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"Experiences at Desert Rock VIII"
by Robert D. Baldwin

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Robert D. Baldwin

Approved: William A. McClelland

William A. McClelland
Director of Research
Training Methods Division

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MEMBERS OF THE RESEARCH TEAM

Monitors - HumRRO

Mr. Shepard Schwartz - Training Methods Division, Team Leader

Dr. Robert Baldwin - Training Methods Division
Mr. John Cook - Armor Human Research Unit
Dr. Ralph Kolstoe - Training Methods Division
Dr. Boyd Mathers - Armor Human Research Unit
Mr. William Montague - Training Methods Division
Mr. Christian Peterson - Leadership Human Research Unit
Mr. Howard Sarvis - Infantry Human Research Unit
Mr. Robert Schroeder - Infantry Human Research Unit
Dr. Robert Vineberg - Training Methods Division

Assistant Monitors - 82nd Airborne Division

Sgt Felipe Alayon - 504 Abn Inf
SFC Edward Brown - 504 Abn Inf
Sgt Antonio Bustamante - 504 Abn Inf
SFC Charles Counts - 325 Abn Inf
SFC Gilbert Dobak - 325 Abn Inf
SFC Mack Gothia - 504 Abn Inf
SFC Lonnie Ledford - 504 Abn Inf
Sgt Phillipe Rios - 504 Abn Inf
SFC Terrel Taylor - 504 Abn Inf

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CHAPTER 1

INTRODUCTION

General

During the interval 25 July through 3 September 1957, a research team representing several of the HumRRO research groups was temporarily stationed at Camp Desert Rock, Nevada for the purpose of observing troop responses to initial exposure to the effects of atomic weapons. In the following sections are presented the military requirement for the study, the HumRRO plan for the observations, an account of actual events at Desert Rock and the results and implications of the observations obtained.

The Military Problem

During the Nineteenth meeting of the CONARC Human Research Advisory Committee (February 1957), it was recommended that HumRRO initiate research to determine the psychological impact of ABC (atomic, biological, chemical) employment on the battlefield. This recommendation was stimulated by the results of a prior CONARC staff study concerning "the possible need for research to develop training methods which will prepare soldiers to fight under conditions of CBR contamination or threat." As part of this staff study, comments and suggestions for possible CBR training research were solicited from certain Army schools in the Continental United States. A need was expressed for research to "develop training methods which will preclude panic engendered by fear of the unknown, such as radioactive fallout. . ." At the conclusion of this study G-1, CONARC suggested that the Director, HumRRO send observers to Desert Rock for the purpose of (a) developing recommendations for improvement in training to avoid panic, and (b) developing a research proposal which will initiate research in the area.

The Research Mission

In response to the CONARC suggestion, the Director, HumRRO assigned Training Methods Division the mission of spearheading the formation of a HumRRO-wide research team of observers for the series of atomic weapon firings (shots) scheduled during Exercises Desert Rock VII and VIII.

The primary objective of HumRRO's participation in the Desert Rock exercises, as stated in June 1957, was to orient selected research personnel from the Training Methods Division, and the Armor, Leadership, and Infantry Human Research Units, CONARC, to problems associated with training troops for participation in atomic warfare. A secondary objective (which subsequently became the raison d'etre for the team) was to gather pilot data relevant to research planning in the area of Army training.

Two opportunities for HumRRO observation were available during the 1957 series of AEC tests at the Nevada Test Site (NTS); Exercise Desert Rock VII scheduled during 25-27 June, and Exercise Desert Rock VIII (DR VIII) scheduled for 19 August. Because of the short lead time, only one observer attended the Desert Rock events in June. Attention was concentrated on the 19 August maneuver.

CHAPTER 2

PRELIMINARY PLANNING

Early Coordination

Official approval of HumRRO's participation in Desert Rock VII and VIII was granted by CONARC in late June, and the Desert Rock Exercise Director and Commanding General, 4th Infantry Division were requested to assist HumRRO in coordinating research for the 19 August shot. The subsequent visit to Camp Desert Rock late in June resulted in preliminary coordination of HumRRO's participation in the U. S. Army Battle Group Test, Exercise HILL AND DALE, scheduled for the 19 August firing of the AEC test weapon, SMOKY. Conferences with the staff of the Exercise Director, Desert Rock VII and VIII, resulted in tentative agreement that periods of time could be allocated to HumRRO for conducting testing of troops of the 1st Battle Group, 12th Regiment, of the 4th Infantry Division. This time could be allotted during (a) the "dry run" (the full-dress rehearsal for the maneuver), (b) the hour immediately following the detonation, and (c) immediately following conclusion of the maneuver. In subsequent conferences at Fort Lewis, Headquarters of the 4th Infantry Division, preliminary arrangements were made for troop availability for observation purposes, for a limited amount of testing, and for coordination of the research activities with troop movement, training, and maneuver plans.

Exercise HILL AND DALE

As of 1 July 1957, Exercise HILL AND DALE utilized a three-phase problem requiring the participation of an infantry battle group, a helicopter battalion, and supporting elements. The three phases were constituted in the following manner:

1. Preparation of an infantry battle group (IBG) defensive position for protection against the effects of atomic attack.

The June conference at Desert Rock resulted in the following agreements concerning time allotments for HumRRO testing:

1. Unspecified amounts of time during the exercise rehearsals (14-17 August) and the post exercise inspection of the defensive positions (22 August).

2. Approximately one hour immediately following the shot on 19 August. During this interval troops were scheduled to occupy observer positions while awaiting AEC clearance to leave the area.

3. An unspecified amount of time during the dry-run for Shot SMOKY, tentatively scheduled for 18 August.

The conferences at Desert Rock and Fort Lewis also revealed it would not be possible to employ live firing of individual weapons in the test site area as a proficiency measure because of the lack of regulated small arms ranges and the consequent hazards to army observers, AEC personnel, and installations.

At Fort Lewis, considerable information was obtained concerning the composition of the troops comprising the task force. The force was to include five rifle platoons, one weapons platoon, a mortar battery, and a headquarters and service company. In addition, one platoon of Canadian infantry would be integrated in the task force on an across-the-board basis. The task force would contain the best units in the group, but no attempt would be made to select the best individual troops. Only men with at least one year of service, however, would be included. The troops had received no special training for atomic warfare or atomic maneuvers beyond one showing of the 1952 Desert Rock training film.

The Research Problems

Since the initial coordination at Desert Rock and Fort Lewis indicated that HumRRO's mission at Desert Rock could be supported in terms of troop availability and housekeeping requirements, the attention of Training Methods

Division was next directed towards preparation of a preliminary research plan. As a result of conferences with the Central Office and within Training Methods Division, it was decided that the pilot studies would concentrate on two aspects of troop reaction to atomic weapon usage: (1) response upon first exposure to the initial effects of an atomic detonation, and (2) reactions to the contamination of terrain by nuclear radiation.

The first area of inquiry was an assessment of the extent to which the performance of highly learned combat tasks is impaired immediately following first exposure to the initial effects of an atomic detonation. Both individual and small unit tasks were considered. This area was considered important due to the possibility that witnessing the detonation and experiencing the blast and thermal effects of the shot in combat might have a disruptive effect upon combat proficiency.

The second area of study was concerned with the utilization of contaminated terrain for protective or other combat purposes. Historically, terrain has been perceived by the combat soldier as a source of protection from enemy fires. Conceptually, the ground is a "friend" to a GI. In atomic combat situations, however, it is likely that the soldier will be required to traverse terrain that is contaminated by nuclear radiation. It was believed that a determination should be made of the qualitative effects of operating in a contaminated area upon the performance of military personnel.

It was immediately recognized that studies in these behavior areas would be complicated by the difficulty of achieving combat realism in the test situations. Because of time limitations, there was no opportunity to try out various combat-relevant tests before departing for Camp Desert Rock. It was necessary to select military tasks and develop tests of

proficiency which appeared to be both relevant to combat duties and possessed the required measurement characteristics of reliability, objectivity, and sensitivity to individual differences. Further complications evolved from the safety requirements for troop participation in these AEC tests. It would probably be extremely difficult to detect any indication of impairment in military proficiency under the safety restrictions employed at the Nevada Test Site. At best, the pilot studies could only hope to detect a trend or tendency for performance to be degraded under such operating conditions, assuming that the effects of nuclear detonations are disruptive of military proficiency. It was hypothesized that the disruptive consequences of observing atomic effects might operate through several modes or mechanisms: Shock, bemusement, "gawking", wonderment, and fear might occur immediately after the shot; panic, or more probably, milder forms of anxiety might be generated when personnel were required to traverse radicactive terrain. Under the safety regulations in force at Desert Rock, it was recognized that shock (total inability to respond) and panic (total disorganization and flight) would not be observed. The research problem was to obtain data that could be examined to detect the occurrence and effects of the milder forms of performance disruptions.

The Initial Tests Selected

The following tests were initially selected for use at Desert Rock:

1. A rifle disassembly-reassembly test. This test was considered relevant to the combat situation because of the frequent necessity in some military campaigns for personnel to field strip their individual weapons for inspection and cleaning purposes prior to going into action. Field stripping the M-1 rifle was also regarded as a task representative of a larger number of highly learned or overlearned military tasks requiring

eye-hand coordination. Proficiency in this task was to be determined in time (speed of performance) and errors for each individual. It was to be administered immediately after the detonation of SMOKY.

2. A test of the ability of four-man groups to assemble on a specified point, collect and load supplies on a pallet, carry the loaded pallet to a designated position, and return to their individual positions. This small unit test was devised to detect disruptions in team performances associated with atomic blast effects. This type of task is frequently encountered in infantry operations, particularly within heavy weapon platoons. It was also selected as being representative of the types of activities required to reorganize positions hit by enemy artillery fires. It was planned to score this task in terms of speed of assembly of the four man team, time required for task completion, and amount of supplies transported. This test was to be administered subsequent to completion of the rifle stripping task.

3. An abbreviated combat or infiltration course. This course would be constructed as close as possible to ground zero for SMOKY and would require troops to run and crawl over terrain containing barbed wire obstacles. The test would be scored in terms of amount of time required to traverse measured lengths of terrain by crawling and running with reference to a prescribed desired rate of speed. The infiltration course would be set up on terrain that would be marked as radicactive and perceived by troops as contaminated. The test was to be designed to detect any tendency for troops to "gallop" or "straggle" while crossing contaminated ground during offensive engagements. It was planned to administer this test on 22 August when the troops returned to the SMOKY ground zero area for inspection of the fortifications prepared on 14 August.

4. A combination Information-Attitude Questionnaire. The questionnaire would be administered at two points during the training for HILL AND DALE: (1) After arrival at Desert Rock and before receiving the prescribed atomic weapons orientation program, and (2) shortly after the orientation. The questionnaire would be analyzed to determine the relationship between attitude changes and performance after the detonation of SMOKY.

The Research Design

For each selected task, the participating troops would be given intensive preliminary training at Camp Desert Rock during the period 13-16 August in order to establish stable performance levels for each individual and team. The personnel would be tested during the dry-run on 18 August to obtain measures of proficiency under non-stressful (i.e., no shot) conditions. The 18 August testing would provide control or baseline measurements to be used as standards for comparing the test results obtained after the shot on 19 August (D-day). The differences in proficiency levels occurring between the control and D-day measurements would be statistically analyzed to detect significant performance changes.

The performance test data would also be analyzed with reference to attitude changes expressed in the questionnaire by comparing the D-day performance of troops indicating a decrease in self-confidence with those personnel indicating no change or an increase in self-confidence after the orientation lectures.

The Research Team

A ten-man research team would be formed comprised of civilian scientists from the Training Methods Division, the Armor Human Research Unit, CONARC, the Infantry Human Research Unit, CONARC, and the Leadership Human Research Unit, CONARC. A two-man advance party for the HumRRO team would arrive at Camp Desert Rock on 25 July to complete coordination of the observation and testing plans with the Exercise Director. The remaining members of the team were scheduled to arrive at Desert Rock on 11 August.

CHAPTER 3

EVENTS AT DESERT ROCK[1]/

The Revised Exercise Plan

Upon arriving at Desert Rock, on 25 July, the advance party learned that a drastically revised plan for HILL AND DALE had just been received by the Exercise Director. Whereas the original plan called for a three phase, multi-day maneuver designed to provide ample opportunity for tests of newly developed doctrine, the revised Exercise Plan was based on a one day offensive operation requiring a smaller physical maneuver area. It was also learned that the IBG would observe the firing of SHASTA, an AEC test shot scheduled for 29 July, prior to the exercise. Since the research interest was directed at the reaction of troops to initial exposure to atomic detonations, the plans for the Battle Group to witness SHASTA prior to the firing of SMOKY negated the use of these personnel for HumRRO's research purposes.

It was learned, however, that an additional organization was scheduled for inclusion in the roster of observers for the SMOKY shot; a Provisional Company from the 82nd Airborne Infantry Division was expected to arrive at Desert Rock approximately 30 July. Since official orders had not been received at Desert Rock regarding these troops, the ETA, composition and size of the provisional company was unknown. Tentative plans had been made by the Exercise Director to employ all or part of these troops as minefield sappers during HILL AND DALE. In this role the 82nd Division personnel were to be positioned in trenches at a location approximately 4400 yards from ground zero for SMOKY.

1/ A description of Camp Desert Rock is presented as Appendix A.

The staff of the Maneuver Director indicated that these troops could be utilized by HumRRO for observational and testing purposes, providing permission for such utilization was granted by Continental Army Command. It was also agreed that the airborne troops were not to receive any opportunity to directly observe any shot prior to SMOKY, and they were to be available for testing purposes for approximately one hour following the shot.

The Desert Rock staff suggested that HumRRO study the feasibility of substituting the mine sweeping task for the lifting and loading test in the preliminary plan, because of the relevance of the mine sweeping operation to the general exercise plan. The suggestion was studied, and a mine sweeping test was devised. The test appeared on rational grounds to possess desirable measurements characteristics, although it lacked tactical validity.

Within the next few days, the advance party learned that there were objections to the test requiring crawling over contaminated terrain. It was indicated that the AEC might not permit the employment of this task because of the possible danger to troops of radiation burns from beta particles. It was agreed that it might be necessary to withhold the troops from the crawling course in the event that the beta contamination (or gamma contamination) was high. At that time it was not possible to obtain an exact statement of the maximum radiation dosage permitted for the crawling course.

