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[redacted]

OPERATION MINUTE GUN

SHOT HUDSON SEAL

SUMMARY REPORT

[redacted]

MAY 1969

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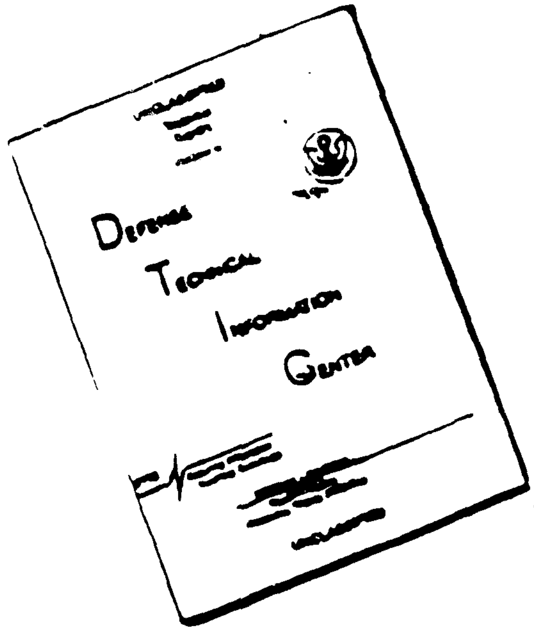

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POR 6300
(WT-6300)

OPERATION MINU[illegible] GUN

SHOT HUDSON SE[illegible]

PROJECT OFFICER'S REPORT

HUDSON SEAL SUMMARY REPORT [redacted]

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MAY 1969

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Cri[redacted]clear We[redacted]Design Inf[redacted]ion - DOD [redacted]210.2 applies.

[redacted]

ABSTRACT [redacted]

[redacted] Hudson Seal was an underground nuclear test sponsored by the Department of Defense (DOD). It was executed in the U12n.04 tunnel at the Nevada Test Site on 24 September 1968. [redacted] Additional experiments were sponsored by the DOD and the Atomic Energy Commission.

[redacted] The detonation was completely contained. [redacted]

([redacted] This report presents a general description of the Hudson Seal configuration; a discussion of the pretest experiment planning; a chronology of significant events and observations; a description of posttest conditions in the n.04 drift; a summary of experimental results; and recommendations for future tests. [redacted]

[redacted]

PREFACE [redacted]

[redacted] This Hudson Seal Summary Report was prepared to provide a consolidated source of information on the test operations, experiments, and results. Normally an interim report of this nature, containing preliminary results and observations, would have been prepared and would have been followed by a final report after the individual experimenters' Project Officer's Reports (PORs) had been published. This procedure could not be followed for Hudson Seal due to the commitment of the principal personnel to other test activities. However, the publication of this document at this time allows it to report more complete results on many experiments even though the PORs have not yet been published.

[redacted] While this is to be considered a final summary report since the principals soon will no longer be involved in the test program, it must be recognized that some of the results presented may be changed somewhat when analyses are completed and PORs published. However, the major conclusions presented are expected to remain valid. The information in this report is based on personal notes of the authors, data presented by the experimenters at a posttest Project Officers' Meeting, and on experimenters' Summary Reports. The conclusions drawn in this report are those of the authors and have not necessarily been coordinated with nor approved by the experimenters or their agencies.

[redacted]

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[redacted]

[redacted]

[redacted]

[redacted]

CHAPTER 1

INTRODUCTION

[redacted] The Hudson Seal event was an underground nuclear weapon effects test in the Department of Defense Minute Gun Series of tests [redacted] Hudson Seal was executed on 24 September 1968 in a specially prepared drift (U12n.04) in the n-tunnel complex in Area 12 of the Atomic Energy Commission's (AEC) Nevada Test Site (NTS).

[redacted] The primary objectives of this event were to:

[redacted]

(4) Investigate the environmental effects on other systems, components and materials.

[redacted]

[redacted]

The achievement of these objectives included analytical prediction of sample responses, measurement of the Hudson Seal responses, correlation of these data and extrapolation of the results to the system operational threat environment. The exposure requirements of the primary experiments fielded in support of these objectives determined the Hudson Seal test configuration and source characteristics.

[redacted]) [redacted]

[redacted] Hudson Seal employed an evacuated, horizontal 1100-foot line-of-sight (LOS) pipe from the nuclear device to the experiments

[redacted]

located in two test chambers at 900 and 1100 feet. Additional experiments, primarily diagnostics, were mounted in several smaller pipes of various lengths extending from the back of the test chambers. Active data were recorded via coaxial and multiconductor cables laid from the test chambers to recorders in an alcove and in instrumentation trailers on the mesa and at the tunnel portal. The LOS pipe and tunnel in the vicinity of the nuclear device and out to a distance of about 400 feet incorporated several features designed to contain the detonation products and energy after passage of the radiation into the LOS vacuum system. In addition, devices were installed to protect experiments from device-generated or secondary debris, while other containment features were employed to isolate the test drift and tunnel from the atmosphere. While the overall test configuration was based on similar designs successfully employed with previous events in the Minute Gun Series, some improvements and changes were made to achieve the specific objectives of this test.

