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(WT-2293)(EX)
EXTRACTED VERSION

OPERATIONS NOUGAT AND SUN BEAM

Organizational, Operational, Funding, and Logistic Summary

Deputy Chief of Staff
Weapons Effects and Tests
Field Command
Defense Atomic Support Agency
Sandia Base, NM

27 February 1964

NOTICE:
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Extracted version prepared for
Director
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This report covers the organizational, operational, funding, and logistic portions of the DoD-DASA effort at the Nevada Test Site during Operations Nougat and Sun Beam. Operations included Shots Hard Hat, Marshmallow, Danny Boy, Johnie Boy, Small Boy, Little Feller I and II, and the Vela-Uniform Program. The field activities started in November 1961 and ended in September 1962.

Appendixes A through G contain shot and meteorological data, copies of statements of authority and agreements, information on reporting procedures, and a list of all reports resulting from both the Nevada and Pacific test operations conducted during 1962. The reports on the Pacific tests are listed as a convenience to readers interested in related projects in Operation Dominic.

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FOREWORD

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

The material which has been deleted is either currently classified as Restricted Data or Formerly Restricted Data under the provisions of the Atomic Energy Act of 1954 (as amended), or is National Security Information, or has been determined to be critical military information which could reveal system or equipment vulnerabilities and is, therefore, not appropriate for open publication.

The Defense Nuclear Agency (DNA) believes that though all classified material has been deleted, the report accurately portrays the contents of the original. DNA also believes that the deleted material is of little or no significance to studies into the amounts, or types, of radiation received by any individuals during the atmospheric nuclear test program.

OPERATIONS NOUGAT
AND SUN BEAM

ORGANIZATIONAL, OPERATIONAL, FUNDING,
AND LOGISTIC SUMMARY

Deputy Chief of Staff
Weapons Effects and Tests
Field Command
Defense Atomic Support Agency
Sandia Base, New Mexico

ABSTRACT

This report covers the organizational, operational, funding, and logistic portions of the DOD-DASA effort at the Nevada Test Site during Operations Nougat and Sun Beam (previously called Dominic II). Operations included Shots Hard Hat, Marshmallow, Danny Boy, Johnie Boy, Small Boy, Little Feller I and II, and the Vela-Uniform Program.

The field activities started in November 1961 and ended in September 1962.

Appendixes A through G contain shot and meteorological data, copies of statements of authority and agreements, information on reporting procedures, and a list of all reports resulting from both the Nevada and Pacific test operations conducted during 1962. The reports on the Pacific tests are listed as a convenience to readers interested in related projects in Operation Dominic.

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Chapter 1

INTRODUCTION

This report covers the activities of the Continental Test Organization (CTO) of the Weapons Effects and Tests Group (FCWT), Field Command, Defense Atomic Support Agency (FCDASA), from November 1961 through September 1962. During this period, as in past test series, a Joint Atomic Energy Commission (AEC)-Department of Defense (DOD) test organization conducted the activities at the Nevada Test Site (NTS).

The AEC is charged with the management of the NTS. During joint operations, the DOD Test Group relies on the AEC for certain types of support. Appendix C contains a copy of the Memorandum of Agreement between the AEC and DOD, which outlines the areas of responsibilities as they existed for the 1962 NTS test activities. This report will not attempt to cover the AEC activities during this period but will briefly describe the AEC-DOD relationship.

The Project Officers Interim Reports (POIRs) covering the preliminary results of the technical projects have been distributed and will be superseded by the Project Officers Reports (PORs) as the final data becomes available. This report does not include the technical findings of the projects but rather is meant as a record of the operational and logistical aspects of the operation. A listing of all PORs for both the Nevada and Pacific operations is included in Appendix A.

1.1 MISSION

The FCDASA mission for weapons effects testing was first outlined in the two documents shown in Appendix D (in 1959, the Armed Forces Special Weapons Project became the Defense Atomic Support Agency). These guidelines are still in effect although minor modifications have been made when necessary. The mission may presently be summarized as follows:

(1) To exercise technical direction of atomic weapons effects tests of primary concern to the Armed Forces and the weapons effects phases of developmental or other tests of atomic weapons involving nuclear detonations within the Continental United States and overseas.

(2) To coordinate and support all DOD activities and assist in the support of the AEC in the conduct of joint tests involving nuclear detonations within the Continental United States.

(3) To complete detailed plans, prepare for and conduct the technical programs, and assist in the preparation of technical and operational reports of tests.

(4) To coordinate military operational training, troop participation, troop observer

program, and the DOD aspects of official visitor and public information programs. (During operational phases of joint AEC-DOD continental tests, this organization is integrated into the AEC organization at the test site.)

Because of the crash nature of the 1962 test series, the programs were passed down from Headquarters, DASA, by bits and pieces as the information became available. Many of the previously planned programs were increased in scope or modified; in addition, completely new programs were defined. To consolidate and clarify all the directives issued up to that time, Chief, DASA (CHDASA), sent a message to Commander, FCDASA, 16 February 1962, summarizing the directions concerning the test series as of that date (Appendix E). Further changes to the test programs were made as they became necessary.

Table 1.1 lists the activities conducted at NTS during the Nougat and Sun Beam series. Figure 1.1 shows the shot locations at NTS.

1.2 ORGANIZATION

Figure 1.2 shows the general parallelism of AEC and DOD organizational structure as it pertains to nuclear weapons testing at NTS. Levels of coordination are indicated, and the operational control of actual tests is shown.

The FCWT organization as it existed for the 1962 test series is shown in Figure 1.3.

The NTSO-FCWT (joint AEC-DOD) organization for nuclear testing at the Nevada Test Site is shown in Figure 1.4. The dual nature of FCWT in connection with activities at the Nevada Test Site should be noted. As FCWT, it coordinated DOD activities and integrated into the Nevada Test Site Organization (NTSO), furnishing a Military Deputy to the Test Manager, supplementing other NTSO positions as required, and furnishing the DOD Support Director and the coordinating staff for DOD activities. As CTO, it was a user of the test site.

The Continental Test Organization as it existed for Operation Sun Beam is shown in Figure 1.5. The Assistant Deputy Chief of Staff for CTO served as Military Deputy to the Test Manager, NTSO, as Chief of the DOD coordinating staff in NTSO, and as Test Group Director of CTO.

1.3 PERSONNEL

On 4 January 1962, the strength of CTO was as listed in Table 1.2. A gradual buildup of personnel, beginning the latter part of January and extending into March, brought actual strength up to that authorized. It was soon determined that assigned personnel were working 60 to 70 and more hours a week, and that additional help was needed. On 28 March, FCDASA was requested by FCWT to provide an additional 2 officers, 21 enlisted men, and 2 civilians.

Throughout April, these personnel reported either at Sandia Base or NTS. As readiness dates approached and additional test requirements were received, it was apparent more help was needed. In mid-May, FCWT submitted a manpower study to FCDASA, requesting that CHDASA provide 38 officers and 42 enlisted men to augment the strength at NTS. Subsequently, CHDASA directed FCDASA to meet the requirement and later asked the three services for certain critical personnel. On 1 June, the CTO strength at NTS had increased to 60 officers and 140 enlisted men. Personnel continued to report from Sandia Base; Headquarters, DASA; and the services. By mid-July, there were 92 officers, 186 enlisted men, and 9 civilians assigned to CTO. In addition to those personnel assigned to CTO, 66 officers and 112 enlisted men at NTS were assigned to DOD project agencies; many of these personnel assisted the CTO assigned personnel when necessary.

After the events were completed, only those personnel required for the rollup operations were retained, and a personnel phaseout plan was implemented. By 4 August, the CTO strength, including Sandia Base and NTS personnel, had dropped to 52 officers and 98 enlisted men. A comparison of personnel buildup with workloads is shown in Figure 1.6.

As Figure 1.6 illustrates, the peak personnel strength was reached during the period when the workload was rapidly decreasing. Although most of these personnel were very well qualified and would have been of great value earlier in the operation, they were not effectively used because of their late arrival.

At the time the moratorium on nuclear testing was first lifted, FCWT had been reduced to a skeleton group as a result of the minimum personnel requirements during the moratorium period. It was anticipated that, in the event testing was resumed, this group would serve as a nucleus around which the Test Group would be built.

Upon resumption of testing, action was taken immediately to bring FCWT to authorized strength. In addition, efforts were made to obtain augmentation personnel in adequate numbers to field the initially authorized tests, as well as to complete the planning required for anticipated tests. The initial study requesting personnel augmentation was prepared in October 1961 and quickly approved by the Joint Chiefs of Staff (JCS). In general, the services reacted rapidly in providing personnel for assignment against the 86 augmentation manpower spaces approved by the JCS on 17 November 1961. However, all the newly authorized manpower spaces were not filled until May 1962. In general, these were officer personnel who required special scientific or technical backgrounds, which it is assumed the services experienced some difficulty in providing on an extremely short lead time.

At the time the moratorium was lifted, the nuclear testing program was envisioned as having a reasonably long preparation period, as had been the case in past test operations. There was also a sincere question in many quarters as to whether the national foreign policy would permit resumption of full-scale nuclear testing. In addition, the loss of the requested personnel from their current assignments might have resulted in extreme delays in the projects on which they were working and might have caused undue personal hardship on the individuals. These factors resulted in a natural reticence to request large numbers of technically qualified personnel from the Armed Forces.

Although some question existed as to whether final approval for conducting the tests would be granted, the various laboratories responsible for weapons effects studies were anxious to plan scientific projects. Requests for project participation on planned tests and proposals for additional tests poured into Headquarters, DASA. For example, Shot Small Boy, which consisted of 31 projects in December 1961, finally had a total of 73 identifiable projects by the time it was finally executed. Because of the uncertain outlook for testing after the 1962 test series, every effort was made to satisfy as many testing requirements as possible during that series.

In early January 1962, directions were received by FCWT that additional testing would be conducted in the Pacific area. The initial personnel requirements generated by the Pacific operation were met by pulling personnel from staffs already overburdened by the Nevada operational requirements.

Efforts to obtain more personnel continued. Requests were filled on an individual basis from within Headquarters, DASA, and FCDASA. Studies requesting more complete relief of the personnel problem were submitted periodically but were for the most part not acted upon because of the uncertainties of continued testing.

As of the present time (April 1963), no satisfactory solution to the problem of personnel procurement for crash programs in nuclear testing has been found. The permanent staff of FCWT has been enlarged to the point where it can handle currently proposed test

operations, provided a reasonable lead time is available. Various proposals have been made in an attempt to prepare for crash programs similar to Operations Nougat, Dominic, and Sun Beam, but the proposals have been deemed impracticable or not in the best interests of the overall DOD scientific effort. A comprehensive study of the overall mission, functions, and organization of the entire DASA complex is currently underway at the Washington level. An important part of this study concerns the proper organization and manning for the planning and field execution of DOD weapons effects tests. However, the present national policy governing nuclear testing is such that it appears unlikely that our test capability will ever again be reduced to the low level reached during the nuclear testing moratorium that began in 1958 and ended in 1961.

TABLE 1.1 SHOT SUMMARY*

Date, 1962	Shot
15 Feb	Hard Hat
5 Mar	Danny Boy
28 Jun	Marshmallow
7 Jul	Little Feller II
11 Jul	Johnie Boy
14 Jul	Small Boy
17 Jul	Little Feller I

* This listing does not include the shots in the Vela-Uniform Program (detection improvement studies) conducted on a continuing basis since 6 September 1961.

TABLE 1.2 CTO PERSONNEL STRENGTH, 4 JANUARY 1962

	Officer	Enlisted	Civilian	Total
Authorized	35	88	4	127
Assigned	21	66	2	89

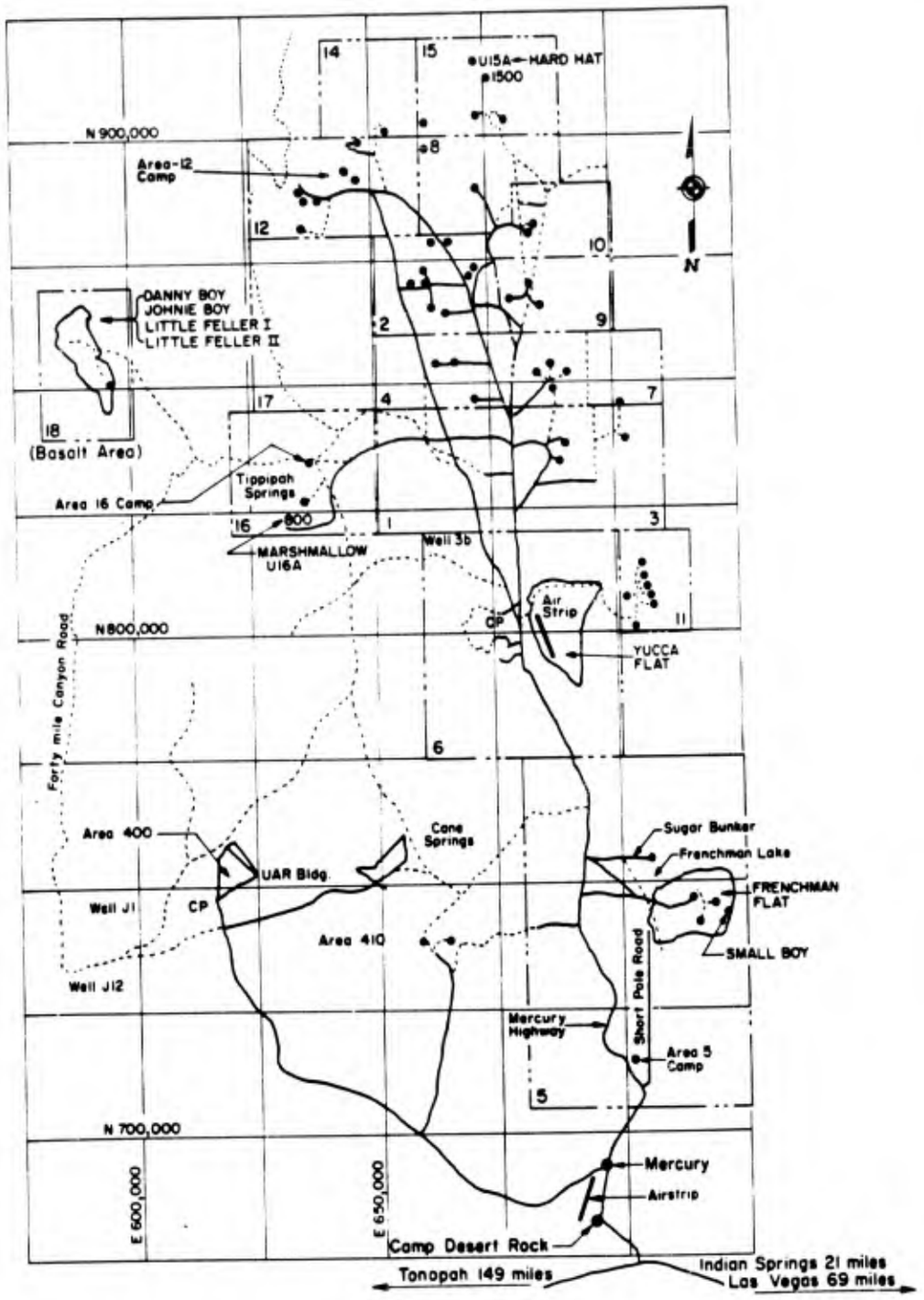


Figure 1.1 Map of Nevada Test Site.

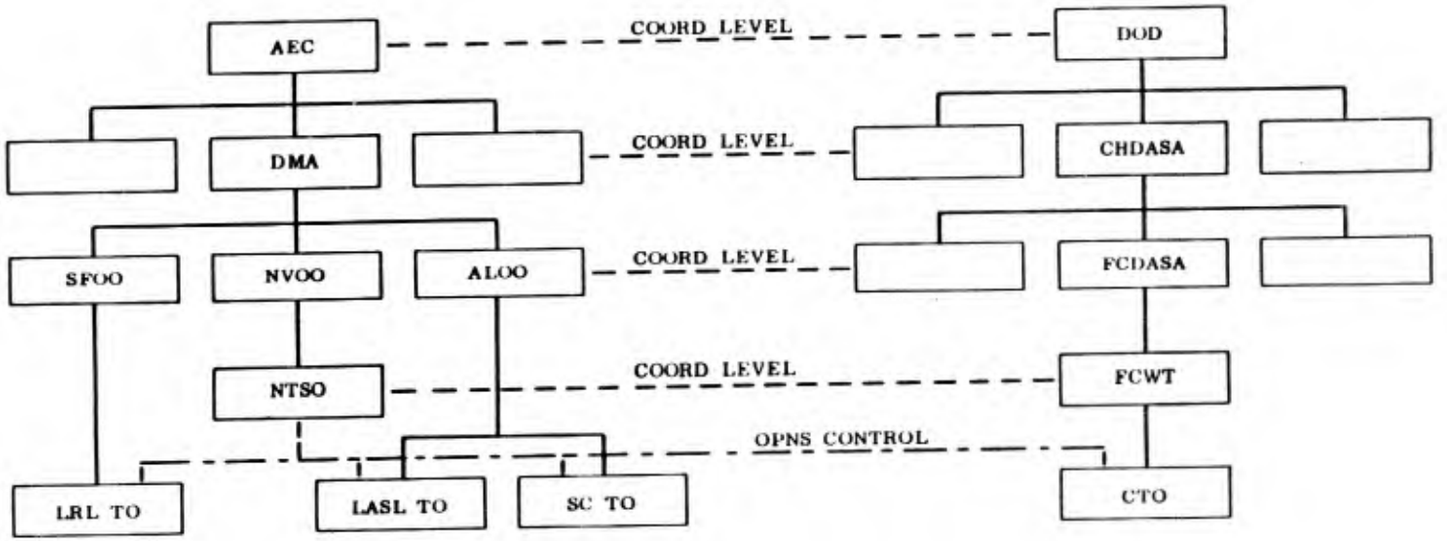


Figure 1.2 AEC-DOD organizational parallelism.

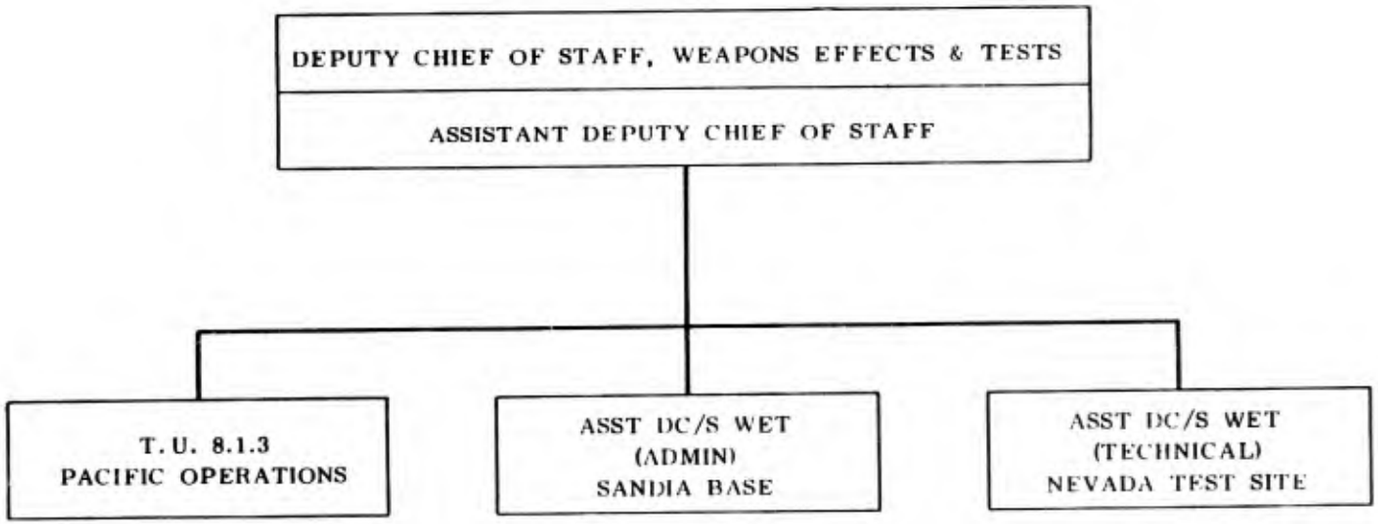
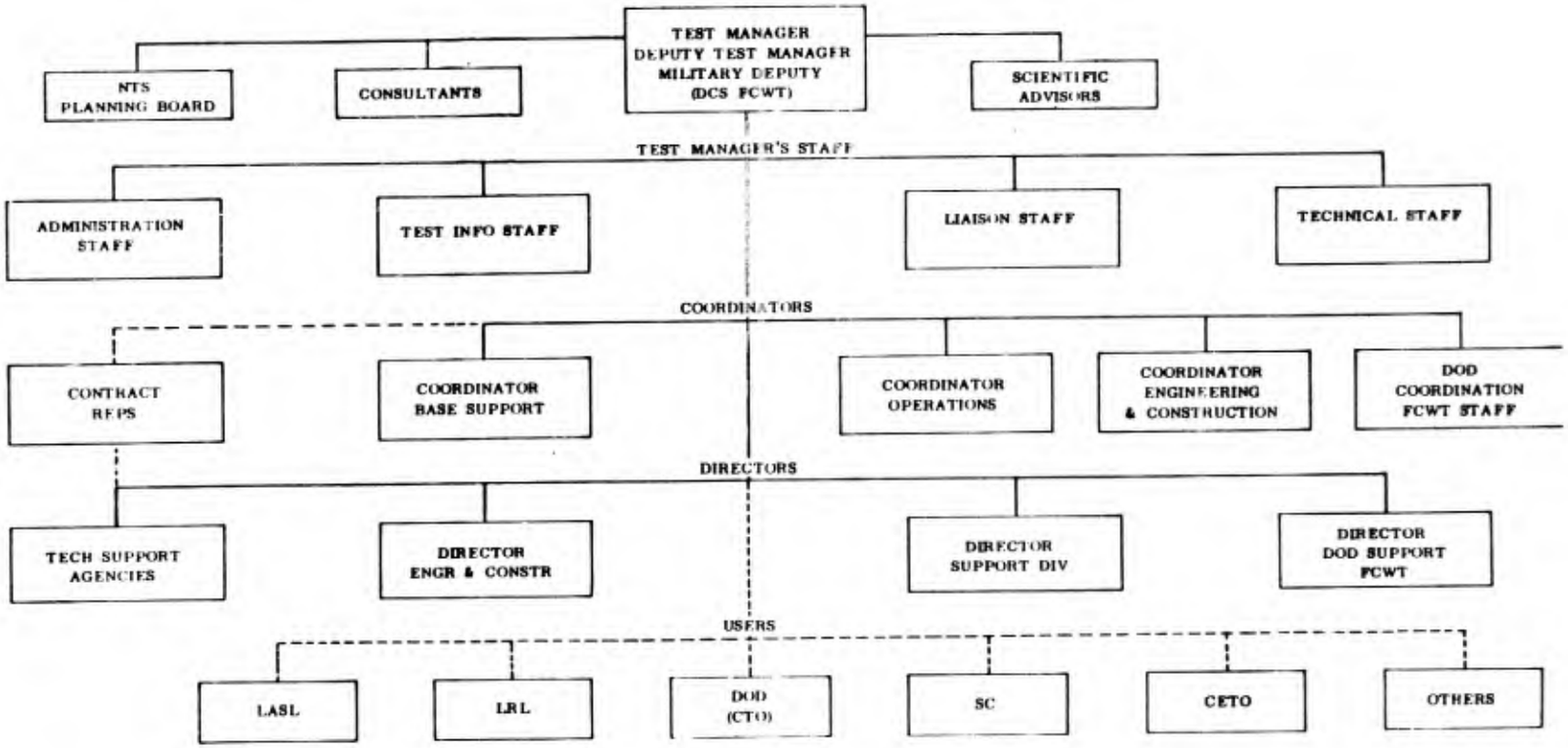


Figure 1.3 FCWT organization for 1962 test series.


TEST MANAGER
DEPUTY TEST MANAGER
MILITARY DEPUTY
(DCS FCWT)
NTS
PLANNING BOARD
CONSULTANTS
SCIENTIFIC
ADVISORS
TEST MANAGER'S STAFF
ADMINISTRATION
STAFF
TEST INFO STAFF
LIAISON STAFF
TECHNICAL STAFF
COORDINATORS
CONTRACT
REPS
COORDINATOR
BASE SUPPORT
COORDINATOR
OPERATIONS
COORDINATOR
ENGINEERING
& CONSTRUCTION
DOD
COORDINATION
FCWT STAFF
DIRECTORS
TECH SUPPORT
AGENCIES
DIRECTOR
ENGR & CONSTR
DIRECTOR
SUPPORT DIV
DIRECTOR
DOD SUPPORT
FCWT
USERS
LASL
LRL
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OTHERS

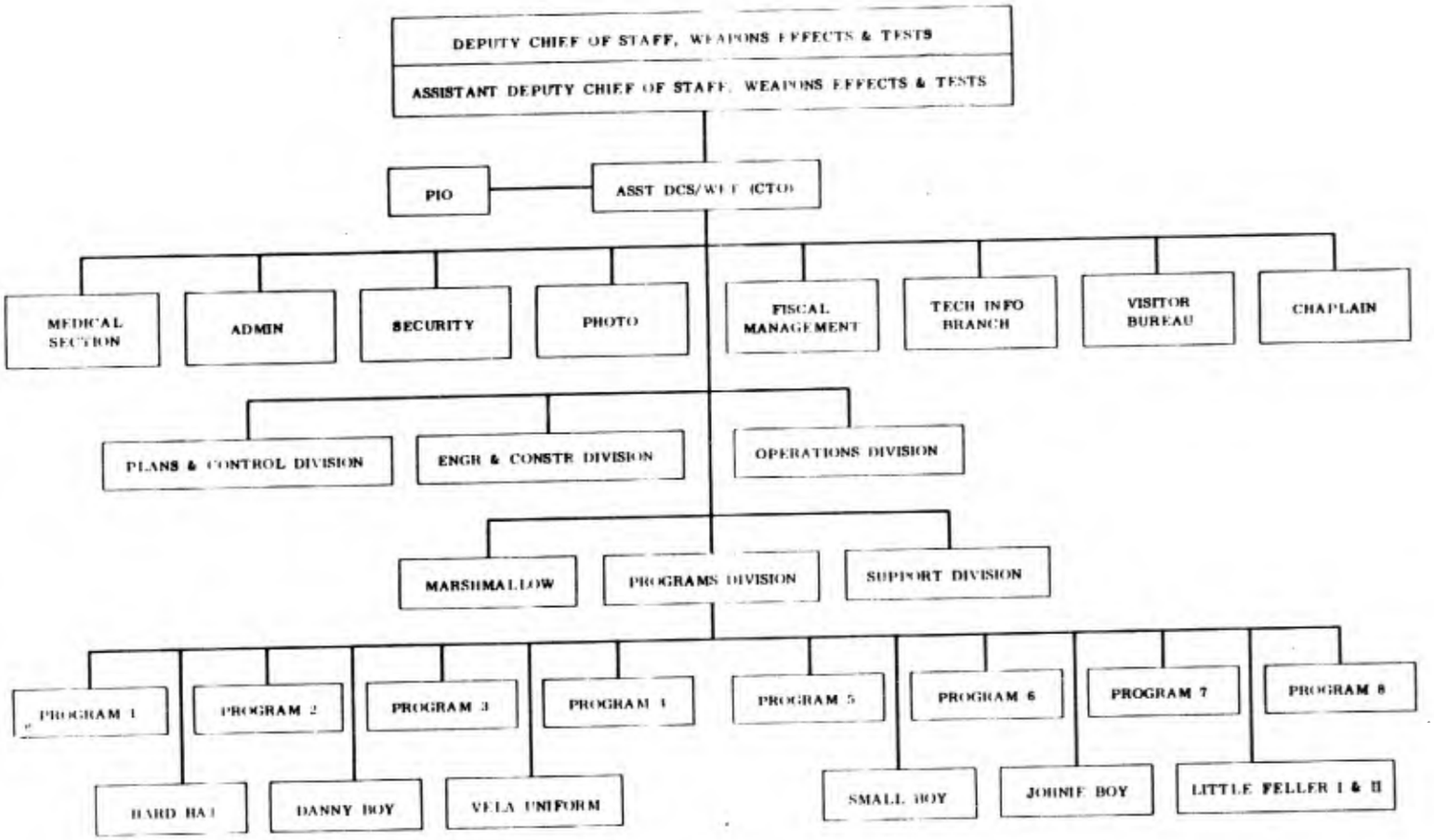

Figure 1.5 Continental Test Organization.

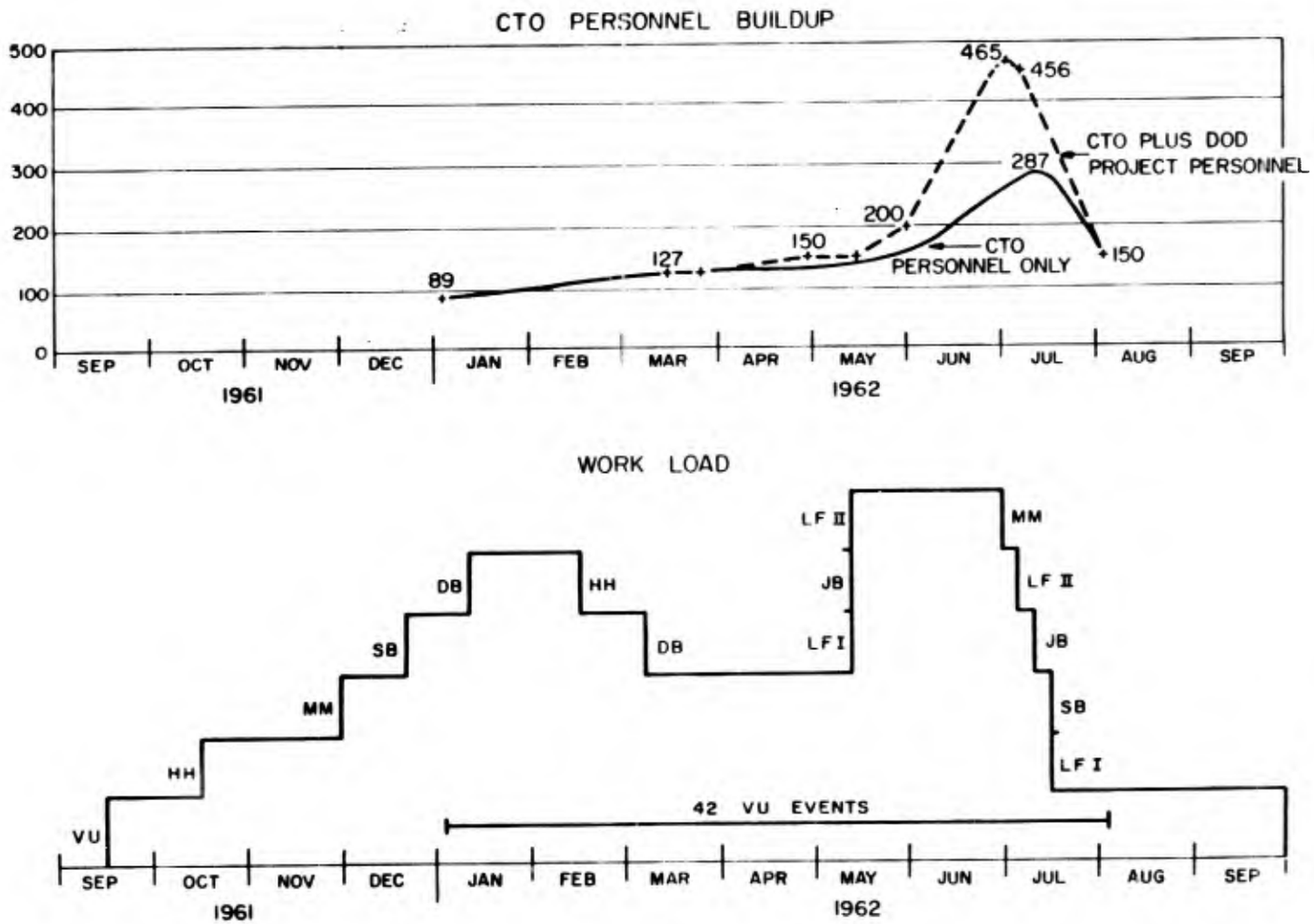

Figure 1.6 Comparison of personnel buildup with workload, September 1961 through August 1962.

Chapter 2

ADMINISTRATIVE SUPPORT

2.1 ADMINISTRATION BRANCH

The Administrative Office at NTS was staffed to provide the same services as the Administrative Office in FCWT at Sandia Base. During the peak load in the summer of 1962, there were 2 officers and 7 enlisted men assigned. Services were provided as follows:

2.1.1 Mail and Records. Classified and unclassified documents were processed through the Administrative Office, which had at its disposal a cryptographic center (provided by the AEC on a contract basis) and postal facilities, both located within Camp Mercury. Official and personal mail service was provided on a daily basis. Registry service was provided through the local post office for the mailing of classified documents.

A classified document primary account was established at the site in October 1961 by Field Command. Commonly referred to as a drop account, it provided the Test Organization with the necessary flexibility to monitor and control classified material with a minimum of security problems and a maximum of efficiency. Secondary accounts were established for the technical programs, to provide them with classified material on a permanent basis.

Files were based on the Functional Files System, but they were difficult to maintain in this system. Although the Test Organization as a whole was set up on the decentralized files system, it proved practical to maintain a message reference file in the Administrative Office.

A courier system was operated on a daily basis between the base camp and forward areas. This was mainly operated under a civilian contract system, however, liberal use was made of military traffic to those areas.

2.1.2 Finance. The main effort in this area was to provide assistance in the filing of per diem vouchers for military personnel, regardless of home station, on TDY at the site. After a trip to NTS by the Finance Officer, it was recommended that a full-time finance clerk be assigned to the Administrative Office when testing hit a peak. A check-cashing facility was provided by a local contractor, with appropriate personnel appointed to authenticate identification of individuals desiring to cash checks (a local requirement). As needed, assistance was given on problems arising with respect to other financial matters.

2.1.3 Publications. Publications to include applicable service regulations, Field Command directives and memorandums, and other pertinent reference material were maintained by the Administrative Office. They covered, generally speaking, the administrative functions of the office, while logistic references were retained by the Support Branch. Administrative blank forms were also stocked by the Administrative Office for issuance to the Test Organization as a whole.

2.1.4 Reproduction. Reproduction facilities were available in the form of a Multilith Model 80, Thermo-fax, and APECO machines. Administrative personnel in the office were given on-the-job training in the operation of these machines. A major drawback was that only limited maintenance could be performed, and damaging delays were experienced, in that repairmen had to be brought in from distances of 70 to 125 miles. A local printing plant was available on a contract basis; however, limited time and funds in this instance also were hinderances.

2.1.5 Miscellaneous Services. The Administrative Office maintained a personnel locator system whereby all military personnel, assigned to or under the operational control of the Department of Defense, could be located. At best, this operated poorly, because many personnel failed to comply with the local directive requiring them to register with the office. An effort was made to require all military organizations to place a statement in TDY orders directing their people to register or sign in with the DOD Test Organization upon arrival; this was not entirely successful. In line with this, a personnel information roster and a telephone directory were published by the office.

Travel orders were cut from time to time by the Administrative Officer for personnel attached directly to the Test Organization. Local bulletins and SOP's were issued as needed. Morning report changes were sent as required, in addition to strength reports, to cognizant units.

2.2 SECURITY BRANCH

The Security Branch planned and provided (1) clearance of personnel into and out of the test site, (2) badging of personnel, (3) classification of documents and photography (still and motion pictures), and (4) counterintelligence activity as required.

Security guidance and procedures were established in the FCWT CTO SOP's, 205 series, for continental test operations. Additionally, joint AEC-DOD security instructions for NTS were published and issued to personnel arriving at the site. These instructions set forth certain basic rules and regulations required at the site.

The DOD Security Office, located at Camp Mercury, was responsible to the Deputy Test Manager (Military) for physical security of the DOD programs, access control of DOD personnel visiting the camp, and investigation, review, and classification of documents and photographic media. The AEC was responsible for furnishing physical security, the guard force, and physical barrier requirements of DOD Security.

Badging was performed by AEC upon request of and certification by DOD. The badge office was operated by Federal Services, Incorporated (FSI) personnel under contract to AEC. The DOD Security Officer certified all DOD visitors or project participants associated with DOD programs at NTS, by use of the NTS badge card.

Liaison for traffic enforcement was established with the Nye County Sheriff's Department.

Two security guard posts were established at the DOD compound, 15 February 1962.

One officer and two enlisted men (clerk-typists) manned the security office from October 1961 to May 1962. In June and July, the office staff was augmented by an additional officer. The manpower requirements for security personnel were based on the magnitude of the test operation and number of project participants. During peak operation, the intelligence coverage was performed by three Intelligence Corps (INTC) agents from the 901st Intelligence Corps Detachment, Sandia Base, New Mexico.

Document and photographic media review and classification services were conducted for all projects on an on-call basis. Approximately 100 POIR reviews were conducted. Approximately 5,000 photographic prints and 101,000 feet of motion-picture film were reviewed. Approximately 3,000 debriefing certificates were sent to FCWT for file.

Table 2.1 summarizes the security activities at NTS during the operational period.

2.3 FISCAL MANAGEMENT OFFICE

During 1962, the FCWT Fiscal Management Office carried out the budgeting and funding functions for both the overseas and continental nuclear test programs. Budget and funding actions were carried out under the provisions of the DASA Manual for Nuclear Weapons Effects Financial Management.

The continental program began in September 1961 and initially involved reprograming the available Vela-Uniform funds from the Vela-Uniform Shade series to participation in the Nougat series. This reprograming involved approximately $3.1 million (Table 2.4).

The next budgeting was for Shot Hard Hat. It was initially budgeted at approximately $1.3 million and, after add-ons and adjustments, finally cost $1,576,523.00 (Table 2.5).

Funding actions for Shot Small Boy were released to FCDASA on 9 January 1962. At that time, the DASA budget was $8,865,000.00. Immediately, the service-funded Program 7 came into existence and finally resulted in controlling an additional $348,233.00. Delays, program refinements, and adjustments increased the DASA budget an additional $3,482,935.00, for a new final total of $12,696,168.00 (Table 2.6).

Final funding action for Shot Marshmallow was not released to FCDASA until 2 February; however, incremental funds had previously been provided. The initial Marshmallow budget, 15 December 1961, was $9,969,910.00. This was the initial budget approved by CHDASA and actually led to the funding release of 2 February 1962. Delays, program refinements, and adjustments increased the budget $396,331.00, for a new final total of $10,366,241.00 (Table 2.7).

On 17 January 1962, funds were released by CHDASA to FCDASA in the amount of $1,452,640.00 for Shot Danny Boy, which was equal to the initial budget. Refinements in this program resulted in a savings of $838,567.00, for a final budget of $614,073.00 (Table 2.8).

Funds in the amount of $1,396,000.00 were released by CHDASA to FCDASA on 1 June for Shot Johnie Boy, which was equal to the initial budget. Refinements in this program resulted in a saving of $287,796.00 for a final budget of $1,108,204.00 (Table 2.9).

On 5 June, funds in the amount of $1,241,000.00 were released by CHDASA to FCDASA for Shots Little Feller I and II. This release was equal to the initial budget. Refinements in the program decreased the budget by $230,951.00, for a final total of $1,010,049.00 (Table 2.10).

In addition to the above funds, approximately $1,000,000.00 was expended in X-Mil funds (operating funds not chargeable to research programs) during this program in accordance with Part 3, Paragraph 3, DASA Manual for Nuclear Weapons Effects Financial Management.

The normal procedure prescribed in the DASA manual requires that all initial test fund budgets be gathered and coordinated by CHDASA. With the exception of Small Boy, all of the above programs were, however, completely budgeted by FCDASA.

The experience gained in carrying out the budgeting and funding functions for these operations points up the fact that, if strict adherence to the DASA manual is maintained, the efficiency of these functions and their support and value in accomplishing the scientific effort are greatly increased.

2.4 PUBLIC INFORMATION OFFICE

All public information was released by the AEC-DOD Joint Office of Information (JOI). The international sensitiveness of nuclear weapons testing caused the national policy on public information to be limited to releases necessary to preclude public alarm. In practice, news releases with text approved by AEC/Washington, CHDASA, and DOD Public Affairs were made as preshot and postshot announcements on events that might be publicly observable. News media observers were not authorized for any of the events.

2.5 VISITORS BUREAU

Established in late September 1961, shortly after the resumption of U. S. nuclear tests, the Visitors Bureau was placed under the supervision of the FCWT PIO and staffed with personnel on TDY from FCDASA. The staff consisted of one officer and two enlisted men, who were augmented by escort officers and drivers as required. During events of primary interest to DOD, such as Hard Hat and Marshmallow when large numbers of observers were on hand, 12 to 15 escort officers were required. Escort officers were obtained from FCDASA and Sixth Army on a request-when-needed basis.

Facilities consisted of a quonset in the DOD area at Mercury, which housed the office and a briefing room. During the peak periods from January to June 1962, office space was obtained near the Las Vegas Commercial Airport (McCarran Field) to assist in handling visitors. The visitor bureau personnel met arriving visitors, arranged quarters, provided transportation, arranged for tours and briefings, and obtained appropriate escort officers. Visitors were of three major categories:

(1) DOD military and contractor personnel on official business. This was a continuing and daily workload with visitors to attend meetings, confer with personnel at NTS, visit site locations, etc. It is estimated that, during Operations Nougat and Sun Beam, visitors of this type averaged more than 500 per month.

(2) Senior DOD officers for orientation, briefing, and tour of the test site. These were groups headed by general officers of the Air Force, Army, and Navy to obtain the latest information on U. S. testing and to see the activity at the test site. During Operations Nougat and Sun Beam, there were approximately 18 groups of VIP level and numerous other groups requiring special attention.

(3) On all events of primary interest to the DOD, official observers were present. For Hard Hat and Danny Boy, there were approximately 150 to 200 observers, and Marshmallow had in excess of 1,000.

2.6 TECHNICAL INFORMATION BRANCH

The Technical Information Branch (TIB) at NTS provided limited drafting and typing assistance to projects in the field for special situations, edited and processed the POIRs for printing, and prepared briefing charts for use at the site.

Operations Nougat and Sun Beam, conducted concurrently at the Nevada Test Site, generated a record total of 107 projects reporting on weapons effects tests conducted during a 20-day period. TIB was responsible for processing the POIRs submitted by these projects during a period of less than 2 months. This responsibility included: (1) coordinating the preparation of the interim reports in accordance with DASA requirements, (2) reviewing certain aspects of the technical content, and (3) performing preliminary editorial review.

In addition, TIB prepared much of the original artwork and typed many of the manu-

scripts, in offering assistance to numerous project agencies that lacked the required resources for preparing the POIRs in the field.

The very heavy demand for briefing charts constituted a sizable portion of the TIB workload. During the approximate 45-day period from 15 June to 1 August 1962, TIB prepared approximately 170 briefing charts. During this same period, TIB also prepared approximately 170 pieces of original artwork for POIR manuscripts.

Most of the projects completed their POIR manuscripts at NTS, to comply with DASA instructions disseminated in a 20 April 1962 letter from CHDASA (Appendix F), which required that copies of each draft POIR be forwarded to Headquarters DASA within 30 days of the last event reported upon. As a result, the POIRs were published and distributed in record time.

Each POIR draft was first reviewed by the appropriate Program Director. The draft was coordinated by TIB, then reviewed and approved by the Deputy Test Manager (Military).

After completion of this on-site processing, the approved manuscript was transmitted to the Technical Information Branch, FCWT, at Sandia Base. There the POIR was given final analysis and editorial review and was prepared for printing (preparation of camera copy). After final makeup and proofreading, the camera copy was transmitted to the Field Command Printing Plant, FCTG, Sandia Base, for printing. Printed copies were transmitted to FCWT for preparation of mailing materials and then to the Field Command Adjutant General for distribution. (The PORs were processed as outlined in Appendix F.)

In early June, TIB at NTS was manned by three enlisted men only. By mid-June two officers, on temporary duty from Headquarters DASA, were assigned. At the peak of the workload, the branch had been augmented to a total strength of 2 officers, 10 enlisted men, and 1 civilian.

TIB occupied Quonset 36 in the DOD compound, together with a Headquarters Sixth Army liaison team (2 officers, 1 clerk). For a part of the time, the building was also occupied by approximately four Support Division personnel.

2.7 MEDICAL SERVICES

One medical officer and six corpsmen were authorized the Las Vegas Branch, Support Division, and assisted in operating a dispensary in Building 100 at Camp Mercury.

The facility, drugs, medicines, and most medical and surgical instruments were provided by the AEC. The daily sick call was scheduled from 0800 to 1000 hours on weekdays and from 0900 to 1000 hours on Sundays and holidays. Two ambulances were provided this activity by the Field Command Table of Allowances. Additional ambulances were made available by the AEC as site population dictated.

The primary responsibility of this military contingent was to treat DOD personnel, but the staff could and did administer treatment to AEC and contractor personnel as specified in AEC-DOD reciprocal agreements. Patients requiring hospitalization were moved by ambulance to Nellis Air Force Base Hospital or to a civilian hospital as appropriate.

2.8 CHAPLAIN SERVICES

The AEC as the government agency operating the Nevada Test Site was responsible for providing a chapel facility. One or more office-type trailers were used for this purpose. Chairs, lectern, and organ were also supplied with the facility.

The assistance of the Field Command, DASA Chaplain was secured to arrange loans of chaplains from Sandia Base, Lake Mead Base, and Indian Springs Air Force Base.

The out-of-pocket travel expenses of these chaplains were reimbursed by the AEC contractor. Both Protestant and Catholic chaplain kits were available from Table of Allowance equipment authorized FCWT. When feasible, personnel of other than Protestant or Catholic faiths were provided transportation to adjacent civilian communities to attend services upon their request.

As indicated in Table 5.12, the manning chart provided for one chaplain on TDY.

2.9 PROGRAM 9

2.9.1 Mission. The mission of Program 9 is to provide all types of photographic support, during both testing and nontesting periods, as required by FCWT and DASA. The following areas of support are specifically itemized.

Provides, by furnishing or arranging for, all photographic services required to support DOD operations. Normally, budgets and funds for all photographic support required by DOD agencies. Administers, coordinates, and controls all photography, and photographic badging, in support of DOD activities.

Photographic support is provided, through DOD service facilities available, or by contract with, Army Pictorial Center; Lookout Mountain Laboratories; Edgerton, Germeshausen and Grier, Inc. (EG&G); and other contract agencies.

Photographic support provided includes but is not limited to:

(1) Technical photography.

(2) Documentary photography.

(3) Photographic processing, including still, motion picture, and oscilloscope paper, in color or black and white.

(4) Refrigerated storage of photographic materials.

(5) Projection equipment and facilities.

(6) Classification and reclassification of photographic materials as required.

(7) Acts as official archives and depository of photographic negative materials and maintains reference film library containing technical motion pictures and still photographs taken during test operations; assembles catalogs, accounts for, reproduces, and stores films and photographs.

(8) Coordinates and plans photographic test functions with CHDASA and other scientific agencies participating in test programs in continental and overseas test programs.

(9) Produces Class A motion-picture film reports as directed; acts as technical advisor.

(10) Plans and manages execution and report preparation of such scientific experiments as are assigned.

(11) Provides management in the design of modifications to aircraft for optical and photographic operations.

(12) Manages or monitors data reduction and analysis of optical records.

(13) Is responsible for the manufacture of photographic briefing materials and for the issue and maintenance of a Presentation Book and master prints of briefing slides, charts, and other visual materials.

2.9.2 Technical Photography. Program 9 determined the requirements and solicited proposals from qualified agencies for accomplishment of the technical photography. During Nougat and Sun Beam, technical photography was performed for FCDASA by EG&G, U. S. Air Force, U. S. Army, and, in some cases, by the Sandia Corporation.

