Presentation by Dr. W. F. Libby, Member, U. S. Atomic Energy Commission
Before National Security Council on Thursday, October 16, 1958

Mr. President:

My portion of the presentation covers the remainder of our program with the subjects:

a. Basic Research

b. Radioactive Fallout

c. Isotopes

d. Plowshare - the non-military use of nuclear explosives,

and e. Weapons Program, particularly:

(1) The U.S.-U.K. exchange,

(2) The results of Hardtack I in the Pacific,

(3) The anticipated results of Hardtack II and any future tests which might be held.

RESEARCH

The AEC is a principal bulwark for basic research in the physical sciences especially in fields of particular interest such as high energy physics and nuclear and atomic structure. It is on this solid base that everything we do rests and the strength and weaknesses of our program largely are traceable to this $100 million item in our budget. This gives us our new men and ideas which nurture and nourish everything practical we do. For example, at present several programs are limited by the properties of materials which have yet to be discovered.

RADIOACTIVE FALLOUT

Radioactive fallout is being studied intensively as to its occurrence and the effects of its radiations on the health and heredity. We sample everything from the stratospheric upper air on down and systematically record the strontium-90 and cesium-137 levels present. These studies tell us the whole story in broad outline--the whole story of the circulation through the upper atmosphere, the precipitation from the lower air on raindrops, the entering of the food chain in milk and vegetables and finally the location in the human body. We have been less successful on the effects. We can say where the fallout is and how much radiation it gives, but the effects it has are more difficult to measure. All we have now are upper limits. The future will probably clarify these aspects for us.

ISOTOPES

Isotopes and their radiation continue to be, next to peace itself, our most tangible peaceful use of the atom. They are now saving the taxpayer hundreds of millions of dollars annually through reduced manufacturing costs for industry and promise to reach the level of several billions if our present plans for an Isotope Development Program--similar to the familiar Power Development Program--succeed. This program was just launched this fiscal year.

PLOWSHARE

Our Plowshare people are investigating several peaceful applications, as illustrated on this chart.

The mechanical and thermal effects of the explosion may enable economical recovery of oil from hitherto unexploited deposits.

Many civil engineering projects which are almost impossible by conventional means may become entirely feasible with nuclear explosives.

Removal of overburden or break-up or ores by nuclear explosives may aid mining operations. For example, Kennecott Copper has found a large copper ore deposit which cannot be mined economically by present methods. Nuclear breakup may allow economical leaching in situ to be used. Their Mr. Boyd has been in to see us and is very interested in learn of the breakup capabilities of nuclear devices.

If it can be tapped, the vast reservoir of contained heat resulting from an underground explosion may produce cheaper power.

Useful isotopes are produced within a nuclear explosion--in a few microseconds amounts can be made which would require months in an atomic pile. The difficult is their recovery and purification by economical methods. This is under study.

The intense heat and pressure of a nuclear explosion may enable scientific experiments otherwise unperformable such as new methods of geophysical measurement of the earth's interior by seismological observation.

We have plans to conduct certain specific experiments in the near future, and these I have set out on my second chart.

[redacted]

DOE Ltr

(b) In July or August of next year we will fire a 10 KT shot 1200 ft. underground in the Solado salt formation 30 miles from Carlsbad, New Mexico. Specific tests will examine the recoverability of heat for power, and of valuable isotopes. In addition we will gain further information on underground shots in general.

(c) We are working with the U. S. Bureau of Mines, and through them with the oil industry at large, to prepare a joint AEC-industry project for the fall of 1959. The explosion would be about 1500 ft. underground on Government land in the Green River oil shales of northern Colorado. Breakup of the shales would enable recovery of oil by an in situ combustion process.

(d) The Richfield Oil Company has proposed an experiment in the Athabaska tar sands of northern Alberta. If this proves interesting to the Canadian Government as well, the experiment can be performed in early 1960. The explosion would provide a sump in an underlying hard rock, and by its heat would initiate oil flow from the surrounding sands.

(e) Of the many possible civil engineering projects, I shall mention only three:

(1) A second isthmian canal for which the Panama Canal Company is studying the use of nuclear explosives.

(2) A harbor at Cape Thompson in northwest Alaska, for which we have completed an on-site survey.

