt Wells Pilot Plant, Inyokern, were endeavoring to produce satisfactory quality castings. There was then no further immediate need for the production of quality castings at Yorktown, and work at this station was canceled.

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SECTION 2 - NAVAL AMMUNITION DEPOT, McALESTER, OKLAHOMA

2-1. The facilities of the Naval Ammunition Depot, McAlester, Oklahoma, were used for two important operations for Los Alamos: the loading of the "pumpkins" or practice bombs, and the production of non-quality Composition B castings.

2-2. As described in Chapter 2 of this volume, the pumpkins were training bombs developed by California Institute of Technology, as a part of the work of Project Camel. They approximated the design of the final bomb in external appearance and ballistic characteristics.

2-3. The Institute had the contract for the development and initial production of the pumpkins, and the Bureau of Ordnance made the facilities of the Naval Ammunition Depot available to C.I.T. for loading them.

2-4. Actual loading of pumpkins at McAlester commenced early in April, 1945, and rapidly approached two per day as development difficulties were eliminated. By 15 May 1945, development was considered complete, and the Bureau of Ordnance, at the request of Los Alamos, let contracts for the continued production of pumpkins at the same sources developed by California Institute of Technology. Loading activity at McAlester had reached the rate of about 75 per month when production was stopped at the end of hostilities. During the course of this work, about 340 pumpkins were delivered to the Depot for loading, and of this number about 230 were loaded and shipped.

2-5. The production of non-quality Composition B castings was a separate project, assigned to the Naval Ammunition Depot, McAlester, about April, 1945, by the Bureau of Ordnance, in accordance with the

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suggestion of Los Alamos to relieve part of the load on the Naval Mine Depot, Yorktown.

2-6. In April, 1945, the necessary molds for non-quality castings were furnished to W.A.D., McAlester, by Los Alamos. Actual production commenced during the latter part of May, and continued until September, 1945. Between 25 and 30 sets, each consisting of 76 non-quality castings, were produced and shipped by the Depot.

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SECTION 3 - NAVAL AUXILIARY AIR STATION, SALTON SEA, CALIFORNIA

3-1. The facilities of the Naval Auxiliary Air Station, Salton Sea (Sandy Beach), California, were used for bombing tests for the Los Alamos Project.

3-2. During the early fall of 1944, Admiral Parsons pointed out to General Groves that fuse development work then in progress would require drops from high altitude to sea level or below. The existing bombing range facilities at Muroc Army Air Base, California, and at Wendover Field, Utah, would not permit test drops of this type, and, as it was considered essential to prove the fusing in drops to low levels, General Groves was asked to make the necessary arrangements to permit test drops in the Salton Sea Area during November and December, 1944.

3-3. On 26 October 1944, General Groves authorized an inspection trip to the Naval Auxiliary Air Station, Salton Sea, and vicinity, to determine whether or not this area would be satisfactory. The inspection was made on 4 November 1944, and it confirmed the usefulness of the Salton Sea area, subject to certain improvements which were requested. About 7 November 1944, the Chief of Naval Operations directed the Commandant of the Eleventh Naval District to make the facilities of the Naval Auxiliary Air Station, Salton Sea, available to the Los Alamos Project for special bombing tests.

3-4. The first use of this bombing range was on 4 December 1944, and the facilities continued in intermittent use, for fuse and ballistic tests and for training of bombing crews, until August, 1945. About 150 test and training drops were made on this bombing range.

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3-5. It was learned at Los Alamos, early in October, 1945, that the N.A.A.S., Salton Sea, was among the air stations which were recommended to be closed at that time. Further developments in fusing and ballistics seemed to require the continued use of a sea level bombing range, and Admiral Parsons and Dr. S. S. Bradbury, Director, therefore recommended, on 22 October 1945, that the Manhattan District should maintain sea level bombing facilities in the Salton Sea area, notwithstanding the closing of the N.A.A.S., Salton Sea. Negotiations to acquire the necessary facilities were begun immediately, and eventually brought to a successful conclusion, in July 1946.

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SECTION 4 - OTHER ITEMS OF NAVY PARTICIPATION

4-1. To make the record of the participation of the Navy in the Los Alamos project more nearly complete, mention should be made of other Naval installations which contributed in one way or another useful and valuable assistance.

4-2. Naval Ordnance Test Station, Inyokern, California. The important cooperation of this Station is described in some detail in the history of Project Camel, in Chapter 2 of this Volume, to which reference should be made.

4-3. Navy Yard, Mare Island, California. This installation furnished special tropical packing facilities during the spring and early summer of 1945, in connection with the shipping of materials for the creation of the overseas base for delivery of the atomic bombs.

4-4. Naval Ammunition Depot, Port Chicago, California. This Depot rendered major assistance in the temporary storage and overseas shipment of explosive components.

