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~~SECURITY INFORMATION~~ AEC 129/46

December 17, 1952 COPY NO.______

ATOMIC ENERGY COMMISSION

PART II - FISSIONABLE MATERIALS
PART III - WEAPONS
PROGRESS REPORT TO THE JOINT COMMITTEE
JUNE THROUGH NOVEMBER 1952

Note by the Secretary

Attached for the consideration of the Commission during the week of December 15, 1952, are Part II (Fissionable Materials) and Part III (Weapons) of the Progress Report to the Joint Committee. The charts referred to are included in copies 1 through 9 only. As stated in AEC 129/45, Part III (Weapons) will be transmitted to the Joint Committee as a separate document.

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ROY B. SNAPP
Secretary

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PART III

WEAPONS

1. The major events of the period included:

a. Successful detonation of the first full-scale thermonuclear device at Operation IVY, in November 1952;

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c. First flights of guided missiles made with atomic warheads (dummy cores).

Thermonuclear Program

DOE ARCHIVES

Test of DELETED

2. The President on January 31, 1950, directed the Commission "to proceed to determine the technical feasibility of a thermonuclear weapon." Less than three years later, on November 1, 1952 (Eniwetok date), a large-yield thermonuclear device, DELETED was detonated with an energy release of 6-8 megatons, preliminary estimate. This was somewhat larger than the 4-6 megatons expected, and is the equivalent of 300 to 400 times the 20 kiloton energy release of the so-called nominal fission bomb. The DELETED was assembled and detonated in a small building on the ground surface, near the center of a small island,

Elugelab, located at the northern side of the Eniwetok Atoll. The detonation, designated the MIKE shot of Operation IVY, resulted in the following general phenomena, based on preliminary observations:

a. All of the island and portions of two adjacent ones were obliterated; a crater four-fifths of a mile in diameter and 80 feet in maximum depth was formed. (The earth shock was detected by seismographs in the United States, and presumably the world over.)

b. The mushroom cloud rose 26 to 28 miles, with a stem roughly 8 miles in diameter and a cloud top about 40 miles across.

c. Radiation was high on the islands near the detonation, but decayed sufficiently in three days to permit recovery of photographic and other scientific recordings.

3. Nearly ideal weather conditions prevailed and recovery of scientific data was excellent. Radiological conditions permitted manning the aircraft control tower on Parry Island one-half hour after detonation and ships reentered the lagoon the day after the shot. The radioactive cloud drifted circuitously at great height for several days in the general area of the Marshalls, undergoing normal radioactive decay and being diffused and dissipated in the air currents. Airborne radioactivity was detected in the United States and other countries, but the concentration was low and there was no health hazard. (See map of world-wide monitoring stations in Part VI, Biology and Medicine.)

Direction of Thermonuclear Development

4. The detonation of DELETED has established the feasibility of achieving a thermonuclear reaction in liquid deuterium on a large scale and of using the resultant neutrons to cause exten-

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5. Because the DELETED required extensive cryogenic (low-temperature) facilities for the special handling of liquid hydrogen, the AEC and the DOD had previously agreed that the first attempt at designing a deliverable thermonuclear weapon for emergency capability would be based on "dry" rather than "wet" (cryogenic) principles. The design of such a deliverable weapon, DELETED avoids the cryogenic problems by incorporating deuterium in dry hydride form (lithium 6 deuteride). The lithium 6 would absorb neutrons during the explosion and be converted to tritium, which would react with the deuterium to produce high-energy neutrons which would cause fission of natural uranium.

6. The DELETED warhead is to be incorporated in a weapon, DELETED which may weigh as much as 50,000 pounds. In order to assure compatability of aircraft and weapon and to achieve early delivery capability, the Air Force is working closely with the AEC. DELETED

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7. As a result of the favorable outcome of the DELETED experiment, it appears desirable to develop a "wet" type of thermonuclear weapon in parallel with the "dry" type. Although cryogenic and logistic aspects of a "wet" weapon pose serious problems,

Thermonuclear Weapon Capability

8. In order to accomplish the immediate objective of emergency capability with a thermonuclear weapon at the earliest possible time, the AEC and the DOD in June 1952, established a special working team consisting of representatives of Los Alamos Scientific Laboratory (responsible for the warhead assembly), the Sandia Laboratory (fuzing and ballistics assemblies) and the Air Force Special Weapons Center (aircraft adaptation and ground assembly facilities). Production of the DELETED for this purpose is mainly dependent upon the availability of lithium 6 to be produced at Oak Ridge (see Part II, Fissionable Materials). Over-all design of a deliverable weapon is underway but will not be firm for several months. Dummy models have been constructed for ballistic and fuzing studies and drop tests have begun.