Logistic Support of the Testing

During the interval 26-31 July, the advance party prepared a detailed plan of the HumRRO activities for submission to the Exercise Director while awaiting additional information regarding the ETA of the 82nd Division personnel. The logistical requirements for the study were

tentatively coordinated with the Desert Rock Staff, pending CONARC's approval of HumRRO's utilization of the airborne personnel. Support required for the testing program included the following major items:

1. A strip of terrain in the Nevada Test Site (NTS) 200 yards wide and 1200 yards long for the forward area testing. This strip would lie in a north-south direction (approximately) with the southern bcundry approximately 4500 yards south of the ground zero for SMOKY, and the northern edge located at 3200 yards from ground zero. The eastern edge of the strip would lie on a N-S line located 50 yards west of the western bcundry of the trenches.

2. An area of land within the limits of Camp Desert Rock for the preliminary training of the airborne troops in the tasks.

3. One hundred and fifty dummy antitank mines; one hundred and twenty mines emplaced according to a prescribed pattern in the NTS area, and thirty dummy mines emplaced in the training course at Camp Desert Rock.

4. One hundred and twenty hand grenades (practice).

5. Barbed wire and pickets for construction of the infiltration courses in the NTS area and the CDR training area.

6. The support of Post Engineers for construction of the courses and clearing a 100 by 100 yard "pad" in the NTS area for the administration of the rifle stripping test.

Additional discussion occurred with reference to the hazards associated with crawling over contaminated terrain. The Exercise Director's staff believed that there might be some danger of burns from beta and gamma radiation. No decision was made, however, regarding the maximum radiation level permissible for this task, although a limit of 20 millircentgen had been suggested.

The Revised HumRRO Testing Plan

A revised plan of test for the HumRRO data gathering activities was submitted for the approval of the Exercise Director on 31 July. This plan provided for the following events arranged with reference to SMCKY's H-hour (i.e., time of detonation).

1. At H minus 30 minutes (one-half hour prior to detonation) the troops occupy trenches located 4500 yards South of Ground Zero (Reference Figure 1), maintaining squad integrity.

2. At H plus 2 minutes (two minutes after the detonation) the troops move by squads to the clearing 50 yards west of the trenches.

3. At H plus 5 minutes the troops complete administrative formations of the 11 man testing groups and begin the rifle disassembly-reassembly test on a whistle blast.

4. At H plus 20 minutes the troops proceed to the southern edge of the minefield and enter the minefield as individuals on whistle blast to begin locating and removing dummy AT mines.

5. At H plus 35 minutes troops cease the mine clearing task on a whistle blast and reform by platoons at the northern edge of the mine field.

6. At H plus 42 minutes, troops depart mine field area for the crawling course located 1100 yards north toward ground zero.

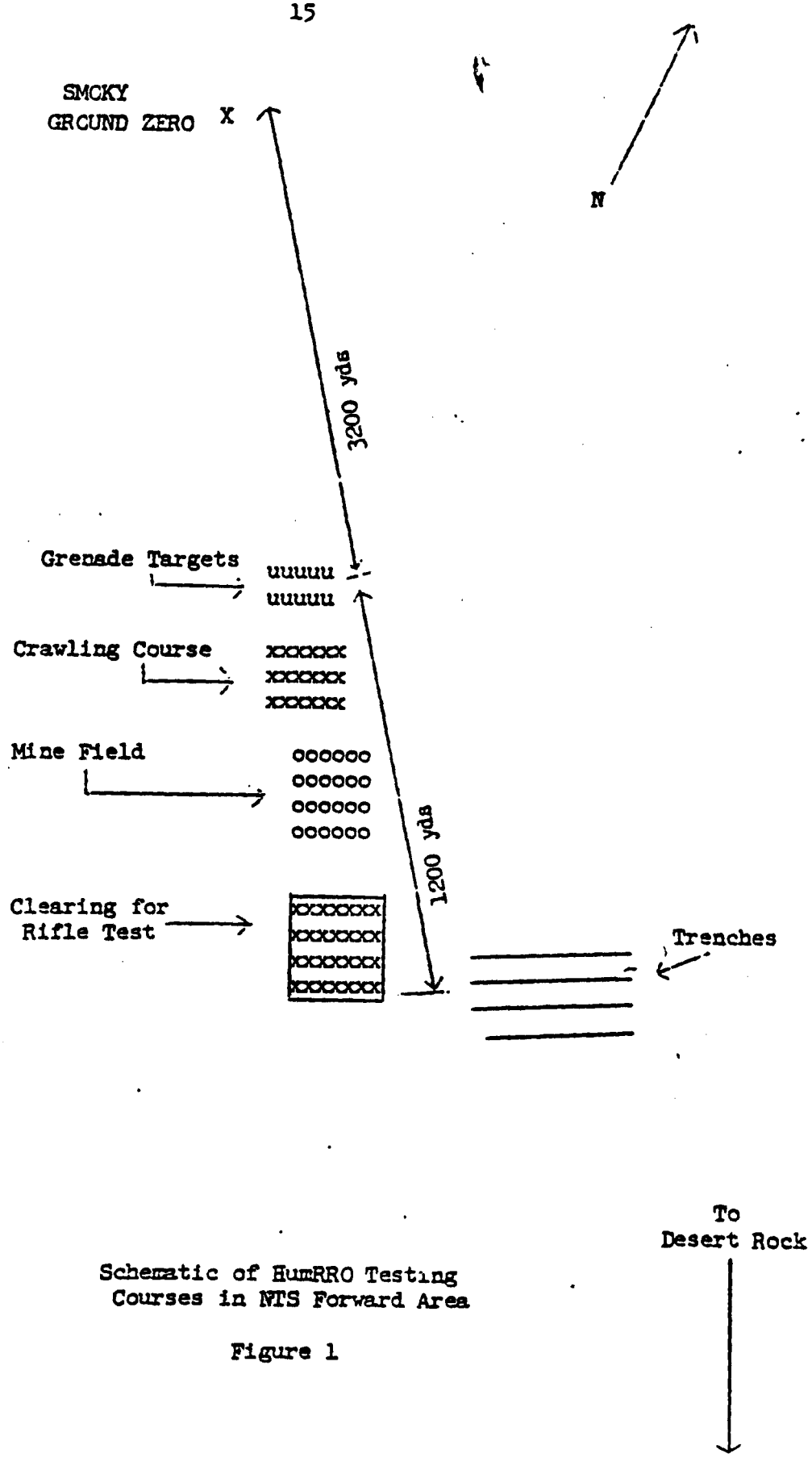
7. At H plus 60 minutes, first squad begin the crawling test.

8. At H plus 70 minutes, first squad completes the crawling test.

9. At H plus 110 minutes, final squad completes the crawling course.

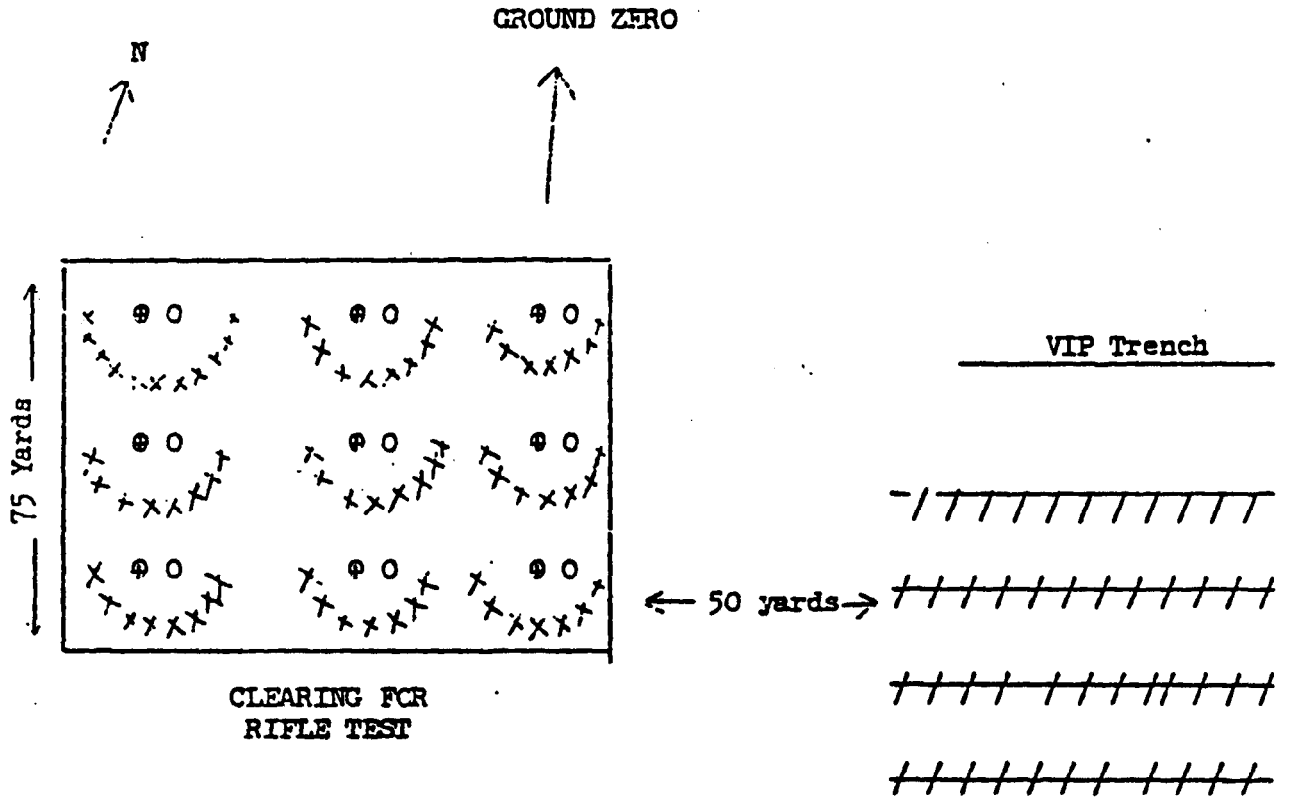
As of 31 July, the HumRRO tests consisted of the following:

1. The M-1 Rifle Stripping Test: At H hour the troops and monitors would be in position in the western portions of the second and third trenches (reference Figure 2), each man wearing a protective mask. The HumRRO



Schematic of HumRRO Testing
Courses in NTS Forward Area

Figure 1



LEGEND

X X X Paratrooper

O O O NCO Assistant Monitor

⊕ ⊕ ⊕ HumRRO Monitor

Troop Trenches

RIFLE TEST and TRENCH AREA

Figure 2

monitors would be in the extreme western portions of the trenches and the chief HumRRO monitor would be with the company commander and the Radiological Safety Control Officer from Camp Desert Rock. At H plus 2 minutes, subject to approval by the RAD-SAF Officer following monitoring of the immediate trench area, the Unit commander would give the company orders to unmask, dust conditions permitting, and move out of the trenches to the clearing located west of the trenches. The troops, preceded by the HumRRO monitors, would exit the six foot deep trenches, via steps cut into the earth. The troops preceded by the HumRRO monitors, would proceed to the clearing and after locating their predesignated monitor, would form in administrative semi-circular formations.

Following assembly of the troops, each HumRRO monitor and NCO assistant monitor would check each squad for absentees and the presence of tools for the rifle disassembly test. (It was subsequently learned that the troops would not require a combination tool for the test. The level of disassembly utilized in the task required only the use of a pointed instrument, such as the tip of the bayonet, to remove the follower arm pin from the receiver.) The assistant monitors would then instruct the troops to spread their ponchos on the ground and to assume a kneeling position in front of the poncho in preparation for the test. Upon a signal (a whistle blast) from the Chief HumRRC Monitor, the HumRRO Monitor for each squad would order the troops in his group to begin the test, simultaneously beginning the timing by means of a stop watch. The individual soldier was instructed to disassemble the M-1 in the following manner, placing each part removed on the poncho:

1. By pulling downward on the trigger guard, remove the trigger housing group from the rifle.

2. Separate the barrel and receiver group from the stock group.

3. Using the point of the bayonet or a stick, remove the follower arm pin from the receiver.

4. Remove the follower arm, bullet guide and operating-rod catch-spring from the receiver.

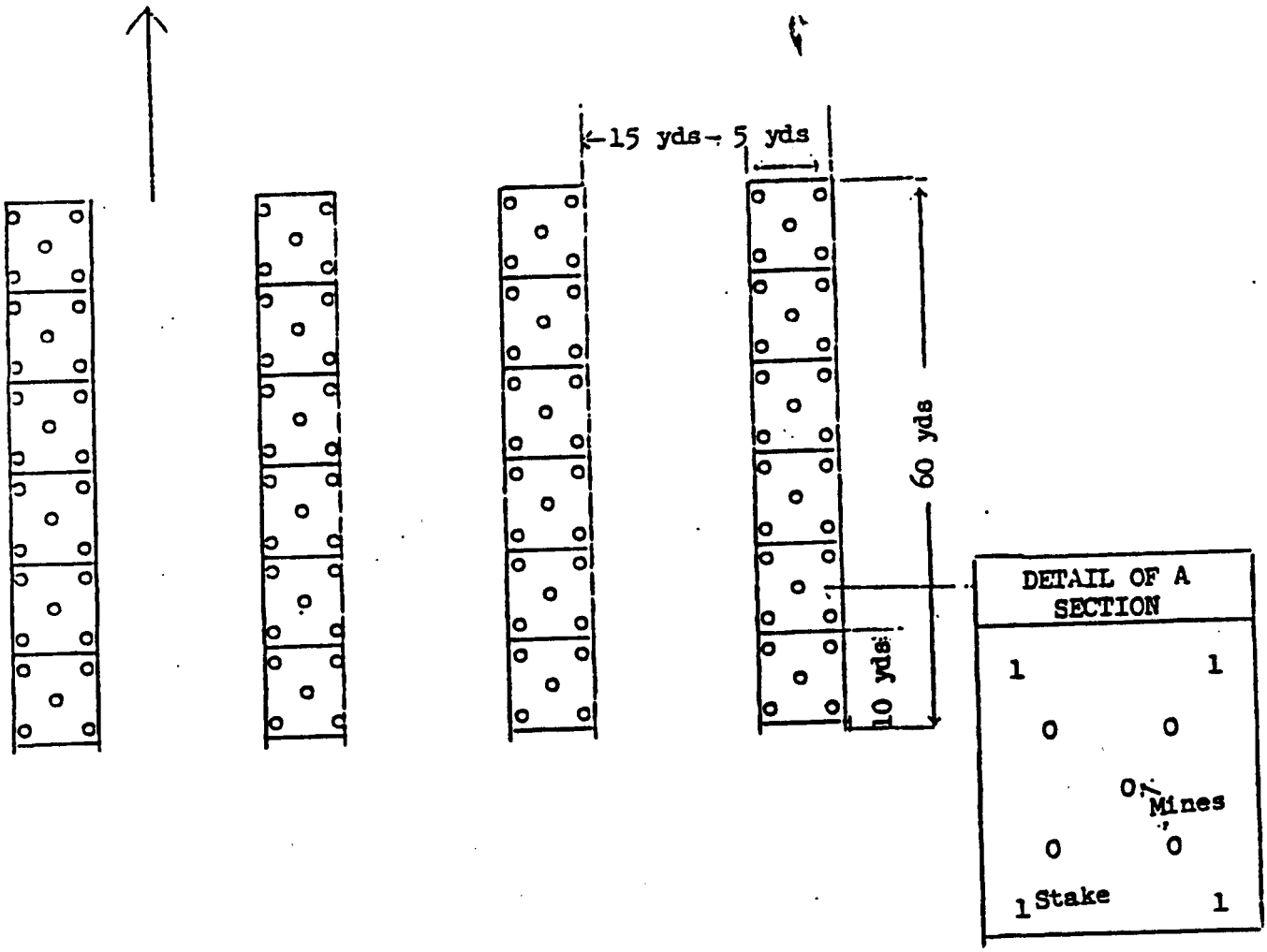
5. Lift the follower assembly from the receiver.

