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December 17, 1951

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ATOMIC ENERGY COMMISSION

PART III - WEAPONS
PROGRESS REPORT TO THE JOINT COMMITTEE
JUNE THROUGH NOVEMBER 1951

Note by the General Manager

1. Attached for the consideration of the Commission on Wednesday, December 19, 1951, is Part III - Weapons - of the Progress Report to the Joint Committee. As stated in AEC 129/36, containing the body of the report, this part will be transmitted to the Joint Committee as a separate document.

2. Shortly after the preceding progress report was transmitted early last June, the Executive Director of the Joint Committee requested the Director of Military Application by letter of June 25, 1951, (see Appendix) to present charts in future progress reports showing graphically, but without divulging numbers, the scheduled and actual progress in the weapons program in a manner similar to that for the fissionable materials program.

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3. One chart along these lines is included in Part III. Two other charts have also been prepared, but for security reasons it is recommended that they not be included in the report to be transmitted at this time. They will be available for the information of the Commission when Part III is considered. It has been suggested that the additional charts might be shown to the Joint Committee at a special meeting.

M. W. BOYER
General Manager

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~~By Authority of U. S. Atomic Energy Commission~~
~~Per L. H. Noble, OBS, 4p Date 12-17-51~~
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PART III

WEAPONS

1. The immediate objectives of the weapons program for accomplishment during 1952 are to:

a. Construct and test a large-scale thermonuclear device in the Fall of 1952.

b. Make the Mark 6 operable and begin stockpiling the Marks 5, 7, 8 and 9 fission weapons in the first half of 1952.

c. Complete the construction of and begin operating major new research, development, production and storage facilities.

2. In addition to these short-range goals, the weapons program will continue to proceed as rapidly as feasible in developing new fission weapon models, in improving the quality and performance of weapon components and incorporating improved components in the stockpile, and in conducting such full scale weapon development tests as may be required to further the weapons program.

3. The major events of the period may be briefly mentioned here. Stockpiling of the Mark 6 weapon began in August 1951, but

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the weapon is not yet operable because of difficulty with the electronic portion of the fuze. [redacted]

DOE 6.1(a)

DOE 6.1(a)

The full scale tests performed in Nevada in October and November 1951 (Operations BUSTER and JANGLE) gave new information for weapon development purposes and included for the first time surface and underground detonations. A large scale thermonuclear device having an estimated energy release of 1-15 megatons TNT equivalent is being designed for testing at Eniwetok.

Weapon Production

4. A major part of the production effort has been devoted to making new components and incorporating these into the stockpile ("conversion programs") and to initiating production operations on the Mark 5, 6, 7, 8, and 9 weapons.

Mark 4 Weapon. (Implosion-type bomb; outside diameter 60 inches; approximate weight 10,800 pounds)

5. [redacted]

DOE 6.1(a)

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[redacted] DOE 6.1(a)

6. Other modifications to the Mark 4 weapon have been continued. These include principally the change to a new antenna nose plante of reduced weight, and the addition of a special device to the present electronic fuze, designed to detect an enemy attempt to jam the fuze by electronic means and to delay complete arming of the fuze if jamming is present.

Mark 6. (Implosion-type bomb; outside diameter 60 inches; approximate weight 8,500 pounds)

7. Production of this weapon began in August, 1951. [redacted] DOE 6.1(a)

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[redacted]

DOE 6.1(a)

Tom Initiator

9. Conversion of the stockpile of nuclear cores to accommodate the new smaller initiator, called Tom, which was started in October, 1950, has been completed.

10. The permissible lower limit of radioactivity for initiators has been reduced to half the previously specified value. On the basis of statistical probability, the change will result in a slight increase in the average yield of weapons. This modification appreciably reduces the amount of polonium which must be produced to maintain initiators in the stockpile.

Fractional Crit Core

DOE 6.1(a)

[redacted]

Abee Fuze

12. The new electronic fuze (Abee), which has been produced for use in the Mark 5 and Mark 6 bombs and which may be used in the Mark 7 and Mark 12 bombs, was designed to give maximum protection from the possibility of enemy jamming and is a highly complicated device. Several difficulties have become apparent

in the production model which have delayed its approval as an operational item. Every effort is being made to resolve the troubles as rapidly as possible. A special team of about 65 persons at the Sandia Corporation is devoting full time to analyzing the difficulties in the fuze, and the manufacturer is assisting in the effort. In addition, a number of the fuzes has been turned over the the Armed Forces for independent study and analysis at each of the three service laboratories - the Army's Evans Signal Laboratory, the Naval Research Laboratory, and the Air Force's Wright Air Development Center. [redacted] DOE 6.1(a)

Plant Facilities[1]

13. Construction work at the Pantex Ordnance Plant (Project ORANGE) near Amarillo, Texas, is scheduled to be completed in June, 1952. Following a shakedown period, full production is scheduled to begin in September, 1952. [redacted] DOE 6.1(a)

14. The expanded H.E. facilities at the Iowa Ordnance Plant (Project SUGAR) are scheduled to be completed in April, 1952, and this will about double the capacity of the portion of this plant used for AEC work.