The responsible agency worked very closely with Program 9 and with the other projects to insure that the scientific phenomena were properly photographed, i.e., optimum frame

rates and angles, so that measurements and data reduction and analysis could be made. Upon completion of the measurement photography, copies of the film were made available to the project concerned and to the Program 9 archives.

2.9.3 Documentary Still Photography. During test periods, the function of providing still photo coverage for the scientific projects and documentation of the event itself, as well as all types of still photo support required at the test location, was given to an agency to perform as a project. This effort was designated Project 9.2 and, depending on the anticipated workload, consisted of from 1 officer and 5 enlisted men to 2 officers and 11 enlisted men. At least 2 men were put on flying status to handle low-level (under 5,000 feet) vertical and oblique aerial photography.

Project 9.2 was required to provide every type of photo-support under all field conditions. It also supported other (non-DOD) agencies at times, and in turn received support from them. Some measure of support was given to such agencies as the AEC, Lawrence Radiation Laboratory (LRL), Los Alamos Scientific Laboratory (LASL), EG&G, and Reynolds Electrical and Engineering Company (REECO). A tabulation of the photo production of Project 9.2 during Operations Nougat and Sun Beam is given in Table 2.2.

2.9.4 Photographic Processing. Prior to resumption of testing in 1961, a 10- by 40-foot specially designed photo-trailer was installed at Sandia Base and operated by Program 9 personnel. All necessary types of photographic processing and operations were performed there.

When testing resumed, this trailer was sent to NTS. Project 9.2 personnel were responsible for photographic processing at NTS.

As a result of the experience gained during this operation, efforts are being made to increase Program 9's processing capability. Based on previous experience, the least costly and most versatile method of providing the required capability would be in the form of mobile, self-contained trailer laboratories. These units could be easily and quickly deployed as needed by standard transportation means and require little or no site preparation. During test periods, one or two highly skilled operators could train the necessary augmentation service personnel and operate the laboratories in the field. During nontest periods, the laboratories could be used, stored, redeployed, or loaned with the costs of upkeep borne by the user as with other DASA test equipment.

Test activity has clearly shown that four general types of laboratory capability, or configurations, will be required for future test operations. Each should be a self-sufficient unit: black-and-white 16/35-mm motion-picture processing and printing laboratory, black-and-white and color still processing and printing laboratory, color 16/35-mm motion-picture processing and printing laboratory, and preliminary measurement, data reduction, film handling and storage laboratory.

Based on the best estimates available, at least two trailers of each type would be required to provide a minimum capability for future test operations. Only in this manner can the increasing demands for optical and photographic recordings be met for both continental and overseas operations.

2.9.5 Documentary Motion Pictures. The requirements for the various types of motion pictures such as effects films, commander's reports, etc., and straight documentary films were handled as Project 9.3. Although this was done by various military agencies in the past, in this test series documentary and production films were produced for

FCDASA by Lookout Mountain personnel. Project 9.3 ranged in size from 2 enlisted men to 2 officers, 6 enlisted men, and 4 civilians at the height of Operations Nougat and Sun Beam.

In addition to making the required films, Project 9.3 had the processing, editing, and other associated steps in movie production accomplished at their home base in Hollywood, California. It was there also that all of the original negatives were stored in air-conditioned, humidity-controlled vaults. The use of this film was by authorization of Program 9, such control being necessary because of the nature and classification of the material. This control was still necessary after reclassification by the DOD Classification Officer, to prevent unauthorized use or release of DASA film.

A Command Representative was appointed by CHDASA, and a Technical Representative was appointed by FCDASA to coordinate and to give approval to the script, the interlock print, and to the answer print, and to make sure the release prints met all requirements, both scientific and technical. Direct contact between these representatives and the production agency was authorized at all times.

The number of release prints to be made was decided by CHDASA. The distribution of these prints was determined according to the type audience they were made for, their security classification, and the purpose of the film, i.e., training, information, etc.

All motion pictures were exposed on 35-mm color negative from which color prints, 35- or 16-mm, and/or black-and-white 35- or 16-mm prints could be made. A general summarization of the amount of original 35-mm color negative exposed is given in Table 2.3.

2.9.6 Storage of Photographic Materials. All film, prior to exposure, was treated as contraband material. Since film stored for any length of time, and in warm weather, requires refrigeration, this film was kept in large locked refrigerators. This service was offered to those projects authorized to do their own photography; and during Operations Nougat and Sun Beam as much as 60 ft^3 of motion-picture film, dosimeter film, still film, and photographic emulsion was in storage.

Responsibility for storage and safekeeping of motion-picture films of all test activities was given to Program 9 as was the supervision of the use and reuse of these films.

Still-picture negatives, color transparencies and negatives, and various types of test negative material are maintained and filed in Program 9. This material is available to all authorized agencies upon request.

TABLE 2.1 DOD SECURITY AND CLASSIFICATION ACTIVITIES

	Jan	Feb	Mar	Apr	May	Jun	Jul
Personnel Badging	327	385	435	439	604	1,332	1,667
INTC * Site Survey		1					
Security Surveys, Limited		1				1	1
Unannounced INTC Checks		4	4	4	4	4	5
Security Lectures		4	8	8	8	12	10
Visual Technical Inspections				1	1	6	2
Security Violation Investigations		4	2	3	2		
General INTC Investigation		5	5	7	15	20	15
Document Classification		4	11	9	8	25	101
Photographic Classification		200	300	800	700	1,500	1,500
Security SOP's Rewritten						2	2

* All INTC activities were carried out by the 901st Intelligence Corps Detachment from Sandia Base, New Mexico.

TABLE 2.2 PHOTOGRAPHIC PRODUCTION FOR OPERATIONS NOUGAT AND SUN BEAM

Shot	Prints			Negatives and Duplicate Negatives	Number of Work Orders
	4 × 5	8 × 10	11 × 14		
Danny Boy	593	438		78	14
Hard Hat	6,241	1,674	6	228	52
Marshmallow	5,058	11,267	22	1,336	139
Little Feller II	588	1,880	8	140	13
Johnie Boy	174	343	8	36	6
Small Boy	8,124	8,369	12	1,376	141
Little Feller I	972	1,392	8	169	9
Sedan	68	863		37	6
All Nougat Series	2,677	5,465	12	718	148
TOTALS	24,395	31,691	76	4,118	528

TABLE 2.3 SUMMARY OF MOTION-PICTURE FILM EXPOSED

Shot	Motion-Picture Footage
Danny Boy	13,700
Hard Hat	19,600
Marshmallow	30,000
Little Feller II	9,900
Johnie Boy	5,900
Small Boy	49,400
Little Feller I	21,700
Sedan	2,400
All Nougat Series	50,000
TOTAL	202,600

TABLE 2.4 DASA BUDGET, VELA UNIFORM

PROJECT	AGENCY		AMOUNT
Program 1			
1.1	Sandia Corporation		$ 574,943.59
1.2	Stanford Research Institute		938,176.32
1.3	Edgerton, Germeshausen and Grier		241,687.81
1.4	United States Coast and Geodetic Service		429,883.26
1.6	Holmes and Narver		22,153.48
1.7	Space Technology Laboratories		112,136.88
1.8	Sandia Corporation		8,268.31
		Total	$2,327,249.65
Program 9			
9.1	Waterways Experiment Station		$ 108,663.61
9.2	Army Pictorial Center		57,000.00
9.3	Army Pictorial Center		19,214.00
9.3	Lookout Mountain Air Force Station		112,400.00
9.4	Atomic Energy Commission		3,600.00
9.5	United Electro Dynamics		34,962.77
9.61	Field Support		279.26
9.62	Logistical Support		-0-
9.99	Air Force Special Weapons Center		5,000.00
39.0	General Support		936.46
39.1	Field Support		65,000.00
39.2	General Support		46,334.71
60.6	Special Radio Broadcast Facilities		71,471.41
60.6	Edgerton, Germeshausen and Grier		1,711.33
		Total	$ 526,573.55
Miscellaneous			
XXX	Miscellaneous		$ 82,750.77
XXX	Nevada Test Site / Obligation Authority		117,150.42
XXX	Telephone		1,287.23
XXX	Ammunition - Hawthorne		4,647.63
XXX	MISMA		2,400.00
XXX	Ground Hog		8,720.85
		Total	$ 216,956.90
		Grand Total Funded	$3,070,780.10

TABLE 2.5 DASA BUDGET, HARD HAT

PROJECT	AGENCY	AMOUNT
Program 3		
3.1	Holmes and Narver / Reynolds Electrical and Engineering Company	$ 703,450.77
3.2	Stanford Research Institute	133,598.90
3.3	Sandia Corporation	191,674.46
3.6	Colorado Bureau of Mines	13,639.02
3.11	Edgerton, Germeshausen and Grier, Inc.	3,629.84
	Total	$1,045,992.99
Program 9		
9.2	Army Pictorial Center	$ 3,375.00
9.3	Lookout Mountain Air Force Station	2,864.34
9.4	Atomic Energy Commission	3,457.80
9.7	Holmes and Narver / Reynolds Electrical and Engineering Company	274,737.14
9.8	Holmes and Narver / Reynolds Electrical and Engineering Company	206,340.93
9.9	Field Command	8,783.25
60.5	Holmes and Narver / Reynolds Electrical and Engineering Company	20,753.80
70.1	Nevada Test Site	2,866.70
70.4	Communications Nevada Test Site	1,811.01
70.5	Field Command, Defense Atomic Support Agency - Travel	1,766.73
70.6	Obligation Authority / Nevada Test Site	3,773.55
	Total	$ 530,530.25
	Grand Total Funded	$1,576,523.24

TABLE 2.6 DASA BUDGET, SMALL BOY

PROJECT	AGENCY	AMOUNT
Program 1		
1.1	Ballistics Research Laboratory	$ 367,056.43
1.2	Stanford Research Institute	220,369.83
1.3	Air Force Special Weapons Center	166,514.77
1.4	Naval Ordnance Laboratory	23,919.96
1.5	Stanford Research Institute	87,762.72
1.6	Sandia Corporation	294,434.84
1.7	Space Technology Laboratories	45,537.51
1.8	Waterways Experiment Station	72,427.09
1.9	Waterways Experiment Station	36,553.44
	Total	$ 1,314,576.59
Program 2		
2.2	U. S. Army Signal Research and Development Laboratory	$ 188,955.48
2.3	Nuclear Defense Laboratory	45,698.00
2.4	Nuclear Defense Laboratory	42,989.00
2.7	United States Weather Bureau	45,182.00
2.8	Nuclear Defense Laboratory	159,730.00
2.9	Navy Radiological Defense Laboratory	492,531.48
2.10	Navy Radiological Defense Laboratory	260,700.00
2.11	Navy Radiological Defense Laboratory	140,700.00
2.12	Nuclear Defense Laboratory	99,508.00
2.13	Nuclear Defense Laboratory	67,561.00
2.14	Navy Radiological Defense Laboratory	102,088.28
2.15	Ballistics Research Laboratory	135,367.99
	Total	$ 1,781,011.23
Program 3		
3.1	Massachusetts Institute of Technology	$ 50,093.79
3.2	Waterways Experiment Station	310,832.39
3.3	Naval Civil Engineering Laboratory	78,164.67
3.4	Ballistics Research Laboratory	268,834.10
	Total	$ 707,924.95
Program 6		
6.1	Sandia Corporation	$ 1,439,342.00
6.2	Diamond Fuse Ordnance Laboratory	1,505,100.00
6.3	Hughes Aircraft Company	1,158,250.00
6.4	Signal Research and Development Laboratory	369,576.00
6.5	Sandia Corporation	533,001.68
6.6	Air Force Special Weapons Center	472,549.00
6.7	United States Coast and Geodetic Service	19,375.94
6.8	Air Force Special Weapons Center	57,496.00
		102,211.70
	Total	$ 5,656,902.32

TABLE 2.6 CONTINUED

PROJECT	AGENCY	AMOUNT
Program 7		
7.1	Air Force Special Weapons Center	$ 105,000.00
7.14	Air Force Special Weapons Center	112,000.00
7.2	Army Tank Automotive Center	12,500.00
7.5	Army Engineer Research and Development Laboratory	6,200.00
7.6	Army Electronics Proving Ground	1,950.00
7.61	Reynolds Electrical and Engineering Company	2,000.00
7.8	Nuclear Defense Laboratory	13,000.00
7.9	David Taylor Model Basin	55,000.00
7.10	Nuclear Defense Laboratory	3,000.00
7.12	Army Signal Engineering Agency	10,000.00
7.13	Aeronautical Systems Division	5,500.00
7.14	Air Defense Command	11,500.00
7.15	Aeronautical Systems Division	7,500.00
7.17	Engineer Research and Development Laboratory	3,083.30
	Total	$ 348,233.30
Program 9		
9.1	Field Command, Defense Atomic Support Agency	$ 2,073,032.59
9.2	Army Pictorial Center	10,000.00
9.3	Lookout Mountain Air Force Station	12,562.72
9.4	Field Command, Defense Atomic Support Agency	25,000.00
9.5	Field Command, Defense Atomic Support Agency	94,464.47
9.7	Field Command, Defense Atomic Support Agency	151,173.34
9.8	Edgerton, Germeshausen and Grier	12,502.27
9.10	Waterways Experiment Station	10,000.00
9.71	Field Command, Defense Atomic Support Agency	456,969.82
9.72	Edgerton, Germeshausen and Grier	41,814.34
	Total	$ 2,887,519.55
	Grand Total Funded	$12,696,167.94

TABLE 2.7 DASA BUDGET, MARSHMALLOW, FY 1962-1963

PROJECT	AGENCY	AMOUNT
Program 8		
810	Naval Research Laboratory	$ 31,329.00
811	Edgerton, Germeshausen, and Grier	430,383.99
813	Lockheed Missile and Space Division	553,943.00
816.1	Stanford Research Institute	413,829.00
816.2	Stanford Research Institute	241,710.00
816.3	Stanford Research Institute	109,780.00
808	Stanford Research Institute	290,500.00
822	Stanford Research Institute	115,880.00
823	American Science and Engineering	158,759.00
824.1	Air Force Special Weapons Center	3,000.00
824.2	E. H. Plesset Associates	32,109.12
824.4	Atomic Energy Commission	75,151.00
830	Air Force Special Weapons Center	138,200.00
832.1	Air Force Special Weapons Center	472,000.00
832.2	Air Force Special Weapons Center	220,000.00
833.4	American Science and Engineering	485,562.00
835.1	Air Force Special Weapons Center	25,000.00
835.2	Air Force Special Weapons Center	86,800.00
836.1	Air Force Special Weapons Center	283,500.00
838	Air Force Special Weapons Center	48,700.00
841	Edgerton, Germeshausen and Grier	347,872.42
842	Edgerton, Germeshausen and Grier	1,342,319.47
842A	Air Force Special Weapons Center	85,304.28
851.2	Atomic Energy Commission	421,146.28
851.3	Edgerton, Germeshausen and Grier	297,536.73
851.4	Holmes and Narver	3,007.35
852.2	Atomic Energy Commission	382,133.00
852.4	Atomic Energy Commission	2,029,116.27
852.5	Reynolds Electric and Engineering	106,051.97
854.1	Lockheed Missile and Space Division	860,633.00
855	Atomic Energy Commission	106,575.24
856	Atomic Energy Commission	21,848.22
859.3	Reynolds Electric and Engineering	87,805.93
859.4	Field Command, Defense Atomic Support Agency	4,215.36
892	Army Pictorial Center	14,625.00
893	Lookout Mountain Pictorial Service	29,298.00
894	Atomic Energy Commission/Oak Ridge	9,450.00
000	Atomic Energy Commission	1,166.71
	Grand Total Funded	$10,366,241.34

TABLE 2.8 DASA BUDGET, DANNY BOY

PROJECT	AGENCY		AMOUNT
Program 1			
1.1	Sandia Corporations		$ 43,836.71
1.2	Waterways Experiment Station		104,681.65
1.3	Edgerton, Germeshausen, and Grier		49,689.33
1.5	Reynolds Electric and Engineering Company		15,216.67
1.6	Waterways Experiment Station		32,756.65
1.7	Space Technology Laboratory		6,099.97
1.9	Lawrence Radiation Laboratory		-0-
		Total	$252,280.98
Program 2			
2.4	Lawrence Radiation Laboratory		$ 6,442.12
2.5	Nuclear Defense Laboratory		69,374.00
		Total	$ 75,816.12
Program 9			
9.2	Army Pictorial Center		$ 5,000.00
9.3	Lookout Mountain Air Force Station		9,126.97
9.4	Atomic Energy Commission/Oak Ridge		10,000.00
9.9	Lawrence Radiation Laboratory		39,831.82
9.11	Field Command		2,817.65
9.12	Reynolds Electric and Engineering Company		7,466.43
9.71	Holmes and Narver		91,619.61
9.72	Reynolds Electric and Engineering Company		117,779.03
O/A	Obligation Authority		2,334.15
		Total	$285,975.66
		Grand Total Funded	$614,072.76

TABLE 2.9 DASA BUDGET, JOHNIE BOY

PROJECT	AGENCY		AMOUNT
Program 1			
1.1	Ballistics Research Laboratory		$ 110,000.00
1.2	Waterways Experiment Station		120,000.00
1.5	Waterways Experiment Station		32,500.00
1.7	Reynolds Electric and Engineering Company		7,000.00
1.9	Waterways Experiment Station		100,000.00
1.11	Waterways Experiment Station		45,500.00
1.12	Stanford Research Institute		37,446.00
1.13	Air Force Special Weapons Center		15,492.12
1.14	Sandia Corporation		9,909.58
1.15	Sea Space		22,383.00
		Total	$ 500,230.70
Program 2			
2.3	Nuclear Defense Laboratory		$ 37,000.00
2.4	Nuclear Defense Laboratory		23,000.00
2.8	Nuclear Defense Laboratory		81,000.00
2.9	Navy Radiological Defense Laboratory		88,465.00
2.13	Air Force Special Weapons Center		8,979.57
2.16	Engineer Research and Development Laboratory		20,000.00
2.20	Nuclear Defense Laboratory		100,000.00
		Total	$ 358,444.57
Program 6			
6.6	Air Force Special Weapons Center		$ 75,748.82
		Total	$ 75,748.82
Program 9			
9.2	Army Pictorial Center		$ 5,000.00
9.3	Lookout Mountain Air Force Station		14,854.45
9.4	Reports		10,000.00
9.5	Atomic Energy Commission / Communications		10,525.58
9.6	Reynolds Electric and Engineering Company		5,174.45
9.61	Reynolds Electric and Engineering Company		56,917.97
9.7	Holmes and Narver		62,134.25
9.10	Waterways Experiment Station		6,669.75
9.60	Obligation Authority		2,503.44
		Total	$ 173,779.90
		Grand Total Funded	$1,108,203.99

TABLE 2.10 DASA BUDGET, LITTLE FELLER I AND II

PROJECT	AGENCY	AMOUNT
Program 1		
1.1	Ballistics Research Laboratory	$ 102,326.47
1.3	Ballistics Research Laboratory	80,101.81
1.5	Engineer Research and Development Laboratory	16,142.37
1.9	Waterways Experiment Station	35,173.11
	Total	$ 233,743.76
Program 2		
2.3	Nuclear Defense Laboratory	$ 57,687.92
2.4	Nuclear Defense Laboratory	24,000.00
2.8	Nuclear Defense Laboratory	44,728.42
2.16	Engineer Research and Development Laboratory	39,185.79
2.17	Northrup Aviation Corporation	230,705.95
2.20	Nuclear Defense Laboratory	90,278.39
	Total	$ 486,586.47
Program 8		
8.1	Signal Research Development Laboratory	$ 19,348.75
	Total	$ 19,348.75
Program 9		
9.2	Army Pictorial Center	$ 10,279.64
9.3	Edgerton, Germeshausen and Grier, Inc.	14,195.68
9.4	Reports	10,000.00
9.5	Communications	13,568.85
9.7	Holmes and Narver	53,846.24
9.10	Waterways Experiment Station	80.08
9.60	General Support	25,000.00
9.61	Field Support	140,000.00
9.62	Obligation Authority	3,399.22
	Total	$ 270,369.71
	Grand Total Funded	$1,010,048.69

Chapter 3

ENGINEERING AND CONSTRUCTION

3.1 MISSION

The mission of the Engineering and Construction Division (E&C), FCWT, was to provide construction and field support at the various test sites in support of the DOD nuclear tests.

Other collateral functions consisted of coordinating site selection activities, developing plot plans and instrument layouts, writing button-up and reentry plans, and providing technical test construction advice and services to other personnel of FCWT. In addition, liaison was effected between the AEC Architect-Engineer, construction contractors, and the projects. Project personnel were not authorized direct contact with construction contractors.

3.2 ENGINEERING

The engineering portion of the mission was accomplished by determining, reviewing, and coordinating all construction requirements of approved scientific programs. The approved requirements were forwarded to the proper agency for design and planning. The engineering section reviewed all designs for practicability, suitability, and timeliness. On approval by the engineering section, field construction was directed.

The flow of criteria and accompanying coordination required from the submission of a project's requirements until receipt of the requirements by the construction contractor is indicated in Figure 3.1.

3.3 CONSTRUCTION

All field construction in support of the DOD test activities was accomplished by E&C. To accomplish this portion of the mission, a permanent field office was manned at NTS by as many as 10 engineer officers. The branch coordinated all phases of support construction between the construction contractor and scientific personnel, inspected construction as it progressed, monitored the expenditure of allocated funds, and provided field support in the form of labor, equipment, and incidental materials to all projects in the field.

In addition, E&C formulated and supervised the execution of the button-up plan, coordinated on device emplacement, provided support for the reentry activities, and supervised the postshot recovery of data and instruments.

The scope of the work accomplished during Operations Nougat and Sun Beam is outlined below.

3.3.1 Hard Hat. Work was begun in early November 1961, and all projects were completed for the ready date of 15 February 1962. Responsibility for the work was taken

over from LRL, Lollipop event, in an inactive state and reactivated in a week. The work accomplished consisted of completing the underground instrument holes, installing 16 structural test sections and the 450 gages in the total of 48 test sections, drilling 8,550 feet of deep instrument holes, and installing numerous underground and surface instruments. E&C assisted in the emplacement of instruments and supervised the grouting of all holes. Figures 3.2 and 3.3 show the scope of construction.

A summary of the major construction items follows:

Project 1.2, Close-In Earth Motion. Gages were installed at seven surface locations and various depths in seven deep vertical holes at horizontal ranges from 0 to 3,000 feet. In addition, six small-diameter heavy-walled tubes were placed in holes drilled from the Station 1500 tunnels, with the remote ends penetrating the explosion cavity. Instrumentation required the installation of 72 gage channels with necessary recorder shelters and facilities.

Project 1.3, Surface Motion Photography. One portion of the project required that two target arrays and two camera stations be built. The second portion required the construction of three inertial weight and camera stations at ranges from surface zero of 50, 450, and 950 feet. The inertial weight target assembly consisted of a weighted indicator suspended on a helical spring from a 100-foot tower in front of a graduated target. The tower and targets were rigidly anchored in the ground.

Project 1.4, Strong-Motion Seismic Measurements. Nine strong-motion stations, each consisting of an instrument shelter mounted on a concrete pad and provided with the necessary timing signals, were constructed.

Project 3.1, Loading, Response, and Evaluation of Rock and Tunnel Liner Structures. The plan of instrumentation for the tunnel liners was developed by the University of Illinois in collaboration with Stanford Research Institute (SRI) and Holmes and Narver, Inc. (H&N). Forty-eight structures were instrumented. A total of 859 measurements, 108 transient and 751 static, were required by the plan. The instrument plan is illustrated in Figure 3.4.

Project 3.2, Electronic Measurements in Rock and Tunnel Liner Structures. Forty-three test structures were instrumented with 108 channels for electronic measurements that were recorded at a recording station on the surface, 2,000 feet from the main vertical shaft.

Project 3.3, Particle Motion, Stress, and Strain in Granite. This project made particle-motion and free-field measurements in six deep underground instrument holes drilled from the tunnel floors. Instrument installation, 1,986 feet of drilling, a surface recording park, and cabling for recording and timing signals were required to support this project.

Project 3.11, Photographic Measurements in Rock and Tunnel Liner Structures. Three underground camera stations were constructed, to photograph structures during the test.

Project 3.12, Reed Gage Measurements in Rock and Tunnel Liner Structures. Twenty shock spectra gages were installed on underground structures and in canisters grouted in the floor of the horizontal access tunnels.

Air Force Technical Applications Center (AFTAC) Projects. In addition to the above-listed projects, E&C supported 15 AFTAC-sponsored projects. Although no great

construction volume was involved, a great deal of time-consuming coordination of small details required many man-hours.

AEC Projects. AEC projects measuring permanent displacement, hydrodynamic pressure, shock pressure, and stress history were supported. Major effort consisted of underground drilling, placing of instruments, and running of recording cables.

Following Hard Hat, E&C supervised the reentry and recovery of instruments and structures. This work extended over a period of about 4 months.

3.3.2 Marshmallow. E&C performed its normal mission in support of Marshmallow and, in addition, provided one program director to supervise the 850 series programs. The event was originally scheduled to occur in the 01 drift of the U12e tunnel in Area 12. Damage to the tunnel incident to the Antler event and predicted seismic activity resulting from scheduled adjacent events required that the project be located in a remote and relatively quiet area. E&C coordinated all activities necessary to select a new area, and, after extensive investigation, Area 16 was selected as the most suitable.

The E&C Officer, functioning as a program officer, supervised the following projects and, in addition, was responsible for coordinating and scheduling all activity underground:

Project	Title
851.2	Common Pipe and Support
851.4	Pipe Response
852.1	Excavation of Tunnel and Construction
852.2	Vacuum System Installation and Operation
852.4	Tunnel Construction
852.5	Field Support
854.1	Catchers and Closures
854.2	End Plate Shields
854.3	Imploder Components
854.4	Flux Screens
855.0	Reentry
856.0	Timing and Signals

Work was begun on the site in early November 1961, and the tunnel was portaled, 27 November. The work proceeded on a 3-shift, 7-day-week basis, and tunnel excavation was completed 5 March 1962 (Figures 3.5 and 3.6). The total length of drift was 3,005 feet, and a volume of 28,450 yd^3 of rock was excavated. Dressing of the drift, including alcoves, shield wall, coaxial cable, mechanical systems, etc., required an additional $2\frac{1}{2}$ months.

E&C supervised the contracting for the purchase and fabrication of the vacuum system. The system was installed by EG&G, supported by REECO labor. The installation work started 20 March 1962 and was completed 3 May. Construction effort was also expended on other major facilities such as machine shops, trailer-mounted recording centers, etc.

At shot time, the vacuum was drawn down to 0.7 micron of mercury.

Reentry was completed and sample recovery was begun 1 week after the shot. Recovery was completed 12 August, and the tunnel was turned over to the AEC for additional postshot exploration.

3.3.3 Danny Boy. This shot was fielded by LRL for DOD. One officer of E&C served on the staff of the Technical Director and coordinated all DOD construction requirements

through the LRL E&C Division. LRL supervised and inspected all field construction. The major items accomplished under this organization were: (1) instrument emplacement drilling of four 120-foot drill holes and one 60-foot drill hole, (2) postshot drilling of three 300-foot drill holes, and (3) construction of two revetted camera stations.

3.3.4 Johnie Boy. This shot was fielded by DOD, and all engineering and construction activities were under the supervision of E&C. All site selection activities were coordinated, and field activities were supervised by E&C. Major construction items provided for this event were as follows:

Project 1.1, Airblast. Constructed 12 stations along the blast line, provided anchoring system for airborne stations, installed instruments, installed recording cables, and provided a revetted recording bunker.

Project 1.2, Ground Motion. Provided five underground instrument stations from 200 to 500 feet from ground zero.

Project 1.5, Throwout Distribution. Installed 200 collectors in an array 360° around ground zero at distances from 200 to 2,000 feet.

Project 1.7, Shock Spectra. Constructed four stations and protective structures around ground zero.

Project 1.9, Crater Dimensions. Placed 15 sand columns in 120-foot drill holes at various distances from ground zero.

Project 1.12, Surface Permanent Displacement. Provided second-order pre- and postshot survey of an array of concrete monuments located 360° around ground zero at distances from 100 to 500 feet.

Project 1.13, Permanent Displacement at Depth. Drilled and cased six 100-foot-deep holes at various distances around ground zero.

Projects 2.3 and 2.4, Radiation Measurements. Installed multiple passive dose rate detectors.

Project 2.9, Fallout Sampling. Installed 16 fallout collector stations at various distances around ground zero.

Project 6.6, Electromagnetic (EM) Effects. Installed electromagnetic instrumentation and constructed a recording bunker.

To complete the scientific studies, it was necessary to provide and supervise extensive postshot field support activities over a period of 8 months.

3.3.5 Little Feller I. Because of the purpose of this shot, very little construction support was required from E&C. In general, only field support items, including surveying and road construction, were furnished.

3.3.6 Little Feller II. Engineering support for this shot followed the normal test support pattern, with E&C coordinating the site selection activities, providing all construction support, and conducting postshot activities through January 1963. Construction closely followed that of Johnie Boy and is not repeated here.

3.3.7 Small Boy. Site selection studies for this shot were initiated in the fall of 1961, and a firm ground zero site was approved by the DOD Test Director in December 1961, after coordination with the agencies conducting the primary EM experiments.

The assembly of construction criteria was begun in December 1961 and not fully completed until shortly before shot time. This situation made planning and execution of the construction particularly difficult but could not be avoided, because new projects were continuously being added, and changes to existing projects were frequent. An attempt to stabilize the situation was made by establishing cutoff dates for submission of criteria changes, but lack of enforcement broke down the system.

Small Boy had the most extensive participation of any DOD event. Fifty-three scientific projects were supported in the field. Major construction was required by the blast and shock and EM programs. Other construction, though not as extensive, was exacting. At the peak of the workload, 10 military engineers were assigned to E&C at NTS. One of the complicated problems faced was the assignment of real estate within the test array. This problem was solved generally to the satisfaction of all projects; however, the full-time effort of one officer was required to plan and coordinate the details. The planning was further complicated by the requirement of many EM projects that no wire or solid metal objects be placed in the vicinity of their data-collecting instruments. The extensive participation in Small Boy makes it impracticable to list in detail the major construction items required to support the scientific program; however, the job included deep-hole instrumentation, erection of antennas, construction of massive underground recording bunkers, road and trail construction, and many other items (Figure 3.7).

3.3.8 Vela-Uniform. Throughout the entire period of Operations Nougat and Sun Beam, E&C provided construction support for Vela-Uniform projects, regardless of shot participation. Support was given to 117 projects participating on 42 events. It ranged from drilling and instrumenting deep underground (1,200 feet, maximum) holes to providing survey support to fix the position of trailer-mounted surface stations.

The tabulation of events, DOD participating projects, and construction support costs in Table 3.1 helps to envision the magnitude of the activities engaged in by E&C during 1962.

3.4 PROBLEM AREAS

The paramount problem encountered during these operations was the compressed time frame in which events were planned, fielded, and fired. The short time frame frequently required E&C to begin construction before the scientific projects had completely finalized their requirements. This procedure complicated the coordination problem, required frequent field changes, and increased costs.

A second major problem was created by the sudden transition from a relatively orderly procedure to a sudden crash effort. This crash effort introduced many inexperienced people into the overall program and resulted in much inefficiency, accompanied by increased costs. Many of the new people, including those of the support contractor, attempted to take shortcuts or change the existing system, thus introducing confusion, conflicts and, at times, ruffled tempers. The support contractor had a particularly difficult time when required to expand forces by a factor of approximately 4 to satisfy the support requirements. Many of the new employees were exploiters. This resulted in poor workmanship, errors, and omissions, which increased the workload on the E&C

personnel. The Architect-Engineer organization also faced the rapid expansion problem and was handicapped by inexperienced personnel. Problems of the Architect-Engineer had a severe effect on all following steps in the construction process.

Other problems that affected the progress of construction included temperatures ranging from subfreezing to above 100° F, strong dust-laden winds that frequently caused shutdown of field work, and the relatively wide scattering of sites on which events were scheduled.

TABLE 3.1 SUMMARY OF CONSTRUCTION ACTIVITIES

Shot	DOD Projects	Construction Cost
Hard Hat	25	$ 1,111,000
Marshmallow	26	3,208,000
Danny Boy	14	682,000
Small Boy	53	4,040,000
Little Feller I and II	24	395,000
Johnie Boy	17	674,000
Vela-Uniform (42 events)	117	806,000
TOTALS 49	276	$10,916,000

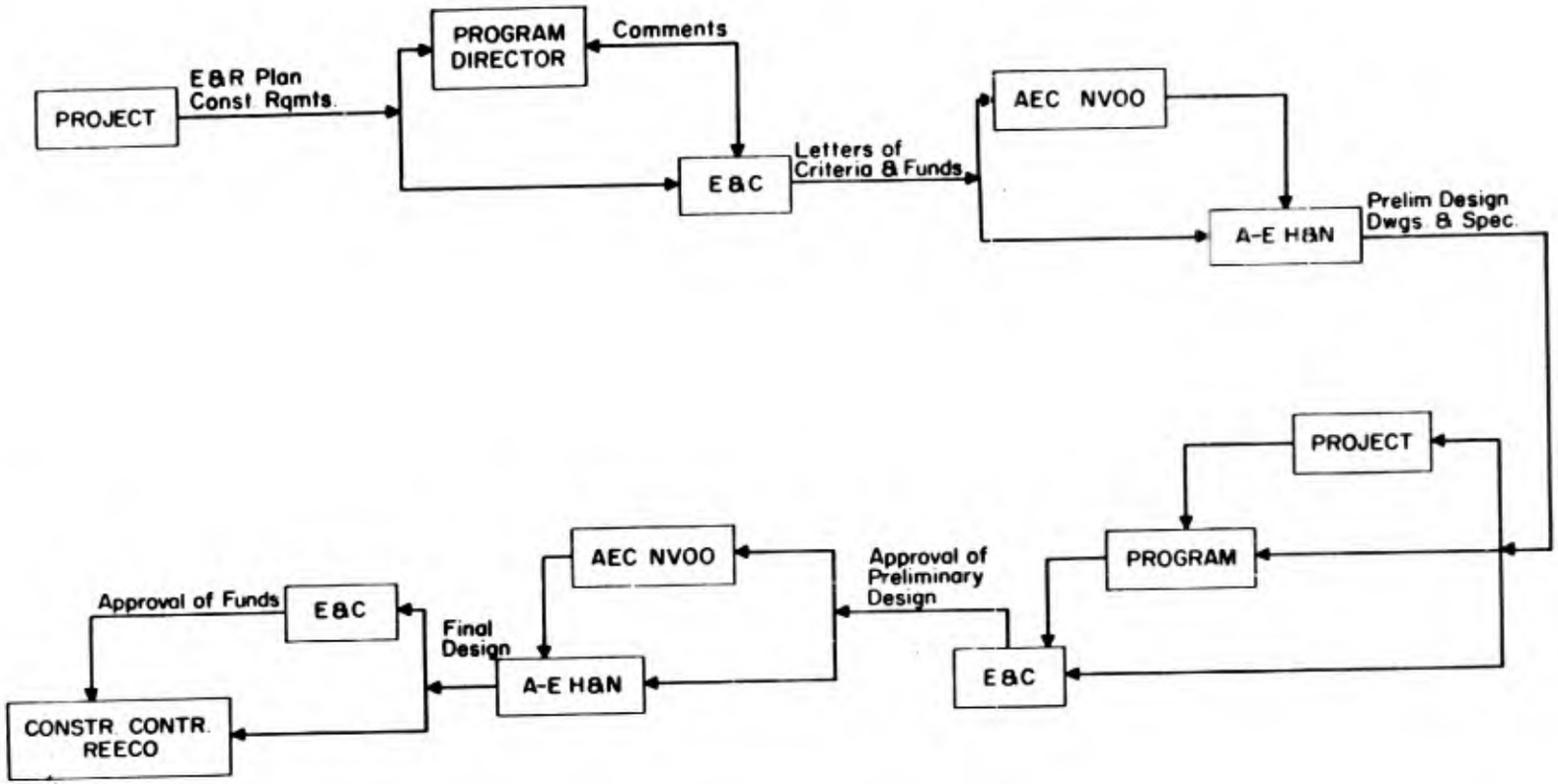

Figure 3.1 Construction flow chart.

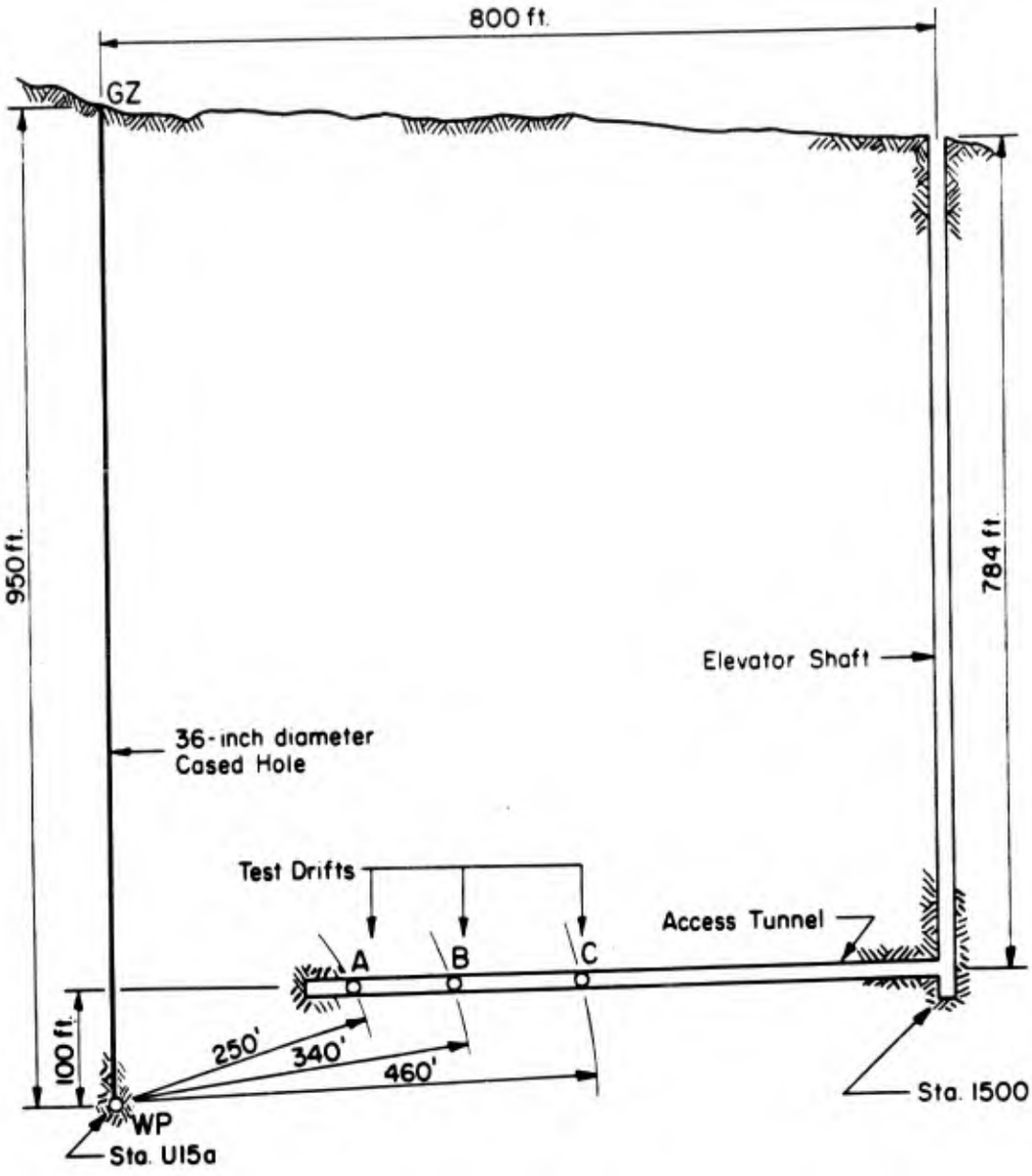

Figure 3.2 Cross section view of Hard Hat tunnel.

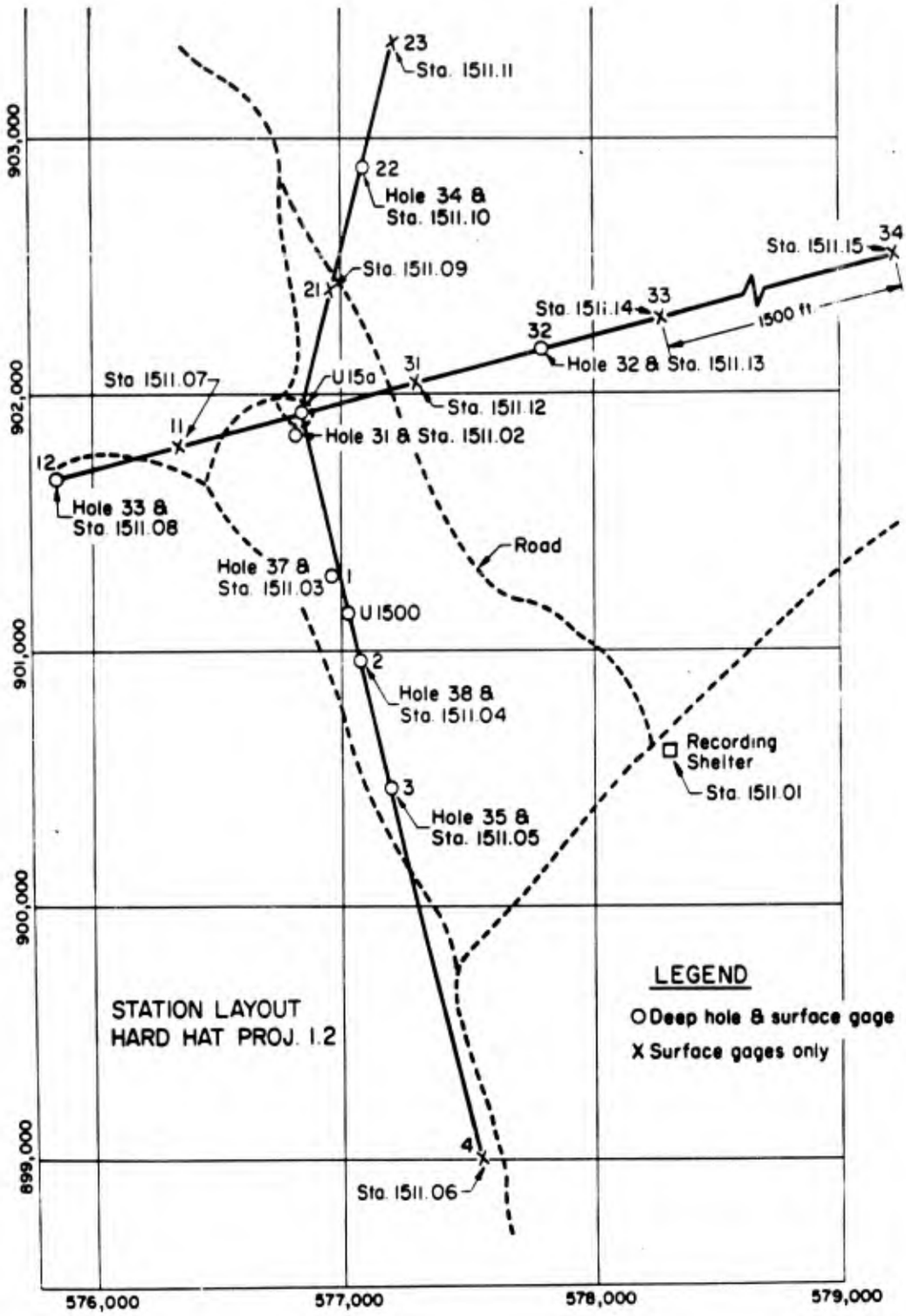

Figure 3.3 Surface instrumentation, Shot Hard Hat.

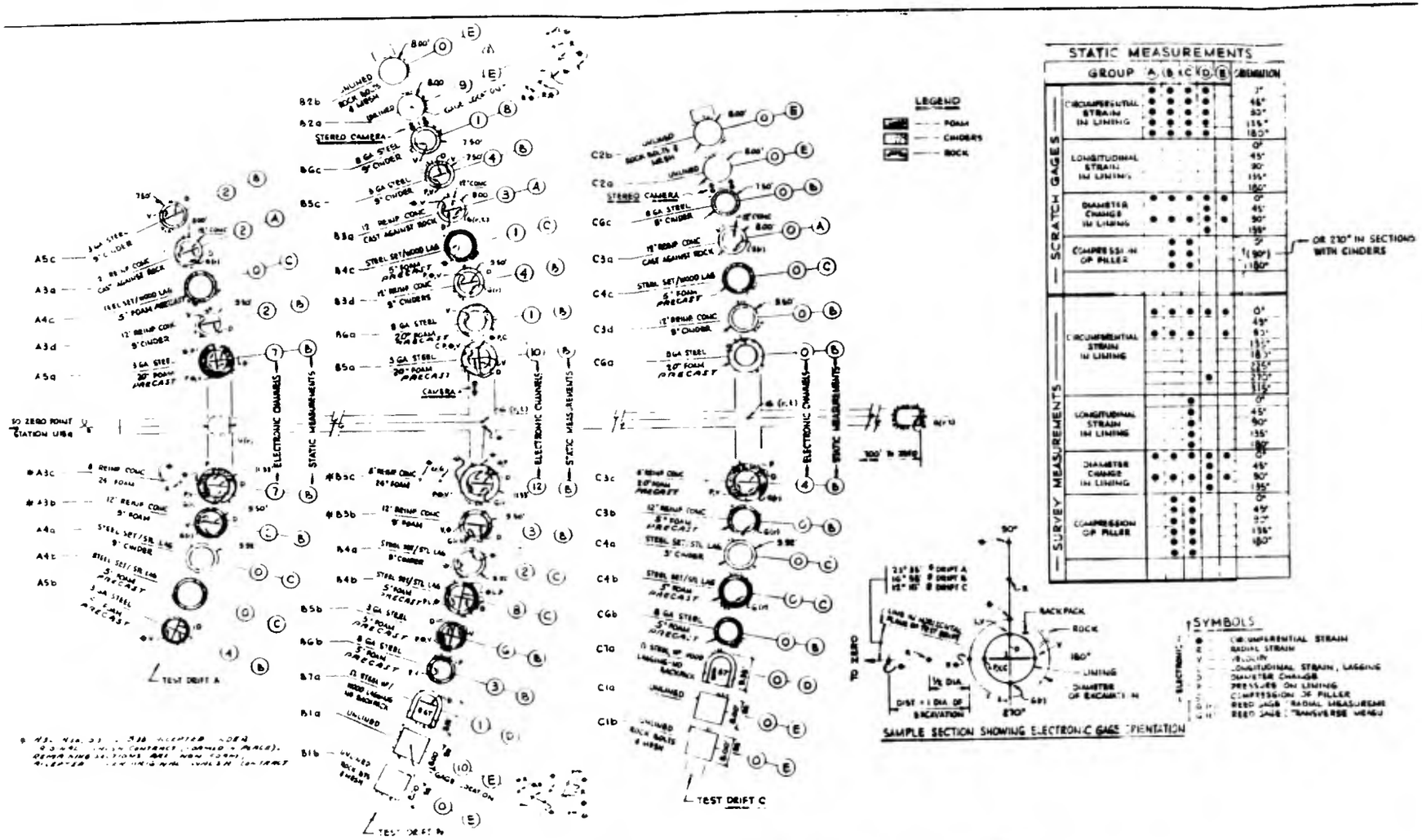

Figure 3.4 Instrumentation plan, structural response program, Shot Hard Hat.

Figure 3.5 Area 16 portal area, 1 November 1961, prior to beginning of tunnel and general construction, Shot Marshmallow. (DASA NOU-028-07)

Figure 3.6 Area 16 portal area, 7 May 1962, Shot Marshmallow. The tunnel portal is at upper left. (DASA 330-01-NTS-62)

Figure 3.7 Ground zero, Shot Small Boy. (Sandia Corporation photo)

Chapter 4

OPERATIONS

4.1 FUNCTIONS

The functions of the Operations Division were as follows:

(1) Prepared the operations plan in coordination with the program directors to include the conditions under which a shot would be cancelled or held.