6. Disengage and remove the operating rod from the receiver.

7. Lift the bolt from the receiver, completing the disassembly.

As each man completed disassembly of his weapon, he would raise the "stripped" barrel and receiver at arms length and call out his name. The monitor or assistant monitor, whoever was nearest, would visually inspect the weapon for complete disassembly. Upon acknowledgement of the inspection each man would begin reassembly of the weapon. Upon completion of reassembly each troop would stand, hold up his weapon and again call out his name in a loud and clear manner. At this instant, the HumRRO monitor would call out the elapsed time indicated by the chronograph (i.e., stop watch), and the assistant monitor would record this time on the record form next to the individual's name. When all troops had completed the test, all weapons would be inspected by the assistant monitor for proper assembly. Errors in assembly were to be appropriately recorded.

2. The Mine Field Test. A simulated mine field would be located in the Nevada Test Site in an area approximately 4300 yards from ground zero. The mine field would be 65 yards wide (East-West dimension) and 60 yards long (north-south direction). Although the whole area immediately north of the trenches would be assumed to be mined, dummy AT mines would only be emplaced in the 65 by 60 yard area. These mines would be emplaced in four lanes. Each lane would be five yards wide (see Figure 3), and the lanes would be separated by a distance of fifteen yards. Each of the five by sixty yard lanes would be divided into six sections, each section being five yards wide and ten yards long. Four stakes would mark the corners of each section. There were to be a total of twenty four such sections in the



SCHEMATIC OF MINE FIELD

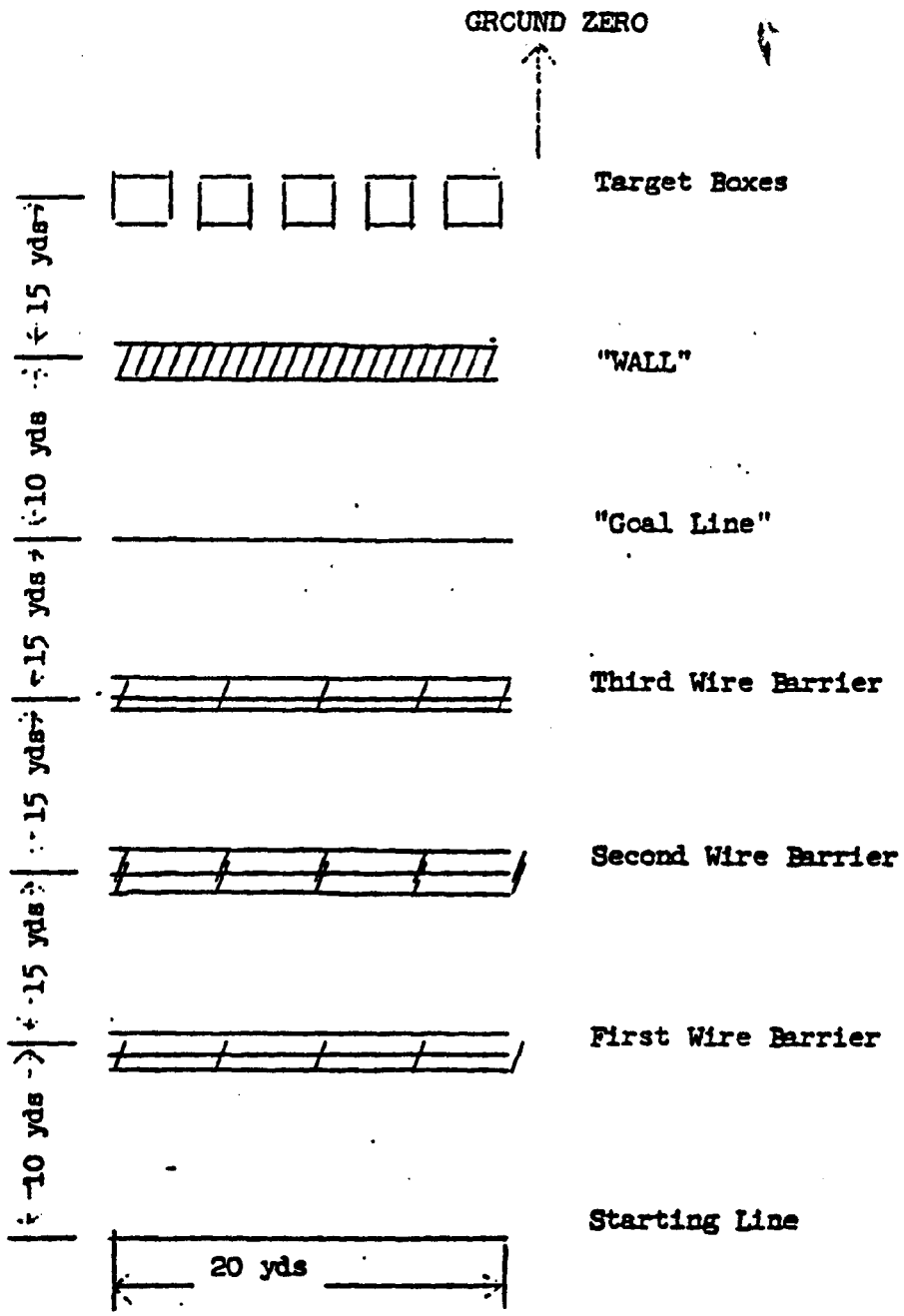
Figure 3

simulated mine field. Within each section five AT mines were to be "dug-in" to a depth of approximately six inches. These mines would be arranged in a uniform pattern in each section: one mine to be located in the approximate geometric center, and one mine to be emplaced three paces from the center mine in the direction of each corner. The task would require location of the center mine by probing with a bayonet, pacing off the distance to each mine placed on the diagonal of each rectangle and probing with a bayonet until each of the diagonally emplaced mines was located. Each mine was to be removed from the section and placed alongside the lane. This test was based on the following tactical assumption: (1) prior reconnaissance of the area with mine detectors had revealed the pattern of emplacement by aggressor; (2) it had been determined that there were only AT mines in the area, therefore, personnel could move over the terrain on foot without danger from antipersonnel mines; (3) the situation required four lanes, five yards wide and sixty yards long to be cleared of AT mines for movement of vehicles; and (4) the lanes to be cleared had been staked out previously by the reconnaissance party.

The test would begin at approximately H plus 20 minutes; i.e., after the troops would move by platoons to the area approximately 50 yards north of the pad cleared for the rifle test. Upon signal from the Chief HumRRO monitor, the troops would move, as individuals, to their assigned mine field stations and begin locating and removing the dummy mines. Four men, selected at random from the company, would be assigned to each 5 by 10 yard section. No attempt would be made to designate a leader for each team. Prior to the testing in the forward area, the troops would be given intensive preliminary training on a training course (consisting of only one lane of mines) at Camp Desert Rock. The individual soldier would always

be assigned to the same section, and the composition of each four man team would be constant during the training and testing phases. Performance on the test would be scored in terms of time required to remove all five mines, with a maximum time limit of 15 minutes being established for the task. Absentees from each team would be recorded at three intervals during the test (5, 10 and 15 minutes after the starting whistle) to detect absences, if any, from the work groups on D-day.

3. The Infiltration (Crawling) Course. The infiltration course was located in an area approximately 1200 yards north of the trenches and 3300 yards south of ground zero (c.f. Figure 4). The course was constructed in an area 80 yards long and 20 yards wide (c.f. Figure 4). The test would require the following activities: a group of four men abreast, each man carrying a light field pack, protective masks, and M-1; each man would walk 10 yards from a starting line to a "cow pasture" type wire barricade. This barricade would consist of four strands of barbed wire loosely hung on pickets placed five yards apart. The bottom strand would be fastened so that the wire was approximately two inches from the ground. Upon reaching the first barrier, each man would go under the wire and crawl for 15 yards to a second wire barrier. Going under the second wire fence, each man would continue crawling for another 15 yards to a third wire barrier. After going under the third barrier, he would crawl an additional 15 yards to a line marked by engineers tape pegged to the ground. Upon reaching the tape each troop would run for fifteen yards to a simulated wall (actually constructed of baling wire suspended on pickets and laced with engineers tape), drop to the ground, ready a dummy grenade, rise up, and throw the grenade at a pit of dimensions four by four feet, located at a distance of 15 yards from the "wall". (Subsequently this infiltration course was



Schematic of Infiltration Course as Originally Designed

Figure 4

changed from its original design. These changes will be described in a later section of the report.) After completing the throw the troops would crawl to the western side of the course and present their weapon to a HumRRO monitor for inspection for cleanliness and functioning. It was planned that at approximately one hour following the detonation of SMOKY, the first troops would arrive at the crawling course. Since the test was concerned with the effect upon infiltration performance of crawling over contaminated terrain, standard U.S. Army Radiation Hazard Markers would be placed around the crawling course area, whether or not actual contamination occurred. Twenty milliroengten markers (yellow cones) would be placed approximately 100 yards south of the course, black spotted yellow cones (contamination greater than 20 mr, but not specified) would be located approximately 50 yards south of the crawling course, and five roengten markers (red cones) would be placed between ten and twenty yards north of the crawling course. The troops would be instructed about the markers and their significance at the time of the orientation lectures at Camp Desert Rock. If the course actually was contaminated by the fallout from SMOKY, the markers would be indicators of hazard, although the amount of radiation present would not be accurately indicated. If the terrain was not contaminated as a consequence of the detonation, the markers would serve as invalid indicators of a radiation hazard. If the latter condition prevailed, it was planned to brief the participating troops on the lack of an actual hazard after the tests had been completed.

Approval of these tests was granted by the Exercise Director on 2 August, and construction of the testing course in the Nevada Test Site and the training course at Camp Desert Rock began, both labor and material being furnished by Desert Rock. This construction was subsequently completed on 9 August.

The 82nd Airborne Arrives

On 31 July it had been learned that the Provisional Company from the 82nd, referred to as Task Force BIG BANG, would arrive at Desert Rock approximately 12 August. BIG BANG would consist of seven officers and one hundred and thirteen (113) enlisted personnel. Since the remainder of the HumRRO team was not scheduled to arrive at Desert Rock until 11 August and SMOKY was scheduled to be fired 19 August, it was apparent that intensive training of the enlisted personnel, as well as the HumRRO examiners, would be required in order to stabilize performance on the tasks prior to the shot. It was not known, however, how much training would be required to stabilize performance, since there had been no opportunity to try out the tasks prior to the arrival of the airborne unit. In addition it would be necessary to train the members of the HumRRO team in the administration and scoring of the tests at the same time that the assistant monitors and participating troops were learning the tasks. Although this procedure was not ideal, no alternative was available.

On 5 August the HumRRO advance party informally learned that Commanding General, CONARC had officially requested the Commanding General, 82nd Airborne Division to cooperate with HumRRO in accomplishing the testing mission at Desert Rock. Official confirmation of this request was not received by the HumRRO team, however, until several days later.

Task Force BIG BANG of the 82nd Division arrived at Camp Desert Rock the evening of 12 August, a few hours after the HumRRO team had received official confirmation that this group would support the HumRRO testing mission. The task force consisted of 170 personnel, including seven officers and 163 enlisted personnel, fifty more personnel than had been anticipated. Approximately one hundred of the enlisted personnel were equipped with the M-1 rifle, the remainder carrying carbines. The HumRRO

team decided that it would limit the testing mission to the personnel equipped with the M-1; the personnel equipped with carbines would be utilized as a source for assistant monitors and for general support of the testing program. The sample of troops to be tested were organized into nine squads, each consisting of eleven men.

Description of the Sample

1. The average (arithmetic mean) age was 22 years, with ages ranging from 18 to 33 years.

2. The sample was composed of 88 per cent regular Army volunteers, nine per cent draftees, and three per cent recalls from reserve status.

3. Over sixty per cent of the 99 men were of enlisted rank equivalent to Corporal or above (18% were E-4's, 36% were E-5's). Approximately 39 per cent were privates or PFC's.

4. Approximately 50 per cent of the group had at least completed a 12th grade education, 8 per cent had finished no more than 8th grade, and 6 per cent had started but not finished college. There were no college graduates in the sample of 99 enlisted men.

5. Approximately 25 per cent had been in a fire fight and/or under enemy shell fire, the majority having not experienced actual combat.

6. Approximately 50 per cent had accumulated at least two years of active military duty and 23 per cent had over five years of active duty.

7. Only three per cent of the group previously had witnessed an atomic detonation.

8. During the previous twelve months, approximately 75 per cent of the troops had heard at least one Army training talk on the atomic bomb and its effects. One-fourth of the sample could not recall having heard even one training talk in this time period.

Information and Attitude Changes

On 14 August, two days subsequent to the arrival of the troops at Desert Rock, the Provisional company was briefed on the purpose and content of the HumRRO testing. Then they were administered a questionnaire designed to assess the men's backgrounds, amount of previous exposure to atomic weapons, and their knowledge and attitudes regarding such weapons. A copy of the questionnaire appears in Appendix C. This assessment constituted the baseline measurement of information and attitudes. On 19 August, after the troops had experienced three days of training with the HumRRO tasks, the company was given a two hour indoctrination lecture on atomic weapons and their effects by members of the Camp Desert Rock instructor group. This lecture had been coordinated previously with the HumRRO team to insure coverage of informational topics included in the questionnaire. The orientation was followed by a second administration of the questionnaire. The objective of the administrations was to determine the effects of the troop information program upon knowledge of weapon effects and troop attitudes, particularly the effects of information gain upon expressed anxiety and individual estimates of the anxiety level of other personnel in the company.

