

February 16, 1962 ~~DECLASSIFIED~~ SANITIZED

PROPOSED ATMOSPHERIC TEST PROGRAM

E.O. 11652, Sec. 11  
ERDA Letter 8/1/77  
By mtg NARS, Date 4/11/77

This memorandum will review and bring up to date the major objectives, the program content, and the operational plans for the proposed atmospheric test program. A list and brief descriptions of the events now being planned are given in attachments. More detailed explanations of important departures from the original program are given in the body of this document.

General Objectives

The over-all objective of the program is to increase our understanding and improve our technology in the fields of weapons and weapon effects. During the three-year test moratorium the information gained from the 1958 BARDTACK series was exploited to the utmost both to design the most advanced weapons that could prudently be stockpiled without further testing, and to extend our understanding of the underlying principles by calculation and analysis. Further progress was difficult and slow. Inability to experimentally test extensions of existing principles and new ideas gravely hampered the weapons laboratories, reduced their momentum and, indeed, made it difficult to hold together the experienced teams of scientists and engineers.

Resumption of underground testing has, of course, permitted progress in important areas, and has had an invigorating effect on the laboratories. It is possible, though with difficulty in many cases, so to test all present [redacted] devices, including the [redacted] devices. With improved techniques it may be possible in the relatively near future to test [redacted] devices of yields up to, say, 100 KT, and higher limits will probably ultimately be reached. However, experiments and tests at the larger yields must be conducted in or above the atmosphere; furthermore, certain weapons effects measurements can be conducted only in the atmospheric environment to which they pertain.

In the proposed atmospheric program stress has been placed on certain areas of special military interest, importantly those relating to delivery capabilities of our weapons in the face of enemy defenses and to our own defense against enemy weapons. Specific objectives include (1) increased knowledge of the effect of nuclear explosions on hardened missile bases, on missiles and their warheads and on radar and communications, all of importance to both offense and defense; (2) developments leading to decreased nuclear vulnerability of our own offensive warheads; (3) decreased weight-to-yield ratios of strategic missile warheads; decreased weight at given yields would permit greater diversity and pre-strike mobility of vehicles, and the incorporation of such penetration aids as clustered warheads or decoys and the hardening of individual missiles; conversely, higher yields would permit detonation at higher

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altitudes, increasing the problems of defensive systems; (4) developments increasing the effectiveness of our own defensive weapons through enhanced effects and through decreased weight-to-yield ratios, permitting longer range and higher altitude delivery at given yields or greater kill range at given weights. Corollary benefits would result from greater diversity of delivery methods for tactical weapons and economies in the use of nuclear materials, of importance for tactical and defensive weapons where large numbers must be deployed over wide geographical areas.

### The Technical Program

The technical program has been developed in the realization that no great advance in weapons technology can be anticipated from any one proposed experiment. Progress is much more likely to result from a broadly based inter-related series of experiments--some empirical in nature, some based on careful calculations--from which one can move forward to bolder advanced concepts. The experiments and tests must, therefore, be considered in the context of the gains that can be expected from the program as a whole, underground and atmospheric, recognizing that it falls logically into three principal categories: (1) tests of advanced concepts leading to better understanding and to markedly improved and less vulnerable weapons; (2) tests of actual weapons, incorporating substantial extrapolations from previously tested configurations so that both developmental and verification objectives are achieved; and (3) measurements of weapons effects, primarily the responsibility of the DOD.

The presently proposed experiments and tests are listed in Appendix "A" together with their estimated yields. (Possible additional proposals from the DOD are not included.) Brief descriptions of each event and its purpose are given in Appendix "B". The twenty-five items are expected to be reduced by one or two by further consolidation of the plans.

Deletions and Additions. The list incorporates several changes from that recommended to the President on November 29 by the NSC Committee on Atmospheric Testing Policy.

The following deletions have been made from the November 29 list:

1. The [redacted] and the three [redacted] experiments have been shifted to the underground program. C - RD
2. The "Lute" experiment, intended to investigate the possible advantages of [redacted] could not be readied in time for this test series. A related, low-yield experiment will be done as part of the underground program. S - RD

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3. The original [redacted] a [redacted] device with only a [redacted] has been deleted from the program. The original [redacted] a full-scale, [redacted] device has been redesignated [redacted] (In view of the omission of the preliminary experiment, it is considered prudent to include a second, more conservative, device, designated [redacted] as a contingency item to be used only in case of gross malfunction of the first device.)