Additional Effort on Thermonuclear Research

9. The Commission's decision to postpone indefinitely the construction of a production linear accelerator developed by the University of California Radiation Laboratory has been mentioned in Part II, Fissionable Materials. During the summer a group was organized in the Radiation Laboratory to participate in the thermonuclear weapons program. The primary functions are (1) research and development leading to new or extended weapon design concepts, and (2) development and application of instruments and equipment for recording data during weapon test operations. This group is now located in a separated area of the facility at Livermore, California, the site of the MTA pilot model. Current plans call for a rapid growth in personnel to an operating level of about 1,200 persons by July 1954. Project Matterhorn, conducted at

and Los Alamos Scientific Laboratory. The UCRL group is actively underway with preparations to test thermonuclear weapon concepts in the next continental tests during the spring of 1953 (Operation UPSHOT) and the next Pacific tests in late 1953 or early 1954 (Operation CASTLE).

Full-Scale Weapon Tests

King Shot - Operation IVY

10. The thermonuclear shot (Mike) at Operation IVY has been described above. On November 14 (Eniwetok date) the highest yield fission explosion to date was successfully executed (King shot).

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The test was performed as an air drop from a B-36. Preliminary estimates give a yield of about 550 kilotons TNT equivalent, which is more than 27 times the energy release of a nominal 20 kiloton bomb. DELETED

Operations UPSHOT and KNOTHOLE, (Nevada, spring 1953)

11. Operation UPSHOT is a weapon development test of primary interest to the Commission. The detonations being planned for this operation will be for the purpose of conducting component studies

KNOTHOLE, under the cognizance of the Department of Defense, will include a test of weapons effects and an operational test of the artillery-fired atomic projectile (Mark 9).

12. The two operations will be run concurrently.

Other Tests

13. Additional full-scale tests are tentatively planned as follows:

a. Operation CASTLE (Pacific Proving Ground, late 1953 or early 1954). The purpose of this operation is to test several large yield thermonuclear devices, including one or more deliverable designs. Bikini Atoll has been approved as an auxiliary test location supplementing Eniwetok, and one or more of the tests in this series will probably be carried out there.

b. Operation DOMINO (Nevada Proving Ground, spring of 1954 or fall of 1953, depending on CASTLE schedule). The purpose is to test new developments in fission weapon field and components of thermonuclear weapons within the limits of the yields permissible in Nevada.

c. Operation REDWING (Pacific Proving Ground, 1954 or 1955). Purpose: Thermonuclear weapons test.

Weapon Production and Stockpiling

Weapons in Stockpile

14. In the stockpile now are the following implosion-type bombs and nuclear components, with indicated choices of yield for interchangeable cores:

Weapon

Mark 4
Mark 5
Mark 6
Mark 7

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15. The gun-type models in stockpile now are the Mark 8 (bomb for subsurface detonation) DELETED and the Mark 9 (280 mm projectile) DELETED

Status of Work on Production Models

16. Mark 4 (implosion-type bomb, outside diameter 60 inches, approximate weight 10,800 pounds). Conversion of Mark 4 bombs to Mark 6 was resumed following a temporary postponement because of difficulty with the new fuze for the Mark 6. Routine functional surveillance of Mark 4 components has been suspended as a result of progress in the conversion program, which is now scheduled for completion in May 1953, rather than June 1953.

17. Mark 6 (implosion-type bomb, outside diameter 60 inches, approximate weight 8,500 pounds). The conversion of Mark 6 Mod 0 bombs in stockpile to the Mark 6 Mod 3 has been completed. DEL

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Several additional improvements, principally changes in the fuzing system, are under development and will be incorporated in stockpiled weapons prior to the advent of the Mark 13 bomb.

18. Mark 5 (implosion-type bomb, outside diameter 44 inches, approximate weight 3,100 pounds). This weapon is being stockpiled. The cartridge mounting assembly is being modified to permit use both as a bomb component and as a missile component.

19. Mark 7 (implosion-type bomb, approximate outside diameter 30 inches, approximate weight 1,600 pounds). This weapon is being stockpiled.

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Stockpiling of this weapon is continuing. The 38 M weapons, early capability design, have been retired from the stockpile.