Preliminary Training

At the time of arrival of Task Force BIG BANG, available information indicated that SMOKY would be fired on 19 August. This schedule would require the control or baseline measurements to be made no later than the morning of 18 August (Sunday). In accordance with this deadline, intensive training of troops on the tasks to be tested was begun on 14 August. This training was intended to serve several purposes: (a) The participating troops would become skilled in the performance of these tasks and, it was hoped, achieve a stable level of proficiciency prior to the baseline measurement; (b) the monitors (HumRRO team members) and assistant monitors

(NCO's from Task Force BIG BANG) would become highly proficient in administering and scoring of the tasks, and (c) deficiencies in the test administration and scoring procedures would become apparent.

Several difficulties did become apparent during the initial days of training. Since the original infiltration course required troops to crawl for a total distance of 45 yards, repeated practice over this rock-strewn course resulted in extensive damage to fatigues and a heavy incidence of skinned and bleeding elbows. As a result, performance on this task became quite variable, and the experience was painful to the participating troops. The damage to uniforms did not help the morale problem, either.

During the week of 12 August, it was learned that the AEC had established a schedule of SHASTA plus ten days for SMOKY. The SHASTA firing had been postponed nineteen times since its original scheduled firing date of 29 July. The SHASTA plus 10 days requirement for SMOKY had two influences upon the HumRRO testing mission: (a) the need for obtaining a baseline requirement prior to 19 August was negated, thereby providing additional time for preliminary training of the paratroopers; (b) if SHASTA continued to be postponed, the contingent postponement of SMOKY promised to create problems in establishing firm plans for training and testing; and (c) such postponements might have a deleterious effect upon morale among the paratroopers.

On 18 August SHASTA was fired and observed by the HumRRO team. (Descriptions of personal observations of SHASTA and DOPPLER, by members of the research team, are presented in Appendix B). In keeping with the established contingency, SMOKY was rescheduled by the AEC for 28 August.

During the week of 19 August, the training of the paratroopers continued, and the tests were modified, where necessary, to facilitate administration and to obtain desired measurement characteristics.

The major changes were the following:

1. Several of the HumRRO monitors experienced difficulty in recording the rifle test scores, since there was a tendency within a few squads for many of the troops to complete reassembly of the M-1 almost simultaneously. This was corrected by using two stop watches for these squads, and having the assistant monitors record times for half of the squad while the HumRRO monitor recorded the performance of the remainder. The change reduced the span of control required of the monitors for successful administration of this test.

2. The time limit for the mine field test was reduced from fifteen to five minutes, the latter being sufficient time for completion of the task.

3. The infiltration course was revised as follows:

a. the crawling distance was reduced from 45 to 15 yards to alleviate the damage to bodies and uniforms.

b. a foxhole was dug between the second and third wire fences, and troops were instructed to sprint from the second barrier to the foxhole, remain in the hole for an estimated 10 seconds, sprint to the third barrier, and go under the wire. The actual time spent in the foxhole would be recorded by monitors to determine if the ability to estimate time was affected by operations in contaminated terrain.

c. the throwing distance for the grenade task was reduced from 15 yards to 12 yards to increase the number of hits from 50 per cent.

d. each troop was instructed to throw two grenades successively rather than one.

The troops were first trained in the revised infiltration course at Camp Desert Rock on 22 August, the day before the troops' first familiarization visit to the forward area.

The Familiarization Run

On 23 August, the paratroopers were taken to the forward area of the Nevada Test Site for the first time. The purpose of this visit was to familiarize the troops with the terrain and to provide a practice run for the whole sequence of events to occur on D-day: movement to and from the trenches, movement to the clearing for the rifle test, locating the lanes for the mine field, and navigating the 1000 yards forward to the infiltration course. It was believed that preliminary experience on the infiltration course would be extremely important for two reasons: (a) the terrain in the forward area differed in rock concentration and composition from that in the Camp Desert Rock training course, and (b) the lanes through the crawling course in the forward area were not marked by the scuffing action of the crawling troops.

The troops departed Camp Desert Rock at approximately 0830 hours on 23 August, arriving at the SMOKY trenches at approximately 1100 hours. After locating and inspecting the trench positions previously prepared by Post Engineers, the squads were assigned to their positions in the two forward troop trenches, went through the routine commands associated with a count-down, filed out of the trenches and marched to the area cleared for the rifle test. After completing the rifle test, they were marched to the south edge of the mine field area and were briefed on the location of the lanes. After completing the mine clearing test, the troops proceeded, one platoon at a time, to the infiltration course. There the troops were assigned to lanes in the course according to a previously prepared roster, and they ran the course once. As each platoon completed the infiltration course, it withdrew on foot to the trench area where a field mess had been established. On this day, 96 of the paratroopers reported for duty.

No training or testing activities were scheduled during the weekend, 24-25 August, and a majority of the troops went on a 24-hour pass to Las Vegas.

The Baseline Measurements

The control or baseline measurements were scheduled for 26 August, a Monday, two days prior to the expected firing of SMOKY. The following time table was followed for the collection of the baseline data:

1. The Provisional company and monitors departed Camp Desert Rock in truck convoy at 0300 hours, 26 August, arriving at the SMOKY trench area at 1445 hours.

2. The troops rested on the ground outside the trenches until 0525 hours, when they were commanded to enter the trenches by squads.

3. At 0527, the troops were ordered to don protective masks. Because of the distance separating the trenches, only a few of the troops heard the order and complied.

4. At 0535 the company bugler "sounded off" and the troops departed the trenches for the rifle test clearing.

5. The troops began the rifle test on command at 0540 hours and completed it at 0545 hours.

6. The company moved to the mine field at 0550 and completed the mine clearing at 0555. Four of the mine clearing teams were interrupted before completing the task by a premature command from a platoon leader to proceed to the crawling course.

7. The first platoon arrived at the infiltration course at 0615 hours and completed the test by 0624. The last platoon departed the course at 0757 hours.

8. All personnel withdrew to a field kitchen in the trench area upon completing the infiltration course.

On 26 August, 98 enlisted personnel reported for duty.

The Period of Suspense

Following the collection of the baseline data, the attention of the HumRRO team and the task force was concentrated totally upon the anticipated firing of SMOKY. On 27 August, it was announced that a second weapon, FRANKLIN PRIME, had been scheduled coordinately with SMOKY for the morning of 28 August, in the event that SMOKY was postponed. At the request of the Company Commander, it was decided to allow the carbine-equipped platoon from the task force to observe the firing of FRANKLIN PRIME in the event that SMOKY was not detonated. At 1630 hours, 27 August, it was announced that SMOKY was postponed, but FRANKLIN PRIME, a balloon shot, was expected to go at 0530 hours, 28 August. This shot was observed by the HumRRO team, the assistant monitors and the carbine-equipped troops.

The morning of 28 August arrived attended by the information that the outlook for firing SMOKY on subsequent days was not good, because of the sensitivity of the shot to adverse weather conditions. The staff of the Exercise Director suggested that the HumRRO team study the feasibility of utilizing another shot, one less demanding in terms of weather requirements. The team agreed to such a proposition, providing the following conditions could be satisfied:

1. The alternate weapon would be of sufficient yield to have an emphatic effect upon troops located at the minimum safe distance from ground zero (minimum safe distances are specified by Department of the Army).

2. A mine field infiltration course and clearing for the rifle test would be constructed in the Nevada Test Site area to be utilized for the alternate shot.

3. Sufficient time and access to the new forward area courses would be provided prior to detonation for conducting a familiarization run and a baseline test.

It was tentatively agreed that a tower shot, GALILEO, scheduled for 0500 hours, 4 September, would be suitable for HumRRO purposes. The necessary construction for the new courses would be completed in time for a familiarization run on 2 September and a baseline measurement on 3 September. It was agreed that the HumRRO mission would be attached to GALILEO in the event that SMOKY was not fired prior to 4 September.

The 0500 firing of GALILEO generated a new problem: Since the firing would occur pre-dawn, the troops either would need training under low illumination conditions or artificial illumination would have to be provided in the forward area for the baseline and D-day measurements. For the GALILEO testing, it was agreed that trenches would be dug at a distance of 2700 yards from ground zero, thereby placing the crawling course at 1500 yards from the tower. The GALILEO area was subsequently reconnoitered by the HumRRO team, and Post Engineers began a survey of the terrain. (Prior to the initiation of construction, however, the plan to utilize GALILEO for testing purposes was cancelled the next day (30 August), after it was learned that adverse weather might also interfere with the scheduled firing of this weapon).

On 29 August, two additional events occurredthat had a bearing on the testing mission: (a) Four of the HumRRO team were required to depart Desert Rock for their permanent stations, necessitating conversion of NCO's to monitors and training of new assistant monitors, and (b) it was mutually agreed by the HumRRO team and the task force that the troops would be withdrawn after 5 September.

On 30 August, it was also learned that GALILEO might be delayed as much as one week because of weather. Since any delay beyond 5 September would exceed the established deadline for testing completion, it was decided,

during a conference with the Desert Rock staff, that the HumRRO mission would be attached to WHEELER. WHEELER, a balloon shot, would be less sensitive to adverse weather than either SMOKY or GALILEO, both of which were tower shots.

Since WHEELER was scheduled to be fired on 1 September, a crash program of construction and troop training was instituted for the collection of new baseline data. Post Engineers began construction of the courses in the WHEELER area at 1500 hours, 30 August. Through intensive efforts on the part of the engineers, the courses were completed at 2200 hours the same day, the personnel working under portable floodlights to complete the work. During the afternoon of 30 August, new assistant monitors were given instruction in their duties during a session in which all the paratroopers practiced the tasks. During this training session, a very marked reduction in morale of the paratroopers was observed by several of the HumRRO personnel. This effect may be attributed to the repeated delays in firing SMOKY, the continual need to practice these elementary tasks to maintain performance levels, and the expectation that the troops would not be granted weekend passes because of the uncertain firing schedule.

At 1630 hours, 30 August, it was learned through the Desert Rock staff that there was a good possibility that the AEC would fire SMOKY the next morning. It was decided, however, in view of the repeated postponements of this weapon firing, that the Post Engineers would continue construction of the WHEELER courses. Two alternate courses of action were available to the HumRRO team: (a) If the AEC decided to fire SMOKY, the task force would occupy the trenches in the SMOKY area and the D-day measurements would be taken, beginning at 0530 rather than 0500 to equate the illumination levels between the D-day and baseline measurements; (b) If SMOKY was postponed by

the AEC, the task force would occupy the positions prepared in the WHEELER area, and new baseline measurements would be made without a prior familiarization run. Neither alternative was optimal, however, with respect to control of extraneous factors possibly influencing performance on the tests.

The Coup de Grace

At 2345 hours, 30 August, the testing team was informed that the AEC still planned to fire SMOKY. Unfavorable wind directions in the forward area, however, negated the possibility of occupying the SMOKY trenches because of expected contamination of the trench and testing area by fallout. In addition, the wind conditions were such that there was a great likelihood that the courses just completed in the WHEELER area would also be contaminated for several days by the fallout from SMOKY. As a result, all observers for SMOKY would be positioned approximately 12 miles from ground zero. If SMOKY should be fired, both sets of courses would be contaminated for a prolonged period. Data could only be collected for the infiltration course, and then only two to three days after the detonation when the radiation level had decayed to a permissible level.

Since continuation of the testing mission now appeared futile, the HumRRO team decided that the task force should witness the firing of SMOKY in order to accomplish their own (82nd Airborne) training mission. If possible, the HumRRO team would attempt to collect data for the crawling course in the SMOKY area as soon as troops were allowed to enter the area during the succeeding few days.

Proceeding to the designated location for observers, the HumRRO team, now five members strong but supplemented by enlisted monitors, and the task force waited through the seemingly endless night for the firing of SMOKY. At 0445 hours, 31 August, the AEC announced that the H-hour for

SMOKY had been postponed from 0500 to 0530 hours. With this impromptu postponement, the possibility arose of collecting rifle test data at a time comparable to that employed for the baseline measurements. Unfortunately, however, the troops were deployed over a very extensive area along with the monitors and the materiel required for administration of the test was located in a vehicle one mile from the observer area. The motivation to overcome these obstacles among the few team members that had not become separated was extremely low.

At 0530 hours, SMOKY was fired. Information subsequently received revealed that the courses in the WHEELER area were contaminated along with the terrain in the vicinity of SMOKY's tower.

GALILEO Again

On 1 September, as a result of conferences with the Desert Rock Staff, the HumRRO testing mission was again attached to GALILEO, scheduled for detonation on 2 September. Because of time limitations, no construction of courses would be attempted; consequently, the mine field task was dropped from the test battery. It was planned that troops would be stationed in the open (no trenches) approximately 4500 yards from the tower. Since it was not feasible to have Post Engineers clear an area for the rifle stripping test, the troops would assume the administrative formations utilized for the test prior to the detonation of the weapon. Each squad would locate a small clear area for the testing. It was planned that the rifle test would be administered at two points in time: (a) one minute after the shock wave hit the troops the test would be administered to six squads of 12 men each, and (b) five minutes later the remaining four understrength squads would begin the test. The squads were not assigned to the testing times at random. This change in administration of the rifle test was necessitated by the departure from Desert Rock of two more members of the HumRRO team, leaving only three civilian monitors, supplemented by NCO's from the task force.

After the rifle testing was completed, it was planned that the troops would be transported to the infiltration course located in the SMOKY area for testing. Entry of troops into the SMOKY area would be contingent upon approval of the Camp Desert Rock Radiological Safety Officer, following his survey of the area on 2 September.

At 0130 hours, 2 September, the task force departed Camp Desert Rock, arriving in the GALILEO area approximately 0245. The troops remained in the open trucks until approximately 0500 when they moved on foot to the area designated for observation and testing purposes. The early morning air seemed unusually cold in comparison with previous nights, and several groups of men built brush fires while waiting for the detonation. A subsequent inquiry revealed that ambient temperature on 26 August 0530 hours was 78 degrees, whereas the temperature at 0530 hours on 2 September was 67 degrees. The wind on 26 August was 12 knots per hour out of the south, whereas on 2 September it was 14 knots per hout out of the north. The values of temperature and wind velocity for the period between 0130 and 0530 are not known.

Two of the NCO monitors were not present, having failed to return from a weekend pass. Only 80 of the original sample of 99 paratroopers were present for the same reason.