[redacted] Chapter 2 of this report contains a description of the Hudson Seal test configuration and the rationale for the choices made during the planning and fielding of the event. A discussion of the containment, event chronology and general posttest condition of the tunnel, vacuum system, and data recording facilities also are included in

[redacted]

Chapter 2. Chapter 3 is devoted to the experiments and contains their rationale, description, results, and the impact of these results on the systems for which the data were sought. The experiment and test facility conclusions and recommendations are summarized in Chapter 4.

[redacted]

[redacted]

[redacted]

CHAPTER 2

GENERAL TEST DESCRIPTION AND CHRONOLOGY [redacted]

History [redacted]

[redacted]

[redacted] A subsequent rescheduling of Midi Mist to June 1967 (when it was executed) and resulting rescheduling of Dragon Mist to the fall of 1967 dictated review of Dragon Mist objectives and experiments, particularly in relation to Doe Foot, [redacted]

[redacted] During the winter of 1966-67 Dragon Mist and Doe Foot were combined into a single event, Hudson Seal, scheduled for the spring of 1968 [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] Unforeseen and unprecedented construction problems, however, prevented attainment of the Air Force requested date with an event of this size and scope; [redacted]

[redacted]

[redacted] This action required evaluation of the experimenters' capabilities to meet the then-current field installation dates and resulted in rescheduling Hudson Seal to August 1968 and Ming Vase (formerly Double Barrel) to October 1968, [redacted]

[redacted]

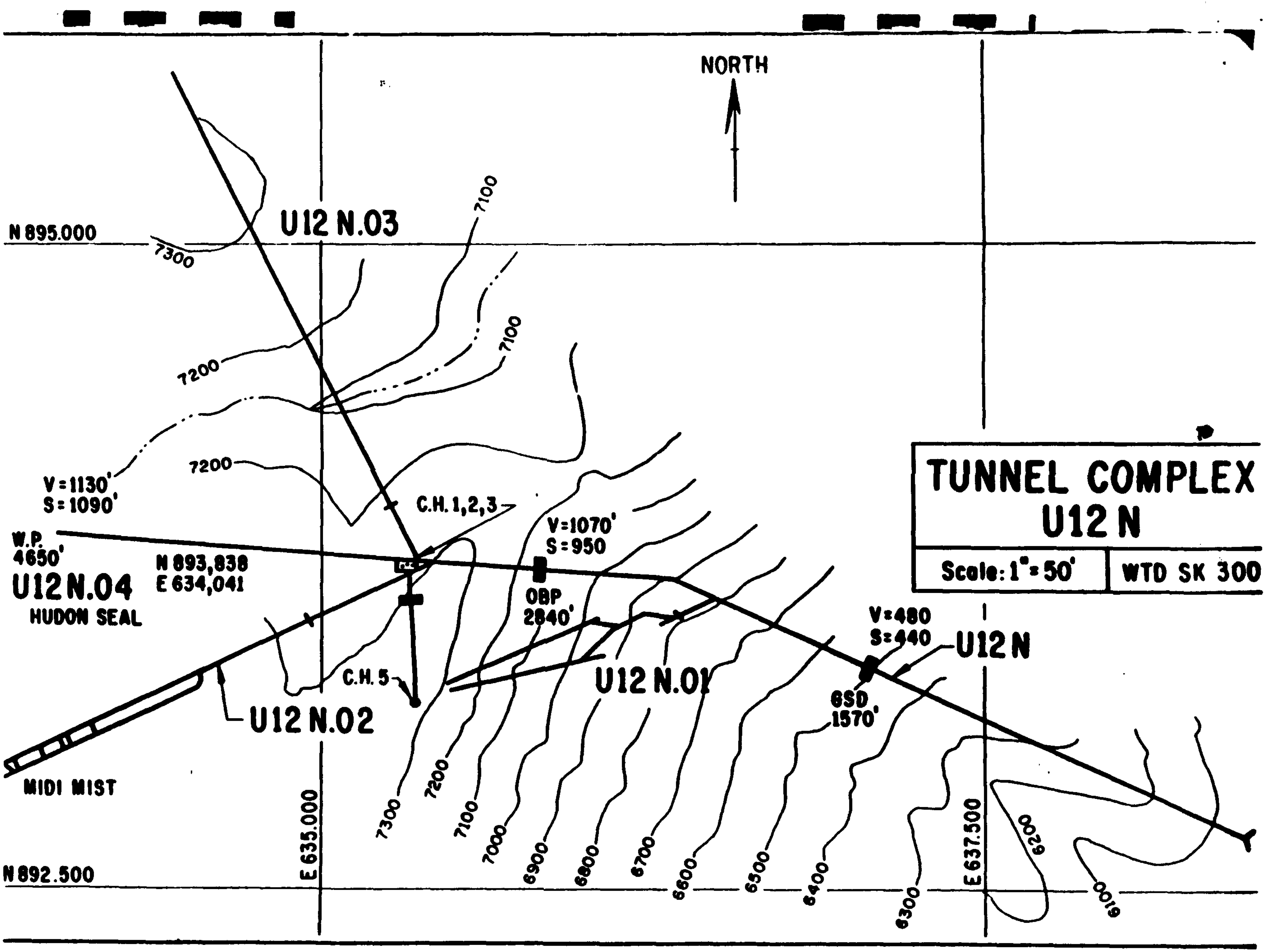
[redacted]