(2) Prepared the Rad-Safe and reentry plans.

(3) Prepared the plan for personnel control during button-up.

(4) Prepared the air operations plan.

(5) Prepared the air support plan and arranged for the required air support.

(6) Coordinated with AEC for use of the bombing range areas outside the test site.

(7) Planned and arranged for communications facilities required for the test.

(8) Obtained authorization for use of radiofrequencies.

(9) Planned and arranged for timing signals required by the projects.

(10) Obtained and provided required meteorological support.

(11) Planned and coordinated troop participation.

(12) Controlled personnel movements in the test area during button-up.

(13) Controlled reentry and recovery in coordination with program directors.

(14) Arranged for training and certification of Rad-Safe monitors.

(15) Notified off-site agencies and projects of shot time and shot delays.

4.2 BACKGROUND

The Operations Division, CTO, was active at NTS for all events of Operations Nougat and Sun Beam. The branch was increased from 2 officers and 2 enlisted men in January 1962 to 12 officers and 6 enlisted men, during Sun Beam, and was organized as a division under the Test Group Director.

For Operations Nougat and Sun Beam, the activities of the Operations Division included preparation of technical/operational plans, reentry plans, shot delay plans, and air operations plans; preparation and distribution of shot schedules; reviewing and submitting event cards for DOD scientific test projects; operation of a forward control point (FCP) on shot and subsequent days to control reentry into the test areas; scheduling Rad-Safe monitor training for test project personnel; and maintaining radiation exposure records. The division also consolidated communications requirements, requested the purchase of additional equipment to support the test projects, consolidated timing and firing requirements, and coordinated the scheduling of a series of dry runs to assure receipt of the signals by the projects. An important activity for Small Boy was the coordination of project use of the Las Vegas Bombing and Gunnery Range for instrument emplacement and recovery.

During the planning phase of Small Boy, the division coordinated the positioning of aircraft and balloons in the airborne test array.

All the Sun Beam events were dependent upon the weather, i.e., upon the direction and speed of the winds. For Johnie Boy and Little Feller I and II, one consideration was that

the fallout from one event should not overlap fallout from another, thus obscuring or disturbing data. Another consideration for Johnie Boy was the amount of fallout that would be deposited off-site. The off-site fallout question compounded the problem on Small Boy in that the emplacement of the fallout collection array was based upon the wind direction stated early in the program, as required to prevent excessive fallout in certain off-site areas.

The Sun Beam events produced some unusual problems in timing and firing. Careful routing of timing cables was required on Small Boy because of the electromagnetic pulse (EMP) experiments. On Little Feller I, because the firing was to be done by troops in the Ivy Flats exercise, the normal electronic firing signal could not be used. For this event, electronic signals were furnished for experimental instrumentation, and voice countdown was furnished to the firing crew for launch. These problems are discussed in more detail in Section 4.4.7.

4.3 AIR OPERATIONS

The air operations responsibilities of the Test Director for Sun Beam were handled by the Operations Division, CTO.

Acting for the Test Director on all matters concerning air support for test programs, Air Operations was responsible for the following:

(1) Acting as coordinating agency for the Test Director and his subordinate units with the AEC and the Air Force Special Weapons Center (AFSWC) on matters pertaining to: consolidation and submission of requirements, allocation of support capability available, and coordination of all test and support air participation activities within the NTS with the Test Director and staff to insure maximum support for the test program. Early in the planning phase for Small Boy, the Operations Division coordinated the positioning of aircraft and balloons in the test array.

(2) Advising the Test Director on feasibility and capabilities of satisfying air requirements.

(3) Maintaining a current list of all aircraft requirements and providing up-to-date information, by event, to AFSWC.

To insure adequate air support, all units subordinate to the Test Director submitted air requirements direct to Operations Division. These were consolidated with scientific laboratory requirements and submitted to AFSWC, the organization responsible for providing necessary aircraft and support for all NTS activities. Generally, these requirements included Rad-Safe surveys, aerial probe surveys, sample return, recovery, photography, air sampling, and special missions generated as the test series progressed.

During Sun Beam, several problem areas were encountered by Air Operations, one of which pertained to the aircraft required in support of the NTS program. In June 1962, it became necessary to request assistance from CHDASA to obtain helicopters for support of Sun Beam from other than normal Air Force sources. Requests for these aircraft through AFSWC had resulted in a letter from AFSWC that stated aircraft with necessary capability were not available from Air Force sources.

Requirements for support and mission aircraft at NTS had been initiated in April 1961, and base support for these aircraft had been planned in October 1961. However, as the size of the NTS program grew, the requirements for aircraft also increased until, in January 1962, Nellis AFB informed AFSWC it could no longer furnish adequate support for the NTS aircraft to be stationed at Indian Springs AFB (ISAFB). In June 1962, CTO informed CHDASA of the impact that limited operations at ISAFB would have on the over-

all test program at NTS and requested that action be taken with Headquarters USAF to provide the support required. CHDASA made the request for assistance to Headquarters USAF, and as a result, Headquarters TAC (Tactical Air Command) was directed to provide the support required at ISAFB. After this key decision was made, support at ISAFB was satisfactorily provided to meet the tight firing schedule.

Control of helicopters in the forward area (Area 18) was accomplished with a single UHF and VHF radio equipment at the FCP. This arrangement was not entirely satisfactory, because no backup radio was available, and no visual observation of the aircraft was possible.

An airlift or shuttle service to transport personnel and cargo between ISAFB and Kirtland AFB was established for the test series. The schedule for the airlift was frequently deviated from, and on many occasions the aircraft was inadequate from the standpoint of available space.

4.4 EVENT ACTIVITIES

The Operations Division activities were governed by the individual events. The types of experiments, time schedules, burst location, and environmental factors varied so much from event to event that each one had to be handled as a separate problem. In this section the events are reported in chronological order rather than by types of operational problems.

4.4.1 Hard Hat.

Planning. Planning for Hard Hat took place during the moratorium on nuclear testing. Construction of the shaft and tunnel was also carried out during the moratorium, with the tunnel and test drift complex all but completed at the time the test ban was lifted (Figure 3.2). After lifting of the test ban, the room at the forward face of the tunnel and the numerous test sections were completed and instrumentation installed.

Rad-Safe. Because it was impossible to foretell the degree that radiation might leak to the surface, several remote-reading radiation monitors were employed around surface zero and the shaft collar. Others, as well as tunnel condition indicators, were placed in the tunnel. To contain the shot and reduce radiation in the shaft and adjacent work area, two sand plugs and a gas seal door were emplaced in the tunnel. Air-sampling pipes were installed through the plugs and the gas seal door to be used during reentry, to determine conditions just forward of the plugs and door.

The initial radiation situation, gathered from remote monitors and ground survey teams, indicated all stations reading background. Containment was complete until H+11 hours, when the cavity formed by the explosion collapsed, developing a chimney for about 200 feet above shot point. Thereafter, radiation levels reached peaks of 500 mr/hr at surface zero and about the same at the bottom of the elevator shaft, while readings inside the gas seal door of the tunnel reached greater than 10 r/hr at one point. These levels decayed rapidly, so that within 2 days the outside readings had returned to background, and in 1 week the tunnel inside the gas seal door was down to approximately background level. At no time did radiation effects become a hazard or a problem in reentry.

Personnel Control, Button-Up, and Reentry. The requirement to lower and test the device and to stem the shot hole, as well as the time-consuming process of filling the sand plugs in the tunnel, caused access to the tunnel to be limited as early as D−6 days. Stem-

ming in the tunnel was completed on D−4 days, with removal of the shaft head-frame equipment beginning the same day. The cap plug was placed on the shaft, and stemming of the U15a hole was completed on D−1 day.

On D-day, roadblocks were established on main access routes into the area as shown on Figure 4.1. After shot time, control of the area was exercised from the FCP. The observer area, reentry party staging area, and FCP were approximately 4 miles from ground zero as shown on Figure 4.1.

At H+2½ hours, the control of the shot area moved to approximately 1 mile southwest of ground zero, where the initial recovery parties were controlled for reentry. Initial surface reentry for radiation survey commenced at H+2 hours. The delay was due to a misfire of the H+5 minute microbarograph calibration shot. After the initial radiation survey and the early recovery, control of entry into the area was moved to a point 200 feet southeast of the shaft collar area.

A plan for reentry on the surface around U15a and for the tunnel itself was issued on 21 December 1961. Several projects required early reentry on the surface to recover data. Since no radiation was evidenced initially, the reentry parties on D-day were allowed to proceed with only control of authorized personnel necessary. On D+1 and D+2 days, parties were allowed into area for stay times commensurate with the radiation situation.

At 1334 hours on D+8 days, initial tunnel reentry commenced with reentry into the shaft. Shaft reentry and repair was completed on D+22 days. Tunnel reentry and recovery commenced on D+23 days and was completed on D+113 days. LRL personnel directed the shaft and tunnel reentry until the tunnel was cleared for normal operations. Coordination of shaft and tunnel reentry and recovery with LRL and CTO Program 3 personnel was also handled by CTO operations personnel.

Air Operations. Air operations on this event presented no problem, consisting only of pre- and postshot aerial photo missions, D-day security sweeps, cloud tracking, and air-sampling missions.

Communications and Timing and Firing. Project communications were provided on the normal DOD net. No special equipment or frequencies were required. The device was fired and other timing signals supplied from the Control Room at CP-1. No unusual signals were required.

Meteorological Support. Satisfactory weather for firing this event was defined as a 2-hour period when the winds were southerly (120° to 230°) to an altitude of 6,000 feet MSL. This was estimated by the U. S. Weather Bureau (USWB) to give a 30 to 35 percent probability of having the necessary winds. A wind from due south was considered ideal.

Hard Hat was scheduled for 1000 hours, 15 February 1962, and was fired at that time without encountering delays. The winds at detonation time were southerly, within the required sector, and no problems concerning weather conditions were encountered.

Off-Site Coordination. Prior arrangements were made with the U. S. Public Health Service (USPHS) to track the cloud off-site, in the event the shot vented. No off-site activity occurred.

4.4.2 Danny Boy.

Planning. Danny Boy was a cratering project conceived and fielded within a very short time. This event was fielded by LRL with program assistance by DOD. CHDASA authorized Danny Boy 10 January 1962. The event was to consist of a cratering shot on

a basalt mesa at NTS, 1 March. This basalt formation is a recent lava flow caprock, forming a mesa 20 miles long by 8 miles wide. The selected device was to have a yield of 470 ± 40 tons and was to be detonated at a depth of 120 feet. The depth of burst was changed to 110 feet on the basis of late information obtained from Hard Hat. (Radiochemistry results show the actual yield was 430 ± 40 tons.) The depth of the shot was selected to provide a maximum crater size with a minimum escape of radioactivity.

On 1 March 1962, the project was completely ready to fire. Authority to shoot, however, did not arrive until a few days later. Danny Boy was fired successfully 5 March.

Rad-Safe. The cloud height was about 3,000 feet with a radius of approximately 1,500 feet. A unique method was used to measure dose rate on the ground, utilizing helicopters equipped with a radar-altimeter corrected scintillation detector. Daily ground surveys were conducted through D+10 days to determine decontamination parameters. For example, on D+5 days the 1.0-r/hr contour had shrunk to within 300 feet of the crater lip. Off-site radiation was measured by aerial radiation survey at approximately 2-mile intervals out to 24 miles from ground zero during the period H+5 to H+7 hours.

Personnel Control, Button-Up, and Reentry. Since this event was fielded by LRL for DOD, control, button-up, and reentry were accomplished by LRL.

Air Operations. Low- and high-altitude cloud tracker (U3A and WB-50), security sweep (L-20), cloud sampler (B-57), and DOD photo (H-21) aircraft participated. In addition, the Nuclear Defense Laboratory (NDL) (Project 2.8) operated HUS helicopters in performing aerial radiation and crater probe missions. A helicopter pad was constructed near the FCP for this operation. Although this experiment was conducted in the same area as Little Feller I and II and Johnie Boy, the FCP was not colocated.

Communications and Timing and Firing. No telephone service was provided for Area 18 operations. All communications in the forward area relied on use of existing VHF radio networks. Timing and firing was done from a scooter trailer positioned adjacent to the FCP.

Meteorological Support. Weather support was provided in Area 18 by USWB. Desired shot-time winds were from the south at 4 to 22 knots. Actual winds were within these tolerances.

Rad-Safe Monitor Training. Because this was the first DOD event (since the testing moratorium ended) involving extensive planned radiation monitoring by projects, a concentrated monitor training program was required. Arrangements were made for this training to be accomplished by REECO.

Off-Site Coordination. No off-site participation was included; however, off-site radiation monitoring was conducted as a routine matter by the USPHS.

4.4.3 Marshmallow.

Planning. Planning for Marshmallow had begun prior to the moratorium on nuclear testing in 1958. The program was mothballed at an 18-month state of readiness during the moratorium but was fielded on a crash basis within 9 months after the moratorium was lifted.

Marshmallow was conducted in Tunnel U16a at NTS (Figure 4.2). The working point (WP) was designed to be at coordinates N 822,611.67, E 635,951.27, and at an elevation of 6,242.43 feet above sea level.

Because of a delay in the Des Moines event, in which some Marshmallow scientific instruments were being tested, the schedule date was changed to provide necessary time to complete testing of equipment. Marshmallow was detonated at 1000 hours, 28 June 1962, without delays.

The FCDASA Technical Operations Plan for this event was issued 2 March 1962. Subsequent to its publication, a detailed reentry plan was developed in conjunction with the Sandia Corporation and published approximately 30 days prior to shot day.

Rad-Safe. See next paragraph.

Personnel Control, Button-Up, and Reentry. The control of the shot area initially was as shown in Figure 4.3. The firing point and FCP were located approximately 2 miles east of the U16a portal area. The observer area and reentry and recovery staging areas were approximately 4 miles northeast of the portal area. This location was directed by the Test Manager as a precaution against a repeat of the type of venting experienced during Des Moines. Radiation and reentry procedures were contained in the above-mentioned reentry plan. Surface reentry radiation surveys were controlled by the Operations Division from the FCP. Surface recovery, tunnel reentry, and recovery were controlled by the Sandia Corporation with necessary DOD support and coordination for its responsible functions. On D+1 day, control of further reentry and recovery moved to the U16a portal area.

Surface radiation surveys began at H+10 minutes, using a helicopter-borne monitoring system and at H+45 minutes by four ground teams of two monitors each. At approximately H+2 hours, when the radiation situation was known, the initial surface recovery parties (for recovery of the 10 instrumentation trailers located above the portal area) were allowed to reenter. No problems were encountered throughout reentry and recovery operations.

On D+1 day, initial tunnel reentry began. Initial reentry and recovery ended on D+4 days but recovery of less critical data continued.

Surface reentry and recovery plans were necessarily flexible because of the nature of the shot, terrain, and susceptibility of the recording instrumentation to radiation. Generally, there were two alternate plans to be used, depending upon the radiation situation and the condition of the road nets. The primary means of recovery was by access road. The alternate system involved use of helicopters and a landing pad constructed on top of the 10 instrumentation trailers.

The initial radiation situation confirmed that the shot had been contained. The vent hole provided for release of radioactive gas and is believed to have been the source of most of the radiation in the entire area. This radiation dissipated rather rapidly and provided no problem for surface reentry or recovery. The tunnel radiation was more intense and did cause a delay in reentry.

Air Operations. Normal cloud tracker (U3A), security sweep (L-20), and photo (H-21) aircraft participated. In addition, three HUS helicopters were deployed to the FCP to be used as part of an alternate recovery plan to recover critical data from the instrumentation trailers above the portal. This plan would have involved shuttle operations to and from the instrumentation trailers, utilizing a helo pad constructed atop the trailer complex. All helicopter operations were controlled from the operations trailer at the FCP. The primary plan was used satisfactorily, and these three HUS aircraft were not required.

Communications and Timing and Firing. No special frequencies were required for this event. Normal telephone and radio facilities were provided to the Program Manager

and his staff. Firing of the device was accomplished from the EG&G scooter trailer located at the FCP. The communications support was inadequate, as a result of late staffing for the communications function and pressing conflict with Small Boy and Area 18 events.

Meteorological Support. Weather support was provided by USWB. The satisfactory weather for firing was defined as northerly or southerly winds. Because of the seasonal variations of the winds, it was felt that a wind from the south would be more likely. The winds at detonation time were southerly, within the required sector, and no problems concerning weather conditions were encountered.

Rad-Safe Monitor Training. Arrangements were made with REECO well in advance of the shot day to establish a training course for project Rad-Safe monitors. REECO then certified these personnel to the AEC as qualified Rad-Safe monitors. In addition, arrangements were made with REECO to establish a mine safety course for Marshmallow reentry parties, to include use of the McKay self-contained breathing system.

Off-Site Coordination. Necessary precautions for possible off-site contamination in event of venting were made to include provision of cloud-tracking aircraft, etc. No off-site activity resulted.

4.4.4 Little Feller II.

Planning. Little Feller II was one of three events added to the Sun Beam series rather late in the operational phase.

It was originally scheduled for 9 July 1962. However, due to the limited amount of time available to complete the series of shots, the target date was moved forward to 7 July. Little Feller II was detonated as scheduled at 1000 hours on 7 July. There were no delays in the time or date of firing.

Rad-Safe. Early radiological survey data was obtained from 11 remote monitors placed 50 to 2,400 feet from ground zero. The 50-foot station was lost at detonation time, leaving a 200-foot station as the closest station. All other stations functioned properly until H+20 minutes, at which time all stations were lost when the main cable was cut by a reentry party. Early and late survey information was provided by REECO and Project 2.8. No unusual radiological problems were encountered. The recovery of Project 6.6, however, involved close supervision because of the requirement that equipment used on Little Feller II be reused on Johnie Boy. H+1 hour and D+1 day surveys are included as Figures 4.4 through 4.6.

Personnel Control, Button-Up, and Reentry. Reentry began at approximately H+15 minutes and continued during daylight hours through D+18 days. Reentry to close-in stations was delayed by the scheduling of Johnie Boy and Little Feller I and by the Ivy Flats exercise rehearsals. The reentry parties were small and, in most cases, consisted of from two to four men. Reentry parties were larger only in cases where laborers were required to provide access to instruments located in bunkers.

Reentry was controlled by the Operations Division personnel (Figure 4.7). Reentry to the closed area was limited to personnel with an approved scheduled reentry card. Prior to each reentry, the point to which each party would proceed was checked against the Rad-Safe map to insure that no party would be cleared into an area with a dose rate greater than 10 r/hr. Each party was required to have a qualified monitor with them during the reentry. The control point was moved from the FCP to a point 1 mile closer

to ground zero, at approximately H+16 hours, to allow closer control of the area and to allow construction to begin again in the adjacent areas. Reentry was interrupted on 10 July for Johnie Boy and remained intermittent until Little Feller I occurred on 17 July.

Air Operations. Air participation consisted of normal cloud tracking (U3A), cloud sampling (B-57), security sweep (L-20), and photo (H-21) aircraft. In addition, three HUS helicopters were operated by NDL (Project 2.8) from a specially constructed helo pad in Area 18, adjacent to the FCP.

Control of helicopters in the forward area (Area 18) was accomplished with a single UHF and VHF radio equipment at the FCP. This arrangement was not entirely satisfactory, because no backup radio was available, and no visual observation of the aircraft was possible.

Postshot helicopter operations were hampered by a large balloon tethered west of ground zero, which was designed to deflate at or about zero time but failed to do so. The balloon had to be pulled down manually, and this caused some delay for early crater probe mission and early aerial Rad-Safe surveys.

Coordination with AEC for Use of Las Vegas Bombing and Gunnery Range. This was accomplished with the AEC operations coordinator, because the range north of Area 18 was involved.

Communications and Timing and Firing. No telephone service was provided for Area 18 operations. All communications in the forward area relied on use of existing VHF radio networks. Firing of the device and provision of necessary timing signals were accomplished by EG&G, using the scooter trailer positioned at the FCP. Timing signals were provided as outlined in Table 4.1 and as shown on Figure 4.8.

Meteorological Support. Weather support was provided in Area 18 by USWB. Desired shot-time wind direction and speed was 170° ± 40° at 4 to 22 knots. Actual wind was from 165° at 9 knots.

Rad-Safe Monitor Training. Arrangements were made with REECO to establish a training course for a small number of Rad-Safe monitors. Almost all programs participating also participated on Small Boy and Johnie Boy and used the same monitors for all events.

Off-Site Coordination. No off-site participation was included; however, off-site radiation monitoring was conducted as a routine matter by USPHS.

4.4.5 Johnie Boy.

Planning. This event was added late in the operational phase of Sun Beam. Prime operational responsibility was assigned to LRL with some support in communications and air operations from DOD.

Johnie Boy was originally scheduled for 12 July 1962 but was moved up to 10 July to facilitate early completion of the test series. The event was delayed 1 day because of unfavorable wind conditions, rescheduled at 0830 11 July, and delayed at that time until 0930 hours because of unauthorized personnel in the control area.

Rad-Safe. CTO placed seven remote monitors at distances of 1,900 to 5,200 feet from ground zero. Two stations failed to operate properly; all others functioned throughout the operation. LRL included eight time-recording remote stations at distances from 600 to 25,000 feet from ground zero. LRL controlled reentry, and CTO Rad-Safe opera-

tions were confined to providing current Rad-Safe information for reference. Such information was obtained from remotes, REECO ground surveys, and Project 2.8. Surveys at H+1 hour and D+1 day are included as Figures 4.9 and 4.10.

Personnel Control, Button-Up, and Reentry. Reentry began at approximately H+10 minutes and was interrupted by the Ivy Flats exercise rehearsals and Little Feller I. It was controlled by LRL personnel from the FCP during the initial reentry. The FCP was moved to within 2 miles of ground zero by the end of the first day (Figure 4.7). This allowed work to continue in the Little Feller I and Little Feller II sites on the days following.

The Operations Division activities after H-hour were limited to coordination of reentry with LRL personnel.

Air Operations. High- and low-altitude cloud tracking (U3A and B-50), security sweep (L-20), cloud sampler (B-57), and DOD photo (H-21) aircraft participated. In addition, NDL (Project 2.8) operated HUS helicopters in performing aerial radiation surveys and crater probe missions. Operations were similar to those for Little Feller II.

Coordination with AEC for Use of Las Vegas Bombing and Gunnery Range. This was accomplished with the AEC operations coordinator, because the range north of Area 18 was involved.

Communications and Timing and Firing. Timing and firing was the responsibility of LRL. All timing signals were received. Table 4.2 is a listing of all timing and firing signals programed for this event.

Meteorological Support. Weather support was provided in Area 18 by USWB. Desired shot-time wind direction and speed was 110° to 200° at 4 to 22 knots. Actual winds were from 185° at 12 knots.

Rad-Safe Monitor Training. Arrangements were made with REECO to establish a training course for project Rad-Safe monitors.

Off-Site Coordination. No off-site participation was included; however, off-site radiation monitoring was conducted as a routine matter by USPHS.

4.4.6 Small Boy.

Planning. Initial planning for Small Boy was conducted by HqDASA. A project officers meeting was held at FCDASA, 10 January 1962, and the revised program book was issued by HqDASA, 22 January. Detailed planning for execution of the event continued at FCDASA and NTS through late June. This planning included provisions for the many projects added to the program after publication of the program book.

Rad-Safe. Radiological safety at shot time and during recovery operations was the responsibility of CTO. The exposure limits under which CTO operated were established by the AEC as 3 rem per quarter with the following exemptions: Projects 2.3/2.4, a total of 5 rem for all events; Project 2.9, 6 rem; Project 2.11, 6 rem; and Project 7.15, 20 rem.

The radiation exposure of each individual under CTO control was recorded and forwarded to the command holding the individual's health record. No conclusive overexposures were received during the operation.

Much of the success for Rad-Safe operations can be attributed to the close coordination of the various organizations involved. Primary support was provided by REECO

Rad-Safe and Project 2.8 (NDL). This support included the following:

REECO Rad-Safe. REECO Rad-Safe personnel and equipment provided radiological surveys; reentry party monitoring services; anticontamination equipment, portable instruments, and dosimetric devices; area control check stations; personnel, equipment, and vehicle decontamination; hot recovery sample handling facilities; readout and recording of dosimetric devices; project monitor training; emergency support as directed; toxicological services as required; and similar Rad-Safe functions as requested.

Project 2.8 (NDL). This project made detailed radiological surveys of the fallout pattern from Little Feller I, II, Johnie Boy, and Small Boy. The information was obtained at very early times and for a period of several days following each event. Through the cooperation of the project personnel involved, such information was made available immediately to CTO Rad-Safe.

Radiation exposure of test personnel was kept within prescribed limits by preentry indoctrination and close control of all recovery personnel. The basic premise for reentry was that the safety of each party was the direct responsibility of a designated party leader, each party would include a CTO-certified monitor or a REECO monitor, no party would proceed beyond the 10-r/hr line, and the party leader should terminate recovery operations well prior to reaching the designated maximum exposures.

It was possible that the B-52 aircrews would be exposed to an overdose of radiation—the NTS allowable being 3 rem per quarter. It was necessary that these crews, plus the reentry personnel of Projects 2.3, 2.4, 2.9, and 2.11 who were to occupy manned shelters at the time of Small Boy, be given waivers to receive a higher radiation dose. The Operations Division Rad-Safe Officer processed the waiver requests and coordinated them with AEC Rad-Safety personnel for approval. The Rad-Safe Officer also participated in discussions between the Test Manager's Scientific Advisor, AEC Rad-Safe, and personnel of Small Boy Project 2.9 as to the protection afforded personnel in the manned shelters proposed by Project 2.9. These shelters, the closest of which was 4,500 feet downwind from ground zero, were approved for occupancy only after the adequacy of their radiation attenuation, ventilation, communications, and escape routes was determined.

Personnel Control, Button-Up, and Reentry. Control on the area was begun at 0600 hours, D−1 day. At this time, roadblocks were established as shown on Figure 4.11. Entry into the area after that time was based on approved access lists published in the Test Manager's schedule of events, which were made up from approved project event cards. This control was to be maintained through shot time. Control was established and removed several times because of weather delays.

Button-up was required to be delayed as late as possible, because much project instrumentation was being powered by storage batteries and consisted of instruments requiring careful recalibration if shut down by lack of power. Button-up was to begin at H−10 hours, the various projects being scheduled to depart the area so that those dependent on battery power or those securing heavy concrete cages or bunkers would be the last ones out. Considerable practice in button-up procedures resulted because of shot delays due to adverse weather.

The primary means used to achieve the necessary indoctrination and control for reentry were as follows:

A reentry plan was issued 7 June 1962. This included a summary of preparations to be made preshot, reentry ground rules, reentry procedures, and Rad-Safety criteria, i.e., dose rate limits, etc.

A list of CTO-certified monitors was published for each event controlled by CTO. Basis for certification was the successful completion of the REECO Monitor Training Course or extensive prior Rad-Safe experience. REECO monitors were not required to be certified by CTO, since they are certified by the NTSO.

A recovery party meeting was held prior to each event, at which time safety procedures were reviewed, possible problem areas resolved, and questions answered.

A CTO Operations Officer checked and briefed individually each early reentry party at the FCP just prior to reentry.

The FCP controlled the reentry of each party. The decision in each case (as it pertained to Rad-Safe) was based upon current Rad-Safe information available in the FCP. This information was obtained from three major sources: (1) remote-reading radiation monitors, (2) rapid preliminary ground survey by REECO (later detailed and special surveys were performed as requested), and (3) detailed information made available by Project 2.8.

Early radiological data was obtained from 10 remote monitors placed from 1,000 to 12,000 feet from ground zero. At H+19 minutes, radio remote monitors were read from a trailer stationed at Well 5. These remotes were located from 600 to 26,000 feet from ground zero. Early and late survey information was provided by REECO and Project 2.8. The AEC instrumentation sector decay rate was slower and delayed recovery for a few days in this area. H+1 hour, D+1 day and D+11 day surveys are included as Figures 4.12 through 4.14.

Reentry began at approximately H+25 minutes on the ground; aerial reentry began at H+30 minutes. The fallout pattern over the manned shelters was such that personnel were permitted to leave most of the shelters by midafternoon, and the last shelter was evacuated at 1930 hours on D-day. Recovery from close-in stations was delayed until D+10 days because of radiation levels. Reentry party size was two to four men in most cases, with larger teams going to those stations and bunkers which had to be reopened to permit data recovery.

Reentry was controlled by Operations Division personnel from the FCP at Point A (Figure 4.11) until 1200 hours on D+1 day, when the FCP moved to Point B. Reentry teams reported to the FCP for permits to enter the controlled area. Prior to issuance of permits, the point to which each team wished to go was checked on the Rad-Safe map to insure that no party would be granted access into an area where the dose rate exceeded 10 r/hr. Each reentry party was required to have at least one qualified monitor.

All roads into the area, except one, were blocked off to insure that personnel entering the area had obtained permission from Operations and were processed by the Rad-Safe control and decontamination stations. This control of the area was maintained even after radiation levels were greatly decreased, in order to preclude sightseers and to protect instrumentation equipment not removed from the area. The area was returned to AEC control at 1800 hours, 27 July 1962.

Air Operations. During the planning phase of Small Boy, coordination of the position of aircraft and balloons in the airborne test array was necessary.

The airborne test array included: one F-100F, two B-52's, two B-57's, one A3D, and one R4Y, plus one weather balloon. Planned shot-time positions of these test vehicles is shown in Figure 4.15.

The F-100F, simulating delivery of a GAM-83, was positioned by an AN/MSQ-1 radar and a fighter director. This flight was practiced until the aircraft was positioned with great accuracy as shown in Figure 4.16.

The B-52's of Project 7.15 were required to be positioned in an airspace such that GAM-77 missiles aboard the aircraft would be subjected to 10^6-rad/sec peak radiation (Figure 4.17), and crews limited to less than 20-rem whole-body exposure. When the device to be employed was changed to the in order to get higher peak pulse, the flight altitude of the B-52's had to be increased 1,800 feet. This brought the B-52 airspace closer to that proposed for the Project 6.8 balloons measuring the electrostatic field. To obtain assurance that the balloons would not interfere with the B-52's, several practice launches of the balloons, designed to be held at a constant altitude by barometrically operated vents, were required. After several such launches, it was determined that the balloons would be sufficiently regulated to preclude interference with the flight path of the aircraft.

The planned positions of other aircraft in the test array were not such as to cause concern. However, the safety of all the aircraft required a close look at six rockets to be fired by Project 2.12 at H+1 minute (Figure 4.18). Project 2.12 was required to present data-verifying planned rocket performance. Further, timing signals were supplied to Project 2.12 such that the rocket-firing circuit could not be closed until H+15 seconds. This delay, plus the rocket time of flight, assured that the aircraft would be clear of the rocket flight path.

Further coordination and scheduling were required for helicopters participating in reentry operations—photographing the area, depositing radiation probes in the crater, making radiation surveys, transporting radiation monitoring personnel to areas inaccessible to vehicles, and serving as aerial rescue units.

Coordination with AEC for Use of Las Vegas Bombing and Gunnery Range. The AEC was requested to obtain permission for use of portions of the range to the east of NTS, because the planned fallout path would be in that direction and several radiation projects desired to place instrumentation in that area. Portions of Indian Springs Valley as well as areas adjacent to NTS were made available. Continuous coordination was required between CTO, AEC, and Nellis AFB to allow co-use of the ranges by project personnel and Nellis pilots. A schedule of use of the ranges concerned by Nellis pilots was published weekly for the guidance and protection of project personnel.

Communications and Timing and Firing. It became apparent during the planning phase for Small Boy that the very number of projects and personnel on that event, coupled with the numbers present at NTS for other DOD events, such as Marshmallow, would create a requirement for communications facilities that could not be met by then existing DOD and AEC assets. To fulfill these requirements, it was necessary that FCDASA purchase additional radio equipment—base stations, remote stations, mobile sets, crystals, and radio relay sets—and some radio-telephone equipment, including switchboard terminal equipment. To alleviate the crowding on one net, an additional DOD radio net was set up. Thus, there was in operation for CTO and its projects two radio nets and a radio-telephone net, involving over 200 radios and 25 radio-telephones.

The timing and firing requirements for Small Boy were as listed in Table 4.3.

The readiness date of 26 June 1962 was met, i.e., all signal cable installed, all DN-11 relays hung, and all tone receivers installed. The EG&G timing and firing system was completely checked out on 26 June.

Dry runs were conducted at 1000 and 1500 hours daily except on cancelled shot days when the dry run at 1000 hours was cancelled. A full-power, full-frequency dry run was conducted on 3 July; all systems were good, and no interference was recorded. Final dry runs took place over a period of 8 days commencing on 6 July. The last final dry run

took place at 1500 hours on Friday, 13 July; all projects received all signals.

Three stations that used tone receivers for relay closures missed signals on test day: Sandia Corporation, Project 6.5, Station 522.20; British AEC, Project 6.12, Bunker C, Station 544.03; and EG&G cloud photo, Project 2.12.

Careful routing of timing cables was required on Small Boy because of the EMP experiments. It was originally desired to activate all instrumentation within a 6,000-foot radius of ground zero by radio tone receivers. Insufficient tone receivers were on hand to accomplish this, so hard-wire circuits, carefully routed, had to be used. Over 10,000 feet of timing cable was blown up by primacord. The cable was elevated on 8-foot stakes as it left the vulnerability area out to 1,600 feet on the EM line. At this point, the cable was lowered to a 3-foot height. This elevation was decided upon so that detonation of the primacord would not disturb the dust on Frenchman Flat and cause interference with fireball photography. The last timing signal received by the EM projects was at minus 5 seconds. This signal activated a system that extracted the timing cable from the A, B, C, D, E, F, and G bunkers and activated a 2-second-delay fuze. The timing cable was detonated at 3 seconds before zero time. This was done so that projects could record free-field data.

EG&G tone receivers were used extensively on this test. Project 2.9, U.S. Naval Radiological Defense Laboratory (NRDL), used tone receivers in the free-field area. Various other projects utilized tone receivers in areas where it would have been impracticable to run hard-wire timing cable because of access and cost factors.

The timing (signal) cable layout for Small Boy is shown in Figures 4.19 and 4.20.

Meteorological Support. Close liaison was maintained between CTO Operations Division and USWB to determine the probability of favorable winds on the scheduled shot date and to observe any buildup of a front that would produce the winds desired. To obtain the fallout pattern desired off-site, a wind from 270° ± 20° at a velocity between 4 and 13 knots at shot time was desired. Lack of favorable winds on the scheduled shot date, 7 July 1962, caused the event to be delayed day by day until a favorable wind pattern permitted detonation on 14 July 1962. The actual wind had an average direction of from 245° and an average velocity of 7 knots.

The formal D−1 day weather briefings held for Small Boy were scheduled at 2100 hours daily, so that latest nationwide weather information was on hand to assist local forecasting and at the same time early enough so that a decision could be made for the following day, before the lengthy, complicated button-up of experimental bunkers and stations was begun. In addition, informal weather briefings for the Operations Division were arranged for the morning and afternoon each day during the 2 weeks before shot day.

Rad-Safe Monitor Training. The large number of reentry teams and manned stations were each required to have a qualified monitor present. To meet this requirement, Operations Division requested REECO Rad-Safe to conduct radiation monitor training courses for project personnel. Such courses were conducted, after which personnel successfully completing the course were certified to the Test Manager as qualified monitors.

Off-Site Coordination. Because of the certainty of off-site fallout, prior arrangements with the USPHS included furnishing sufficient aircraft to that agency for tracking the cloud for a protracted length of time. The USPHS also put out fallout collectors and film badges in the expected downwind path of the cloud.

The Federal Aviation Agency (FAA) was notified and Notices to Airmen (NOTAMS) were published to warn of the expected flash.

Nellis AFB was notified so that no training flights would be conducted in the vicinity at shot time.

4.4.7 Little Feller I.

Planning. Little Feller I was one of three events added to the Sun Beam series rather late in the operational phase. This event was a combination weapons effects experiment and troop training exercise
weapon and subsequent maneuvers in and around ground zero. The shot was unique from an operational standpoint in that the technical program was tailored to fit the schedule established by the Ivy Flats exercise. Operations were designed to obtain a maximum amount of data with a minimum of interference with the exercise plan. It was originally scheduled for 24 July 1962 but was accelerated to 17 July to insure completion of the test series by 19 July. The technical programs were limited in scope, and the time available for construction and installation of equipment was limited by the priority granted to the Ivy Flats exercise in the days preceding the event. The shot was detonated on schedule at 1000 hours, 17 July.

Rad-Safe. Little Feller I was complicated by the necessity for early sample recovery and troop participation. To provide for rapid reentry, 13 remote radiation monitors were placed at distances 1,000 to 7,000 feet from ground zero. Three REECO survey teams were designated to make single penetrations to three key positions, with the provision that they could be recalled prior to completion of the mission if sufficient information was available from the remote monitors to proceed with reentry. Of the 13 monitors, only 2 failed to operate; and 2 teams were recalled. (All teams actually completed their penetrations before recall could be accomplished.) Five remote monitors were lost at H+15 minutes upon exit of the early recovery party. By H+20 minutes, early recovery and REECO survey teams were clear of the area. Six remote monitors remained in operation. During the Ivy Flats exercise, Rad-Safe was accomplished by Ivy Flats personnel who had been augmented with nine experienced CTO monitors. Upon completion of the Ivy Flats exercise, CTO Rad-Safe information became available from REECO ground surveys and Project 2.8. Other than the need for rapid scientific recovery prior to troop participation, no unusual situations were encountered. Surveys at H+1 hour and D+1 day are included as Figures 4.21 and 4.22. A radiation plot of the Little Feller I situation on D+6 days in comparison with Little Feller II and Johnie Boy is shown in Figure 4.6.

Personnel Control, Button-Up, and Reentry. Reentry was divided into two phases. The first phase began at approximately H+3 minutes and terminated at H+25 minutes. This portion was limited to one recovery party to obtain rapid decay neutron and gamma flux data that would have been lost if delayed longer. The remainder of the reentry parties were delayed until completion of the Ivy Flats exercise and the determination that areas to be entered were free of duds. Reentry was restarted at approximately H+3 hours and continued during daylight hours through D+6 days.

Reentry was controlled from the FCP by Operations Division personnel throughout the first day (Figure 4.7). The control point was moved to a position approximately 1 mile from ground zero on D+1 day to allow recovery to continue at the Johnie Boy and Little Feller II sites.

The conflict between the technical programs and the tactical exercise was resolved by close scheduling of the time available for preparation for the event.

Air Operations. Normal cloud tracker (U3A), security sweep (L-20 and H-13), cloud sampler (B-57), and DOD photo (H-21) aircraft participated. In addition, NDL (Project 2.8) operated HUS helicopters in performing aerial radiation surveys after completion of the Ivy Flats exercise. During the maneuver exercise, the Ivy Flats headquarters operated several light aircraft and helicopters over the entire area.

Coordination with AEC for Use of Las Vegas Bombing and Gunnery Range. This was accomplished with the AEC Operations Coordinator, because the range north of Area 18 was involved.

Communications and Timing and Firing. No telephone service was provided for Area 18 operations. All communications in the forward area relied on use of existing VHF radio networks, plus tactical nets provided by the U. S. Army for the Ivy Flats exercise.

Timing and firing for Little Feller I was unusual in that these two functions, which are normally provided by EG&G, were separated. The scientific projects received timing signals from the EG&G timing and firing trailer located in Area 18 at the FCP. Firing was the responsibility of the Ivy Flats headquarters. Detonation was desired by the scientific projects as close to zero time (1000 hours) as possible, i.e., within 1 second. To accomplish this, countdown was given from the FCP by counting from the event clock and broadcasting to the launch site over the Ivy Flats control radio net. U. S. Army tactical radios were used to receive the countdown. The weapon was launched at minus 16 seconds to zero and detonated at plus 576 msec after zero. Figure 4.23 depicts countdown procedures used.

Prior to the event, an artillery registration round damaged the timing cable to Project 6.6 gamma dot station. This station did not receive its minus 5 second signal. All other signals were received, and the countdown was accomplished without difficulty. Timing requirements were as listed in Table 4.4.

Meteorological Support. Weather support was provided in Area 18 by USWB. Desired shot-time wind direction and speed was 170° ± 40° at 4 to 22 knots. Actual winds were from 175° at 10 knots.

Troop Participation. The orientation was conducted under the direction of Commanding General, Sixth Army, in coordination with DASA and AEC. The U. S. Army Infantry School (USAIS), U. S. Army Armor School (USAARMS), U. S. Army Artillery and Missile School (USAAMS), and certain other agencies designated by proper authority provided support for the exercise.

The orientation involved an attack conducted by a mechanized rifle company reinforced with a tank platoon and supported by the battalion mortar and Davy Crockett platoon and a battery of direct support artillery. The attack was launched following the firing of one Davy Crockett nuclear weapon to breach initial aggressor defenses.

The specific objectives were: (1) to test the equipment, tactics, and techniques for the use of the Davy Crockett weapon system in ground combat; (2) to promote confidence in the use of the Davy Crockett; (3) to demonstrate the Army's ability to operate in a nuclear environment using low-yield weapons; and (4) to acquire experience in the preparation and conduct of nuclear technical exercises.

This was a live-fire orientation. To insure safety from radiation, the maneuvering troops remained in their initial positions for an estimated 26-minute period after detonation of the Davy Crockett nuclear warhead. During this period, a radiological survey was performed by DASA/AEC, and critical experimental data was recovered. (For details, consult Davy Crockett Tactical Orientation Plan, Hq CONARC, 18 June 1962.)

Rad-Safe Monitor Training. No requirement existed for training on this event. Minimum project participation utilized already certified monitors. Ivy Flats headquarters provided unit-assigned Rad-Survey teams. However, U. S. Army teams previously trained and assigned TDY with FCDASA accompanied Ivy Flats monitors on initial exercise surveys.

Off-Site Coordination. No off-site participation was included; however, off-site radiation monitoring was conducted as a routine matter by the USPHS.

4.4.8 Vela-Uniform.

Planning. This was essentially a continuing function of the Vela-Uniform participants. No detailed operation plans were required.

Rad-Safe. This was a function of the AEC for the Vela-Uniform series.

Personnel Control, Button-Up, and Reentry. These were accomplished routinely through use of event cards for project personnel and as published in the Test Manager's schedule of events.

Air Operations. Low-altitude cloud tracking (U3A), security sweep (L-20), and photo (H-21) aircraft participated in all events. On some events, when venting was suspected, B-57 cloud sampler aircraft were positioned at ISAFB. All air operations were staged from ISAFB and the CP-1 helicopter pad.

Communications and Timing and Firing. Normal NTS communications facilities were utilized. Limited timing signals were provided to EG&G for action.

Meteorological Support. No unusual requirements existed.

4.5 RECOMMENDATIONS

AFSWC should provide sufficient aircraft under its control to adequately support any future requirements at NTS and arrange for local base facilities to support all aircraft requirements.

A Forward Air Controller (FAC) facility with a dual VHF and UHF radio should be made available for close-in control of aircraft in remote areas. It should be placed so that the FAC would have visual as well as radio contact with all aircraft operating in the area.

Airlift for future operations should be established on a firm schedule, and a C-54 or larger type aircraft should be provided.