The loss of two NCO's and the reduction in number of troops present necessitated a last minute adjustment of the plans for the rifle test. The plan to test approximately 24 men five minutes after the shock wave hit the troops was abandoned, and these men were integrated into the six squads to be tested at H plus 1 minute, four of the squads being increased to 13 men and two squads to 14 men.

At 0540 hours, GALILEO was fired, and the rifle disassembly-reassembly test was begun shortly after the initial shock wave hit the troops. The dust level was quite high, as expected, with resulting impairment of visibility. After the test was completed, a number of the paratroopers commented on the difficulty of accomplishing the test due to the visibility problem and/~~the~~ atmospheric temperature.

Upon the completion of the rifle test, Radiological Safety monitors and one member of the HumRRO team proceeded to the crawling course in the SMOKY area to monitor the radiation level in the area. The task force messed on assault rations while awaiting orders. At 0710, the Task force was informed that the crawling course could be used for a period of only one hour. The troops were briefed by the Radiological Safety Officer on the radiation conditions in the SMOKY area and on the precautions to be taken while in the area. The Task Force then proceeded in convoy from the WHEELER area to the crawling course. The testing on the crawling course began at 0805 and was completed at 0855, all troops withdrawing on foot from the course to the trench area where they mounted the waiting trucks.

The testing had been completed.

CHAPTER 4

RESULTS AND DISCUSSION

Questionnaire Results

In general, troop reaction to the orientation lectures given at Desert Rock was favorable. The questionnaire results indicate that the majority of personnel increased their knowledge of how to protect themselves during A-bomb combat, and a greater proportion of troops stated after the lectures that they would be able to carry out their combat duties effectively than had expressed this belief prior to the orientation. As indicated by the accuracy of their answers to factual questions, the lectures were also effective in ~~calculating~~ INCREASING information about certain weapon effects. Examples of gain in factual information as a consequence of the orientation are presented below:

Question 32: Would radiation from an A-bomb explosion make men in foxholes 1½ miles away permanently sterile (unable to become fathers?) (Mark one)

Answers	Per cent Before Lecture	Per cent After Lecture
1. Many men	4	1
2. Quite a few men	3	3
3. Hardly any men	32	11
4. No men (correct)	56	83

Question 42: How easy do you think it is to notice (feel, taste, see, or smell) radiation from an A-bomb? (Mark one)

Answers	Per cent Before Lecture	Per Cent After Lecture
1. Very easy	7	3
2. Fairly easy	15	5
3. Fairly difficult	29	7
4. Impossible (correct)	46	83
5. (No answer)	3	2

In other areas of weapons effects, the orientation program did not appear to be effective in terms of producing information gains between administrations of the questionnaire. Examples of these information areas are as follows:

Question 33: After an A-bomb is exploded 2000 feet above the ground, how soon would it be safe to walk through ground zero? (Mark one)

Answers	Per Cent Before Lecture	Per Cent After Lecture
1. Immediately afterward (correct answer)	13	39
2. 30 minutes afterward	24	24
3. One hour afterward	22	22
4. One day afterward	13	9
5. 10 days afterward	13	3
6. More than 10 days afterward	7	0
7. (No answer)	6	0

Question 39: After an A-bomb is exploded 2000 feet above the ground, how soon would it be safe to drink water in open tanks one mile away?

Answers	Per Cent Before Lecture	Per Cent After Lecture
1. Immediately afterward (correct answer)	6	16
2. One hour after	5	5
3. One day afterward	5	1
4. More than one day afterward	24	26
5. Never	57	48
6. No answer	2	0

Since a script of the lectures given the troops was not available to the research team, it was not possible to determine whether the inaccuracy of the responses given after the lectures was attributable to lack of inclusion of the topic in the orientation or to ineffective instruction.

Twelve of the forty five items constituting the questionnaire were concerned with troop attitudes towards weapon effects. These items were of two basic types: six of the attitude questions dealt with the individual's estimation of his own feelings, and the other six items were concerned with each individual's estimate of the feelings of most of the troops. For those questions dealing with attitude toward the effects of a weapon detonation, there was, in general, a decrease in the amount of "worrying" from the first to the second administration. This situation is exemplified by the following item:

Question 24: When the A-bomb goes off, how worried do you think you will be about the immediate radiation?

Answers	Per Cent Before Lecture	Per Cent After Lecture
1. Very worried	4	1
2. Quite a bit worried	15	5
3. A little worried	51	50
4. Not at all worried	29	44

There was an increase, however, in concern for both self and other troops with respect to the maneuver in general, as reflected in the changes in answers given to the following questions:

Question 16: How worried are you about going on this A-bomb maneuver?

Answers	Per Cent Before Lecture	Per Cent After Lecture
1. Very worried	1	1
2. Quite a bit worried	1	2
3. A little worried	15	27
4. Not at all worried	82	69

Question 17: How worried do you think most of the troops are about going on this A-bomb maneuver?

Answers	Per Cent Before Lecture	Per Cent After Lecture
1. Very worried	2	1
2. Quite a bit worried	3	3
3. A little worried	39	64
4. Not at all worried	56	32

The reason for the tendency of troops to be more concerned about the maneuver after the orientation lecture is not known. The changes in attitude on other questionnaire items suggest that the change in "anxiety" level may be associated with shifts in attitudes regarding residual radiation. After the orientation lectures, a greater percentage of troops indicated that they were a "little worried" about entering terrain possibly contaminated by residual radiation than so stated before the lecture; however, the percentage of personnel indicating the presence of higher levels of anxiety was less on the second administration than on the first testing. The attitude change might also be attributed to the troops gaining a more realistic and healthy respect for this weapon effect as a consequence of the lectures at Desert Rock. This change in attitude is reflected in the answers given to the following questionnaire item:

Question 26: Suppose that immediately after the A-bomb exploded the troops were ordered to enter Ground Zero. How worried do you think most of the troops would be about any radiation that would be there?

Answers	Per Cent Before Lecture	Per Cent After Lecture
1. Very worried	18	12
2. Quite a bit worried	38	26
3. A little worried	35	48
4. Not at all worried	7	14

Performance and Attitudes Toward Self

The test scores obtained on the Familiarization Day (23 August), the Baseline Day (26 August), and on D-day (2 September) were analyzed statistically with reference to the constancy of attitudes over the two administrations of the questionnaire. The test performance of troops was analyzed first with reference to changes in attitude toward self as reflected by answers given to six items on the questionnaire (items 16, 18, 20, 22, 24 and 26). The sample of troops was divided into two subgroups: those who answered at least one of the questions during the second administration in a manner less favorable to self than on the first administration; and those who either did not change their attitudes or indicated more favorable attitudes toward self. The purpose of the analysis was to determine if the performance trends over testing days would be similar for the two groups differing in attitude change. The average scores obtained by the troops in each subgroup for each of the tests are presented in Table I.

Statistical analysis of the test scores (See Appendix D for analysis of variance) did not indicate any significant differences between the performances of the two subgroups for any of the tests administered. There is no indication, from the data obtained, that the attitude changes toward self are related to subsequent proficiency level.

The statistical analyses did reveal, however, significant differences in proficiency among the testing days. The results of the comparison of average scores obtained on successive days are presented below:

1. Rifle-stripping time.
    a. The average time required for this task on D-day was greater than on the Baseline Day ($p = .05$)
    b. The average time required on Baseline Day was greater than on the Familiarization Day ($p = .01$)

Table I

Average Test Scores and Attitude Towards Self 1/

N = 72

Test and Day	ANXIETY LEVEL: Increased N=33	Constant or Decreased N=39	Total Group N=72
Rifle Stripping Time (in seconds)			
Familiarization	68.7	72.9	71.0
Baseline	93.3	93.8	93.6
D-day	101.7	105.0	103.5
Crawling Time (in seconds)			
Familiarization	64.5	61.6	62.9
Baseline	58.5	57.4	58.0
D-day	60.0	60.4	60.2
Time in Foxhole (in seconds)			
Familiarization	10.1	10.5	10.3
Baseline	11.9	12.9	12.5
D-day	12.8	12.2	12.5
Grenade Score (Nr. Hits)	(N=26)	(N=34)	(N=60)
Familiarization	1.5	1.3	1.4
Baseline	1.1	1.3	1.2
D-day	1.1	1.2	1.2

1/ The variances of the scores for each day are presented in Table V of Appendix D.

2. Crawling Time.

   a. There is not a significant difference in the average crawling time required on D-day and the Baseline day.

   b. The average time required for crawling on the Familiarization day was greater than that evidenced on the Baseline day. ($p = .025$)

3. Time in Foxhole.

   a. There was no difference in average time spent in the foxhole on D-day and Baseline day.

   b. The average time spent in the foxhole on the Baseline day was greater than that observed on the Familiarization day.

4. Grenade Test.

   a. The average number of hits per man on D-day was not different from that on the Baseline day.

   b. There was no difference in performance on the Baseline and Familiarization days.

Proficiency and General Attitude Level

The proficiency test data were also analyzed with reference to a second method of classifying individuals in terms of attitude constancy. This second system employed the answers given to fifteen of the questionnaire items (items 16-27, and 46-48). The fifteen items included the six questions pertaining to the individual's tendency to worry about himself, six questions concerned with the individual's estimate of the amount of worrying characteristic of the rest of the troops, an item dealing with willingness to enter contaminated terrain, and two questions concerning the individual's present readiness for combat. Since each question had four alternative responses varying in implied negativism (or increased

anxiety), it was possible to compute an attitude score for each individual by summing the numerals designating the alternatives for the fifteen items. This method produced a score continuum having a possible range from 15 (all greatly worried) to 60 (not at all worried). The fifteen items were scored in this manner for each of the questionnaire administrations.

The average increment in score between the first and second administration was approximately two points. The sample of 71 troops (one enlisted man was eliminated because of an incomplete questionnaire) was then divided into three subgroups on the basis of the degree of constancy of the attitude scores over the two administrations. Since the mean increment was two points, an individual whose score decreased by two or more points on the second administration was assigned to the Increased Anxiety group, all persons whose score increased by four or more points (mean increment plus an additional two points) was assigned to the Decreased Anxiety group, and the remainder of the sample was assigned to the No-Change group.

The proficiency test scores subsequently obtained on the Familiarization, Baseline and D-days were analyzed, by analysis of variance techniques, with reference to this classification of attitude constancy. (See summary tables VI - IX in Appendix D). The average score computed for each attitude group for each of the proficiency tests is presented in Table II.

With one exception, the results of this second analysis and the conclusions that can be drawn are identical with those obtained for the first method of classifying attitude changes. The one exception occurred for the grenade test. For this test, the interaction of days and attitude groups was statistically significant ($p = .05$). Although the three attitude groups attained comparable proficiency levels for both the Familiarization

Table II

Average Proficiency Test Scores on Each Day

for Three Anxiety Groups 1/

Test and Day	ANXIETY LEVEL Increased N=16	Constant N=26	Decreased N=29	Total
Rifle Stripping				
Familiarization	69.5	70.6	73.3	71.5
Baseline	96.3	86.0	97.0	92.8
D-day	99.0	93.0	114.0	102.9
Crawling time				
Familiarization	65.8	63.5	61.1	63.0
Baseline	58.1	60.0	55.3	57.7
D-day	60.3	60.9	59.1	60.0
Time in Foxhole				
Familiarization	9.6	11.0	10.2	10.3
Baseline	12.2	12.4	13.1	12.6
D-day	13.5	11.5	12.9	12.5
Grenade Score				
Familiarization	1.50	1.48	1.24	1.4
Baseline	.90	.92	1.64	1.2
D-day	1.00	1.16	1.32	1.2

1/ The variances of the proficiency test scores for each day are presented in Table X of Appendix D.

and D-day measurements, there is a significant spread of scores among groups for the Baseline testing. Troops who had either remained constant in attitude or who had become more worried during the interval 14-19 August performed at a lower level on Baseline day, whereas the personnel who previously had become less worried attained the highest proficiency level for the grenade test of any attitude group for any of the three days. The differences in average performance between the Decreased Anxiety group and each of the other two groups were significant ($p = .01$). Since there is no logical explanation of these differences the discrepancy in performance trends is believed to be a chance phenomenon.

Deficiencies in the Study

A number of events occurred during the course of the data collection that negate a decisive interpretation of the testing results. Some of these events were beyond the control of the testing team; the remainder possibly could have been averted. The extraneous factors that may have influenced performance are presented below:

1. Since all troops had observed the firing of SMOKY on 30 August, the rifle test data obtained on 2 September do not provide an estimate of the effects of initial exposure to an atomic detonation upon performance.

2. The difference in ambient temperature of 78 degrees F on 26 August and 67 degrees F on 2 September may have been sufficient to have a degrading influence upon rifle test performance. Studies conducted by the Quartermaster Research and Engineering Center support this hypothesis.1/

1/ Dusek, Ralph E. Manual performance and finger temperature as a function of ambient temperature. Headquarters Quartermaster Research & Engineering Command, U.S. Army, Technical Report EP-68, October 1957.

3. The troops movement schedules utilized for the Baseline and D-day testings were not comparable: the troops departed Camp Desert Rock at 0300 hours 26 August as compared to 0130 hours on 2 September. The amount of rest permitted troops prior to movement to the forward area, therefore, was not equated and personnel were exposed to a colder temperature for a longer period of time on D-day.

4. The motivational and/or morale level of the troops may not have been comparable for the two days, as evidenced by the large number of absentees on 2 September and the disgruntlement among the troops observed on 29 August.

5. On D-day, troops were fed after the rifle test and prior to entry into the contaminated terrain containing the infiltration course. Such feeding did not occur on 26 August. The effect of this event upon D-day performance for the infiltration course is not known. Since the breakfast consisted of assault rations, the effect (i.e., upon morale) may have been detrimental.

6. The composition of the testing team changed substantially between the baseline measurements and D-day. The influence upon troop attitudes and performance of the departure of seven HumRRO examiners cannot be estimated.

7. As indicated by the statistical analyses, there was sufficient variability in average proficiency between 23 and 26 August to suggest that the troops had not achieved stable performance levels at the time the baseline data were collected. Consequently, any differences among scores on the Baseline day and D-day would have to be very large before a performance degradation could be attributed to bomb effects.