4-5. Naval Ordnance Plant, Center Line, Michigan. This plant furnished facilities and personnel for machining and assembly of components under special security restrictions. A considerable amount of work was accomplished at Center Line, principally through close coordination with the Detroit procurement office of the Manhattan District.

4-6. Naval Gun Factory, Washington, D. C., and Bureau of Ordnance. These two Naval agencies collaborated in the design and production of guns and projectiles used by the Los Alamos Project.

4-7. Naval Proving Ground, Dahlgren, Virginia. This installation cooperated in the development of arming and fusing devices for the atomic

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bomb. Small scale field tests of these devices were made at Dahlgren, and subsequently continued at full scale at Muroc Army Air Base. Scale model ballistics tests were also performed at Dahlgren.

4-8. Naval Office at University of New Mexico, Albuquerque, New Mexico. This office helped to preserve the security of the project by serving as a trans-shipment station for Naval equipment destined for Los Alamos.

4-9. Some additional information about the participation of the various Naval installations in the work of the Manhattan District may be found in Volume 2 of this book and in Chapter 2 of this volume. To facilitate consultation of these sources, the following list of references is given:

Naval Mine Depot, Yorktown, Va.-Bk. VIII, Vol. 2, par. 16.7, 19.7; Bk. VIII, Vol. 3, Chap. 2, par. 3-3, 5-4, 10-4.

Naval Ammunition Depot, McAlester, Okla.-Bk. VIII, Vol. 2, par. 19.7; Bk. VIII, Vol. 3, Chap. 2, par. 4-2.

Naval Auxiliary Air Station, Salton Sea, California-Bk. VIII, Vol. 2, par. 9.16, 14.20; Bk. VIII, Vol. 3, Chap. 2, par. 5-1.

Naval Ordnance Test Station, Inyokern, Calif.-Bk. VIII, Vol. 2, par. 9.17, 14.20, 19.3, 19.7; Bk. VIII, Vol. 2, Supple., par. 1.35, 7.24; Bk. VIII, Vol. 3, Chap. 2 (throughout this chapter).

Navy Yard, Mare Island, Calif.-Bk. VIII, Vol. 2, par. 19.7; Bk. VIII, Vol. 3, Chap. 2, par. 6-1.

Naval Ordnance Plant, Center Line, Mich.-Bk. VIII, Vol. 2, par. 14.15.

Naval Gun Factory, Washington, D. C.-Bk. VIII, Vol. 2, par. 7.5, 7.10, 7.22, 7.27, 7.28, 14.15.

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Bureau of Ordnance-Hk. VIII, Vol. 2, par. 7.5, 7.10, 7.21, 7.21, 7.27, 7.53, 19.7;
Hk. VIII, Vol. 2, Suppl., par. 1.35, 1.42; Hk. VIII, Vol. 3, Chap. 2, (throughout
this chapter).

Naval Proving Ground, Dahlgren, Va.-Hk. VIII, Vol. 2, par. 7.10, 7.24,
7.44, 7.45, 7.52

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FOREWORD

This chapter presents an historical account of the activities of the Manhattan District which were carried out at Sandia Base, near Albuquerque, New Mexico, between the summer of 1945 and 31 December 1946, the termination date of the Manhattan District History.

The information given in this chapter supplements that previously furnished, in Volumes 1 and 2 of Book VIII; in particular, Chapter 8, "Ordnance Engineering (Z) Division", of the Supplement to Volume 2, contains a description of the Z-Division of Los Alamos, which was principally involved in the work at Sandia Base.

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CHAPTER 6, SANDIA

6-1. Past History.

Prior to June, 1942, Sandia Base was used as the Albuquerque Municipal Airport and was known as Oxnard Field. It was then purchased by the Government, and the Albuquerque District Engineer constructed a number of CCC type barracks and several pre-fabricated hangars, in preparation for use of the field by the Army Air Force. The base was never operated regularly, however, and eventually it was designated (but not operated) as the Army Air Force Convalescent Center. In April 1945, the Convalescent Center was closed and the field was declared surplus.

The Reconstruction Finance Corporation then took control of the base, and used it as a storage point for obsolete planes. The planes were flown to the base about May, 1945, and were parked there awaiting disposition.

6-2. Early Assembly of Forces and Equipment by Manhattan District.

About 15 August 1945, decision was made by the Manhattan Project headquarters to consolidate storage, assembly, and shipment facilities at Sandia Base. With the contractor for the Reconstruction Finance Corporation then occupying the base, arrangements were made to prevent intermingling of forces, by turning over a portion of the base for the exclusive use and control of the Manhattan District, and segregating this portion by fence and guard systems.

At this time, Captain Sam Musser was assigned to Sandia Base as Post Engineer, and construction forces, provided by R. E. McKee Company, General Contractor for Los Alamos, were moved to the base.