S-RD

The following consolidations have been, or are being, made:

1. The "Sioux" effects measurements will be performed in connection with the DOD hardened missile base effects test, thus eliminating the need for a special shot for "Sioux."
2. The three Los Alamos [redacted] experiments (now designated the [redacted] Series) and the four Lawrence Laboratory [redacted] [redacted], all having the objective of developing high yield-to-weight thermonuclear weapons in the [redacted] class, will be consolidated to reduce the total number by one or more. Plans for this consolidation will be crystallized in the next few weeks.

Five new items have been added to the list. Three of these, the "Encina," the high yield [redacted] "Sunset" and the [redacted] device "Swanee" do not differ markedly in kind from other tests. They are described in the attachments. Two others merit special attention:

1. For many reasons it is desirable to develop the capability of testing in outer space. This method would have the obvious advantages of avoiding fallout and other causes of public agitation; indeed, special and complex surveillance systems would be required even to detect the tests. Tests could be launched from continental bases on whatever schedules were required. Once developed the techniques need not necessarily be more difficult or expensive than off-continent atmospheric tests. One might hope that such a capability, together with advances in underground techniques would eventually largely eliminate the need for atmospheric tests except for those involving environmental effects. With these advantages in mind, there is proposed a very high altitude experiment, the primary purpose of which is to determine the feasibility of, and to gain experience in performing, diagnostic measurements on nuclear explosions at very great distances from the earth. The experiment would also give information of value to the Vela Program for detecting foreign tests, and would yield useful knowledge on the behavior of fission products released at very high altitudes.

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Measurements will be made of the X-ray yield, the neutron spectrum (by time of flight), the gamma rays (giving the [redacted] and the fission yield) and the optical signals. Although similar measurements will be made in connection with the 400 Km effects test "Starfish," they will be of limited value for the primary purposes of this experiment because of the presence of appreciable atmosphere at 400 Km, and for technical and operational reasons relating to the methods of observation. The device.

[redacted] will be exploded at an altitude near 2,000 Km as is feasible. The same launching site and observation stations will be used as for the high-altitude effects tests. It should be noted that this experiment might increase the duration of the series by a week or two, although it is believed that this can be avoided.

2. Balloon test in Nevada. At the present stage of technical development, many of the experiments included in the underground program would yield quicker and more accurate results if performed above the ground; this is of special importance in those having a bearing on the atmospheric program. Furthermore, it has been suggested that world public opinion might be more favorable should the atmospheric series be begun with a test at the Nevada Site. With both considerations in mind, we have tentatively added to the atmospheric series an as yet undetermined low yield device to be fired from a balloon. Of several candidates the final choice will depend on the schedule for beginning the atmospheric program and on the results of underground tests.

Cratering Shot. By letter of February 12 to Mr. Bundy, I have proposed that the DOD cratering shot (DANNY BOY) at the Nevada Test Site be incorporated in the underground testing program even though it will vent appreciably to the atmosphere and some fission products will be released. Should it be decided that this is not appropriate, it should be added to the atmospheric list. It is important that this test be executed on March 1 or very shortly thereafter. The personnel assigned to it form part of the test team needed in other locations for the atmospheric series and should be released as soon as possible.

Nuclear Yield: Fallout Considerations

The program has been planned with due regard to restraint on yield, particularly fission yield. The total estimated yield is slightly less than [redacted] of which about [redacted] are due to fission. These are about the same as in the earlier proposal; the [redacted] is about [redacted] that of the Soviet 1961 series.

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principle incorporated in this device is important to future develop-  
ments of our large-yield weapons and would be the principal avenue of attack  
should it be decided to develop very large yield weapons. These facts,  
together with the of this device fully warrants  
its inclusion in the program despite its high total yield.

