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Joint Committee on Atomic Energy,  
January 1, 1953

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## POLICY AND PROGRESS IN THE H-BOMB PROGRAM:

### A CHRONOLOGY OF LEADING EVENTS

Ten years have elapsed since hydrogen weapons were first seriously studied in the United States. Some informed observers hold that American H-bomb progress, particularly since 1950, has been highly satisfactory; others maintain that as much as five years has been lost; still others take an intermediate position.

This chronology attempts (1) to set forth the major policy reports and events from the wartime period to the present; and (2) to set forth scientific reports and data showing the broad technical outlook for H-bombs at the time each policy decision was made. So far as known, no similar document is in existence.

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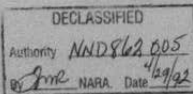
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Introductory Note

Much of the complex history that follows may be clarified if it is considered in terms of five questions about the H-bomb:

1. Can It Be Done? Until recent months technical personnel were unable to state with certainty that an H-bomb is possible at all. The element of doubt was removed by the successful and November 1, 1952 experimental explosions at Eniwetok Atoll.
2. Should It Be Done? The question most intensively debated during the first half-decade of the post-war period was whether or not the United States should make an attempt to achieve the H-bomb. This question was resolved on January 31, 1950 when the President directed the Atomic Energy Commission to proceed.
3. Is Second Laboratory? Since World War II it has been presumed that a fully determined H-bomb development program might require facilities and scientific personnel on a scale akin to the wartime Los Alamos laboratory effort. Thus, since 1950 in particular, there has been a question whether a second major laboratory should be established to assist Los Alamos in hydrogen development. During Summer, 1952, such a second laboratory was undertaken at Livermore, California.
4. When Produce Materials - Before or After Test? Should the nation wait until H-bomb prototypes are tested before steps are taken to produce key materials in quantity necessary for stockpiling these weapons? The extent to which an effort should be made to capsule the lead time between weapons testing and a stockpile-in-being is a subject of controversy.

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H-Bomb Chronology, January 1, 1953  
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5. How Many H-bombs Are Needed?

One school of thought conceives of the H-bomb as a limited-purpose weapon for specialized targets, largely strategic, and suggests that a stockpile numbered in two or three figures might be sufficient. The opposing school conceives of H-bombs as the primary nuclear weapon and, emphasizing tactical uses, suggests a stockpile [numbered in four figures.]

The H-bomb has been called by a variety of names--the "super bomb," the "thermonuclear bomb," the "deuterium bomb," the "tritium bomb," the "fusion bomb," and the "hydrogen bomb," among others. All these names refer to the release of energy in large amounts and involving the fusion of light elements at high temperatures. (In the fission process of an ordinary A-bomb, all of the energy released is derived from the breaking up of heavy atoms.)

This chronology deals mainly with three types of H-bomb:

1. [ ] - Enrico Fermi, Edward Teller, and others first studied this model in 1942. b2  
DOE
2. The "Alarm Clock" - This model, proposed by Edward Teller in mid-1946, was named the "Alarm Clock" because it might "wake up the world." [One version consists of
3. [ ] - Conceived by Edward Teller in Spring, 1951, this device uses b2  
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It was this model--in the form of a test device, not an actual weapon prototype--that conclusively demonstrated the feasibility of H-bombs in the November 1, 1952 full-scale explosion at Eniwetok.

The chronology makes little attempt to cover a half-dozen new and recently proposed models [such as (a device utilizing hydrogen reactions and expected to be deliverable by fighter plane). Only passing reference is made to the "Booster" (evolving from a proposal by J. von Neumann in 1944) because the "boosting" of A-bombs with small amounts of hydrogen materials is primarily a means of enhancing the yield of atomic weapons like those today in stockpile.] b2  
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While several materials have recently been proposed for possible H-bomb use, the key materials figuring both in the events of the past decade and in the present are these:

- (a) Deuterium - hydrogen 2 or "heavy hydrogen," a comparatively cheap substance made in "heavy water" production facilities;
- (b) Tritium - hydrogen 3, a comparatively expensive material made by irradiation of lithium in an atomic reactor;
- (c) Lithium 6 - a metal recovered from ordinary lithium by isotopic separation.

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Executive Program, JAF Chronology, January, 1953  
Doc # DLXXIV  
H-Bomb Chronology

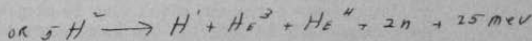
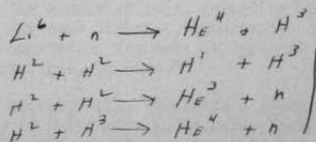
was written by Dickson

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The task of compiling papers reflecting both the leading policy decisions and the broad technical outlook at the time each decision was made is difficult. The information has been closely held; parts of it were never adequately recorded in writing; and parts are subject to varying interpretations. It must be emphasized that virtually none of the Executive Branch papers and reports cited in this chronology became available to the Joint Committee on Atomic Energy until 1950, and the great majority were not available until 1952.

BASIC THERM. REACTIONS:





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I. The Wartime Period

"As early as 1932 there were suggestions by Russian scientists and others that thermonuclear reactions might release enormous amounts of energy. In 1939, thermonuclear reactions were proposed by Hans Bethe to explain the heat of the sun.... But, previous to the atomic bomb, there was no method of attaining the high temperatures necessary for achieving thermonuclear reactions on a large scale."--from an Atomic Energy Commission history of the H-bomb submitted at the Joint Committee's request on December 30, 1949.

Origin  
of the  
"Super"

The first idea of a "Super" or thermonuclear bomb in relation to the United States atomic energy program was evolved after a lunch discussion between Dr. Enrico Fermi and Dr. Edward Teller at Columbia University in early spring of 1942. In this and later talks they considered possible use of an A-bomb as a means of igniting a mass of deuterium (hydrogen 2). In succeeding weeks speculation on basic feasibility ranged widely. But, by the summer of 1942, according to the history of the Manhattan Engineer District, theoretical considerations were well enough understood "to make it apparent that a 'Super' bomb could, in principle, be made."

Tritium  
suggested

In July and August, 1942, there was a series of meetings at the University of California in Berkeley, called by Dr. J. R. Oppenheimer for the purpose of discussing bomb problems and laying down a program of work for a projected new laboratory (Los Alamos). At these meetings the idea of the "Super" was introduced by Dr. Teller and Dr. E. Konopinski and extensively discussed. According to the Manhattan District history, Teller presented his analysis of the mechanism as then proposed and argued that such a bomb is feasible. The history adds, "One further suggestion of great eventual importance was made by Konopinski. [This was to lower the ignition temperature of deuterium by the admixture of artificially-produced tritium (hydrogen 3)."]

Communists  
and the  
1942 Summer  
Conference

[It later became known that a considerable group of communists was active within the Berkeley laboratory during the period of the 1942 Summer Conference. No individuals since cited as belonging to that group were leading participants in the Conference. However, recent Joint Committee inquiries indicate an overwhelming probability that some communist attendance at the meetings did occur and that the cell members had knowledge of the H-bomb discussions.]

According to the Manhattan District History, consequences of the Summer Conference at Berkeley were that investigation of the "Super" bomb continued; and a "Super" project was made a part of the research program planned for the Los Alamos laboratory started in early 1943. Study of "Super" problems took place at Chicago during Fall, 1942; and the Chicago work was instrumental in bringing about a decision to establish a low-temperature (cryogenics) laboratory at Los Alamos, the first new facility completed on this site. However, before Los Alamos was founded, the decision had been made to give priority to A-bomb efforts. In any case it was assumed from the outset that the A-bomb would have to come first -- as means of furnishing the high temperatures necessary to set off an H-bomb.

At wartime Los Alamos work on the "Super" was carried on as a development secondary to that of the A-bomb. Systematic theoretical studies, led by Dr. Teller, date from Fall, 1943.

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Atomic Energy Program, JCAE (Chandrasekhar), January 1, 1953  
H-Bomb Characteristic

Chronology of Atomic Bomb Development  
written by Curran

JCAE Committee  
Dec 1940

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During the winter of 1943-1944 a theoretical obstacle was encountered--loss of heat through so-called "Compton cooling." This factor directed attention toward tritium (hydrogen 3) as a further means of igniting deuterium. Two members of the British wartime mission to Los Alamos performed the most extensive new calculations concerning tritium and deuterium. Meanwhile, an important difficulty (Pu 240) had developed in one phase of t-bomb work; and its solution required almost the full attention of the laboratory.

The Manhattan District history stated as to early 1944:

First tritium  
production.

"In Teller's group further theoretical work was carried on, which confirmed the difficulty of igniting pure deuterium. In May, 1944, Dr. Oppenheimer discussed the matter of tritium production with General Groves and C. H. Greenevald of the du Pont Company. It was there decided that experimental tritium production would be undertaken, using surplus neutrons in the Clinton /Oak Ridge/ pile."

Earlier the decision had been made to construct heavy water production facilities--a decision partly influenced by the possible use of heavy hydrogen (deuterium) in a "Super" bomb. (By the same token, Allied bombing of the Norwegian heavy water production facility that had fallen into German hands was partly intended to deny Germany any supply of deuterium.)

The first major technical-policy report involving the H-bomb was written by Dr. Vannevar Bush and Dr. J. B. Conant and submitted to the Secretary of War on September 30, 1944. Drs. Bush and Conant and General Groves also took this report to President Roosevelt. It stated, in part:

First major  
wartime  
report.

"Some of our theoretical physicists believe that it is extremely probable that the energy generated by the fission of an A-bomb could under certain circumstances produce such a high temperature as to initiate a reaction which has never taken place on this earth, but is closely analogous to the sources of energy of the sun. This reaction involves the transformation of heavy hydrogen into helium. Enormous amounts of energy are released in this reaction. A super bomb using heavy hydrogen (in the form of heavy water) and detonated by an atomic bomb...would be of a different order of magnitude in its destructive power from an atomic bomb itself. We may therefore designate it as a super-super bomb. While such a possibility lies in the future, it could even happen that a bomb of this type would prove feasible within six months or a year after the first atomic bomb is constructed.

"When one considers that such a super-super bomb might be delivered on an enemy target by the principle of a robot bomb or guided missile, or even without this possibility from a bomber coming at night or in overcast guided by modern radar devices, we see how vulnerable would be centers of population in a future war. Unless one proposed to put all one's cities and industrial factories under ground, or one believes that the antiaircraft defenses could guarantee literally that no enemy plane or flying bomb could be over a

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vulnerable area, every center of the population in the world in the future is at the mercy of the enemy that strikes first....

"....The possibility of any major power or former major power undertaking this development, however, seems great indeed...."

"Our present advantage lies entirely in the construction of plants for the manufacture of materials...."

"....The advantage, therefore, that the United States and Great Britain possess in this area of A-bombing is very temporary indeed. We cannot over-emphasize this point...."

"As has already been pointed out in this memorandum, certainly the Russian scientists and perhaps the Germans and others may be before long hard in the race of developing this new type of A-bomb weapon. They could catch up with our present position in the course of three or four years. The danger is that we would never know, if secrecy prevails as between countries, whether indeed this were the case. Hence our own thoughts about using this weapon in a future war might be based on the false premise that our enemies could not retaliate in kind. But more dangerous still are the possibilities of the super atomic bomb.... The devastating effects of this bomb would be of another order of magnitude from the atomic bomb itself and it would require materials that are readily available. One cannot say with certainty that such a bomb can be constructed, but it seems as probable as was the atomic bomb development when this research was first undertaken by the government. But whether or not this particular line should prove profitable from a military point of view one can be certain that there will be unexpected developments which would increase enormously the effectiveness of atomic energy for destructive purposes."

Second major wartime report.

A second major technical-policy report was submitted to the War Department by the "Committee on Post-War Policy," Dr. Richard C. Tolman, Chairman. This report, dated December 28, 1944, recommended under the heading "Military Weapons" as follows:

"The Government should continue the development of nuclear weapons as a project of overriding urgency so long as national security may be endangered. Nuclear fission bombs of greatly improved efficiency are certainly in sight, and thermonuclear bombs of ten-thousand-fold greater power may even be feasible. These latter would permit an enemy in a single day preceding declaration of hostilities to carry out an action which might be decisive for the outcome of a war. Studies of the possible use of fission products as radioactive poisons should be undertaken at such priority as is necessary for military security."

The Interim Committee, headed by the Secretary of War, was formed to advise on highest national policy in the atomic field. This was the Committee which made recommendations to the President and which drafted legislation proposed for the

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Doc # DLXXXIV  
H-Comb Chronology  
January, 1953  
lower written by Dutton  
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Third major  
wartime  
report.

post-war period. A Scientific Panel under Dr. J. R. Oppenheimer, Chairman, counselled the Interim Committee. The major wartime report of this Panel, submitted on June 16, 1945, stated that "the recommendations submitted herewith are predicated on a vigorous healthy activity in this /atomic energy/ field for national security and well-being." The first recommendation in the report was on the H-bomb, as follows:

"A. We believe the subject of thermo-nuclear reactions among light nuclei is one of the most important that needs study. There is a reasonable presumption that with skillful research and development fission bombs can be used to initiate the reactions of deuterium, tritium, and possibly other light nuclei. If this can be accomplished, the energy release of explosive units can be increased by a factor of a thousand or more over that of presently contemplated fission bombs. We think that there are several experimental approaches to this problem, and that perhaps the possibility is not completely excluded that significant thermo-nuclear reactions may be initiated without the use of fission bombs, by refinements in the application of ordinary high explosives and by other methods not yet explored. Work in this whole field bears some analogy to the development of the fission bombs themselves, in that a close cooperation of fundamental physical studies, of semi-industrial techniques, and of rather novel, radical variations in ordnance procedures will be needed to carry the work through. Just for this reason it is the intention of the New Mexico Laboratory to do as much work in this field as is consistent with more immediate wartime commitments. It is quite certain that the close of the war will leave these problems in a preliminary and unresolved state."

The first atomic explosion--the "Trinity" test shot--at Alamogordo, New Mexico, took place on July 16, 1945. For several months preceding, as confidence in the success of this test increased, the H-bomb project attracted growing interest. Once the test was a demonstrated success, many scientists assumed that the H-bomb presented the next challenge for the Los Alamos laboratory. Detailed plans were made for a greatly augmented program. Dr. Fermi gave a series of lectures on the H-bomb for Los Alamos personnel.

The Hiroshima bomb and the Nagasaki bomb were dropped on August 6 and August 9, 1945. The Japanese sued for surrender on August 14, 1945. At the conclusion of the war, the MED history stated,

"the freeing of men from other work made it possible to bring thermonuclear work to a partial completion. The results obtained indicated, in a convincing but not decisive way, that such a weapon is indeed feasible."

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Dissemination 1953, JETC Chronology, January, 1953  
JCRAC Doc # DLXXIV H-Bomb Chronology  
X  
Reviewed by Curran  
Date Rec 80

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II. The Early Post-War Period

September 28, 1945

First major  
post-war report  
to the military.

The Report of the Scientific Panel to the Interim Committee, a major report on over-all and long-range prospects for atomic energy and atomic weapons, was submitted to the office of the Secretary of War by Dr. J. R. Oppenheimer, Chairman. Shortly thereafter Dr. Edward Teller expressed his opinions in a separate letter to Dr. Fermi dated October 31, 1945. Dr. Teller had headed theoretical work on the H-bomb at Los Alamos, but had not seen the official report. Because of the differing views given by the official document and Dr. Teller on the super bomb program, the following points are set forth in contrast:

1. Time and Certainty

Official Report:

Official report  
recommends 15-year  
program (1960).

In the tabular presentation of the Report's recommendations, the "super" bomb was rated as of "highest" importance as a military matter and of "moderate" urgency (the lowest rating of projects included in the table). The report estimated a 15-year period to achieve the "super", "if the policies recommended" in the report were adopted. (Three senior scientists and two further scientists of doctorate level were considered needed for the 15-year program, together with 50 engineers.)

The Report also stated:

"It is by no means certain that a superbomb may be developed in a time of the order of five or ten years. At the present state of our knowledge, however, this possibility cannot be excluded."

Teller estimates  
2 to 5 years.

Teller: "When could the first super bomb be tried out? It is my belief that five years is a conservative estimate of this time. This assumes that the development will be pursued with some vigor. The job, however, may be much easier than expected, and may take no more than two years."