(3) A proposal to improve navigation in the River Madeira, an Amazon tributary in Brazil and Bolivia, by removal of rock bars.

In summary, while some of these applications may prove uneconomical or even impossible, we feel that all should be attempted and may lead to unprecedented advances in their fields. For example, last week in one of our underground shots in Nevada, the tunnel was found afterward to be filled with explosive gas which somehow had been produced by the nuclear explosion, probably from the extreme conditions which gave rapid and perhaps useful chemical transformations. From this lead we may see possibilities of additional utilization of nuclear heat for generation of useful chemical products.

What We Have Learned Concerning the United Kingdom Weapons Program and Cooperation to Date

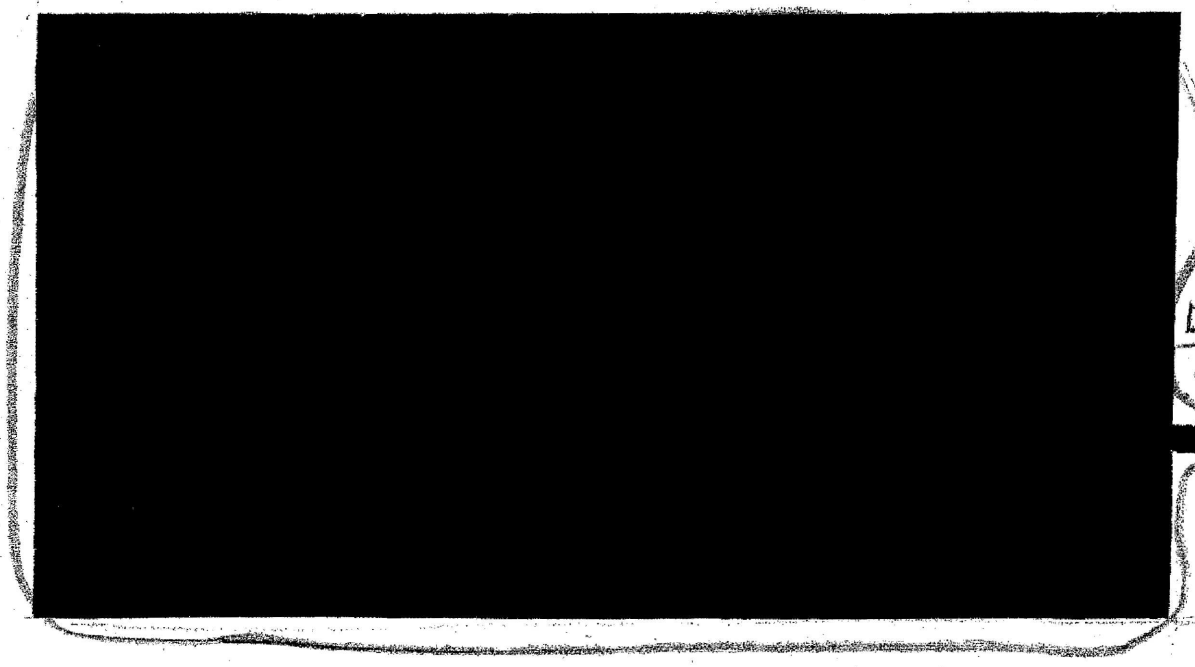
1. Amendments to the 1954 Act, which became law late in this last session of Congress, permitted substantially increased cooperation with regard to weapons design with any nation which had achieved a substantial nuclear weapons capability. The United Kingdom, of course, is the only ally who meets this condition. Immediately after enactment a revised US-UK Agreement for Cooperation was ratified and became effective on 4 August 1958. The agreement specified that collectively we (US-UK) would try to develop the best warheads and bombs for certain specific purposes. The agreement mirrored the fact that the law required that, prior to the time we transmitted any particular US information to the UK, we must secure Presidential determination that that transmission would "promote without unreasonable risk the common defense and security."

2. Since the new Agreement came into force, we have had two long technical meetings with the United Kingdom to exchange certain specified information and to establish plans for further cooperation. As a result of these meetings we realize that the British program is quite well advanced. They have described in detail in the reports I have here their achievements in weapon design and understanding. We believe that there is real benefit to further cooperation, particularly in joint use of scarce talent such as Sir William Penney, their chief weaponeer, possesses.