Practically all of the fission products from the series will be released over the Pacific in such locations that local fallout will be no problem. There will, of course, be no local fallout from the high altitude tests. A special situation does exist with respect to the hardened missile base effects test. In order to produce the desired effects, the device must be fired at such a low altitude that the fireball will touch the ground and a substantial fraction of the radioactivity will be included in the local fallout. The device is, however, of far lower yield than any previously exploded in Nevada so that with careful attention to meteorological considerations, radiation hazard can be avoided. (The situation was described in my December 18, 1961 letter to Mr. Bundy, but a height of burst of 240 feet was assumed rather than the 10 feet or so that will actually be used.)

#### Locations of Tests

The tests will be conducted in three general locations. The missiles carrying the devices involved in the high altitude tests will all be launched from Johnston Island; observations will be made from instrument bearing rockets and from ground-based stations on various islands. The hardened missile base effects test and, if it is so decided, at least one low-yield balloon shot will be conducted at the Nevada Test Site. All the other tests will use Christmas Island as a base of operations. Most or all will be by air drop in the general vicinity of the island, with diagnostic instruments based on ships and in many cases on the Island.

If the very high altitude experiment directed at developing a capability for testing in outer space is indeed performed, results from it, together with those from the hardened missile base test and others will so far remove the need for a surface shot at an isolated island such as Baker, that it would not be required. This has been assumed in the program outlined and the weapons test which would have provided the nuclear explosion is assumed to be an air drop.

#### Schedule Consideration

The series has been planned to cover a period of two and one-half to three months beginning on April 1. This would require public announcement not later than March 15. Because of the close relationship of the latter date to the beginning of the Disarmament Conference, the suggestion has been

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made that a few events be conducted earlier, beginning about March 1. It has further been suggested that the first atmospheric test be conducted in Nevada. Since the hardened missile base effects test cannot be ready before mid-May, we have made preparations to fire a balloon shot in Nevada if so desired. As explained earlier, this would be one of the events now schedule in the underground series which it would be advantageous to conduct above the ground. Five notice at least one week before the scheduled time would be required. Should it be desired one or more follow-up Pacific air drop tests could be conducted during March provided two weeks' advance notice were given.

Summary and Recommendations

The proposed Atmospheric test series described in this memorandum and its attachments would, if carried out, contribute significantly to our understanding of weapons technology and weapons effects, and would make... possible the design of considerably more advanced weapons and weapons systems than now are feasible. Full realization of the potentialities would require, however, that further tests exploiting the new data be conducted at a later date, say, in 1963.

The total yield of all the shots is approximately [redacted]  
[redacted] are due to fission. This is about [redacted] of the fission  
yield of the 1961 Soviet tests. With the exception of one test in Nevada,  
local fallout problems can be avoided.

One, and possibly two or three tests will be conducted in Nevada; three high altitude tests will be launched from Johnston Island; the remainder will use Christmas Island as a base.

The series can be carried out over a two and one-half to three months' interval, beginning on April 1. The starting date could be advanced to as early as March 1 by utilizing an above-ground shot at the Nevada Test Site, assuming one week's notice. Tests in the Pacific would require at least two weeks' notice. Advancement of the schedule would extend the series length by an equivalent amount, since the more complex experiments toward the end cannot be readied earlier.

It is recommended that the proposed program be adopted now for planning purposes and that a decision to carry out the program be made at the earliest possible date.

/s/

Glenn T. Seaborg

Attachments:

1. Appendix "A"
2. Appendix "B"

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APPENDIX "A"

AEC-SPONSORED ATMOSPHERIC TEST PROGRAM

<u>Experiment</u>	<u>Nickname</u>	<u>Sponsor</u>	<u>Yield, Megatons</u> <u>Fission Total</u>
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Part I - ADVANCED CONCEPTS

[Redacted]	1/ *	MESILLA, <sup>OK</sup>	LASL	[Redacted]
		NAMBE, <sup>OK</sup>		
		OTOWI, <sup>OK</sup>		
	2/	CHEYCO, <sup>OK</sup>	IRL	
		YUKON, <sup>OK</sup>		
		TANANA, <sup>OK</sup>		
		MUSKEGON, <sup>OK</sup>		
		YESO, <sup>OK</sup>	LASL	
		[Redacted]	LASL	
		*SUNSET, <sup>OK</sup>	LASL	
		*SWANEE, <sup>OK</sup>	IRL	
		BIGHORN, <sup>OK</sup>	IRL	
	PETIT, <sup>OK</sup>	IRL		
	[Redacted]	LASL		

