7

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FORM OF DOCUMENT	CORRESPONDENTS OR TITLE		DATE	RESTRICTION
~~#3 report~~	~~record of actions~~ open 1-25-91 NLJ 90-134 ~~Secret~~ secret	~~1 p~~	~~06/16/64~~	~~A~~
#4 memo	to Bromley Smith from Charles E. Johnson Secret sanitized 4-17-87 ~~NLJ 86-179~~ SAME SANI. NLJ 016-001-6-1	1 p	07/23/64	A
#~~6 report~~	~~agenda for 534th NSC Meeting~~ ~~confidential~~ open 3-29-90	1 ~~p~~	~~06/16/64~~	~~A~~
#7 memo	for the President from McGeorge Bundy sanitized 6-4-92 NLJ 90-281 Secret ~~Exempt NLJ 86-222~~	3 p	06/13/64	A
~~#8 memo~~	~~for NSC from Bromley Smith~~ ~~Secret~~ open 5-19-92 NLJ 90-273	~~1 p~~	~~06/15/64~~	~~A~~
#9 report	re: nuclear testing Secret	22 p	05/30/64	A
#10 ~~report?~~	Bri~~efing for President~~ Secret Sanitized 10-16-96 NLJ 90-278	22 p	06/64	A
#11 report	Briefing for PRESIDENT, PART II Secret Sanitized 10-16-96 NLJ 90-278	20 p	06/64	A

FILE LOCATION

NATIONAL Security File, National Security Council File
NSC Meetings, Vol. 2 Tab 7, 6/16/64, FY 1965 Underground Nuclear Test Program

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Dr. Donald Hornig, Special Assistant to the President, OST
Spurgeon Keeny, Technical Assistant, Special Assistant to the President
Charles E. Johnson, Senior Member, National Security Council Staff

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NATIONAL SECURITY COUNCIL

RECORD OF ACTIONS

NSC
Action

2490. FY 1965 UNDERGROUND NUCLEAR TEST PROGRAM

Noted a briefing on the underground test program presented by the Atomic Energy Commission and the Department of Defense.

June 16, 1964
534th NSC Meeting
NSC Action 2490

~~SECRET~~

NSC Control No. 170

4

SECRET

July 23, 1964

MEMORANDUM FOR MR. BROMLEY SMITH

SUBJECT: Notes on the National Security Council Meeting, June 16, 1964

The Council met at 12:12 p. m. in the Cabinet Room. The list of attendees has already been given you.

(1) The President noted the presentation by representatives of the Atomic Energy Commission and Department of Defense based on the written "Briefing for the President - Underground Test Program FY 1965" dated June 1964 (Part I, Text and Part II, Charts).

(2) The President was interested in knowing why more tests were being recommended for FY 1965 than had actually been conducted in 1964. He was informed that it was largely due to the lack of any testing whatsoever by the Department of Defense and the cessation of testing during the summer of 1963 while the test ban treaty negotiations were underway. He also asked about the Soviet underground test program [redacted] > (a)(5)

(3) Both Secretary Rusk and Secretary McNamara urged Presidential approval of the underground test program. Rusk urged that the rate of testing be maintained at about the same level as had been followed in the last months of FY 1964. [redacted] (a)(5)

(4) The memorandum for the Chairman of the Atomic Energy Commission from Bundy dated June 22, 1964, "FY 1965 Underground Nuclear Test Program," is a record of the substantive decisions by the President at and following the NSC Meeting.

Charles E. Johnson

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5

ATTENDANCE LIST FOR THE 534th NSC MEETING JUNE 16, 1964, AT 12:00 NOON IN THE CABINET ROOM OF THE WHITE HOUSE

The President of the United States, Presiding

The Speaker of the House of Representatives

AEC
- Glenn T. Seaborg, Chairman
- General Delmar L. Crowson
- John Kelly
- Commissioner Gerald F. Tape
- Commissioner John Palfrey

CIA
- Marshall S. Carter

DEFENSE
- Robert S. McNamara, Secretary
- Cyrus Vance, Deputy Secretary
- W. J. Howard
- General Donnelly
- Harold Brown

JCS
- General Maxwell D. Taylor, USA, Chairman

OEP
- Edward A. McDermott, Director

STATE
- Dean Rusk, Secretary
- U. Alexis Johnson, Deputy Under Secretary for Political Affairs

USIA
- Donald Wilson, Acting Director

BUDGET
- Kermit Gordon, Director

WHITE HOUSE

McGeorge Bundy, Special Assistant for National Security Affairs
Jack Valenti, Special Assistant to the President
Walter Jenkins, Special Assistant to the President
George Reedy, Press Secretary to the President
Major General Chester V. Clifton, Military Aide to the President
Dr. Donald Hornig, Special Assistant to the President, OST
Spurgeon Keeny, Technical Assistant, Special Assistant to the President
Charles E. Johnson, Senior Member, National Security Council Staff

June 15, 1964 CONFIDENTIAL

NATIONAL SECURITY COUNCIL

AGENDA

For the Meeting to be held in the
Cabinet Room of the White House
on Tuesday, June 16, 1964 at
12:00 Noon

Item 1 -- FY 1965 UNDERGROUND NUCLEAR TEST PROGRAM

(Presentation by the Atomic Energy Commission and the Department of Defense)

DCH 3-29-90

534th NSC Meeting

CONFIDENTIAL

NSC Control No. 169

7

THE WHITE HOUSE

WASHINGTON

~~SECRET~~ - [redacted]

June 13, 1964

MEMORANDUM FOR THE PRESIDENT

SUBJECT: FY 1965 Underground Nuclear Test Program

The Atomic Energy Commission has requested your approval in principle of the FY 1965 underground nuclear test program (both AEC and DOD tests), and specific approval for the tests planned for the first quarter of FY 1965. Attached are the formal request letter from the AEC and a written briefing on the test program that will be presented by Dr. Seaborg before the National Security Council.

It is not intended that final decisions on the proposed program will be taken at the NSC meeting. The meeting is for the purpose of identifying and discussing the important factors requiring consideration in acting upon AEC's request after the meeting. A list of certain of the major issues is included below to assist in focusing attention on the essential elements. You may want to draw on this list in quizzing Dr. Seaborg, et al. Then afterward, with your guidance I can produce a revised program.

