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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D.C.

DEC 13 1962

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Dear Bob:

The subject of very high yield weapons is of continuing concern to the Atomic Energy Commission. During the moratorium, major AEC developmental effort in this area was terminated, this action being in consonance with the known requirements of the Department of Defense. As you are aware, our largest yield weapon is the [redacted] in 10,000 lbs.). At the time of entry into stockpile, [redacted] represented our most advanced technology for the achievement of high yields within given weight and size limitations.

The purpose of this letter is to provide estimated present capabilities and limitations as well as our projected capabilities in high yield weapon development. (See enclosure 1 for detailed discussion.) As a result of the recent atmospheric series, the AEC has successfully pursued concepts which may lead to extremely high yields in relatively light configurations but with relatively large diameters. In view of these achievements, we have reviewed our capabilities and associated problems pending a decision to continue development of large yield devices. Dr. Johnson, ATSD(AE), by letter dated August 7, 1962, provided the AEC with the possible requirements of the DOD for nuclear weapon developments, including those which were being considered for application of high yield devices. Accordingly, our analysis has been made of our present and projected capabilities to develop weapons vis-a-vis the proposed requirements of the DOD. For your information, specific systems for which possible future requirements were considered are:

a. High yield FUFO bomb for the B-52 aircraft,

b. High yield warhead for TITAN II (without re-entry), and

c. High yield warheads and bombs for TITAN III, Saturn and the C-133B.

Our present nuclear capabilities to produce advanced high yield weapons can be categorized under three general areas. The first would be the result of refining and increasing of the size and weight of conventional nuclear systems similar to the [redacted] It is perhaps in this area that

[redacted]

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large systems could be available in the shortest time. The second category is that of pursuing the recently tested [redacted] concept. It is in this second area where we would look for a second generation high yield system with relatively high efficiencies and light weights when compared to the first category; however, weapons associated with this concept may have volume limitations. The third category, the third generation of high yield devices, involves concepts yet to be proven feasible. It is in the latter category that we hope to achieve the ultimate in high yield, low weight and acceptable volumes. The enclosure reflects a more detailed description of capabilities within each of the above areas.

There are several factors other than technical (as discussed in the preceding paragraph) which are pertinent in considering the development and production of high yield weapons, defined as those with energy release greater than [redacted] These factors are:

a. <u>Testing</u>. Additional atmospheric testing will be required for the development of any high yield weapons. The amount of testing will vary depending on the complexity of the requirements. For instance, to develop only a high yield FUFO bomb, based on extrapolating present technology, perhaps one test would suffice; to pursue development of several systems using advanced concepts will require numerous tests, possibly spaced over several years.

b. <u>Fallout</u>. Testing high yield weapons raises the historic problem of increasing world-wide fallout. Fortunately, full-scale nuclear testing of high yield weapons is not necessary in all cases. In general, high yield devices can be proof-tested at about [redacted] further, in certain cases, the "low-yield" proof tests would result in fission contribution to a much less degree than that obtained in the "full-yield" version.

c. <u>Impact on AEC</u>. A complete evaluation of the degree of impact on the resources of the AEC must be determined after specific requirements which closely define the size and uses of proposed weapon have been established. For example, the fabrication of high yield nuclear components will require the handling of shapes larger than our production facilities can presently accommodate. Special production equipment must be procured; this requires additional lead time which would not be required for a less radical program. If a high yield bomb is required for lay down application, a new technology as well as a major non-nuclear test program will be required in order to assure sufficient structural rigidity combined with adequate drogueing to achieve this end. Although these are formidable problems, their ultimate solution is within the capability of the AEC. However, the cost of such a development program is great; either other weaponization programs must be delayed, or additional resources must be forthcoming.

d. Presidential Approval. Implicit in the decision of an earlier administration is the requirement that Executive approval must be obtained prior to a major development and production effort to achieve a high yield weapon capability. Before expanding our current program to such a major effort, we believe that Presidential approval should be obtained.

In summary, we wish to emphasize our confidence that the AEC can fulfill the many demands placed upon it if a decision is made for the United States to embark on a high yield weapon capability. However, we would also like to emphasize that a high yield weapon development effort represents a major financial and technical drain on our resources which we would be extremely reluctant to embark on unless a firm decision were forthcoming which would justify our effort. We realize that this is a complex decision; one that will allow the necessary nuclear testing as well as the establishment of firm requirements. With regard to nuclear testing, we could be ready for a test series as early as late summer or early fall of 1963. At the present time, these test preparations do involve the selection of technical designs and areas in which we intend to explore. To this end, your specific requirements, particularly in the area of high yield weapons, are, of course, solicited.