Part II - DEVELOPMENTAL AND WEAPONS VERIFICATION

[Redacted]	QUESTA, <sup>OK</sup>	LASL
	ADOBE, <sup>OK</sup>	LASL
	AZTEC, <sup>OK</sup>	LASL
	ARKANSAS, <sup>OK</sup>	IRL
	*ENCINA, <sup>OK</sup>	LASL
	TRUCKEE, <sup>OK</sup>	IRL

Part III - EFFECTS

400 Km Altitude (Johnston Island)	STARFISH, <sup>OK</sup>	DOD
[Redacted] Km Altitude (Johnston Island)	BLUEGILL, <sup>OK</sup>	DOD
Base Hardening (Nevada)	SMALL BOY, <sup>OK</sup>	DOD
ASROC Effects (at sea)	SWORDFISH, <sup>OK</sup>	DOD

Approximate Yields

Part IV - CONTINGENCY ITEMS

[Redacted]	[Redacted]	[Redacted]
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- 1/ Proposed as a low-yield balloon shot to start the atmospheric test program, if desired; device not yet selected.
- 2/ Total of seven events may be reduced; firm statement in this regard will not be available until about March 1, 1962.
- 3/ Fired if there is a gross malfunction of [Redacted]
- 4/ Fired if earlier tests of similar [Redacted] devices are not definitive.
- \* Tests added since November 29, 1961 letter to the President

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APPENDIX "A"

APPENDIX "B"

Description of Events

Proposed Atmospheric Tests - By Functional Category

I. ADVANCED CONCEPTS

These tests should lead to major advances in nuclear weapon technology. The proposed experiments in the advanced concept area represent a balanced mixture of (1) the empirical approach with early availability of improved weapons in those weight classes known to be of interest, and (2) bolder experimental steps leading toward new devices of significantly higher levels of weapon effectiveness.

1. Balloon Test at Nevada Test Site (Added event)

This item has tentatively been placed on the list in order to provide an initial test above ground at the Nevada Test Site if so desired. Various low yield devices are being considered all of which could advantageously be tested above ground in order to achieve quicker and more accurate results than in underground tests. The final choice will depend upon scheduling considerations and on the results of certain underground tests.

2. [redacted] (MESILLA, NAMBE, and OTOWI) (LASL), and

3. [redacted] (CHETCO, YUKON, TAHANA, and MUSKEGON) (IRL)

These experiments are designed to provide a [redacted] Presently only [redacted] weapons are available in this weight class and yields are limited to [redacted] These experiments are directed toward the development of [redacted] weapons in this weight class with yields in the [redacted] range. Potential military need for such systems exists in the mid-range ballistic missile (MRBM) and the tube launch submarine missile which will require warheads of about [redacted] pounds. With such marked reduction in the weight-to-yield ratio, it will be possible to earmark weight savings for penetration aids. One experiment is designed to lead to a [redacted] warhead.

NOTE: The LASL and IRL are currently investigating the possibility of reducing the total of seven [redacted] events by consolidation.

4. [redacted] (YESO) [redacted] (IASL)

This advanced design, with a first objective of a [redacted] device at about 1,600 pounds, has possible application to the Class D FUFO (full fuzing option) bomb and to warheads and missiles of this general weight class. This design is a major extension from previously tested areas in thermonuclear

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systems and requires experimental verification. The yield-to-weight ratio is approaching [ ] and is appreciably higher than has been experimentally confirmed in this weight class. The design principles can, of course, be adapted to other weights and yields. (We currently have [ ] in this weight range.)

5. [ ] (LASL)

This is a physics investigation of the [ ] warhead which will also provide information on other devices using a similar [ ] Specifically, during the moratorium it has been essential to design conservatively and place strong, possibly unnecessary, restrictions on the [ ] It is proposed to test a design in which the restrictions which have been included in the design of the device proposed for stockpile have been considerably relaxed. The results of this test will either indicate that present precautions are necessary or that greater liberties may safely be taken with consequent improvements in efficiencies and greater flexibility in future designs.