8. The dust level, due to the blast effects of the detonation, was sufficiently high on D-day possibly to interfere with the rifle

APPENDIX A

A Description of Camp Desert Rock 1/

Camp Desert Rock is an Armu village lying in a broad, arid valley 65 miles northwest of Las Vegas on a spur 3 miles from U.S. 95. It is completely surrounded by mountains, high and fairly distant to the south and west (beyond which lies the Colorado River below Lake Mead), lower and nearer to the north and east, in the direction of the test site. It is a cluster of about 150 buildings, a varying number of tents, an airstrip, a vehicle park and a flagpole. A dozen of the more important buildings are of sheet metal construction; remainder are quonset huts and prefab wooden buildings. It has a combined post office and barber shop, a PX, theater, library, medical center, two soft-ball diamonds, a volley ball court, and EM beer hall, NCO club, and an Officer's club. Parked separately are about 25 VIP trailers. The town is not open to the public; entrance is by credentials presented at the guard gate about one half mile from the camp.

Near the flagpole is another, shorter pole bearing a blinking light which can be seen from all parts of the village after dark. If a shot is scheduled for next morning the light blinks blue; if cancelled, for weather or other reasons, it blinks red. This is a very important light. All eating, sleeping, working, relaxation and trips to Las Vegas depend upon its color.

Camp Desert Rock lies at an elevation of about 3200 feet. Like all desert country, especially the more famous Death Valley area 40 miles away, it is very hot in the daytime, cool to cold at night. Administrative and office buildings, the VIP trailers and some of the bunkhouses have been air conditioned (water cooler type); the remainder are heat-traps, easily reaching

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1/ Abstracts from a HumRRO Trip Report prepared by Mr. Howard C. Sarvis, Infantry Human Research Unit.

115 - 120 inside by mid-day. Where night operations are necessary, as they are in most A-shots, this sets up a personnel problem until physical adjustment is made, as daytime rest is difficult to impossible. Extra food, up to half a gallon of liquids with meals, and constant intake at other times, help to combat the fatigue and water loss, and to provide enough water for body recovery through normal kidney action.

Water is limited, being hauled by tank truck 21 miles; however, it is adequate. In the latrines there are batteries of showers, as well as other appliances. Daily showers and change of inner clothing are mandatory. The mop tub is constantly busy with people, up to full colonels, washing out their sox and underwear. Laundry of outer clothing is uncertain, taking from four to twelve days. If a large quantity of clothing is not taken, this may be solved by putting on the (less dirty) clothing taken off a few days before.

All operations and decisions in the Nevada Proving Grounds are under the control of the Atomic Energy Commission representatives. They have their own police force and distinctly painted vehicles, and their own village, Mercury, about 2½ miles from U.S. Army Camp Desert Rock. At this village is the first check point for entrance to Frenchman and Yucca Flats; about a mile farther in is another similar gate. Security is very strict. No entrance of any kind is allowed into Mercury until need is established beyond doubt. Mercury, too, has its pole with blinking red or blue light.

Until a person is issued a special identification badge, no one can visit the proving grounds except in convoy under escort. Names have to be placed on convoy rosters a day or two before, to permit time for printing and distribution to Army and AEC agencies along the route. Each person is assigned his bus or other vehicle, is checked into it before setting out, and similarly on the return trip. By sending our security clearance dates beforehand

our clearances were verified by TWX, we were photographed on arrival at the Camp, and three days later we received our permanent identification badges, which gave us freedom to pass the gates to the forward area at all times (but not into Mercury itself), except a couple of hours before a detonation.

To shoot or not to shoot is finally decided by the AEC chief at Mercury, usually as a result of a weather conference, and the shots go off pretty much for the purposes of the AEC, with the Army or anybody else to benefit if they can, or so it seems. This should be allowed for and remembered if there are any future opportunities for HumRRO to participate.

Briefings, instruction, and orientation lectures of one sort or another were going on much of the time we were at Camp Desert Rock, and many of the team members attended them, when the daily training programs for the airborne troops, the nightly trips to see A-shots and the imminence of physical collapse from loss of sleep did not prevent attending.

APPENDIX B

Section I

Introspections on SHASTA 1/

Saturday night, August 18, we were sitting around on the patio of the Officers Club about 2230 "socializing" and wondering when Shot Shasta would go. This was the 19th day, or so, that it had been postponed. A vehicle reared up. Loudspeaker called, "Attention all personnel! Attention all personnel! Shasta is on! Shot Shasta is on!"

We immediately went to tell the others. Then I went to bed for three hours so I'd be rested.

At 0130 on Sunday morning Boyd Mathers shook me awake and I was so jumpy I came up swinging. I dressed and went to the VIP mess where I had been told coffee was being served. I noticed they had real cloth table cloths. While having coffee and cake a major came in and said he thought it would go tonight; weather was good over the flat and it was very unusual to have a shot re-scheduled to go at such a late hour, so the AEC must think conditions were just right.

I left the mess hall and Vineberg drove up with a carryall (station wagon) full of our people. We drove out of Desert Rock and passed through the check points at Mercury a couple of miles up the road, then drove 25 miles to Yucca Flat. We arrived at our observation point, which is called Goose Nob, at 0230, not to be confused with News Nob, which is nearby for wheels and reporters.

I had been there twice before, and both times the shot had been postponed at the last minute. Bob parked the vehicle and we climbed out for our third go at the thing. This time the loudspeaker was playing slow hill billy or cowboy music. The other times it had featured such things as Beethoven's

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1/ Prepared by William E. Montague, 23 August 1957.

Tenth Quartet. Goose Nob is situated on the slope of a hill or mountain at the south end of Yucca Flat. A square pebbled area of about a hundred feet on a side has been leveled off and brightly illuminated by two enormous hooded lights on a thirty foot pole. In the forward portion of this square is the "pig pen", as Vineberg called it, a fenced-in section containing twelve rows of 25 foot long wooden benches painted gray. I went through the opening and sat down on the rear bench. Soon Pete joined me. A couple of Army sedans were there at the site before us, and a few minutes after we arrived two buses of soldiers pulled up and the troops spread out over the area, some to talk, some to read and some to lie down on the benches and sleep.

I sat there and took notes and talked to Pete, who used to teach Physics. He pointed out the constellation of Casseiopea to me, and we finally located Orion low on the eastern horizon under the half moon. We think we found Polaris, though the Big Dipper was too much for us. Pete said it was partly hidden by the ridge of mountains barely discernable against the night sky to our north across Yucca Flat.

At 0255 the music went off the air and a voice made substantially the following announcement:

"This is Dragnet. Five minutes until H minus two hours.'

Three more vehicles arrived; a jeep, an ambulance and a sort of truck with a crane, perhaps for recovering any cars that should get stuck off the road. The men parked their cars and dispersed over the observation point. Some of the officers and men collected around the small snack bar building which, though well lighted and supplied with a telephone, contained no snacks or refreshments whatsoever.

The loudspeaker crackled on again:

"This is Dragnet. Stand by for time back. In one minute the time will be H minus two hours. H minus two hours . . . thirty seconds . . . ten seconds . . . five, four, three, two, one, back." At the instant of back we saw a small, bright hemisphere of orange fire silently blossom and die far out on the blackness of Yucca Flat. Then the voice continued:

"Next time back at H minus one and one-half hours. Next time back at H minus one and one-half hours."

"That was the metering charge," I said. Pete had his watch out and was timing the interval until the sound of the explosion reached us. "That's twelve hundred pounds of TNT", I said. "At least that's what I hear it's supposed to be".

Pete said that for the last two times we had come out to the site the charge had contained twenty-four hundred pounds. In any event, we never heard it. Apparently the wind was away from us. The first time we came to the site I had counted fifty-seven seconds before the sound reached us. With sound traveling at about a thousand feet per second I calculated the charge had been detonated about eleven and a half miles from us. On that first evening I hadn't known about the charge, and the flash had made me flinch my eyes away. I was set to hide my eyes from any nuclear detonation and the TNT had triggered me off. "Well", I said. "Since we couldn't hear the metering charge, maybe that means the wind is right. Away from us and Las Vegas. Maybe they won't postpone the shot again."

A growly metallic voice from a jeep's radio chanted:

"Earthquake calling, This is Earthquake calling".

followed by some other words I could not distinguish.

The floodlights illuminated the grotesque little Joshua trees and low clumps of brush for about fifty yards beyond the wire down the slope to our front. Beyond the light the vast expanse of the valley was inky black, pinpointed here and there by the many-mile distant lights of a road marker, a tower, or a vehicle traveling on some late, pre-shot business.

Pete and I discussed the expanding universe and the red shift. The night was cool. At intervals we heard two other time hacks. We watched what we presumed was the light of a weather balloon ascending from Yucca Lake, a dry lake bed off to our right. The balloon seemed to drift very slightly to the north as it rose, its light blinking constantly.

At H minus forty five minutes all personnel were instructed to move into the wired-in area. A few troops and officers who had been outside the wire came in and took seats. The voice from the loudspeaker instructed us regarding the operation.

> "The shot you are to witness this morning is Shasta. It is expected that the yield will be approximately half of nominal. We are viewing the shot from a position approximately twelve miles from ground zero. Personnel wearing density goggles can observe the fireball. Personnel wearing goggles -- approved four point two density goggles or higher -- can observe the fireball. However, they must not look directly at the fireball until after the detonation -- look to the right or left of the fireball. Look directly at the fireball only after the initial intensity of the light has faded. Personnel without goggles will turn and face away from the direction of the shot three to five minutes before zero and shield their eyes with either the right or left arm. After the shot you will be told when to turn around and view the fireball. This will be approximately five seconds after zero. In the event of a miss-fire remain in position with the eyes shielded until given instructions. When told to turn, you can turn and observe the fireball and the cloud. The cloud is expected to rise thirty to thirty-five thousand feet with fall-out to the west and north, then northeasterly at fifteen degrees."

The loudspeaker gave some additional information regarding certain projects that would track the cloud, then cut off. Vineberg said, "I'm cold!"

We noticed some vehicle lights coming back across the flat. I wondered if they had armed the device. Pete unwrapped a sandwich and offered some of it to the rest of us, but I was not interested. I noticed that the person two benches in front of me had brought a pillow and blanket and was making good use of them.

"This is later than we've ever been," someone said. "Maybe they won't cancel it this time."

The loudspeaker came on again to tell us that the time was H minus thirty minutes and to repeat the instructions regarding the protection of our eyes. A jet whined high over us and looking to my right I noticed that the air strip was lit up. Immediately in front of us a group of six or seven soldiers was gathered out beyond the wire. Someone said they were Army photographers. Another jet went over. I noticed an increase in nervousness as the time approached. I wanted to face away even though it was much too early. I was afraid of a premature detonation. Those around me denied similar feelings, but I noticed some of them no longer looked in the direction of the shot. We sat leaning forward, looking at the ground.

At H minus twenty minutes I heard a background voice over the loudspeaker say to someone near the microphone, "It's hooked up now, Boy!" Then the loudspeaker spoke to us:

> "This is Dragnet. In one minute it will be H minus fifteen minutes, and so on, with a time tone every minute thereafter."

Pete said, "This is the tape. The machine is committed." I smiled and thought of Baldwin's idea for a "manual override for electric safety".

Two men were still asleep, at least ostensibly. Seasoned troops. Most of us were inclined to laugh at anything as time ran down. I gestured out toward the thing in the dark and said "Poof!" throwing my hands wide. Everyone laughed. I asked Ralph if we were going to go through with the "Shut up and deal" routine when everyone turned to stare at the fireball. We thought we would not.

The time tones were coming every minute and with each one the tension went up a notch. At H minus eight minutes I stopped taking notes. I didn't want to clutter up the subjectivity of the experience. At H minus five minutes we turned around on the benches without waiting for the order to do so and covered our eyes. I removed my glasses and held them firmly by the temple piece in my right fist. I buried my eyes in my left elbow and pressed my left arm tight against my face with my right fist. It was dark and lonely in there. I began to tremble. My stomach muscles knotted up. Then the tenseness spread to my chest muscles. I became irritated at myself and made a definite effort to relax, which relieved the muscular strain but did little to reduce my mind's tension. I imagined running away, then thought of how trivial would be the increase in distance that I could add by running for the short remaining time, since a twelve mile distance already seperated us from the device.

"H minus one minute."

I pressed my arm tighter against my face.

"H minus thirty seconds."

The awful, marching inexorability of the thing came over me. Zero time was speeding toward me like a car you cannot dodge. In the darkness I heard Boyd say, "It's going to be too late to postpone it!" I thought rapidly for something witty to say, such as yelling "Shasta is postponed for another twenty four hours!" but gave it up.

> "H minus twenty seconds. . . H minus ten seconds. . . five, four, three. . . (I scrunched my eyes shut and pulled my arm in on them). . . two, one, zero."

At zero time I saw, in the darkness, a dim far off pink glow that brightened and spread, held steady for a second, then dimmed and shrunk. I knew it was the light from the device and I knew how blindingly bright it

must be to reach our eyes at all under such protection. It really felt as though nothing had happened--just the soundless soft pink glow. A voice behind me (probably someone who had been through the count-down for Diablo, the shot that was a dud) cried, "Yeah! It went off!!"

The loudspeaker said, "Turn!" As I uncovered my eyes I noticed it was still dark. Nothing had changed. Then we turned and I saw the thing that had been created. Far out across the miles of wasteland below us there was now dimly visible in the first morning light the golden fireball boiled and churned like a genii from a bottle, cooled to orange splotched with deep dirty brown, cooled to heavy violet and as it cooled its shimmering blue corona contracted and glowed around it. The fireball rises at a speed of sixty miles an hour, but at this distance its ascent seemed slow.

> "Brace yourself," the loudspeaker said. "The shock wave will be here any time now."

We got set. Some of us debated whether the shock wave could exceed the speed of sound. I didn't know whether to expect a crack, or a roar, or what. Then I heard what sounded exactly like a long line of freight cars "bumping" in the distance, a low quickly punctuated rumble that lasted three or four seconds and faded away. The cloud, subtending the same angle to the eye as a fifty-cent piece held at arm's length, had lost its brilliance. Raggedly oval, it lifted up from the desert. Beneath and around it the dust stood in almost static silhouette.

A quick bright flash startled me! Just the photographers with their flashbulbs. Then the floodlights were cut off, which made it easier for us to observe the mushroom. It was decidedly lopsided. Pete said that the stem of the mushroom should shear off. A weather balloon went up from the flat. Then a group of vehicles could be seen in the dim morning light

taking off down the road to recover certain test equipment. A jet flew through the edge of the cloud, collecting samples. A moment later a rocket blazed upward and slanted into the cloud, disappearing abruptly as it entered. The cloud was very large now, much higher than the mountains in the background.