The proposed program which will consist of between 65 and 78 tests consists of the following elements:

AEC weapons development tests	[redacted]
AEC Project Plowshare tests	
DOD weapons effects and Vela tests	
Tests for the U.K.	
Total	

1.3 (a)(5)(?)

This will compare with an estimated total [redacted] by the end of FY 1964.

The direct AEC and DOD costs of the test program in FY 1965 will be \$189.3 million as compared with \$171.3 million in FY 1964. The AEC budget item for weapons development tests for FY 1965 (\$117.2 million) is now \$13.5 million below the level required to finance the 45-55 tests now being proposed.

~~SECRET~~ - [redacted]

Since the signature of the Limited Test Ban Treaty, the Soviet Union has conducted three underground tests which we have detected.

ISSUES FOR DISCUSSION

(1) Is a more than 50 per cent increase in the number of tests justified?

The pertinent considerations bearing on the size of the program are national security requirements, relative emphasis on nuclear weapons development versus other types of weapons development, international opinion as to size of the U.S. program, and Congressional opinion, particularly on the Kennedy commitment relating to "safeguards," which calls for a testing rate [redacted] shots per year. In regard to the Congressional attitude it should be borne in mind that the interested Committees and Members of Congress will become informed of your decisions almost immediately. 1.3 (a)(2)

MY OWN VIEW IS THAT A MODEST CUTBACK FROM RECOMMENDATION IS JUSTIFIED.

(2) Should we conduct tests in the megaton range?

Is the requirement for research and development in the very high yield area sufficiently urgent to justify tests in the megaton range at this time? Do we really need to have a 50-100 MT device ready for test within 90 days if the Limited Test Ban Treaty should be abrogated? When could effects tests using these very high yield devices actually be conducted since DOD has made no provision to fund these very expensive tests?

MY GUESS IS WE COULD GO SLOWER ON THIS

(3) Should additional funds be provided for the AEC development program?

An additional $13.5 million are required to fund the full 45 AEC weapon development shots. AEC proposes to use certain anticipated savings in weapons production that would otherwise revert to the Treasury. Failing this additional sum, AEC weapon development program would be restricted to a maximum of 35 tests. I THINK WE COULD BE MORE SAVING

(4) How tightly should we interpret the Limited Test Ban Treaty?

One proposed Plowshare test and two DOD effects tests are questionable under the terms of the Treaty. Although they are very low yield, they will produce radioactivity in the atmosphere that might be detected outside the borders of the U.S.

I think these are not worth the risk

(5) Should any tests be conducted outside the Nevada National Test Site?

The program includes one large test next Spring on Amchitka Island, Alaska, and one test in a salt dome near Hattiesburg, Mississippi. Both tests are designed to improve our ability to detect, identify and locate clandestine underground nuclear explosions.

MISSISSIPPI IS ALL RIGHT. I think, but Alaska has problem.

McG. B.

McGeorge Bundy

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL SECURITY COUNCIL
WASHINGTON 25, D.C.

~~SECRET-RESTRICTED DATA~~ June 15, 1964

MEMORANDUM FOR THE NATIONAL SECURITY COUNCIL

SUBJECT: FY 1965 Nuclear Test Program

Attached are two documents which will serve as the basis for discussion at the meeting of the National Security Council on Tuesday, June 16, 1964.

Bromley Smith
Bromley Smith
Executive Secretary

Enclosures
(1) Copy of letter to the President from AEC re WHETSTONE, dated May 30, 1964, trans. four enclosures
(2) Briefing for the President: Part I - Text and Part II - Charts, dated June, 1964

DECLASSIFIED
E.O. 12356, Sec. 3.4
NLJ 90-273
By [illegible], NARA, Date 5-13-92

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NSC Control No. 168

10

This document consists of 21 pages
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BRIEFING FOR THE PRESIDENT

UNDERGROUND TEST PROGRAM FY 1965

PART I: TEXT

Presented by

Representatives of the AEC and DOD

JUNE 1964

1885

WHETSTONE PROGRAM

WEAPONS DEVELOPMENT TESTS

To better understand the mechanics of underground testing and how this is related to the weapons development program, an explanation of typical device emplacements used for weapons, PLOWSHARE, or DOD purposes in their respective test operations is useful.

CHART 1

The first chart shows typical underground test installations. On the left is a normally stemmed emplacement. The nuclear device is emplaced in a small canister at the bottom of a drilled and cased hole, which is backfilled or "stemmed" with dense material, generally pea gravel. The material has never been thrown out by the explosion. The center diagram is a view of a large canister including typical diagnostic equipment which might be placed above the device. The emplacement on the right is typical of an installation which employs a line-of-sight pipe to the surface. Emplacements of this type are used in experiments where it is desired to expose samples to initial radiation fluxes directly from the device. This type emplacement is used primarily to determine the effects of neutron irradiation. This installation requires several types of closure mechanisms at various points in the pipe to insure containment of explosion debris. The line-of-sight pipe itself is capped at the top. The neutrons are sufficiently energetic to penetrate this cap. Experience has shown that subsidence of the area surrounding the detonation cuts off the release of radioactivity should some emission occur in spite of all precautions taken to prevent it. To summarize, the major problem of containment rests with a thorough understanding of the geology of the surrounding area more than it does with the specific type of emplacement used in a particular test. We have gained considerably more insight into this problem since the PIKE venting and have applied the lessons learned to the planning and evaluation of all future events to provide a higher degree of assurance that no treaty violations will occur.

CHART 2

The second chart summarizes the numbers of nuclear tests by type and medium of detonation that have been conducted by the United States for weapons development, DOD and PLOWSHARE which have occurred since the Soviet termination of the voluntary test moratorium in September 1961, as well as those projected for Fiscal Year 1965. In terms of total numbers of events, the tests proposed for Fiscal Year 1965 are comparable to those in earlier years when testing was conducted both underground and in the atmosphere. As you know, early in Fiscal Year 1964 the partial test ban treaty was initialed. The underground test program was revised to reflect the limitations of the treaty and to fulfill safeguard provisions associated with our treaty commitment. The underground test program before the treaty was [redacted] The revision increased this number; however, the late start of the series has limited the total number of tests that could be conducted in this year. Finally, the DOD and PLOWSHARE programs planned for the coming fiscal year are expanded.