TABLE 4.1 SIGNAL CHART, SHOT LITTLE FELLER II

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EVENT NAME: LITTLE FELLER II SPONSOR: DOD SHOT DATE: 7/7/62 SHOT TIME:

STATION	USER	PROJECT	CP /8	TIMING STA.	VC	EGG NET	TONE	0	-60M	-45M	-30M	-5M	-10M	-5M	-3M	-2M	-1M	-30S	-15S	-10S	-5S	-4S	-3S	-2S	-1½S	-1S	-½S	ZERO TEST	+½S	SPECIAL
ZERO RACK	SC	TEF	✓		✓	✓											W/DECARM		TO SECARM									FIRE		
MONITORS									A.C. Load – A.C. Line – AC Stabilizer – Prec. Accy – Arm – X Volts H Volts																					
									Fire Mon – S Unit Mon.																					
GAMMA DOT 1911.09	ARSHP SC	69																				W					W			290' S70°W
CABLE RADIAL STA 1811.03	AFSWC SC	66																		W										200' N25°E
FREE FIELD STA 1811.02	"	66												W'		W'	W			W										1000' N25°E
FREE FIELD STA 1811.01	"	66												W		W'				W										200' N10°W
PHOTO STA 1803.11	EG&G	93												W											W	W		W		125' from GZ
FB PHOTO STA 1	EG&G	95.1										W		W			W					W			W	W		W		5000' South
FB PHOTO STA 2	EG&G	95.1										W		W			W					W			W	W		W		2700' West
MICROBAROGRAPH STA A	BRL	"						2 PR			W							W	W			W			W		W			1900' S30°W
" STA 11	BRL	"						2 PR			W								W			W			W		W			17000' S 4°W
" STA 7	BRL	"																							W		W			190' S33°W
AIR WEATHER								2 PAIR TO CP 1200 1ST VERT FROM SOD																						

TABLE 4.2 SIGNAL CHART, SHOT JOHNIE BOY

PAGE 1 OF 1 PAGES

EVENT NAME: Johnie Boy SPONSOR: LRL SHOT DATE: 7/11/62 SHOT TIME:

STATION	USER	PROJECT	CP	TIMING STA	VC	EDGE WET	TONE	00	-60M	-45M	-30M	-15M	0M	+5	+10	+20	+1M	+30S	+15S	+10S	+5S	+4S	+3S	+2S	+1½S	+1S	+½S	ZERO TEST	-½S	SPECIAL
Zero Rack	S.C.	T&F	✓		✓	✓			28 Barometers							W Precision	W Arm											Fire		
Monitors									AC Load - A. Line - AC Stability - Pre Amp - Amp - X Unit Hi Volt																					
									Fire Mon - S. Unit Mon																					
#29, 31 E 33	NRDL	2.9	✓															W												Locate At Sta 33
#30, 32 E 34	NRDL	2.9	✓															W												Locate At Sta 32
#28, 21, 27 E 24	NRDL	2.9	✓															W												Locate At Sta 24
#26	NRDL	2.9	✓															W												
#01	NRDL	2.9	✓															W												Locate At Sta 01
#11, 13, 17 E 14	NRDL	2.9	✓															W										W		5000' South
FB Photo Sta #1	EG&G	45.1	✓									W		W		W		W		W				W				W		4000' East
FB Photo Sta #2	EG&G	45.1	✓									W		W		W		W		W				W				W		
Free Field Sta.	AFSWC	6.6	✓											W		W			W											650' N66°E
Instrument Van	WES	12	✓														W		W							W				4000' S80E
EM Shielded Bunkers	AFSWC	6.6	✓																W							W				1993' S26W
D Dumpster	AFSWC	6.6	✓																		W					W				750' N22E
Balloon Hookup Net	BRL																									W				350' SW from 62
Air Weather									2A from Kirtland AFB to CP																					
Recording Shelter Sta A	BRL	1.1	✓						20C			W							W			W			W					2000 S of 62
Microbarograph Sta "H"	BRL	1.1	✓						20C			Located At CP																		
Self Recording Sta "B"	BRL	1.1	✓																						W	W				560's AT
Recording Package Sta "D"	BRL	1.1	✓									W		W					W			W			W	W				Balloon Over 62
Self Recording Sta "A"	BRL	1.1	✓																						W	W		A 35' D		Balloon 35' from 62
Self Recording Sta "B"	BRL	1.1	✓																						W	W		A 35' C		Balloon 35' from 62
Main Microbarograph Sta	BRL	1.1	✓		✓																									

TABLE 4.3 SIGNAL CHART, SHOT SMALL BOY

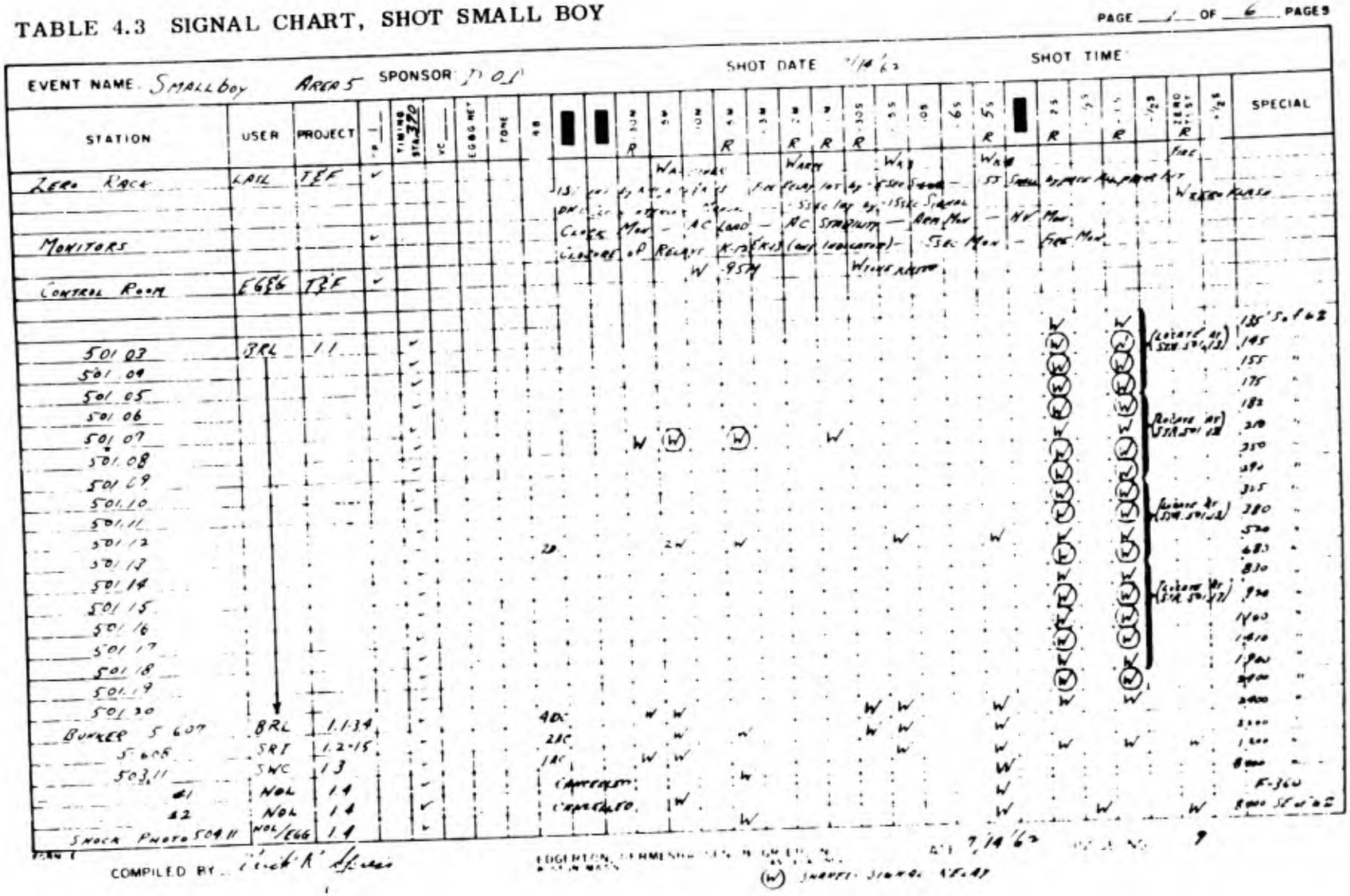

TABLE 4.3 CONTINUED

PAGE 2 OF 6 PAGES

EVENT NAME: Shallboy Area 5 SPONSOR: D O D. SHOT DATE: 7/14/62 SHOT TIME:

STATION	USER	PROJECT	CP	TIMING STA/22	VC	EGG& WET	TONE	60			30R	-30	-60	-90	-30R	-30	-22R	-11R	-30R	-180	-105	-60	-30R		-22R	-1/4 S	-11R	-1/2 S	ZERO TEST	+1/2 S	SPECIAL
											R														R		R		R		
#1	USCEGS	1.4	✓																						R		R		R		
#2	"	1.4	✓																						W		W		W		
#3	"	1.4		✓																					W		W		W		
#4	"	1.4		✓																											
S-608	SC	1.6		✓				10C			W	W					W	W									W		W		
F-300	LRL/NRDL	22.1		✓		✓															AC Radio Mod.										
S-604	SRDL	22-64		✓		1Pz	Mod								(R)									W							605 noise
S-605	SRDL	22-64	✓	✓		1Pz	Mod	1Pz Mod Sq. CP							(R)									(W)							604 noise
S-606	SRDL	22-64		✓		1Pz	Mod								(R)									(W)							606 noise
541.01	NRDL	2.7									R																				Shared w/ 2.13
541.02											R																				Shared w/ 2.13
541.03											R																				
541.04											W										Install inside Stations										Shared w/ 2.13
541.05											W																				
541.06											W																				Shared w/ 2.13
541.07											R																				
541.08											R																				
541.09											(R)																				Shared w/ 2.13
541.10											R																				
541.11											R																				
541.12											R																				
541.13											R																				
541.14											R																				
541.15											R																				
541.16											R																				
541.17											R																				
541.18											W																				
541.19											R																				
541.20											R																				
541.21											R																				
541.22											R																				
541.23	NRDL	2.7	✓	✓							W																				
											R																				

FORM E

COMPILED BY Erick K. Guess

EDGERTON, GERMESHAUSEN & GRIER, INC. BOSTON, MASS LAS VEGAS, NEV

DATE 9/14/62 ISSUE NO. 9

(W) - SHARED SIGNAL RELAY (R) - SHARED RADIO SIGNAL

TABLE 4.3 CONTINUED

EVENT NAME: Small Boy Area 5 SPONSOR: DOD SHOT DATE: 7/6/62 SHOT TIME:

STATION	USER	PROJECT	CP	TIMING STATION	VC	EGG&G NET	TONE	0.0	[redacted]	[redacted]	R-30M	-3M	0M	R-5M	-3M	R-2M	R-1M	R-30S	-5S	-10S	-6S	R-5S	[redacted]	R-2S	-1/2S	R-1S	-1/2S	ZERO REF SET	+1/2S	SPECIAL
541 27	NRDL	29		✓																										
541 62	NRDL	29	✓															R												
541 65	NRDL	29	✓															R												
541 70	NRDL	29	✓															R												
541.73	NRDL	29	•															R												6400' S/SE
522.06	NDL	2.12		•										R								R								32000 NW
Cloud Photo	EG&G	2.12		•																										Shared With 29
541 01	NDL	2.13	✓															(R)												Shared With 29
541 02	NDL	2.13	✓																											
541 04	NDL	2.13		•														(R)												Shared With 29
541 06	NDL	2.13	✓																											Shared With 29
545.01	BRL	2.15		•																										19,200 NE
515.01	WES	3.2		•																										325 Surf 62
	WES	3.2		•																										080 Surf 3
515-02	WES	3.2		•																										4000 Surf 3
5-610	BRL-ARC DOFL	61-62-63		•			1PS	Mod																						675 NOISE
5-611	DOFL-ARC BRL	6162-63	✓	•			1PS	Mod																						1650 NOISE
5-602	BRL-ARC DOFL	61-63-63		•			1PS	Mod																						4650 NOISE
5-603	DOFL-ARC BRL	61-62-62		•			1PS	Mod																						9800 NOISE
519 01	DOFL	6.2		•																										650 NOISE
519 02	DOFL	6.2		•																										975 NOISE
519 03	DOFL	6.2		•																										1650 NOISE
519 04	DOFL	6.2		•																										1450 NOISE
519 05	DOFL	6.2		•																										1450 NOISE
519 06	DOFL	6.2		•																										4650 NOISE
519 07	DOFL	6.2		•																										9800 NOISE

FORM 1

COMPILED BY Frank R Shelton

EDGERTON, GERMESHAUSEN & GRIER, INC. BOSTON, MASS. LAS VEGAS NEV.

DATE 7 14 62 ISSUE NO 9

(W) - Shared Signal Relay (R) - Shared Radio Signal

TABLE 4.3 CONTINUED

PAGE 4 OF [illegible] PAGES

EVENT NAME [illegible] SPONSOR [illegible] SHOT DATE [illegible] SHOT TIME

STATION	USER	PROJECT	CP	TIMING STA 220	VC	FOGGNT	TONI	BB	[redacted]	[redacted]	W 30E R	W	W 10	W 6 R	W 5	W 2 R	W 1 R	S 30E R	S 15	S 10	S 6	S 5 W	[redacted]	S 2 R	S 2/3	S 1 R	S 1/3	ZERO RESET	S 2/3	SPECIAL
5?-5	[illegible]	?2		✓							W			W			W					W								1650 SSBW
[illegible]	[illegible]	?2		✓							W			W			W					W								625 N/6E
[illegible]	[illegible]	6.2		✓							W			W			W					W								1650 N/6E
[illegible]	[illegible]	?2		✓							W			W			W					W								4050 N/6E
522.?	SC	?5	✓					[illegible]						R		R	R													B500
522.?2			✓											R		R	R													B2000
522.?3				✓										W		W	W													B6000
522.04			✓											R		R	R													E2000
522.05				✓										W		W	W													E6000
522.06				✓				1DC						W		W	W													C6000
522.07			✓											R		R	R													A500
522.08			✓											R		R	R													A2000
522.??				✓										W		W	W													A6000
522.?				✓										W		W	W													D2600
522				✓										W		W	W													D11000
522.?2			✓											R		R	R													S-500
522.13			✓											R		R	R													S2000
522.?4				✓										W		W	W													S6000
522.?6			✓											R		R	R													FF450
522.18			✓											R		R	R													FF2000
522.19			✓											R		R										Shared W/ST 59.09				FF6000
522.20	SC	6.5	✓											R			R													FF26000
"B" Bunker	BSD AFSC	6.6	✓					1K						R			R									R				800 AT 290°
"E" Bunker			✓											R			R									R				800 AT 275°
"G" Bunker			✓											R			R									R				900 AT 268°
"J" Bunker			✓											R			R									R				900 AT 238°
"H" Bunker			✓					1DC						R			R									R				1500 AT 251°
S-612 "L" Bunker			✓											R			R									R				3300 AT 208°
S-613 "N" Bunker	BSD AFSC	6.6	✓											R			R									R				3300 AT 193°
S2601	DRI SWC	6.9		✓								W										W				On Road West of Receiver Site				
543.02	MHD	6.11	✓				NEW 300 Pumping Sta.															R				R				[illegible]
S-615	MHD	6.11	✓																					R		R				1600 W.162

COMPILED BY Erik R. [illegible] EDGERTON, GERMESHAUSEN & GRIER, INC. BOSTON, MASS. LAS VEGAS, NEV. DATE 7/14/62 ISSUE NO. 9

TABLE 1.3 CONTINUED

EVENT NAME: SMALLBOY AREA 5 SPONSOR: D.O.D SHOT DATE: 7/14/62 SHOT TIME

STATION	USER	PROJECT	CP	TIMING STA. 720	VC	EGG NET	TONE	88			R-30M	-15M	-10M	-5M R	-3M	-2M R	-1M R	-30S R	-15S	-10S	-6S	-5S R		-2S R	-1/2S	-1S R	-1/2S	ZERO TEST R	+1/2S	SPECIAL
544.01	BAFC	6.12	✓														R	R												1600 N 32 W
544.02	BAFC	6.12	✓														R	R												4000 N 32 W
544.03	BNEC	6.12	✓														R	R												10000 N 32 W
5-609 K' BUNKER	BSD SNC	7.1		✓								W	SHADOW				W		W		W		W		OUTAGE				1200 AT 268°
5-610 'M' BUNKER	BSD SNC	711-713 718		✓								W	"				W		W		W		W		"				3000 AT 300°
5-611 'Q' BUNKER	BSD SNC	711-713 718		✓								W	"				W		W		W		W		"				700 AT 118°
5-614 'C' BUNKER	BSD AFSC	7.14		✓														W				W								5700 AT 5775 W
528.12 A PAD	BSD AFSC	7.14																												2800' S35W
528.13 B PAD	BSD AFSC	7.14																												4150 S35W
528.15 C PAD	BSD AFSC	7.14																												5700 S35W
528.14 D PAD	BSD AFSC	7.14																												7200 S35W
545.01	ERDL	7.5		✓							W							W	W			W								2200 S78E
COMPONENT TEST STA	NOL	7.8		✓													W													625 S78W
BUNKER 3.3a	MB	7.9		✓				3DK														W								2900 S6.5W
SX-8 #1	NDL	7.10		✓								W																		1300 S.16E
#2	NDL	7.70		✓								W																		1800 S.16E
FIRE BALL PHOTO 501.13	LASL/EGG	15		✓								W					W							W			W			4000 W
FIRE BALL PHOTO 501.12	LASL/EGG	15		✓								W					W							W						10900 S W
1902.01	LASL	19		✓																										115 S 60 E
1902.02				✓																										158
1902.03				✓																										158
1902.04				✓																										179
1902.05				✓																										205
1901.01				✓																										229
1902.06				✓																										229
1902.07				✓																										229
1901.02				✓																										262
1901.03				✓																										262
1901.04				✓																										295
1901.05				✓																										295
1901.06				✓																										315
1901.07	LASL	19		✓																										345

F-300

FORM E

COMPILED BY Frank K Spears

EDGERTON, GERMESHAUSEN & GRIER, INC. BOSTON, MASS LAS VEGAS NEV.

(W) - SHARED SIGNAL RELAY

DATE 7.19.62 ISSUE NO 9

TABLE 4.3 CONTINUED

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EVENT NAME Smallboy Area 5 SPONSOR DOD SHOT DATE 7/14/62 SHOT TIME:

STATION	USER	PROJECT	CP	TIMING SIG	SC	CODE NET	340	88	[redacted]	[redacted]	ROS-R	RS	RO1	RS-R	RE	R7-R	R1-R	SOS-R	SS1	SO1	S9	S5-R	[redacted]	S2-R	S1/1	S1-R	S1/1	ZERO DETECT R	S1/1	SPECIAL
1901.08	LASL	17		·														W				W		W						380 from 62
1901.09	LASL	17		·														(W)				W		(W)	Lower & 1901.09					394 " "
1901.10	LASL	17		✓														(W)				W		(W)						425 " "
1901.11	LASL	17		✓														W				W		W	Lower & 1901.12					574 " "
1901.12	LASL	17		✓														(W)				W		(W)						643 " "
~~1901.13~~	~~LASL~~	~~17~~		—					Cancelled									W				W		W						~~577~~
100.1 Thru 100.4	SCLL	27		✓											W					2W	W	W		W		W				100 " "
150.1 & 150.2	SCLL	27		✓											W							W				W				150 " "
200.1 Thru 200.9	SCLL	27		✓				10C							W					3W	W	2W		(W)		(W)				300 " "
Maneuver Sta.	SCLL	27		✓				10C							2W	W					W	W		W		W				1500 " "
Recording Trailer	SCLL	27		✓				10C								W	W									W				12000 " "
S-616 Bunker	SC	45.7		✓														R				R				R				600 " "
S-619 Bunker	SC	45.7		✓							W	W		W			W	W	W			W				W				2500 " "
S-608	SC	45.3		✓																		(W)		W		W				1200 S of 62
F-726	SC	45.7		✓													W	W'				W				W				+150m
F-211	SC	45.7		✓																						W				+150m
G-311	LRL	22	✓														W													3000' South
Photo Sta.	SC	45.7		✓										W								W								
SW 27	NRDL	2.9		✓														R												
SW 25	NRDL	2.9		✓														R												
SW 26	NRDL	2.9		✓														R												
G-297	SC	45.3				Net 8 - 1 Hour Voice Hack					- Net 13 Time Tone							R	Fixed Message from Base Sta							R				Sta N of 62
	NOL	78.1	✓					10C																(W)		(W)				175' @ 286°
	SCLL	27		✓																				W		W	Lights			210' @ 286°
	SCLL	27		✓																				(W)		(W)				240' @ 286°
	SCLL	27		✓																					(W)					3000' SE
Photo Station	DTMR	7.9		✓									Skipped [illegible] Edge Sta [illegible]																	

COMPILED BY Erik R Agnes [signature]

EDGERTON, GERMESHAUSEN & GRIER, INC. BOSTON, MASS. LAS VEGAS, NEV.

(W) - Shared Signal Relay

DATE 7/14/62 ISSUE NO. 7

TABLE 4.4 SIGNAL CHART, SHOT LITTLE FELLER I

PAGE 1 OF 1 PAGES

EVENT NAME: LITTLE FELLER I SPONSOR: J' OD SHOT DATE: 7/17/62 SHOT TIME:

STATION	USER	PROJECT	CP	TIMING STA.	VC	EG&G WET	TONE	60	-60S	-45S	-30S	-15S	-10S	-5S	-3S	-2S	-1S	-30S	-15S	-10S	-5S	-4S	-3S	-2S	-½S	-1S	-½S	ZERO TEST	+½S	SPECIAL
AREA 18 CONTROL POINT	EG&G	T&F							H-30 M. RUNS CONTROL																					
1-J FLOYD CONTROL POINT	D.O.D.	D.O.D.							H-30M SIMULTANEOUS CONTROL																					
FREE FIELD STA 1811.05	MTS/SC	6.6												W		W	W		W											(100' 200' from G2
CABLE STA 1811.06	"	6.6																			W					W				340' S40°W
GAMMA STA 1811.07	"	6.6			(CABLE DESTROYED BY ARTILLERY FIRE)																									2000' NORTH
F.B. PANEL STA 1	EG&G	95.1											W	W		W					W			W	W			W		1000' W
F.B. PANEL STA 2	EG&G	95.1											W	W		W					W			W	W			W		
AIR WEATHER									2 PAIR TO CP from 1st Junction Box. (CABLE DESTROYED by ARTILLERY FIRE)																					

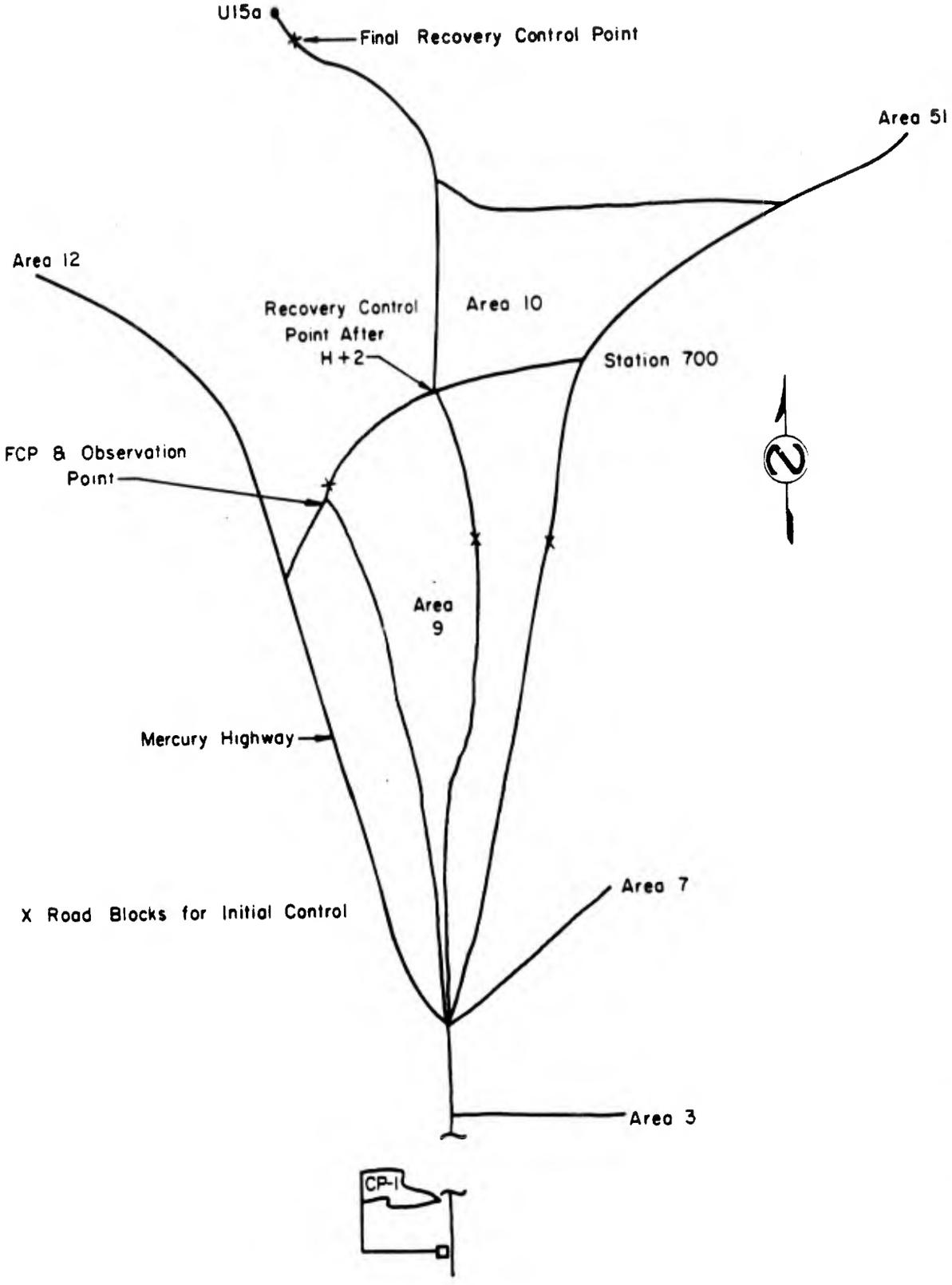


Figure 4.1 Control point map, Shot Hard Hat.

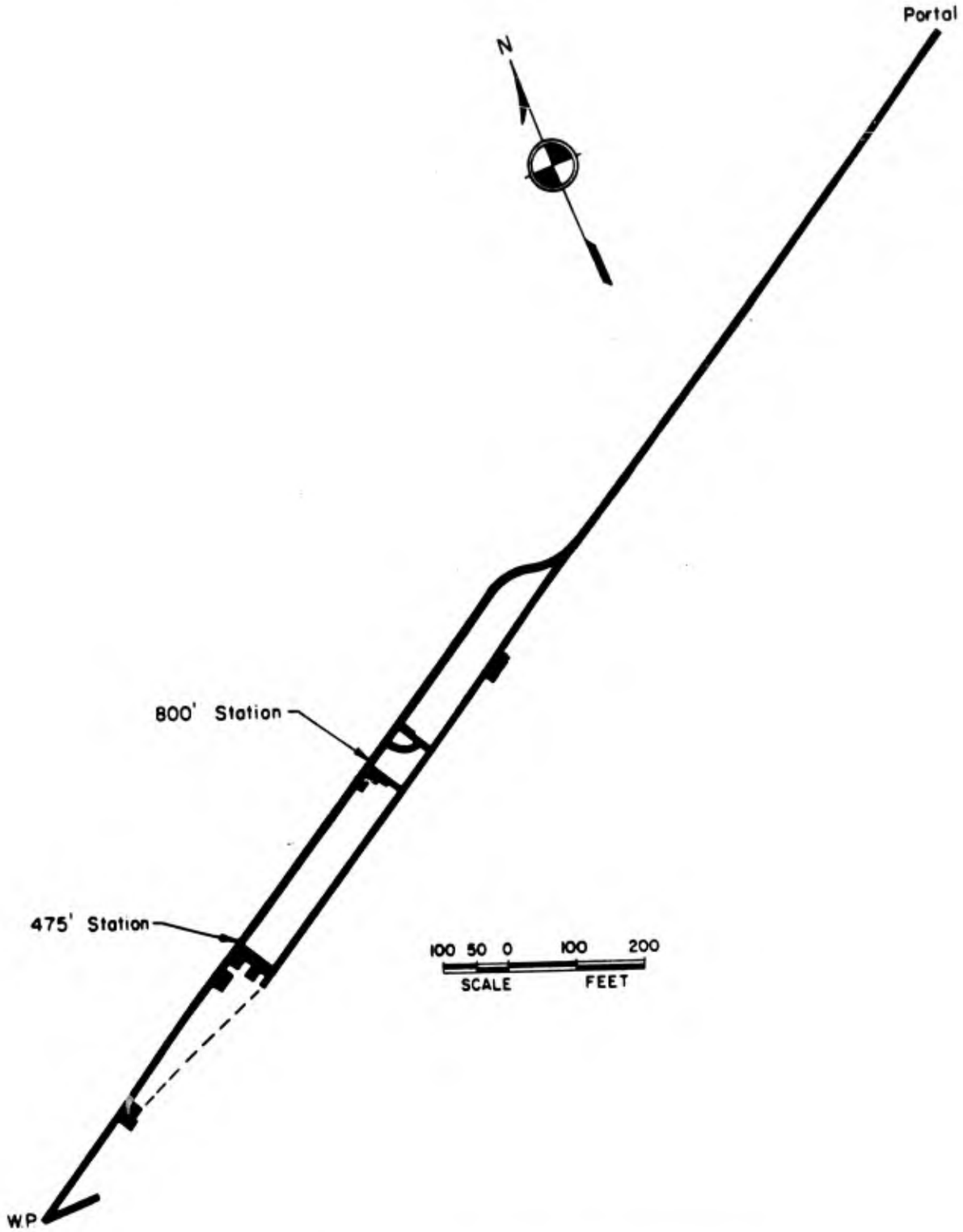


Figure 4.2 Tunnel U16a layout, Shot Marshmallow.

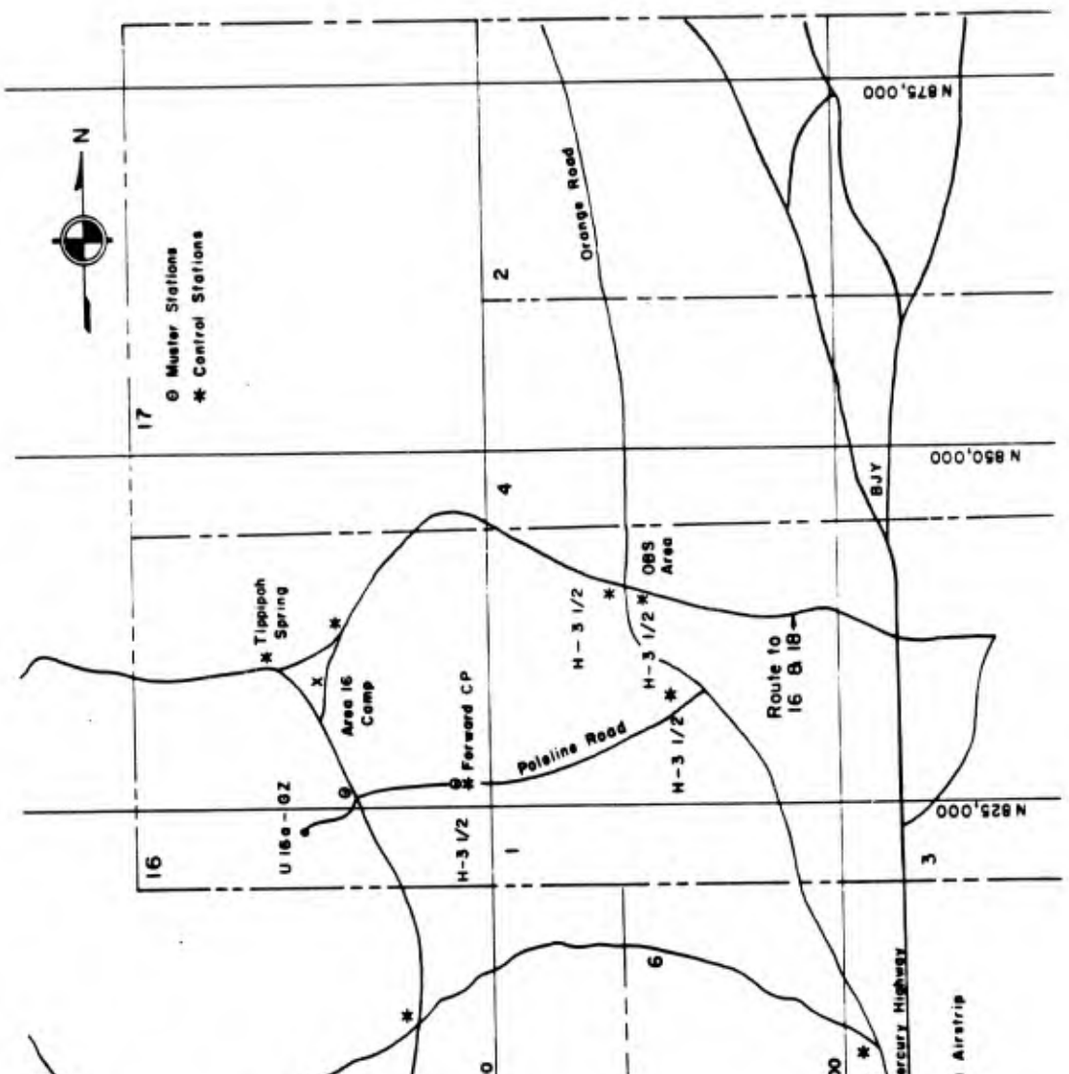


Figure 4.3 Area 16 control locations, Shot Marshmallow.

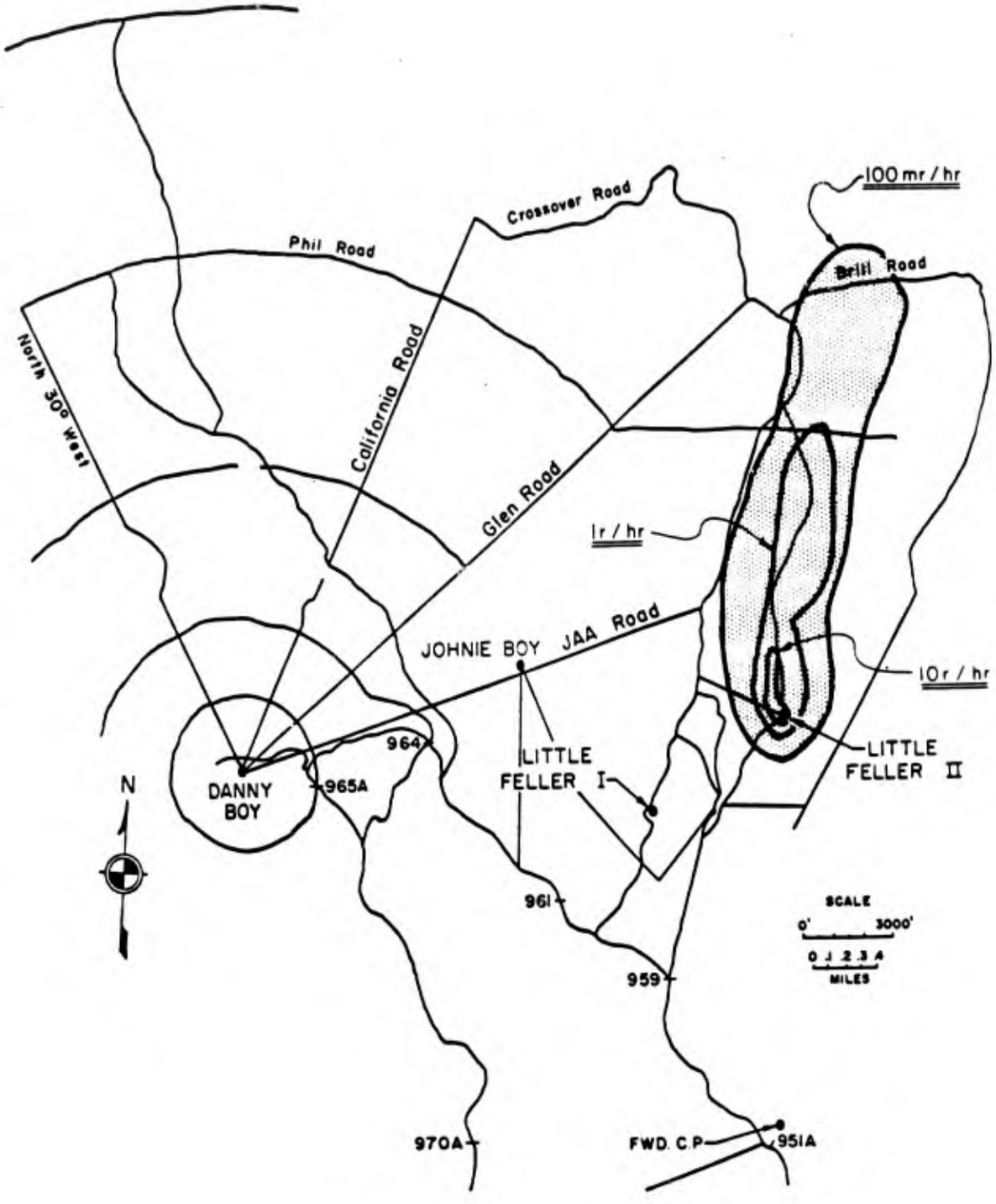


Figure 4.4 Radiological survey, Shot Little Feller II, H+1 hour.

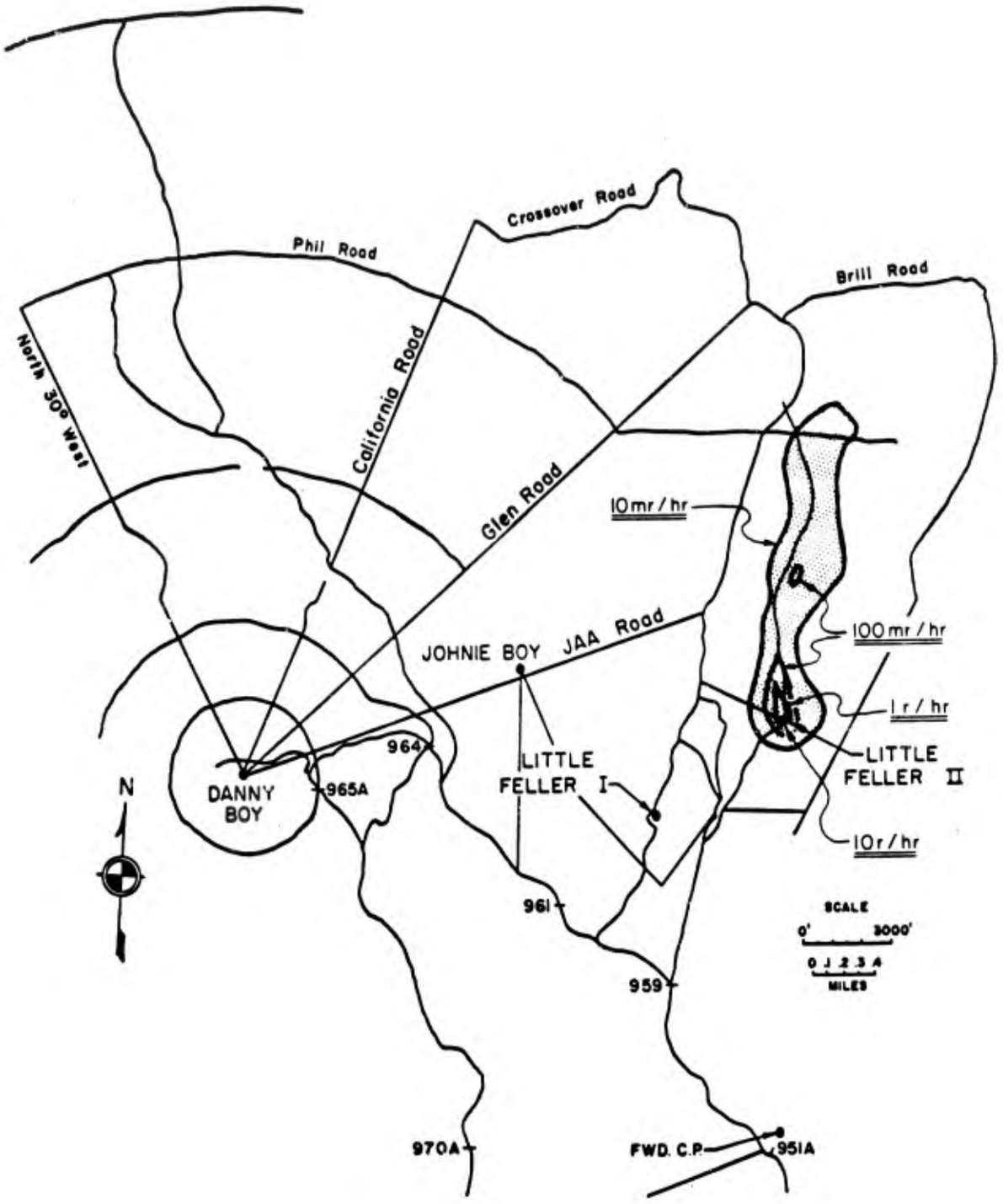


Figure 4.5 Radiological survey, Shot Little Feller II, D+1 day.

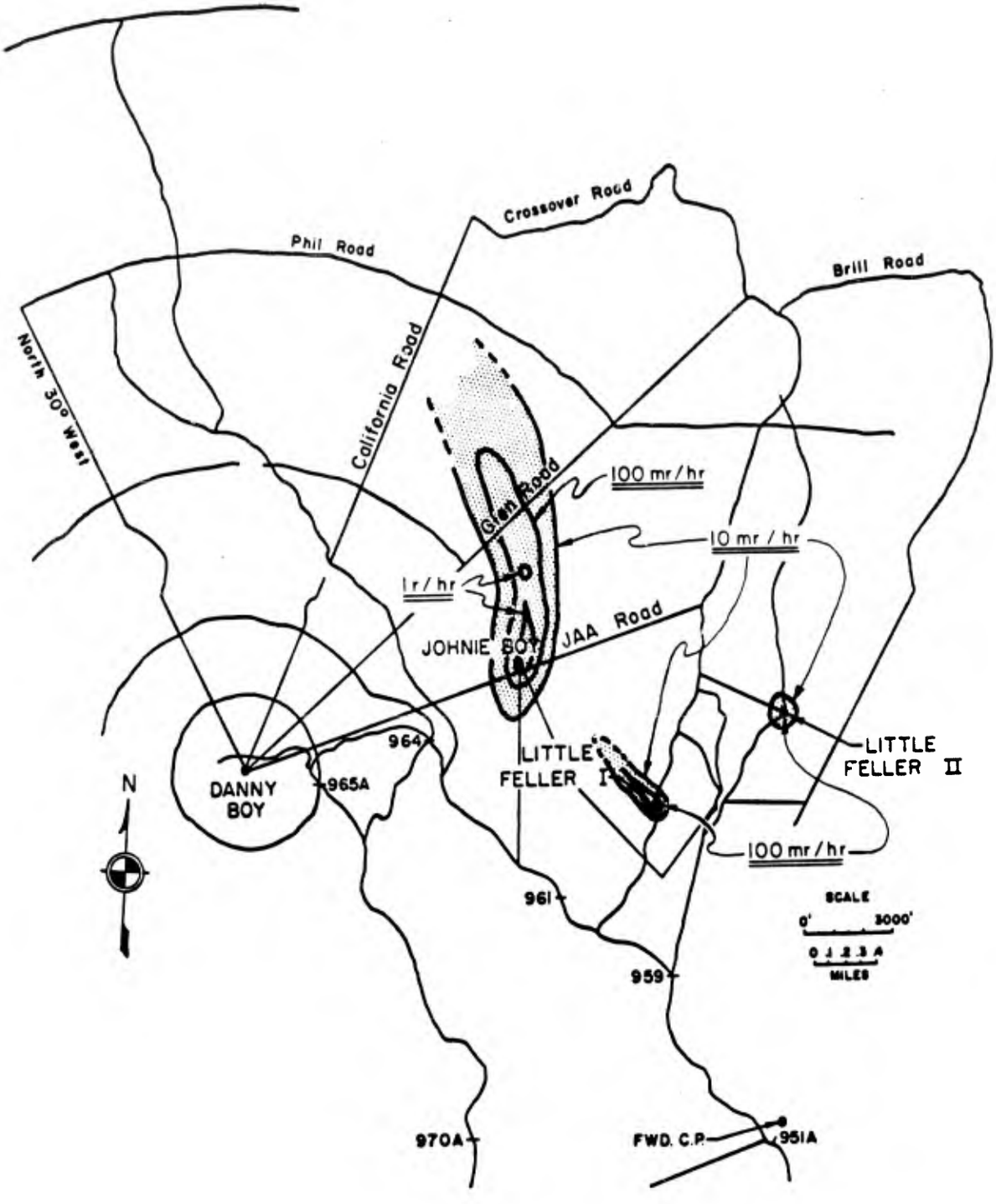


Figure 4.6 Radiological survey, Shots Little Feller II, D+16 days; Johnie Boy, D+12 days; and Little Feller I, D+6 days.

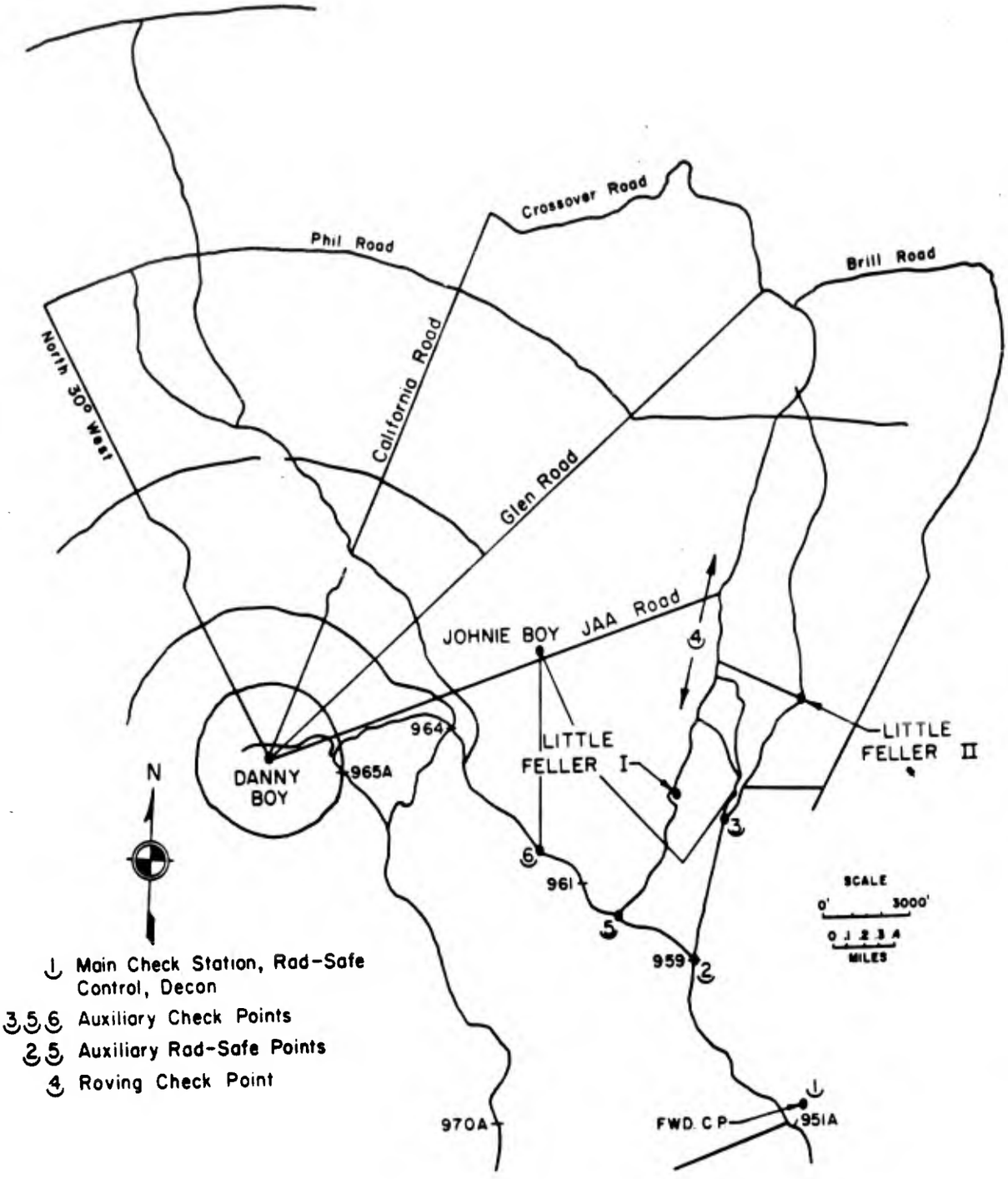


Figure 4.7 Control points, Area 18.

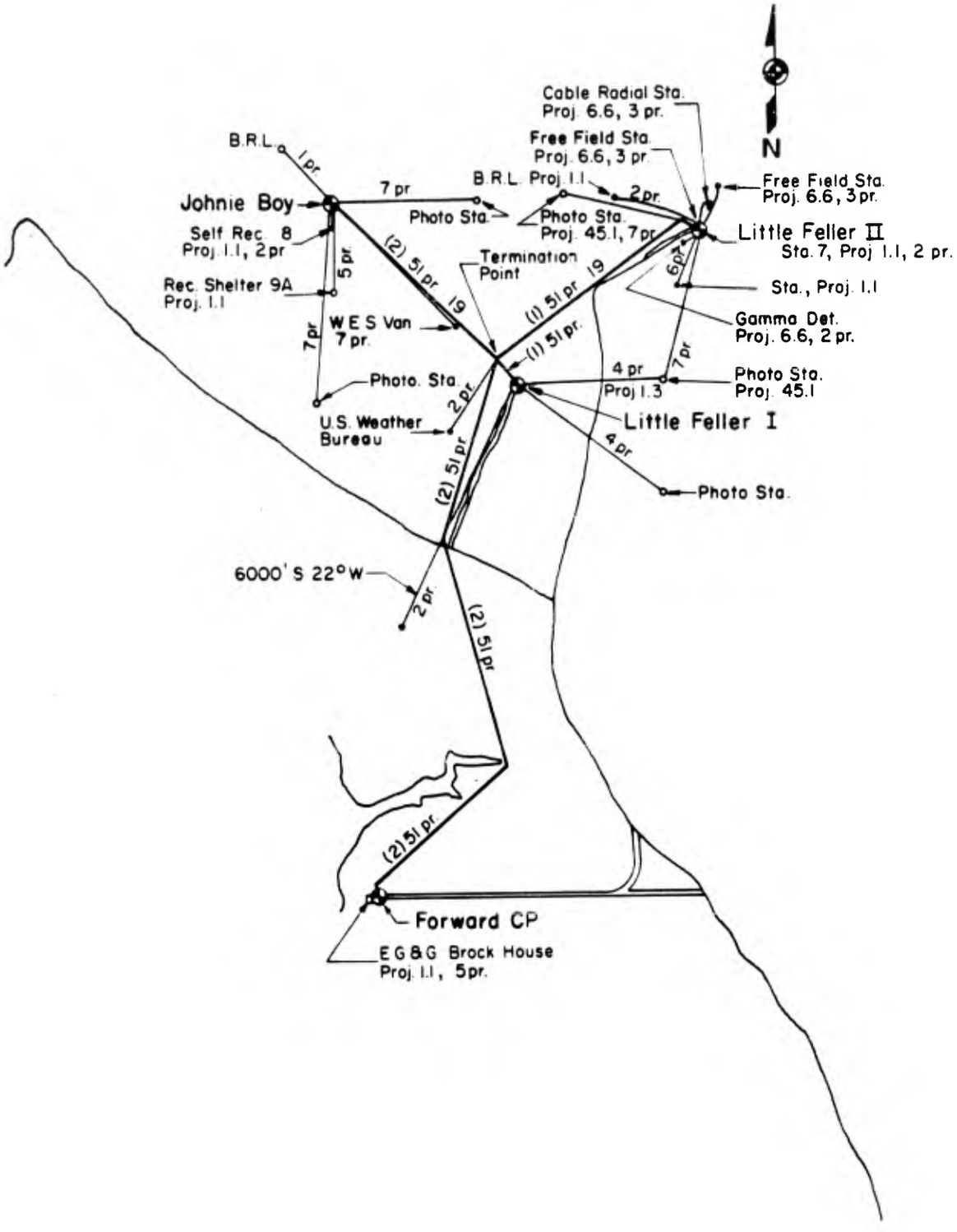


Figure 4.8 Timing signal layout, Area 18.