6. [ ] (SUNSET) (LASL) (Added event)

This is a physics investigation of an advanced version of the [ ] warhead which will also provide information on other devices using a similar basic design. This experiment will test a design of the [ ] (modified even further than the [ ] that may lead to a marked increase in yield within the same general parameters which will allow adaption to the [ ] will be produced in any case.

7. [ ] (SWANEE) (LRL) (Added event)

This experiment, at about [ ] will provide salient information on [ ] in this yield region, and on [ ] in general. The experiment would provide valuable data on the [ ] various components involved. Use of such a warhead in an AICBM missile may prove advantageous because of a reduced radar effect associated with the significant reduction in [ ]

8. [ ] (HIGHORN) [ ] (LRL)

This experiment is designed to obtain about [ ] in the 3,000 pound class, as compared to the present [ ] design at 3,000 pounds which gives [ ] thus possibly [ ] The prime feature of [ ] design is the use of [ ] as opposed to the conventional [ ] approach in this weight class. The experiment involves a [ ] to prove the concept and to determine over-all

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efficiency. Since this device represents a considerable extrapolation, provision has been made for a contingency device of more conservative design, to be fired only if [redacted] has a gross malfunction.

9 [redacted] (LRL)

The [redacted] is designed to reduce the weight from [redacted] pounds in [redacted] range which would permit the addition of penetration aids to the [redacted]. The [redacted] is a [redacted] device with a [redacted]. While several experiments are probably required to realize the final objective, it will not be possible to field more than one experiment in the initial atmospheric series.

10. 1-2000 Km [redacted] (LASL) (Added event)

This third high altitude shot is proposed in addition to the two DOD high-altitude effects tests (T at 50 Km, and 1.4 MT at 400 Km). The primary purpose of this added AEC experiment is to determine the feasibility of performing diagnostic measurements on nuclear tests conducted in space; the advantages of "space" testing include elimination of fallout, elimination of disruptive effects on communications, etc. This experimental shot is planned to be conducted at Johnston Island using the same type vehicle (THOR) planned for the two DOD shots. Data available from a "known" yield is necessary, hence [redacted]

[redacted] will be used for this event. Diagnostic measurements will be made from solid fuel rockets launched to about 200 Km altitude from Kauai and 700 Km altitude from Ft. Arguello, as well as by land-based equipment.

II. DEVELOPMENT AND WEAPONS VERIFICATION

Testing, in this general category, is limited to designs that are such great extrapolations from tested configurations as to warrant testing both to provide normalization points for more advanced designs and to verify design of weapons designated for stockpile. Because of the large yields involved, it is not practical to test these items at full yield in an underground environment; to test underground at reduced yield is not practical since, in each case full yield determination is one of the primary objectives of the test. These tests are:

1 [redacted] (LASL)

This is a [redacted] warhead for the [redacted]. Since this warhead will be the backbone of a major system, an immediate confirmation test is important. There is no substitute warhead available at this level of performance in the time frame contemplated. In addition to its confirmation role, the test will provide a normalization point for more advanced designs.

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2. [redacted] <sup>DC</sup> (ADOBE) [redacted] (LASL)

This is of the same family of warheads as the [redacted] described elsewhere. The [redacted] version, [redacted] has particular application to the NIKE ZEUS. In addition to providing additional confirmatory information on [redacted] designs in general, the purpose of this test is threefold: first, to further knowledge of the actual kill effectiveness of this design in producing lethal effects [redacted] on incoming enemy ICBM's; second, to provide a normalization point for this particular configuration; and third, to provide a "known" yield device for the [redacted] event, [redacted]

3. [redacted] <sup>DC</sup> (AZTEC) [redacted] (LASL)

This is a [redacted] warhead for the [redacted]

[redacted] (This weapon was originally designed with a [redacted] to relate it more closely to a tested device, but a decision was made to go to a more [redacted] efficient spherical secondary.) The effect of these departures should be experimentally verified. There is no substitute warhead available in this weight-yield class.

4. [redacted] <sup>DC</sup> (ARKANSAS) [redacted] (LRL)

This is a [redacted] warhead for the advanced [redacted] system planned to enter stockpile in [redacted]

[redacted] In addition to providing a [redacted] normalization point for future, advanced designs, this experiment will also confirm the present design of this warhead.