21. Mark 9 (280 mm artillery-fired atomic projectile). Artillery projectiles of regular production quality are being stockpiled. A test of this weapon, fired from the 280 mm gun, is planned at Nevada in the spring of 1953.

Weapon Component Production and Conversion

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23. Initiator production. Production of polonium 210 initiators for both implosion and gun-type weapons continued on schedule.

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24. Weapon production facilities.[2] Construction of the Pantex Ordnance Plant, Amarillo, Texas, and the expansion of the Iowa Ordnance Plant, Burlington, Iowa, were completed and the

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plants are operating. These facilities produce high explosives for the Marks 5, 6 and 7, and perform final assembly of the nonnuclear components of these weapons for delivery to stockpile. Construction of the Rocky Flats plant, Colorado, for the design, fabrication, assembly and inspection of nuclear cores, was 60 percent complete at the end of October. Inspection and assembly of cores continued in a part of the plant, and initial operation will occur progressively in other parts as construction is completed. Over-all construction completion is scheduled for April 1953, and all parts of the plant will be operating by July 1953.

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Participation by DOD in Weapon Production

26. Thus far participation by the Department of Defense in the development and production of atomic weapons has been confined to work on specific components. In these cases agencies of the DOD, such as the Ordnance Department, have been engaged as contractors in a manner similar to AEC's arrangements with industry. Responsibility for funds and program direction has rested with the Commission.

... months the Commission and the Department of advisability of having the DOD participate directly in nonnuclear development and production. A statement of agreed concepts has been prepared and concurred in by the Department of Defense and the Commission. In furtherance of the agreed weapon concepts, the Commission has recently proposed, subject to the approval of the President, that primary responsibility for the development and production of nonnuclear portions of the gun-type weapons, that is, artillery-fired projectiles and penetrating gun-type bombs, be assigned to the Department of Defense. If this proposal is approved, the functions of development, design procurement and production of nonnuclear components and assemblies for gun-type weapons would be performed by the laboratories, plants and facilities of the Department of Defense.

Research and Development

New Bombs

28. Mark 11 (gun-type bomb of advanced design, for subsurface detonation). DELETED

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DELETED Production of the Mark 11 is scheduled to begin in the fall of 1954.

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29. Mark 12 (implosion-type bomb, approximate outside diameter 22 inches, approximate weight 1,200 pounds). The development phase is expected to be completed in February 1953. Stockpiling should begin in February 1954.

30. Mark 13 (implosion-type bomb, outside diameter 60 inches, weight and length undetermined). This weapon is in the early

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31. Atomic depth bomb. By joint arrangement with the Navy, a development program for the depth bomb is now underway with the Navy being responsible for nonnuclear components and AEC for the warhead. The XW-7 (Mark 7) warhead will be used for this purpose. The military requirement calls for a design providing detonation down to 2,000 feet, while assuring the safety of the delivering helicopter, blimp or airplane. The weapon is expected to be designed and tested by 1955.

Rockets and Guided Missiles

32. Air-launched rocket. A military requirement was received in November 1952 for the development of an air-launched, rocket-propelled atomic weapon, which will carry the XW-7 warhead. A joint arrangement with the Navy will be employed for this development also. The air-launched rocket will be designed to permit low-level tactical delivery from distances of 12,000 to 30,000 feet and from altitudes as low as 500 feet, while assuring safety of the delivering aircraft. It is expected to be designed and tested by the end of 1954.

33. Warheads for guided missiles. Chart III-A shows the design, production, and operational stockpile schedules of the warheads for the principal warhead-missile combinations currently being developed. Since the preceding Progress Report, development of XW-5/Major and XW-12/Air-launched rocket has been suspended. New development schedules for the XW-12/Talos are being developed and the XW-13/Major previously shown has been redesignated the XW-13/Redstone.