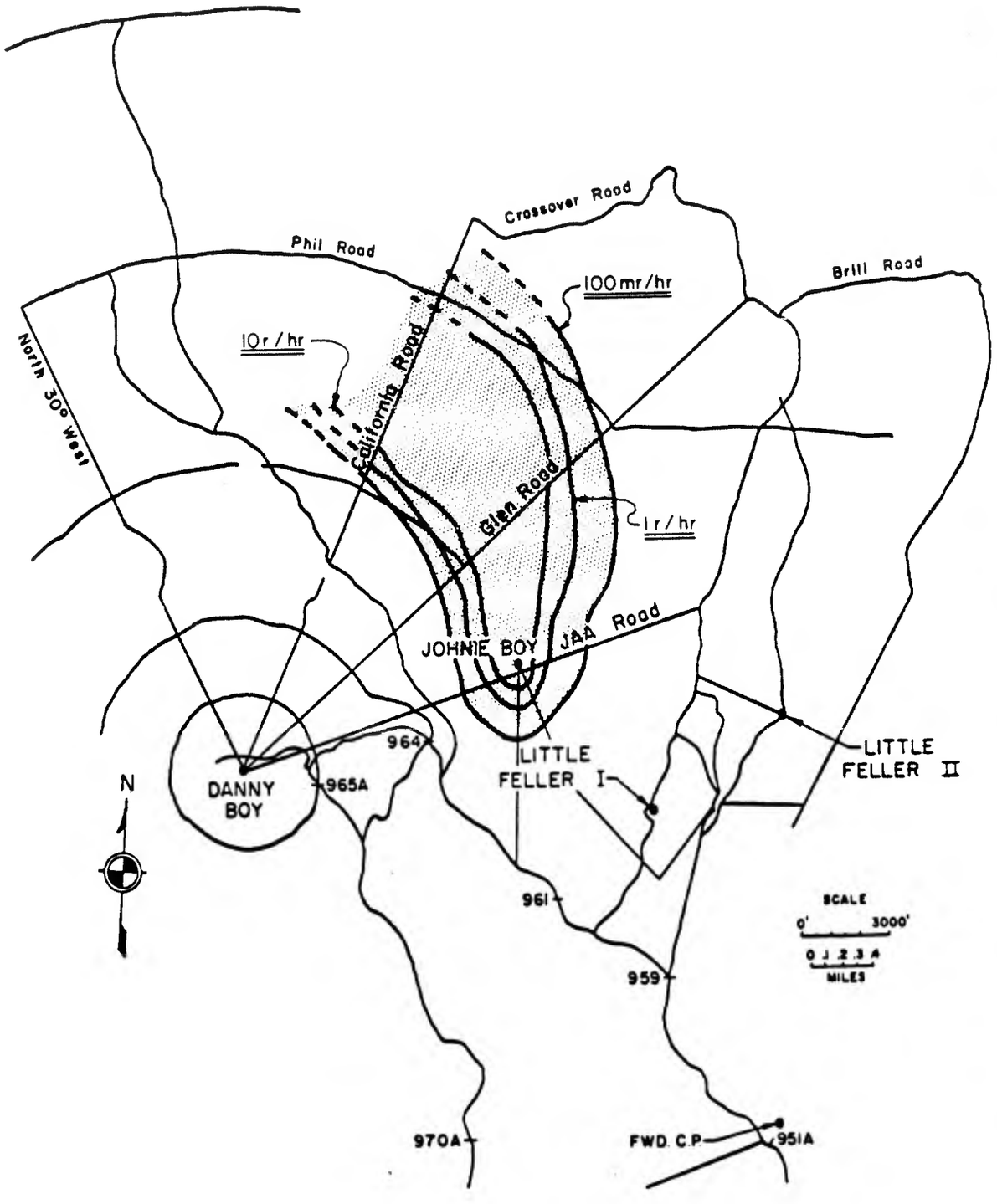


Figure 4.9 Radiological survey, Shot Johnie Boy, H+1 hour.

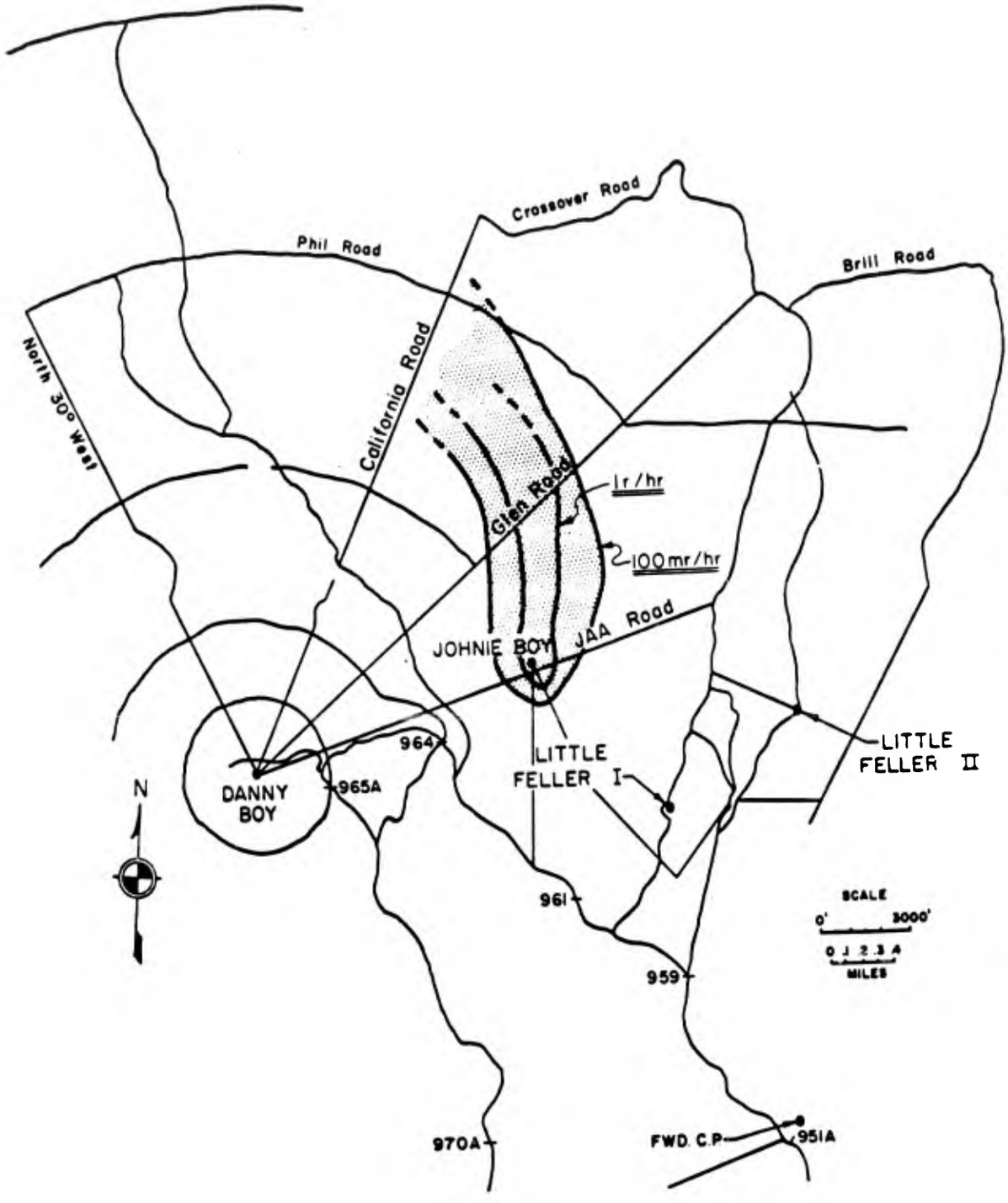


Figure 4.10 Radiological survey, Shot Johnie Boy, D+1 day.

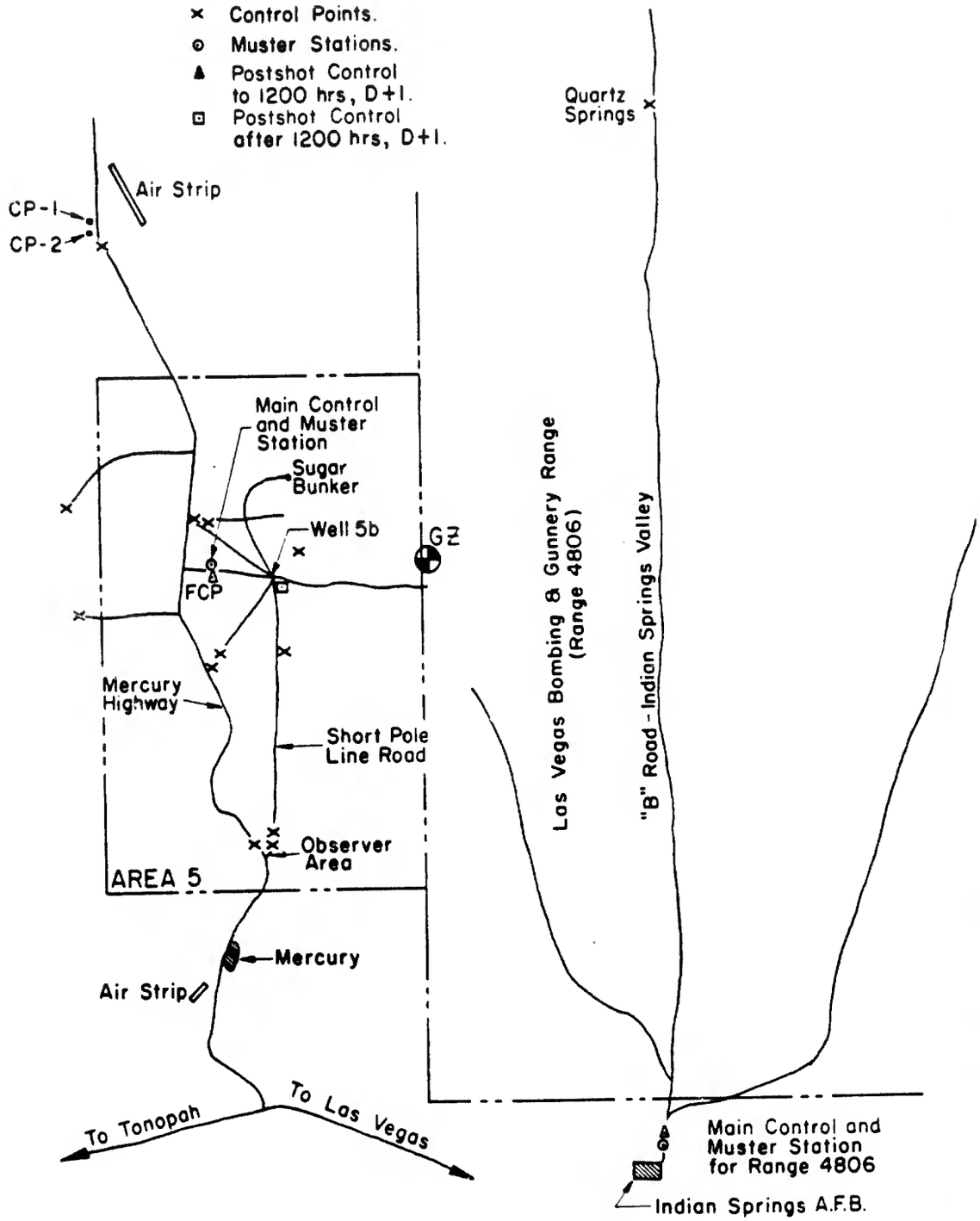


Figure 4.11 Area control, Shot Small Boy.

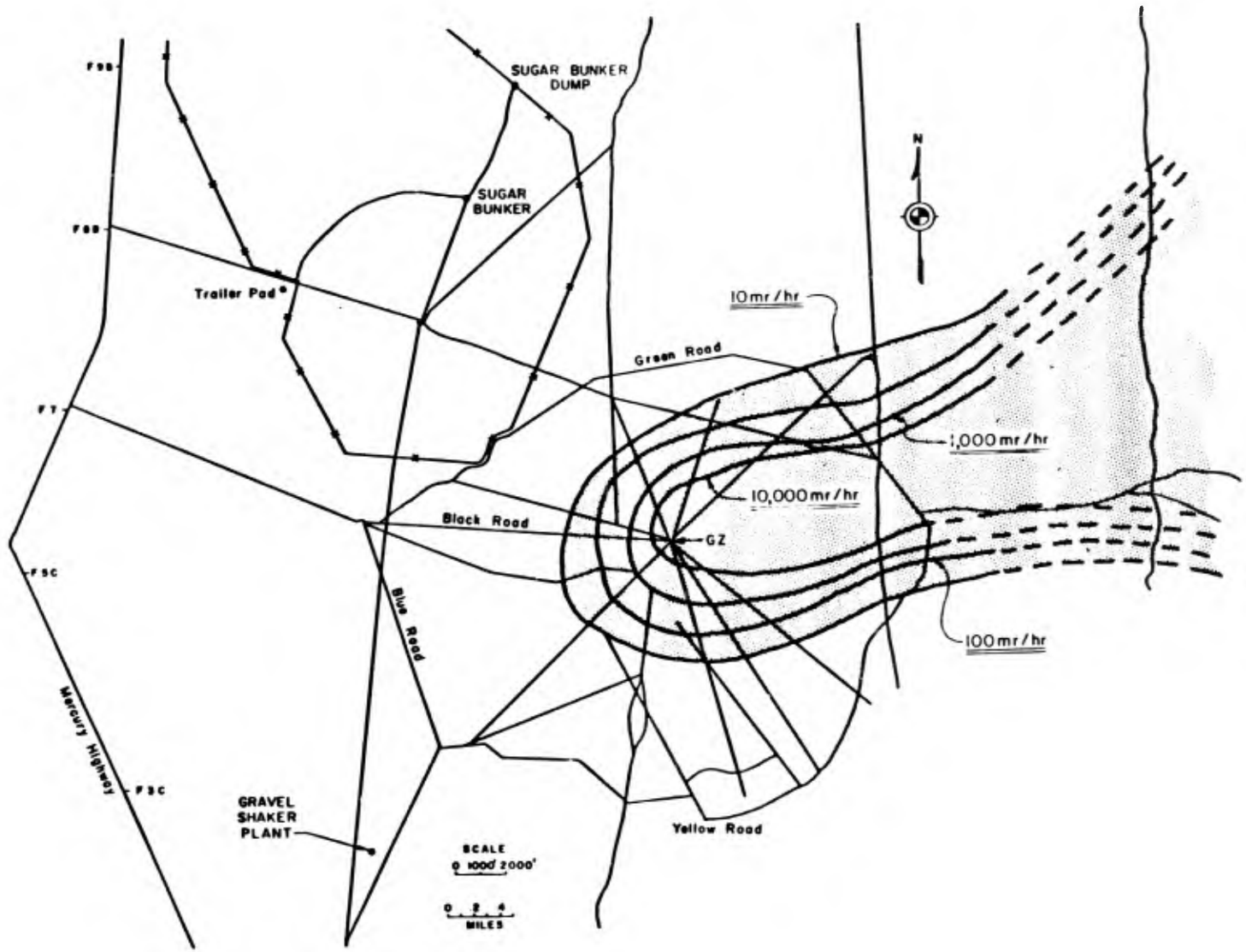


Figure 4.12 Radiological survey, Shot Small Boy, H + 1 hour.

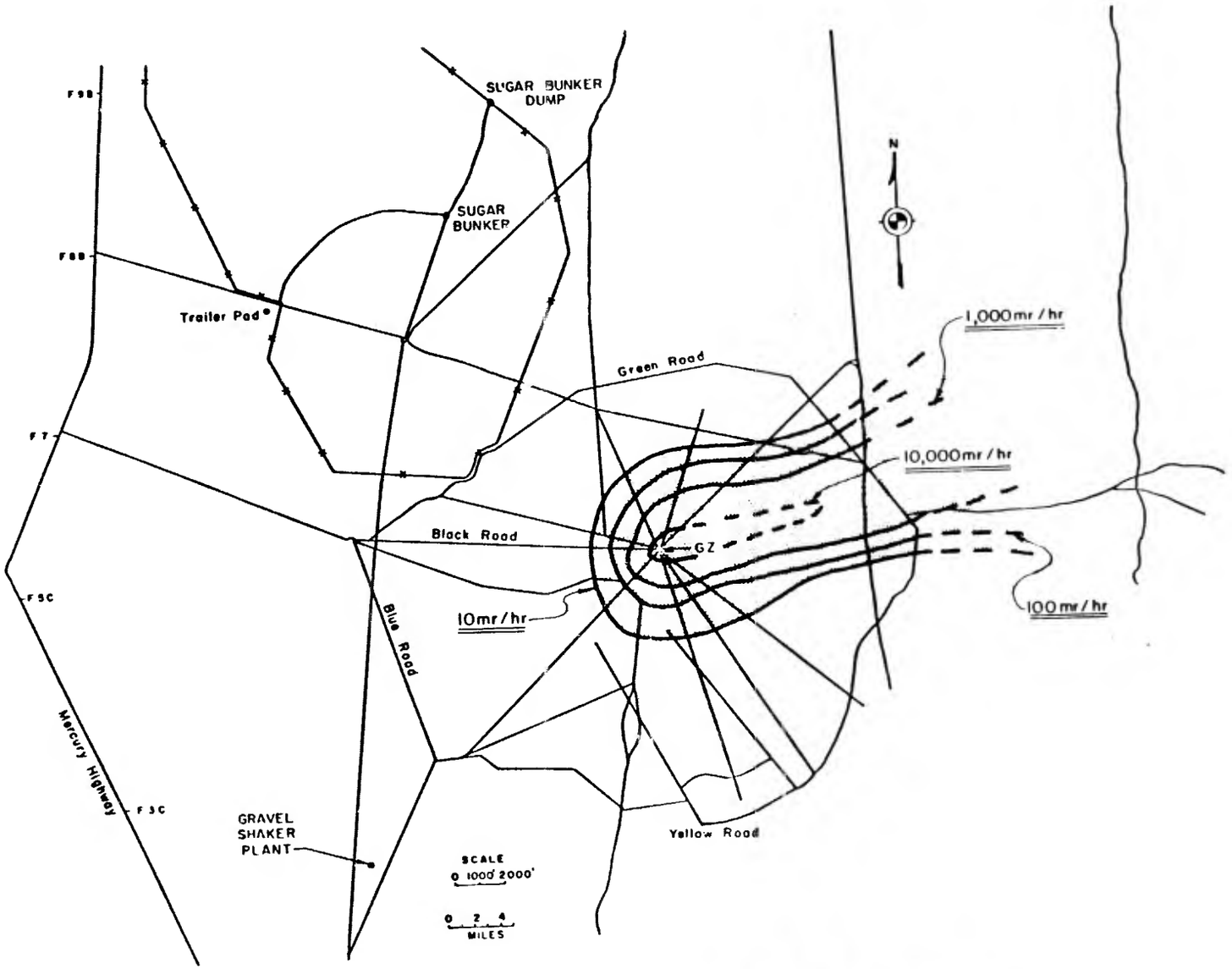


Figure 4.13 Radiological survey, Shot Small Boy, D + 1 day.

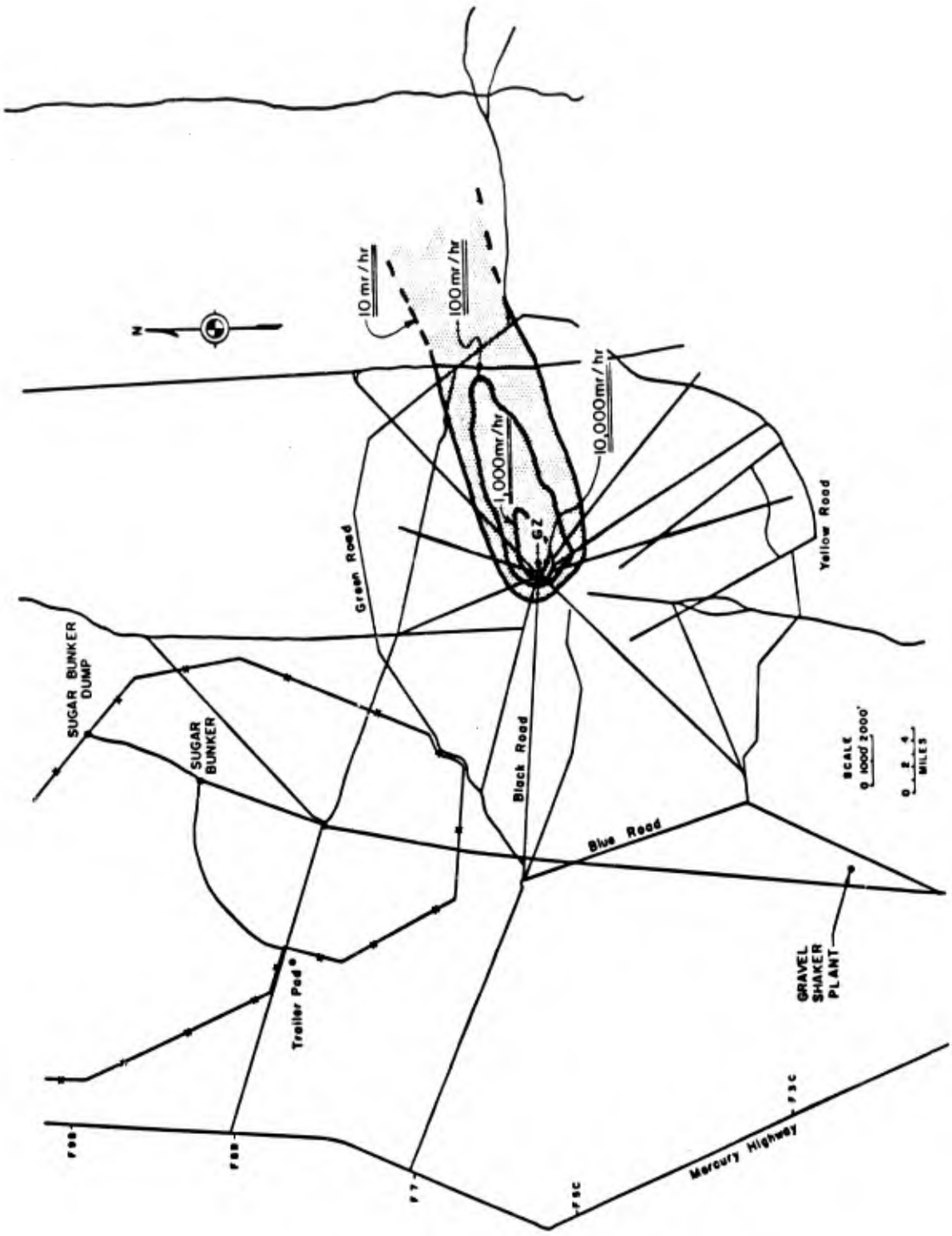


Figure 4.14 Radiological survey, Shot Small Boy, D+11 days.

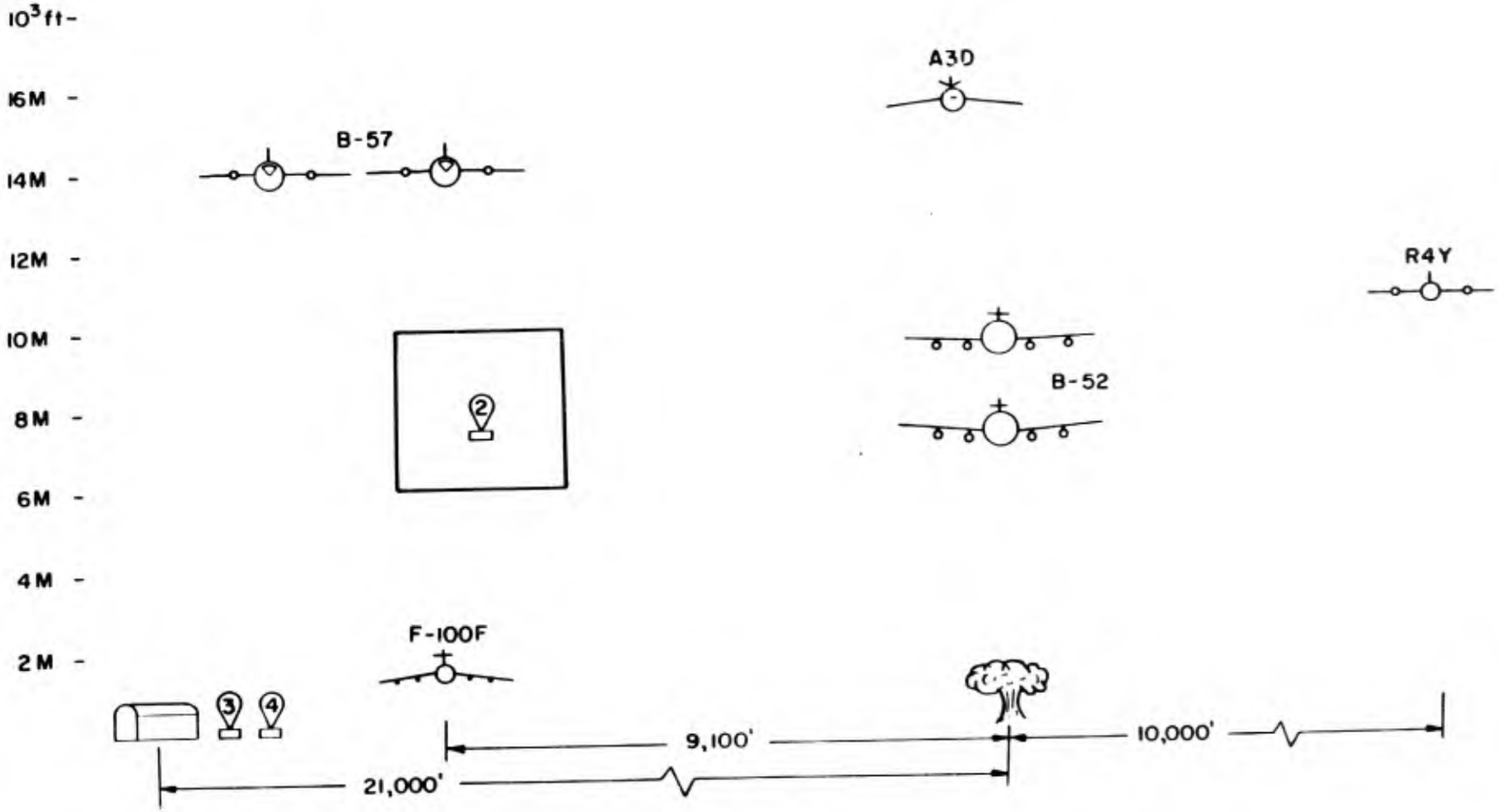


Figure 4.15 Profile view of aircraft and balloons, H-hour, Shot Small Boy.

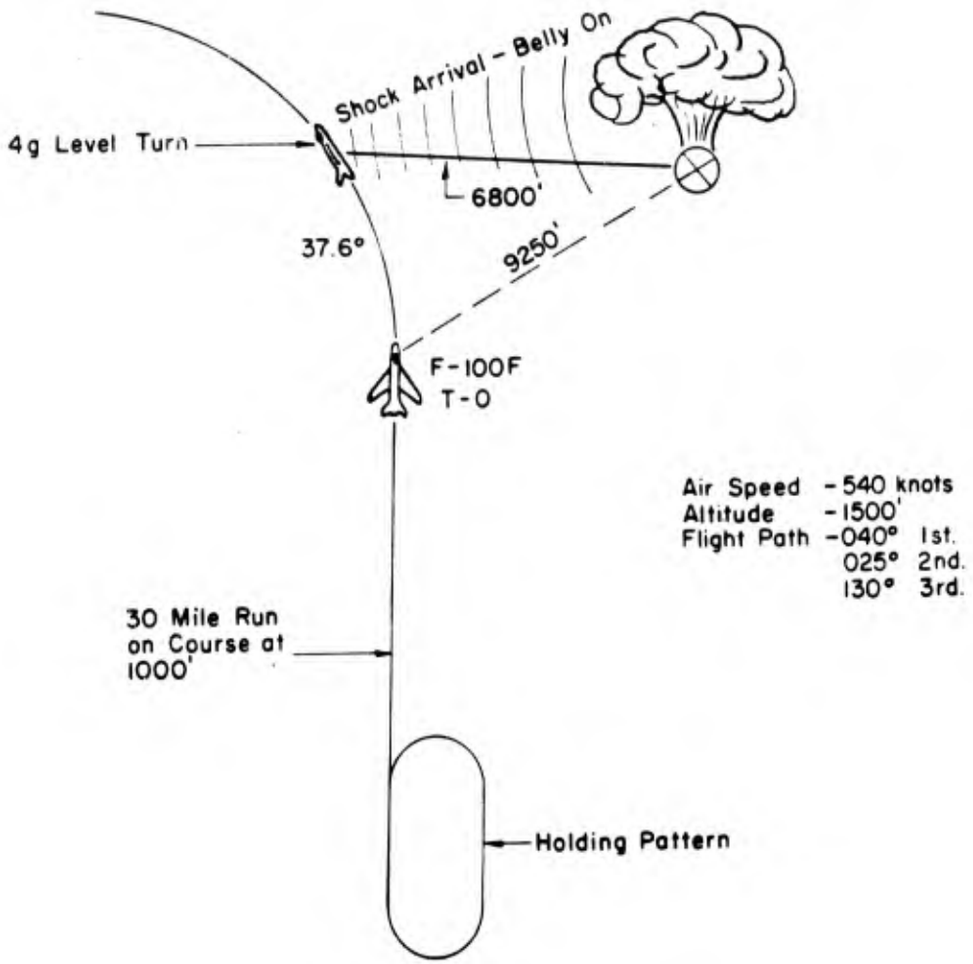


Figure 4.16 F-100F project, Shot Small Boy.

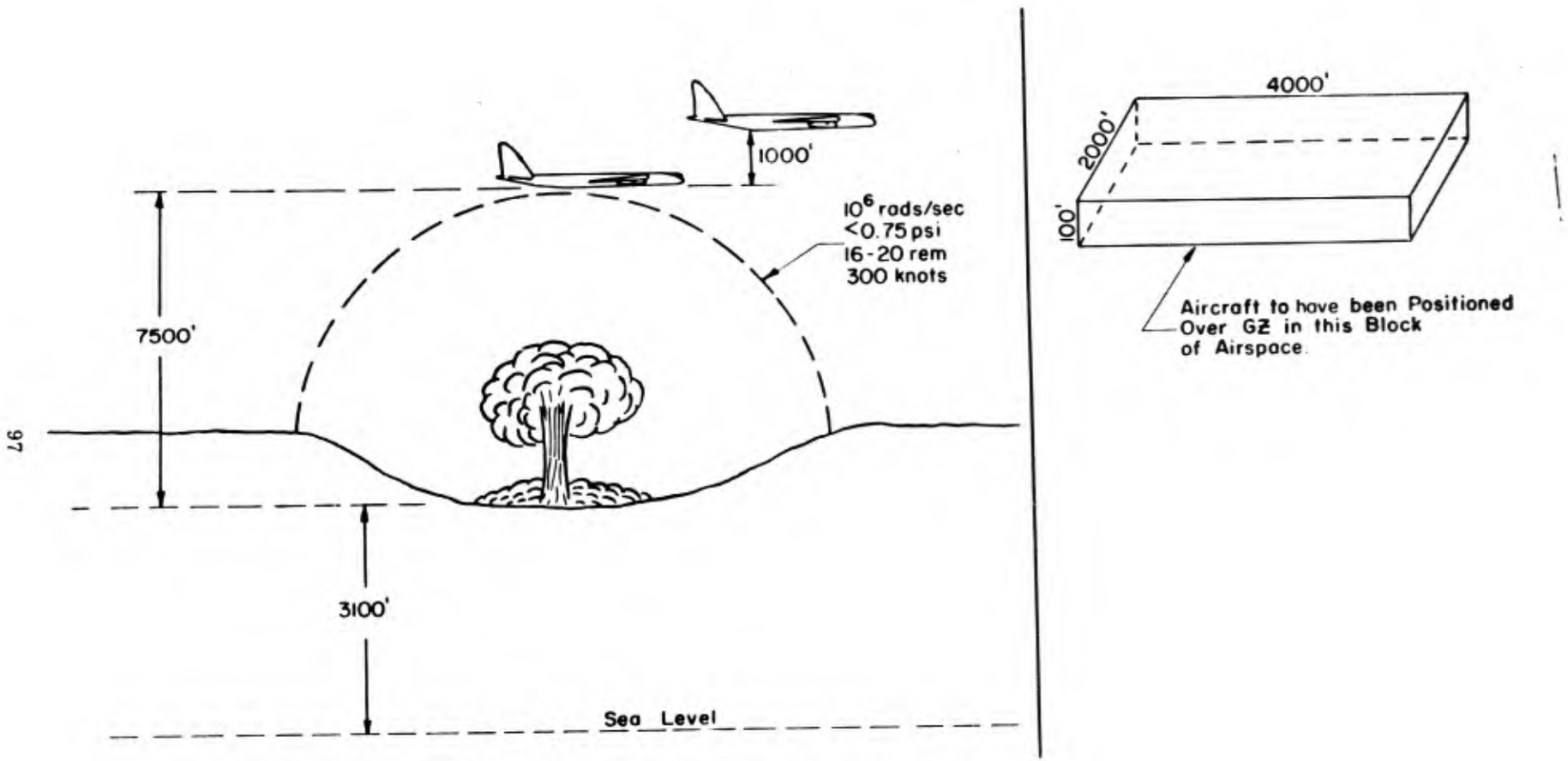


Figure 4.17 B-52/GAM-77 project, Shot Small Boy.

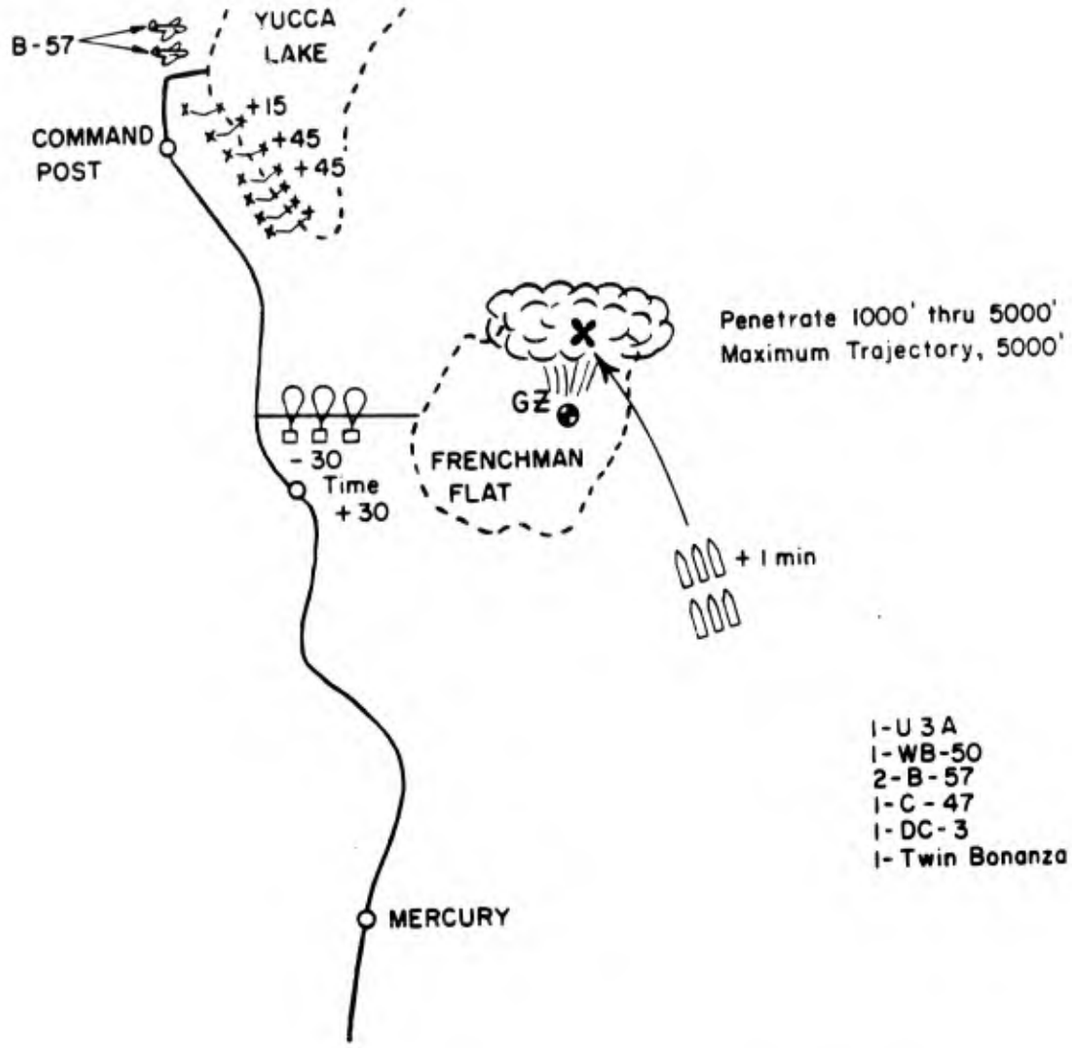


Figure 4.18 Aircraft and rocket operations, Shot Small Boy.

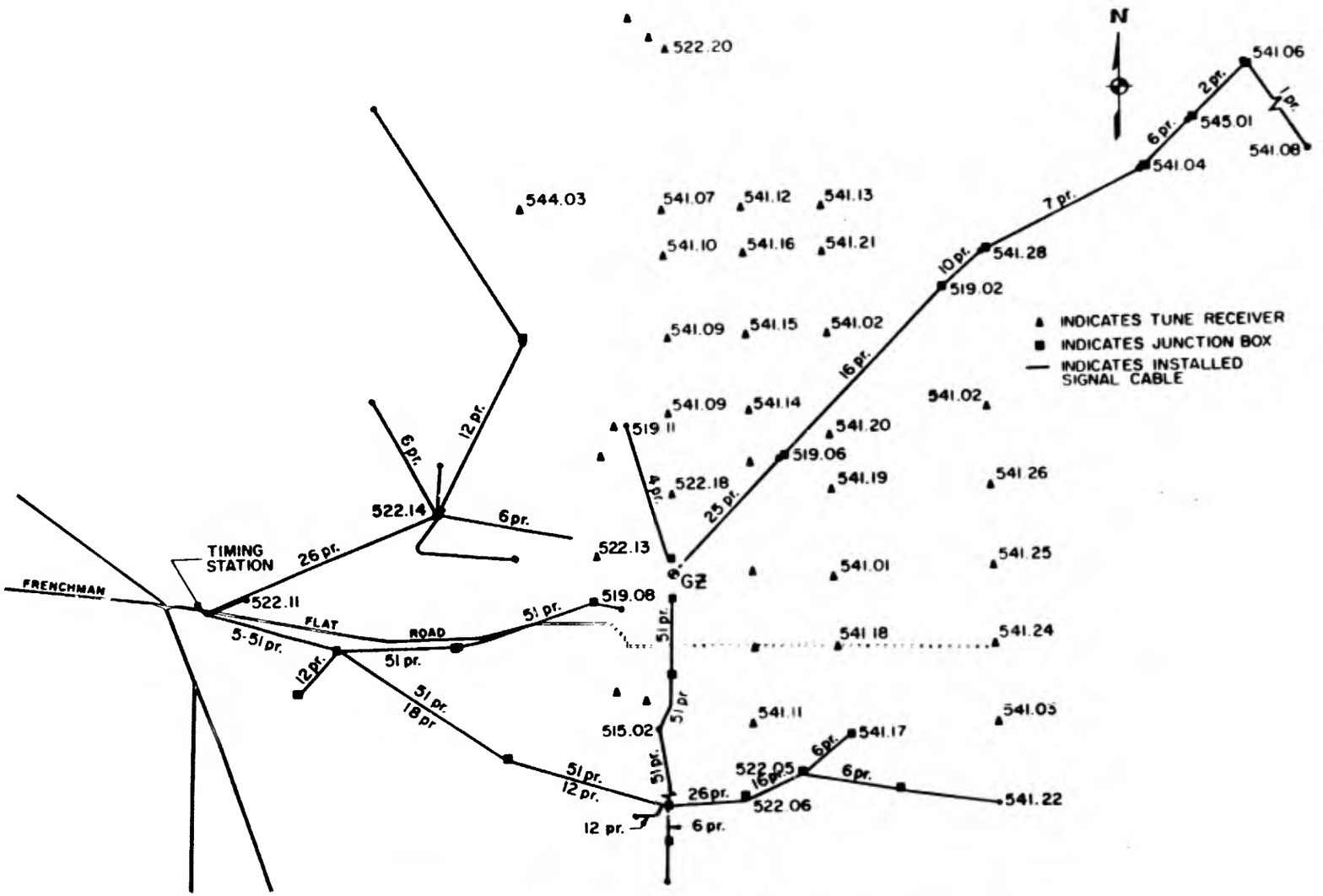


Figure 4.19 Complete timing signal layout, Shot Small Boy.

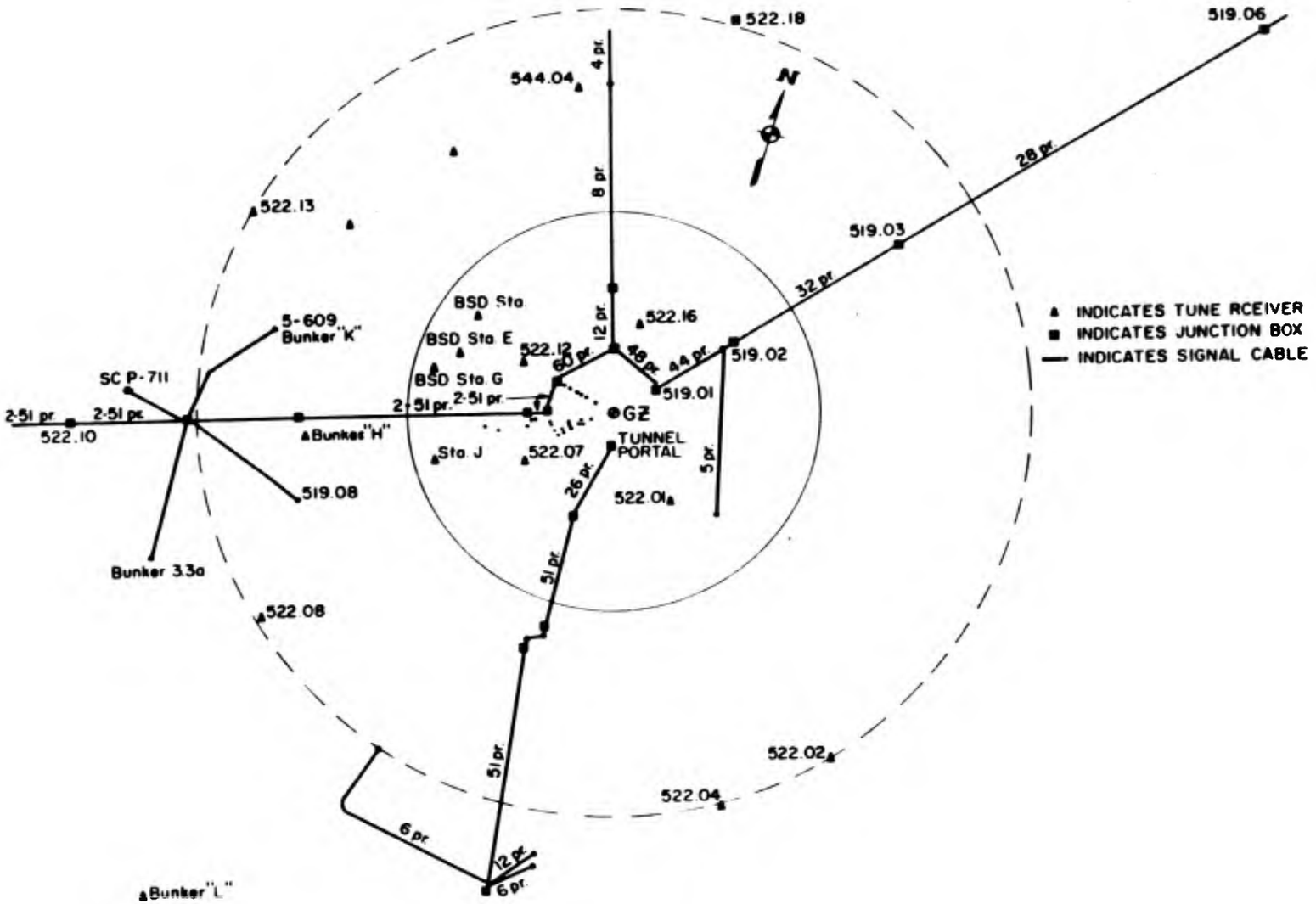


Figure 4.20 Timing signal layout, 2,000-foot radius, Shot Small Boy.

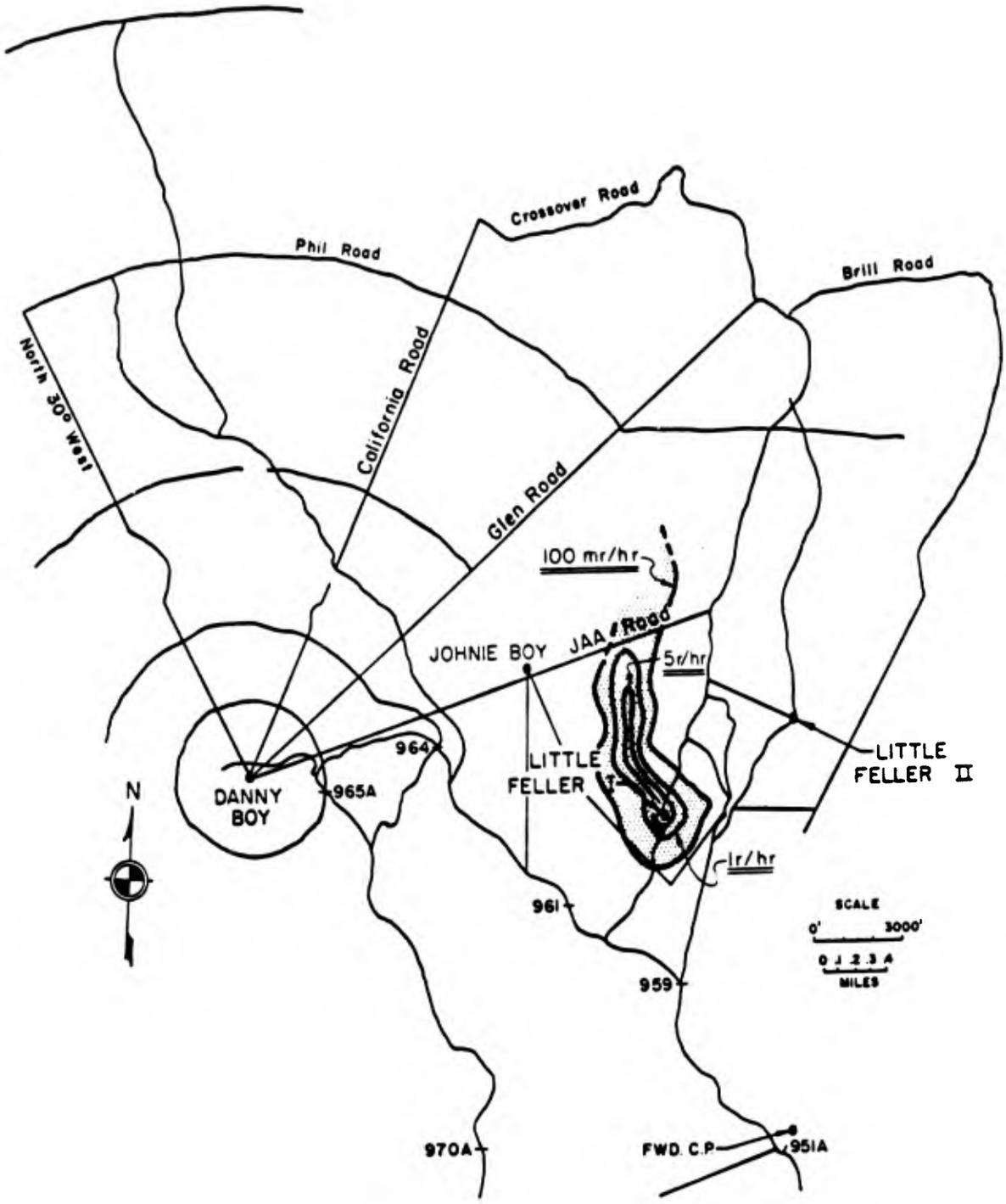


Figure 4.21 Radiological survey, Shot Little Feller I, H+1 hour.