5. [redacted] <sup>DC</sup> (ENCINA) [redacted] (LASL) (Added event)

This experiment is designed to: (1) provide a normalization point for further, advanced designs, and (2) to verify this reduced yield version, which has not been tested, of the [redacted] lay-down bomb. The [redacted] yield version differs from a previously tested device in that the distribution of [redacted] has been significantly changed. The version will comprise about [redacted] of the [redacted] stockpile total.

6. [redacted] <sup>DC</sup> (TRUCKEE) [redacted] (LRL)

This warhead is for the [redacted] The present design, although based on tested devices, is extrapolated sufficiently to warrant testing to confirm design goals, in this weight class, of the [redacted] principles involved.

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III. NUCLEAR WEAPONS EFFECTS

Tests in this category are designed to provide critically needed information of the nuclear effects of nuclear explosions on missiles and related components, missile sites, radar and communications, and naval vessels and their equipment.

1. 400 Kilometers (1.1 MT) (STARFISH) (DOD)

This experiment is vital to the technical evaluation of possible United States AICBM systems and of enemy defenses by our ICBM's. Theoretical studies of such a shot indicate it to be of critical importance in terms of evaluating the disruptive effects of nuclear explosions on communications and radar over extensive areas and for prolonged times. The theory is sufficiently difficult and complex to require experimental verification. It is also important to gain information on the effects of large nuclear explosions at this altitude on: (a) various materials (and assemblies) characteristic of ICBM re-entry vehicles and (b) decoys, which might be distinguished by their response to such effects. Some, but not many, such experiments of an exploratory nature would be attempted on this test to examine X-ray and other effects.

2. [redacted] Kilometers [redacted] (BLUEGILL) (DOD)

This shot has been chosen for the purpose of studying blackout of AICBM discrimination radar. The yield has been selected so that useful information on [redacted] can be simultaneously obtained. Under some conditions [redacted] is expected to intercept in this region and the possibility of blacking itself out must be examined. While the TEAK and ORANGE events of HARDTACK bracketed this altitude (37 Km and 75 Km, respectively) they were fired for other purposes and were not sufficiently well-instrumented to obtain the required blackout data. Effects of the kind described in 1. above on missile samples will also be measured.

3. Anti-submarine Test-ASROC [redacted] (SWORDFISH) (DOD)

The employment of ASROC against enemy submarines could involve a large portion of the Navy's present and future ships. There is considerable uncertainty regarding the ability of the submarine detection equipment to operate in the period following an ASROC shot. There is also uncertainty as to the nuclear radiation hazard to the delivery ship following an ASROC shot that may require changing the delivery distance. Operational ASROC equipment will be used, with the detonation at a depth of 750 feet in the Pacific Ocean. The test will be instrumented to obtain as many effects data as possible in the time scale available.

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4. ~~Hardened~~ Missile Site Vulnerability Test (SMALL BOY) [redacted] (DOD)

The purpose of this test is to evaluate the ability of ICBM sites to survive a first strike attack, in which severe electromagnetic damage may occur to sensitive electronic equipment associated with missiles in silos, the launch control centers and various communication links.

The device will be detonated very near the surface at the Nevada Test Site. (Results from a test conducted on Pacific Island coral soils saturated with salt water would not be indicative of the desired information.) Since the situation of actual concern may involve enemy detonations of megaton yield, [redacted] is the minimum yield that would be meaningful, with the possibility that a larger yield may be needed for a future test. This shot will also provide important information regarding cratering and the effects of blast on hardened underground structures.

In addition to the above, this explosion will be used as a source of radiations in order to measure their effects on various component parts of nuclear warheads. These measurements collectively designated the "SIOUX" experiment, were originally expected to require a special shot.

IV. CONTINGENCY ITEM -- [redacted]

(IRL) (Added item)

A number of [redacted] devices utilizing [redacted] source will be tested during the atmospheric series. If these experiments indicate that this general type of design proves less well understood than now believed, it is proposed that the [redacted] be tested. This is the device used in [redacted]

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[redacted]