15. By mid-1953 further capacity for high explosives production and non-nuclear assembly work will be required in addition to that being provided at the Iowa Ordnance and Pantex plants because of increased military requirements for non-nuclear assemblies of several models. The extent and proposed location of the expanded capacity is presently under consideration.

1/See Appendix "B" of main report for construction progress schedules.

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16. Work at the Rocky Flats plant (Project APPLE), near Denver, Colorado, is proceeding satisfactorily. Assembly of nuclear cores is to begin there in April, 1952. The plant is scheduled to be completed in January, 1953.

Weapon Development

Thermonuclear Program

17. Theoretical work, as well as an extensive amount of laboratory experimental work, has continued on the thermonuclear problem. The result of the two thermonuclear tests at Eniwetok in May, 1951, and of the subsequent investigation is that the decision has been made to construct a large-scale experimental thermonuclear device and test it at Eniwetok in the fall of 1952 (Operation IVY). [redacted] DOE 6.1(a)

[redacted] DOE 6.1(a)

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19. This device will not use lithium 6, but calculations and laboratory experiments indicate it will be required in quantity for use in other designs of thermonuclear devices. A pilot plant for separating this isotope is in operation at Oak Ridge, and a plant capable of producing the material in quantity is to be constructed at Oak Ridge for operation by about January, 1953.

20. A possible range of yield for this device has been estimated at between 1 and 15 megatons TNT equivalent, or 1,000 to 15,000 kilotons TNT equivalent; this would be 50 to 750 times the 20-kiloton yield of the Nagasaki-type atomic bomb. [redacted] DoE 6.1(a)

21. A special group has been established at the Los Alamos Scientific Laboratory to coordinate and direct the design and construction effort on the test device. Additional theoretical work must be done, and the results applied to the design and construction work, which is just beginning. Procurement of many critical materials and parts must be accomplished, and new technical problems must be solved, including for the first time the preparation and handling of large quantities of liquid deuterium and liquid hydrogen, a major undertaking in itself.

22. In addition to the 1952 test project, consideration continues to be given to all feasible avenues of approach to a thermonuclear weapon. (One approach which appears promising involves the use of lithium 6, which is discussed above.) This work involves fundamental theoretical investigations, calculations of the performance of different systems, experimental physical measurements, and other laboratory and engineering work in a variety of fields, such as cryogenics, metallurgy, chemistry, etc.

23. Tritium Production. Based on an over-all appraisal of the needs of the thermonuclear program, the possibilities in fission weapon development, and fissionable material requirements for weapons, the Commission decided, with the concurrence of the Department of Defense, (a) to discontinue the enriched U-235 loading of the H pile at Hanford for tritium production, (b) to continue to use the excess reactivity of pile H, or its equivalent, for tritium production, and (c) to use the excess reactivity in four of the Hanford piles, or the equivalent, for the production of uranium 233, discussed later.

Fission Weapon Development

24. Condensed development schedules for the several fission models are shown in the adjoining chart. The status and progress of work on fission weapons, by weapon model is as follows:

Mark 5. (Implosion-type bomb; outside diameter 45 inches; approximate weight 3,100 pounds)

25. Production of components has been in progress for several months. Weapon operability will be dependent on deliveries of the associated test and handling equipment required for this model. In general, design of test and handling equipment for a given weapon cannot be frozen until design of the weapon has been finally established; hence, production of the associated equipment, much of which is special electronic apparatus, tends to become the controlling factor in achieving stockpile operability. Initial stockpiling of bombs will begin in February 1952, and the operational stockpile date is May 5, 1952.

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Mark 7. (Implosion-type bomb; approximate outside diameter 30 inches; approximate weight 1,600 lbs.)

26. The production model was given a full-scale test at

SCHEDULES OF DEVELOPMENT FOR NONNUCLEAR WEAPON ASSEMBLIES

[redacted]

DoE 6.1(a)

1—Placement of orders, tooling, and fabrication of sub-assemblies.