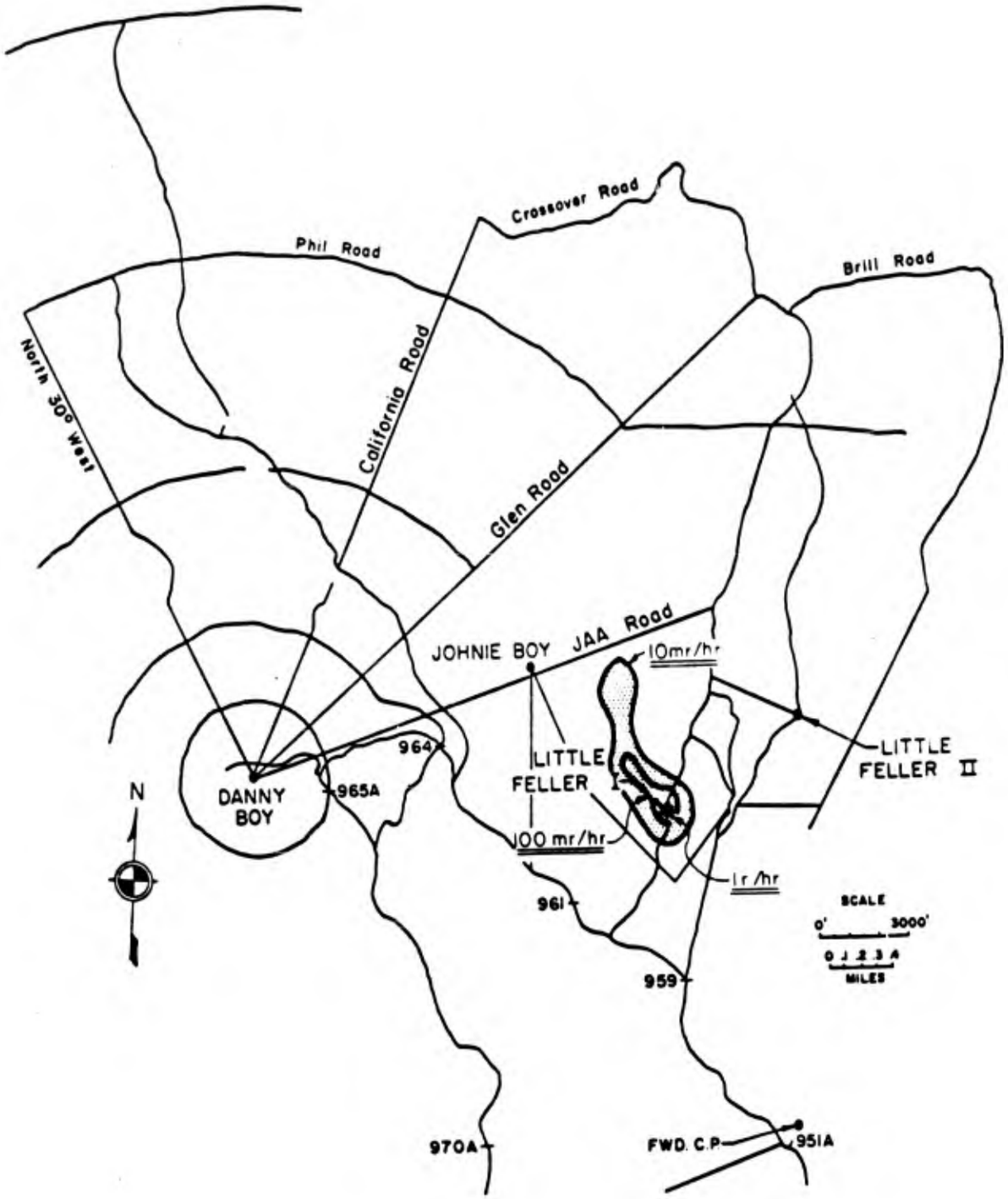


Figure 4.22 Radiological survey, Shot Little Feller I, D+1 day.

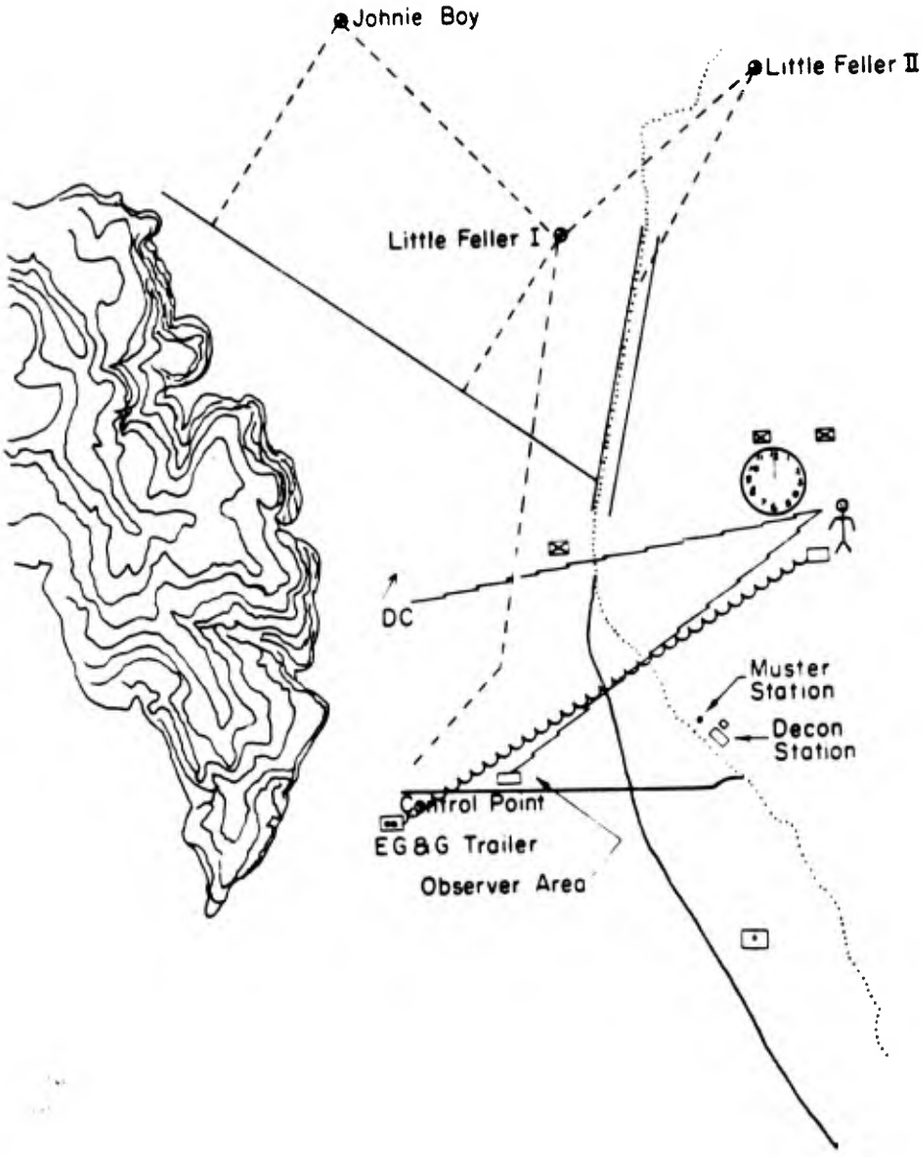


Figure 4.23 Firing procedure, Shot Little Feller I.

Chapter 5

SUPPORT

5.1 MISSION OF SUPPORT DIVISION

The Support Division, CTO, was charged with responsibility for all general logistic support of DOD test operations including but not limited to the following:

(1) Allocation and assignment of office and laboratory space.

(2) Minor new construction to base camp facilities, including addition and extension to utilities.

(3) Modification and alteration to real property in base camps as required to meet needs.

(4) Maintenance and repair of support facilities.

(5) Arranging for adequate housing and the assignment of personnel thereto.

(6) Providing or arranging for all general support equipment required.

(7) Providing, maintaining, and operating an adequate vehicle fleet to support field test operations.

(8) Maintaining and operating a supply and procurement activity responsive to the needs of the DOD Test Organization and adequate to meet its requirements.

(9) Maintaining and operating a commercial transportation activity to receive and process all incoming and outgoing DOD shipments, to include on-site project storage to accommodate agency needs.

(10) Maintaining and operating a medical dispensary for routine out-patient treatment and emergency care, including operation of ambulance services and close liaison with the AEC and local military medical treatment facilities (see Section 2.7).

(11) Within the limit of funds and facilities, providing or arranging for recreation and other services essential to the general welfare and morale of personnel.

(12) Performing such other functions and tasks assigned from time to time.

Specifically excluded mission responsibilities are those matters having to do with:

(1) Engineering and construction in forward test areas and that concerned with the technical and specific support of projects.

(2) Forward area communications and operations relating to timing and signaling.

(3) Functions assigned to other elements of the DOD Field Test Organization.

The Support Division, CTO, consisted of the office of the Director placed over the Las Vegas Branch, so that in effect the OIC of the Las Vegas Branch acted as the Deputy Support Director. The Las Vegas Branch was the only subordinate element of the Support Division.

The Support Division headquarters was manned with 1 officer and 1 enlisted man.

The CTO Support Division Director carried out those staff actions that were essential in providing, in an efficient and effective manner, all general support of the DOD projects participating in weapon test programs. Appropriate authority was delegated to the Support Director to organize, use, and control the facilities, personnel, and funds made available for this purpose.

In most instances, normal military service policies and procedures were followed in performing the logistic functions. The specific and detailed instructions were contained in FCWT directives, bulletins, and CTO SOP's. Because of the interrelationship between AEC and the DOD in providing general logistic services at NTS, many of the DOD procedures were designed to be compatible with the AEC's standing procedures. This was particularly so in the case of supply, transportation, and funding activities where AEC provided considerable support for DOD operations.

5.2 SUPPLY AND PROCUREMENT

5.2.1 Mission. To provide personnel, facilities, and procedures for the rapid and efficient procurement and issue of supplies and equipment required for support of DOD field test operations. Responsible for: receiving, segregating, distributing, and/or storing incoming project agency shipments; receiving and processing outgoing shipments; and indefinite-time, on-site storage of project agency equipment and materials when requested.

5.2.2 Organization. The supply and local procurement mission and functions were performed through the two permanent DOD supply activities, which were a part of the NTS Branch, Support Division, namely, DASA Supply Account HD 1006 established by Field Command Directive 65-31, and NTS Branch Property Book 003 established by the DC/S, Weapons Effects and Tests Group. These are standard Army-type base and unit supply accounts operated under Army Regulations. Both activities are included in the FCWT organization chart as the Supply Section, NTS Br, Spt Div.

5.2.3 Manning. The permanent and peak augmentation manning for 1962 operation at NTS is indicated in Table 5.1.

5.2.4 Operations. The Accountable Officer, DASA Supply Account HD 1006, had the primary responsibility for all supply and procurement operations at NTS. To effectively perform this mission, he was designated an Ordering Officer, i.e., an agent to the Field Command Purchasing and Contracting (P&C) Officer, and he was provided with authority to obligate funds for the Finance Officer, Sandia Base, within specified limitations. These authorities were specific and were delegated by the P&C Officer and Finance Officer directly to the Accountable Officer by name rather than by position.

Under established DASA and DOD policy, the Accountable Officer, HD 1006, was authorized to submit requisitions to any military depot, General Service Administration (GSA) Store or against GSA schedules, and to the cognizant government agency for any item reported surplus.

The Accountable Officer in his capacity as Ordering Officer was authorized to prepare and process purchase orders (SF 44) to local vendors (the Field Command P&C Office determined that Los Angeles was a local source for NTS) for individual purchases not to exceed $250.00. This dual capacity permitted him to place purchase orders (DD 1155) on GSA stores or against GSA schedules without limitation, other than unobligated funds available to him.

Purchase requests were submitted to the Field Command P&C Officer, when it was necessary to place orders on commercial vendors outside the local area or when the purchase was estimated to be over $250.00. Such purchase requests were initiated by the Accountable Officer based upon demands for issue placed upon him.

Paperwork on cargo shipments, both in and out, was processed in the Supply Section offices located in Building 211, a 12,000-ft^2 Butler-type warehouse. Shipping documents were prepared for outbound items, and they were received and processed for inbound shipments. It should be noted that test equipment and other items processed for shipment, either in or out, were not picked up for property accounting purposes. All such items were processed on an intransit basis with accountability remaining with the using (shipping) agency.

Statistical data concerning requisitioning and procurement transactions for the HD 1006 account are not included in this summary report. This information is maintained by the accountable officer for 3 years and by the Field Command Comptroller and P&C Offices. For the most part, this information is contained in the FIA Monthly Stock Management Report and the Monthly Procurement Summary by Purchasing Officer.

The Property Book Unit was the intermediate supply activity extending the supply support out to the separate organizational elements and individuals. Its functions included: receiving and assisting projects with their requests for supplies and equipment; maintenance of informal accounting records for nonexpendable property; operation of the warehousing and storage facilities (the HD 1006 account did not maintain stock balances or stock records; it requisitioned only when a demand was placed upon it and issued the item immediately upon its receipt); inventory, management, and requisitioning to maintain stocks of commonly used expendable supplies; and providing personnel and equipment to assist in the movement of furniture and equipment between storage facilities and locations of use.

A significant aspect of the property book operation involved the stockage and maintenance of office furniture and equipment, to outfit approximately 40,000 ft^2 of office and laboratory space. During the 3-year lapse in major field test operations, office furniture and equipment inventories at NTS were reduced through inspection and administrative condemnation of broken, damaged, worn, obsolete, and otherwise uneconomically repairable items, which were turned in to salvage. These actions were beneficial in purging inefficient and useless items from the supply system so that the remaining items represented a pure inventory of useful equipment. As the plans and requirements for test programs became more firm in the early part of 1962, it was determined that office furniture and equipment on hand were grossly short of needs. The principal items short were: typewriters, desks, tables, safes, file cabinets, chairs, drafting tables, and drafting equipment. Additional quantities of all of the above, except for drafting tables and equipment, were purchased through the HD 1006 account from GSA stores or schedules. The drafting items were procured from commercial vendors. Total funds expended for this property exceeded $20,000.00, and was prorated to the several separately funded programs being conducted. This property was retained at NTS to support future operations.

All of the supporting services at NTS, except pay of personnel, travel and per diem, were funded by obligation authority and reimbursable orders (EAO) placed on the Albuquerque Operations Office (ALOO), AEC, for support by its contractors. All of the records essential to control the commitment and obligation of authorized support funds were maintained by the Accountable Officer, HD 1006 account. Table 5.2 gives the overall costs for AEC contractor and direct DOD support for CY 1962.

5.2.5 Policies and Procedures. The specific and detailed policies and procedures for operation of supply activities at NTS were contained in FCWT Directive 60-4. Supplementing instructions for project agencies were contained in the 60 series, FCWT CTO SOP's, and in FCWT bulletins.

The basic supply policy was one of minimum stocks with a responsive and expeditious procurement and issue system. This policy provided a basis for efficient and effective supply support operations and proved to be highly satisfactory in meeting the many and varied short-notice demands generated by the test programs.

Prestocked items were maintained in the property book activity. These were limited to commonly used office supplies, materials, machines, equipment, and furniture essential for general support of all participants. Since the motor vehicle fleet was principally one of commercial types, it was advantageous to keep a very limited stock of expendable spares, and to purchase stock replacement and other items from commercial vendors as they were needed. Biweekly purchasing trips to Las Vegas were adequate to meet all the usual and normal demands for issue.

5.3 TRANSPORTATION

5.3.1 Mission. To provide personnel, facilities, and procedures to operate the following activities:

Commercial Transportation. To prepare and issue Government Bills of Lading for outbound cargo shipments; receive, inspect for damage, identify, and complete the paperwork and documentation on inbound cargo shipments; prepare and issue transportation requests for persons authorized official travel; report shipping requirements to and obtain routing orders from the Defense Traffic Management Service (DTMS); make reservations for passenger travel by commercial conveyance; and coordinate all phases of DOD cargo and personnel movements into and out of NTS.

Motor Pool. Maintain a base pool of general purpose and selected special purpose vehicles to support field test operations; provide and operate additional vehicles from loan and rental sources as required to meet needs; establish and provide control of vehicle use through review of requirements, and by implementing sound dispatch, operator licensing, and indoctrination procedures; and maintain and operate a service station and tire repair facility.

Vehicle Maintenance. Maintain and operate shops to perform field-level maintenance on assigned and on-loan DOD vehicles; provide and operate complete lubrication facilities; by inspection and through other quality control techniques, insure that efficient and effective maintenance procedures were used and that satisfactory standards of safety and serviceability were maintained; coordinate activities with the motor pool to insure proper service and maintenance on vehicles rented or on loan from the AEC or leased from commercial sources; and arrange for repair or overhaul of vehicles by commercial firms, when the work required exceeded the capability of assigned personnel and/or facilities.

Electric Power Generators. Maintain an inventory of gasoline and diesel-engine-driven electric power generators ranging from 0.5 to 75 kw in output and providing a wide selection in voltage, phases, wires, cycles, and control of electric output characteristics; review and validate electric power requirements from test projects; determine when it was necessary to buy, rent, or borrow generators to meet established requirements; arrange for personnel equipment, and vehicles to move generators to and from shot sites; and provide or arrange for the routine servicing, maintenance, and repair of generators.

5.3.2 Organization. The transportation activities were carried out by the permanent Transportation Section, NTS Branch, Support Division, Mercury. Nevada. The four

elements of the Transportation Section were organized along standard U.S. Army and Air Force lines and consisted of: (1) Commercial Transportation, (2) Motor Pool, (3) Vehicle and Equipment Maintenance, and (4) Power Generator Unit.

5.3.3 Manning. A summary of the permanent and peak augmentation manning of the Transportation Section, Mercury, Nevada for the 1962 operations is given in Table 5.3.

5.3.4 Commercial Transportation Operations. Commercial transportation operations were conducted from the office located near Building 211, Mercury, Nevada. Inbound and outbound cargo was handled jointly by the transportation NCO who prepared and/or processed the transportation documents, and the supply warehousemen, who operated the forklifts and other handling equipment and assisted with packing, crating, counting, and inspection of cargo shipments. One enlisted transportation specialist assisted by one clerk-typist managed the commercial transportation activities during the first half of 1962. During the buildup for the Ivy Flats exercise and continuing through the Sun Beam rollup operation, one additional specialist was assigned to help with the additional workload. These three enlisted men handled the weapon test workload generated by the projects and provided much assistance to the Ivy Flats logistic staff. It should be noted that the Sixth Army performed all the staff planning for movement of their personnel and equipment into and out of NTS. The Exercise Headquarters had its own transportation officer, but he relied heavily upon the Field Command personnel to provide advice and to furnish direct assistance in implementing transportation movements. The Field Command, Staff Traffic Manager, FCLG, was especially helpful during retrograde shipments of the Ivy Flats impedimenta and personnel, and spent 3 weeks at Camp Mercury for this purpose.

A summary of the DOD Commercial Transportation activities at the Nevada Test Site for 1962 is given in Table 5.4.

5.3.5 Motor Pool Operations. All DOD motor vehicle operations were managed and controlled through the Las Vegas Branch, Support Division, Motor Pool located at Camp Mercury. Because of the limited dispatch and service station facilities and because of projects' operational requirements, most of the fleet was controlled by weekly dispatch. This permitted program directors and project officers full authority to use their assigned transportation on a 24-hour, 7-day-week basis as they deemed necessary to perform their jobs. It insured that the Motor Pool would have an opportunity, at least weekly, to inspect, service, and schedule vehicles for any essential maintenance and repair. As a rule the system was effective but did present at least two significant disadvantages: (1) Some projects with large numbers of vehicles had long periods when they did not have any operational requirement for all of them. Vehicles thus dispatched were, as a practical matter, lost to the Motor Pool Officer to meet short-term transportation needs. (2) Weekly dispatch placed an additional responsibility on project and program officers, who were already heavily burdened with their technical tasks, to insure that their vehicles were not misused or abused in operation or for lack of proper servicing.

The advantages gained by having vehicles always immediately available to the projects and the considerably fewer men needed to handle vehicles on weekly versus daily dispatch outweighed the disadvantages. It is, therefore, recommended that similar procedures be used for future operations.

Planning to determine the overall vehicle requirements was complicated by the short time frame and the fact that shots, programs, and projects were continually added even after the original test and support staff and operating personnel had moved to the field.

Even more critical than planning under these adverse circumstances was locating suitable sources that could provide vehicles in the short time available. An adverse factor, which had a great impact on the AEC NTS Organization's capability to meet part of the DOD vehicle requirements, was the starting of concurrent overseas testing. The immediate effect was the withdrawal of vehicles tentatively allotted for DOD use, and a reduction of NTS vehicles due to overseas shipments. The major part of the problem of supplying vehicles was finally resolved by coordination between the AEC, CHDASA, and the Chief of Naval Operations. The Navy was carrying a considerable inventory of 4 × 2 and 4 × 4 pickup trucks as emergency reserve, which it desired to up-date. Several hundred of these were purchased by the AEC and used at either the Nevada or overseas test sites. This was the means by which the AEC acquired sufficient vehicles to provide 155 at NTS for use on DOD programs.

During the moratorium on nuclear weapons testing, several studies were conducted on the most economical size and type of vehicle fleet to be maintained by the DOD at NTS. The conclusions reached indicated that only limited numbers of 4 × 4 vehicles would be needed for future tests. As a direct result, approximately forty 4 × 4 tactical vehicles were excessed and removed from the DOD NTS fleet during 1960 and 1961. These conclusions proved to be erroneous and with the short notice and rapid implementation of Small Boy, Marshmallow, Johnie Boy, and Little Feller, this type of vehicle was in extreme short supply. Some twenty 4 × 4 vehicles were rented from the AEC to meet part of the Small Boy requirements. Additional 4 × 4 types were furnished by participating DOD projects. When Johnie Boy and Little Feller were approved for implementation, on even shorter notice than Marshmallow and Small Boy, the AEC could not meet the DOD's additional needs for 4 × 4 vehicles. The DOD Support Director made limited inquiries to Las Vegas and Los Angeles commercial vendors and to the GSA for assistance, with negative results. These agencies did not maintain or have procurement sources that could provide large numbers of vehicles on less than 60- to 90-day notice. It should be noted that the maximum peak requirements were raised by two factors: (1) addition of unrelated events, and (2) slippage in the Marshmallow and Small Boy shot dates, so that operational requirements were concurrent or overlapping.

The problem of providing additional 4 × 4 vehicles was resolved by going through military command channels to the Department of the Army for assistance. The Field Command and Chief DASA logistic staffs, Office of the Chief of Ordnance, and the Army's Red River and Rock Island Depots provided excellent and rapid response to our request. In approximately 2 weeks, forty, Code I, tactical reserve vehicles were removed from storage and shipped to NTS. Red River supplied thirty ¾-ton, M37 weapon carriers, and Rock Island supplied ten ¾-ton, M43 field ambulances. These were furnished on 90-day loan under agreement that DASA would bear all shipping costs and the costs to return the vehicles to Code I status. The average shipping and depot maintenance costs per vehicle were just over $1,000.00 or about $350.00 per month. The ten ambulances and twenty of the weapon carriers were returned to Pueblo in October 1962. The Army agreed to extend the loan on 10 weapon carriers for an additional 180 days for continued use at NTS.

As mentioned earlier in this summary, several comprehensive studies were made concerning the size and type vehicle fleet most economical and suitable to meet the DOD NTS mission. Through these it was concluded that a base fleet of approximately 150 vehicles should be maintained, and that additional quantities to meet peak workloads should be rented or leased. With the overlapping Vela-Uniform, Nougat, and Sun Beam events, the maximum requirements peaked at about 465 vehicles. These were met through: use of the permanent DOD NTS fleet, augmented by FCDASA excess; leasing from AEC NTS

resources; borrowing from DOD resources; leasing from commercial resources through the AEC Support contractor; leasing by civilian agencies, specifically for performance of their DASA contract; and use of DOD vehicles furnished by military agencies for performance of their projects.

The decision to maintain a base fleet of approximately 150 vehicles at NTS is considered valid, from a practical and economical point of view. This will provide adequate general and special purpose vehicles to meet the continuing workload, and to provide a base for support of major operations. In this regard and in consonance with DOD policy as stated in AR 58-1 (AFM 77-1), it is recommended that civilian agencies be requested to furnish vehicles for the performance of their contract, when DOD vehicles are not available. FCWT CTO SOP 50-8 was published in May 1962 to provide procedures to implement this policy. Its maximum effectiveness was greatly reduced, because most of the agencies were already in the field and other resources had been arranged for. However, if advanced planning time will permit compiling overall requirements, so that agencies can be advised to furnish their own vehicles, advantages will accrue to DOD.

(1) A wider base for obtaining the required types of vehicles is provided, thus more supplies are involved and the limited agency demands can be met.

(2) FCDASA would not have to maintain a large fleet that would tend to become obsolete, present a high inventory cost, and result in a high cost of maintenance both in storage and in use.

(3) Projects would be assured of late model, maintenance-free transportation.

(4) DOD maintenance cost during peak operations would be drastically reduced.

(5) Rental and leasing rates are generally much cheaper at locations other than Las Vegas and NTS.

(6) Agency-furnished vehicles provide a means for moving personnel and things between home plants and the test site. And, such vehicles can be used in these isolated locations to provide agency personnel transportation for morale and welfare purposes.

A recapitulation of the peak motorized vehicle inventory by type and source is given in Table 5.5. Table 5.6 is a typical daily motor vehicle status report used during 1962. Table 5.7 lists the special purpose and special use vehicles in the DOD NTS Motor Pool.

It was essential to provide gasoline and oil servicing facilities at forward area locations because of wide dispersion of activities, weekly vehicle dispatch system, long periods of continuous work at shot sites, establishment of living camps at job sites, and the necessity for keeping personnel and equipment on the job to meet high-priority work schedules. Two means were employed to meet this requirement. (1) In Area 16, a 600-gallon fuel servicing trailer was set up and operated by the Marshmallow program. Resupply of gasoline and oil was provided through the DOD Motor Pool at Camp Mercury. This facility provided the bulk of the DOD forward area refueling. (2) Occasional refueling for DOD agencies operating north of Frenchman Flat was provided by reimbursable work order to REECO. A price of approximately 20 cents per gallon was negotiated for delivery of fuel to such forward area stations as: CP-1, Yucca Flat, and Area 12. These two means proved to be adequate and effective in fulfilling this requirement.

Refueling and servicing of vehicles operating out of Camp Mercury were provided at the DOD Motor Pool on a 24-hour, 7-day-week basis.

The Ivy Flats exercise organization operated its own motor pool and service station activities in Areas 12 and 16. The Field Command Support Unit provided assistance by establishing a reimbursable order with the local vendor for delivery of gasoline. Oil and lubricants were obtained from quartermaster supply depots and brought to the test site by the exercise units.

5.3.6 Vehicle Maintenance Operations. Complete field maintenance shops were operated at Camp Mercury by the NTS Branch, Support Division, for the routine inspection, maintenance, repair, and lubrication of DOD-assigned, borrowed, and project-furnished vehicles. Vehicles obtained for DOD use on a rental basis through REECO were serviced and maintained by REECO facilities. This included AEC-owned, AEC-leased, and short-term commercial rentals.

Major repairs on commercial-type DOD vehicles were handled by contracting on an individual job basis with garages in Las Vegas. Such repairs were limited in number and generally involved body and/or frame work, rather than the engine, power train, or operating accessories.

Limited but expeditious and timely assistance was provided by Fort Irwin and the U. S. Army Tooele Depot in providing spare parts and replacement assemblies for tactical vehicles. For example, Fort Irwin loaned four, M35, 6 × 6 trucks, and provided a replacement engine and transmission, at a time when they were sorely needed for support of Johnie Boy and Little Feller. Tooele accepted a telephone requisition, made up the order, provided special delivery service to a commercial airline, and air-shipped spare parts needed to repair the electric brake system on several M35 trucks.

There were no major problems encountered in the maintenance of vehicles. Minor confusion arose concerning the number of project-furnished vehicles, both DOD and civilian, that were to be maintained and the amount and degree of maintenance they were authorized to receive. These were easily resolved and can be avoided by closer coordination between support and the project agencies to determine and disseminate information on the number and types of vehicles they will furnish and the period of time they will be at the test site. Enforcement of an SOP similar to FCWT CTO SOP 50-8 should resolve most of the problems in this area.

The DOD Vehicle Maintenance Shops were operated on a single-shift basis, with special crews working overtime as required to complete repairs on vehicles urgently needed to meet operational requirements. At other times, standby mechanics were on call to handle emergency repairs on an immediate-response basis. These procedures proved adequate to meet the mission needs and to maintain general high standards of safety and serviceability for the entire fleet. There were complaints; however, almost without exception, these were attributed to the fact that many 8- to 10-year-old vehicles were in the DOD fleet, and these simply could not be restored to and kept in the same trouble-free conditions of new, late model vehicles. This, again, is a reason for adopting a policy of having contractors furnish their own vehicles. The further adequacy of the maintenance provided is substantiated by the fact that there was no backlog of deferred maintenance requiring a major expenditure of man-hours and funds to restore vehicles at the termination of field tests. On release by the agencies, the vehicles were quickly inspected, repaired as necessary, and returned to the Motor Pool for further use as necessary.

Figure 5.1 indicates the obsolescence of the NTS DOD motor vehicles. This situation resulted in excess maintenance and poor reliability.

5.3.7 Power Generator Operations. The power generator requirements and activities associated with the tests showed very clearly that:

(1) The information on electric power characteristics contained in E&R Plans was inadequate to determine exact needs. This generally was limited to total power, voltage, and type of current. Often, only voltage and current or only kw's were shown.

(2) Use of old equipment obtained from DOD excesses and by borrowing from military sources, in general, resulted in inadequate or barely acceptable power resources.

(3) More attention should be given to the job site operating conditions. For example; the most severe conditions of dust and heat were encountered on Small Boy, thus drastically reducing output performance and life of equipment.

(4) Project personnel were often inexperienced and used improper procedures in starting and operating generators, thus causing damage and shortening the life of equipment; for example, starting and stopping generators while they were under full load. There were other instances when large units (30 and 60 kw) were operated over long periods under conditions requiring only a small fraction of total available output.

(5) Available DOD power generator personnel were too few in number to perform all of the required service and maintenance. This problem was increased by the wide dispersion of equipment in the field and the generally poor operating conditions.

Based upon the above experience, the following recommendations are offered:

(1) Amend the E&R Plan to include a separate detailed, power generator annex.

(2) Give more attention to planning and providing good operating sites by eliminating heat and controlling dust. Small cost in this respect can save equipment and many dollars in servicing and maintenance.

(3) Provide instruction to project personnel in starting, stopping, and operating techniques and procedures. Require that they demonstrate this knowledge.

(4) Have the E&C Branch establish an Electric Power Operations Unit for future field tests. This unit should review and approve all electric power requirements in the light of the overall plans and requirements for testing and job site construction. This unit should work closely with the Support Division to provide specific instructions on procurement of equipment, job siting, servicing, maintenance, and disposition of generators. Responsibility for providing generators and arranging for their servicing and maintenance should remain as a Support Division function.

It should be recognized that Small Boy required unusually large and complicated electric power resources. There were over 40 power generators sited in and around Frenchman Flat, and many of these required removal a short time before the shot. As previously mentioned, the extreme conditions of heat and dust affected their performance and resulted in frequent and serious breakdowns. These problems very rapidly outgrew and exceeded the DOD Support Unit's capability of resolving them with its assigned personnel and available backup equipment. A solution was eventually provided through four principal actions:

(1) An Electrical Engineering Officer was assigned to the E&C, CTO, and given full responsibility for management of all Small Boy power generators.

(2) Arrangements were made with LRL to borrow a limited number of large generators to replace DOD units that needed maintenance.

(3) Arrangements were made with REECO to provide additional replacement and backup generators on a reimbursable basis.

(4) A reimbursable work order was arranged with REECO to provide 24-hour, 7-day-week servicing and maintenance on approximately 30 generators connected with the most important projects in the Frenchman Flat area.

The above actions were essential to the performance of Small Boy and made it possible for the six men assigned to the DOD Generator Unit to provide essential support on the several other concurrent programs.

Tables 5.8 through 5.10 indicate the status of DOD generators at NTS during 1962.

As a result of the experience gained in connection with providing and operating power generators, it was agreed that the entire DOD inventory should be inspected by qualified technical personnel to determine which units should be retained and which should be salvaged as uneconomical or otherwise unsuitable. This action was accomplished by E&C

Division, Field Command Logistics Group, from 30 July to 11 August 1962. Critical and detailed inspection resulted in disposal of 32 generators. Specific recommendations were made concerning the modification and repair of six 60-kw Caterpillar generators and the useful life retention of other units.

5.3.8 Transportation Policies and Procedures. The 50-series FCWT Directives, Bulletins, and CTO SOP's provided the principal policies and procedures under which transportation and related activities were performed. In general, these are established publications and continue in force from year to year with revision as required to keep them current and in consonance with overall testing and support concepts.

5.4 CAMP SERVICES

As part of its mission, the Support Division provided or arranged for normal camp services for all DOD-sponsored personnel and projects, consistent with their needs and the resources available.

These functions were performed or managed through the Las Vegas Branch and its subordinate operating elements. Two exceptions were housing and ground safety; separate elements were designated and assigned these tasks under supervision of the OIC, Las Vegas Branch, because of their importance and the significant workload involved.

The total manning for those functions involved additional duty of personnel assigned throughout the Support Division, particularly the Las Vegas Branch. Therefore, only those positions primarily concerned with these services and not otherwise included in this summary are shown in Table 5.12.

5.4.1 Housing. The providing of adequate, suitable housing for DOD personnel was identified by the AEC as a major problem, sufficient to prevent essential support of the scheduled Nougat and Dominic series and other concurrent programs. Coordinated effort between FCDASA and ALOO was successful in bringing this matter to the attention of CHDASA and the AEC Washington offices for speedy resolution. The principal factors involved were: (1) the need for housing for approximately 1,000 DOD personnel, (2) housing which could be provided quickly, (3) housing which could be located adjacent to work areas to reduce portal-to-portal costs in an extremely high wage area, and (4) housing near job sites to permit longer on-the-job time and increase the effectiveness of management personnel.

Most of the above requirements were met by rental and erection of prefabricated, modular, trailer camps. A 400-man camp was located in Area 16 and used initially and primarily for Marshmallow (Figure 5.2). A 600-man camp was sited in Area 5 for support of Small Boy. These camps were funded and set up by the AEC under its responsibilities assumed by the AEC-DOD agreement for use of NTS (Appendix C). They were supplied under contract to the AEC by Northland Camps Incorporated, a Canadian firm. Northland was the successful bidder in competition with four or five U.S. suppliers, who responded to invitations for bids made by REECO through its Las Vegas Procurement Office. Authority to import the camp facilities (10- by 50-foot trailers) was provided by the DOD, which certified their need as vital to the defense programs. Further, in this regard FCWT was designated to prepare the customs release documentation required to secure entry of the trailers into the United States from Canada.

There was some minor contention between the DOD and the several AEC contractors concerning the allocations of housing in Camp Mercury. The DOD was allotted 150 beds of the 2,082 available for male personnel. This condition required approximately 50

officers and enlisted men to be billeted in the Area 5 camp, even though their principal duty station was in Camp Mercury. This arrangement caused minor complaints concerning transportation to and from Area 5, lack of a theater, and limited recreation facilities in Area 5. On the other hand, those who lived in Area 5 enjoyed an excellent mess hall and comfortable, quiet quarters.

Another housing problem resulted from the decision to perform the Ivy Flats exercise. The Army planning staff came to NTS in May 1962, prepared to bring personnel and equipment to set up complete field housing and messing under tents. This idea was dropped in favor of using available facilities in Areas 12 and 16, augmented by use of Desert Rock for housing only. In Area 16, 150 beds were allocated for the Ivy Flats headquarters and control group. In Area 12, 725 beds were allocated for field exercise troops. Approximately 200 beds were reserved at Desert Rock for logistic and air support personnel.

Because of the limited available housing at NTS, senior visiting officers and other notable persons were encouraged to stay in Las Vegas, when their duties required that they remain overnight in the area. This means was used exclusively for the large observer group present for Ivy Flats. Thirteen air-conditioned commercial buses were leased through REECO from the Las Vegas-Tonopah-Reno (LTR) Bus Company to transport this VIP group between Las Vegas and Area 18.

Table 5.13 shows the DOD projected maximum population for NTS in April 1962. These figures were developed from E&R Plans. Table 5.14 gives the projected DOD housing requirements for June through August, as of 1 June 1962. Table 5.15 shows allocation and use of Camp Mercury housing for DOD personnel, as of May 1962. Table 5.16 shows total available housing in Camp Mercury by type of facility, May 1962. Shown in Table 5.17 is a typical daily DOD Housing Report.

5.4.2 Messing. All feeding at NTS was operated by REECO. Personnel were required to pay for their meals as taken. Mess halls were operated in all the major camp sites, and mobile messing facilities were provided at temporary job sites as required.

Most DOD personnel took their meals in one of three dining halls, depending on locations of billets and working areas. The dining halls were in Mercury, Area 5, and Area 16. Meals were served a la carte; they were generally of excellent variety and quality but were fairly expensive.

The AEC permitted REECO to enter into an agreement to feed the Ivy Flats exercise troops living in Area 12 (and dining in that mess hall only for control purposes) at a flat rate of $1.25 per man per meal. Persons thus authorized to be fed were provided with an identifying mark on their badges. They were required to eat at specified times, and a joint Army-REECO headcount was taken as the basis for determining the charges to be made. In addition, the Area 12 mess hall provided individual sack lunches, when troops were to be in the field.

Exercise personnel living at sites other than Area 12 were required to pay for their meals individually as taken. The principal reasons for contracting to feed the field exercise troops (as opposed to the exercise headquarters, logistics support, evaluation and control, and air support personnel) were: (1) they could be easily controlled in large units, (2) they were isolated, and (3) it eliminated any problems that would have arisen if individuals had been required to carry sufficient personal funds to cover their major expense.

5.4.3 Office and Laboratory Space. The primary objective was to provide adequate office, laboratory and shop space for the DOD Test Organization and the participating agencies.

FCDASA owned and controlled 32,640 ft^2 of office and laboratory space, in 34 quonsets located within the DOD compound at Camp Mercury. These facilities provided the principal source for meeting the test organization's and the projects' needs. The Las Vegas Branch, Support Division, occupied 12,000 ft^2 in three Butler buildings, which were a part of its permanent facilities, used for offices and warehousing. The Motor Pool, located adjacent to the warehouses, was equipped with adequate vehicle maintenance shops, lubrication equipment, service station, and other essential supporting facilities.

Because of the magnitude of the several concurrent DOD programs being conducted, there was not adequate space in the DOD compound for all requirements. Three principal actions were taken to resolve this problem. (1) AEC contractors were requested to relinquish a number of DOD quonsets that had been loaned to them. (2) All available space was reviewed and continually monitored to assure its full use. (3) Twelve office trailers were obtained on either a lease or maintenance-cost basis depending upon whether they were leased or owned by the AEC. Five of these were used to provide additional space for the CTO and were located adjacent to the DOD quonsets. Seven trailers were spotted adjacent to quonsets used by the projects to provide them additional space.

The total available space in the compound was 36,990 ft^2, 32,640 in quonsets and 4,350 in office trailers.

Additional office space was provided at forward area job sites by using 16 house trailers (average size 8 by 26 feet) obtained from DOD excesses at Fort Carson, Colorado, and Desert Rock, Nevada. These were obtained at no cost, other than shipping, and they proved very useful. They provided temporary forward area office space for Small Boy, Hard Hat, Marshmallow, Johnie Boy, and Little Feller.

The Marshmallow Program arranged for and had established its own work camp located in the tunnel portal area. For the most part, it consisted of seven 10- by 55-foot office trailers leased from the AEC, twelve M242 van trailers obtained from DOD excess, plus three or four shop trailers provided by project agencies.

Ivy Flats required extra office space, which was not available at the time plans were being made for its execution. The AEC agreed to lease eight additional 10- by 55-foot office trailers, and these were delivered between 25 and 29 June 1962. The exercise headquarters was located adjacent to the Area 16 housing camp to take advantage of existing communications, power, water, sewerage, and other essential facilities. In addition this location provided easy access to quarters and messing facilities and to Area 18 where the exercise was conducted.

In the summer of 1962, a $25,000.00 project was approved and funded through CHDASA to move five 20- by 48-foot quonsets from Desert Rock and one from Frenchman Flat to the DOD compound at Mercury. These were obtained from the Army at no cost to DASA. They represented a partial replacement for Building 200, a 7,000-ft^2 structure that was condemned and razed in 1961.

5.4.4 Facilities Maintenance. Maintenance of both permanent and temporary camp facilities required for support of CTO was funded and performed by the AEC, under terms of the AEC–DOD agreement for use of NTS (Appendix C). Minor alterations, modifications, and improvements to DOD facilities were funded by FCDASA.

Maintenance of facilities included the following services funded and performed by the AEC: (1) scheduled trash collectors for all areas, (2) janitorial services for all office facilities, (3) periodic outside policing of living and office areas, (4) fire and safety inspection and availability of fire fighting equipment and personnel at all times, and (5) installation, removal, or relocation of telephones.

5.4.5 Laundry and Dry Cleaning. The unit supply activity, Las Vegas Branch, Support Division, operated a laundry and dry cleaning pickup and delivery service. Cleaning was taken to a commercial firm in Las Vegas for processing, whereas laundry was taken to the government facility at Nellis or to a commercial firm, depending upon the desire of the customer. All transactions with the military laundry and commercial firms were conducted on a cash basis.

To permit operation on a cash basis, the enlisted man assigned this duty used his personal funds to pay for the services rendered, and then collected from customers at the time they picked up their clothing, to reimburse himself. Although the use of personal funds was recognized as an undesirable feature in this system, no suitable alternative could be found. Nevertheless, the system did eliminate the need for maintaining an operating fund (for which there was no legal basis), and it reduced the possibility of losses due to carelessness or indifference on the part of DOD personnel assigned to provide this service.

In addition to the above service, washing machines, driers, and electric irons were available at Camp Mercury to all personnel at no cost. One washer and drier were located in the men's latrine in the DOD compound, and REECO maintained several units in a small building adjacent to the 500-series dormitories.

5.4.6 Morale and Welfare. Recreational facilities at NTS were limited and for the most part were operated by REECO; however, they were available to all DOD personnel. Two AAFMPS theaters were operated by the DOD, one each in Camp Mercury and Area 12. Other facilities included recreation halls providing snack bars, beer, pool, table tennis, shuffleboard, television, and card tables; a joint AEC-DOD library; horseshoe pitches; softball diamonds for both players and spectator participation; outdoor basketball and volleyball courts; and limited indoor facilities for physical training, such as weight lifting.

The above morale and welfare facilities were augmented by scheduled weekly bus service to Indian Springs, where arrangements were made to use the military facilities, and to Nellis and Las Vegas for weekend shopping. Several bus trips were operated to areas of interest near NTS, such as Hoover Dam and Lake Mead.

Projects were permitted to use their assigned transportation for trips to Indian Springs to shop in the PX and Commissary and to get haircuts. These were authorized by the project and program officers and were controlled by issuing one-time off-base trip tickets.

CTO personnel from the Albuquerque area were permitted to use the air shuttle to visit their families, when they could be spared from their duty sections, and provided seats were available.

All personnel were authorized to use the military tieline between NTS and Sandia Base during nonduty hours. This, perhaps, proved to be the most important single service in the maintenance of good morale.

TABLE 5.1 NTS SUPPORT DIVISION MANNING SUMMARY

	Perm	Augmentation	TDY	Total
Officers	2*		1	3
Enlisted Men	8	5	11	24
Totals	10	5	12	27

* OIC NTS Br had additional duty of Property Book Officer.

TABLE 5.2 STATUS OF SUPPORT FUNDS, 31 DECEMBER 1962

Funds	O/A Number	Funded	Committed & Obligated	Balance
O&M FY 62	11-62-4	44,450.00	44,450.00	0
O&M FY 63	11-63-2	16,000.00	3,880.20	12,119.80
Vela-Uniform	20-62-4	107,150.42	108,428.36	(1,277.94)
X-MIL	26-62-4	75,000.00	66,784.50	8,215.50
Hard Hat (01)	27-62-4	5,000.00	3,976.68	1,023.32
Marshmallow	28-62-4	54,000.00	53,012.61	987.39
Small Boy	30-62-4	30,000.00	33,687.81	(3,687.81)
Danny Boy	31-62-4	5,000.00	2,287.57	2,712.43
Small Boy (07)	32-62-4	11,500.00	5,964.64	5,535.36
Johnie Boy	33-62-4	5,000.00	2,496.56	2,503.44
Little Feller I&II	34-62-4	5,000.00	2,719.85	2,280.15
Ivy Flats	35-63-1	1,500.00	0	1,500.00
Ivy Flats	36-63-2	11,500.00	3,018.36	8,481.64
X-MIL	47-63-2	25,000.00	19,749.74	5,250.26
Small Boy	50-63-2	300.00	0	300.00

Funds	EAO Number	Funded	Expended	Balance
	1105-			
X-MIL	0201-61	63,440.46	66,282.66	(2,842.20)
Vela-Uniform	1275-65	42,788.67	35,378.05	7,410.62
Hard Hat (01)	1249-63	10,000.00	9,339.92	660.08
Marshmallow	1267-61	35,000.00	33,605.17	1,394.83
Small Boy	1346-62	115,000.00	19,487.63	95,512.37
Danny Boy	2025-63	25,000.00	6,728.15	18,271.85
Johnie Boy	2143-64	67,500.00	0	67,500.00
Little Feller I&II	2143-62	25,000.00	0	25,000.00
Ivy Flats	2166-62	11,500.00	0	11,500.00

TABLE 5.3 NTS TRANSPORTATION SECTION MANNING SUMMARY

	Perm	Aug	TDY	Total
Commercial Transportation				
Officers	1*			1
Enlisted Men	1	1	1	3
Subtotal	2	1	1	4
Vehicle Maintenance				
Officers			1	1
Enlisted Men	13	5	7	25
Subtotal	13	5	8	26
Motor Pool				
Officers			1	1
Enlisted Men	1	3	24	28
Subtotal	1	3	25	29
Power Generator Unit				
Officers	0	0	0	0
Enlisted Men	1	1	4	6
Subtotal	1	1	4	6
Total Trans Section				
Officers	1		2	3
Enlisted Men	16	10	36	62
Grand Total	17	10	38	65

* Transportation Officer has responsibility for all transportation activities and operations.