Document (Reference 1) was prepared based on this configuration and experiment complement. In June 1968 the Hudson Seal schedule was slipped 5 weeks to allow [redacted] sufficient time to prepare experiments for fielding and to relax the tight final button-up schedule.

Tunnel and Recording Locations [redacted]

[redacted] During the course of this definition of Hudson Seal various tunnel locations and alternates were investigated. The initial location, U12 n.03, was geologically poor, would have required extensive rehabilitation and was in jeopardy if Midi Mist, being readied in U12n.02, failed to stem. An exploratory core for U12n.04 was taken as a possible location should Midi Mist contain but rehabilitation of U12n.03 prove not to be practical. Mining of U12e.10, with its associated down-hole cable installation and mesa trailer park, was begun as a possible alternate site for Hudson Seal, but was given over to Dorsal Fin which was executed in February 1968. An exploratory core was taken and mining of U12e.11 was initiated for possible Hudson Seal use; mining was discontinued when the suitability of U12n.04 was proven.

[redacted]) In July 1967, after post-Midi Mist examination, U12n.04 was selected for Hudson Seal. The n.04 drift (Figure 2.1) was selected to enable reuse of many of the facilities installed for Midi



TUNNEL COMPLEX
U12 N
Scale: 1" = 50'
WTD SK 300
NORTH
N 895.000
N 892.500
E 635.000
E 637.500
U12 N.03
U12 N.04
HUDON SEAL
U12 N.02
MIDI MIST
U12 N.01
U12 N
W.P.
4650'
V = 1130'
S = 1090'
N 893,838
E 634,041
C.H. 1,2,3
C.H. 5
V = 1070'
S = 950
OBP
2840'
V = 480
S = 440
GSD
1570'
7300
7200
7100
7000
6900
6800
6700
6600
6500
6400
6300
6200
6100

Figure 2.1

[redacted]

Mist. Among these facilities were the gas seal door (GSD); the overburden plug (OBP) collar; the downhole cable alcove and cable holes (C.H. 1, 2, 3, 5) with cables installed to the mesa trailer park; and the trailer park and portal facilities. The n.04 drift was mined during the remainder of 1967 and prepared for the LOS pipe by March 1968.

[redacted] Since the experiment requirements had been translated into an 1100-foot LOS pipe with two approximately 10-foot diameter test chambers (TC), the n.04 drift was prepared as indicated in Figure 2.2 which also depicts the pipe and stemming and containment features (to be discussed later). The device or working point (WP) was located at Scientific Station (SS) 0 (Nevada State Coordinates N893,838, E634,041). Alcoves were mined in the tunnel rib near each test chamber and at several other locations to contain power supplies, signal conditioning equipment, vacuum pumps, cable terminations and working space.

[redacted] Coaxial and multiconductor signal, control and power cables were extended in the n.04 drift from the downhole cable alcove (C.H. 1, 2, 3) and buried in a trench in the left side (looking towards the WP) of the tunnel to each location in the tunnel or alcoves where they were required. Jumper cables and vacuum feed-through connectors were used to make connections to the experiments and

[redacted]

Page 15 is deleted

transducers. The other ends of these cables led from the downhole cable alcove through cable holes 1, 2, 3, and 5 to the mesa trailer park, where 28 recording trailers were installed; or were laid in the tunnel to the n.01 drift where GE Integrated Recording Packages (IRPs - hardened tape recorders) were located; or to the tunnel portal where five other instrumentation trailers were placed. These cable runs were installed during the spring and early summer of 1968 and turned over to the experimenters at the end of July.