2. Scope and Scale of Effort

Official Report:

"The problem of the superbomb is comparable in size to the problem solved by the Los Alamos Laboratory of developing a fission bomb out of the fissionable materials. In one respect at least, the problem actually is more difficult. Indeed the very feasibility of a superbomb does not appear now, on theoretical grounds, as certain as the fission bomb appeared certain, on theoretical grounds, when the Los Alamos Laboratory was started. On the other hand, it is reasonable to assume that the work would not be carried out on conditions of extreme urgency."

Teller: "The scientific effort is probably comparable to the work which has been done at Los Alamos on the atomic bomb. In addition a number of production jobs are

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Interim Committee Program, SCRC Chronology, January, 1953  
Case # DLXXXIV H-Bomb Chronology

Chronology of Atomic Bomb and its Development by Paulson

SCRC Confidential  
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required. Some of these will be undertaken anyway in connection with future development of the atomic bomb. Others, notably the production of tritium, can be accomplished by small changes in plants which are already projected. The total production effort needed is small compared to that which has so far gone into the atomic-bomb project."

### 3. The Feasibility Question

#### Official Report:

The interim report proposed a 15-year program which "would be necessary primarily in the attempt to decide whether a superbomb is possible and, if this question should be answered in the affirmative, in order to develop the general features that should be incorporated in the design."

Teller: "...in my opinion the chance of success is good enough at the present time to justify a large-scale program."

### 4. Morality and Recommendations

#### Official Report:

"We ourselves are convinced that the development, even as it stands today, of atomic weapons, has served to sharpen and deepen the crisis in international relations and to reinforce the conviction, to which this last terrible war has brought such earnestness, that conceptions of national welfare which have dominated past centuries are inadequate for the maintenance of the peace and well-being, either of this country or of the world. We do not believe that the improvements in present weapons, which are certainly possible, can add very much to the force of this argument; nor do we find it consistent with our hopes for the future to recommend the prosecution of a competitive armaments development in the field of atomic weapons."

"...we should point out that for the most part the development of weapons is a fairly straightforward activity, closely related to military developments in other fields. There is one exception. This is the superbomb. This weapon (and there is a reasonable possibility that it can be made) would bear to atomic weapons about the same relation as these do to Blockbusters. The development of these weapons is not an assured possibility; what is assured is that the problem of either developing them or establishing the futility of the effort is comparable in difficulty to that which has been studied at Los Alamos during the last years. It is our recommendation that no such effort should be invested in this problem at the present time, but that the existence of the possibility should not be forgotten, and that interest in the fundamental questions involved should be maintained."

Recommendation  
against H-bomb  
effort.

Teller: "Most of the development and production work on the super bomb can proceed simultaneously with development and production of the atomic bomb. The time needed by another country to produce a super bomb may not be much longer than the time needed by them to produce an atomic bomb...."

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Transmittal Program, JCRF (Chronology), January, 1953  
Doc # DLXXXIV H-Comb Chronology

Chronology of Atomic Bomb and its  
Development by Durban

JCRF, Conf. 5-10  
Dec. 1950



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"No detailed plans have been made how to put these explosive energies to beneficial use. But I consider it a certainty that the superbomb will allow us to extend our power over natural phenomena far beyond anything we can at present imagine....

"There is among my scientific colleagues some hesitancy as to the advisability of this development on the grounds that it might make the international problems even more difficult than they are now. My opinion is that this is a fallacy. If the development is possible, it is out of our powers to prevent it. All that we can do is to retard its completion by some years. I believe, on the other hand, that any form of international control may be put on a more stable basis by the knowledge of the full extent of the problem that must be solved and of the dangers of a ruthless international competition. The terrible consequences of a super bomb will not be avoided by ignoring or postponing the issue but by wise and provident planning."

October 1, 1945

With the close of the war, the future of the Los Alamos Laboratory was uncertain. The Supplement to the Manhattan District History stated:

"One group, headed by one of the most senior members of the laboratory, contended that the laboratory should become a monument--that it should be abandoned and its functions, if necessary or useful to peacetime activity, taken up elsewhere.

"Another philosophy suggested that the laboratory should abandon its production activities in connection with atomic weapons, and should conduct only peaceful research, or basic research whose application might be in the indefinite future.

"Still another philosophy held that the basic purpose of the laboratory was atomic weapon research and development, and that for the present at least, the design and production of atomic weapons might or must continue."

During this period, and until the Atomic Energy Commission took charge, the Laboratory operated on the interim philosophy expressed by Dr. Bradbury to the Coordinating Council at Los Alamos. The policy on the "super" was stated as follows:

"We will propose that the fundamental experiments leading to the answer to the question 'Is or is not a Super feasible?' be undertaken. These experiments are of interest in themselves in many cases; but even more, we cannot avoid the responsibility of knowing the facts, no matter how terrifying. The word 'feasible' is a weasel word--it covers everything from laboratory experiments up to the possibility of actual building--for only by building something do you actually finally determine feasibility. This does not mean we will build a super. It couldn't happen in our time in any event. But some day, someone must know the answer: Is it feasible?"

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Interim Supplement to the Manhattan District History, SRAE Chronology, January, 1953  
Doc # DLXXXIV H-Cont Chronology

Chronology of Atomic Bomb and Super  
written by Division

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October 5, 1945

The "Super Handbook" was published at Los Alamos. It contained a collection of technical data and computations.

October 8, 1945

A further technical report on the "super" program was issued at Los Alamos. Among other things, investigation of tritium production in quantity was recommended.

October 17, 1945

Dr. J. R. Oppenheimer resigned as director of Los Alamos and was succeeded by Dr. Norris Bradbury. TIME magazine reported on October 29 as follows: "...Before Oppenheimer went to Washington from New Mexico to testify, a newspaperman asked him whether the atomic bomb had any significant limitations. Said he: 'The limitations lie in the fact that you don't want to be on the receiving end. If you ask, "Can we make them more terrible?" the answer is yes. If you ask: "Can we make a lot of them?" the answer is yes. If you ask: "Can we make them terribly more terrible?" the answer is probably.'"

December 13, 1945

Dr. Teller filed a disclosure of invention for a boosted-type A-weapon. (A "boosted" A-bomb was successfully tested in May, 1951).

April 14, 1946

A technical report, entitled, "Prima Facie Proof of the Feasibility of the Super" was issued at Los Alamos. The report concluded that the material in its pages constituted "prima facie proof of the feasibility of the Super"; that "a large scale theoretical and experimental program for the development of a thermonuclear bomb is justified"; and that "concomitant with this program the production of tritium should be undertaken, beginning at a rate of about 1 gram per day and increasing as the results of the Los Alamos' program may indicate."

May 28, 1946

Klaus Fuchs and Dr. John von Neumann filed a disclosure of invention, S-5292X, on an H-bomb model.

Fuchs-von  
Neumann patent.

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Dr. Hans Bethe, in his recent memorandum referred to below, suggested that this 1946 invention may be distinguished from our present H-bomb ideas on the following two grounds:

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Memorandum for the President, SCMP (Chandrasekhar), January 1, 1953  
The Doc # DLXXXIV  
H-Comb Photo/105  
Working at the time & not sent to  
University by Dutton  
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Date for 10

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June 12, 1946

Second  
major  
Los Alamos  
technical  
report.

Thirty-one scientists, including Klaus Fuchs of Great Britain, reported on the April conference on the "super" at Los Alamos. The report incorporated previous work on thermonuclear weapons, under the Manhattan District project and stated the following as the unanimous conclusions of the conference:

"It is likely that a super-bomb can be constructed and will work...

"There is at present no indication that any of the basic physical processes have been neglected, nor is it considered likely that any additional basic processes will need to be taken into consideration...

"The detailed design submitted to the conference was judged on the whole workable...

"In each case of certain doubts discussed in the report it was seen that should the doubts prove well-founded, simple modifications of the design will render the model feasible...

"It seems therefore very likely that a super can be constructed and that the following materials will be needed for its construction:

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"...It has been estimated by the members of this conference that ... work would take a time on the order of one or two years as performed by a laboratory the size of and functioning as efficiently as Los Alamos functioned at its wartime peak. In the time estimated, of course, the period has not been included which is needed for the building up of the laboratory. It may be pointed out, however, that most of this work could be performed while the tritium and other needed materials are produced. Actual testing of the super might take place a short time after the component materials become available."

The June 12, 1946 Report of the April Conference on the "Super" concluded with the following statement:

"...further decision in a matter so filled with the most serious implications as is this one can properly be taken only as part of the highest national policy."

What steps were in fact taken to determine the "highest national policy" are unknown. No thermonuclear issue was taken to the President of the United States until after detection of the first Russian explosion, in September 1949.

(The April 25, 1950 report by the Committee of Senior Responsible Reviewers on the then discovered espionage activities of Klaus Fuchs stated as follows on thermonuclear weapons:

"With regard to thermonuclear weapons Fuchs' information was hardly less complete than his information on A weapons. He was a principal participant in the 'Super' conference of April 1946. In addition he was probably familiar with the 'Booster' idea and may have obtained

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Atomic Energy Program, 1946-1953, January 1, 1953  
# DLXXXIV H-Form Chronology  
unreviewed by Dickson  
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vague information on the very early proposals of the 'alarm clock' from another member of the British Mission. From Fuchs' statement to Perrin it appears that he described the ideas current in Los Alamos when he left, in the design and method of operation of a super bomb.")

The January 30, 1950 interview of Dr. M. Perrin with Fuchs to determine technical data transmitted to Russian agents also states as to "the tritium bomb":

"He [Fuchs] said that he was very surprised to have the question put by the Russian agent in these particular terms and it suggested to him ... that the Russians were getting information from other sources."

(The June 12, 1946 Report on the April Conference on the Super and the April 14, 1946 report of "Prima Facie Proof of the Feasibility of the Super" were reprinted in full on February 16, 1950, as technical reports LA 575 and 551, after the hydrogen program was, as stated by Dr. Bethe, "resumed ... on the basis of the theoretical assumptions of 1946.")

June 15, 1946

Klaus Fuchs left Los Alamos.

July 23, 1946

A technical report, "Possibility of Initiating a Theronuclear Reaction" was published at Los Alamos.

August 30, 1946

Drs. Teller, Oppenheimer, Konopinski and Bethe filed a disclosure of invention of a series of H-bomb devices. The patent application stated "...it is deemed to be within the scope of the present invention to employ any type of explosive fast chain reaction system as a detonator for a thermonuclear reaction and not to limit the invention to the various embodiments herein described." Among the six specific designs included in the application was a fission detonated thermonuclear bomb with a yield stated as ten million tons of TNT.)

August 31, 1946  
Origin of  
"Alarm Clock"

The "Alarm Clock" H-bomb device was suggested by Dr. Teller at Los Alamos.

Fall, 1946

In the Denver conference on controlled thermonuclear reaction of June 1952, it was stated that "In 1946 at Los Alamos ... people turned to apply what had been learned into industrial directions. Among others, Teller, Fermi, and R. R. Wilson speculated on the possibility of controlling a thermonuclear reaction. Much of what follows in later years/ arose from these speculations." As of 1946, the deuterium-deuterium and tritium-deuterium reactions were understood, but serious obstacles were recognized to practical achievement of controlled fusion of light elements. Two approaches to peacetime applications were discussed in the June 12, 1946 "Report of Conference on the Super," but the theory was not considered advanced "to the point where a prediction about feasibility could be made."

Peaceful  
uses

October, 1946

At Los Alamos, Dr. Teller submitted a proposed outline of a laboratory program for the super bomb and argued for proving ground tests.

November 14, 1946

Since the Atomic Energy Commission was to direct activities after January 1, 1947, Dr. Bradbury, in anticipation of questions, prepared a letter to the Commission.

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First H-bomb  
policy issue  
presented  
to AEC.

This letter, presented to the Commission on its first  
trip to Los Alamos, stated as follows on the hydrogen  
bomb:

"Again, at the close of the war, it was known  
that a possibility existed of employing elements  
of low atomic weight in a 'Super' weapon which,  
if capable of development, would be thousands of  
times as effective as the present weapon. Since  
the program for such a weapon as then conceived  
would involve a laboratory fully as extensive as  
Los Alamos at the peak of its activity, and would  
require as well large developments in other portions  
of the Manhattan District, the interest of the  
laboratory was restricted to determining the feasi-  
bility of the weapon and to research and theoretical  
calculations bearing towards this end. These inves-  
tigations, in which we have had the advice and con-  
sultation of previous experts in this field, have  
led to no decrease in our expectations that such a  
weapon could be constructed were the necessary  
effort to be expended thereupon. Furthermore, there  
has appeared a somewhat different suggestion as the  
result of these considerations which indicates the  
definite possibility of a weapon many times superior  
to the present one but lying reasonably within the  
capabilities of this laboratory."

November 15, 1946

A technical report on the "Alarm Clock" was published  
at Los Alamos, stating that "At the present time it seems  
that the proposal is right, provided there is

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January 1, 1947

The Atomic Energy Commission officially took over  
from the Manhattan Engineer District.

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2011 Doc # DLXXXIV H-Bomb Chronology, January, 1955

Continued by R. L. R. & Co. and by  
University of Chicago



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III Before the Russian Explosion: 1947 - 1949

Bethe on 1947-1950 period.

A. General. "After the summer of 1947," Dr. Bethe stated in his Memorandum on the History of the Thermo-nuclear Program dated May 28, 1952,

"work on large-scale thermonuclear reactions was curtailed, first because no idea for a thermonuclear weapon seemed to exist that offered great and immediate promise, and second because it was felt that the Los Alamos Laboratory, with its limited scientific personnel, could not carry this work in addition to its more immediate responsibilities of improving fission weapons."

Dr. Bethe also stated that by the end of 1947 calculations on the "Alarm Clock" were "not very promising" and were stopped.

Teller on 1946-1950 period.

Dr. Edward Teller, in his comments on the history of our thermonuclear program dated August 14, 1952, stated that:

"The thermonuclear work at Los Alamos was at an almost complete standstill between the spring of 1946 and January 1950. Only one big scale device, the 'Alarm Clock,' was considered in that period, and the work of only three senior people was involved (Richtmyer for approximately eight months, Nordheim for approximately a month, Teller approximately two months, and, in addition, the work of perhaps two or three computers for a full year.)"

AEC Report on 1945-1949 period.

A "History of United States Activities in the Super-bomb Field", submitted by the Commission on December 30, 1949, at the Joint Committee's request, noted that:

"No progress was being made on the 'Super' bomb in the period after the end of the war until the summer of 1947..."

At this time, the History states, "the possibilities were reviewed... There were still some doubts but the conclusion stated was that the 'Super' was probably feasible." "After the theoretical study of the 'Super' at Los Alamos in the summer of 1947, the next development of importance," the History notes, "occurred in connection with consideration of the program of the Los Alamos Scientific Laboratory for the calendar year 1949," discussed below.

B. Reports: During this period there were two major reports dealing with the H-bomb, one a 1947 technical report concerned with proposed models, and the other a review of atomic weapons prospects submitted to the military establishment in 1948.

(1) Scientific Report. On September 26, 1947, Dr. Teller wrote a technical memorandum "On the Development of Thermonuclear Bombs." It attempted to pull together all aspects of the H-bomb prospects as of that time. As to the model, the memorandum concluded that it was "probably feasible" but that "its complex construction gives little hope that it can actually be made to work in the next three to four years. It requires, furthermore, considerable amounts of tritium."

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As to the Alarm Clock, the report concluded that feasibility hinged upon whether or not there would be

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the construction of the Alarm Clock will not encounter extremely big difficulties. While this is not very probable, it should be noted in view of possibilities that may be open to our competitors as well as ourselves."

Lithium 6  
suggested

In this 1947 report, Dr. Teller proposed use of lithium-6 deuteride in the Alarm Clock. He suggested that production be investigated since

would be

needed."

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The report also suggested that two thermonuclear tests be undertaken as soon as possible after the Pacific test operation scheduled for the spring of 1948 (Sandstone) so that data from these tests could be used to determine feasibility of the Alarm Clock.