12958 6.1(a)

CHART 3

The AEC weapons development program planned for FY 1965 in the WHETSTONE series is shown in chart 3 by major research and development objective.

The broad nature of each R&D objective along with recent accomplishments and expected achievements in 1965 follow.

1. Reliability is a stringent requirement which must be achieved for each and every nuclear system, and requires the conduct of proof tests and safety tests. Proof tests are normally conducted prior to entry of the warhead into the stockpile and is the proof that each final warhead design will perform as planned. Safety tests are simulated accidental detonations performed to insure that no nuclear yield will result from accidental detonation of a warhead. For example, during NIBLICK we verified

b-2(a)
12958
6.1(a)

Equally important is a technical solution to those unforeseen and unexpected problems, which experience has shown will arise. As much as one-fifth of our total testing effort has been expended in this area of maintaining, as well as certifying the reliability of the weapons currently in stockpile.

2. Penetration Capability of our warheads for ICBM systems such as POLARIS, MINUTEMAN and TITAN, into defended target areas has become a major weapon design consideration. To further evaluate the "hardness" of nuclear warheads, including their ability to withstand a heavy flux of high energy neutrons, we plan as part of the underground program to subject appropriate components to the effects of nuclear detonations and determine vulnerability of the warhead by measurement. Present ICBM warheads must be considered as "first generation", in that their design was determined when relatively minimal consideration was given to penetration of an ICBM defense. A "new" or "second generation" of warheads is now being developed with the primary objective of enhancing our penetration capability. During NIBLICK, design features which will be incorporated into the next generation warhead for MINUTEMAN were determined. In WHETSTONE, several underground vulnerability measurement tests of entire warheads and re-entry vehicles will be performed, including the test of the design of integrated re-entry vehicles having the ability to withstand extreme nuclear environments. As another means of improving penetration capability, we are developing small warheads with a big punch, [redacted] In summary, one of the major objective areas being pursued in the 1965 program is the achievement of a greater understanding of the criteria to be met to achieve maximum penetration of warheads.

12958 6.1(a)

3. High Yield Capability for the U. S. [redacted] 12958 6.1(a)

During DOMINIC, the last atmospheric test series, several new concepts were successfully tested which could lead to high yield weapons in relatively lightweight packages. [redacted] 12958 6.1(a) These proven concepts are being further developed in the underground test program. Thus far, the maximum yield tested underground is [redacted] We believe we will be able to successfully test devices with a yield as high as 1 MT to 1-1/2 MT underground; then we can fully develop advanced strategic weapons in this yield range. These state of the art developments will permit devices if required (not engineered weapons) having a full-scale yield of perhaps 50 to 100 MT, to be designed with reasonable assurance of performance. Devices can be fabricated to the extent desirable under the readiness program.

Tests underground during the NIBLICK series have demonstrated design improvements that correct marginal performance of devices fired in the air during DOMINIC. Further, it has been demonstrated that theories predicting achievement of high thermonuclear efficiencies are sound. The program for FY 1965 is keyed to additional progress in three specific design approaches to improve the KT/lb ratio. This work is limited to state of the art development and extension of these concepts to very high yields in efficient designs. Weaponization in the 60-100 MT range would require atmospheric testing.

4. Tailored Outputs. This category refers to the development of weapons designed to achieve specific weapon outputs, for instance, the enhancement or suppression of radiation output. Thus, the neutron output might be increased without increasing yield. Achievement of tailored outputs will permit our operational commanders increased flexibility in weapons employment and weapon system design, particularly in tactical and anti-ballistic missile warfare systems.

Achievement of significant advances in tailored outputs has been a most difficult technical problem. Significant advances have been and can yet be made. [redacted] 12957 6.1(a) The effects of these weapons can be tailored by enhancing the prompt radiation with a reduction in the blast and thermal effects, or by suppressing the radiation output, with a large reduction in long persisting radioactive fallout. Both of these items offer significant improvement in operational flexibility. In short, the trade-offs are reduced blast, greater radiation, and reduced fallout.

In WHETSTONE we are planning to test prototypes of tactical weapons for use in ASW, tactical bombs, ABM systems and warheads for tactical missiles. Further, we plan to determine the performance and effects of reduced blast in a clean enhanced weapon, and to explore the possibilities of an enhanced X-ray device.

5. Advancement of Basic Technology is a continuing objective. It is a product resulting from maintaining a top-level, well-equipped and dedicated scientific laboratory staff. The degree that this objective is achieved provides a degree of assurance that no new and important nuclear weapon concept is overlooked or is allowed to lie dormant and remain unexplored.

New concepts require extensive research and calculational efforts, and testing offers the opportunity to verify feasibility of the most promising theories. We can expect major advances from our research effort in the future as long as we can maintain this ability to test the products of this research. Experiments in the WHETSTONE series will investigate the feasibility of such possibilities as [redacted] Tritium decays and therefore must be replaced in the warhead. Achievement of this objective would considerably reduce the logistics problem. 12958 6.1(b)
Other objectives include the development of very lightweight primaries [redacted] Successful achievement of this objective would provide very small, lightweight high-yield weapons for a number of applications. A further objective is

to produce very small nuclear devices which would produce yields in the region [redacted] 12958 6.1(a)

CHART 4

Chart 4 is an example of the steps, each requiring an underground test, associated with the development of a typical nuclear weapon component--in this case a weapon primary. The first test established feasibility, and the following two tests proved out an additional and new feature. Further alterations were required to permit use [redacted] In the fourth test the [redacted] 12958 6.1(a) The design must also meet stringent safety requirements and have these confirmed by another test. After design adjustments had been made, the required yield was measured under various conditions of gas fill of the pit to simulate stockpile life.

This sequence is illustrative of the fact that several tests are required to prove new concepts. We have tried both ways, that is, step by step and all changes incorporated in one test. The latter course has not proven successful.

CHART 5

The application of the results of testing underground are shown in [redacted] 12958 6.1(a) Major components shown in this cutaway view are (9) the firing set; (21) the fission primary; (23) the thermonuclear secondary; [redacted]

12958 6.1(a)

CHART 6

WHETSTONE I

The details of WHETSTONE I are shown on chart 6. [redacted]

12958 6.1(a)

Characteristic of any experimental program is that some of the planned events are interrelated and strongly dependent upon the outcome of preceding events, and depending on success and failures, changes will be required. As in the past, we will provide your staff with information concerning desired revisions.