LOS Pipe ([redacted]

[redacted] The LOS pipe was similar to the pipes employed on previous Minute Gun tests. [redacted]

Pages 17 & 18 are deleted

[redacted]

[redacted]

[redacted] The LOS pipe and its associated subsystems were installed, aligned and tested during the spring and summer of 1968. Experiments inside the test chambers and attached to the pipe stubs were installed during July and August and were connected to their cables for checkout. The instrumentation trailers were placed in the trailer park and at the portal during June and participated in cable and experiment checkout during July and August. [redacted]

Page 20 – 29 are deleted

[redacted] [redacted]

[redacted]

[redacted]) [redacted]

[redacted] The Hudson Seal spectrum was similar to corresponding portions of the Midi Mist and Tapestry spectra. A comparison of the final predicted spectrum and the measured spectrum is presented in Chapter 3.

Stemming and Containment [redacted]

[redacted] The Hudson Se[redacted] pipe and tunnel configurations were designed to provide containment of the weapon debris and energy within the first few hundred feet of LOS pipe and tunnel (the stemming region). This stemming and containment design employed the best features of Midi Mist and Dorsal Fin, both of which were well contained. The basic containment plan is shown in Figure 2.2 and Table 2.1.

[redacted]

Page 31 thru 34 are deleted

[redacted]

[redacted]

[redacted] The overall performance of the containment system was good; the *remote* radiation *monitor* readings indicated only neutron activation adjacent to the test chambers. Performance of individual segments of the containment system are difficult to ascertain. Based on stemming diagnostic measurements (Stanford Research Institute - Project 9.62) a general picture of the stemming action may be obtained.

[redacted]

[redacted]

[redacted]

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[redacted]

[redacted]

[redacted]

<u>Water Control</u> ([redacted]

([redacted]) A unique problem was experienced on Hudson Seal with water flowing into the tunnel at several locations. Water flowed into the zero room excavation at one time at a rate as high as several gallons per minute and at the time final stemming was started the flow rate was still 2 to 3 gal/min. Temporary equipment had been installed to pump the water out of the tunnel through the portal and the zero room was sealed with plastic sheeting and a roof.

[redacted] [redacted]

[redacted]

[redacted]

[redacted] Since the water flow rate was too high to allow it to continue unchecked during the stemming and button-up period, a special water control system was designed and installed. Two automatic submersible pumps were placed in the zero room sump and two additional automatic pumps were placed in sumps just forward of TAPS 1 and 2. A positive displacement pump was added to the water line outside of TAPS 1. In addition to the water control system, air conditioning was supplied to the zero room to control temperature and humidity. The air was circulated through supply and return pipes which were valved at the TAPS. Controls and monitors for the pumps, air conditioner, and the special hardened valve systems through each TAPS plug were remoted to the FMS and CP-1.

[redacted] During the early stemming stages the water control system operated successfully with one of the zero room sump pumps maintaining a 1-minute on/5-minutes off cycle. When the zero room was buttoned-up, however, the pump frequency slowed to approximately 1-minute on/30-minutes off. This was ascribed to the build-up of a positive air pressure in the zero room due to the restricted return flow of the air conditioning system. This positive zero room pressure helped pump water from the zero room sump. The 1-on/30-off cycle was maintained for the [illegible] tton-up period except

[redacted]

[redacted]

when the status of the air conditioner or pumps was changed.

[redacted] At 7 minutes before zero time the valves were closed and the pumps and air conditioner shut down to maintain the integrity of the containment system.

Timing and Firing Control and Countdown ([redacted]

[redacted] The central timing and control system was located in a control room at CP-1. A 15-minute countdown provided discrete timing signals for operation of the instrumentation in the unmanned recording trailers, experiment systems, device firing system and for various functions in the tunnel. Manual controls were provided for a number of other functions. Status of the instrumentation trailers, the device firing system and several other important operations were monitored and displayed in the control room. The vacuum system monitors and controls were located in the manned FMS trailer, about halfway between CP-1 and n tunnel. Timing signal dry runs were held to check out the timing, firing and data recording systems and various countdown hold plans. Holds during the countdown were practiced many times during the dry runs and included holds as late in the countdown as -0.8 seconds, verifying the desired countdown flexibility. Repeated practice of various hold situations paid large dividends on shot day.

([redacted] The Hudson Seal construction and field preparation schedule is summarized in Figure 2.13. After completion of the installation and checkout of the experiments a mandatory full participation dry [redacted]

[redacted]