TABLE 5.4 COMMERCIAL TRANSPORTATION SUMMARY

FREIGHT	
Inbound	
Bills of Lading Completed	315
Pounds of Cargo Handled	2,814,374
Prepaid Bills Processed	346
Pounds of Cargo Handled	1,074,687
Military Air Shipments:	
Number of Pieces	128
Pounds Handled	10,494
Outbound	
Bills of Lading Prepared	117
Pounds of Cargo Handled	2,996,118
Military Air Shipments:	
Number of Pieces	16
Number of Pounds	857
PASSENGER	
Transportation Requests Issued	198
Number of Passengers Involved	299
Travel Reservations Made for Holders of Round Trip Tickets	453

TABLE 5.5 MOTOR VEHICLE INVENTORY AT PEAK OF OPERATIONS

	NTS Rental	AEC	Coml	DOD	Loan	Total
MOTOR VEHICLE						
DOD, NTS Motor Pool:						
Sedan	20	2	4	27	0	53
Pickup	13	96	0	84	0	193
Carryall	0	23	0	25	0	48
Panel	0	0	0	9	0	9
Wagon	0	0	0	4	0	4
Jeep	0	1	0	10	0	11
Truck, 4x2	0	0	0	5	0	5
Truck, 6x6	0	0	0	2	4	6
Tanker	0	0	0	2	0	2
Ambulance	0	0	0	4	10	14
Bus	0	0	0	5	0	5
Weapon Carrier	0	0	0	5	30	35
Wrecker	0	0	0	2	0	2
Tractor, 5-ton	0	0	0	3	0	3
Totals:	33	122	4	187	44	390
Non-motorized and materials handling equipment						16
Civilian contractor-furnished vehicles						61
DOD Project-furnished vehicles						23
GRAND TOTAL (ALL SOURCES)						490

TABLE 5.6 TYPICAL MOTOR VEHICLE STATUS REPORT, 6 JULY 1962

PART I ASSETS			PART II ASSIGNED (Part I DOD owned, rented, and loaned, less special purpose)	
DOD-owned		203	Support Group	12
General purpose	164		Test Group	30
Special purpose	39		Visitors bureau	1
DOD-rented		159	Vela-Uniform	17
AEC	122		Marshmallow	16
REECO	33		Small Boy	216
Com'l	4		Johnie Boy	20
DOD loaned		44	Little Feller	12
Contractor Furnished		61	Danny Boy	1
Small Boy	47			
Marshmallow	14			
Vela-Uniform	0		TOTAL ASSIGNED	325
Military Service furnished		23	PART III IN MAINT	25
Small Boy	23		PART IV AVAILABLE	17
Marshmallow	0			
Vela-Uniform	0			
Total Assets	490			

TABLE 5.7 SPECIAL PURPOSE VEHICLES, DOD NTS MOTOR POOL

The following special purpose vehicles are included in the daily motor vehicle status report.

Type	Quantity
Passenger bus	5
Trailer ¼-ton	2
Trailer, 1½-ton	1
Truck, 2½-ton, 6x6	2
Truck, 2½-ton, 4x2	5
Tractor, 5-ton, 4x2	2
Tank trailer, 600-gal	1
Tank truck, 1,200 gal	2
Wrecker, 5-ton, 6x6	2
Forklift, 2,000-pound	1
Forklift, 4,000-pound	2
Forklift, 6,000-pound	2
Trailer, 12-ton	1
Trailer, 6-ton	3
Tractor, 5-ton, 6x6	1
Dolly	1
Semitrailer, tank, gasoline	2
Ambulance	4
TOTAL	39

TABLE 5.8 SUMMARY OF GENERATORS ON HAND

Category	Total Quantity	Maximum Output (kw)							
		75	60	45	30	10	5	2.5	1.5
Pre-Dominic Inventory	33	3	4	0	8	4	11	3	
Gained from DOD Excess	29		1	5	21			1	1
July 1962 FCDASA Inventory	62	3	5	5	29	4	11	4	1
On 180 Day Loan from Air Force	39		7		1	9	12	10	
Total On Hand July 1962	101	3	12	5	30	13	23	14	1

TABLE 5.9 GENERATORS ON 180-DAY LOAN FROM AIR FORCE

Quantity	FSN	Make	Fuel	Output (kw)	Volts	Cycles	Phase	Wire
6	6115-635-3845	Caterpillar	Diesel	60	120/220 208/416	60	3	4
1	6115-235-8683	Buda	Diesel	60	120/220 208/416	60	3	4
1	6115-376-7006	John Reiner	Gasoline	30	120/220 208/416	60	3	4
8	6115-697-2417	Onan	Gasoline	10	120	60	1	2
1	6115-376-7003	Hollingworth	Gasoline	10	120	60	1	2
12	6115-844-2052	PU-286/G	Gasoline	5	120	60	1	2
10	6115-228-5815	PE 75	Gasoline	2.5	120	60	1	2

TABLE 5.10 FCDASA INVENTORY OF POWER GENERATORS, NTS

Quantity	Make	Fuel	Output (kw)	Volts	Cycles	Phase	Wire
3	Buda	Diesel	75	120/240 208/416	60	3	4
4	Stewarts & Stevens	Diesel	60	120/240 208/416	60	3	4
1	Consolidated	Diesel	60	120/240 208/416	60	3	4
5	Cummings	Diesel	45	120/240 208/416	60	3	4
2	International	Diesel	30	120/240 208/416	60	3	4
6	GMC	Diesel	30	120/240 208/416	60	3	4
1	Consolidated	Diesel	30	120/240 208/416	60	3	4
5	John Reiner	Gasoline	30	120/240 208/416	60	3	4
2	Consolidated	Gasoline	30	120	60	3	3
3	Onan	Gasoline	30	120	60	3	3
10	John Reiner	Gasoline	30	120	60	3	3
3	Onan	Gasoline	10	120	60	1	2
1	O'Keefe & Merritt	Gasoline	10	125/250	60	1	2
4	Hollingworth	Gasoline	5	120/208	60	3	4
5	Onan	Gasoline	5	115	60	1	2
1	Sig Corp	Gasoline	5	115	60	1	2
1	O'Keefe & Merritt	Gasoline	5	120/240	60	1	2
3	Onan	Gasoline	2.5	115	60	1	2
1	Lealand	Gasoline	2.5	115	60	1	2
1	Briggs & Stratton	Gasoline	1.5	115	60	1	2

TABLE 5.11 TYPICAL DOD GENERATOR STATUS REPORT, 6 JULY 1962

	kw						
	75	60	45	30	10	5	Under 5
On Hand	3	11	5	29	12	23	15
Assigned:							
Marshmallow	0	1	0	1	0	0	0
Small Boy	2	4	1	11	8	8	8
Vela-Uniform	0	1	0	6	0	0	0
Little Feller & Johnie Boy	0	0	0	0	3	8	6
Total in Use	2	6	1	18	11	16	14
Deadlined	1	4	3	2	1	2	0
Available	0	1	1	9	0	5	1

TABLE 5.12 CAMP SERVICES MANNING SUMMARY

Organizational Element	Perm	Aug	TDY	Totals
Office of the OIC Las Vegas Branch				
Officer	1		1	2
Enlisted	2		3	5
Subtotal	3		4	7
Ground Safety				
Officer			1	1
Enlisted			0	0
Subtotal			1	1
Religious Services				
Officer			1	1
Enlisted			0	0
Grand Totals				
Officer	1		3	4
Enlisted	2		3	5

TABLE 5.13 DOD NTS PEAK POPULATION FORECAST, APRIL 1962

	Off	EM	Civ	Total
DOD Test Gp	45	115	0	160
Small Boy	60	136	419	615
Marshmallow	36	10	124	170
Vela-Uniform	7	7	61	75
Totals	148	268	604	1,020

TABLE 5.14 DOD NTS PEAK POPULATION FORECAST, JUNE 1962

Activity	Off	EM	Civ	Beds	Location
FCDASA CTO	85	150	5	240	Camp Mercury
Vela-Uniform	10	10	40	60	Camp Mercury
Subtotals	95	160	45	300	
Marshmallow (DOD)	36	10	124	170	Area 16
Small Boy (DOD)	55	160	375	590	Area 5
Totals	186	330	544	1,060	

Table 5.15 CAMP MERCURY HOUSING ASSIGNMENTS, MAY 1962

Location	Facility	Use	Number of Beds (100% Design)	Average Number Pers Billeted
Mercury	Dorm 507	Officers	34	33
Mercury	Trailer 2	Officers	4	2
Mercury	Dorm P	Enlisted	44	40
Mercury	Dorm S	EM/Civ	34	46
Mercury	Dorm W	EM/Civ	34	47
Mercury	Dorm Q	Off/Civ	As req'd & avail	6
Mercury	Dorm K	Civilian	As req'd & avail	3
Subtotals			150	177
Area 5	Temp Camp	Off/EM/Civ	550	200*
Area 16	Temp Camp	Off/EM/Civ	308	130*
Totals			1,008	507

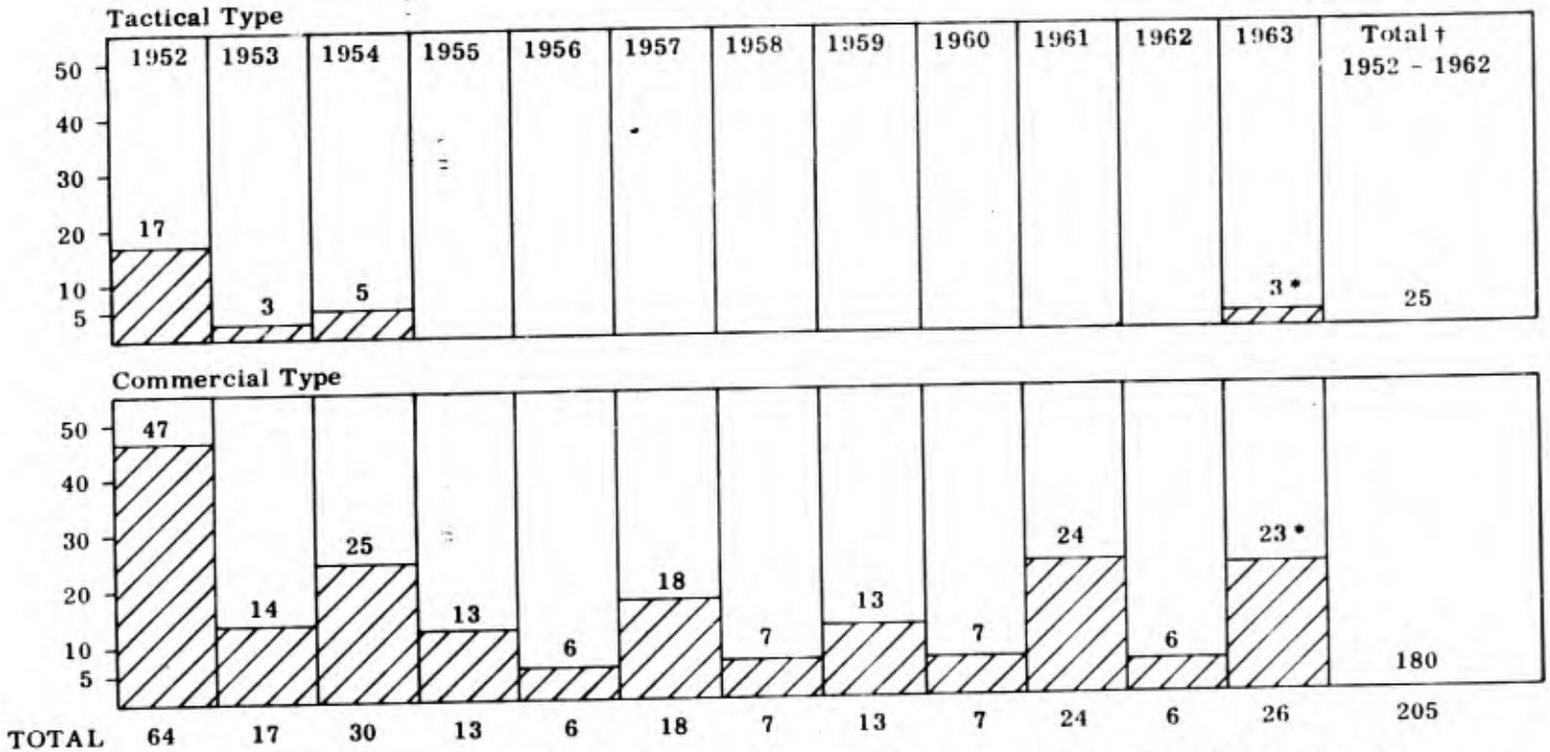
* In use on 26 May 1962. Fifty billets in Area 5 and 100 in Area 16, set aside for REECO labor and camp services personnel, are not included in the totals.

TABLE 5.16 TOTAL HOUSING AVAILABLE IN CAMP MERCURY, MAY 1962

	Quantity	Capacity		Number of Beds
Dormitories	37	34		1,258
	3	44		132
			Subtotal	1,390
Trailers	137	4		548
	20	3		60
	128	2		256
	66	1		66
			Subtotal	930
			GRAND TOTAL	2,320
LESS				
Married Quarters	19	2		38
Women's Dorms	4	34		136
Women's Dorms	1	44		44
Women's Trailers	5	4		20
			Subtotal	238
Net available for men				2,082

TABLE 5.17 TYPICAL DAILY DOD HOUSING REPORT

Total Space	Area	Dorms	Spaces Left	Spaces Filled
600	5			
	Officers	H	21	54
	Civilians	D-E-F	72	303
	Enlisted	G-½C	5	145
150	Mercury			
	Officers	S-507	0	72
	Civilians		0	16
	Enlisted		0	62
408	16			
	Total		127	281
200	12			
	Total		188	12
226	Desert Rock			
	Total		144	82



* 10 sedans; 4 station wagons; 2 buses, 12-passenger; 2 buses, 37-passenger; 1 trailer, 1½-ton, 2-wheel; 4 trucks, pickup, ½-ton; 1 trailer, fuel, 600-gallon; 1 trailer, water, 400-gallon; and 1 truck, gas, 1,200-gallon.

† Does not include 1963 vehicles.

Figure 5.1 Vehicle inventory by year of manufacture.

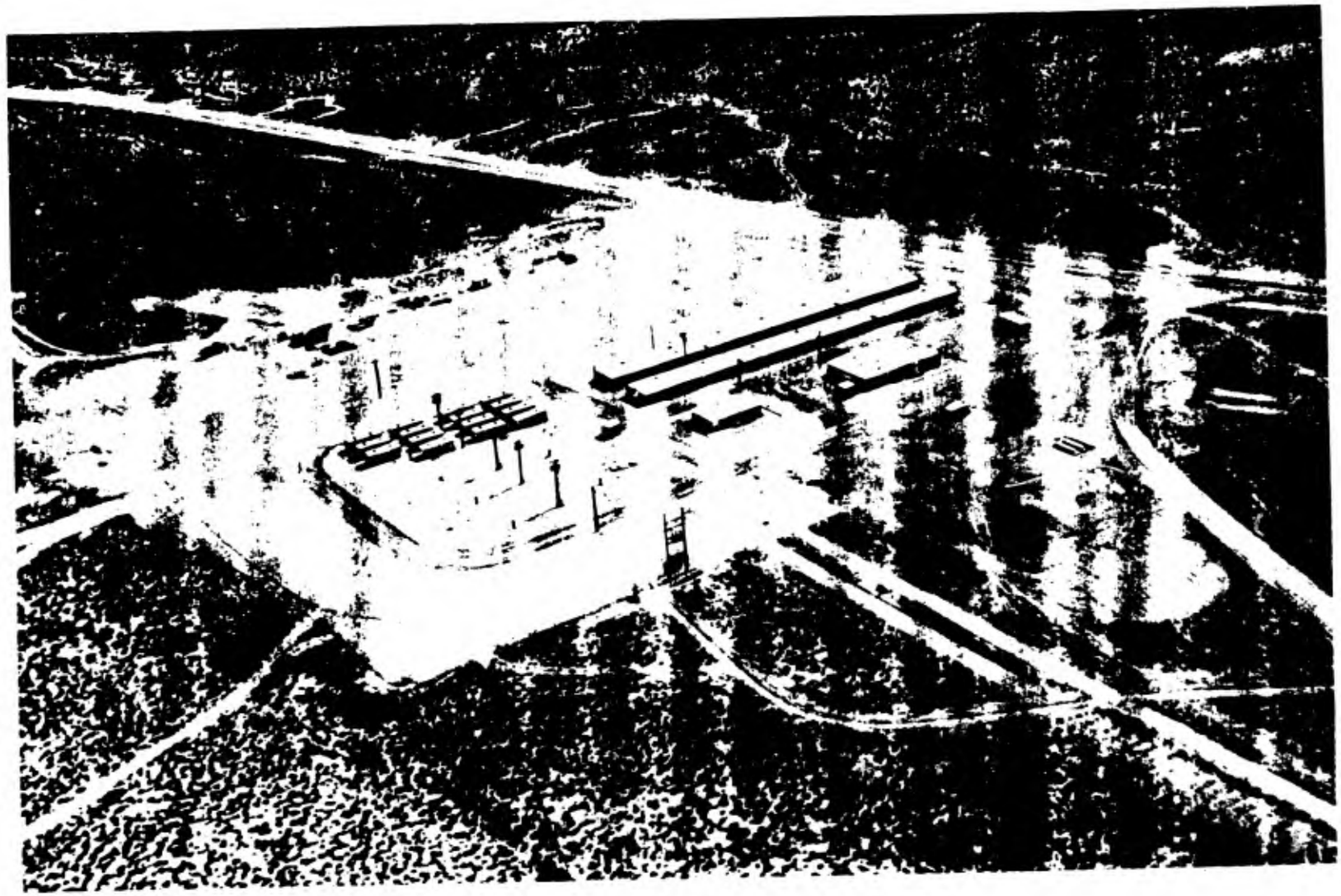


Figure 5.2 Housing camp, Area 16. Over two-thirds of the small trailer units had already been moved to other areas at the time this photo was taken. (DASA 67-06-NTS-63)

Chapter 6

PROGRAMS

The Programs Division was responsible for the technical experiments conducted by the DOD on all nuclear tests. Under ideal conditions, the experiments were part of a package program prepared and funded by CHDASA. The package program outlined the experiments, indicated the contractors who would perform the experiments, and provided many details necessary to begin moving the experimental projects to the test location.

Because of the moratorium on nuclear testing and the accompanying restrictions on any planning for tests, there was not time for separate planning and operational phases on this test series. Many changes were made in the experimental programs after the Test Division received what would normally have been a complete program package. A few experiments were deleted, many were added, and all had to be modified to some extent to accommodate them to the other experimental programs and field conditions.

The technical results of the experimental programs are documented in the Project Officers Reports (Appendix A). The purpose of this chapter is to give general coverage of the scope and magnitude of the Programs Division effort during this test series. Shot and meteorological data is contained in Appendix G.

6.1 ORGANIZATION

The Programs Division was divided into eight distinct programs covering the general areas of nuclear effects of interest to the DOD. The programs are as follows:

(1) Program 1, blast, shock, and ground motion measurements.
(2) Program 2, prompt and residual nuclear radiation.
(3) Program 3, effects on structures.
(4) Program 4, biomedical effects.
(5) Program 5, effects on aircraft in flight.
(6) Program 6, electromagnetic phenomena.
(7) Program 7, miscellaneous studies of specific interest to a particular service and funded by the service.
(8) Program 8, thermal radiation.

Each program was headed by a Program Director, who was responsible to the Chief, Programs Division, for the management of his program. In general, Programs Division personnel were assigned to the various programs in accordance with their scientific background and experience; in many cases, however, the assignments were based on the workloads being carried by the individual programs.

The study of the effects from nuclear detonations has, through the years, become increasingly sophisticated and complicated. Along with an understanding of the basic parameters has come an appreciation and concern for more subtle and, often, more dangerous effects. The individual nuclear events conducted at NTS during 1962 were each primarily concerned with comprehensive measurements of a particular phenomenon;

therefore, the Program Director responsible for the study of the particular phenomenon concerned was designated the Program Manager for that nuclear event. The crash nature of the entire series also necessitated a strong management organization with responsibility and authority held at the lowest management level possible.

In July 1961, the Director of Program 3 was designated Program Manager of Hard Hat. In September, Program 1 took over the Vela-Uniform Program, and Program 8 assumed management of Marshmallow. Small Boy came under the management of Program 6 in December, and Program 2 took over Danny Boy in January 1962. Little Feller and Johnie Boy were begun in May 1962 after CTO had set up operations at NTS. By that time, the managing organizations for the various events were working smoothly and had their hands full with their individual projects. It was necessary, therefore, to assign two of the Deputy Test Directors as Event Coordinators on these shots.

The increasing complexity of the scientific experiments performed on nuclear tests has made it desirable to have senior scientists available during all phases of the operation. These were men of recognized stature in the particular field of science under investigation. In some cases (Small Boy and Johnie Boy), Scientific Advisors were appointed, to make their talents readily available to the Program Managers. In another case (Marshmallow), the senior scientist became a part of the organization under the Program Manager, with the Program Directors reporting direct to him on all technical matters. The exact organizational location of the senior scientist depended upon the Program Manager, the complexity of the experiments, and the desires of the senior scientist. The function of the senior scientist was to insure that the experiments obtained the scientific information required. How this was accomplished varied from individual to individual and from program to program.

6.2 FUNCTIONS

The Program Manager bore the full responsibility for all phases of management of the program insofar as the DOD interests were concerned. He coordinated technical, scientific, operational, and fiscal aspects of the programs. To accomplish the management supervision for which he was responsible, the Program Manager had the responsibility and authority to:

(1) Review and approve or modify the experimental techniques and scientific approaches as proposed by civilian agencies performing under contract.

(2) Review and approve or modify construction and installation procedures proposed by AEC subcontractors.

(3) Coordinate and integrate laboratory and field efforts of major participating agencies as well as numerous supporting agencies retained on a consultant basis.

(4) Manage the preparation for fielding and on-site management of the fielding of the program.

(5) Review budgets, estimates, and funding actions, and reprogram funds as necessary so that the most effective use was made of available resources.

(6) Submit preoperation plans and reports and postoperation reports.

During this test series, the Program Manager's responsibilities were discharged through the Offices of the Program Directors who were responsible for the immediate supervision and direction of the individual projects. The duties of each Program Director included:

(1) Directing the projects assigned to the program in executing the mission of the program, the provisions of the contracts, and the policies of the Government and the Program Manager.

(2) Assuring that the provisions of the contracts were being met in a satisfactory manner.

(3) Assuring that plans and reports were submitted at times and in forms required by instructions. Reviewing POIRs and PORs for completeness and technical accuracy and forwarding comments through channels to the Technical Information Branch.

(4) Reviewing E&R Plans, obtaining comment or concurrence from appropriate agencies. Resolving comments or disagreements, or submitting a recommended solution through the chain of command.

(5) Maintaining competence in scientific aspects of each project of his program.

(6) In major matters of scientific disagreement or interference, submitting a recommended solution to the Scientific Advisor.

(7) Within his area of scientific and technical competence, resolving questions pertinent to his program and passing information on such actions through the chain of command.

(8) Maintaining detailed, complete, current written information on the fiscal status of each element of his program.

(9) Preparing for dispatch the correspondence and messages pertinent to his program.

(10) In the course of diligent surveillance of his program, warning the Program Manager of approaching crises in timely fielding of projects, financial overruns, and other conflicts in use of common resources such as time, space, and channels. Presenting cogent information on all aspects of problems and recommended solutions.

6.3 PROGRAMS AND PARTICIPATION

Four of the seven DOD effects shots—Small Boy. Johnie Boy, and Little Feller I and II—were designated as Sun Beam (later changed to Dominic II by the AEC) events, a part of the Dominic series of atmospheric tests conducted in the Spring of 1962. The other three—Danny Boy, Hard Hat, and Marshmallow—were carried out as part of the Nougat series of underground tests.

All seven of these DOD events were accomplished on a crash basis with a very short preparation time following the lifting of the moratorium on testing. Although most of the extensive tunneling in granite for Hard Hat had been done under Project Lollipop, a planned high explosive (HE) shot, it was rapidly completed and converted to the nuclear Hard Hat shot and executed in 4 months. Danny Boy was fielded and executed in less than 2 months. The very complex Marshmallow event, involving extensive tunneling, a large and exacting vacuum system, and an intricate instrumentation array, was fielded and executed in 7 months. The evergrowing, complex, and knotty Small Boy—whose stature eventually grew to 73 identifiable scientific projects (with a number of others unidentified specifically) and over 500 instrument stations—was fielded and executed in 7 months. Johnie Boy and Little Feller I and II were fielded and executed in 2 months, late in the period.

Concurrently, Vela-Uniform participation in the 42 AEC developmental shots was being managed. It must be noted, too, that these field phases on the seven events were not separate disassociated periods; much of this work was going on concurrently. Figure 1.6 presents a consolidated diagram of this effort.

The objectives of the Sun Beam series and concurrent DOD events covered a large portion of the broad spectrum of nuclear weapon effects studied on previous series. Each event was centered, however, on an area of primary interest designed to obtain new knowledge or extend existing knowledge in fields of interest deemed particularly important to the DOD.

Although Program 800 (Marshmallow) was handled as a separate effort and therefore was not a part of Programs Division, the mission and objectives closely parallel those of the Programs Division and are, therefore, included in this chapter.

6.3.1 Hard Hat. The primary objectives of Hard Hat were to obtain basic information from the effects of an underground nuclear detonation on the mechanics of tunnel damage in granite and to relate this information to the loading and structural responses of various tunnel liners subjected to such a detonation.

Because of the absence of a comprehensive program to study nuclear explosion effects on tunnels and tunnel liners in previous AEC test operations, and the need for better design criteria and procedures for tunnel liners, a test program was developed by H&N. This program, originally planned for Project Gnome of the Plowshare Program, was submitted to the AEC in April 1959.

Headquarters DASA, upon review of H&N's program, determined it was a close correlation to work submitted to DASA by the University of Illinois. Consequently, a meeting with representation from DASA, AEC, and H&N was held July 1959. A decision was made to combine the two proposals in the Lollipop Program as Project 29, Structural Response Program.

Lollipop, under LRL direction, was a planned nuclear detonation in granite and a part of the Seismic Improvement Program, the forerunner of the Vela-Uniform Program.

Construction for Project 29 commenced in Area 15, in November 1959 and was suspended in October 1960. The suspension was partially due to difficulties encountered in securing satisfactory in-situ specimens of polyurethane foam tunnel liner back packing material (Figure 6.1).

In June 1961, representatives of cognizant agencies met at HqDASA. Plans were made to resume necessary construction for completion of Project 29 as a structural effects test. This test was to be solely sponsored and executed by DASA and was renamed the Hard Hat event. Participating projects are listed in Table 6.1.

When the Nougat series commenced in September 1961, Hard Hat was approved as a 5-kt nuclear event. Vela-Uniform participation was authorized. Construction commenced in October, and Hard Hat was detonated 15 February 1962.

Since Hard Hat was contained, reentry/recovery work commenced almost immediately. This work was completed in June 1962.

6.3.2 Danny Boy. This was one of a comprehensive series of surface and near-surface cratering shots planned to obtain information of interest to DOD with regard to hardened underground structures and to tactical and strategic applications of demolition and cratering. For the hardened structures application, this series was designed to develop an understanding of the manner in which energy is coupled into the ground and an analytic method of calculating expected ground shock and motion effects for all yields and any soil structure. These objectives were related to those outlined for Hard Hat. The cratering and demolition applications were likewise concerned with the coupling of energy into the ground but from the viewpoint of predicting cratering and demolition effects. Both applications were, of course, concerned with the variation of effects with yield and depth of charge.

Danny Boy was planned and fielded within a very stringent time frame. The technical scope of the test was formulated in early January 1962 and was based largely on a program already developed by LRL for Plowshare. Through arrangements made by CHDASA with LRL, a technical director for Danny Boy was assigned by that laboratory. The field

organization consisted of members of CTO and the LRL field staff, working jointly under the Military Deputy Test Manager. Table 6.2 lists the participating projects.

Danny Boy was originally scheduled for 1 March 1962, but two corrective 48-hour delays ordered by higher authority resulted in rescheduling to 5 March.

6.3.3 Marshmallow. The purpose was to study the source characteristics and the effects of a nuclear detonation in a high-altitude environment. This was accomplished by an extensive vacuum system. Specifically studied were the

Table 6.3).

Shot Logan during Operation Hardtack (1958) was planned and executed in 45 days in an effort to get some information on before the nuclear test moratorium went into effect. For the most part, the test was unsuccessful. Planning based on the Logan experience was then started by LRL for an experiment that would obtain the desired information. This experiment was designated Marshmallow. In February 1959, the responsibility for the experiment was transferred from LRL to FCDASA. At that time, the experimental projects were to be brought to an 18-month readiness stage and mothballed. In September 1961, FCDASA was instructed to reactivate the experiment and take it to the field for execution on an accelerated time schedule of 9 months.

A critical-path technique was used for the scheduling of the myriad of parts and personnel required to be at the right place at the right time. Some of the tasks were without precedent, and the time estimates for their completion were nothing more than educated guesses. Even these crude estimates served their purpose. In the long run, the over- and underestimates balanced each other, and the milestone steps were pretty much on schedule. This management technique is highly recommended for future test activities.

Rescheduling of the shot from 5 to 28 June was necessitated by the delay in the Des Moines event. Des Moines was used as a test of the ability of Marshmallow instrumentation to operate in the radiation environment of a nuclear detonation. Only background-type measurements were attempted. The Marshmallow experiment was successfully performed on 28 June.

One aspect of Marshmallow that warrants special mentioning is the Area 16 camp (Figure 5.2). This camp was constructed to provide living facilities for 400 men close to the Area 16 portal area. The advantages of the camp more than repaid the initial costs involved. With quick access to the portal work area, all project personnel worked evenings during the week. Without these additional man-hours, it would have been impossible to meet the time schedule. The delay cost for the shot was conservatively estimated at $25,000.00 per day. The additional costs incurred by locating the living and eating facilities in Area 16 rather than in Mercury were much lower than the delay costs would have been.

6.3.4 Little Feller. The Little Feller shots were part of a large scientific program to get a better understanding of the effects obtained

They were accomplished in a 70-day period, from the date on which a decision was made to proceed to the date of execution of the last shot. During this period, FCDASA was actively engaged in extensive operations for three other DOD shots and routine operations for several AEC developmental shots. Competition for area, construction, agency participation, and time was pressing throughout the period. Extensive use of overtime and careful manipulation of project agencies were necessary to effect the shots in the available time.

Originally three Little Feller shots were considered: one was to be exploded from a static position, 40 feet above ground level; the second was to be from a static position,

3 feet above ground level; and the third was to be launched tactically after having been fuzed to detonate at a height of burst of 40 feet. A military tactical exercise was planned to be accomplished in connection with the third shot. In early planning, the 40- and 3-foot static shots were identified as Little Feller I and Little Feller II, respectively. During planning, the third shot was dropped, and the 40-foot static shot was changed to a 3-foot launched shot, in connection with a tactical exercise. Little Feller I was retained to identify this shot, even though, in chronology, it occurred after the 3-foot static shot (Little Feller II).

Projects accomplished in connection with the Little Feller shots are listed in Table 6.4.

Little Feller I. This was a first in U. S. Army history. The device was a fired in its military configuration by U. S. Army personnel in connection with a troop exercise, 17 July 1962.

Measured effects, obtained on a limited scale because of the troop exercise, were similar to those observed during Little Feller II.

Over 900 troops participated in the tactical orientation, which involved close coordination between activities of technical and tactical personnel. Headquarters space and some living quarters were furnished by the AEC in the Area 16 camp. Most of the troops were housed at the Area 12 camp. Personnel were fed at the dining facilities in Areas 12 and 16. Construction was accomplished by REECO within the AEC facility.

This shot demonstrated A secret report on the complete tactical operation was prepared by the Sixth United States Army: Final Report, Ivy Flats, Headquarters Sixth United States Army, Presidio of San Francisco, California, 22 August 1962.

FCDASA responsibilities were accomplished through the normal organization of FCWT and NTSO, augmented by the Sandia Corporation.

Little Feller II. Little Feller II was executed, 7 July 1962, as a companion shot for Little Feller I,

FCDASA responsibilities were accomplished through the normal organization of FCWT and NTSO, augmented by the Sandia Corporation. For this shot, the Sandia Corporation furnished the Test Group Director (Mr. A. J. Max) and was responsible for all functions related to detonation of the weapon.

6.3.5 Johnie Boy.

The initial directive concerning plans for Johnie Boy as a DOD-sponsored event in Operation Dominic II was received by FCDASA, 11 May 1962. The event was to be conducted by LRL under general guidance of AEC. Table 6.5 lists participating projects.

The planning was complicated by the fact that there were five DOD events and several AEC events scheduled during the same time period. Only certain areas of NTS were suitable for this particular experiment, and all of these areas were being used for other events during the same time. In addition, many of the personnel and much of the test equipment were involved in two or more events. Early in June, plans were completed for the experimental effort, shot date, and shot location. This left 5½ weeks for fielding the experiment. Several days were lost when the area was closed for Little Feller II and again during practice troop exercises in connection with Ivy Flats.

Despite many conflicts resulting from this intensified and compressed schedule, Johnie Boy was detonated 23 inches below the surface in Area 18 at 0845 on 11 July 1962, just one day later than the original scheduled date.

6.3.6 Small Boy.

A second major and extensive program of experiments, added to Small Boy after the field phase had begun, was a nuclear weapon vulnerability program These experiments were conducted by the AEC through LASL, LRL, and the Sandia Corporation. The addition of this program introduced complications into the original nominal Small Boy program of about 31 scientific projects: (1) It required a fairly substantial amount of real estate in the near vicinity of ground zero (Figures 3.7 and 6.2). (2) It added a tremendous construction burden to a load that was already considered to be marginal in the time frame required. (3) It posed a significant noninterference problem. (4) With a very tight time scale already forcing everything to the limit, it required changing from a nuclear device on which all previous planning had been done to one having radically different characteristics. This necessitated a considerable effort on the part of other experimenters in recalculating expected effects and redesigning their experiments to fit the characteristics of the new device. It also necessitated a significant amount of redesign and field modification of stations already under construction, as well as those yet to be constructed. Finally, since neither of the new devices under consideration was yet sufficiently proven to be acceptable, it introduced a tremendous uncertainty into the situation. The problem was finally resolved approximately a month before the scheduled test date when one of the new devices was declared acceptable and the decision finalized.

Another major and extensive program added after the initiation of the field phase was a fallout program requiring manned stations, extensive fallout collection arrays out to distances of 35 miles, and monitoring surveys out to 300 miles from ground zero. Fortunately, this did not add a very large burden to the construction load, because much of its equipment was prefabricated. It did, however, require extensive training and coordination on a very short time scale and created a tremendous drain on support facilities already in insufficient supply such as vehicles, communications equipment, laboratory and office space, office furniture, and housing.

Three other significant programs were also carried out on Small Boy. The first was a number of studies connected with hardened structures; it consisted of very close-in blast, shock, and ground motion measurements where the magnitudes of effects were

expected to be large, and tests of model structures. These were all in the original Small Boy program. The second program consisted of a number of tests of service equipment; the third involved tests of aircraft missile deliveries. The projects are listed in Table 6.6.

Small Boy entered the field or execution phase for all practical purposes on 20 December 1961, in a meeting held at HqDASA, when approval for preparation was received in HqDASA and money made available to begin preparation. It entered this phase with 31 DOD projects and a target date of 29 May 1962, established at the meeting. Also, at this meeting, Frenchman Flat was selected as the site, and the conditions for a suitable test area and ground zero were established.

The field construction period began in early February 1962 and terminated about 1 June with the conditional acceptance of the last stations by the project agencies. Construction was hampered by frequent sandstorms (Figure 6.3). User occupancy began when the first stations became available about 1 May and extended until 7 July when the last projects were established in their stations and ready.

On 7 July, Small Boy entered the readiness phase awaiting favorable weather for execution. During this phase, it remained on a continuous D−1 day status. A complete button-up was carried out on the night of 7 July only to have the shot cancelled next morning for weather. A partial button-up was conducted the night of 8 July and cancelled about midnight, again for weather. Button-up procedures were improved and minimized and no further button-ups were carried out until the night of 13 July. This button-up went smoothly, and all was ready at the appointed time.

On 14 July, a delay of an hour and a half from scheduled shot time ensued, waiting for the winds to be just right. The shot was fired at 1030 hours.

Reentry went smoothly, and the last of the manned stations was released by about 1600 hours. Reentry of some stations was delayed for several days due to the Radex situation. Recovery and rollup began and were essentially completed by 4 August.

Small Boy involved 73 identifiable scientific projects consisting of 53 DOD projects, 4 Civil Effects projects, and the large AEC vulnerability program—all in all, over 500 scientific stations. With only a few exceptions, all stations operated successfully, and data was obtained by all but two projects. Their failure to obtain data was not due to equipment malfunction but apparently to the fact that there was none to be obtained.

6.3.7 Vela-Uniform. This program participated in 42 events, most of which were developmental tests conducted by the AEC laboratories. The purpose of this program was to improve the capability of detecting, and identifying as such, underground nuclear detonations.

In July 1960, FCWT started planning for a series of nuclear and HE detonations to provide experimental data for achievement of the original purpose. Before any test shots were actually fired, the moratorium was ended, and Operation Nougat began. The Nougat series took priority on efforts and shot locations. Because of this, the original Vela-Uniform shots were either cancelled or delayed, and instructions were received to collect data from the Nougat series on a noninterference basis. Major experimental effort was expended on approximately five events and less extensive effort on the remainder.

Support was provided one experimental agency on a continuous basis and intermittently for 17 other agencies.

Table 6.7 lists the Vela-Uniform projects that participated during the Nougat and Sun Beam events. Table 6.8 lists the projects that participated during specific events.

Pages 136 through 145
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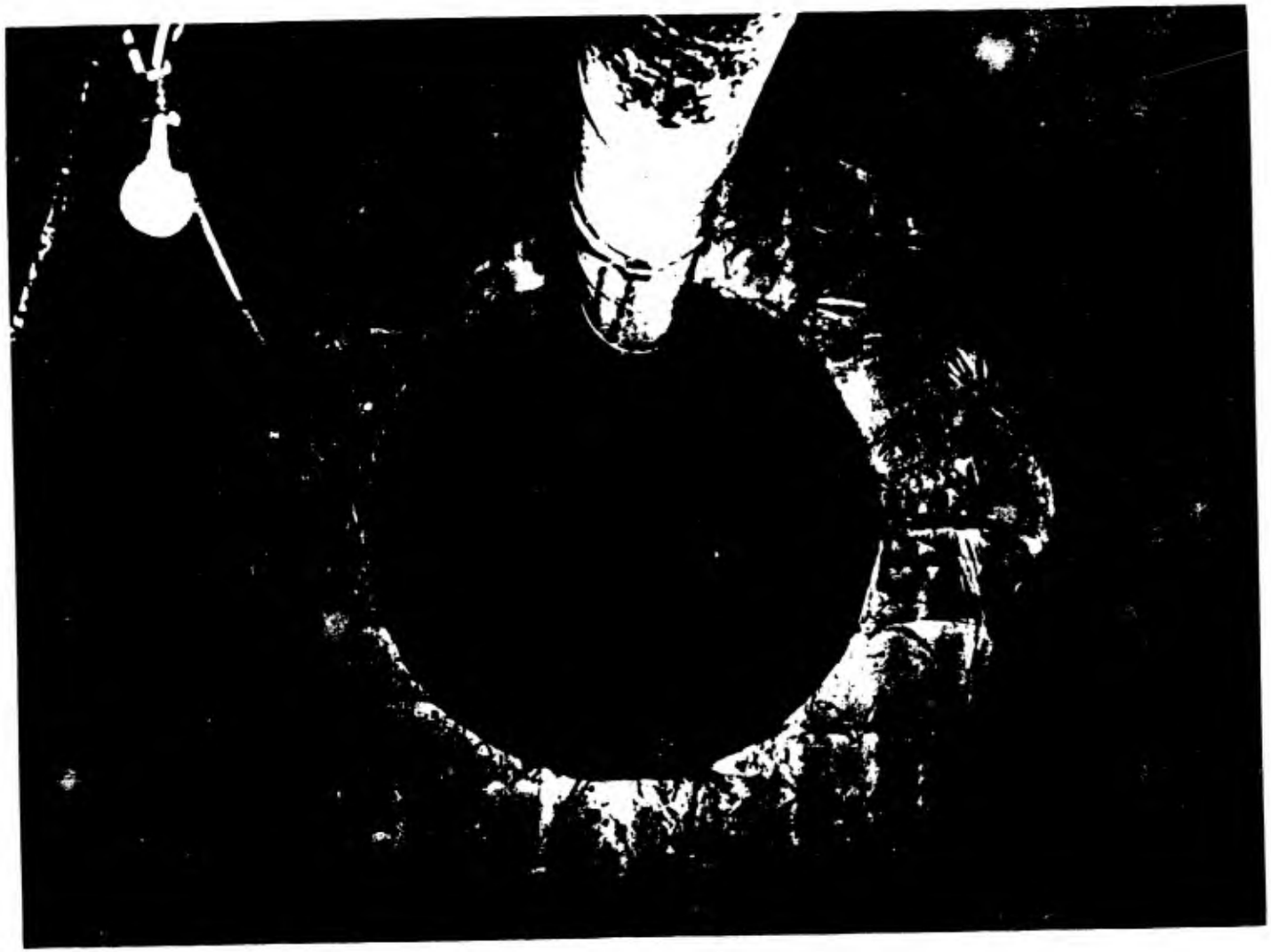

Figure 6.1 Typical tunnel liner with foam back-packing, Shot Hard Hat. (DASA NOU-14-05-NTS-63)

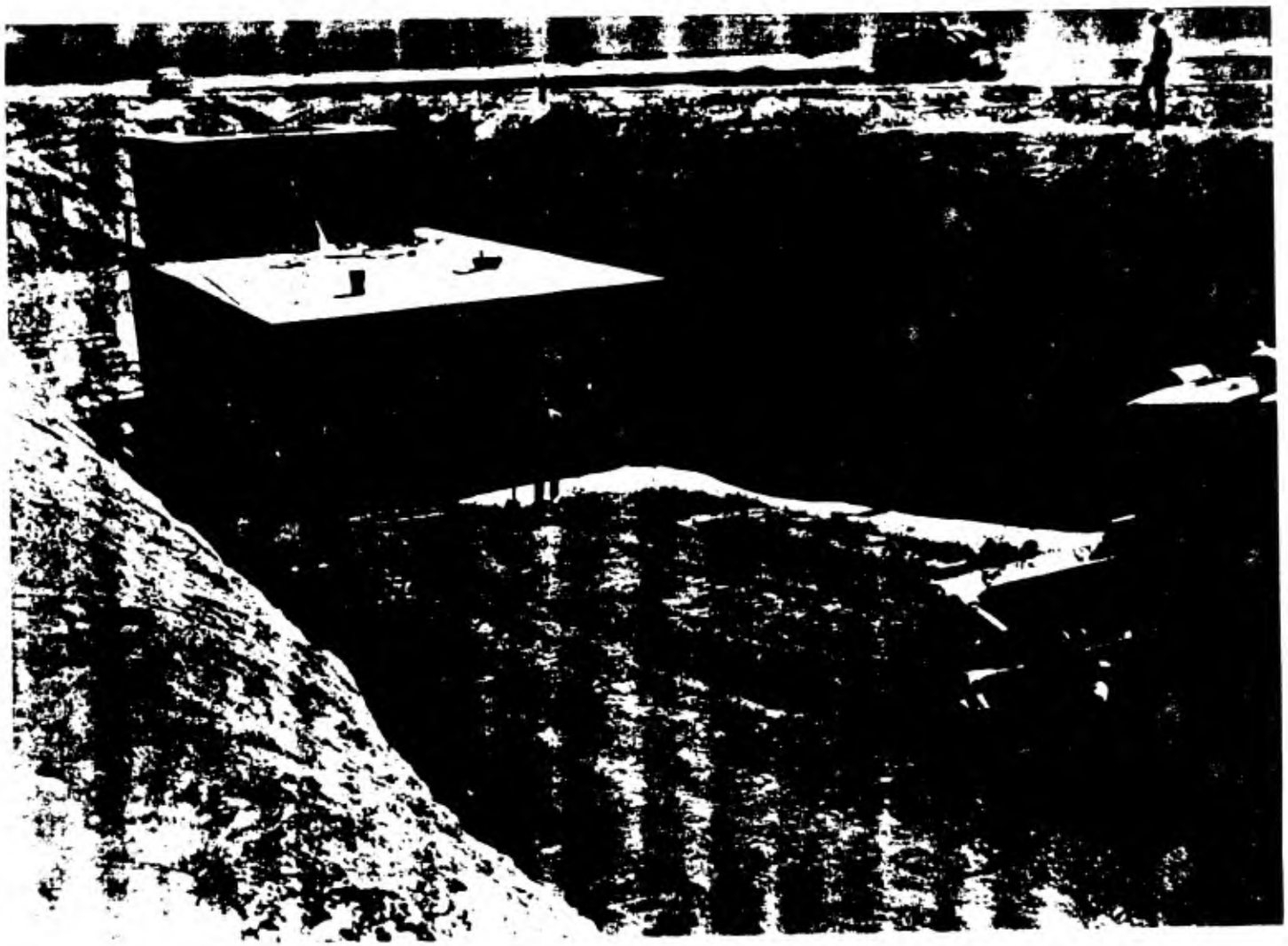

Figure 6.2 Typical bunker construction, Shot Small Boy.
(DASA 217 (NOU-194-01) NTS-62)

Figure 6.3 Sandstorm in Small Boy area. Swirling sandstorms and unpredictable dust devils frequently brought work to a standstill. This type of weather also played havoc with scientific and electric generating equipment. (DASA 195 (NOU-183-08) NTS-62)

Pages 149 through 154 deleted.