DEPARTMENT OF DEFENSE TESTS

Introduction

CHART 7

The most critical problem areas of the nuclear weapons effects program are: (1) Missile system vulnerability, from in-silo, through launch phase and to impact; (2) Electromagnetic pulse effects on electronic systems and communications; (3) Vulnerability of naval vessels; (4) Knowledge of earth shock effects on superhard command and control facilities; (5) Detection and identification of clandestine underground tests.

Not all of these are amenable to solution through underground testing. But, since the ratification of the nuclear test ban treaty we have been studying the results of past tests, together with present Service requirements in an attempt to isolate the problem areas that can be attacked profitably by underground testing.

CHART 8

The [redacted] FY 65 program represents the results of that study and is in our judgment, a vigorous attack on the problem.

In the nuclear blast effects area we have scheduled [redacted] ranging in yield from [redacted] These events are expected to contribute significant information on: (1) Verification of design concepts for deep invulnerable command and control facilities, such as the National Deep Underground Command Center; (2) The vulnerability of our hardened

12958 6.1(a)

missile sites from close in surface detonations; (3) To study the mechanism of radiation energy coupling into earth, and its effect on shock enhancement and transmission; and (4) To study cratering effects in various depths and earth media which will permit development of atomic demolition employment techniques.

[redacted] planned to satisfy nuclear radiation effects requirements. These will range from [redacted] yield. Our primary objectives here are: (1) The study of effects of low fluxes of soft X-rays upon satellite materials [redacted] on re-entry vehicle materials, and (2) To proof test critical military electronic systems (such as guidance and control units, firing and fuzing circuits) and hardened instrumentation for transient radiation effects on electronics.

The underground test detection area is composed of two events - [redacted] One will study the seismic signals of nuclear detonations in a remote active seismic area, the other is the first of a series to study the effects of a large underground cavity on seismic signals. These have application in detecting clandestine foreign tests under a total nuclear test ban.

CHART 9

PILE DRIVER is designed to study and verify design concepts for deep underground hardened facilities such as a National Deep Underground Command Center. This event will provide design information to permit our economical construction of a facility which will be able to survive repeated direct hits from 100 MT surface bursts.

RED HOT - DEEP WELL are comparison events to study the enhancement of [redacted]

TINY TOT is a companion event to the preceding two shots, but studies [redacted]

ALL 12958 6.1(a)

CHART 10

LIONS DEN. [redacted]

CANNED HEAT, a companion shot to LIONS DEN, is also a study of [redacted]

MUD PACK. We are planning a 2-3 shot series of contained low yield events [redacted]

CHART 11

GUM DROP is important for its significance in the event of a nuclear conflict. [redacted]

All 12958 6.1(a)

WISH BONE - RAIN DROP is a two event series in which we will study [redacted]

CHART 12

LONG SHOT is to be a fully contained underground nuclear detonation on Amchitka Island, Alaska, to provide data for the VELA UNIFORM test detection program. Studies have revealed that, of the 170 earthquakes occurring annually in the Soviet Union and which produce a signal larger than 10 to 20 KT, about 75% occur in the Kamchatka peninsula or in the Kurile Islands. Study of the seismic waves from a known explosion in that area will help find means to distinguish them from earthquake waves. Hopefully, this will allow us to eliminate earthquakes from consideration in the policing of a complete nuclear test ban treaty. Amchitka is quite close to Kamchatka and seismic waves from LONG SHOT will travel essentially the same paths to the seismological observatories in the United States. This will allow preparation of travel-time curves from that region, resulting in more accurate location of events there.

SALMON is the first of a series of nuclear events in Project DRIBBLE of the VELA UNIFORM program. Project DRIBBLE is to be conducted in the Tatum Salt Dome, near Hattiesburg, Mississippi, to test the decoupling theory. According to this theory, the seismic disturbance caused by an underground explosion can be significantly reduced, perhaps by two orders of magnitude, when such an explosion takes place inside a cavity of appropriate size. Verification of this theory would obviously affect our capability to detect foreign nuclear tests. The SALMON event will be [redacted] deep and will be recorded at distances of several thousand miles. This will establish the nature of the seismic signal generated in this environment. Two small detonations, [redacted] will follow, one decoupled, the other tamped, providing data to compare tamped and decoupled shot conditions. A further comparison of the results of SALMON with the [redacted] event will permit extrapolating to a [redacted] condition.

PLOWSHARE PROGRAM

Introduction

The unique nature and low cost of the energy available from nuclear explosives indicate a great potential for their peaceful use. Our PLOWSHARE Program is directed toward developing this potential. We are examining three types of peaceful uses: (1) nuclear excavation including digging harbors, and canals; (2) underground engineering, which includes mining, oil recovery, and water resource development; and (3) various scientific investigations which can be conducted only with nuclear explosives.

CHART 13

Chart 13 shows the breakdown of the PLOWSHARE Program with the number of detonations proposed for Fiscal Year 1965 under each category.

Nuclear Excavation

Of all the possible peaceful uses for nuclear explosives, nuclear excavation is the most straightforward, the most widely known and shows the greatest economic advantages. It appears that in large excavation projects, such as a trans-isthmian canal, costs can be reduced several fold by the use of nuclear explosives.

CHART 14

The crater forming process begins as shown in the top sketch with the heat melting the rock back for some distance and completely volatizing the rock. The next sketch shows the shock wave shattering the rock in the vicinity of the detonation and the gas pressures expanding the cavity. The cavity then grows more rapidly toward the surface since the resistance of the earth above the point of detonation is less than the pressure in other directions. This process continues until the surface of the earth is pushed up and breaks and quantities of rock are ejected. Then, much of the broken rock remains within or falls back into the crater as shown by the sketch at the bottom, entrapping well over 90 per cent of the radioactive debris that has been produced. This is one of the phenomena which assures us that nuclear excavation can be done safely.

Additional safety can be provided by developing nuclear explosives which derive only a small part of their energy from the fission process, which creates radioactive fission products while deriving most of their energy from the fusion process. Such explosives are known as clean devices.