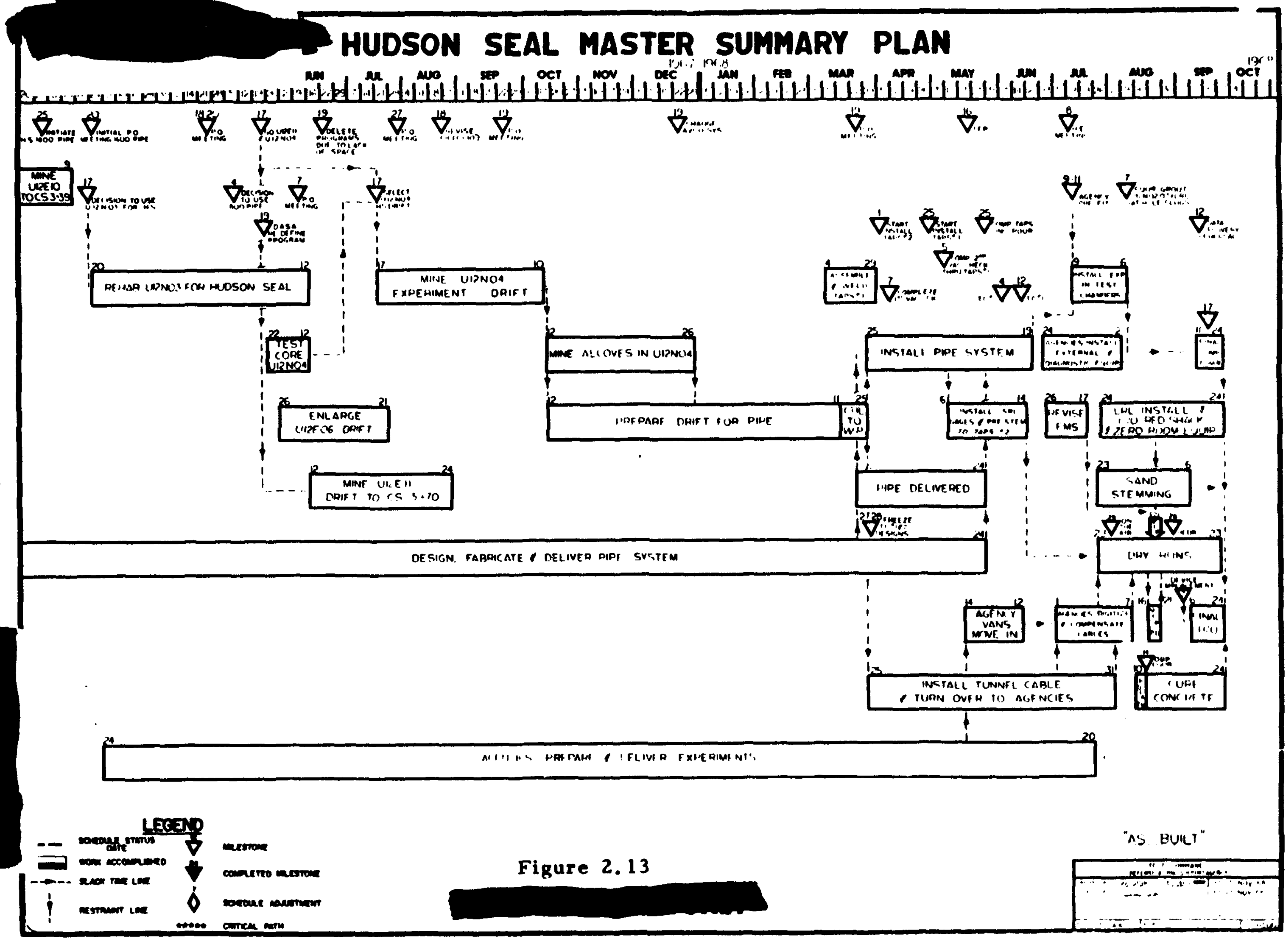

Figure 2.13

[redacted]

[redacted]

[redacted]

run was held on August 21st to confirm operation of all experiments and systems in as near shot-time electrical configuration as possible. A similar dry run was held on August 28th after installation of the HE experiments. The device was installed on September 3rd and a hot dry run was held on September 6th to test the device systems. Final stemming commenced the same day following verification of a successful hot dry run. The final vacuum system pumpdown started on September 11th but the pipe was brought back to atmospheric pressure on the 16th to repair an experiment malfunction. The pump-down was resumed on September 18th and proceeded more rapidly than previously since the roughing pumps were used to maintain a partial vacuum while the removed experiments were repaired. After a weather briefing on September 23rd the shot-time was set at 0830 on the 24th.

[redacted] The countdown on shot day proceeded as outlined below:

0730 - [redacted] recorder located in the tunnel malfunctioned. It was decided to proceed since the data was also telemetered to CP-1 and recorded, but with some loss of time resolution.

0814 - Monitors indicated erratic transducer power in the [redacted] monitor system. The 0830 zero-time was postponed and repairs started in the CP where the problem was located.

[redacted]

[redacted]

[redacted]

0922 - Repairs were completed and a zero time of 0945 was scheduled.

0930 - Countdown started.

0935 - At -10 minutes similar [redacted] monitor problems developed. The countdown was stopped and the timing system reset.

0942 - The -15 minute signal was sent manually and a new zero time of 0953 was established.