Appendix B

LIST OF ABBREVIATIONS

AAFMPS	Army and Air Force Motion Picture Service
A-E	Architect-Engineer
AEC	Atomic Energy Commission
AFCRL	Air Force Cambridge Research Laboratories
AFM	Air Force Manual
AFSAM	Air Force School of Aviation Medicine
AFSWC	Air Force Special Weapons Center
AFSWP	Armed Forces Special Weapons Project (changed to DASA)
AFTAC	Air Force Technical Application Center
ALOO	Albuquerque Operations Office, Atomic Energy Commission (also ALO)
AMCD	Army Missile Command, Redstone Arsenal (formerly AOMC)
AOMC	Army Ordnance Missile Command, Huntsville, Alabama (changed to AMCD)
APC	U. S. Army Pictorial Center
APRL	Applied Physics Research Laboratory
AR	Army Regulation
ARA	Allied Research Associates
ARF	Armour Research Foundation (changed to IIT)
ARPA	Advanced Research Project Agency
ASD	Aeronautical Systems Division, U. S. Air Force
ASE	American Science and Engineering Company
ASRDL	U. S. Army Signal Research and Development Laboratory
ASTIA	Armed Services Technical Information Agency (changed to DDC)
ATAC	Army Tank Automotive Center (formerly OTAC)
AWRE	Atomic Weapons Research Establishment (Great Britain)
BC	Boeing Aircraft Company
BRL	Ballistic Research Laboratories
BTL	Bell Telephone Laboratories
cal/cm^2	calories per square centimeter
CETO	Civil Effects Test Organization, AEC
CHDASA	Chief, Defense Atomic Support Agency
CONARC	Continental Army Command
CP	Command Post
CTO	Continental Test Organization
Cubic	Cubic Corporation
D-1 day	Time in relation to scheduled shot day
DASA	Defense Atomic Support Agency (formerly AFSWP)
DB	Danny Boy
DCA	Defense Communications Agency
DC/S	Deputy Chief of Staff
DDC	Defense Documentation Center (formerly ASTIA)
DMA	Division of Military Application
DOD	Department of Defense
DOFL	Diamond Ordnance Fuse Laboratory (changed to HDL)
DRI	Denver Research Institute, University of Denver
DTMB	David W. Taylor Model Basin
DTMS	Defense Traffic Management Service
E(λ)	energy as a function of wavelength
E(t)	energy as a function of time
E(Total)	Total energy integrated over time and wavelength

E&C	Engineering and Construction
EG&G	Edgerton, Germeshausen and Grier, Inc.
EHP	E. H. Plesset Associates, Inc.
ELRDA	Army Electronic Research and Development Activity
EM	electromagnetic
EMP	electromagnetic pulse
E&R	Experiment and Requirements
ERDL	U. S. Army Engineer Research and Development Laboratories
FAA	Federal Aviation Agency
FAC	Forward Air Controller
FCLG	Field Command,Logistics Group
FCP	Forward Control Point
FCTG	Field Command, Atomic Weapons Training Group
FCWT	Field Command, Weapons Effects and Tests Group
FSI	Federal Services, Inc.
GCA	Geophysics Corporation of America
GEOTECH	Geotechnical Institute
GSA	General Services Administration
GZ	ground zero
HAC	Hughes Aircraft Company
HDL	Harry Diamond Laboratory (formerly DOFL)
HE	high explosive
HH	Hard Hat
H&N	Holmes and Narver, Inc.
HOB	height of burst
IIT	Illinois Institute of Technology, Research Institute (formerly ARF)
INTC	U. S. Army Intelligence Corps
ISAFB	Indian Springs Air Force Base
ITR	Interim Test Report (now called POIR)
JB	Johnie Boy
JCS	Joint Chiefs of Staff
JOI	Joint Office of Information
JTF	Joint Task Force
KN	Kaman Nuclear
kt	kiloton
LASL	Los Alamos Scientific Laboratory
LMAFS	Lookout Mountain Air Force Station
LMSC	Lockheed Missiles and Space Company
LRL	Lawrence Radiation Laboratory, University of California
MHDRI	MHD Research, Inc.
MIT	Massachusetts Institute of Technology
MITLL	Massachusetts Institute of Technology, Lincoln Laboratory
MM	Marshmallow
MSL	mean sea level
NADC	U. S. Naval Air Development Center
NBSCRPL	National Bureau of Standards, Central Radio Propagation Laboratory
NC	Northrop Corporation, Ventura Division
NCEL	Naval Civil Engineering Laboratory
NCO	noncommissioned officer
NDL	Nuclear Defense Laboratory
NEL	U. S. Navy Electronics Laboratory
NMC	Naval Missile Center
NMTC	Naval Missile Test Center
NOL	U. S. Navy Ordnance Laboratory
NOTAMS	Notices to Airmen
NRDL	U. S. Naval Radiological Defense Laboratory
NTS	Nevada Test Site
NTSO	Nevada Test Site Organization
NVOO	Nevada Operations Office, AEC
OCSO	Office of the Chief Signal Officer, U. S. Army
OIC	Officer-in-Charge

OTAC	Army Ordnance Tank Automotive Command (changed to ATAC)
OTO	Office of Test Operations
P&C	Purchasing and Contracting
PIO	Public Information Office(r)
POIR	Project Officers Interim Report (formerly called ITR)
POL	petroleum, oils, and lubricants
POR	Project Officers Report (formerly called WT)
PST	Pacific Standard Time
RCA	Radio Corporation of America
RDB	Research and Development Board
RDT&E	research, development, test, and evaluation
REECO	Reynolds Electrical and Engineering Company
rem	roentgen equivalent man (mammal)
RPA	U. S. Army Signal Radio Propagation Agency
R/V	reentry vehicle
SB	Small Boy
SC	Sandia Corporation
SCC	U. S. Army Strategic Communications Command
SFOO	Santa Fe Operations Office, AEC (now ALOO)
SGC	Space General Corporation
SOP	standing operating procedures
SRI	Stanford Research Institute
SRDL	U. S. Army Signal Research and Development Laboratory
STL	Space Technology Laboratories
TAC	Tactical Air Command
TDY	temporary duty
TI	Texas Instruments, Inc.
TIB	Technical Information Branch, FCWT
TU	Task Unit
TWX	teletype message
UCLA	University of California at Los Angeles
UED	United Electro-Dynamics, Inc.
USAAMS	U. S. Army Artillery and Missile School
USAARMS	U. S. Army Armor School
USAEPG	U. S. Army Electronic Proving Ground
USAIS	U. S. Army Infantry School
USAPC	U. S. Army Pictorial Center
USASCC	U. S. Army Signal Corps Center
USC&GS	U. S. Coast and Geodetic Survey
USGS	U. S. Geological Survey
USNCEL	U. S. Navy Civil Engineering Laboratory
USPHS	U. S. Public Health Service
USWB	U. S. Weather Bureau
VU	Vela-Uniform
WES	U. S. Army Corps of Engineers, Waterways Experiment Station
WP	working point
WT	Weapons Test Report (now called POR)
WU	Western Union Telegraph Company, Directorate of Communications, Department of the Air Force

Appendix C

AEC-DOD MEMORANDUM OF AGREEMENT, JANUARY 1961

MEMORANDUM OF AGREEMENT
ATOMIC ENERGY COMMISSION — DEPARTMENT OF DEFENSE
USE OF NEVADA TEST SITE FACILITIES

FCWT – 186 B-14
Contract No. AT(29-2)-1077

THIS AGREEMENT entered into this 14th day of January, 1961, by and between the Atomic Energy Commission (hereinafter called AEC) represented by the Albuquerque Operations Office (hereinafter called ALO) and the Department of Defense (hereinafter called DOD) represented by Field Command, Defense Atomic Support Agency (hereinafter called FC/DASA):

WITNESS THAT:

WHEREAS, the AEC operates certain facilities under the jurisdiction of the Manager, ALO, for conducting nuclear weapons tests and high explosives tests together with related weapon and seismic improvement experiments and demonstrations conducted at the Nevada Test Site (hereinafter called NTS): and WHEREAS, the DOD has need to conduct or participate in certain nuclear and non-nuclear tests and experiments; and

WHEREAS, certain nuclear and non-nuclear experiments conducted at the NTS under AEC jurisdiction are of joint AEC/DOD interest;

NOW THEREFORE, the parties mutually agree as follows:

1. Upon approval of this agreement, Memorandums of Agreement AT(29-2)-294 (Nevada Proving Ground Operations, dated February 23, 1953), Funding and Allocation of Expenses at Nevada Proving Ground (AT(29-2)-295), dated May 14, 1954, and Security Agreement, Nevada Test Operations, dated November 17, 1952, are superseded and cancelled.

2. The Assistant Manager for Test Operations, AEC-ALO, and the Deputy Chief of Staff, Weapons Effects Tests, FC/DASA, are designated representatives of the Manager, ALO, and the Commander, FC/DASA, respectively for the implementation of this agreement.

3. The Manager, ALO-AEC, and the Commander, FC/DASA, are jointly responsible for interpreting the provisions of this agreement.

4. The terms and conditions of this agreement may be modified from time to time by the execution of formal amendments mutually agreed upon by the signatories.

5. The Assistant Manager for Test Operations, AEC-ALO, and the Deputy Chief of Staff, Weapons Effects Tests, FC/DASA, are authorized to issue implementing procedures regarding areas of joint interest.

6. The Division of responsibility between AEC and DOD and detailed terms and conditions are contained in Annexes "A" through "H" which are appended to and hereby made a part of this agreement.

7. This agreement becomes effective on date of last signature and remains in effect for an indefinite period. It may be terminated by either party only after negotiations between the parties hereto for the purpose of reaching an understanding as to the time and conditions on and under which the termination shall be effective.

In the event negotiations do not result in conditions mutually agreeable to both parties, either party may then terminate the Agreement upon giving 120-day written notice to the other party.

ATOMIC ENERGY COMMISSION

14 JAN 1961 (date)

K.F. Hertford, Manager
Albuquerque Operations Office

DEPARTMENT OF DEFENSE
by Field Command, Defense
Atomic Support Agency

14 JAN 1961 (date)

Harold C. Donnelly
Major General, USAF
Commander

ANNEX A
MEMORANDUM OF AGREEMENT
AEC/DOD
USE OF NEVADA TEST SITE FACILITIES

GENERAL POLICIES AND RESPONSIBILITIES

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
1. Proposal for Use of NTS	The Office of Test Operations (OTO) will refer applications to the NTS Use Committee or the NTS Planning Board, as appropriate. These groups may call a meeting with the proposed user and any other user parties for consideration of the proposal. They will then submit recommendations to the Assistant Manager for Test Operations or to the Manager, Albuquerque Operations. The Office of Test Operations, after review of the proposal, will submit recommendations to the Manager, ALO. The Manager, ALO, will approve or disapprove use of NTS for the proposed project, or at his discretion, may submit to DMA for consideration. In cases of limited time, the Test Manager may, at the request of the potential user, waive the use of a formal proposal in favor of a joint meeting of interested parties which will be called by the Test Manager. The degree to which the standard procedure will be followed is dependent upon the magnitude and permanence of the proposed activities. In cases of temporary activities involving little or no permanent construction which obviously will not interfere with other existing user activities, the Test Manager may authorize the activity.	The FC/DASA will submit a formal proposal to ALO covering: a. Description of the proposed activity. b. Operational aspects of the proposed activity. c. Probable degree of support required by the NTS organizations. d. Potential hazards, either to on-site or off-site populations. e. Answers to questions which have been presented by the OTO. f. Proposed funding arrangements. g. Results of discussions with other users.

ANNEX A CONTINUED

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
2. Construction and Maintenance	Construct and maintain all facilities at NTS except, when mutually agreed, certain facilities which are unique to DOD or are of a distinct training value to DOD may be constructed by DOD. Determine quality of operation and maintenance of all NTS facilities.	Coordinate to assure compliance with AEC policy. Perform certain construction and maintenance unique to DOD as mutually agreed with AEC.
3. Technical Responsibilities	The NTSO is adapted to the concept of operation that users will generally be assigned areas of authority, and the controlling user or agency will have such control over activities by others conducted in those assigned areas as they consider necessary. The organization shall encourage the resolution of conflicts between the user groups and shall refer such conflicts to the Test Manager only after user group negotiations have failed.	The technical user group has the ultimate responsibility for conducting its technical program. Each group has its own technical objectives, method of internal operation and channel for program justification. The NTS Organization will not exercise any control or coordination over the technical portion of the programs. The Test Manager will delegate to the Test Group Directors operational, coordinative, and safety responsibilities in his geographical area of technical control, limited only by AEC policy. The organizational structure of the user groups is the responsibility of the individual sponsoring agency. The Test Group Director shall have complete responsibility for the readiness of his program, and his opinion as to this readiness shall be accepted as final by the Test Manager.
4. Organization and Staffing	The Test Manager is appointed by the AEC. The NTS Organization (NTSO) is so conceived as to provide the user organizations with a maximum of latitude to conduct their activities to their best interests while, at the same time, providing the most efficient support services with minimum control consistent with economical and safe use of the test site and its facilities. Key positions in the NTSO are filled on a full-time basis. Actual presence at NTS will depend upon the scope of activities at any particular time. The responsibility for the degree of staffing at any particular time rests with the Test Manager. Appointments to the NTSO will be published as a Test Manager's Bulletin, with special assignments pertinent to a particular program as a part of the Test Manager's Operation Order for that program.	The Technical Group Director is appointed by the technical user. The user groups are considered as complete organizational units and staffed to satisfy the requirements of these parent organizations and their assigned mission at the test site. The internal organizational structure of the user groups is not a responsibility of the NTSO management; however, a gross overstaffing of any group which would tend to saturate facilities of the test site to the detriment of other groups will require the intervention of the Test Manager. However, user groups may, at their discretion and with the consent of the Test Manager, call upon supporting groups for assistance in completing its staffing pattern.

ANNEX A CONTINUED

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
5. Lines of Communication and control	See Organization Chart, NTSO-SOP	It is understood that user groups and support groups will operate on a basis of mutual cooperation and understanding of each other's problems and that only in very unusual situations will conflicts have to be referred to the Test Manager for resolution. Informal working level channels of communication are encouraged with various user groups and user and support groups as long as the Test Manager's staff and coordination groups are kept adequately advised of activities in areas of their responsibilities. Formal channels, when required, are indicated on the Organization Chart, NTSO-SOP; all Test Group Directors have direct access to the Test Manager.
6. Nuclear Weapons Test Capability	The NTS is primarily maintained for the purpose of conducting nuclear weapons tests. The Test Manager will, after appropriate coordination with technical users and the Division of Military Application, Washington, D.C., direct the temporary cessation of other operations if their operations would seriously interfere with the conduct of such tests.	Coordinate operations schedules with the Test Manager. Comply with cessation of operations directives issued by the AEC to permit the conduct of nuclear weapons tests.
7. Labor Relations	Provide, through AEC contractors, appropriate craftsmen for the performance of technical and logistical support. Maintain liaison and negotiate with union organizations concerned with work at the NTS. Administer CPFF and lump-sum contracts which include personnel appendices to AEC prime contracts, specifying AEC policy regarding personnel matters.	Provide funding and determine requirements, furnishing requirements to AEC for execution. Provide technical guidance as necessary to support personnel. Assure non-use of civilian laboratory technicians for accomplishment of tasks assigned to union craftsmen.
8. Operational Safety and Interference	Provide final authority as to safeness of proceeding with an operation or experiment; coordinate all on- and off-site safety activities and operational schedules; resolve problems of operational interaction which apparently cannot be resolved between users. If necessary coordinate operational problems with parent organizations of technical users to obtain determination or acceptance of delays.	Coordinate with other technical users in development of operational plans. Provide AEC with current information regarding operational runs, tests, and experiments, and related hazards, as required by NTSO and AEC, Washington policy.
9. General Funding	a. Fund for and construct facilities at the NTS which are required by AEC, including common support facilities for joint use by AEC and DOD. b. Fund for, operate, and maintain permanent base facilities, including temporary administration and housing facilities for weapons test activities. Absorb costs of: (1) operation and maintenance of base camp, including forward area feeding and housing and forward area permanent facilities at an established stand-by level as determined by the AEC; and (2) AEC users share of costs for activities other than weapons test activities in excess of the basic stand-by operating and main-	a. Fund for facilities at the Nevada Test Site which are required for exclusive DOD use. b. Fund for operation and maintenance of DOD facilities and equipment. Reimburse AEC for a predetermined pro-rata share of the operation and maintenance costs for activities other than weapons tests over and above the established stand-by maintenance level. The pro-rata share of costs shall be negotiated annually or when significant program

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
	tenance level. (Such costs are to be shared by all major users of NTS on the basis of estimated user participation in total NTS activities.)	changes are involved which will result in a major addition or reduction in the operation and maintenance costs.
	c. Fund for research and development projects of primary interest to AEC, including related construction and field support to scientific organizations.	c. Fund for research and development projects of primary interest to DOD, including related construction and field support to scientific organizations.
	d. Share the funding of joint interest research and development projects, including related construction and field support to scientific organizations, on a proportionate basis mutually agreeable to the AEC and the DOD.	d. Share the funding of joint interest research and development projects, including related construction and field support to scientific organizations, on a proportionate basis mutually agreeable to the AEC and the DOD.

ANNEX B
TO
MEMORANDUM OF AGREEMENT
AEC/DOD
USE OF NEVADA TEST SITE FACILITIES

LOGISTICAL SUPPORT

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
1. Procurement by AEC	Fund and provide local procurement on a reimbursable basis.	Determine requirements, fund for, and submit requests to AEC for service required.
2. Equipment and Supplies	Fund and procure own requirements. Within established programs provide emergency equipment and supplies to DOD on a reimbursable basis. Request essential "military type" items from DOD on a reimbursable basis.	Fund and procure own requirements. May use AEC as an emergency source or service agency for obtaining repair parts and expendables. Provide AEC on a reimbursable basis, essential "military type" items not otherwise available to AEC.
3. Property Loans	Loan available property to DOD for specified periods of time. Details of loan to be negotiated at time of requirement.	Loan military and available DOD property to AEC for specific time period. Details of loan to be negotiated at time of requirement.
4. Transportation:		
a. Motor Vehicles	Fund and operate common use motor pool and provide DOD requirements on reimbursable basis.	Determine requirements, fund and submit requests to AEC for vehicles from common pool; operate motor pool, as required for own use.
b. Common Use Transportation of Personnel	Arrange for common use transportation for personnel; provide DOD requirements on a reimbursable basis.	Determine requirements, fund, and submit requests to AEC for support from common use activity on a reimbursable basis. Operate transportation activity as required for own use.
c. Common Use Transportation of Property	Provide for contract commercial service between Las Vegas and NTS, furnishing such service to DOD on a reimbursable basis.	Determine requirements and submit request to AEC for use of contract commercial service on a reimbursable basis.
5. Billeting and Messing	Provide and operate facilities for support of all agencies and personnel on a reimbursable basis.	Determine requirements, submit requests to AEC and insure payment of charges made to individuals.

ANNEX C
TO
MEMORANDUM OF AGREEMENT
AEC/DOD
USE OF NEVADA TEST SITE FACILITIES

ENGINEERING AND CONSTRUCTION

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
1. New Construction, Major Rehabilitation, and Relocation of Existing Structures and Facilities.		
a. Permanent buildings and facilities.		
(1) For AEC use.	Design, fund, and construct.	Coordinate on request.
(2) For DOD use.	Authorize locating at NTS, approve site, design, and construct.	Fund and provide guidance for location and design.
(3) For Joint use.	Fund, design, and construct.	Provide guidance, if appropriate.
b. Construction of temporary structures and facilities other than scientific structures:		
(1) For AEC use.	Fund, design, and construct.	Coordinate on request.
(2) For DOD use.	Authorize locating at NTS, approve site, design, and construct.	Fund and provide guidance for design and construction, if appropriate.
(3) For Joint use.	Fund pro-rata share, design, and construct.	Fund pro-rata share and provide guidance if appropriate.
c. Scientific structures and facilities.	Fund, design, and construct own requirements. Design and construct DOD requirements on reimbursable basis.	Fund. Provide requirements to AEC. Provide guidance as appropriate.
2. Minor Rehabilitation or Alteration of Existing Structures.	Fund own requirements. Perform DOD work on reimbursable basis.	Fund own requirements. Provide requirements to AEC and provide guidance as appropriate.
3. Maintenance.		
a. Permanent facilities.	Fund and perform all maintenance.	Determine own requirements; submit to AEC.
b. Temporary and scientific facilities.	Fund own requirements; perform all maintenance.	Fund own requirements; advise AEC of requirements.
4. Utilities.	Fund, operate, and maintain established utility system, and extensions of primary systems. Fund, construct, and operate utility systems for own use. Provide extension of utilities to DOD on reimbursable basis.	Fund for extensions in connection with DOD activities. Provide requirements to AEC.

ANNEX C CONTINUED

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/RESPONSIBILITY
5. Real Estate.	Allocate areas for DOD use, such allocation constitutes interagency agreement for land use.	Provide requirements to AEC.
6. Field Support. (Special Order Work)	Fund and provide own requirements. Perform support for DOD on reimbursable basis.	Fund and provide requirements to AEC.

ANNEX D
TO
MEMORANDUM OF AGREEMENT
AEC/DOD
USE OF NEVADA TEST SITE FACILITIES

COMMUNICATIONS AND ELECTRONICS

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
1. Telephone:		
a. Site exchange and distribution system	Fund and provide all common user service, including installations, operation, and maintenance.	Determine own requirements and submit consolidated requests to AEC for service. Fund for service not available from existing AEC facility.
b. Toll Calls	Fund own requirements.	Fund own requirements.
c. Issued Lines, Service, and/or Equipment	Fund and provide all common user service and own requirements. Provide and/or arrange for DOD requirements on a reimbursable basis.	Determine own requirements, submit consolidated requests to AEC, and fund for such support.
d. Scientific or Experimental Station Facilities and/or Service	Fund own requirements. Provide and/or arrange for DOD requirements on a reimbursable basis.	Determine own requirements, submit consolidated requests to AEC, and fund for such support.
2. Radio:		
a. VHF/UHF-FM Mobile & Fixed Station Service	Fund and provide all service, including installation, operation and maintenance.	Determine own requirements and submit consolidated requests to AEC for service. Fund for service not available from existing AEC facilities.
b. HF Point-to-Point Service	Fund and provide all test site terminal facilities, including installation, operation, and maintenance required for own use.	Determine own requirements and submit consolidated requests to AEC; and fund and provide all distant terminal facilities for own use, including installation, operation, and maintenance.
c. HF/VHF/UHF-Air Ground Service	Fund and provide existing system, including operation, installation and maintenance.	Determine own requirements and submit consolidated requests to AEC for service; and provide special purpose military equipment to AEC as necessary for furnishing such service.
d. Voice Countdown Service	Fund and provide service, including operation, installation, and maintenance.	Determine own requirements and submit consolidated requests to AEC for service; and provide special purpose military equipment to AEC as necessary for furnishing such service.

ANNEX D CONTINUED

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
e. Air Navigational Aids	Fund and provide existing system installation, operation, and maintenance.	Determine own requirements and submit consolidated requests to AEC for service; and provide special purpose military equipment to AEC as necessary for furnishing such service.
f. Special Purpose Aircraft Tracking and/or Positioning Facilities	Fund and provide own requirements.	Fund and provide own requirements.
g. Frequencies and Voice Call Signs	Obtain authorization and allocate requirements for common user systems and facilities and own use; and coordinate all user requirements.	Obtain authorization and allocate requirements for own use and coordinate these with AEC.
3. Message Service		
a. Communications Center	Fund and provide service, including operation, installation, and maintenance.	None.
b. Government Teletype, both terminals on-site	Fund and provide service, including operation, installation and maintenance.	Provide special purpose military equipment to AEC as necessary for furnishing such service.
c. Commercial TWX	Fund and provide own requirements.	Fund own toll charges.
d. Cryptographic	Fund and provide service, including operation, installation, and maintenance.	Provide special purpose military equipment to AEC as necessary for furnishing such service.
4. Signal Cable System:		
a. Basic Scientific Station Service	Fund and provide all service, including operation, installation, and maintenance.	Determine own requirements and submit consolidated requests to AEC for service.
b. Transmission Lines and/or other Distribution Systems to Existing AEC Scientific Areas.	Fund and provide necessary support.	None.
c. Temporary Transmission Lines and Associated Equipment from General Scientific Areas to Scientific Stations.	Fund own requirements	Determine own requirements and submit consolidated requests to AEC for service; and fund for this support.
d. Timing signals (EG&G type services)	Fund own requirements	Determine own requirements and submit consolidated requests to AEC for service; and fund for this support.

ANNEX E
TO
MEMORANDUM OF AGREEMENT
AEC/DOD
USE OF NEVADA TEST SITE FACILITIES

SECURITY AND CLASSIFICATION

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
1. Security Areas and Access	Establish own requirements.	Establish own requirements.
2. Identification Badges	Establish requirements for issue, fund, and provide facilities for badging.	Determine own requirements and submit verification or certification to AEC for badging service.
3. Physical Security	Fund and provide all support, including guard force.	Determine own requirements and submit requests to AEC for support.
4. Classification and control of information, documents, and material	Fund and provide own requirements.	Fund and provide own requirements.

ANNEX F
TO
MEMORANDUM OF AGREEMENT
AEC/DOD
USE OF NEVADA TEST SITE FACILITIES

MEDICAL

ITEM	AEC/ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
1. Dispensary and/or other Facilities	Fund and provide as required for joint use.	Coordinate and assist as required.
2. Medical Facility Operation	Fund, furnish necessary supplies and equipment, and supervise over-all joint facility operations.	Coordinate and assist as required.
3. Personnel and Staff	Fund and provide necessary doctors, aidmen, nurses, and other staff as necessary to furnish medical care.	Fund and provide necessary personnel as required to assist AEC in furnishing medical care to DOD participants.
4. Patient Care and Treatment	Provide for emergency treatment for all test participants.	Coordinate and assist as required in providing service to DOD participants.
5. Individual Health Records	Maintain for own personnel	Maintain for own personnel.
6. Ambulance Service	Provide service for own personnel and assist DOD as necessary.	Fund and provide service for own personnel and assist AEC as necessary.

ANNEX G
TO
MEMORANDUM OF AGREEMENT
AEC/DOD
USE OF NEVADA TEST SITE FACILITIES

GENERAL RESPONSIBILITIES, SUPPORT, AND SERVICES

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
1. Operating Policy, Directives, SOP's etc.	Fund, develop, and publish for all operating areas and participants.	Review and coordinate AEC publications and fund, develop, and publish policy guidance for own activities.
2. Radiological Safety	Provide for safety of all participants and general public; and develop, fund, and implement necessary support programs for site operations, including repository of exposure records.	Determine requirements and submit consolidated requests to AEC for support; provide assistance to AEC as requested and within capability; and implement programs in DOD operational areas of responsibility.
3. Industrial Safety and Fire Protection	Provide for safety of all participants and general public for activities conducted at the site; implement fire prevention and protection measures for all participants, property and facilities; and develop, fund and implement necessary support programs for site operations.	Determine requirements and submit consolidated requests to AEC for support; provide assistance to AEC as requested and within capability; and implement programs in DOD operational areas of responsibility. DOD will fund for safety and fire protection installations which are integral to facilities required by and funded by DOD.
4. Hydrological, Seismological, and Meteorological Programs for Public Safety	Provide support for all participants, including development, funding, and implementation of programs necessary for mission accomplishment.	Determine requirements and submit consolidated requests to AEC for support; provide assistance to AEC as requested and within capability. Implement and fund programs in DOD operational areas of responsibility.
5. Aircraft Support, Military type	Determine requirements and submit consolidated requests to DOD for support.	Fund, approve requirements, and arrange for provision of all support for joint AEC/DOD operations.
6. Legal and Claims	Fund and provide all legal and claims service associated with AEC responsibilities.	Fund and provide all legal and claims service associated with DOD responsibilities.
7. Evacuation & Disaster Plans	Develop, publish, and implement as required for site operations.	Coordinate and assist AEC as required in implementation.
8. Public Information	Develop joint plan in association with DOD; provide coordinator for activites of primary interest to AEC and assistant coordinator for activities of primary interest to DOD; and furnish proportionate share of manning and operating costs.	Develop joint plan in association with AEC; provide coordinator for activities of primary interest to DOD and assistant coordinator for activities of primary interest to AEC; and furnish proportionate share of manning and operating costs.
9. Visitors Bureau	Develop joint plan in association with DOD; furnish proportionate share of manning and operating costs; and provide direct support and assistance to all AEC observers and visitors.	Develop joint plan in association with AEC; furnish proportionate share of manning and operating costs; and provide direct support and assistance to all DOD observers and visitors.

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
10. Personnel Administration	Fund and provide own requirements.	Fund and provide own requirements.
11. Recreation, Chaplain, and Postal Services	Fund and provide certain common user services as agreed and own requirements.	Fund and provide certain common user services as agreed and own requirements.

ANNEX H
TO
MEMORANDUM OF AGREEMENT
AEC/DOD
USE OF NEVADA TEST SITE FACILITIES

PHOTOGRAPHY

ITEM	AEC-ALO RESPONSIBILITY	DOD-FC/DASA RESPONSIBILITY
1. Technical	Fund own requirements. Provide and /or arrange for DOD requirements on a reimbursable basis.	Determine own requirements, submit requests to AEC, and fund for such support.
2. Documentary Still Pictures	Fund and provide support at NTS prior to activation of DOD facilities for an event. At that time determine own requirements and submit requests to DOD for support required.	Determine own requirements and submit requests to AEC for support prior to activation of DOD facilities at NTS for an event. At that time fund and provide support for AEC/DOD participants.
3. Public Information	Determine own requirements and submit requests to DOD for DOD support required. Still picture requirements handled as in 2. Fund own requirements for newsreel, TV films, etc.	Provide and/or arrange for AEC and DOD newsreel, TV films, and similar support as requested on a reimbursable basis. Responsibility for still pictures same as in 2b.
4. Repository		
a. Technical Film	Fund and provide own requirements for storage.	Fund and provide own requirements for storage.
b. Documentary & Public Affairs Film	Determine own requirements and submit requests to DOD necessary for support.	Fund and provide facilities and service for permanent storage and issue as requested by AEC.

Appendix D

MEMORANDUMS DEFINING MISSION

18 January 1952

MEMORANDUM FOR THE CHIEF, ARMED FORCES SPECIAL WEAPONS PROJECT

Subject: Atomic Weapons Testing

1. The Joint Chiefs of Staff have approved the following general policy for future military participation in field tests of atomic devices and weapons:

a. For tests involving nuclear detonations and conducted within the continental United States, the Chief, Armed Forces Special Weapons Project (AFSWP) will:

1. Exercise technical direction of weapons effects test of primary concern to the Armed Forces and the weapons effects phases of development or other tests of atomic weapons.

2. Coordinate military participation and assistance in support of the Atomic Energy Commission in the conduct of tests of atomic weapons.

b. Individuals provided by the Services to assist in the conduct of such tests will normally be attached to the AFSWP for the preparatory, operational, and roll-up phases. Military organizations required for preparatory, operational, and roll-up tasks will remain under the command of their appropriate services and will perform their assigned tasks on a mission basis pursuant to requests from the Chief, AFSWP to the Services concerned.

2. In the performance of these functions, the Chief, AFSWP will:

a. Continue to have responsibility for preliminary plans and budgets for military phases of atomic tests.

b. Make such arrangements, through established channels, as may be necessary to coordinate plans and operations with the Atomic Energy Commission.

c. Submit recommendations to the Chiefs of the Services as to assistance required.

3. The Joint Chiefs of Staff have approved military participation in Operation SNAPPER. The test program and expenditure of funds which you submitted to the Chiefs of the Services by letter, dated 8 November 1951, have been approved, subject to such adjustments as may be made by the Research and Development Board. The Joint Chiefs of Staff have also recommended that the Services assign appropriate priorities to the projects under their jurisdiction to facilitate the procurement of equipment, personnel, and supplies for the conduct of SNAPPER.

4. The responsibilities outlined in paragrah 1 above, apply to the special test to determine the airblast effects of atomic weapons, as well as to Operation SNAPPER.

/s/ J. Lawton Collins
J. LAWTON COLLINS
Chief of Staff, U.S. Army

/s/ Hoyt S. Vandenberg
HOYT S. VANDENBERG
Chief of Staff, U.S. Air Force

/s/ W.M. Fechteler
W.M. FECHTELER
Chief of Naval Operations

DEPARTMENT OF DEFENSE
ARMED FORCES SPECIAL WEAPONS PROJECT
Washington 25, D.C.

4 August 1952

SWPGG

SUBJECT: Augmentation of Responsibilities

TO: Commanding General, Field Command
Armed Forces Special Weapons Project
P.O. Box 5100
Albuquerque, N.M.

1. Effective immediately, pursuant to General Order Number 10 of this headquarters, the responsibilities of the Field Command are augmented to include the following:

a. Exercise technical direction of weapons effects tests of primary concern to the Armed Forces and the Weapons effects phases of the developmental or other tests of atomic weapons involving nuclear detonations within the Continental limits of the United States.

b. Coordinate military participation and assistance in support of the Atomic Energy Commission in the conduct of tests of atomic weapons involving nuclear detonations within the Continental limits of the United States.

2. The Chief, Armed Forces Special Weapons Project, will continue to budget for military participation in future atomic tests, will make preliminary plans and will present technical programs to the Research and Development Board (RDB) for approval. You will be charged with completion of detailed plans, preparation for and the conduct of the technical program and the submission of complete reports upon the conclusion of Field operations.

3. In the detailed planning and preparation for the conduct of the tests, you will represent the Chief, Armed Forces Special Weapons Project, as an agent of the Department of Defense for coordination with the Atomic Energy Commission, its contractors and any other Government agency participating in test activities. You are further directed to arrange with the Manager of the Santa Fe Operations Office for the implementation of the military effects programs and Service support and participation during the period of test operations, pursuant to such general agreements between the Atomic Energy Commission and the Department of Defense as are in effect at the time.

4. You are directed to coordinate the detailed planning of training participation by Service Forces. This coordination will commence upon notification by this headquarters that troop training participation programs have been approved by appropriate Service Chiefs.

5. Direct communications with all participating organizations are authorized. The Chief, AFSWP, will arrange for basic agreements with Service agencies conducting experimental projects. Such technical direction of their projects as is necessary to their efficient conduct and integration with other projects is vested in you. In the event that you consider projects not feasible, or that major changes in scope or objective are warranted, the matter will be referred to this headquarters.

/s/ Herbert B. Loper
HERBERT B. LOPER
Major General, USA
Chief, AFSWP

Appendix E

GUIDANCE FOR 1962 TEST SERIES

DEPARTMENT OF DEFENSE
DEFENSE ATOMIC SUPPORT AGENCY
Washington 25, D. C.

DASATP/960

16 February 1962

SUBJECT: Guidance for DOD Experimental Programs Associated with Full Scale Nuclear Tests

TO: Commander, Field Command
Defense Atomic Support Agency
Sandia Base, Albuquerque, New Mexico

1. Reference is made to the following:

a. SECRET letter, DASATP/960, this headquarters, 15 March 1961, subject: "Guidance on Research and Testing for Effects of Nuclear Weapons (U)."

b. UNCLASSIFIED letter, DASABS-924, this headquarters, 9 August 1961, subject: "Transmittal of HARD HAT Technical Program."

c. SECRET letter, DASATP/984, this headquarters, 26 December 1961, subject: "DOD Weapons Effects Programs, Operation FISH BOWL (U)."

d. SECRET letter, DASATP/960, this headquarters, 9 January 1962, subject: "DOD Weapons Effects Programs, Operation MARSHMALLOW (U)."

e. SECRET letter, DASATP/983, this headquarters, 22 January 1962, subject: "Revision of Operation SUN BEAM (U) Program Book."

f. UNCLASSIFIED letter, DASATP/960, this headquarters, 2 February 1962, subject: "DOD Weapons Effects Programs, Operation MARSHMALLOW (U), Transfer of Funds for."

g. SECRET message, DASABS, this headquarters, 59736, 12 January 1962.

h. SECRET message, DASABS, this headquarters, 603476, 17 January 1962.

i. UNCLASSIFIED letter, DASAAG-9 062.2, this headquarters, 16 February 1962, subject: "Status of DASA Photographic Program for Currently Approved Test Operations."

2. Reference 1a provided guidance which was then current for the conduct of DASA experimental programs associated with obtaining nuclear weapons effects data. The resumption of nuclear testing has required changes in these previously planned DASA experimental programs. Major programmatic decisions have been required by the urgent press of events; new or drastically revised programs have been included in an unexpected test series with little advanced planning. As a result, your headquarters has on occasion been requested to plan, establish, and supervise major test programs based upon fragmentary, or incomplete directives and authority. To rectify this unavoidable situation and re-establish normal channels of authority and responsibility, this letter is intended to serve as a compendium of directives for presently authorized DOD experimental programs associated with full-scale nuclear tests.

3. VELA-UNIFORM. A separate nuclear test series in support of the VELA-UNIFORM program is no longer envisaged, although some of the individual events or phases may be executed at a later date. Instead, the technical objectives of the former VELA-UNIFORM Explosion Series will be accomplished, insofar as possible, through participation in suitable nuclear detonations designed primarily for other purposes.

a. Project SHADE is cancelled and no further planning will be done for a separate VELA-UNIFORM Explosion Series at the Nevada Test Site. That portion of the VELA-UNIFORM Explosion Series which was to have been detonated at NTS has been redirected. Consequently, Department of Defense projects formerly incorporated in SHADE are participating in Operation NOUGAT on a non-interference basis. It is desired that Commander, Field Command continue to utilize those events in Operation NOUGAT which most closely approximate those of the originally scheduled Project SHADE and thereby gather a maximum of VELA-UNIFORM data. Commander, Field Command is requested to exercise his best judgment in selecting events for project participation, within the limitations of authorized funds, in order that maximum and optimum data may be obtained. This headquarters will be informed of planned participation by means of the VELA-UNIFORM Monthly Report, VELA-UNIFORM DOD Participation Reports, or by more rapid means of communication when necessary. The following comments apply to former SHADE events:

(1) Since none of the presently planned detonations of Operation NOUGAT closely approximates the PORPOISE event, plans for this event are postponed. ARPA, in coordination with VELA-UNIFORM Ad Hoc Group on Detection of Nuclear Detonations will evaluate results of seismic data obtained in Operation NOUGAT, and subsequently review the need for PORPOISE. Commander, Field Command will not undertake technical preparation for the PORPOISE event until so directed by this headquarters. It is requested that this headquarters be advised if and when any field test program shows promise of attaining the PORPOISE objectives.

(2) Preparations for the SHOAL event will proceed through the site exploration and selection stages. The Atomic Energy Commission is responsible for investigating the Sand Springs, Nevada area as a SHOAL site. Commander, Field Command is requested to cooperate with AEC/ALO as required during these preliminary phases. When appropriate, Commander, Field Command will be requested to implement a Department of Defense Technical Program for the SHOAL event.

(3) The LINEN event has been cancelled and the Atomic Energy Commission has allocated the former shot site to other purposes. No further planning for large (kiloton or greater) underground chemical explosions in support of VELA-UNIFORM is required or authorized at present. Disposition of the high explosive procured for LINEN has been authorized. Although primary responsibility for disposition lies with the Atomic Energy Commission, Commander, Field Command is requested to cooperate with AEC/ALO as required. Commander, Field Command has been requested to obtain 1,300 tons of this high explosive for VELA-UNIFORM; 500 tons for U. S. Geological Survey and 800 tons for DASA. The explosive will be stored at the Naval Ammunition Depot, Hawthorne, Nevada.

b. Field work on Project DRIBBLE has been suspended awaiting a clarification by ARPA, concerning its current requirements, technical program and desired schedules. Meanwhile, essentially all DOD work and planning on DRIBBLE will be suspended. Commander, Field Command is authorized to assist the AEC/ALO in its activities concerning site selection and device matters as requested. The requirement for a DOD Project DRIBBLE Technical/Operational Plan is suspended. Pending further notification, reporting on DRIBBLE is limited to required funding reports on VELA-UNIFORM funds. Unobligated VELA-UNIFORM funds previously programmed for DRIBBLE will be utilized for VELA-UNIFORM participation in Operation NOUGAT.

c. Project GROUNDHOG has been definitely postponed and contract negotiations have been suspended. The requirement for a Technical/Operational Plan is suspended and no reports other than funding need be submitted unless specifically requested. Commander, Field Command is requested to retain a record of GROUNDHOG activities to date and discontinue all other associated activities, pending further notification. Any unobligated VELA-UNIFORM funds previously programmed for GROUNDHOG planning and allocated to Commander, Field Command will be utilized for movement of the 1,300 tons of high explosives mentioned in paragraph 3a(3) above. ARPA has advised this headquarters that the requirements for GROUNDHOG will be reviewed in light of the results of detection data acquired from NOUGAT and that no further action is desired until this review is completed.

d. Commander, Field Command is requested to take all possible action to assure that technical experimental project agencies participating in the VELA-UNIFORM Program, as modified by either this headquarters or Air Force Technical Applications Center, will be given maximum support to insure their

participation in scheduled events. Commander, Field Command is specifically relieved, however, of responsibility for that portion of Project 8.4 (Long Range Seismic Measurements) which involves notification of volunteer civilian participants by radio broadcast. To date, an UNCLASSIFIED broadcast of shot count-down has been made only for the GNOME event due to security classification. This restriction will continue until the security classification of shot time is lifted.

e. TWX Shot Reports, indicating the degree of VELA-UNIFORM success of each shot, will be submitted to ARPA within 24 hours after a shot. Chief, DASA will be an information addressee on all TWX Shot Reports. Preliminary Project Shot Reports will be submitted by Department of Defense sponsored projects at such times as directed by Commander, Field Command, DASA. In addition to such other distribution as Commander, Field Command desires, this headquarters, ARPA and AFTAC will each receive six copies of any Preliminary Project Shot Report. Two copies of each Preliminary Project Shot Report will be sent to the Division of Military Applications, Atomic Energy Commission. ARPA is expected to specify additional distribution at a later date. Based on review of these reports, ARPA will determine whether the information being generated by the different projects warrants their continued participation. Within the limitation of authorized funds, all projects will continue to participate unless specifically cancelled by ARPA.

4. MARSHMALLOW. Inasmuch as the originally planned site of MARSHMALLOW (U12e01) has been diverted to other purposes, authority was given to Commander, Field Command to select, in conjunction with AEC/ALO, a new tunnel site (Area 16) that would satisfy the MARSHMALLOW experimental requirements. Reference 1d forwarded a program package restating the objectives of the program and listing the approved projects. Commander, Field Command is requested to continue execution of the MARSHMALLOW programs as stated therein. Authority is also granted Commander, Field Command to conduct preliminary MARSHMALLOW exploratory and calibration experiments on such events as are necessary and possible on a non-interference basis. The extent of these experiments is dictated by the amount of funds allocated to Commander, Field Command for this purpose. By separate correspondence, the latest of which is reference 1f, funds have been authorized by this headquarters for the performance of MARSHMALLOW; the MARSHMALLOW program and the program of preliminary testing will be executed with these funds.

5. HARD HAT. Reference 1b forwarded the HARD HAT technical program which included a listing of projects and corresponding objectives. Commander, Field Command is requested to continue planning and execution of the HARD HAT event as a part of Operation NOUGAT.

6. SUN BEAM. Reference 1e forwarded the Weapons Effects Program for the SMALL BOY event of Operation SUN BEAM. Commander, Field Command is requested to continue planning and execution of the SMALL BOY event in accordance with above reference.

7. FISH BOWL. Reference 1c forwarded the Weapons Effects Program for the STAR FISH and BLUE GILL events of Operation FISH BOWL. Commander, Field Command is requested to continue planning and execution of the FISH BOWL events, subject to directives from the Commander, JTF-8 during the operational phase. Commander, Field Command is requested to coordinate with Commander, JTF-8 regarding additional instructions for the operational phase.

8. DANNY BOY. Reference 1g forwarded preliminary details for the DANNY BOY event. Reference 1h forwarded the details on the technical program. Commander, Field Command is requested to cooperate with LRL in the management and execution of the weapons effects program for this event.

9. SWORD FISH. The JCS has given the Commander, JTF-8 the responsibility for the conduct of this event. The technical program is being prepared by the Navy in coordination with this headquarters. It is anticipated that Commander, Field Command will be requested to assist to a limited degree with the execution of a weapons effects program for this event. Additional details on this operation will be forwarded at a later date.

10. Photographic Coverage. Reference 1i provides information on the present requirements for photographic coverage of approved test programs.

11. Funding. Commander, Field Command is requested to comply with the provisions of the "DASA Manual for Budgeting and Administration of Funds and Property in Support of Nuclear Tests."

12. Guidance Concerning Future Programs. Inclosure 1 contains the proposed weapons effects tests for FY 63 as forwarded to the JCS on 5 January 1962. In addition, the following operational names and their UNCLASSIFIED meanings have been approved:

SILVER FOX	-	Proposed Continental Operation to be conducted in 1963
BLUE ROCK	-	Proposed Overseas Operation to be conducted in 1963
BUCK SKIN	-	Proposed Continental Operation to be conducted in 1964
STRONG ARM	-	Proposed Overseas Operation to be conducted in 1964

FOR THE CHIEF:

/s/ John W. Gannon
/t/ JOHN W. GANNON
Rear Admiral, USN
Deputy Chief

1 Incl
Proposed Nuclear Weapons
Effects Tests for FY 63
DASA 59510, Cys 24&25 of
40 Cys, SECRET-RD

Appendix F

REPORTING PROCEDURES

Subsequent to previous test operations, there was a steady increase in the time delay between collection of data in the field and publication of the data in a report. To accelerate the flow of DOD effects information from the 1962 tests, Headquarters DASA published a letter, 20 April 1962, subject: Weapons Test Report Procedures. The letter modified the procedures set forth in the manual, Preparation of Weapon Test Reports, March 1958.

The modifications pertained to report content, submission dates, review procedures, printing, and report nomenclature. The Interim Test Report (ITR) became the Project Officers Interim Report (POIR), and the Weapons Test Report (WT) became the Project Officers Report (POR). The POIR and POR were the experimenter's reports to CHDASA, rather than DASA reports.

The POIR was primarily a description of the experiment, a listing of the data records obtained, and a presentation of such preliminary results and conclusions as might be immediately derived. Draft copies of the POIR were to be forwarded to CHDASA within 30 days of the last event to which the POIR applied.

The POR was the final report; its primary purpose was to present the data in reduced form with all corrections, calibrations, etc., explained and applied. Copies of the draft POR were to be forwarded to CHDASA within 6 months after the last event.

All necessary editorial functions and technical review were retained by FCDASA. The POIR was published for limited distribution by Field Command. The POR was published by the Division of Technical Information Extension, USAEC, at Oak Ridge, Tennessee.

Security review and classification of the POIR was performed by Field Command. The POR was reviewed by Headquarters DASA for security classification and distribution. Headquarters DASA did not review the POR for technical content.

Appendix G

SHOT AND METEOROLOGICAL DATA

Page 177 deleted.

TABLE G.2 METEOROLOGICAL CONDITIONS

Shot	Hard Hat	Danny Boy	Marshmallow	Little Feller II	Johnie Boy	Small Boy *	Little Feller I
On Surface:							
Atmospheric pressure, mb	879.4 (Yucca Flat)	880.8 (Yucca Flat)	882 (Yucca Flat)	883 (Area 18 CP)	883.8 (Yucca Flat)	904	880.5 (Yucca Flat)
Air temperature, °C	10.9	6.9	31	33.1	28.4	34.4	31.1
Dew point, °C	3.9	−2.8	−4.2	−2.7	−6.1	4	−1.5
Relative humidity, pct	62	50	10	10 (Yucca Flat)	10	15	15
Wind:							
Direction, degrees	180	—	—	170	195	135	—
Velocity, mph	24	—	—	7	7	2 to 5	—
At Elevation of Ground Zero, MSL							
Atmospheric pressure, mb	844 (Yucca Flat)	832 (Area 18)	838	845	848	906	844
Air temperature, °C	6.0	5.3	24.7	26.5	24.3	35	25
Dew point, °C	−2.2	−12.2	—	—	—	4	0.2
Relative humidity, pct	56	27	—	—	12	15	19
Wind:							
Direction, degrees	186	170	140	171	195	135	200 (at FCP)
Velocity, mph	24	13	18	7	7	2 to 5	15
At Burst Point:							
Atmospheric pressure, mb	—	—	810	845	848	906	—
Air temperature, °C	—	—	21.5	26.5	24.3	35	—
Dew point, °C	—	—	—	—	—	4	—
Relative humidity, pct	—	—	—	—	12 (Statis)	15	—
Wind:							
Direction, degrees	—	—	—	171	197	135	—
Velocity, mph	—	—	—	7	7	2 to 5	—

* Sky condition clear; visibility unrestricted.

TABLE G.3 WINDS ALOFT, SHOT LITTLE FELLER II

Height	Direction	Speed
ft		mph
Surface	170°	7
6,000	190°	14
7,000	180°	17
8,000	180°	13
9,000	180°	10
10,000	180°	10
11,000	140°	7
12,000	120°	13
13,000	110°	19
14,000	100°	16
15,000	090°	9
16,000	140°	3
17,000	200°	7
18,000	200°	8

TABLE G.4 WINDS ALOFT, SHOT JOHNIE BOY

Height	Direction	Speed
ft		mph
Surface	195°	7
6,000	170°	7
7,000	160°	7
8,000	160°	11
9,000	160°	16
10,000	170°	15
11,000	180°	12
12,000	180°	15
13,000	190°	17
14,000	200°	21
16,000	200°	22
18,000	200°	27
20,000	200°	23

TABLE G.5 WINDS ALOFT, SHOT SMALL BOY

Height	Direction	Speed
ft		knots
Surface	135°	Variable with gusts from 2 to 5 mph
4,000	145°	4
5,000	170°	5
16,000	230°	7
18,000	260°	13
20,000	280°	23

TABLE G.6 WINDS ALOFT, SHOT LITTLE FELLER I

Height	Direction	Speed
ft		mph
Surface	200°	15
6,000	200°	13
7,000	190°	12
8,000	170°	12
9,000	170°	11
10,000	150°	11
11,000	140°	11
12,000	150°	13
13,000	180°	16
14,000	180°	20
15,000	180°	23
16,000	190°	25

Pages 181 and 182 deleted.