CHART 15

The progress we have made and the additional improvement we think possible are illustrated by these fallout patterns. The one on the left side is a scale drawing of the fallout pattern of the 100 KT SEDAN cratering event. The SEDAN device had a total yield of 100 KT with [redacted] from fission. Since SEDAN we have successfully tested a 90 KT device, with [redacted] fission. The other fallout pattern at the bottom shows the fallout which would result if SEDAN were conducted with this cleaner device. With additional testing, we think

12958 6.1(a)

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a device can be developed with [redacted] fission regardless of total yield. With such devices, the amount of radioactivity produced and released is essentially the same regardless of the size of the explosion. This is illustrated by the top figures on the chart. Thus, device development is an important prerequisite to a nuclear excavation capability. 12958 6.1(a)

We are planning three to five device development tests in Fiscal Year 1965.

In addition to minimizing the amount of radioactivity reaching the surface by the use of clean devices and the entrapment inherent in the crater forming process, there are other techniques which probably can be developed to enhance the entrapment of radioactive materials underground.

CHART 16

This chart illustrates one of these techniques. [redacted]

12958 6.1(a)

This "down-the-hole" technique can be partially investigated by deeply buried detonations, one of which is scheduled for the end of Fiscal Year 1964 and another in Fiscal Year 1965.

In addition to developing cleaner devices and means of keeping radioactive debris underground, we need to learn more about cratering technology and the distribution of the very small amounts of debris reaching the atmosphere.

CHART 17

The series of figures on the left illustrate the kinds of cratering experiments conducted in the past. The figure in the center illustrates Project Sulky, which is proposed for execution next winter. Sulky would involve the detonation of a 100-ton all-fission device. This device would be emplaced so that no more than the equivalent of 1 ton of fission products would escape to the surface. If technology permits, debris impaction might also be undertaken in connection with Sulky. Gaseous tracers such as tritium would also be added to the device so that the escape mechanism and distribution characteristics of gases in cratering detonations can be studied. After the Sulky results have been evaluated and correlated with the status of development of clean devices and debris impaction techniques, other essential experiments in the cratering program can be designed and proposed. The kinds of experiments required are illustrated by the sketch on the right.

If the recommendations of the recent State Department report concerning international observation and cooperation in our nuclear excavation program are adopted, we would propose to develop plans for and carry out an international observer program in conjunction with Sulky. Since we hope to execute Project Sulky next winter and since the planning and implementation of an international observer program would require several months, we propose to submit our plans for Sulky for consideration soon.

The economic payoff for nuclear excavation is tremendous.

CHART 18

This chart lists a few of the more than 100 projects for nuclear excavation which have been suggested throughout the world. In addition to the wide geographical distribution of potential projects, this chart also indicates the wide variety of purposes they would serve. Neither the devices nor the technology are available to undertake any of these projects at this time. The capability to undertake small and simple projects can be developed in about three years. The capability for large projects such as the trans-isthmian canal which is currently under study will require about five years.

Underground Engineering

Much of the world's natural resources exist underground. The concentrations and locations of these resources are such that for many, their recovery is very difficult or not possible or economic by conventional means.

Fracturing or breaking-up the environment of these resources is one of the principal means for facilitating their recovery. Based on data acquired principally from previous tests, such as HARDHAT, it appears that nuclear explosives can be used to accomplish this fracturing.

CHART 19

This shows a sketch of the effects which have been observed from the HARDHAT event. HARDHAT was a [redacted] underground in granite. 12958 6.1(a)

Many mineral, gas, and oil resources are found in or near limestones. Since the extent of the effects depends largely on the type of rock in which the detonation occurs, we are proposing a 10 KT detonation in limestone next year. The decomposition products of limestone are appreciably different from those of granite. Therefore, investigation of the effects of a deeply buried nuclear shot in limestone is an essential prerequisite to using nuclear explosives in the recovery of these resources.

Some of the applications which have been proposed in the underground engineering category are listed on the chart. We have had serious discussions with various industrial and local government groups about each of these and expect to receive one or more proposals for cooperative experiments or demonstrations in this area within the next 12-18 months.

Scientific

A nuclear explosive has many properties which make it a valuable research tool. One of these properties is the very large neutron flux produced. These neutrons can be used to bombard target materials so that new isotopes of existing elements and probably even new elements can be formed. We have conducted several tests directed toward this objective and have achieved some success. We believe we now can design a device which will produce rare or new isotopes and have, therefore, planned one such experiment in the first quarter of Fiscal Year 1965.

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This document consists of 19 pages
No. 23 of 75 Copies, Series R

BRIEFING FOR THE PRESIDENT

UNDERGROUND TEST PROGRAM
FY 1965

PART II: CHARTS

Presented by
Representatives of the AEC and DOD

JUNE 1964

SANITIZED
E.O. 12958, Sec. 3.6
NLJ 90-278
By ___, NARA Date 9-16-96

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RESTRICTED DATA

NUCLEAR TEST PROGRAM

SINCE SEPTEMBER 15, 1961

12958 6.1 (a)

SECRET

RESTRICTED DATA

CHART

~~SECRET~~

AEC UNDERGROUND WEAPON DEVELOPMENT TESTING
PROGRAM FOR FY 1965

6.2(a)

12958
6.1(a)

CHART 3

TYPICAL DEVELOPMENTAL TESTING FOR WEAPON

PRIMARY ADVANCEMENT

SERVICE SET

12958
6.1(a)

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SERVICE SET

XO 12356
6.2(a)

12958
6.1(a)

SERVICE SET

SECRET

WHETSTONE I EVENTS

·LRL

Name	Yield (KT)	Remarks

I. AEC Weapons Development

12958 6.1(a)

SECRET

SERVICE SET

PROBLEM AREAS

(1) Missile system vulnerability, from in-silo, through launch phase and to impact.

(2) Electromagnetic Pulse effects on electronic systems and communications.

(3) Vulnerability of naval vessels.

(4) Knowledge of earth shock effects on superhard command and control facilities.

(5) Detection and identification of clandestine underground tests.