0944 - [redacted] monitor problems again caused the countdown to be stopped and the system reset.

0955 - The -15 and -10 minute signals were sent manually and a zero time of 1005 set.

1000 - A tape recorder in a trailer at the portal (Project 9.64) malfunctioned but the countdown was not held because it was confirmed that the most critical data was being received and displayed in CP-1.

1005 - The device was detonated at 1005:00.087 PDT (uncorrected for WWV propagation time) with all device monitors indicating normal operation.

1006 - Electrical power at the portal and in the tunnel (except for TV power) was disconnected as planned.

1010 - Power in the trailer park was disconnected as planned.

[redacted]

[redacted]

[redacted]

[redacted]

Recovery [redacted]

[redacted] Reentry to the instrumentation trailers for data recovery commenced within an hour and personnel in the trailer park felt cavity collapse when it occurred at +2½ hours. Data recovery from the mesa and portal was completed without incident by +3½ hours. On September 25th reentry was made into the tunnel and pipe. General conditions were as noted previously. The SS 2 debris scoop contained a number of rocks up to ∿2 inches in diameter while in SS 2 itself only dust and ∿ 1-inch diameter rocks were found. However, several experiment filters and protective cable shrouds from SS 2 were found between SS 2 and the filter catcher. TC 1 debris consisted only of dust. Postshot views of the test chambers are shown in Figures 2.14 and 2.15. The filter catcher was down and may have caught the SS1A filter (which was found near the debris scoop) and other debris propelled down the pipe by the onrush of air entering the pipe, probably at the SPSs and at a break in the pipe at SS 715.

[redacted] Subsequent information from the experimenters revealed that the filter was down, or was falling, at zero time. [redacted]

Pages 47-49 are deleted

[redacted]

plates and the shadow of the filter catcher frame on the pin-hole camera located at SS 1B.

[redacted] Design of the uplatch and release was considered to be very conservative; this fact was confirmed by extensive postshot tests of the uplatch tantalum strip. Although the position of the filter catcher was not monitored, it was observed to be up as late as September 18th, after another underground test (the last prior to Hudson Seal) was executed. In short, the occurrence was completely investigated but no completely satisfactory reason for the filter catcher to fall prematurely was found. [redacted] The attenuation of a single cord and near the cord edges was correspondingly less. It does not appear at this time that the presence of the bungee cord in the LOS will materially affect the experimental results.

[redacted] Recovery of the experiments proceeded unhampered and on schedule starting on D+2. Results of the experiments along with their descriptions are presented in Chapter 3.

[redacted]

[redacted]

CHAPTER 3

EXPERIMENTAL PROGRAM AND RESULTS SUMMARY ([redacted]

[redacted]

[redacted] This chapter contains a summary of the major Hudson Seal experiments. It includes a brief description of the major experiments and the rationale for their inclusion in Hudson Seal. A summary of the results of most of these experiments also is included. For complete descriptions and results, the reader should refer to the appropriate Project Officer's Reports (PORs) (References 4 and 5).

[redacted]) The diagnostic experiments are discussed first in order to define the environment to which the effects experiments were exposed. [redacted] experiments are presented next and are followed by the several additional experiments included in Hudson Seal.

Environmental Measurement[redacted]

[redacted]

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[redacted]

[redacted] A large number of diagnostic experiments were included in Hudson Seal to provide a comparison of techniques and verify the predicted environment. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] Only preliminary analyses of the Sandia diagnostics have been accomplished and thus the results were not included in arriving at the consensus. After the pressures of the Cypress event are relieved the data analyses will be completed. [redacted]

([redacted]) [redacted]

[redacted]

[redacted]

[redacted]

TC2. Data recording was accomplished in the trailer park and some signals from the slow diagnostics were redundantly telemetered to CP1 for recording and early analysis. [redacted] The other measurements, including the pin-hole camera, also provided good data.

[redacted]

[redacted]

[redacted]

and calculations were performed independently by SRI and EG&G. Infrared calorimeters also were fielded at TC1 but produced no usable data. The two analyses produced results in general agreement [redacted]

([redacted]) [redacted]

[redacted] [redacted]

[redacted]

[redacted] Project 8.58 - Nuclear Defense Laboratory. Neutron and gamma fluence and neutron spectral measurements were passively made by exposure of activation foils and dosimeters at shielded locations in the test chambers and in two tunnel alcoves. These data provided environmental information for the shielded experiments using only the neutrons and gamma rays.

[redacted] Project 9.62 - Stanford Research Institute. In addition to the stemming and containment diagnostics discussed in Chapter 2, triaxial acceleration measurements were made at two locations near TC2, and on and near TC1. Measurements of temperatures and pressures in the test chambers also were attempted.