Dr. Teller stated as follows on the relation between the A-bomb program and a thermonuclear program:

"...I believe that from the military point of view, the Super or the Alarm Clock will not actually make the fission bomb obsolete. It will, however, give rise to new types of effects and can be matched with the help of fission bombs, only at a probably much greater cost. This is all the more true because of the fact that the expense in the case of the Super and the Alarm Clock will essentially go into research and developments while a much greater fraction of the expense in the case of fission bombs goes into more straightforward industrial production. Thus, the efforts along the two lines are not mutually exclusive because they involve to a considerable extent different personnel and different facilities."

Finally, the memorandum emphasized that tritium production had a good chance of being "the determining factor in the early construction of any thermonuclear bomb."

Second major  
policy report  
to military.

(2) The Long Range Objectives Report. The second major report in this period is that of the Panel on Long Range Objectives for the Atomic Energy Committee of the Research and Development Board. Submitted by Dr. J. R. Oppenheimer, Chairman, on August 18, 1948, it was the next major report of its kind after the Report of the Interim Committee, made to the Secretary of War in 1945. It considered all possible military aspects of atomic energy through approximately 1958. The section of the report dealing with thermonuclear warheads stated in part that:

"The Panel recognizes the importance of work directed toward the development of this thermonuclear weapon, but in view of the magnitude and complexity of the problem, the special personnel requirements, and the uncertainties as to the characteristics of a feasible weapon, it believes that this long-range objective

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cannot and will not be attacked at this time with the extensive scientific and industrial effort which characterized the wartime Manhattan District developments."

C. The G. A. C. During this period also the General Advisory Committee reported to the Atomic Energy Commission. The GAC was established by the Atomic Energy Act of 1946 to advise the AEC on "scientific and technical matters." In its report of February 14, 1947, submitted by Dr. J. R. Oppenheimer, Chairman, the GAC stated in part:

"The second point where we would wish to revise the [1945] Panel recommendations is this: In those recommendations it was suggested that work on thermonuclear explosives be pursued in a leisurely and rather scholarly manner, lest it interfere with the many other pressing developments in atomic energy. The encouraging results of preliminary study in this field, the existence of suggestive new proposals for thermonuclear explosives, but above all, our conviction that, properly understood, the pursuit of thermonuclear problems would strengthen rather than weaken the quality of work on atomic weapons, would make us now wish to assign a higher urgency to this work..."

"We have ... the following general suggestions:

"That the development of the thermonuclear program be undertaken, not in competition with, but as a stimulation to improvement in the standards of laboratory work..."

"That should it appear, as the Committee believes unlikely, that a strong group of men interested and qualified in the development of atomic weapons will be more willing to undertake this development at a site other than Los Alamos, this course should not be discarded as too costly or too dangerous."

In its April 3, 1947 report, the GAC asked for bi-annual reports on the "Super", and commented as follows:

"Finally, in our discussions in the General Advisory Committee and at Los Alamos, we have come to appreciate that rapid progress in the development of thermonuclear explosives is not to be anticipated; nevertheless, we are convinced that at least for the present studies bearing on this problem are contributing to the health of the Los Alamos project, and laying the foundation for further progress in the future."

The fourth report, dated June 1, 1947, noted the following:

"We should again, however, wish to emphasize that the omission of hydrogen 3, Tritium both from domestic out-of-project distribution and from foreign distribution, coupled with the publication of data indicating the existence of large amounts of this isotope, is very bad security indeed."

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H-Comb Chem/AS  
General Program, GENC Chemistry, Chemistry, 1953

Chemistry of Hydrogen 3 and Tritium  
known known by Dickson

Doc # 60

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On October 10, 1947, as a "Miscellaneous Recommendation" the GAC stated as follows on the September, 1947 report of Dr. Teller:

"Thermonuclear Energy. The Committee considered the admirable report of Dr. Teller on the status and prospects of weapons based on thermonuclear reactions. On the basis of this report we concluded that the program of basic studies recommended in the report should be encouraged as a healthy and useful part of the work of the Los Alamos Laboratory, and at least a necessary condition for progress in this field. The Committee wished to study the matter further before endorsing proposals for greatly increased tritium production on the one hand, or for a weapons test of thermonuclear reagents on the other. These questions were made an order of business for the forthcoming meeting. The Committee did, however, note that even with the most optimistic interpretation of present knowledge the realization of thermonuclear weapons is many years in the future, and that in many cases our knowledge of the subject is fragmentary and inadequate. We believe that the remoteness of the military application and the difficulty of the problem do not justify the high classification -- 'Top Secret' -- now attached to this work. We further believe that it is desirable precisely because of our inadequate understanding, to stimulate further participation in the study of these problems. We therefore recommend to the Commission that scientific work bearing on the development of thermonuclear reactions be classified not higher than 'Secret'."

The G.A.C. also recommended "declassification of all nuclear properties of tritium." The first of four views given for the recommendation was as follows:

"As pointed out above, the military application of thermonuclear reactions, which alone might seem to justify retaining classification on the properties of tritium, is a very long-range problem, to the solution of which a knowledge of the properties of tritium contributes relatively little."

The questions of "greatly increased tritium production," and a "weapons test of thermonuclear reagents," noted in the sixth report above, were reviewed in the tenth report, June 6, 1948, as follows:

G.A.C.  
recommends  
boosted  
A-bomb.

"Thermonuclear Weapons. In accordance with our expectation, we considered a development of thermonuclear weapons and the related problem of Tritium production. Of the various models of such weapons, for instance the Super and Alarm Clock, one and only one appears to be capable of fairly rapid development; [this is the so-called Booster.] With the scope of effort now available, the other weapons are at best in the remote future; and in the absence of clear, well-defined, and over-riding military requirements therefor, and of an increase in the personnel available for their development, scheduled and active work upon them hardly appears practicable. On the other hand, the development of the Booster appears feasible leading to a test in two to five years from now. This will give some practical experience, and the corresponding discipline, in the field of thermonuclear reactions and will serve to put the whole subject on a sounder basis and tend to reveal any errors in our views which might be relevant for the future. At the same

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Document Program, JCNF Chemistry, January, 1953  
Doc # DE XXIV H-Comb Chemistry

Monopoly of Atomic Bomb and its  
Development by Curzon

JCNF Com. 5-10  
Doc # 40

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time, such weapons, while not offering any immediate promise of radical improvement in cheapness or in effectiveness over those now available, may have certain economic or tactical advantages whose value can be determined only when design and performance are better known."

(The GAC also called for production of  
of tritium per year at Hanford for a "Booster" test within  
two to three years.) /

In its report of October 27, 1948, the GAC referred to the Report of the Panel on Long Range Objectives, submitted to the RDB on August 16, 1948. The GAC said it "had no specific comments to make...; we thought it a useful document."

The following reference to thermonuclear matters also occurred in this report:

"Specifically, to the questions asked of the Commission by Los Alamos, we are glad to take note of the Commission's assurance of tritium production and we share the views suggested in covering staff memorandum to the Los Alamos report that the decision to push and test be deferred."

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On the matter of expansion of facilities at Los Alamos, the OAC stated:

"We have examined the proposals for the construction of a more permanent technical area at Los Alamos and have been asked to comment on the advisability of such a construction program at Los Alamos. Our views are the following:

GAC comment on  
laboratory policy.

"(a) We have at the present time no reasonable alternative to Los Alamos as a weapons development center. We firmly believe that this question should not at the present time be raised and that any expressed doubt as to the permanence of Los Alamos could have only adverse effects.

"(b) On the other hand, we believe that in recognizing Los Alamos as a weapons development center, the permanence of the installation and program should not be exaggerated. Technical, military, and even political developments may affect the nature of the work and of the requirements. This point among others causes us to believe that the very high expense (\$107,000,000) of the proposed construction should be reexamined."

First A-bomb  
military re-  
quirements set:  
1953 goal.

D. The Defense Department and the AEC. In October, 1947 the Joint Chiefs of Staff laid down a military requirement for "x" number of A-bombs to be on hand by January 1, 1953. (No H-bomb requirements were included.) This was the first military requirement established since the end of the war, and the first after publication of the 1946 "Report on the Conference of the Super" and the proposal of the "Alarms Clock."

In Fall, 1948 the Atomic Energy Commission, the General Advisory Committee, and the Military Liaison Committee agreed upon a test of a [boosted] A-weapon, which was scheduled for 1951. At the same time there was sub-

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commutation program, DEN Chronology, January, 1953  
see Doc # DEXXIV H-Emb Chrono/053

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stantial agreement that this was the only avenue to be pursued by scheduled test. In June, 1948 Dr. Oppenheimer, Chairman, submitted the GAC views to the AEC in a report stating that the Super and the Alarm Clock "are at best in the remote future; and in the absence of clear, well-defined, and overriding military requirements therefor, and of an increase in the personnel available for their development, scheduled and active work upon them hardly appears practicable." Military views were preliminarily stated in August 1948 when Dr. Oppenheimer, Chairman, submitted to the Defense Department the Report of the Panel on Long-Range Objectives, commenting that "this long-range objective [The H-bomb] cannot and will not be attacked at this time with the extensive scientific and industrial effort which characterized the wartime Manhattan District developments." Both the GAC and the Panel specifically recommended the [boosted] A-bomb shot.

On April 13, 1949, following issuance of these reports and the agreed program for test of the [Booster], Mr. William Webster as Chairman of the MLC wrote the AEC expressing Defense Department views on the Panel Report:

"In general, these views [of the National Military Establishment] constitute approval by the National Military Establishment of this Report.... [However,] in regard to development of thermonuclear... assemblies the National Military Establishment is impressed with the military importance of possible end results of these projects and agrees to the desirability of their continuation so long as there appears to be reasonable possibility of useful discoveries."

On July 27, 1949 Chairman Lillienthal of the AEC replied to the MLC in part as follows:

"In regard to thermonuclear assemblies, theoretical studies are continuing at Los Alamos at a pace which does not interfere seriously with more urgent elements of the laboratory program. A substantial research program is in progress on the fundamental nuclear properties of the light elements, and this will have a bearing on thermonuclear reactions. As you know, considerable effort is also being expended in developing, for test in 1951, an experimental booster system employing the light elements tritium and deuterium along with fissionable material, although it is not possible to say at this time whether this will lead to a satisfactory weapon model. It should in any case increase the basic knowledge needed for developments in this field."

Second A-bomb  
military re-  
quirements set:  
1956 goal.

Following the 1947 A-bomb requirements to be achieved by 1953, new requirements were established in Spring, 1949. These were to be achieved by January 1, 1956. [No requirements for H-bombs, H-bomb materials, or for determination of the feasibility of the H-bomb were established for this period.]

E. The Joint Committee and the AEC. The Atomic Energy Act of 1946 states that "the Commission shall keep the joint committee fully and currently informed." On November 27, 1947, the AEC submitted a "Program Goals" report, prepared at the request of Senator Hickenlooper, Joint Committee Chairman. This report covered "major goals of certain leading programs" for the five years following its date. No reference was made to H-bomb efforts.

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On February 11, 1948, May 15, 1948, August 20, 1948, and November 19, 1948, the AEC submitted "Progress Reports" to the Joint Committee. The latter report listed the following as "the primary goals of the Commission's weapon program:

- "a. To produce, with the consent and direction of the President, atomic weapons of the required types and quantities.
- "b. To maintain these weapons in readiness...
- "c. To do research and development leading to new and improved atomic weapons and to carry out experimental tests of such weapons."

These documents did not refer to the H-bomb. However, two 1949 reports to the Joint Committee allude to work on the [Booster.] The January 31, 1949 Progress Report described this subject as follows:

"Research is also being conducted on two new types of nuclear components. The first will incorporate a small amount of previously untested material in an effort to explore nuclear reactions in light elements as well as to achieve greater efficiency in the use of presently employed heavy fissionable material."

The July 29, 1949 Progress Report commented on the same subject as follows:

"Work continues on the design of a weapon containing [ ] and a weapon making use of nuclear reactions of the lighter elements. Experimental models of both types are to be tested [in 1951.]"

The Commission informed the Joint Committee about a possible H-bomb material, tritium, on two occasions, once in 1948 and once in 1949. It will be recalled that in early 1947 and several times thereafter the GAC indicated that laboratory amounts of tritium should be made available to private universities for non-secret basic research and that a failure to do so "is very bad security indeed" since omission of tritium from the list of isotopes shipped to private users for open and published work might attract attention to United States interest in this material as a possibly basic H-bomb ingredient. A controversy developed involving the GAC, the AEC, and the HLG on the question of whether Soviet intelligence would be most likely to perceive the relationship between tritium and the H-bomb if this material were distributed in laboratory amounts for non-secret research or if it were withheld from such distribution. After extended discussion and meetings between the GAC, the AEC, and the HLG, and after a decision that this matter need not be referred to the President for final solution, the three groups agreed that, on balance, tritium should be added to the list of isotopes shipped to private users. The Commission informed the Joint Committee by letter dated June 24, 1948 and addressed to Senator Mickenloper. It stated in toto as follows:

"The Commission has recently authorized the addition of two isotopes for distribution in limited amounts in this country to the list of those already available for off-project use. These ad-

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The 1947-48  
tritium  
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Declassification Program, 20th Anniversary, January, 1953  
The Doc # DLXXXIV H-Font Character

History of Atomic Bomb and its  
Development by Dr. H. A. J. Curran

20th Anniversary  
Doc # 10



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ditional isotopes are tritium, a radioactive isotope of hydrogen, and helium-3, a stable isotope of helium. The Commission's action includes declassification of basic data on these isotopes.

"Distribution of tritium will make available to the research workers in this country a powerful tool for investigating many fundamental problems of biology, medicine and organic chemistry, including studies of plant growth, physiological processes and syntheses of biological and pharmaceutical materials. The peculiar usefulness of tritium in the above applications lies in the fact that it is the only radioactive isotope of hydrogen, which occurs in virtually all organic molecules. In addition, tritium is of fundamental interest to modern nuclear theory.

"Distribution of these isotopes has been approved after careful consideration by the Commission of security problems. The Commission believes institution of this program will greatly strengthen two aspects of the present situation as regards security. One of these concerns the implications as to the extent of the Commission's present interest in tritium which can be drawn as a result of the anomalous and rather obvious silence on this fundamental, widely useful, and rather easily made (in reactors) isotope which it is known the Commission possesses.

"The second aspect concerns the broader security implications connected with a serious need for developing and extending sources of very fundamental information and for encouraging and strengthening basic research on isotopes of this sort. The problems connected to the possible application of tritium are very long range in nature and depend very strongly on new advances in theory and experiment. It is our belief that strength and security depend, in no small measure, on progress in fundamental science and that such progress overshadows any possible losses from revelation of information attending this action.

"The British and Canadian reactors will soon be able to produce tritium and it is to be expected that soon other nations can and probably will readily repeat the basic measurements on tritium, since only very small quantities are required.

"The Military Liaison Committee has no objections to the Commission's action to authorize domestic distribution of tritium and helium-3 to off-project agencies and the declassification of basic data on these isotopes. The General Advisory Committee has strongly endorsed the program.

"We will be glad to furnish any further information the Committee may desire on this matter."

The Commission also informed the Joint Committee about tritium in the January 31, 1949 Progress Report under a discussion of slug failures in one of the Hanford piles, as follows:

"This [file] interruption resulted from a burst lithium fluoride slug which was being irradiated for the production of tritium (hydrogen 3)."

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On March 8, 1949 the Joint Committee staff director wrote the Congressional liaison officer of the Commission outlining topics for discussion in the forthcoming March 10, 1949 meeting with the Commission. Two of the five topics for which coverage was requested were the "super bomb" and "plans for the 1951 tests, the types of weapons to be tested, and the reasons therefor." Those matters came up in the March 10, 1949 meeting; and the Commission, at its own request, gave testimony off-the-record. The H-bomb was not mentioned, but there were references to the Booster shot scheduled for 1951.

The following is the pertinent extract from an August 17, 1949 memorandum from the Committee staff director to the file after a conference with Brigadier General McCormack, Director of Military Applications, AEC:

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"I asked whether or not sufficient emphasis is being placed upon the so-called super bomb and experiments in that connection. Gen. McCormack explained that work on T35 and the [redacted] involve refinement of the existing implosion weapon and that such refinement is a necessary condition precedent to achievement of the fantastic temperatures necessary to create a thermo-nuclear reaction. In other words, just as most of the [redacted] work planned for Arco [redacted] is identical with what would have to be done if our supreme and overriding objective were a nuclear airplane, so the work on T35 and the [redacted] are likewise identical with what would be necessary to do if a thermo-nuclear weapon were our supreme and overriding objective. Gen. McCormack specifically endorsed the appropriateness of this metaphor. As a matter of fact, he pointed out that the giving of priority to T35 should not be taken to imply that this work is proceeding at the expense of the so-called super bomb. The latter is in a purely research phase whereas the former is in a developmental phase - and the awarding of priorities is meaningful chiefly with respect to development and not with respect to research. In short, he gave the impression that we were traveling along the road toward a thermo-nuclear reaction as rapidly as is possible. By the same token, the Soviets will hardly succeed in bypassing extensive work on uranium bombs and moving directly to super bombs."