2—Difficulties with electronic test equipment and the fuzing system have delayed the operational stockpile date to February 1, 1952.

Mark 10. (Gun-type bomb designed for airburst only.)

29. Gun-type weapons can be made smaller in diameter than the implosion-type. The requirement for this bomb arose from the desire to have a weapon which could be delivered by small aircraft which could not carry the smallest implosion-type weapon (Mark 12) under development. However, the priority now given to this model is low since the potential advantages to be gained from work on other models are much greater. Development work on the Mark 8 and Mark 11 may be expected to contribute information of use in the development of the Mark 10. The tentative date for initial stockpiling of this weapon is early 1955.

Mark 11. [redacted] DOE 6.1(a)

30. Wind tunnel tests are being made on various configurations of the ballistic case. The scheduled stockpile date is early 1955.

Mark 12. [redacted] DOE 6.1

31. The approximate size of this weapon has now been established, the outside diameter to be about 22 inches. [redacted] DOE 6.1(a) Full scale tests are expected to be conducted at Nevada in the spring and again in the fall of 1952. However, the design of this weapon involves so many variations from earlier implosion models that first deliveries to the stockpile are not scheduled to be made until October 1953.

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Mark 13. (Implosion-type bomb; previously designated "Improved 60-inch weapon.)

32. Possible improvements to the Mark 6 bomb which are under consideration for the future were mentioned in the preceding progress report. The effort at this stage consists principally of work on new components, for example the external initiator. Increasing the length of the bomb from 128 inches (the length of the Marks 4 and 6) to 145 inches is desirable, but this is controlled by bomb bay size in aircraft. The date when aircraft with larger bomb bays will become available in sufficient numbers therefore influences the design of the weapon. Stockpiling of the Mark 13 is tentatively scheduled to begin early in 1954.

33. Other major development activities in the field of fission weapons are as follows:

34. Uranium 233. Uranium 233 is a fissionable material which, in ordinary implosion weapons, would probably be somewhat less effective than plutonium but considerably more effective than U 235. [redacted] DOE 6.1(a)

[redacted] DOE 6.1(DOE 6.1(a

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36. If desired, uranium 233 could be produced to some extent in the Savannah River reactors, at a sacrifice in tritium production. In addition, consideration is being given to the construction of a "converter" pile to convert uranium 235 to uranium 233.

37. Smaller Nuclear Cores. A list of nuclear cores, with pertinent data, is given in Table I for reference purposes.

38. Plutonium cannot be used in the gun-type weapons (Mark 8, 9, 10, and 11) because of its high neutron background and resulting large predetonation probability. [redacted] The production of the Mark 8 and Mark 9 in appreciable numbers in 1952 will therefore entail a sizeable diversion of uranium 235, and result in a temporary "excess" of plutonium. [redacted] DOE 6.1(a)

39. [redacted] DOE 6.1(a)

40. New High Yield Nuclear Core. [redacted] DOE 6.1(a)

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[redacted] DOE 6.1(a)

T: blc I - Nuclear Core Types

[redacted] DOE 6.1

41. External Initiator. [redacted] At least one type of external initiator is to be ready for full-scale testing in the spring of 1952. The advantage would be in starting the nuclear chain reaction at a more nearly optimum time during the implosion than can be done at present and thus increasing the energy release. An [redacted] DOE 6.1(a)

external initiator would be particularly important if hollow cores of fissionable material were to be needed for a very high yield implosion-type weapon of the order of 500 kilotons TNT equivalent, now under development.

42. Long-life Initiator. Several experimental initiators have been produced from actinium 227, which has a half-life many times longer than polonium 210, the radioactive isotope presently being used in initiators. Additional development work is required, however, before an actinium initiator can be recommended for stockpile use.

43. High Explosives and Detonators. The extensive research and development effort on high explosives and detonators has produced a number of improvements, including the cored H.E. development mentioned above. [redacted] DOE 6.1(c) This development makes possible a thinner lens system, providing more space for the inner portion of the H.E. sphere in implosion-type weapons, which in turn makes possible greater compression of the core and thus greater yield from the same amount of fissionable material.

44. The proportion of RDX explosive in the RDX-TNT mixture can be increased, which will also give somewhat greater compression and a corresponding increase in yield for the new models.

DOE 6.1(c)

[redacted] This technique is particularly important in the development of implosion-type warheads for rockets and