While the question of the military requirement for very high yield weapons is one for your decision, we are all aware that the USSR has a definite high yield capability, and the accruing politico-psychological advantages thereof are being exploited to the maximum. It may well be that more than purely military needs ought to be considered. I suggest, therefore, that we prepare a joint letter to the President raising the question as to whether we should have a high yield weapon capability, considering not only the military requirements for such weapons, but also the resulting political implications.

If you wish to discuss this subject further, we will be most pleased to do so. A copy of this letter is being provided to Mr. McGeorge Bundy.

Sincerely yours,

(Signed) Glenn T. Seaborg

Chairman

The Honorable Robert S. McNamara
The Secretary of Defense

Distribution:
(1A,2A: Addee
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11A: R&D Retained
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Enclosure:
Estimate of the AEC Capabilities for the Achievement of High Yield Weapons

Secretariat 024093.3

R&D	DMA	AGM	DGM	GM
Gottschalk/ Betts GWG/mch				
12/ /62	12/ /62	12/ /62	12/ /62	12/ /62

ESTIMATE OF THE AEC CAPABILITIES FOR THE ACHIEVEMENT OF HIGH YIELD WEAPONS

First Generation Bombs

First generation high yield weapons would be "conventional" in that they involve the [redacted] Much test history of this [redacted] has provided confidence in our ability to provide weapons in the megaton range with rather firm dimensional and weight estimates. Current capabilities of the two nuclear laboratories on first generation weapons are as follows:

a. (1) The Los Alamos Scientific Laboratory has provided the following parameters on a conceptual high yield bomb:

Yield (total)	-	DELETED
Fission yield	-	
Weight	-	30,000 lbs.
Diameter	-	69 in.
Length	-	276 in.
Laydown	-	10,000 lbs. additional

It is possible to vary slightly the stated weight and yield trade-off but the maximum yield-to-weight appears to be about [redacted] If a requirement materializes for a weapon of this nature, a test would be proposed of a clean version at a total yield of [redacted] of which would be fission. A period of somewhat in excess of three years would be required for development.

(2) The LASL has also proposed a clean version of the above weapon having a total yield of [redacted] of which [redacted] would result from fission. It would be required to test such a development at a yield of [redacted] of which would be fission.

b. The Lawrence Radiation Laboratory has proposed a "scaled-up" [redacted] in which it is possible to achieve [redacted] at a weight of 20,000 lbs. (non-FUFO). The initial development period to ready such a device for testing would be about one year. With an additional period of time, further extrapolation of the [redacted] concept could result in a [redacted] device weighing about 30,000 lbs.

NOTE: Although each laboratory has used a different initial concept a comparison of the two approaches reflects that within the present state-of-the-art it would be feasible to design a [redacted] weapon in the 20,000 - 30,000 lb. weight class (non-FUFO).

[redacted]

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Second Generation - [redacted]

a. The [redacted] concept was first demonstrated in the Zuniloo event of Operation Dominic. The gratifying results of this test opened a new range of possibilities in the design of high yield thermonuclear warheads, particularly in weights above 1,000 lbs.

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b. The success of [redacted] (which was a considerable improvement over the [redacted] has increased our confidence in pursuing the [redacted] concept. This concept, as opposed to the more

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Weight	Yield
2,000 lbs.	DELETED
18,000 lbs.	

DELETED

c. Several points should be noted concerning the [redacted] development. First, by basic design, this family of weapons has a high fusion to fission yield ratio. Also, the current state-of-the-art indicates relatively large diameters (possibly in excess of eighty inches for a [redacted] device, too large to fit in a B52 bomb bay). Further, to develop any particular weaponized version of a [redacted] weapon will probably require at least two atmospheric tests - one experimental test at the approximate weight and yield, plus a prototype test. Lastly, it is estimated that at least a four year developmental period will be required to FPU for any weaponized version of [redacted]

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Third Generation

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a. To approach further the theoretical upper limit yield-to-weight ratio, it is necessary to burn thermonuclear fuel at high efficiency with a [redacted] Success of the [redacted] concept has demonstrated one technique for producing high compression in a large mass of thermonuclear fuel with resulting high efficiency. With the [redacted] approach, however, there is a predictable limit to the reduction in the weight of case [redacted] In order to substantially further reduce this type of limiting weights, a new type of thermonuclear design has been proposed. In this design,

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b. It is premature to predict capabilities in this area; however, a test involving this principle is planned for inclusion in the next series of atmospheric tests.

Work Load

The impact on the AEC development and production complex to initiate a specific high yield weaponization program is of considerable magnitude. This is understandable when one realizes the weights, volumes and types of materials being considered. Also, with respect to pre-production tooling, the AEC will have to establish new fixtures and equipment of magnitudes heretofore unknown insofar as nuclear weaponry is concerned. In summary, to produce high yield weapons will require a scope of effort much larger than any previous AEC weaponization effort.

[redacted]