The 1949  
Soviet explo-  
sion.

F. The Soviet Explosion. On September 23, 1949, President Truman announced an atomic explosion within the Soviet Union. This event occurred one year before "the earliest possible date" and four years before "the most probable date," as officially estimated to the Joint Committee by the Central Intelligence Agency.

The following are extracts from a December 10, 1952 letter written by former AEC Commissioner Lewis L. Strauss at the Joint Committee's request:

"In November, 1946, when the U. S. Atomic Energy Commission was set up, the best informed U. S. estimates of Soviet capabilities in the fields of nuclear research and large-scale engineering placed the possible completion of the first Russian atomic weapon in a future period between 1955 and 1960, with the majority of opinion tending to the later date. I was concerned with the validity of these estimates for several reasons,--(A) publication of the Smyth report had saved the Russians time which would have been expended in several unproductive approaches

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to the problem if they had gone down the same roads that we did; (B) Russian disregard for safety factors would enormously simplify their atomic enterprise compared with ours; (C) in so new an art, there was always the possibility of a shortcut which we had not found; (D) the Canadian spy exposures convinced me that espionage had already yielded returns to the Soviets and that there were most probably other traitors who had continuing access to our own project.

"As you are aware, I at once undertook to see what was being done to watch for a test of an atomic weapon by the Russians, similar to the tests we had made at Alamogordo in 1945 and at Bikini in 1946. When I discovered that we were conducting no monitoring of any kind, I called on Secretaries Forrestal and Patterson with as strong an argument as I could make and responsibility was thereupon assigned to a part of the Services, as you know. While monitoring was thereafter instituted, it did not become an effective enterprise until well into 1948 and there were substantial lapses when no monitoring was done. An atomic explosion which occurred in Russian territory was detected in August, 1949. It is regularly referred to as the "first" but there is no evidence that it was actually the first Russian test. There have been at least two atomic explosions in Russian territory since that date."

"The first detected test or explosion was announced to the public by the President on 23 September 1949. On 5/ October following, I wrote a memorandum to my fellow Commissioners on the Atomic Energy Commission in which I stated that we were confronted by a condition where our relative lead could no longer be maintained, irrespective of how many A-bombs we might make, and that even our arithmetical superiority could be cancelled out by a surprise attack...."

"Some previous work of a theoretical nature had been done on the so-called super-bomb under the Manhattan District but it had been shelved in favor of improvement on the A-bomb...."

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Memorandum for the President, JCRF (Security), January 1, 1953  
JCRF Doc # DLXXXIV H-Form Chron 1025

Chronology of Atomic Bomb and its  
Development by Dr. Robert Serber

Doc # 1025

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IV. From the Russian Explosion to the President's H-bomb Decision.

September 23-29  
1949

On the afternoon of the President's announcement of the Soviet atomic explosion and on succeeding days, the Joint Committee met with the Atomic Energy Commissioners and others to discuss all ways and means of rapidly increasing U.S. production of atomic weapons. The agenda for discussion, prepared by the Joint Committee, included "all-out" hydrogen bomb efforts.

"Testimony by the Commission before the Committee on September 29 on "all-out" effort to develop hydrogen bombs was in toto as follows:

Committee raises  
H-bomb issue.

"The Chairman. The next subject is all-out efforts toward thermonuclear bombs.

"Mr. Wilson. On that as you know, one of the models to be tested in 1951 is the booster, which is a step toward a possible thermonuclear bomb, and this is going to take, I think, all of the energy and efforts that can be expended on it between now and the test in 1951 to have a booster ready, so that perhaps General McCormack can add to that, but we feel that there is a large amount of effort on that, and about all that can be poured into it at this time.

"General McCormack. I think that that is true. We reviewed about a year ago, or a year ago last summer, with the National Military Establishment, the program leading toward a really super-weapon, a thermonuclear weapon and as best as anyone could see then the first and necessary step would be something along the lines of the booster as laid out and that would take two or three years to do.

"The thermonuclear weapon itself according to our best scientific advice is a really major endeavor and can certainly spread over a period of a number of years. We have got to achieve temperatures greater than we have achieved in any atomic explosion thus far even to trigger the thing if it can be triggered. That is a fact that we are trying to determine in the next test--Can it be triggered? Because if it can then there is a huge development program ahead of us.

"The Chairman. If it were achievable, how many times would it magnify the destructiveness of the present bomb?

"General McCormack. If all of the theory turned out, it is infinite. If all of the theory turned out you can have it any size up to the sun or thereabouts that you wanted. I think one talks in terms of the super weapon as being one million tons or more of the TNT equivalent.

"Commissioner Pike. There is some question as to who would want to fly the airplane.

"General McCormack. As near as theory can say now, it will be a huge thing. Delivery by railroad train or perhaps boat seems to be in order.

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the Doc # DLXXXIV  
H-bomb Chronology  
January, 1953  
Chronology of Atomic Bomb and its  
Development in Duration  
JCHP Doc 540  
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"Commissioner Pike. There is one point that goes on with that that perhaps might be brought in here, that in the use of tritium, hydrogen 3, it requires a great deal more reactivity than we have in any pile we have built or under contemplation unless we look forward to a considerable reduction in plutonium production.

"My own belief is that if we look forward to a success of the booster in 1951, it is not too early to put in the works right now another pile beyond our plutonium production pile, devoted to the production of hydrogen 3 in considerable quantities. This would be doing quite a little finessing, and a month or so ago I would have questioned even the sense of bringing it up. I don't question it now and I think that it should be put on the table."

September, 1949

Start of  
lithium-6  
program.

The Quarterly Progress Report for the summer and early fall, 1949, stated that lithium-7 "may be of great value as a reactor coolant" but that "Lithium-6, on the other hand, absorbs neutrons readily and its presence in a reactor coolant would have a poisoning effect. Oak Ridge National Laboratory has begun an investigation to determine whether these lithium isotopes can be economically separated on a large scale by means of distillation."

October 5, 1949

Commissioner Strauss sent the following memorandum to the four other Atomic Energy Commissioners:

The Strauss  
memorandum.

"The purpose of this memorandum is to raise a question for immediate consideration in the light of the information as to progress which has been apparently made in Russia.

"In the days since the President's announcement I have found a tendency in my own thinking to resort to the prospect of increased production of fissionable material and weapons as the logical procedure. Although this is very important, I now feel strongly that it is not enough. The frequently expressed thought that we must 'maintain our lead' is generally taken to mean that we must have a larger stockpile of weapons than the Russians because we began sooner and can make them faster. Of these latter considerations, however, only the fact that we began sooner can be relied upon absolutely. And, in any case, we can only maintain our lead in some arithmetical difference since our relative lead is most likely to decrease.

"It seems to me that the time has now come for a quantum jump in our planning (to borrow a metaphor from our scientist friends)--that is to say, that we should now make an intensive effort to get ahead with the super. By intensive effort, I am thinking of a commitment in talent and money comparable, if necessary, to that which produced the first atomic weapon. That is the way to stay ahead.

"I recommend that we immediately consult the General Advisory Committee to ascertain their views as to how we can proceed with expedition."

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This memorandum was taken by Commissioner Strauss to Admiral Sidney Souers, Executive Secretary to the National Security Council, with a request that it be shown to the President--and some days later the President did see it. Mr. Strauss also took the memorandum to Senator McMahon, Chairman of the Joint Committee, on October 6, 1949.

October 10, 1949

The Lawrence-Alvarez luncheon.

As reflected by a memorandum in the Joint Committee files, the following developed from a luncheon at which Dr. Lawrence and Dr. Alvarez of the Berkeley Radiation Laboratory and Senator McMahon and Mr. Minshaw of the Joint Committee were among those present:

"The two scientists expressed keen and even grave concern that Russia is giving top priority to the development of the thermonuclear super-bomb. They pointed out that the Russian expert, Kapitsa, is one of the world's foremost authorities on the problems involved in light elements. This fact, along with the logic that Russia might experience great difficulty in competing with us in the production of 'conventional' atomic bombs, means that she has every incentive to concentrate on being first to acquire the super-bomb. Drs. Lawrence and Alvarez even went so far as to say that they fear Russia may be ahead of us in this competition. They declared that for the first time in their experience they are actually fearful of America's losing a war, unless immediate steps are taken on our own super-bomb project...."

"Dr. Lawrence said that not nearly enough is being done on the super-bomb at present; that the contemplated Booster test in 1951 is only a mincing step...."

"Another point which Dr. Lawrence made was that a super-bomb might be obtainable within 1 1/2 or 2 years, assuming that an all-out wartime type of effort is made. Both scientists expressed concern because our own atomic project is so small and involves such a meager outlay of money and resources relative to the size of our total defense effort, and relative to the size of the effort which the Russians may have elected to exert."

October 11, 1949

AEC raises H-bomb issue with GAC.

Following the discovery of Russia's achievement of the A-bomb, the Commission instituted a review of the atomic energy program and consulted with the General Advisory Committee. The H-bomb problem was considered necessarily raised with the GAC by the following sentence in the Commission's letter to them on this date: "The Commission is, of course, asking itself afresh in the light of the Russian explosion if the presently planned program constitutes doing everything that is reasonable and possible for us to do for the common defense and security."

October 13, 1949

The Joint Committee issued a report to Congress stating that "Russia's ownership of the bomb, years ahead of the anticipated date, is a monumental challenge to American boldness, initiative, and effort."

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H-Comb Chronology  
Chronology of H-bomb & bomb work  
Warren W. Brown by Durham  
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October 13, 1949

Controversy over whether to engage in a major H-bomb program existed at Los Alamos, as elsewhere. Preparatory to a discussion of the Laboratory program with the Commission scheduled for October 19, a major meeting of Laboratory personnel was held on the H-bomb question at Los Alamos. Sentiment was in favor of a major program. ✓

Dr. Teller addressed an open letter to the Laboratory entitled "Super Bomb and the Laboratory Program," which outlined "why it is essential for us to develop a Super Bomb at the earliest possible time or else be able to say with reasonable confidence that the Super is not feasible." It stated in part as follows:

"It seems that the Russian rate of progress is at least comparable to, if it does not exceed, the rate of progress in this country.... If the Russians continue to make actual progress faster and if we lose the atomic armament race, it will make little difference whether the reason has been the particular brilliance of Russian scientists or the exaggerated caution and thoroughness of our own group...."

"If the Russians demonstrate a Super before we possess one, our situation will be hopeless."

Dr. Teller proposed an "all-out" effort, if the Laboratory "can marshal the necessary support from Washington for a really vigorous program."

Although Dr. John Manley eventually opposed an H-bomb program and resigned from the Los Alamos laboratory after the Presidential decision to proceed, he addressed an open letter to his colleagues on October 13, 1949 reading in part as follows:

The Manley letter.

"Whatever statements the National Military Establishment or the Atomic Energy Commission have made or may make concerning the effect of the detonation of a Russian bomb, the Laboratory should admit at least to its own personnel that the current Laboratory program has not been geared to such an event in 1949. Rather, it has been tacitly assumed that this event would not occur before 1952, a date beyond the expected 1951 fruition of current programmatic work [i.e., the boosted A-bomb test]. At the very least, therefore, the Laboratory should consider that it has lost some three years of time. Nor is this all, for the simplest assumptions as to relative rate of progress of this country and the USSR give strong support to the contention that it would be dangerous to assume that their progress is any less than ours; in fact, it can be quite likely maintained that it is appreciably greater.... The Laboratory is to be discussed with the Commission on October 19.

"Certain trends of reactions to the situation are apparent. They range from an all-out effort to make a real discontinuity in the rate of power as rapidly as possible by developing the super-bomb to almost a

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'business-as-usual' attitude but involving as much speedup as possible in the normal type of business, the production of present-model weapons. The Russian achievement should teach us at least one thing: that our state of ignorance of their efforts is so nearly complete that we should no longer assume any time scale for their developments but rather choose our action so as to strengthen our position as rapidly as possible and maintain a rate of progress limited only by our resources for a relatively long period of time."

October 14, 1949

The Joint Committee invited General Bradley, General Vandenberg, Admiral Struble, and others to testify on the hydrogen issue. A memorandum prepared immediately after the meeting contains the following, in part:

Views of the  
Joint Chiefs.

"One of the things which the military is pre-eminently concerned with as a result of the early acquisition of the bomb by Russia is its great desire that the Commission reemphasize and even accentuate the development work on the so-called super-bomb. General Vandenberg discussed this subject briefly and stated that it was the military point of view that the super-bomb should be pushed to completion as soon as possible, and that the general staff had so recommended. In fact, his words were, 'We have built a fire under the proper parties'—which immediately brought forth Senator Hickenlooper's comment, 'Who are the right parties?' General Vandenberg replied that it was being handled through the Military Liaison Committee." Within the MLC the Air Force members advocated development of the H-bomb. Admiral Ofstie initially expressed opposing views. However, following extensive discussions, all MLC members essentially agreed that for politico-psychological reasons the United States could not afford to be second in achieving such a weapon. The MLC was thus unanimous in recommending that feasibility be determined."

October 17, 1949

McMahon  
recommendation  
for H-bomb.

Senator McMahon wrote to Mr. Lilienthal to urge that our hydrogen weapons effort be "as bold and urgent as our original atomic enterprise." He also requested a detailed report on: "the history of our activities in the super bomb field; what is now being done and planned to be done; and whether or not an all-out, supreme effort comparable to the Manhattan District wartime endeavor is contemplated...." The Senator concluded his letter by stating that "it is the sense of the Joint Committee that the current situation dictates unusual and even extraordinary steps...."

In a meeting with Admiral Hillenkoetter, Director of CIA, Senator McMahon stated that "the detection of Russian progress upon the super-weapon is of the greatest and utmost importance to us. Because, frankly, if they should get it and we should not have it...it might well mean the difference between our existence as a nation and not existing.... You are bearing a very heavy responsibility."

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October 18, 1949

The Committee discussed at length ways and means of increasing atomic production and accelerating the hydrogen program. [The Boosted A-bomb test, scheduled for 1951, was again described by the Commission as the first step. It was recognized that enough tritium would be available only for this shot,] and that development of tritium production would take time. Commissioner Dean stated that the Super was "in the blackboard stage."

In this meeting Senator McMahon stated that "the job of the Committee now is a full-speed attack on the super bomb program, and that is going to call for a larger budget estimate."

October 19, 1949

On this date Dr. Bradbury, Director of the Los Alamos Laboratory, gave the Commission preliminary views of what the laboratory could do to carry forward thermonuclear work.

October 22, 1949

Senator McMahon wrote Secretary Johnson requesting a report on long range detection of Soviet efforts toward super weapons.

October 27, 1949

A subcommittee under the chairmanship of Representative Holifield and including Representatives Price, Jackson, and Hinchshaw, met at Los Alamos and discussed the hydrogen bomb problem. Dr. Bradbury, the laboratory director, showed that achievement of a hydrogen weapon might bring about a "vertical discontinuity" upward in the curve representing future Los Alamos progress in bomb development. He said that this might be accomplished in three years--i.e., by 1952--with urgency short of the wartime effort.

October 28, 1949

The subcommittee, under Mr. Holifield, and including Senator Knowland, met at Berkeley, California, and discussed with Dr. E. O. Lawrence the hydrogen program and the fastest possible means of achieving a gram of neutrons per day for tritium production.

October 30, 1949

The General Advisory Committee to the Atomic Energy Commission unanimously recommended against pursuing the development of the super bomb with high priority.

G.A.C. recommendation against H-bomb.