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CHART 7

SERVICE SET

DOD UNDERGROUND NUCLEAR TEST PROGRAM FY 65 12 TESTS

Area of Interest	No. of Tests	Yield	Primary Objective
Blast Effects			
Radiation Effects			
Underground Test Detection			

12958
6.1(a)

SERVICE SET

BLAST EFFECTS

Shot Name and Date	Yield	Test Condition Nevada	Primary Objective

12958
6.d(a)

SERVICE SET

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BLAST EFFECTS (Cont'd)

Shot Name and Date	Yield	Test Condition Nevada	Primary Objective

12958
6.1(g)

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SERVICE SET

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RADIATION EFFECTS

Shot Name and Date	Yield	Test Condition Nevada	Primary Objective

(12958 6.1(c)

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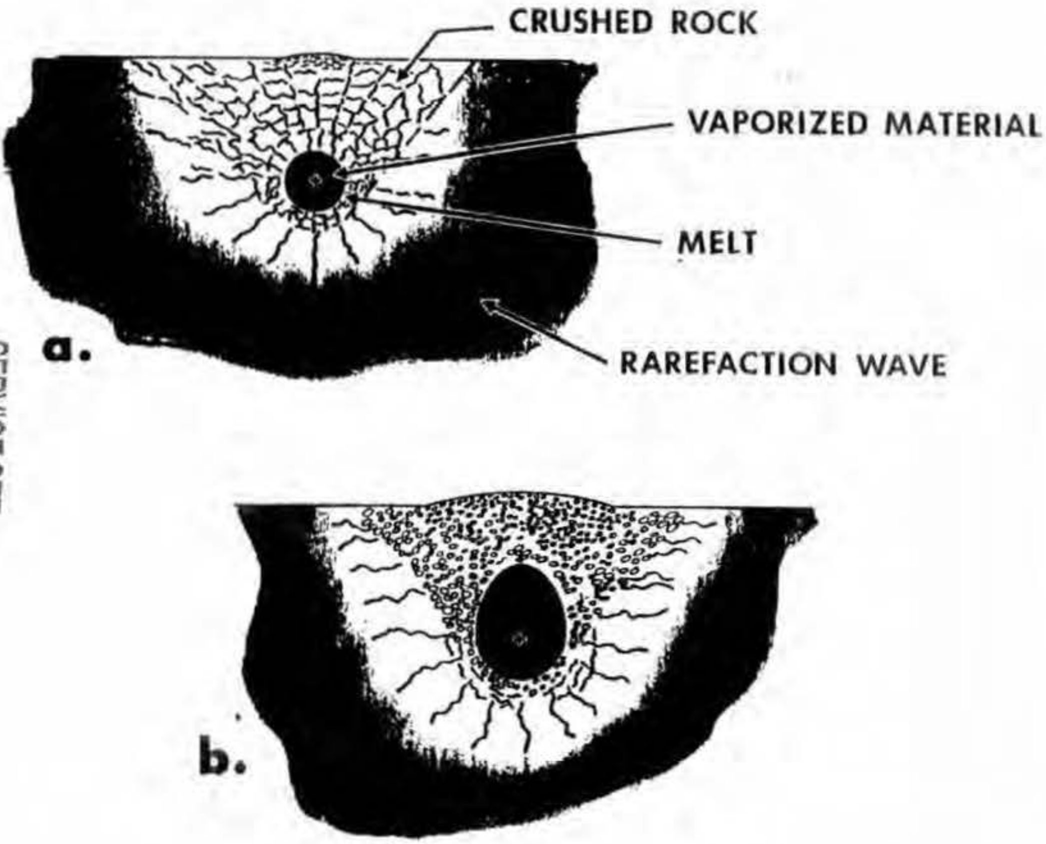
UNDERGROUND TEST
DETECTION

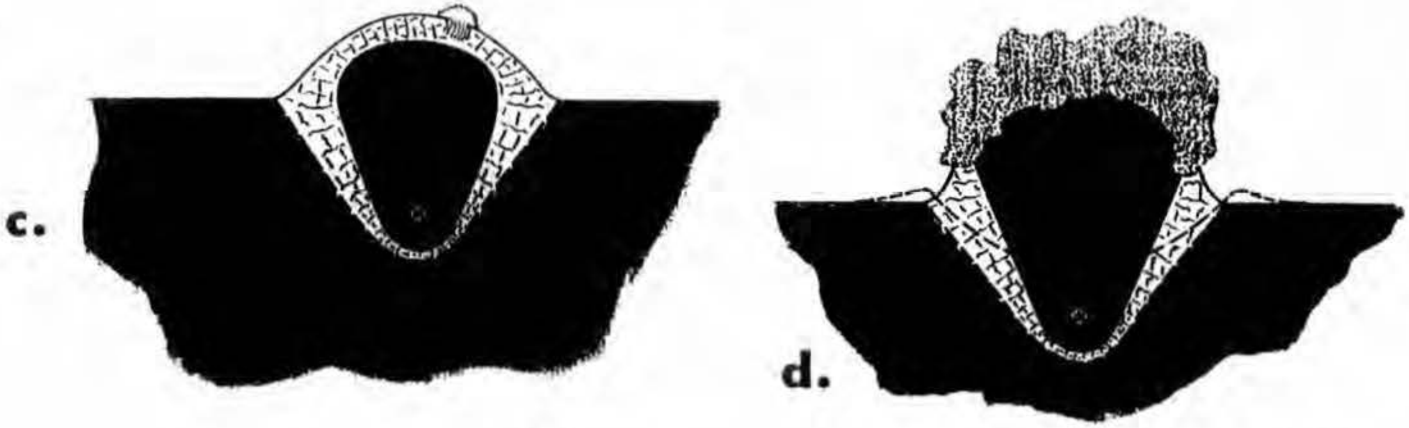
Shot Name and Date	Yield	Test Condition	Primary Objective