[redacted] Acceleration measurements made in the left rib of the tunnel at SS 850 near TC2 indicate ground shock arrival time o[redacted] an average velocity of the shock front of[redacted] with maximum accelerations occurring betwee[redacted]nd[redacted]. Peak radial accelerations were initially[redacted] (towards the portal) followed immediately by acceleration towards the WP which went off scale a[redacted] The next recorded peaks ar[redacted] off scale a[redacted] off scale a[redacted]d off scale at[redacted] The initial peak vertical accelerations were[redacted]n[redacted] which were repeated for

[redacted]

3 or 4 oscillations. The peak transverse accelerations initially recorded were [redacted] off scale a[redacted] and [redacted]

[redacted]) The accelerometers mounted on the floor of the tunnel at the same distance were affected by the motion of the pipe, which was coupled to the ground by pipe stands and rails and the heavy support pad for TC2, as well as the ground motion. Earlier arrival times o[redacted] msec were recorded with a very early single radial oscillation at about [redacted] apparently entirely from pipe shock from the SPS HE which was fired at zero time. Initial radial ground motion is towards the WP with a weak [redacted]eak followed by immediate reversal and saturation at [redacted] for abou[redacted]. Vertical acceleration was initially downward with a peak at [redacted] Two oscillations later the maximum acceleration of [redacted]was recorded. Initial transverse acceleration was to the left with a peak a[redacted] followed by saturation at [redacted]

[redacted]) Two of the three accelerometers buried in the tunnel floor at SS 1050 were lost prior to zero time. The third recorded an unexplained pulse at [redacted] The first ground motion was recorded a[redacted] (average velocity o[redacted] with immediate saturation at [redacted]or [redacted]

([redacted]

 [redacted]

[redacted]

signals attributed to ground motion were recorded at [redacted] (average velocity o [redacted] t [redacted]. Peak accelerations due to ground motion and which were quickly damped were [redacted] wards the portal, [redacted] upward and [redacted] left. A displacement gage located between the rear of TC1 and a point on the tunnel wall 22 feet towards the portal indicated a shortening of less than [redacted] inches. This compared well with a total relative displacement of pipe stubs and stands, and with a post-shot survey which indicated the test chamber moved [redacted] towards the portal while the floor in the area moved less than [redacted]

[redacted] No temperature variations were noted in the test chambers. The low range pressure gage at TC 2 was saturated at zero time and did not return to base line; the high range gage (0-2000 psi) did not indicate a pressure change. Pressure measurements at TC1 indicate an [redacted] rise at [redacted]

[redacted]

[redacted]

Pages 61-63 are deleted

[redacted]

[redacted]

[redacted] Results:* The only active data producing directly usable results were some of the thermocouple measurements and A&F and

* [redacted]

[redacted]

[redacted]

component data. Much of the strain, accelerometer, resistance thermometer, and quartz transducer data are difficult to interpret due to noise, ground shock effects, pretest malfunctions and event produced defects. The interpretable data did not seem to correlate very well with predictions or observed effects.

[redacted]

 [redacted]

Pages 66-81 are deleted

*[redacted] Other than the postshot overall test chamber photographs (Figures 2.14 and 2.15) and the postshot view [redacted] at SS 2 (Figure 3.3), no results photographs are furnished in this report as it is expected that such pictures are available to the reader.

[redacted]

[redacted]

at SS 1A; they were damaged in the overtest at SS 1B but provided sufficient protection for the liner.

[redacted] The recovered samples all appeared normal; however, the substructure bond has not yet been examined.

[redacted] Detailed examination of the propellant is yet to be accomplished.

[redacted] (f) A number of components [redacted] were exposed at SS 1B to determine if they would satisfactorily operate posttest. [redacted] Visual examination of the components and firings of some of them indicated no damage. Detailed tests have not yet been completed.

[redacted]

[redacted]

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[redacted]

[redacted]

[redacted]

([redacted]) [redacted]

[redacted]) <u>Project 8.41 - Los Alamos Scientific Laboratory.</u> A number of separate experiments related t[redacted]materials and components and interaction phenomenology were performed:

[redacted]

[redacted]

Page 85 is deleted

[redacted] FC[redacted]

[redacted]

[redacted] Sandia fielded a large number of small advanced development, phenomenology and instrumentation experiments at SS 1B and 2.

[redacted]D)The instrumentation experiments included cable noise

[redacted]

[redacted]

[redacted]

measurements, a study of torsion bar sample size influence, investigation of various other momentum gage designs, a blowoff material measurement, measurement of radiation effects on strain gages, a detonator mounting effects study, manganin and lithium pressure transducer tests, quartz signal multiplexing, and incidental environmental measurement devices. Usable data were obtained from the majority of these experiments. Analyses are incomplete and are continuing.