While the GAC "strongly" favored the boosted A-bomb program, it was the "opinion of the majority that the super H-bomb itself should not be undertaken and that the Commission and its contractors understand that construction of neutron producing reactors is not intended as a step in the super program." The General Advisory Committee further stated that "no member of the Committee was willing to endorse the proposal 'to pursue' the development of the super bomb 'with high priority'." The General Advisory Committee reported further as follows:

"It is notable that there appears to be no experimental approach short of actual test which will substantially add to our conviction that a given model will or will not work, and it is also notable that because of the unsymmetrical and extremely unfamiliar conditions obtaining, some considerable doubt will surely remain as to the soundness of theoretical anticipation. Thus we are faced with a development which cannot be carried to the point of conviction without the actual construction and demonstration of the essential elements of the weapon in question. This does not mean that further theoretical studies

Dr. Glenn Seaborg made a statement  
that the GAC did not  
participate in a decision

against pursuing

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could be without avail. It does mean that they could not be decisive. A final point that needs to be stressed is that many tests may be required before a workable model has been evolved or before it has been established beyond reasonable doubt that no such model can be evolved."

G.A.C. comment  
on feasibility.

The Committee stated that it was "unable to give a specific probability rating for any given model," but that "an imaginative and concerted attack on the problem has a better than even chance of producing the weapon within five years."

The report further stated:

G.A.C. raises  
moral issue.

"It is clear that the use of this weapon would bring about the destruction of innumerable human lives; it is not a weapon which can be used exclusively for the destruction of material installations of military or semi-military purposes. (Its use therefore carries much further than the atomic bomb itself the policy of exterminating civilian populations.) It is of course true that super bombs which are not as big as those here contemplated could be made, provided the initiating mechanism works. In this case, however, there appears to be no chance of their being an economical alternative to the fission weapons themselves. It is clearly impossible with the vagueness of design and the uncertainty as to performance as we have them at present to give anything like a cost estimate of the super. If one uses the strict criteria of damage area per dollar and if one accepts the limitations on air carrier capacity likely to obtain in the years immediately ahead, it appears uncertain to us whether the super will be cheaper or more expensive than the fission bomb."

The report concluded as follows:

"Although the members of the Advisory Committee are not unanimous in their proposals as to what should be done with regard to the super bomb, there are certain elements of unanimity among us. We all hope that by one means or another, the development of these weapons can be avoided. We are all reluctant to see the United States take the initiative in precipitating this development. We are all agreed that it would be wrong at the present moment to commit ourselves to an all-out effort toward its development."

"We are somewhat divided as to the nature of the commitment not to develop the weapon. The majority feel that this should be an unqualified commitment. Others feel that it should be made conditional on the response of the Soviet government to a proposal to renounce such development. The Committee recommends that enough be declassified about the super bomb so that a public statement of policy can be made at this time. Such a statement might in our opinion point to the use of deuterium as the principal source of energy. It need not discuss initiating mechanisms nor the role which we believe tritium will play. It should explain that the weapon cannot be explored without developing it and proof-firing it. In one form or another, the statement should express our desire not to make this development. It should explain the scale . . .

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and general nature of the destruction which its use would entail. It should make clear that there are no known or foreseen non-military applications of this development. The separate views of the members of the Committee are attached to this report for your use."

H-bomb conference cancelled.

Plans were cancelled for a major H-bomb conference with senior scientists not then in the atomic energy program, scheduled to meet at Los Alamos on November 7, 1949.

November 1, 1949

Senator McMahon wrote the President requesting that in case the President felt inclined not to press ahead with the H-bomb, the Senator be given an opportunity to be heard.

November 2, 1949

The President replied to Senator McMahon's letter of the day before by saying that the hydrogen problem had not yet reached his desk but agreeing to the Senator's request to be heard, if necessary.

November 4, 1949

In the foreward to the Quarterly Progress Report submitted on this date it is stated that "one result of the Soviet accomplishment is to make somewhat plainer the reasons for the high sense of urgency the Commission has been seeking to inculcate and maintain throughout the atomic energy enterprise. Equally important perhaps, the September announcement is leading to a re-evaluation of the minimum elements of the Commission's program."

First A.E.C. document to Joint Committee on H-bomb

The foreward also stated that "The Commission is currently giving consideration to the problems relating to thermonuclear weapons and is discussing these problems with the General Advisory Committee and representatives of the Department of Defense and the Department of State." In the body of the report, the thermonuclear program is referred to as follows: "Booster weapon. Development continued on an experimental weapon for test in 1951 which uses small amounts of hydrogen isotopes to 'boost' the yield from a fission weapon. This booster weapon, as previously reported to the Joint Committee, has been part of the Los Alamos Laboratory program for some time. Development of a booster weapon could be an initial step in the thermonuclear field. Thermonuclear reactions may offer the possibility of very great energy yields through fusion of the light elements."

This Progress Report was the first document ever sent to the Joint Committee that mentions the super bomb or H-bomb.

November 8, 1949

In briefings at Los Alamos, it was stated to Senator McMahon, Chairman of the Joint Committee and to Mr. LeBaron, Chairman of the MLC, that Los Alamos expected to develop a Super in the normal course of events by 1959 or thereabouts.

November 9, 1949

A.E.C. recommendation against the H-bomb.

The Commission referred the hydrogen-bomb issue to the President for decision, together with technical data, the views of the Commissioners, the report of the General Advisory Committee on this issue, and the views of individual members of the GAC. (The Commission split on the issue, with a majority of three--Commissioners Lilienthal, Pike and Smyth--recommending against an immediate major hydrogen program; and a minority of two, Commissioners Strauss and Dean favoring such a program.)

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It will be recalled that Commissioner Strauss on October 5, 1949 recommended maximum H-bomb effort and that the Commission immediately consult the GAC "as to how we can proceed with expedition." Six days later, on October 11, 1949 (according to testimony before the Joint Committee given January 27, 1950) the Commission considered the H-bomb issue "necessarily raised" with the GAC by the following sentence in a letter to the GAC of that date: "The Commission is, of course, asking itself afresh in the light of the Russian explosion if the presently planned program constitutes doing everything that is reasonable and possible for us to do for the common defense and security."

The Commission further testified before the Committee that in making its referral to the President on November 9, 1949 the issue before the Commission "was really framed by the GAC" as follows:

"the General Advisory Committee recommended that we should not go ahead with a high priority hydrogen bomb program, that the country should not go ahead with it, and that the President should make an announcement to the effect that we were not going ahead with it."

November 18, 1949

A technical report, "Preliminary Survey of Physical Effects Produced by Superbomb," was published in Los Alamos by Drs. Reines and Snydman. A 40-megaton weapon (i.e., a weapon having an energy release equivalent to 40-million tons of TNT) was assumed for this study of H-bomb effects. It was concluded that winds of hurricane velocity would cover an area of about 400 square miles; that such a bomb would char wood at 20 miles; and that it "would clearly be extremely effective against troop concentrations over areas of the order of at least a few hundred square miles."

November 21, 1949

McMahon letter to the President.

Senator McMahon, following conferences at Sandia, Los Alamos, Hanford, Argonne and elsewhere in connection with the hydrogen bomb problem, wrote the President a 5,000-word letter. It urges in vehement terms that the hydrogen program go forward not only from a development but also from a production viewpoint, on a "crash basis," and that our military thinking be realigned to take in super weapons manufactured on a quantity basis.

The letter concluded that:

"Although any other decision would almost guarantee disaster for our nation, in my opinion, I thoroughly agree with the opposite school of thought that armaments races lead to war. I agree that ours are the cities most threatened by the super. I agree that if war comes--and if it is postponed until Russia accumulates a stockpile of supers and fission bombs, or even fission bombs alone--Western civilization may well crumble whether we win or lose. I consider the most significant single aspect of the present situation to be this: With each day, week, and month that passes, the Kremlin acquires an added supply of fissionable material. My thesis, however, is that if we let Russia get the super first, catastrophe becomes all but certain--whereas, if we get it first, there exists a chance of saving ourselves...."

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"Since this issue, involving as it does survival of extinction of whole populations, transcends all others of importance, it should be treated in the most important possible manner."

Copies of this letter were later sent to the Secretary of State, the Secretary and Deputy Secretary of Defense and the Chairman of the A.E.C.

November 25, 1949

Senator McMahon verbally advised the President that, in the Senator's opinion, the Joint Committee strongly advocated the most vigorous hydrogen program and that the great majority of the Joint Committee members would agree with the opinions expressed in his letter of November 21, 1949. The President stated that a three man subcommittee of the National Security Council, consisting of the Secretaries of Defense and State, and the Chairman of the Atomic Energy Commission, had been appointed to study and make a recommendation on the Super. (Referred to below as the Atomic Energy Committee of the N.S.C.)

November 28, 1949

Mr. Lillenthal, in reply to Senator McMahon's letter of October 17, 1949, concerning the super bomb and expansion of production facilities, stated the Commission's views on the super bomb had been transmitted to the President.

December 3, 1949  
Further G.A.C.  
recommendation  
against the  
H-bomb.

The General Advisory Committee filed a further report, again unanimously recommending against large-scale efforts to develop a hydrogen bomb.

December 7, 1949

The November 9, 1949 memorandum of A.E.C. to the President raised but left open the question of how many "super-bombs" might be exploded without polluting the atmosphere with radioactive substances. On December 7, 1949, the Commission stated in a further letter to the President that on a "very conservative" basis the number was 500, and that with less conservative figures, the number might reach 50,000.

December 30, 1949

The commission, in response to Senator McMahon's letter of October 17, 1949, submitted a history of United States activities in the super bomb field. This five page history states that thermonuclear work at Los Alamos "reached its highest intensity in the Spring of 1945, continuing for several months after the end of the war."

After this period, the report stated, "no progress was being made on the 'Super' bomb until the Summer of 1947" when the possibilities were again reviewed. At this review, it was said, "There were still some doubts but the conclusion stated was that the 'Super' was probably feasible."

The development next in importance after 1947 was said to be the program proposed for calendar 1949 for Los Alamos. The program comprised four aspects: (1) continued theoretical research on the "Super"; (2) theoretical study of nuclear interactions between light elements; (3) development of the "Booster", a device to increase the efficiency of an ordinary A-weapon; and (4) study of a gun-type weapon to ignite a "Super" bomb.

The report stated that this program was approved with qualifications that: "The Commission will be prepared to support the fabrication and testing of at such time as it is clear that the testing of such a weapon is the bottleneck in the development

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of a 'Super'. Information available to the Commission does not indicate that this is the case at present." The report concludes that--with the announcement by President Truman of the first Russian atomic tests--"several scientists at Berkeley and at Los Alamos began to feel that the United States has no effective alternative to a very great effort towards the development of thermonuclear weapons. Proposals for greatly expanding the production of tritium and for rapidly accelerating the development of thermo-nuclear weapons have been made."

January 3, 1950

Senator McMahon wrote President Truman two letters concerning the urgency of the hydrogen bomb program.

January 9, 1950

The Joint Committee met in Executive Session and discussed the views of the General Advisory Committee in extenso, as well as new piles to permit tritium production. The October 30, 1949 report of the General Advisory Committee and the supporting views of individual GAC members against an immediate major hydrogen bomb program were read. The November 21, 1949 letter of Senator McMahon to the President was also read and discussed. Senator Knowland stated that "it is inconceivable to me that this country would get itself into a position where the Soviet Union might have it the H-bomb and we would be left without it."

January 11, 1950

✓ No report from Central Intelligence had yet commented on "Super" bomb activity in the U.S.S.R. On this date, Senator McMahon wrote Admiral Hillenkoetter, Director of the Central Intelligence Agency, and requested that any significant information indicating Soviet efforts to build a super-bomb be brought to the attention of the Joint Committee immediately.

January 18, 1950

Senator McMahon again wrote the President concerning the urgency of a decision on the hydrogen bomb issue.

January 20, 1950

The Joint Committee met with the Joint Chiefs of Staff and discussed the hydrogen bomb program. General Bradley, in his opening statement, stated that the views of the Joint Chiefs of Staff were as follows:

"We believe that an effort should be made to develop the thermonuclear bomb. Just how much of a crash program you make out of it is open to argument and maybe you shouldn't call it a 'crash' program but we do believe that certainly the steps to develop it should be taken much faster than have been taken in the ordinary course of events at Los Alamos.

The production  
issue: JCS views.

"One way to express it might be that we believe it ought to get top priority, certainly to the point where we find out whether or not the thermonuclear bomb is feasible. We feel that such a program could be carried out for \$100 millions or \$200 millions if you do not try to develop at the same time production facilities and methods. We feel at the present time that we should not go to that until we find out it is feasible."

Later in the meeting, discussion again touched on the question of whether the hydrogen program should go forward on a production as well as an experimental basis. The following is recorded:

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"Senator McMahon. ...We can go ahead with the \$100 to \$200 million developing a hand-made bomb and then wait...and seeing whether it will work or not, and then set up, for want of a better term...a production line for the other bombs.

"That would, in my opinion, endanger us very much. Regardless of the cost of setting up the production line simultaneously with your experimental plant, it would seem to follow to me at least, that we might have to do it for this reason, that the Russians...have been working as we know, back in the 1930's on fission, and we also know that when the bomb was exploded in Hiroshima they suffered, according to them, a blow to their prestige to say nothing of the shift in the balance of power in the world....

"What is to guarantee that they will not, having achieved the A-bomb, forego stockpiling and imitate us, and why wouldn't they go right into the thermonuclear field? If they do that, what is to guarantee that they will not produce one as quick or quicker than we will?

"I think one of the worst things that we could do ourselves is to continue this business of under-estimating them and over-estimating ourselves.

"Senator Tydings. I don't think that we have any choice.

"Senator McMahon. We were 40% wrong on the estimate of the time that they would have a bomb. Now, 40% wrong on the next estimate and we aren't going to have any time with which to think about it because we won't be here to do the thinking.

"Senator Millikin: I suggest that 40% wrong is 100% wrong. If you miss a train by five seconds you might as well miss it by five hours.

"Senator McMahon: That is very well taken. It therefore seems to me that we should gear our thinking upon the basis -- I don't like the term 'crash', but certainly on an all-out effort to bring this along as fast as we can, both on the production and experimental and do them simultaneously, and that is the way we did the Oak Ridge proposition."

January 23, 1950

[Admiral Hillenkoetter, Director of CIA, replied to Senator McMahon's letter of January 11, 1950, and stated that "there is essentially no information available at the present time ... to estimate Soviet capabilities with regard to super-bomb development and production -- but the resolution of this problem is first priority in our efforts on the Soviet atomic energy program at the present time."]

January 24, 1950

In Britain Klaus Fuchs confessed to espionage.

January 25, 1950

Dr. Smyth, on behalf of the Commission and at the request of the Joint Committee, furnished cost estimates for development of the thermonuclear bomb. Development through process test was estimated to cost somewhere between \$61 million and \$107 million. Of this figure, between \$30 and \$50 million was charged to the Eniwetok tests and between \$31 and \$37 million was allocated to operating expenses at Los Alamos, additional Los Alamos facilities, and the cost of producing tritium at Hanford.

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RE Doc # DLXXXIV H-Emb Chron 1953

Continuation of Atomic Bomb Draft by  
written by Dickson

SCAF Com Staff  
Dec 1950

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January 27, 1950

Strauss  
testimony

Between \$20 and \$50 million was roughly estimated for ordnance engineering; and new production reactors for approximately [redacted] was estimated to cost between \$100 million and \$200 million. The total estimated expense for the next three years came to between \$181 million and \$357 million, of which approximately one-half was for new reactor facilities to manufacture tritium.

The Committee exhaustively explored with the Commission the hydrogen bomb problem and the 3 to 2 recommendation of the Commission against immediately proceeding. Tritium production was also discussed. Commissioner Strauss testified as follows on his position:

"I made for my own purposes a number of premises. The first was that the production of such a weapon appears to be feasible, that is to say, there appears to be at least a 50-50 chance of it being successful. In that I believe that my colleagues and I are in general accord.

"Second, that the recent accomplishments by the Russians indicate that the production of thermonuclear weapons by them is not outside of the field of their technical competence. If they could make an atom bomb they could probably make that.

"The third was that I did not feel that there was any likelihood that they would be dissuaded from doing it on moral grounds. I won't go into any lengthy discussion of that, but I didn't see how a government of atheists could necessarily be swayed by a moral consideration....

"My fourth premise was that there was no secret about this, because the possibility of producing a thermonuclear weapon had been suggested a number of years ago and it was in the general literature, and it was not a matter which was an invention, a secret invention or idea of our own, that there was every reason to suppose that Russian scientists were familiar with the idea or the notion as we were.