[redacted]

DoE 6.1(b)

DoE 1.5(b)



DOE 1.5(b)

DOE 6.1(a)

DOE 1.5(b)

OBJECTIVES HARDTACK PHASE II

INTRODUCTION - The tests being conducted during HARDTACK II consist of 15 full-scale nuclear detonations definitely scheduled at this time plus some ten to twelve safety firings.

For simplification purposes, I have divided the tests into three general categories (Chart: Development Tests, Exploratory, and Experimental).

DEVELOPMENT TESTS.- (Chart: Anti-submarine rocket) This test is centered on developing a warhead for the anti-submarine rocket, ASROC. DoE 6.1(a) [redacted] Furthermore, the entire design must be ruggedized for safe water entry. Initial tests of this design required three safety shots. DoE 6.1(a) [redacted] A third is now scheduled.

(Chart: Recoilless rifle-missile) [redacted] DoE 6.1(a) It will be 11 inches in diameter, 25 inches long and weigh approximately 50 pounds.

(Chart: 155 mm. Implosion Shell) This device has already been tested safetywise and full scale. Preliminary results indicate both were successful.

[redacted] DoE 6.1(a)

Chart: (POLARIS - Improved Primary) One of the primary objectives of this test series is the development of a warhead for the POLARIS submarine launched IRBM. [redacted] DoE 6.1(a)

(Chart: Small missiles) A low yield warhead is being developed for several missile uses. [redacted] DoE 6.1(a)

(Chart: Insurance of safety in stockpile designs) All development tests which I have mentioned have paralled safety shots. Safety shots will insure that devices being tested for subsequent stockpile will not

give a significant nuclear yield if detonated through fire on crash. At present there are a total of 12 planned. To date 6 of the safety shots have been fired. Most of these shots are being fired in 500 foot holes. One which contains no plutonium has been fired from a captive balloon.

EXPLORATORY - In the exploratory field we have two main objectives. The first of these (Chart) is to develop low yield warheads for tactical missiles of the future. Future missile systems will be smaller, lighter and more accurate and will require lighter weight low-yield warheads. We are testing several designs which could be placed "on the shelf" in order that they would be available for use with the new missile systems.

For an immediate capability in the low yield area we have modified one of our presently stockpiled items. [redacted] DoE 6.1(a) This test will provide us with an immediate low yield capability in missiles for which newer types will not be in stockpile for some time to come.

EXPERIMENTAL - In the experimental category we are examining three general areas.

[redacted] DoE 6.1(a) This device will be fired underground with the X-ray experiment taking place in a 10-inch vacuum tube some 160 feet long.

Briefly the other two experimental devices concern:

a. A new very low yield clean design principle. [redacted] DoE 6.1(a)

[redacted] DoE 6.1 It is intended to produce very high compression, and therefore economy in the use of active material.

FUTURE COURSES OF DEVELOPMENT

You may wonder what we had intended to do by full-scale testing after HARDTACK, and what will be precluded by a test suspension. Without going into detail, I shall mention the following lines of investigation:

[redacted]

DOE 6.1(a)

RESULTS OF HARDTACK PHASE I

As you know, sir, from earlier report which were more complete than mine will be today, during the period April 28 to August 17, we conducted in the Pacific a series of 28 weapons development, one proof-test, and 5 weapons effects shots. The purposes for which these shots were designed are shown on my third chart. I shall discuss each purpose briefly:

a. [redacted] DoE 6.1 (a)

b. [redacted] DoE 6.1(a)

c. Development of new higher-yield weapons in the range of a few hundred pounds. This is an entirely new class of weapons which did not exist before HARDTACK. [redacted] DOE 6.1(a) This is such a remarkable development.

[redacted]

DoE 6.1(a)

The first application will be to anti-ICBM system (Zeus), and then to new solid-fuel ICBM's, and it may solve our problem of the IM and Polaris if we can check it out with certain other systems.

d. Development of a very light low-yield warhead for tactical use such as the Army's Davy Crockett. This effort was initiated in HARDTACK Phase I with two shots but is being continued in Phase II, and I have one of these here this morning.

e. [redacted]

DoE 6.1(a)