The radio in the jeep came on with a crackly fast voice, "earthquake-Two-Step-this-is-Earthquake-over." At H plus fifteen minutes the first vehicles left our area. "Well," someone said. "Let's go." As we rose I noticed that the top of the cloud was pinkish white on its eastern face where it caught the first rays of the morning sun. Pete pointed out that the bottom of the stem was lifting clear off the ground and slanting away. He called this a good shear. On the ride back to Desert Rock and breakfast we watched the pink cloud over the hills behind us as it split slowly into three or four separate strata, each thinning and drifting away on the morning air. Frankly, it had been a little disappointing. But then, it was only a half-size shot, and we <u>had</u> been twelve miles away.

Section II

Observations of DOPPLER 1/

DOPPLER was a balloon shot. By using a balloon, higher shots may be made than are practical with towers. These simulate air drops, but with better control than is possible when actually dripped from an aircraft. They are "cleaner" than tower shots, for they do not kick up so much dust nor contain the many tons of vaporized metal, all radioactive; therefore, they are less sensitive to weather and high altitude winds, the main requirement being less than 15 mph surface wind, for launching the balloon. DOPPLER was reported to be a "half-nominal" shot, fired at an altitude of 1500 feet.

I saw it from trenches 3500 yards from ground zero. It is better to say that I experienced it from the trenches, for it is quite a different matter than viewing a spectacle from News Knob, a safe 10 miles away. At closer range it gets personal. An earlier start has to be made, for this is a convoy trip and every person has to be checked in and out from the printed rosters. Loading began at 2330, return was delayed by sweepoff and personal radiation clearance at the deontamination station, but in time for a late breakfast.

With full gear, heavy clothing, steel helmet, gas mask, and canteen, we arrived at the trenches and were escorted to our positions by about 0230. There was nothing to do for two hours but try to get some rest in the deep, rutted dust underfoot, or in the nearby stony ground (which was very cold) with a prickly bush for a pillow; that or talk, gaze at the

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1/ Abstracts from a HumRRO trip report prepared by Howard C. Sarvis, 12 September 1957.

brilliant star display or the little winking light below the horizon said to be ground zero. At 0430 all were aroused and filed down the dirt ramps into the trenches, black slots in the earth two feet wide, five feet deep, several strings of them possibly a quarter of a mile long. The stars were still bright and motionless, but the little blinking light was rising now, very slowly, almost imperceptibly. They were letting up the balloon; it seemed certain that the shot would go.

At H-minus ten minutes, we could see the balloon, a tiny thing in the great pre-dawn landscape, a pearly golf-ball magically suspended just above the horizon, still with its blinking light.

The time hacks were coming every minute now, "...This - is - Dragnet. In thirty seconds it will be H minus nine minutes. -- Ten -- seconds. Nine - eight, - seven - six - five - four - three - two - ping-g-g-g! H minus nine minutes." Click.

At H minus three minutes we put on our gas masks and helmets, faced half-right in the trenches and crouched, eyes closed, arm tightly against the goggles of the mask. The three minutes seemed interminable, breathless in every sense; then came the silent, brilliant, white flash.

I could feel the heat of the fireball reflecting from the wall of the trench above me. I peeked, but quickly shielded my eyes again. It was still furnace bright. The ground wave caught me unaware, three distinct shocks, seeming to raise me about a foot each time, with the terrible sensation of being detached from anything solid or reliable and thoroughly shaken, as in an earthquake. It <u>was</u> an earthquake. Well, I thought, that's over, I've been in earthquakes before, now I can still see a little of the

fireball, but as I was arising the shock wave struck, a cracking blast like that at the muzzle of a cannon, accompanied by a clatter of pebbles on the helmet. Then it was over and I stood up.

That blinking light hadn't been so distant after all. We weren't looking across the desert at DOPPLER, we were looking right up the smooth shaft of its stem. It rose and rose, straight up into the sky, intense, salmon pink from internal fires, fading to delicate coral as the mushroom cap spread into the morning sun.

Appendix C

Department of the Army
Washington, D. C., August 1957

Study DR- 8 _____

WHAT WE WANT YOU TO DO

1. Read every question or statement carefully to make sure you understand it before marking your answer.

2. Mark some answer to every question. If you have more to say, add it, but first mark one of the suggested answers.

3. If there is anything you don't understand, please raise your hand and ask about it.

4. Check and make sure you have answered every question before you turn in your paper.

How to Answer These Questions

Most of these questions have several different answers printed right after the question. In front of each answer is a box like this: ___. Read all the answers under the question, then make a cross in the box in front of the answer you pick, like this _x_.

1. What is your name? (write in) _____
(First name) (Middle initial) (last name)

2. How did you come into the Army this time? (Mark one)

   1. ____ I was called in from the Reserve
   2. ____ National Guard was called up
   3. ____ I was drafted
   4. ____ I volunteered for the Regular Army

3. Have you ever been in a fire fight or under enemy shell fire? (Mark one)

   1. ____ Yes, I have been in a fire fight and under enemy shell fire
   2. ____ Yes, I have been in a fire fight but not under enemy shell fire
   3. ____ I have been under enemy shell fire only
   4. ____ No, I have not been in a fire fight or under enemy shell fire

4. When were you born? _____ (Day) _____ (Month) _____ (Year)

5. In what state were you born? _____
(Name of state or foreign country)

6. How far have you gone in school? (Mark only one answer, indicating the highest grade you completed)

   1. ____ Less than 5th grade
   2. ____ Finished 5th grade
   3. ____ Finished 6th grade
   4. ____ Finished 7th grade
   5. ____ Finished 8th grade
   6. ____ Finished 9th grade
   7. ____ Finished 10th grade
   8. ____ Finished 11th grade
   9. ____ Finished 12th grade
   10. ____ Went to college but did not finish
   11. ____ Graduated from college

7. What is your Army rank? (Mark one)

1. ____ Private (E-1 or E-2)
2. ____ Private first class (E-3)
3. ____ Corporal or Sp 3c (E-4)
4. ____ Sergeant or Sp 2c (E-5)
5. ____ Sergeant first class or Sp 1c (E-6)
6. ____ Master or first sergeant or M Sp (E-7)

8. How much ACTIVE military duty altogether have you had? (Mark one)

1. ____ Two months or less
2. ____ Over two months up to six months
3. ____ Over six months up to a year
4. ____ Over a year up to two years
5. ____ Over two years up to five years
6. ____ Over five years up to ten years
7. ____ Over ten years.

9. Have you ever seen an atomic explosion before at a distance of ten miles or less? (Mark one)

1. ____ I have never seen an atomic explosion that close before
2. ____ I have seen one atomic explosion that close
3. ____ I have seen more than one atomic explosion that close.

10. If you answered YES to the above question, please describe when and where you saw the atomic explosion. (Write in)

_____

_____

_____

_____

_____

11. In the last year or two how many separate Army training talks do you remember hearing on the Atomic bomb and its effects before coming to Desert Rock this time? (Mark one)

1. ____ None at all
2. ____ One talk
3. ____ Two talks
4. ____ Three talks
5. ____ Four talks
6. ____ More than four talks

12. Have these talks helped you to understand how to protect yourself in case you were sent into A-bomb combat? (Mark only one)

1. ____ I have not heard any talks on this subject
2. ____ The talks helped me a great deal
3. ____ The talks helped me a little
4. ____ The talks did not help me at all

13. If you were sent into combat now in which A-bombs were used, how well would you be able to carry out your combat duties? (Mark one)

1. ____ I think I would be able to carry out my combat duties very well
2. ____ I think I would be able to carry out my combat duties fairly well
3. ____ I don't think I would be able to carry out my combat duties very well
4. ____ I don't have any idea how I would do

14. If you were sent into combat now in which atomic weapons were not used, how well would you be able to carry out your combat duties? (Mark one)

1. ____ I think I would be able to carry out my combat duties very well
2. ____ I think I would be able to carry out my combat duties fairly well
3. ____ I don't think I would be able to carry out my combat duties very well
4. ____ I don't have any idea how I would do

15. What will be the height of the A-bomb explosion you will see during the exercise? (Mark one)

1. ___ The bomb will be exploded about 3,500 feet above the ground
2. ___ The bomb will be exploded about 2,000 feet above the ground
3. ___ The bomb will be exploded about 700 feet above the ground
4. ___ The bomb will be exploded about 300 feet above the ground
5. ___ The bomb will be exploded on the ground
6. ___ Other (Write in) _____

_____

_____

16. How worried are <u>you</u> about going on this A-bomb maneuver? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

17. How worried do you think <u>most of the troops</u> are about going on this A-bomb maneuver? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

18. How worried do you think <u>you</u> will be when the A-bomb is exploded? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

19. How worried do you think <u>most of the troops</u> will be when the A-bomb is exploded? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

20. When the A-bomb goes off, how worried do you think <u>you</u> will be about the bomb's <u>blast</u> effect? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

21. When the A-bomb goes off, how worried do you think <u>most of the troops</u> will be about the bomb's <u>blast</u> effect? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

22. When the A-bomb goes off, how worried do you think <u>you</u> will be about the bomb's <u>fire flash</u>? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

23. When the A-bomb goes off, how worried do you think <u>most of the troops</u> will be about the bomb's <u>fire flash</u>? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

24. When the A-bomb goes off, how worried do you think you will be about the immediate radiation? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

25. When the A-bomb goes off, how worried do you think most of the troops will be about the immediate radiation? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

26. Suppose that immediately after the A-bomb exploded the troops were ordered to enter Ground Zero. How worried do you think you would be about any radiation that would be there? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

27. Suppose that immediately after the A-bomb exploded the troops were ordered to enter Ground Zero. How worried do you think most of the troops would be about any radiation that would be there? (Mark one)

1. ___ Very worried
2. ___ Quite a bit worried
3. ___ A little worried
4. ___ Not at all worried

28. What caused the greatest number of casualties from the A-bomb attacks on Hiroshima and Nagasaki in 1945? (Mark one)

1. ___ Lack of oxygen after the explosion
2. ___ Blast effects and falling objects
3. ___ Burns from the flash or fires
4. ___ Radiation

29. Which type of atomic explosion do you think leaves the greatest "residual" (long lasting) radiation at Ground Zero? (Mark one)

1. ___ Air burst at 2,000 feet
2. ___ Air burst at 500 feet
3. ___ Surface burst
4. ___ Underground burst

30. Which one of the following types of burns is most like the flash burns on exposed skin caused by the heat wave from an A-bomb? (Mark one)

1. ___ Burns from hot oil
2. ___ Burns from a hot stove
3. ___ Burns from gunpowder
4. ___ Burns from radium

31. Suppose an A-bomb like the one at Hiroshima were exploded 2,000 feet above the ground in flat, open country. How many people would be killed by radioactive materials falling to the earth? (Mark one)

1. ___ Many people would be killed by radioactive materials
2. ___ Quite a few people would be killed by radioactive materials
3. ___ Hardly any people would be killed by radioactive materials
4. ___ No people would be killed by radioactive materials

32. Would radiation from an A-bomb explosion make men in foxholes 1½ miles away permanently sterile (unable to become fathers)? (Mark one)

1. ___ Many men would be made permanently sterile
2. ___ Quite a few men would be made permanently sterile
3. ___ Hardly any men would be made permanently sterile
4. ___ No men would be made permanently sterile

33. After an A-bomb is exploded 2,000 feet above the ground, how soon would it be safe to walk through Ground Zero? (Mark one)

1. ___ Immediately afterward
2. ___ 30 minutes afterward
3. ___ One hour afterward
4. ___ One day afterward
5. ___ 10 days afterward
6. ___ More than 10 days afterward

34. How many of the children born in Japan were misshapen or deformed because of radiation from the A-bombs in 1945? (Mark one)

1. ___ Many children were misshapen or deformed
2. ___ Quite a few children were misshapen or deformed
3. ___ Hardly any children were misshapen or deformed
4. ___ No children were misshapen or deformed

35. How easy is it for a person to catch radiation from someone who has been exposed to it? (Mark one)

1. ___ Very easy
2. ___ Fairly easy
3. ___ Fairly hard
4. ___ Impossible

36. How many of the ships in the Bikini tests in 1946 had to be sunk because they were too radioactive to be used again? (Mark one)

1. ___ Many ships had to be sunk
2. ___ Quite a few ships had to be sunk
3. ___ Hardly any ships had to be sunk
4. ___ No ships had to be sunk

37. How many of the men two miles from an A-bomb explosion would be unable to have sexual intercourse because of radiation effects? (Mark one)

1. ___ Many of them would be unable to have sexual intercourse
2. ___ Quite a few of them would be unable to have sexual intercourse
3. ___ Hardly any of them would be unable to have sexual intercourse
4. ___ None of them would be unable to have sexual intercourse

38. How dependable do you think Geiger counters are for detecting radiation in a radioactive area? (Mark one)

1. ___ I have complete confidence in Geiger counters
2. ___ I have a great deal of confidence in Geiger counters
3. ___ I have a little confidence in Geiger counters
4. ___ I have no confidence in Geiger counters

39. After an A-bomb is exploded 2,000 feet above the ground, how soon would it be safe to drink water in open tanks one mile away? (Mark one)

1. ___ Immediately afterward
2. ___ One hour afterward
3. ___ One day afterward
4. ___ More than one day afterward
5. ___ Never

40. After radioactive particles get on the skin, how many of them can be removed by scrubbing with soap and water? (Mark one)

1. ___ Almost all of them can be removed
2. ___ Most of them can be removed
3. ___ Few of them can be removed
4. ___ Almost none of them can be removed

41. Is the following statement TRUE or FALSE? "Radiation sickness is almost always fatal." (Mark one)

1. ___ True
2. ___ False

42. How easy do you think it is to notice (feel, taste, see, or smell) radiation from an A-bomb? (Mark one)

1. ___ I think it is very easy
2. ___ I think it is fairly easy
3. ___ I think it is fairly difficult
4. ___ I think it is impossible

42a. Explain your answer to the previous question (Write in): _____

_____

_____

_____

_____

43. Suppose an A-bomb were exploded 300 feet above the ground. How dangerous would it be to move into Ground Zero one hour after the explosion? (Mark one)

1. ___ It would be very dangerous
2. ___ It would be quite dangerous
3. ___ It would be a little dangerous
4. ___ It would not be dangerous at all

44. Will sheep left in foxholes one mile from Ground Zero during the exercise die of radiation from the effects of the A-bomb? (Mark one)

1. ___ They will die of radiation sickness immediately
2. ___ They will die of radiation sickness in a few days
3. ___ They will die of radiation sickness, but not for two or three weeks
4. ___ They will get radiation sickness, but will not die
5. ___ They will not get radiation sickness at all

45. A bank of earth one foot thick will stop a 30 cal. machine gun bullet, fired from 1,500 yards (about one mile) away. If an A-bomb were exploded 1,500 yards away, how much radiation would be stopped by a bank of earth one foot thick? (Mark one)