"My fifth assumption was that the time in which the development of such a weapon could be perfected was of a considerably shorter order than that which had been required to produce the atomic bomb, and that it was not possible for any of us to guess when such a development might start in Russia or might have already started, and that therefore the sands were running out of the glass.

"My sixth premise was that the historical policy of our government is not to have its military forces less well armed than those of any other country. I cite the Naval Agreement, and there are various other agreements that established that policy.

"My final assumption, which we have learned a good deal more about as Dr. Smyth has testified, was that there might very well be tactical employment of such a weapon that was not applicable to the atomic bomb.

"I thereupon came to the conclusion that we should go ahead and produce the bomb, or try to produce it, firstly because I didn't think a statement that we would unilaterally renounce it would be credited in the Kremlin; secondly that when and if after such a

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statement, we subsequently decided to produce the weapon, it would be tantamount to a declaration of hostile intent; and thirdly, because until general disarmament is universal, our arsenal must not be less well equipped with weapons than the arsenal of any other country in the world."

Dean testimony

Commissioner Dean testified that he entertained virtually identical views, and further that the program submitted by Los Alamos suggested (if given a "go-ahead") that the laboratory might be able to conduct a major test in 1952.

In this meeting Chairman McMahon observed:

"...I want to advert for a moment to the possibility which I am very frank to say disturbs me very much, the possibility of making this thing directly out of deuterium without the intermediary of tritium.

"It occurs to me that if that is a possibility of even ten or fifteen percent, we could well be in desperate danger within months."

The following also was said:

Outlook for peaceful uses

"The Chairman. Doctor, the GAC recommendation had one statement in it that rather surprised me. It had many statements that surprised me but one in particular that intrigued me was the statement that the development of the super bomb would result or could result in no useful acquisition of future useful methods in industry or for the good of mankind. They said that with great certainty.

"Isn't that contrary to the usual scientific approach, namely, that any development that is made in science may have great potentialities for the use of mankind?

"Commissioner Smyth: I think that you have me nicely on the horns of a dilemma, because I think scientists often do make the second statement that you have made, and on the other hand I agree with the first statement, with the statement of the GAC, as far as I can judge. I suppose the answer would be this, that there might be by-products of some of the investigations, and I don't see quite what, but there might be, that could be useful. But here we are dealing with such enormous temperatures and pressures that as far as the process itself is concerned we can't see any, or I can't conceive of any peaceful use for it. I can't conceive at the present time of any thermonuclear automobile, so to speak."

January 30, 1950

The Committee met with Dr. Oppenheimer, Chairman of the General Advisory Committee, to hear his views on the hydrogen problem. The Committee discussed a recommendation by the Joint Committee to the President on the hydrogen issues. In this meeting, as in the three previous meetings, the Committee discussed the desirability of publicly recommending an all-out hydrogen program.

On the same day, Dr. M. W. Perrin, the British physicist, interviewed Klaus Fuchs for four hours. In this interview Fuchs disclosed the details of the technical information which he had passed to Russian agents from 1942 to 1949.

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January 31, 1950

Presidential  
decision to  
determine  
feasibility.

President Truman announced his decision in favor of a stepped-up hydrogen program. The responsibility for determining the rate and scale of the thermonuclear effort was lodged jointly in the Commission and in the Department of Defense.

The same day he had received a recommendation to this effect from the Atomic Energy Subcommittee of the National Security Council, which had met in the morning. The recommendation came from Secretary of State Acheson and Secretary of Defense Johnson.

[A memorandum of the staff director attached to the Joint Committee minutes for January 31, 1950 indicates as follows:

The decision on the H-bomb was reached two or three weeks earlier than expected by the Joint Committee, which had been seriously discussing whether to issue a public recommendation.

The Fuchs espionage activities--and their bearing on the hydrogen bomb--were known to at least two of the three members of the special Atomic Energy Subcommittee of the National Security Council, Secretary Johnson and Chairman Lillenthal, and were also known to the GAC. The Fuchs case apparently was not known to Secretary Acheson and definitely was not known by the Joint Committee until some two days after the decision.

The Special Atomic Energy Subcommittee of the National Security Council was appointed in mid-November, 1949, and held its first meeting on the morning of January 31, 1950. Though the classified directive is dated this day, it was not finalized until several days thereafter.

On January 31, 1950 certain of the Executive Branch principals entertained substantial personal doubt as to whether Russia had in fact achieved the H-bomb.

Considerable additional information would have to be developed in order to gain full insight into what actually took place.

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V. The Decision to Undertake Savannah River.

January 31, 1950

The afternoon of the President's announcement, the Joint Committee met with the Commission and discussed at length the best course of action, including in particular the questions of production facilities and of proceeding simultaneously among alternative lines. There was also discussion as to whether the Commission needed additional money for the hydrogen program, and the Committee was told that added funds were not required at that time.

A. Commissioner Dean testified that

The production  
issue:  
Dean comment.

"...we have already lost some time and I hate to see us lose any more. I divide the urgency into two parts, first at Los Alamos...so far as tritium production is concerned, which is the other big thing, I would push it very fast. As I see it right now the only thing that we can get tritium with fast is the Hanford reactor... I go along parallel on the best other neutron producers we can get, because we can get tritium from them, or we can get plutonium from them."

February 1, 1950

The General Advisory Committee submitted its nineteenth Report, noting "that the determination of national policy to proceed with the development of the super-bomb occurred during the course of this Meeting...." The General Advisory Committee commented as follows on the question of how much tritium should be produced:

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"Los Alamos believes that it must have [of this material within two years] in order to meet the proposed test schedule. It is clear to us that this requirement cannot be met by extending present methods of tritium production.... The approval of the Los Alamos program thus depends either on Los Alamos accepting a reduction in requirements for tritium or on providing for a rapid conversion to enriched pile operation at Hanford, this operation to start within six to nine months of the present date. Since this conversion involves problems of stockpile and production as well as the serious and irksome problems of the conversion of an industrial enterprise to a new purpose, and the construction of plants not yet designed, we recommend to the Commission that very serious attention be given to this point. If it does not appear that the problem can be solved within the indicated time, and if it likewise does not appear that a reasonable test can be performed with [of tritium] then it would be wise to defer the date of the test, and thus to revise the Los Alamos program."

GAC comment  
on time of H-bomb  
test.

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February 3, 1950

Klaus Fuchs was arrested in England and the Joint Committee was informed of the Fuchs espionage case. Mr. Lilienthal testified as follows on Fuchs' knowledge of the H-bomb from 1944 until June 1946, the period in which Mr. Lilienthal stated he would have had contact with American super bomb efforts:

"I think the only safe assumption is to say that as far as we had gone, he knew everything we did. It seems this group of British scientists knew more about the H-bomb than our own people did."

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February 8, 1950

Tritium decision.

The Commission instructed Hanford and Oak Ridge to start immediately on a program to produce tritium by the end of 1951, looking toward an initial test of a thermonuclear reaction in 1952.

February 10, 1950

The Joint Committee, meeting with the Commission, raised issues concerning interpretation of the President's directive dated January 31, 1950, and whether the directive asked for the most that could be done. The directive read as follows:

Text of presidential directive.

"The White House, January 31. My dear Mr. Lillenthal: After consideration of the report by the Special Committee of the National Security Council, consisting of the Secretary of State, Secretary of Defense, and the Chairman of the Atomic Energy Commission, designated by me to advise me on this problem, I hereby direct the Atomic Energy Commission to proceed to determine the technical feasibility of a thermonuclear weapon, the scale and rate of effort to be determined jointly by the Atomic Energy Commission and the Department of Defense, and that the necessary ordinance developments and carrier program be undertaken concurrently. I have also decided to indicate publicly the intention of this government to continue work to determine the feasibility of a thermonuclear weapon; and I hereby direct that no further official information be made public on it without approval. I am sending copies of this letter to the Secretary of State and Secretary of Defense for their information. Sincerely yours, Harry Truman."

Senator Bricker inquired as to the difference between the public release made by the President and the top secret directive to the Commission. On this point, Commissioner Dean testified as follows:

"There is one difference between the public announcement made by the President, which was that the Commission was to continue work on this—I think that is the wording—and this language here, which reveals that the work is not as far along as we would like to admit to unfriendly powers. This indicates there is a good deal of theoretical work and laboratory work still to do."

The following testimony was given on whether the directive asked for the most that could be done:

"The Chairman. Are all of the Commission of the opinion that this directive is the most that can be done, orders the most that can be accomplished in this field?

ABC comment on directive.

"Commissioner Pike. Well, a careful reading of it, Mr. Chairman, does not give us direction to go as far as we intend to go. I think I am speaking for the Commission in this. We are interpreting it quite broadly and if we find we are going beyond what we think to be a reasonable interpretation, it is my belief we should go to the Secretary of Defense and get the directive broadened."

The Commission was questioned and the individual members present were questioned whether more money was then needed for the stepped-up hydrogen program. The Committee was assured that it was not.

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Thermonuclear Program, JCS Memorandum, January 1, 1953  
JCS Doc # DLXXXIV H-Comb Chronology

Chronology of Atomic Bomb sent to  
Commissioner by Truman

JCS Com Sec  
Dec 1950

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February 16, 1950

The two leading technical manuals on the hydrogen bomb, originally published at Los Alamos in Spring, 1946, were republished on this date. These two manuals were "Prima Facie Proof of the Feasibility of the Super" (dated April, 1946) and "Report on the Conference on the Super" (held in April, 1946).

1946 H-bomb reports re-published.

February 23, 1950

In a meeting with General Bradley, the following discussion about the Fuchs case and the hydrogen bomb occurred:

"The Chairman. I am also advised that before Fuchs left Los Alamos, he withdrew from the archives everything that we had on hydrogen bombs, kept it for an inordinate period of time. They also contained diagrams for the proposed construction of them, and there is no question, but what they went to the Soviets in--I won't be certain of the date, but I think it was 1946.

"General Bradley. That is my understanding.

"The Chairman. Now, I am constantly bedeviled by the thought that they have done their hydrogen and atomic developments contemporaneously, and any idea that they aren't ahead of us, while I think the chances are that they are not, but how do I know?

"We say, 'Well, where would they get the tritium?' And I believe that is the best assurance that we have got that, so far as we know--our intelligence, for instance--they haven't been in that particular business, but we don't know.

"General Bradley. There is no reason that they shouldn't be considerably ahead of us in this thing, because they had those drawings and, as I understand it, our original plan has to go through the A-bomb to the H-bomb, and then we quit when we got the A-bomb, and didn't go through to the complete development of it, and they may have because Fuchs was in on that, he knew it.

"The Chairman. We did go ahead.

"General Bradley. But in a slow way."

March 3, 1950

In a Joint Committee meeting, Dr. Teller testified as follows:

"Due to very many reasons, work on the hydrogen bomb has not gone forward at any appreciable rate between 1945 and 1949, let us say, roughly. One of the reasons...was that people who had the required technical skill felt that they should go back to pure scientific jobs, and most of them did."

March 9, 1950

The Atomic Energy Subcommittee of the National Security Council made a recommendation to the President, in part, as follows that:

Second presidential directive.

"(a) The Atomic Energy Commission continue making preparation looking toward quantity production of materials needed for thermonuclear weapons, especially tritium, to the extent necessary to avoid delay between the determination of feasibility and the start of possible weapon production.

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- "(b) The Department of Defense and the Atomic Energy Commission make a report with recommendations as soon as feasible with respect to the scale of preparation for production of materials needed for thermonuclear weapons, especially tritium, this report to include a discussion regarding the feasibility of meeting the production goals of the expanded program which the President approved last October."

The President approved these recommendations on March 10, 1950.

March 10, 1950

At the unanimous request of the Joint Committee, the Chairman addressed a letter to the Secretary of Defense which asked for:

"...the comment of the Defense Department on the question of whether or not we are spending the right amount of money upon and allocating the right quantity of resources to our atomic energy program.

2. "I note that, since the war, we have devoted somewhat less than one-fortieth of our total military spending to atomic weapons (exclusive of methods of delivery) and somewhat less than one percent of our total national budgets to this purpose. Our current scale of effort is similar. Specifically, do you now regard--and do the Joint Chiefs now regard--such a scale of effort as adequate to the defense of the United States?"

Start of McMahon-Johnson correspondence.

In a meeting with the Atomic Energy Commission, the following questions and testimony occurred:

"Representative Cole. Is it your conclusion and presumption from the Fuchs case that the Russians know as much about the hydrogen bomb as we know, or as we knew last summer?"

"Commissioner Smyth. They probably do not know exactly the same things but they probably know as much. I think that would be my guess.

"Commissioner Strauss. You had to add to that that they have apparently known it since 1947. That is the unfortunate part of it.

"Representative Elston. They might have started work on it in 1947 and we didn't.

"Commissioner Strauss. Precisely."

March 10, 1950

Start of the "Family Committee"

Following the President's directive of January 31, 1950, a theoretical group was established at Los Alamos with direct responsibility for accomplishment of the Los Alamos thermonuclear program. It was called the "Family Committee" and met on this date. The "Family Committee" began with the theoretical assumptions developed by 1946 and with the principal model of that period, namely, the

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Dr. Hans Bethe, Dr. Edward Teller, and other leading physicists disagree widely on the extent to which our present successful approach to H-weapons is a straightforward development from the 1946 technical papers which had been compromised by Fuchs to the U.S.S.R. Though this scientific problem cannot be resolved here, it is basic to an estimate of relative Russian progress. Because of

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its importance, some detail is necessary as to the 1946 concepts and their evolution to Dr. Teller's proposal of made in 1951 and tested with outstanding success in 1952.

The 1946 idea can be likened to lighting a match.

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Following the reprinting of the 1946 technical reports (in February 1950), the minutes of the first meeting of the Family Committee (March 10, 1950) show that

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March 13, 1950

On March 6, 1950, Senator McMahon wrote Acting AEC Chairman Pike as follows:

"At the hearings recently attended by Dr. Teller, it was suggested that certain scientists would be most helpful to the present program.

"What thoughts does the Commission have relative to bringing them in as quickly as possible? Can the Joint Committee be helpful?

"I regard this as a matter of preeminent importance."

On March 13, 1950, Commissioner Pike, Acting Chairman, replied in part as follows:

"Los Alamos has been informed that it has the firm backing of the Commission in their efforts to procure additions to its staff. However, at the time of this writing it does not appear that any major unexpected difficulties have arisen. It was to be expected quite naturally that many of the scientists who have been approached would show some reluctance to sever their ties with their parent institutions and that it would take them some time to make up their minds as to the wisdom or propriety of joining the staff at Los Alamos. These misgivings are, in our opinion, to be best resolved between the Laboratory and the individual. We feel, therefore, that the Commission and the Joint Committee can be most helpful at this time by allowing the Laboratory to work out the problem without the interjection of a third party.

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Memorandum Program, SCRF/Chandigarh, January 1, 1953  
JHE Doc # DEXXIV H-Code Chronology

Chronology of Atomic Bomb and its  
Development by Ruchon

SCRF Gen Sol  
Doc Box 40

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"Should it become apparent at any time, however, that it would be helpful to the Laboratory to have our assistance or the assistance of any other third party we shall be quick to so indicate."

March 23, 1950

Looking toward a meeting with the Defense Department, Senator McMahon wrote the Secretary of Defense asking whether H-bombs were "so new and different as to alter the strategic picture" and whether the Defense Department regarded "H-bombs as merely bigger and better A-bombs, or...likely to inject radical new factors into our present military calculations."

March 24, 1950

On October 22, 1949 Senator McMahon had requested a report on the long-range detection of super-bomb activity in Russia. In acknowledging the Senator's letter on October 27, 1949, the Secretary of Defense stated that the Department of Defense was carefully reviewing the entire problem to determine probable objectives and emphasis in the detection program in light of the Russian explosion announced on September 23, 1949. The Joint Committee was informed on March 24, 1950 that a panel convened to undertake this study had submitted recommendations which "included sharply increased emphasis in research and development looking toward the feasibility of long range detection of foreign thermonuclear explosions...."

March 27, 1950

Public information issue.