34. During this period the first actual flight tests of

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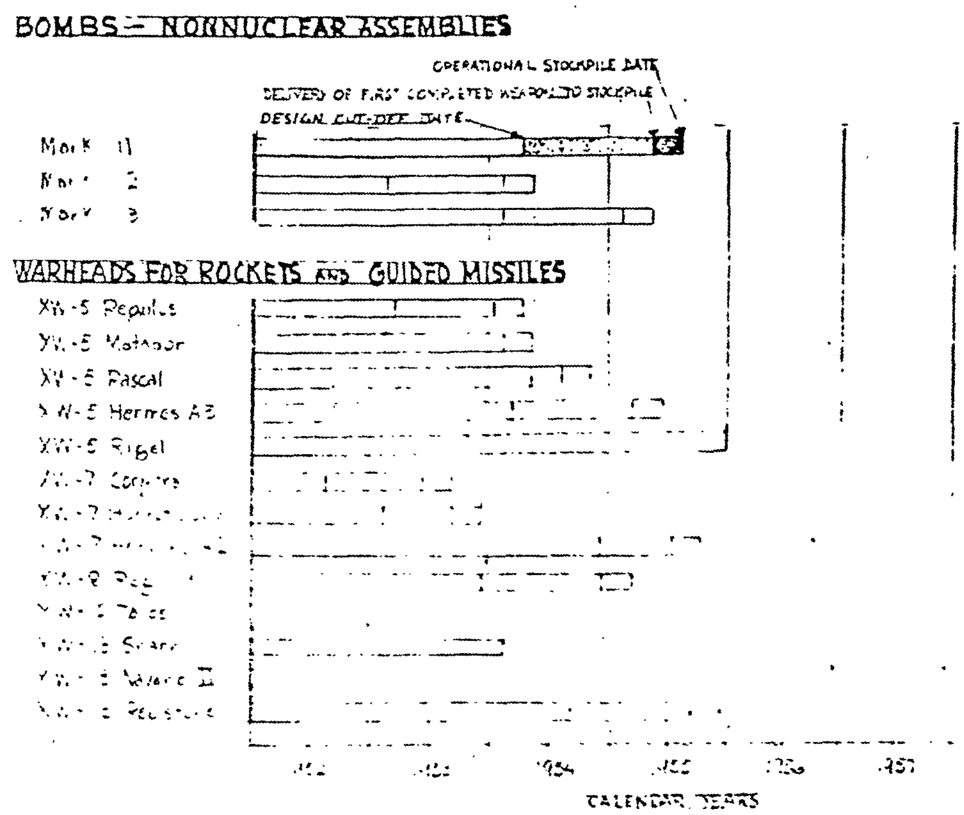
WEAPON DEVELOPMENT SCHEDULES



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contractors. The XW-7/Corporal received six successful flight tests at White Sands, New Mexico, and the warhead installation was released to production on August 28, 1952, looking toward initial delivery to stockpile in June 1953. The XW-5/Regulus received a first flight test in August and a second in November at the Naval Air Missile Testing Center, Point Mugu, California. The XW-7/Honest John was first tested in November 1952 at White Sands, New Mexico, and the first test of the XW-5/Matador is scheduled for December 1952.

35. AEC work on adapting assemblies to warhead use in missiles and rockets is centered at Sandia Laboratory. A large outdoor centrifuge at Sandia and a rocket-propelled sled moving on a track, at Holloman Air Force Base, New Mexico, are being used to simulate the high accelerations encountered in rocket propelled devices.

Initiator Development

36. New concepts are being studied that might increase the yield of implosion weapons and also reduce present costly initiator requirements. Among these are the external initiator, tested at Nevada in June 1952. Some success was achieved with the external betatron initiator, although the period of delay in initiating the nuclear reaction in this particular test shot was not as great as desired, with the result that the increase in yield was less than is believed possible by this method. Studies are being made of the feasibility of achieving similar effects through modifica-

... addition to continuing studies of

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Uranium 233

37. Production of small quantities of U-233 at Hanford and processing at Oak Ridge are continuing. In view of the limited quantities of U-233 presently available, it is believed that more information can be obtained by detailed non-destructive experiments than by a test shot, and a full scale test is not planned at present.

38. It is estimated that the value of one gram of U-233 in standard implosion weapons (less than 100 kilotons) is about the same as that of DELETED of plutonium. U-233 may have usefulness for weapons

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Estimates of the cost of U-233 indicate that this substitution could be made only at an appreciable increase in the dollar cost per unit of explosive force delivered to a target.

39. Production of U-233 in sufficient quantities to make this application attractive would probably require the construction of a converter-type reactor, and special separations plant, which would produce U-233 from thorium by burn-up of U-235 obtained from gaseous diffusion plant operation.

40. Further studies of the nuclear and weapon properties of U-233 are being made. DELETED

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radiological warfare in the light of recent information that significant quantities of RW agents could be made available from waste materials at Hanford and later at Savannah River without interfering with the scheduled production of plutonium. The Department of Defense has requested the Commission to construct radiological warfare production facilities with the object of accelerating the RW program and achieving weapon capability in 1956.

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