1. ___ Almost all of the radiation would be stopped
2. ___ About half of it would be stopped
3. ___ About one quarter of it would be stopped
4. ___ None of it would be stopped

46. During some A-bomb maneuvers, houses are built close to Ground Zero to find out what effect the A-bomb explosion will have on them. If a special detail of troops is needed to inspect these houses after the explosion to find out if they are dangerously radioactive, would you volunteer to go? (Mark one)

1. ___ I would certainly volunteer
2. ___ I would probably volunteer
3. ___ I would probably not volunteer
4. ___ I would certainly not volunteer

46a. Why did you answer the previous question the way you did? (Write in)

_____

_____

_____

_____

47. How much more training do you think you would need before going into combat in which A-bombs would be used? (Mark one)

1. ___ I need a great deal more training
2. ___ I need quite a bit more training
3. ___ I need a little more training
4. ___ I need no more training

48. How much more training do you think you would need before going into combat in which A-bombs would not be used? (Mark one)

1. ___ I need a great deal more training
2. ___ I need quite a bit more training
3. ___ I need a little more training
4. ___ I need no more training

49. If you have any ideas or suggestions about how atomic exercises or training could be improved, please write them here:

APPENDIX D

Summary Tables for Analyses of Variance

Table I

Summary of Analysis of Variance

Rifle Stripping Score X Days X Two Anxiety Groups

Source	df	SS	MS	F	p
Between Subjects	71	97,409	- - -	- - -	
Between Anxiety Groups (G)	1	386	386	0.28	N.S.
Error between S's	70	97,022	1,386		
Within subjects	144	143, 275	- - -	- - -	
Between Days (D)	2	40,032	20,016	27.02	.001
Interaction: D X G	2	128	64	0.09	N.S.
Error within S's	140	103,706	741	- - -	

T-tests for Differences between Pairs of Days

$$t = \frac{M_1 - M_2}{\sqrt{\frac{2\,MS_{error\ (w)}}{n}}}$$

2 Sept vs. 26 August

$$df=142 \qquad t = \frac{103.49 - 93.58}{4.536} = 2.18;\ p = .05$$

26 August vs. 23 August

$$df=142 \qquad t = \frac{93.58 - 70.96}{4.536} = 4.99;\ p = .01$$

Table II

Summary of Analysis of Variance

Crawling Score X Days X by Two Anxiety Groups

Source	df	SS	MS	F	p
Between Subjects	71	27,694	- - -	- - -	
Between Anxiety Groups (G)	1	71	71	0.180	N.S.
Error Between S's	70	27,623	395	- - -	
Within Subjects	144	20,904	- - -		
Between Days (D)	2	898	449	3.16	.05
Interaction: D X G	2	95	48	0.34	N.S.
Error Within S's	140	19,910	142	- - -	

T-tests for Differences between Pairs of Days

1. 2 September vs. 26 August:

$$t_{df=142} = \frac{60.19 - 57.96}{1.988} = 1.12;\ p = .30$$

2. 26 August vs. 23 August

$$t_{df=142} = \frac{57.96 - 62.94}{1.988} = -2.50;\ p = .025$$

Table III

Summary of Analysis of Variance

Foxhole Time X Days X Two Anxiety Groups

Source	df	SS	MS	F	p
Between Subjects	71	2,001	- - -	- - -	
Between Anxiety Groups (G)	1	5	4.924	0.173	N.S.
Error Between S's	70	1,996	28.52	- - -	
Within Subjects	144	1,671	- - -		
Between Days (D)	2	230	114.847	11.32	.001
Interaction: D X G	2	22	10.750	1.06	N.S.
Error Within S's	140	1,420	10.144		

t-tests for Differences Between Pairs of Days

1. 2 September vs. 26 August:

$$t_{df=142} = \frac{12.47 - 12.49}{0.531} = -.038;\ p = .90$$

2. 26 August vs. 23 August:

$$t_{df=142} = \frac{12.49 - 10.29}{0.531} = 4.14;\ p = .01$$

Table IV

Summary of Analysis of Variance

Grenade Score X Days X Two Anxiety Groups

Source	df	SS	MS	F	p
Between Subjects	59	32.417	- - -		
Between Anxiety Groups (G)	1	0.141	0.141	0.254	N.S.
Error Between S's	58	32.276	0.556	- - -	
Within Subjects	120	61.333	- - -		
Between Days (D)	2	1.300	0.650	1.285	N.S.
Interaction: D X G	2	1.289	0.644	1.273	N.S.
Error Within S's	116	58.744	0.506	- - -	

t-tests for Differences Between Pairs of Days

1. 2 September vs. 26 August:

$$t_{df=118} = \frac{1.167 - 1.216}{0.118} = -0.415;\ p = .70$$

2. 26 August vs. 23 August:

$$t_{df=118} = \frac{1.216 - 1.367}{0.118} = -1.28;\ p = .30$$

Table V

Variance of Proficiency Test Scores
Self-Attitude Classification

Test and Day	Increased Anxiety N=33	Decreased or Constant N=39	Total N=72
Rifle Stripping Time (in seconds)			
Familiarization	105.92	250.40	188.62
Baseline	571.83	1307.00	970.13
D-day	523.73	2572.85	1636.28
Crawling Time (in seconds)			
Familiarization	300.73	247.67	274.00
Baseline	162.31	126.40	143.12
D-day	216.70	269.57	245.38
Time in Foxhole (in seconds)			
Familiarization	8.54	10.30	9.54
Baseline	29.39	18.87	23.94
D-day	20.24	9.20	14.33
	(N=26)	(N=34)	(N=60)
Grenade Score (Nr. Hits)			
Familiarization	0.40	0.50	0.47
Baseline	0.53	0.63	0.60
D-day	0.49	0.46	0.47

Table VI

Summary of Analysis of Variance

Rifle Score X Days X Three Anxiety Groups

Source	df	SS	MS	F	p
Between Subjects	70	96,435	- - -		
Between Anxiety Groups (G)	2	5,506	2,753	2.06	N.S.
Error Between S's	68	90,929	1,337	- - -	
Within Subjects	142	140,258	- - -		
Between Days (D)	2	36,656	18,328	24.767	.001
Interaction: D X G	4	2,910	728		N.S.
Error Within S's	136	100,692	740	- - -	

t-tests of Differences Between Pairs of Days

1. 2 September vs. 26 August:

$$t = \frac{M_1 - M_2}{\sqrt{\frac{2\,MS_{error\ (w)}}{n}}} = \frac{102.92 - 92.83}{4.565} = 2.210;\ p = .05\ (df=70)$$

df=n-1

2. 26 August vs. 23 August:

$$t = \frac{92.83 - 71.45}{4.565} = 4.683;\ p = .01$$

df=70

Table VII

Summary of Analysis of Variance

Crawling Score X Days X Three Anxiety Groups

Source	df	SS	MS	F	p
Between Subjects	70	26,204	- - -		
Between Anxiety Groups (G)	2	443	221.5		N.S.
Error Between S's	68	25,761	378.8		
Within Subjects	142	21,757	- - -		
Between Days (D)	2	1,011	505.5	3.34	.05
Interaction: D X G	4	145	36.2		N.S.
Error Within S's	136	20,601	151.5		

t-test for Differences Between Pairs of Days

1. 2 September vs. 26 August:

$$t_{df=70} = \frac{60.04 - 57.68}{2.066} = 1.43;\ p = .20$$

2. 26 August vs. 23 August:

$$t_{df=70} = \frac{57.68 - 63.00}{2.066} = 2.575;\ p = .05$$

Table VIII

Summary of Analysis of Variance

Time in Foxhole X Days X Three Anxiety Groups

Source	df	SS	MS	F	p
Between Subjects	70	1928.6	- - -		
Between Anxiety Groups (G)	2	8.4	4.2	0.15	N.S.
Error Between S's	68	1920.1	28.2	- - -	
Within Subjects	142	2413.7	- - -		
Between Days (D)	2	243.8	121.9	7.90	.001
Interaction: D X G	4	70.1	17.5	1.14	N.S.
Error Within S's	136	2099.7	15.4	- - -	

t-tests of Differences Between Pairs of Days

1. 2 September vs. 26 August:

$$t_{df=70} = \frac{12.53 - 12.64}{0.659} = 0.167;\ p = .90$$

2. 26 August vs. 23 August:

$$t_{df=70} = \frac{12.64 - 10.32}{0.659} = 3.524;\ p = .01$$

Table IX

Summary of Analysis of Variance

Grenade Score X Days X Three Anxiety Groups

Source	df	SS	MS	F	p
Between Subjects	59	35.87	- - -		
Between Anxiety Groups (G)	2	2.34	1.170	1.989	N.S.
Error Between S's	57	33.53	0.588	- - -	
Within Subjects	120	63.33	- - -		
Between Days (D)	2	1.23	0.615	1.27	N.S.
Interaction: D X G	4	7.03	1.758	3.64	.01
Error Within S's	114	55.07	0.483	- - -	

Analyses of D X G Interaction

1. Simple Analysis of variance of performances on Familiarization Day, 23 August:

Summary Table

Source	df	SS	MS	F	p
Between Anxiety Levels	2	2.88	1.44	3.01	.10
Within Cells	57	27.30	0.48	- - -	
Total	59	30.18			

2a. Simple Analysis of Variance of performances on Baseline Day, 26 August:

Summary Table

Source	df	SS	MS	F	p
Between Attitude Groups	2	7.68	3.84	7.68	.005
Within Cells	57	28.50	0.500	- - -	
Total	59	36.18			

Table IX (continued)

2b. t-tests of Differences in Pairs of Attitude Groups for 26 August:

1. Decreased anxiety vs. Constant Anxiety:

$$t = \frac{1.64 - 0.92}{\sqrt{0.50\left(\frac{1}{25} + \frac{1}{25}\right)}} = \frac{0.72}{0.2} = 3.60;\ p = .01$$

$df = 48$

2. Decreased Anxiety vs. Increased Anxiety:

$$t = \frac{1.64 - 0.90}{0.265} = 2.79;\ p = .01$$

$df = 33$

3. Constant Anxiety vs. Increased Anxiety:

$$t = \frac{0.92 - 0.90}{0.265} = 0.075;\ p = .90$$

$df = 33$

3. Simple Analysis of Variance of Performance on D-day, 2 September:

Summary Table

Source	df	SS	MS	F	p
Between Anxiety Groups	2	0.80	0.40	0.74	N.S.
Within Cells	57	30.80	0.54	- - -	
Total	59	31.60			

Table X

Variances of Proficiency Test Scores
General Attitude Classification

Test and Day	Anxiety Level: Increased	Constant	Decreased	Total Sample
Rifle Stripping Time (in seconds)				
Familiarization	101.88	183.62	239.65	190.58
Baseline	599.59	377.96	1592.48	950.70
D-day	548.25	332.69	3284.24	1676.16
Crawling Time (in seconds)				
Familiarization	329.31	152.56	353.17	277.63
Baseline	166.98	130.50	122.49	139.40
D-day	162.96	149.20	369.08	244.24
Time in Foxhole (in seconds)				
Familiarization	7.37	13.34	6.55	9.51
Baseline	19.90	10.40	36.64	23.41
D-day	16.00	3.71	46.93	24.80
Grenade Score (Nr. hits)				
Familiarization	0.45	0.41	0.58	0.50
Baseline	0.69	0.55	0.31	0.60
D-day	0.40	0.53	0.54	0.53

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THE DESIGN AND PERFORMANCE OF A FALLOUT-SHELTER MARKED SHELTER STATION AND ITS SUITABILITY AS A SINGLE-FAMILY SHELTER

4331

by

T. C. Tamura

P. D. LaRiviere

H. Lee

J. I. Pond

UNCLASSIFIED

Partial

U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY

SAN FRANCISCO 24, CALIFORNIA

SECTION 1

INTRODUCTION

Radioactive fallout collection and gross sample analysis were recently completed by this laboratory during a nuclear weapon effects test at the Nevada Test Site. A major objective of the project was to measure, during fallout, the deposition dynamics of the event involving arrival time, mass deposition rate, and time of cessation. The short [illegible] and impracticability of adequate "on the shelf" automatic instrumentation to measure the dynamics of the fallout event led to the choice of utilizing manned stations in the fallout path. From these manned stations, personnel were able to manually control the opening and closing of fallout col[illegible]rs and start gamma-measuring instrumentation during the actual fallout event.

To satisfy the objectives of the projec[illegible], six 4-man shelters were designed, fabricated and installed at the Nevada Test Site. This laboratory has had experience in the design and operation of the manned shipboard stations at Operation Wigwam,[1] Castle[2] and Redwing.[3] The design and operation of a manned fallout shelter was proof-tested at Operation Plumbbob.[4] The laboratory has also pioneered in developing the basic concepts of fallout shelter design,[5,6] performance and management.

It is the purpose of this report to present the design specifications and construction costs of the fallout shelters, to describe their performance, and to point out the adaptability of structures of this type as single-family fallout shelters.

ABSTRACT

The design details, cost analysis and performance characteristics are presented for small, partially-underground fallout shelters utilized as manned stations during a nuclear weapon effects test. Four men occupied each shelter and operated radiation measurement and fallout collection instruments.

Two types of shelters were designed to withstand predicted overpressures: Type I for a 4-psi overpressure and Type II for a 5-psi overpressure. The basic structure consisted of an 8-ft diameter, 10-ft long, 12-gage corrugated steel, multi-plate pipe. A steel entranceway incorporating two right-angle turns provided access to the basic structure. Depending upon the amount of soil backfill, fallout gamma radiation protection factors up to 470,000 were obtained.

The overall performance of the shelters under the conditions experienced was excellent. It is suggested that shelters of this type have application not only for use as manned stations in nuclear weapon testing but can be adapted as well for use in residential areas as single-family fallout shelters.

SUMMARY

Problem

To present the design specifications, cost analysis and performance characteristics of 4-man fallout shelters used as manned stations to obtain experimental measurements during a nuclear weapon effects test.

Findings

Six 4-man shelters installed at the Nevada Test Site afforded protection, during fallout in a nuclear weapon effects test, to personnel operating instruments and collectors.

The design specifications, cost analysis and performance characteristics were determined. To meet the design specifications for the predicted overpressures, a Type I shelter was designed for a 1-psi overpressure and a Type II shelter was designed for a 5-psi overpressure.

Depending upon the amount of soil backfill, fallout gamma radiation protection factors up to 470,000 were obtained.

Shelters of this type have applications not only for use as manned stations in nuclear weapon testing but could be adapted as well for use in residential areas as single family fallout shelters.