The Presidential directive calling for a major hydrogen program instructed that "no further official information be made public" on the H-bomb "without approval." The extent to which the public should be informed gave rise to a controversy between the AEC and the Military Liaison Committee. It was decided that a proposed AEC statement containing no "restricted data" not be published. On March 27, 1950 former AEC Commissioner Bacher made a public address discussing the H-bomb in some detail. In July, 1950 the Joint Committee issued a print entitled "The Hydrogen Bomb and International Control: Technical and Background Information."

March 28, 1950

The March 10 directive of the President on the thermonuclear program was reported to the Joint Committee by the Commission as follows:

"Dr. Smyth. ...First of all, the President has noted that the thermonuclear weapon program is regarded as a matter of the highest urgency, and that there is no need for additional funds beyond those currently estimated for the feasibility tests of the thermonuclear weapon.

Comment on President's second directive.

"I want to emphasize that because I do not think it is entirely clear. The question came up as to whether the estimate of approximately \$100 million--I think it was actually ninety-five--for the test of the feasibility of the process, whether that was enough money if the program is to be pushed as hard as possible.

"You may remember that the original directive was not entirely clear how hard the project was to be pushed. We had assumed it would be pushed as hard as possible. This is just saying he noted that we have said we are doing as much as we can on this feasibility test anyway, and that, therefore, for the feasibility end of it no more money is required.

"Second, he has noted with approval the program for the test of feasibility of thermonuclear weapons and the necessary ordnance and carrier developments as now envisaged by the Atomic Energy Commission and the Department of Defense.

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Thermonuclear Program, SECDEF (Chronology), January 1, 1953  
JONE Doc # DEXXIV H Bomb Chron/103

Chronology of Atomic Bomb and its  
Development by Erickson

ICAF Consulate  
Doc Ref 00

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"Third, he has instructed the Atomic Energy Commission to continue making preparations looking toward quantity production of materials needed for thermonuclear weapons, especially tritium, to the extent necessary to avoid delay between the determination of feasibility and the start of possible weapon production.

"You will remember this was the specific point on which we wanted an additional directive.

"Finally, he has instructed the Department of Defense and the Atomic Energy Commission to make a report with recommendations as soon as feasible with respect to the scale of preparation for production of materials needed for thermonuclear weapons, especially tritium."

The March 10, 1950 directive was commented upon further as follows:

"Mr. Dean: I feel that we are getting along quite rapidly. We asked for this substance, Mr. Chairman, of this new directive, because you will recall the original one was not clear as to what would happen after feasibility had been determined. We did not want a gap in there of three or four years before we got sufficient materials for production.

"Dr. Smyth. We assumed the original directive said more than it did and we wanted this directive to instruct us to begin doing what we were beginning to do.

"Mr. Dean. We also asked for the paragraph about highest urgency, because we felt without that, we would have difficulty stimulating the people throughout the labs to treating it as one of the highest urgency, and we felt that should be in."

April 1, 1950

The GAC reported on problems under consideration by the Commission in connection with the hydrogen program. The report stated in part as follows:

"With regard to the question of urgency, we examined the letter from the Secretary of Defense to the President dated 24 February 1950, and the report to the President of March 9, 1950, by the Special Committee of the National Security Council on the Development of Thermonuclear Weapons. We noted that the development program is here declared to be a matter of the 'highest urgency.' We were informed that the recommendations embodied in this report had the President's approval.

"With regard to the scope of the production of thermonuclear weapons in the event of successful development, no such definitive determinations appear to be available. We note that in the report of the Special Committee referred to above a scale of

a year is contemplated as a production goal. From the General Manager we learned that the plans of the Commission are largely based on the goal of

per year.] From the Acting Chairman of the Commission we learned that, in the absence of official determination, a figure of per year might be suitable for planning purposes.

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H-Form Chron 1055  
January 1, 1953  
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"We state these matters explicitly, since our comments on the Commission program are based on the assumption of these determinations of policy with regard to urgency and production capacity. We have not considered it as a part of our assignment to review the wisdom of these assumptions."

In connection with the Los Alamos program proposed for hydrogen development, the General Advisory Committee stated:

"We are fully aware of the possible sacrifices in the development of more efficient, more flexible, more deliverable, and more useful atomic weapons which the adoption of this thermonuclear program may entail. We have been assured by the Director of Military Application that this is also fully understood by the national military establishment and is accepted by them."

May 3, 1950

The Committee met with Dr. Bethe, who discussed the amount of tritium considered necessary by the scientists to start a thermonuclear reaction, and commented that "...militarily, the H-bomb does not add much to the A-bomb, but...the A-bomb adds very much to conventional armaments."

May 5, 1950

The Secretary of Defense replied to Senator McMahon's letter of March 10 as follows:

"I must apologize for my delay in answering your letter of March 10, wherein you request information as to the sufficiency of the efforts of the Joint Committee on Atomic Energy [sic] in the atomic weapons field.

"I referred your letter to the Joint Chiefs of Staff and have received a memorandum from the Chairman of the Joint Chiefs of Staff, wherein he expresses the views of that body as follows:

"Prior to the atomic explosion in the USSR, the response of the Joint Chiefs of Staff to Senator McMahon's query as to the sufficiency of the overall United States efforts in the atomic weapons field would, in all probability, have been in the affirmative.

"Since the President's announcement of the fact of atomic production by the USSR, however, measures of which you are undoubtedly aware have been initiated to improve the United States position in regard to atomic weapons. More recently, the possibility is being considered that the USSR may have a hydrogen bomb development project. Since the results of these measures depend on various undetermined factors and are thus unpredictable at this time, the Joint Chiefs of Staff are unable to make a categorical answer to the question proposed by Senator McMahon."

"In view of the statement of the Joint Chiefs of Staff, as quoted above, and in view of the world situation as it exists today, I am unable to make a categorical answer to the question you have propounded."

May 6, 1950

Senator McMahon replied to Secretary Johnson as follows:

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CONFIDENTIAL PROGRAM, JCRF (Chemistry), January 1, 1953  
Doc # JCRF XXIV H-Eone Chem 1003  
Chronology of Atomic Bomb sent to  
unpublished by Dickson  
JCRF Conf. Sec. 60

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"In my letter to you of March 10, 1950, I asked what I conceive to be the most important question on military policy which I have advanced in my career as a United States Senator and as a member and presently chairman of the Joint Committee on Atomic Energy--namely, whether or not you and the Joint Chiefs regard the quantum of resources now being devoted to atomic weapons as adequate to the defense of the United States. I believe that this question goes to the heart of the responsibilities of the Joint Committee, the heart of your responsibilities, and the heart of the responsibilities of the Joint Chiefs of Staff. You will recall that the entire membership of the Joint Committee considered the question to be so important that it unanimously requested me to seek your advice.

"In your reply of May 5, 1950, you state that at this time the Joint Chiefs of Staff are unable to make a categorical answer to the question and that you yourself are also unable to make a categorical answer. Frankly, I cannot bring myself to accept the implication that on a question of military policy which all would agree is vitally significant--and which, in my personal judgment, is uniquely significant--the responsible military authorities of the United States are in a state of indecision.

"My letter had its origin in the fact that, to my surprise--and contrary to the prevailing impression among Joint Committee members--neither the Secretary of Defense nor the Joint Chiefs have ever gone on record with the Joint Committee regarding the adequacy of American efforts in the atomic weapons field. Another reason for the letter was doubt in my mind and in the minds of my Committee colleagues as to whether an outlay of less than one-fortieth of our total military spending and less than one per cent of our total national budget for the weapon upon which we most heavily rely is reasonable considering the resources which may be devoted to this same weapon by our Soviet rival. If war should come and if the atomic armaments possessed by the United States should turn out to be inadequate, I cannot imagine myself confronting a board of inquiry with a clear conscience unless today, as Chairman of the Joint Committee, I had asked the responsible military authorities whether they regard our present scale of effort as satisfactory and unless I had secured a definite reply.

"Accordingly, though I appreciate the extreme difficulty of the matter and though I further appreciate that estimates may change as new information is acquired, I earnestly request that you answer and that the Joint Chiefs answer the question propounded. At the earliest opportunity I shall acquaint the Joint Committee with your response of May 5 and with the contents of the present letter."

May 18, 1950

The correspondence between Senator McMahon and Secretary Johnson was read to the Joint Committee. In response to the Committee's request that this matter be pressed to a conclusion, Senator McMahon the next day wrote the following letter to the Secretary of Defense:

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ONE Doc # DEXXIV H-Emb Chron 1953

Transcript of Atomic Bomb Outfit  
written by Dickson

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"The Joint Committee on Atomic Energy met yesterday and discussed the correspondence between us regarding the question of whether or not the scale of our present national atomic energy effort is adequate to the defense of the United States. Considering the importance of this inquiry, and the Committee's interest in it, considering the period that elapsed between my original letter and your original reply, and since the time available to the Committee and to the Congress to weigh the matter during the present session is not unlimited, I promised the Committee members that I would write you again and request as speedy an answer to the Committee's question as possible. Anything that can be done to expedite a definite statement by you and by the Joint Chiefs will be keenly appreciated."

May 25, 1950

It will be recalled that on March 9, 1950, the Special Committee on Atomic Energy of the National Security Council made recommendations to the President looking towards quantity production of materials needed for thermonuclear weapons. The Special Committee proposed that the Department of Defense and the AEC report to the President as soon as feasible with respect to the scale of preparation for production of necessary materials, especially tritium.

Quantity production of tritium proposed.

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June 1, 1950

The President approved these recommendations on March 10, 1950. On May 25, 1950, the AEC and the Department of Defense sent to the President a five-point program, concluding with a recommendation for construction of new reactors moderated by heavy water and to be built at a site "other than Hanford." The recommended production was of tritium per year. It was also recommended that additional construction be undertaken at Hanford to yield twice this amount of tritium annually. The letter pointed out that the tritium production goal could be met by 1956 without interfering with military requirements, unless tritium requirements were higher than expected.

The Secretary of Defense replied to the Joint Committee as follows:

"I have your letter of May 19th advising me of the continuing interest and concern of the Joint Committee on Atomic Energy about the adequacy of our present efforts in the atomic weapons field. I am fully aware of the prime logic in the question you have propounded and recognize the possible unique historical significance of a categorical reply at this time. You will agree with me, I am sure, that the various elements in the atomic weapons program are so dynamic and subject to such an interplay of forces that an answer which might be a correct evaluation of the situation at this time could be obsolete in a matter of months in the future.

"In order to satisfy the concern of the Joint Committee on Atomic Energy, I have again consulted with the Joint Chiefs of Staff, who advise that possibly a more explicit statement as to the effort now being placed in the atomic energy program should be made....

"It is considered that the existing production facilities are not adequate to meet all possible contingencies for taking early advantage for successful research and development, particularly in the thermonuclear field. Further, it is considered essential to provide backup facilities against the

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possibility of war damage. Representations in the premises are being made to the President in concert with the Atomic Energy Commission, and I presume that your Committee will be advised of the President's recommendations thereon in the near future!

June 6, 1950

The Joint Committee met with the Commission and the matter of the May 25, 1950 recommendation to the President for tritium production was discussed. The following testimony is recorded:

"The Chairman. Well, what I want to get is your thinking as to whether you are going to proceed as we did with the A-bomb program--research and production facilities going hand in hand--or whether you will wait until your research is all done on sort of a pilot plant basis and then build your production facilities.

The production  
issue: further  
testimony.

"Mr. Dean. The former. As a matter of fact, the letter from the President, which we got, which was somewhat of an amendment of his original directive to us and dated, I believe, about the tenth of March, directed us to go ahead and get sufficient material beyond test.

"Now, roughly, the proposal which we have submitted to the President in this letter is a proposal for the construction of two or three reactors, natural uranium reactors, heavy water moderated, which would produce tritium at the rate of production of approximately 1 per year by 1952."

"By the end of this year we will have roughly  
for test; by the end of '51 we will have  
roughly

The Chairman presented to the Committee a summary comment on the latest Progress Report of the Commission dealing with the thermonuclear program, as follows:

"The President's directive of March 10, 1950, regarding the H-bomb is interpreted to mean that there must be no delay between a successful weapon test and readiness to start quantity production--not that production is to start as soon as possible on the assumption that the H-bomb will later turn out to be successful. In other words, production appears to be dependent upon the proven success of the weapon, in contrast with the wartime policy of preparing to produce and actually producing before the weapon is tested. In this connection, the Progress Report twice refers to preparatory steps, 'within the limits of available funds.'"

On this point, the following testimony occurred:

"The Chairman. My point is you are carrying on production facilities and your research so that if you reach point A in research, where you think you can explode the bomb and do, you then will be able to dip down and get the materials with which to do it to build future ones.

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Homeowner Program, JENChandsey, January, 1953  
DATE - Dec # 20, 1953 H-Bomb Chandsey

Chronology of H. M. B. and Sept. 1865  
 Given by D. B. B.

22nd June 1960

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"Mr. Dean. That is true, but there will be not a large quantity at that time.

"The Chairman. Is the Commission satisfied with this situation? Do you want to tell us that you are satisfied knowing the stakes that are involved as to speed with which you are working? Of course, nobody is satisfied, but are all the resources going into the thing that can be put in within the limits of human ingenuity to bring this thing to a conclusion?

"Mr. Dean. I would think just about.

The Commission was questioned as to whether time could be saved and whether additional funds would not be required. Committee members asked whether construction of only two heavy water piles would be sufficient and particularly whether construction of an additional Hanford type pile might not also be necessary.

The Joint Committee again unanimously requested the Chairman to write to the Secretary of Defense and again insist as to the adequacy of the program then planned.

June 13, 1950

At the request of the Joint Committee, Senator McMahon dispatched a further letter to the Secretary of Defense, in part as follows:

"In your letter you do not say whether American efforts in the atomic field are adequate. You do say that they will be consistent with our over-all defense expenditures. In one of my previous letters to you, I stated, 'If war should come and if the atomic armaments possessed by the United States should turn out to be inadequate, I cannot imagine myself confronting a board of inquiry with a clear conscience unless today, as Chairman of the Joint Committee, I had asked the responsible military authorities whether they regard our present scale of effort as satisfactory and unless I had secured a definite reply.' While I am glad to know that in your judgment, our atomic effort is consistent with our over-all effort, I cannot--in deepest sincerity--conclude that receipt of this information absolves me or my Committee colleagues from the duty of definitely ascertaining whether or not you and the Joint Chiefs deem our atomic effort to be adequate....

"I earnestly repeat my request--in behalf of the entire Joint Committee--that you state and that the Joint Chiefs state whether or not our scale of effort in the atomic field is adequate to the defense of our country...."

June 16, 1950

Start of Savannah River

The Joint Committee was notified that, on June 8, 1950, the President had approved construction of two new reactors (first two Savannah River reactors). These reactors were to be of the heavy-water type and--in the words of the joint AEC-Defense Department recommendation which the President accepted--were intended to provide "a new tritium production facility."

During the Fall, 1949 controversy that ended with the President's January 31, 1950 decision to proceed with the H-bomb, the amount of expensive tritium that might be required for the "runaway super" was a major technical factor. Shortly before the Presidential decision, Los Alamos resumed the wartime and early post-war calculations

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House Committee Program, JCRS (Chairman), January 1, 1953  
JCRS Doc # 24 XXIV H-Comb Chron 1953

Chronology of Atomic Bomb and its Development by Dickson

JCRS Com. 5-11  
Dec. 1950

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Mid-1950  
technical  
outlook.

on the extent of tritium needs for a successful "super." The initial 1950 calculations indicated an amount very substantially higher than had been estimated the previous fall. By spring and early summer, 1950 the calculations increasingly pointed to even higher figures.

The decision to undertake two new reactors for tritium production, at an estimated cost of a quarter of a billion dollars, was therefore made at a time when the outlook for an H-bomb practical in terms of costly tritium requirements was pessimistic.

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VI. Events Leading to Spring, 1951 Test

June 22, 1950

The Joint Committee met with the Commission and discussed in detail the various alternatives for additional reactor capacity. Committee members commented favorably on a staff memorandum which the Chairman read aloud and which stated that "merely to build two heavy water reactors by 1954 or thereafter is a case of too little and too late...."

June 26, 1950

Senator McMahon wrote the AEC in part as follows:

"Gentlemen: In your letter of June 16, 1950, regarding tritium production, the following statement appears: 'If the thermomuclear weapon should prove feasible, the United States must be in a position to initiate production of the weapon without delay. Accordingly, there must be at hand at that time a sufficient quantity of tritium to construct at least one deliverable weapon, and an operating tritium production capacity that can be expanded readily for such a weapons program as may be considered necessary.' (Italics supplied.)"