[redacted] The material and structural response tests included [redacted] a shock attenuation experiment and materials samples [redacted] Although postshot active data on [redacted] components were lost, satisfactory performance of the system was demonstrated in the laboratory after replacing a cable cut by rupture of the cassette.

[redacted] Four separate experiments were performed by different contractors [redacted]

[redacted]

[redacted]

[redacted]

[redacted] Exposures of thermal batteries, mechanical timers, battery actuators, fire sets, neutron generators, cable solder terminations, and platings inside the neutron generator can

[redacted]

[redacted] [redacted]

[redacted]

indicated survival [redacted]

(2) Lockheed Missiles & Space Co. [redacted]

[redacted] Apparently none of the [redacted] experiments were detonated by the environment. [redacted] Unexplained damage to primer and gas calorimeter phenomenology experiment fixtures precluded meaningful analysis of the specimen [redacted]

[redacted]

Pages 90-91 are deleted

[redacted]

[redacted]

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS SUMMARY [redacted]

EXPERIMENTAL PROGRAM ([redacted]

([redacted]) [redacted]

[redacted]

Page 93 is deleted

[redacted]

[redacted] [redacted]

[redacted]

TEST FACILITY ([redacted])

([redacted]) To an experimenter, the most important features of the test facility seem to be, in order: the proper radiation environment, containment which allows experiment recovery, and physical protection of the experiments. Hudson Seal achieved all of these.

[redacted]

[redacted]

[redacted]) Complete containment of the Hudson Seal detonation products was obtained and only neutron activation radiation levels were measured in the test drift. Thus recovery of the data and experiments was not affected by an adverse environment.

[redacted] No large debris and very little small debris (sand, etc.) damage was experienced at either test chamber. The large debris scoops, the SPSs and the SS 1 filter catcher were effective in stopping the larger debris. Although some SS 2 experiment shields, cable shrouds and the polyethylene filter became debris, none reached the SS 1 experiments.

[redacted] The reason for the SS 1A filter catcher being down or falling at zero time remains a mystery after extensive investigation. The effect of the bungee cord shadow on the SS 1 experiments, while complicating some analyses, was relatively minor. It cannot positively be determined whether or not the filter catcher caught the [redacted] filter; however, it did prevent many other projectiles originating at SS 2 from reaching SS 1. No debris, other than very fine sand, was found on the SS 1 side of the filter catcher.

[redacted]

[redacted]

[redacted]

[redacted] Experience on Hudson Seal demonstrated the feasibility of complete flexibility in the final 15-minute countdown. By closely coordinating the detailed experiment, recording system, device and other timing and monitoring requirements, the timing system was designed with flexibility. Careful and frequent practicing of holds during dry runs tested this system design. The dry runs and the final event countdown demonstrated that; even on an event as complicated as Hudson Seal, it is possible to arrange the system to accept holds at any time during the countdown.

[redacted] In addition to those items of primary concern to experimenters, the operational aspects of Hudson Seal included solution of several unusual problems. Among these were: water seepage in the tunnel (especially in the vicinity of the WP); a very large number of experiments with HE; a large diagnostic effort; and frequent and major changes in objectives, experiments, configurations, and locations over a period of nearly three years. In spite of these difficulties, this complex test was successfully executed and resulted in the acquisition of a large amount of valuable data.

[redacted]

[redacted]

[redacted]

S

1. "Hudson Seal Program Document, DASA 68-54441, August 1968; Defense Atomic Support Agency, Washington, D. C.; Secret Restricted Data.

2. Letter from C. R. Dismukes to CDR D. D. Swift, Test Command, DASA, Subject: Hudson Seal Calculations, dated December 12, 1968; Systems, Science and Software, La Jolla, California; Secret Restricted Data.

3. E. A. Boyric; "Box-A Anti-closure Design for Hudson Seal Event", UCID-15353, June 26, 1968; Lawrence Radiation Laboratory, Livermore, California; Secret Restricted Data.

4. R. A. Damerow; "Sandia Laboratories Participation on Hudson Seal Preliminary Posttest Summary Report", SC-DR-69-22, February 1969; Sandia Laboratories, Albuquerque, New Mexico; Secret Restricted Data.

5. The PORs planned but as yet unpublished are:

Project #	POR #	Agency
8.31	6301	BTL/MDC/KN/SC/PA
8.53	6305	LMSC
8.54	6306	NRDL
8.55	6307	SRI/EG&G

[redacted]

[redacted]

[redacted]

Project #	POR #	Agency
8.56	6308	NRL
8.58	6309	NDL
8.62	6310	LMSC
8.64	6311	AERO
8.63	6312	MIT
8.82	6313	GE
8.83	6314	AVCO
8.84	6315	AFWL
8.91	6316	NOL
9.62	6317	SRI
9.64	6318	GGA
9.7	6319	LMSC

[redacted]

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