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They immediately started renovation of enough buildings to provide for an advance nucleus of the technical and military forces to be moved from Los Alamos on or about 30 September 1945.

The first technical group to move to Sandia Base was composed of the office personnel assigned to Group O-7, Division "O", of the Technical Area at Los Alamos, whose main responsibility was ordnance procurement. On 1 October 1945, the first cadre of officers and enlisted men assigned to the Special Ordnance Detachment at Wendover Field, now transferred from the Army Air Forces to the Special Engineer Detachment, Manhattan District, were moved to the base. By 25 October 1945, the entire detachment had been moved from Wendover Field. This movement comprised not only personnel but also impediments and equipment, including models of the "Fat Man", "Little Boy", and other experimental types in storage at Wendover at that time. Cast explosive blocks were transferred to Fort Wingate, Gallup, New Mexico, and no special Manhattan District materials were left at Wendover Field.

In addition to the above personnel and materials and supplies, all incoming equipment being manufactured at Detroit and Los Angeles was diverted to Sandia Base for receipt, storage or trans-shipment to Los Alamos. During this period, representatives of Z-2 (Air Coordination), Z-3 (Firing), Z-5 (Fusing), and Z-6 (Mechanical Test Laboratory) were assigned to Sandia, on temporary duty only, for the purpose of aiding the Commanding Officer (Lt. Col. R. W. Lockridge) in preparing a plan of operation for the base. During October, 1945, approximately 200 enlisted men, of various grades, were transferred to Sandia.

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6-3. Plans and Operations.

During the period 30 September 1945 to 15 November 1945, plans were prepared and submitted for review to Colonel Seeman at Los Alamos. These plans outlined operations at Sandia Base formerly taken care of by various groups which had operated under Division "O" at Los Alamos. The operations which were carried out by other units, from Wendover Field, were also included in these plans: at Sandia Base, the operations of the former special Ordnance Detachment, now a company of the Special Engineer Detachment; and at Kirtland Field, near the base, the operations of the Flight Test Section, which had been divorced from the 509th Composite Group and had been based at Wendover Field.

(The activities of other components of the 509th Composite Group are described in Section 3 of Chapter 9 of this volume of the Manhattan District History.)

In December 1945, Group 2-1 (Field Test Group) began setting up equipment in anticipation of test drops.

In January 1946, arrangements were made whereby 50 of the 100 FHA family quarters at Kirtland Field would be available for use of Sandia Base personnel.

In February 1946, the demobilization of the Army resulted in the loss of more than half of the enlisted men and officers assigned to the base. This sudden discharge of personnel made Operation Crossroads (see Chapter 8 of this volume) very difficult and was to result eventually in about six months of inefficient operation at Sandia Base.

The site at Trinity was placed under Sandia Base, with the responsibility of preventing personnel from wandering into the test area.

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which was still highly active.

A recommended Table of Organization for a Regular Army Unit, with a mission of assembling and monitoring the bomb, was prepared and submitted to higher headquarters. It was also requested that 12 Regular Army Officers be sent to Sandia Base for orientation for Operation Crossroads, with the idea that they would later return and become a cadre for the Regular Army unit mentioned.

Crossroads training continued at Sandia Base during March, 1946, and included three fused drops by "B" Division. Equipment for Operation Crossroads was shipped both directly to the Port of Embarkation and to Los Alamos.

As a result of the previous request for houses, 60 pre-fabricated housing units were shipped from Hanford Engineer Works, and erection was begun in April, 1946.

The decision was made to move all electronics of Z-Division to Sandia Base, and the construction of a Fusing and Firing Laboratory commenced.

In May, 1946, Group Z-9 (Stock Piling) was formed, and considerable emphasis was placed on stock pile activities (see Volume 2, Supplement, par. 8.16). During June and July, stock piling continued, and the problem of long term storage became important. Sandia Base furnished many data on this problem to higher headquarters.

About August 1946, the long term mission of Sandia Base became apparent: specifically, to be the home of the one Regular Army Unit for handling the bomb, and to be the base for schooling of Army personnel in the use and handling of the weapon. The mission of the base also included

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development work in all phases connected with the actual weapon.

At this time, plans were approved for construction of 148 permanent family quarters in the northeastern section of the base. Action was begun in August, 1946, toward complete divorcement of this station from Los Alamos, and it became the mission of all staff personnel to aim toward normal military base operations, as compared with Manhattan Project war-time short-cut methods.

On 1 September 1946, the 2761st Engineer Battalion (Special) was formally activated as a result of the earlier recommendation for a Regular Army Unit to assemble and monitor the bomb, and, during the following month, qualified enlisted men and officers were transferred to this Battalion. In September, greater emphasis was placed on the construction of permanent buildings on the post. A permanent fire station was approved, and plans were drawn up for troop housing, a post administration building, and a central heating plant.