SERVICE SET

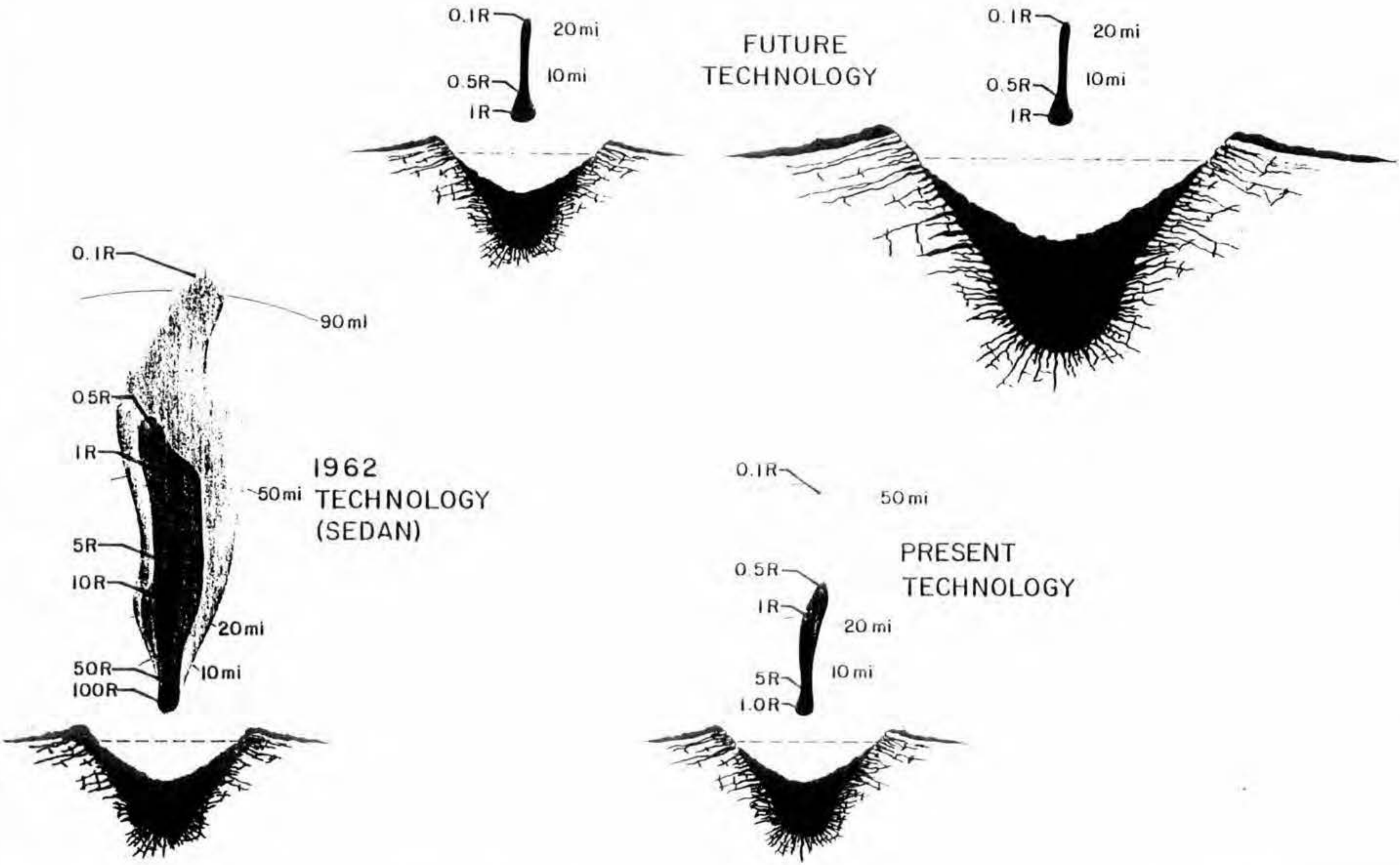
SERVICE SET

CRATER FORMATION PHASES





NUCLEAR EXPLOSIVES DEVELOPMENT



SERVICE SET

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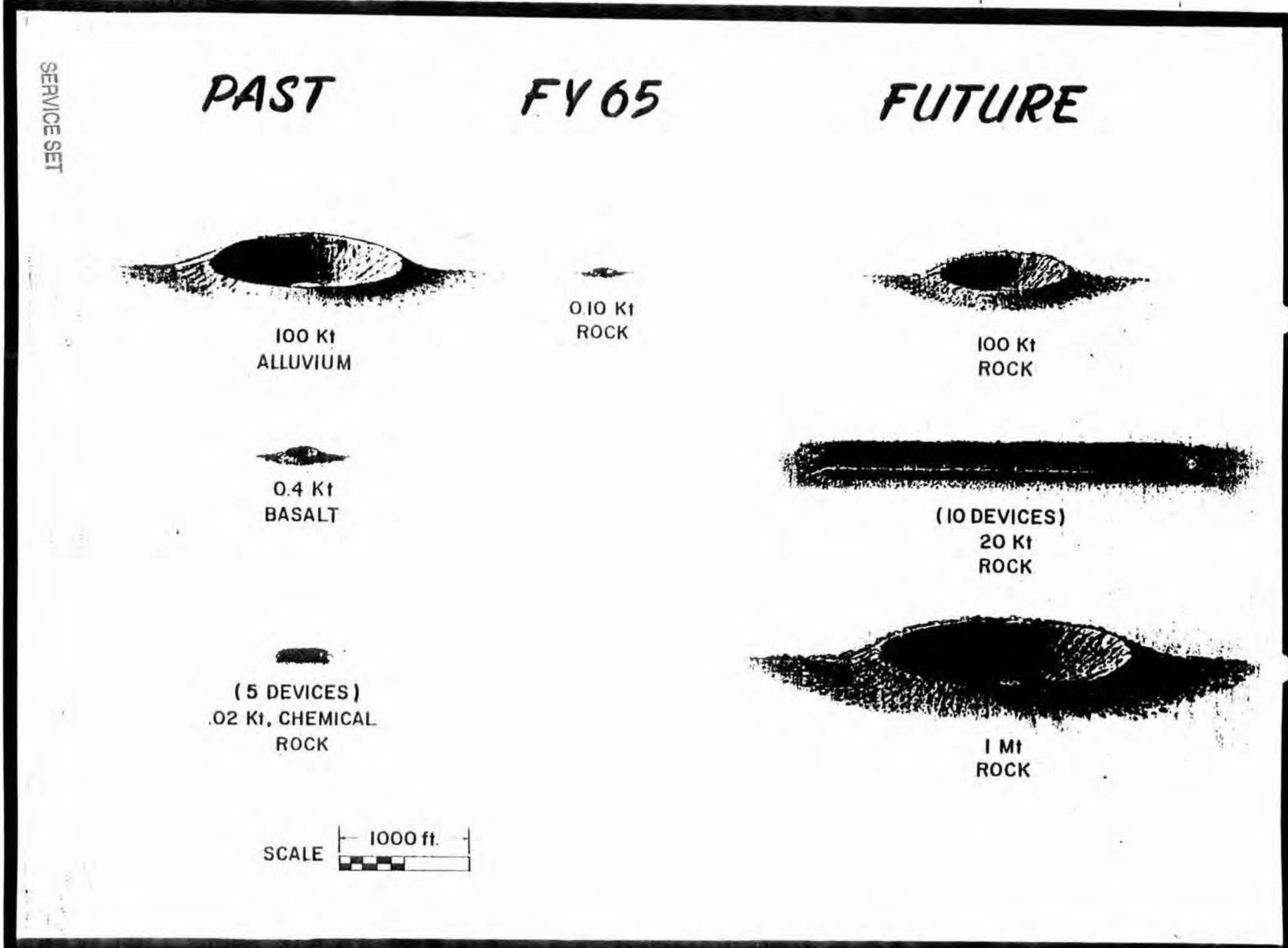
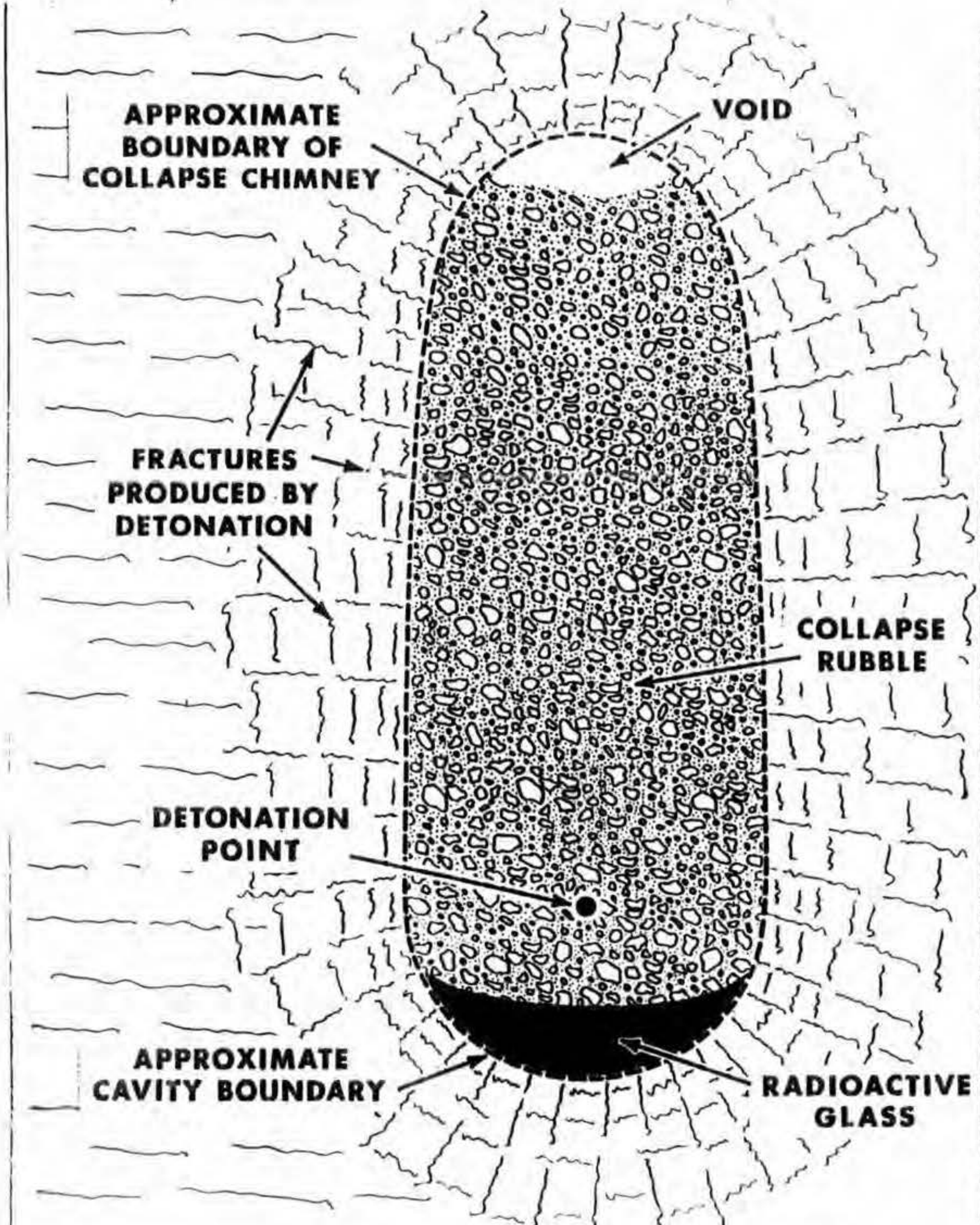

PAST
FY 65
FUTURE
100 Kt
ALLUVIUM
0.10 Kt
ROCK
100 Kt
ROCK
0.4 Kt
BASALT
(10 DEVICES)
20 Kt
ROCK
(5 DEVICES)
.02 Kt, CHEMICAL
ROCK
1 Mt
ROCK
SCALE
1000 ft.

SECRET

SELECTED LIST OF NUCLEAR EXCAVATION PROJECTS

UNITED STATES	California	• Highway and railroad pass through the Bristol Mountains • Part of the West Side Water Conveyance System
	Alaska	• Connection of Spiridon Lake directly to the ocean
	Alabama-Mississippi	• Divide cut for the Tennessee-Tombigbee Canal
LATIN AMERICA	Central America	• Sea-level canal across the American Isthmus
	Brazil	• Development of the Sao Francisco river basin
	West Coast	• Harbors at Arica, Chile and other locations
AFRICA	Tunisia U.A.R.	• Chotts / Qattara — Canals to connect Mediterranean with inland depressions for transportation, power, and mineral resource development
	West Central	• River diversion and development of the Niger-Volta river basins, involving seven countries
AUSTRALIA	Western	• Harbors at Geraldton and other locations • Development of Ord River water resource and storage facilities
ASIA	Thailand	• Canal across Kra Isthmus
	Philippines	• Canal across Luzon Island
	Israel	• Canal connecting Gulf of Aqaba and Mediterranean

SERVICE SET



UNDERGROUND ENGINEERING WITH NUCLEAR EXPLOSIVES

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APPLICATIONS

- MINING
- OIL SHALE
- OIL SANDS
- GAS RECOVERY
- SEWAGE DISPOSAL
- GAS STORAGE
- WATER CONSERVATION
- GEOTHERMAL HEAT UTILIZATION