In October 1946, approximately 40 Regular Army Officers, from several different branches, reported to the base and began training designed to permit the fulfillment of the mission of the Special Engineer Battalion. During the month of October, the Naval Auxiliary Air Station, Salton Sea, California, was manned by enlisted men, under the command of Captain H. H. Johnson from this base, in preparation for use of that installation in some drop tests during the early part of 1947 (see Chapter 5 of this volume, in which the use of the Test Base at Salton Sea for testing during the war years is described.)

In November 1946, the Engineering Group (Z-4), which still remained at Los Alamos, was alerted for movement to Sandia. It was

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planned that all engineering, and as much of the design work as was practicable, would be released from other groups, and made the responsibility of Z-4. Mr. E. L. Cheeseman was made head of the new Electronics subdivision, the mission of which was to supervise and coordinate development, procurement and allied electronic problems throughout Z-Division. At the end of the year, Group Z-4 had not yet moved to Sandia.

At about this time Group Z-3 was activated, as the Assembly Training Group, with Mr. Arthur Machen as leader.

During December, 1946, ten underground magazines in an area near Sandia Base were completed and accepted.

6-4. Intelligence and Security.

Effective 1 November 1946, Intelligence and Security functions of Sandia Base were separated from Los Alamos. Supervision of these functions was placed directly under the Washington Liaison Office. A considerable amount of work was done during the month of November toward establishing a system of clearance, investigations, counter-intelligence work and physical security, so that the base would be able to operate independently of Los Alamos.

6-5. Key Personnel.

The first Commanding Officer at Sandia Base was Lt. Col. Robert W. Lockridge, who headed the first technical group (group O-7, Division "O") which moved to the base about 30 September 1945. In the newly formed Z-Division of Los Alamos Colonel Lockridge was designated as the leader of Group Z-2A (Procurement, Storage and Shipment). In the latter capacity,

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Colonel Lockridge reported to the Division leader, but as commander of the base he reported to the Commanding Officer at Los Alamos, Colonel Seeman.

Lt.Col. A. J. Frelich assumed command of the base on 7 December 1945, upon the release of Colonel Lockridge to civilian status.

In August 1946, Colonel G. M. Dorland was assigned as Commanding Officer of the base, and also Commanding Officer of the 2761st Engineer Battalion (Special), which was then about to be activated. Colonel Dorland remained as Commanding Officer until after the end of the period covered by this history.

Meanwhile, when the first steps were taken to move to Sandia, Z-Division was headed by Mr. Roger S. Warner, who had succeeded J. R. Zacharias on 17 October 1945. In the latter part of March, 1946, Mr. Warner went overseas to take part in Operation Crossroads and left Dr. Dale H. Carson as Acting Division Leader. In July, 1946, Dr. Carson resigned, and Z-Division was left temporarily without an effective head until the return of Mr. Roger S. Warner and Lt.Col. E. E. Wilhoit from Operation Crossroads.

The leading personnel of Z-Division at the end of 1946 were (see Supplement to Volume 2 of this Book, par. 8.23):

| | |
|---------------------------------|-----------------------|
| Division Leader: | Roger S. Warner |
| Alternate Division Leader: | Lt.Col. E. E. Wilhoit |
| Z-1 Field Test | Glenn Fowler |
| Z-2 Mechanical Engineering | R. A. Bice |
| Z-3 Assembly Training | Arthur Machen |
| Z-4 Engineering (at Los Alamos) | R. W. Henderson |
| Z-5 Firing and Fusing | O. L. Wright |

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| Z-6 Mechanical Laboratory | Alan Ayers |
| Z-7 Production | J. L. Rowe |
| Z-8 Informers | William Caldes |
| Z-9 Stock Piling | Wilbur Shaffer |
| Z-10 Supply | Henry Moeding |
| Z-11 Little Boy | Harlow Russ |

6-6. Costs.

The total Manhattan District costs for Sandia Base to 31 December 1946 amounted to \$2,844,146. This figure included the sum of \$79,925 for operation and maintenance of utilities, \$59,795 for construction of utilities, and the balance for construction, design, government payroll, inventories and miscellaneous expense. These figures were obtained from the records of the cost and accounting section at Los Alamos.

6-7. References.

For convenience of cross-reference, the following pages or paragraphs of the History contain further (or confirmatory) information about Sandia Base and about Z-Division's connection therewith:

Book VIII, Vol. 1, pp. 6.30, 6.48, 7.10

Book VIII, Vol. 2, par. 9.13, 19.7

Book VIII, Vol. 2, Supplement, par. 1.33, 1.46, 2.65, 5.39, 5.57, 8.1 to 8.23, 10.5