McMahon question on production at time of test.

"This statement appears to mean that little effort will be made to have at hand enough tritium for, say, five deliverable weapons or ten deliverable weapons at the time when the thermomuclear bomb is proven to be feasible. I would much appreciate your preparing to comment on this matter before the Joint Committee at the same time you comment on whether the construction of two heavy-water reactors by 1954 is, by itself and without construction of a new Hanford-type pile, a program sufficient to protect the security of the United States."

July 10, 1950

The Joint Committee received the Semiannual Report from CIA. The report indicated that, based on then current estimates of the amount of tritium per super weapon, Russia might have sufficient tritium

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July 21, 1950

The Joint Committee met with the AEC and Military Liaison Committee to go over the adequacy of the thermomuclear and fission weapon programs. In response to Committee suggestions that an additional pile be constructed at Hanford for the sake of speed, Commission and Military Liaison Committee witnesses indicated that the weapons gain would be slight and that there would be an excessive strain upon General Electric, the contractor at Hanford, then engaged in building new plants connected with raw materials. Representative Price and others indicated approval of a staff memorandum which stated that the plan to build two new heavy water reactors was "dangerously inadequate" and which expressed the opinion that "at the very least a new Hanford-type pile should also be constructed." Senator Bricker questioned the Commission on means of breaking the heavy water bottleneck.

Mr. LeBaron, chairman of the MIC, and Mr. Dean testified that the military had never asked the Commission about how much our weapons position might be increased over a given period of years, if the scale of effort measured in dollars were increased over the existing and anticipated rates by varying percentages, such as 25%, 50%, 100%, etc.

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Handwritten notes on right margin: "Chronology of Atomic Bomb and test to Commission by Kurbanov"

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August 1, 1950

A memorandum written by Dr. Teller and Dr. Wheeler stated that theoretical analysis was a major bottleneck to faster progress in the thermonuclear field and that the total number of ranking theoretical physicists at Los Alamos was not increasing but decreasing.

August 2, 1950

The Joint Committee met with the Secretary of Defense and the Chairman of the Joint Chiefs of Staff and Mr. LeBaron. At the urgent insistence of the Secretary of Defense, no transcript was taken. However, the following is an extract from a memorandum of what transpired at the meeting approved by the Committee Chairman:

The production issue: Defense Department would wait for test.

"General Bradley and Mr. Johnson both made plain that the present program is essentially designed to determine feasibility of the hydrogen weapon and after this has been done, the desirable rate and scale of production can be properly evaluated. They likewise made it clear that, no one among the military doubts the wisdom of proceeding with the present hydrogen program and that, on the contrary, it is regarded as an essential project. Were Russia to acquire this weapon without our even making the effort to acquire it would be unthinkable, they indicated. They also stressed that the new heavy-water reactors to be constructed mean that we are taking only a minimum risk--since, if it is not worthwhile to make tritium for H-bombs, the reactors could be used to make plutonium. General Bradley noted that one Russian target will require eight ordinary A-bombs, accurately placed, and that an H-bomb might be suitable for this particular target....

End of McMahon-Johnson interchange

"In answer to the Committee's question as to whether or not the scale of our atomic energy project is adequate to the defense of the United States, Secretary Johnson read from a memorandum recently submitted to him by the Joint Chiefs of Staff. This memorandum states that our scale of effort is not considered to be adequate. It adds that the Joint Chiefs favor a very marked expansion of the scale of effort. Secretary Johnson stated that he concurs in these views. The Secretary again and again emphasized, in addition, that he advocates all the plant expansion necessary to convert into weapons all the raw materials we are able to obtain."

August 3, 1950

Senator McMahon wrote a letter to the President arguing for an increase in plant. The letter concludes with this paragraph:

"I am informed that the raw materials which are likely to become available will permit a doubling of present and authorized production of U-235, plutonium, and tritium before ore becomes a bottleneck. With all the earnestness at my command, I maintain that an early decision at least to double present and authorized production by the earliest possible date has become indispensable. In my opinion, these comments substantially reflect the views of the Joint Committee."

August 5, 1950

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memorandum prepared by J. R. McChesney, January 1, 1953  
H-Comb Chronology  
was written by Dickson

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It will be recalled that the 1946

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Start of

August 9, 1950

August 16, 1950

With reduced hopes for work started on another H-bomb model--the so-called Dr. Teller had first proposed in 1946; and on September 26, 1947 he suggested that Los Alamos consider the use of lithium 6 and that production of this material in quantity be investigated. Dr. Teller re-proposed use of lithium 6 in Summer, 1950; and by July Dr. Nordheim and associates began theoretical work.

In response to a Joint Committee inquiry, Mr. LeBaron advised that, as a result of questions which the Committee asked the Commission and the Military Liaison Committee regarding the cost of increasing production by 50%, a paper had been presented to the National Security Council. This paper estimated that the cost of such expansion would be about \$2 billion. Mr. LeBaron further replied that on August 8, the day before, the President directed that Mr. Dean and Secretary Johnson re-examine the entire matter of atomic requirements.

The Joint Committee met in executive session and discussed and approved a further letter to the Secretary of Defense, which was sent on August 22, 1950. The Chairman's letter stated in part that "I assume that no possibility of producing added increments of atomic weapons will be omitted from consideration for failure to investigate the cost and risk factors involved.... I assume finally, that no labor will be spared to reach sound decisions quickly." He requested views of the Department of Defense and the AEC on the following specific points:

- "(1) doubling of present and authorized production rates by 1954;

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Thermonuclear Program, JCRF Chemistry, January, 1953  
JCRF Doc # DLXXXIV H-Font Chemistry

Chronology of Atomic Bomb Development  
known known by Dr. Nordheim

JCRF Chemistry  
Doc # 40

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"(2) a further appropriation request during the present session of Congress; and

"(3) whether or not the stepped-up program you propose is adequate to the defense of the United States."

August 25, 1950

The Joint Committee was informed that H pile was to be charged with

Tritium production.

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September 14, 1950

On this date, the MLC Chairman, Mr. LeBaron, transmitted to the AEC new Joint Chiefs of Staff requirements for "Z" quantity of material and A-bombs to be on hand by July 1, 1956.

Further military requirement for A-bombs established.

No requirements for H-bombs or H-bomb materials were included.

September 19, 1950

Secretary of Defense Johnson replied to Senator McMahon's letter of August 22, and stated that his Department had vigorously "supported a course of action looking forward to the production of the greatest number of atomic weapons that can be made available." The expansion study was forwarded to the President.

September 21, 1950

Senator McMahon wrote Mr. Marshall, the new Secretary of Defense, and the Secretary of State calling attention to correspondence and testimony on the question of atomic expansion and making known the urgency which the Joint Committee felt.

September 23, 1950

The General Advisory Committee commented on a detailed H-bomb report which had been submitted to the G.A.C. by Drs. Edward Teller and John Wheeler. The Teller-Wheeler report covered schemes for the transfer of energy from an A-bomb to the super; analyzed problems to be solved and manpower needs to solve them; presented the first calculations on the advantages of an "Alarm Clock"

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The G.A.C. commented:

"2.a. With regard to the reports made available to us on the thermonuclear program at Los Alamos, we are happy to note that great progress has been made at Los Alamos in setting up quantitative methods for coping with the difficult problems of the hydrogen bomb. We urge the Commission to support these efforts by making computational machinery available to the laboratory. We also note that there is at present a conflict between the requirements of calculation on the hydrogen bomb and calculations on new models of fission weapons. In our opinion both of these activities must continue at very high priority.

"b. We have some misgivings as to the value and relevance of the intensive work which has taken place, and which it is proposed to maintain for the next months."

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We note with regret that because of the demands of this program on the theoretical division and also and particularly, on the work in the research and development of explosives, and on preparation for tests, there is in fact interference between the thermonuclear program and the fission weapon program. We hope that before an actual test of the

is authorized, we may have an opportunity at our next meeting on October 30 to discuss these problems with the Los Alamos Laboratory. In general, in the light of the great promise of fission weapon development, and the present uncertainties with regard to the thermonuclear weapon, we hope that Los Alamos will find it possible so to schedule its work in critical areas that progress in fission weapons will not be delayed."

October 9, 1950

The President approved a new expansion program for three additional reactors at Savannah River (making five in all) thus adding to potential tritium production capacity.

October 20, 1950

In a letter formally notifying the Joint Committee of the President's October 9, 1950 decision, Mr. Dean stated that the expansion program "is considered to be the maximum feasible program without exorbitant or unreasonable expenditure in the light of supplies of ore foreseeable at this time" and that "the program satisfies the most recent statement of minimum military objectives."

October 26, 1950

At Los Alamos design was frozen for the crucial thermonuclear experiment planned

involve

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During Fall, 1950 the Los Alamos H-bomb effort was devoted almost entirely to detailed repetition of calculations concerning the device. However, some theoretical work continued on the "Alarm Clock."

November 1, 1950

The General Advisory Committee, after meeting at Los Alamos, made the following comments on the thermonuclear program in its 23rd report:

"3. (b) The outcome of...calculation...has, of course, directed the attention of the Laboratory to other thermonuclear models. For example, some attention has been directed to the possibility of

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These proposals have not been formulated in enough detail to warrant any assessment of feasibility or of value. They will require and they will receive further analysis.

"(c) We have discussed the proposed test programs incorporated in the Los Alamos report, and have examined with particular care the which, if no unforeseen developments occur, will be part of the test program for the New and elaborate instrumentation forms an essential part of this test. If the tests and the instrumentation are reasonably successful, radically new information will be obtained. This information bears on the

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and will be relevant to many  
thermonuclear models.

"We wish to make it clear, however, that the test, whether successful or not, is neither a proof firing of a possible thermonuclear weapon nor a test of the feasibility of such a weapon. This test is not addressed to resolving the paramount uncertainties which are decisive in evaluating the feasibility of the super. |

"(d) It may be that the Commission will find itself forced to fix rather firm tritium requirements, before the work of the Los Alamos Laboratory can give an altogether rational basis for fixing them. If this should occur, it may be desirable for the Commission to inform Los Alamos of the amount of tritium which could reasonably be committed, and which might be available, for a single weapon or a single test."

November 30, 1950

In a meeting between the Commission and the Joint Committee, the following testimony concerning the H-bomb occurred:

"Mr. Cole. Is there uncertainty in the feasibility, the practicality, the certainty that this will work--you mean that has increased?

"Mr. Dean, There is not as much uncertainty that a bomb could be developed. There is a great deal of uncertainty as to what you would have to pay or be willing to pay for it, because you might find yourself before you are through, depending on the amount of tritium necessary, you might find yourself sacrificing a hundred or one hundred fifty orthodox bombs in order to get one hydrogen bomb.

"Mr. Cole. You are talking about the cost of the new bomb not in dollars but in weapons.

"Mr. Dean. Cost in fissionable material or weapons.

"Mr. Durham. When would you have to make that decision?

"Mr. Dean, The first time we face up to it--and we can go easy at that time, I think--is in March when the question of reloading Hanford piles comes up--about three and a half months off."

December 4, 1950

Senator McMahon wrote Mr. Dean and Mr. LeBaron, Chairman of the MLC, questioning whether the expansion program should not be supplemented, among other items, by immediate construction of additional graphite piles at Hanford.

December 16, 1950

By letter dated September 25, 1950, Senator McMahon had requested a detailed report from the Military Liaison Committee on its functions and activities and "why the statutory right of appeal has never been exercised." (The statute provides that the MLC may appeal through the Secretary of Defense to the President any ABC action, proposed action, or "failure to act" adverse to Defense Department responsibilities.) Senator McMahon's letter requested that "the DE Waters report of 1947 be taken as a concrete example of the Military Liaison Committee in operation."

The report of the MLC, submitted December 16, 1950.

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Non-mutual Program, JGHE Chronology, January, 1953  
JGHE Doc # DLXXXIV H-Bond Chronology  
Chronology of H-Bond Sent to  
was written by Sullivan  
JGHE Confined  
Date first no



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included two "Examples of Military Liaison Committee in Action." Although neither of these took up the DR Waterworks, the MLC chose "The Thermomuclear Tritium Production Expansion Program" as an example of the MLC in action. This section states in toto as follows:

"1. The theoretical possibilities of a thermomuclear weapon have been realized since the early days of the Manhattan Engineer District and experimental programs had always been included in the programs of the Los Alamos Laboratory.

"2. In the Fall of 1948 the Atomic Energy Commission, the General Advisory Committee, and the Military Liaison Committee supported the testing of a booster weapon as a preliminary step toward ascertaining the feasibility of the development of a thermomuclear bomb.

"3. In the early Fall of 1949 the Department of Defense concluded that an accelerated program to determine the feasibility of a thermomuclear weapon might be indicated. On 17 October 1949 the Chairman of the Military Liaison Committee informed the Atomic Energy Commission of this possibility and asked for an Atomic Energy Commission evaluation.

"4. During the month of October 1949 the General Advisory Committee considered this problem and advised the Atomic Energy Commission thereon. The Chairman of the Atomic Energy Commission recommended to the President that the thermomuclear weapon not be developed.

"5. On 14 November 1949 the Chairman of the Military Liaison Committee advised the Joint Chiefs of Staff and the Secretary of Defense of the above action of the Atomic Energy Commission.

"6. On 19 November 1949 the President directed that the problem of determining whether to proceed with the development of a thermomuclear weapon be referred to the Special Committee on Atomic Energy of the National Security Council for the formulation of coordinated recommendations on this problem.

"7. During the period 19 November 1949 to 31 January 1950, the development of a thermomuclear weapon was considered by the Special Committee on Atomic Energy of the National Security Council in which the views of all agencies were incorporated, and on 31 January 1950 this Committee forwarded a report to the President recommending the continued development of the thermomuclear weapon, the scope and rate of progress of which would be determined jointly by the Department of Defense and the Atomic Energy Commission. The same date, the President approved this recommendation.

"8. Immediately upon the receipt of the President's directive, the Atomic Energy Commission began formulating plans and programs in conjunction with the Military Liaison Committee, to make possible the determination of the feasibility of the thermomuclear bomb. In this connection, the Military Liaison Committee proceeded to the Los Alamos Laboratory on 22 February 1950 for the purpose of an on-the-spot appraisal of the Commission program. On 3 March 1950 the Atomic Energy Commission was informed that

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Document # 3188XIV H-Cont Chron 1955

Chronology of Atomic Bomb and its Development by Dickson

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the Committee agreed with the Commission's program.

"9. On 10 March 1950 the President approved the recommendations of the Special Committee of the National Security Council directing the Atomic Energy Commission to make preparations for the production of materials necessary to avoid any delay between determination of feasibility and the start of weapon production. The Commission and the Department of Defense were directed to make joint recommendations to the President through the Special Committee on Atomic Energy of the National Security Council as to the scale of preparation for the production of these materials. On 12 and 13 April the Military Liaison Committee visited Hanford installation for the purpose of observing the Commission's progress, and discussing further plans for the manufacture of certain materials needed for the thermonuclear weapon.

"10. On 15 May 1950 at a joint Atomic Energy Commission-Military Liaison Committee meeting, a draft letter to the President outlining the scale of preparations for the production of materials for the thermonuclear weapon was approved.

"11. On 17 May 1950 the above letter was forwarded to the Joint Chiefs of Staff for their approval by the Secretary of Defense.

"12. On 22 May 1950 the Joint Chiefs of Staff informed the Secretary of Defense that they concurred in the recommendations contained in the proposed letter to the President.

"13. On 25 May 1950 the above joint letter was signed by the Secretary of Defense and the Chairman of the Atomic Energy Commission and forwarded to the President, who approved on 8 June 1950 the recommendations contained therein."

December 19, 1950

Short-term requirements for A-bombs.

The earliest (1947) requirement laid down by the Joint Chiefs--for "X" bombs at the start of 1953--had never been formally supplanted by a new directive from the Defense Department to AEC. In May, 1949, and again in September, 1950, the Joint Chiefs established requirements for 1956, but these did not require that more bombs be on hand by 1953 than the original "X" number. It became apparent that considerably more than "X" number of bombs would in fact be on hand by 1953.

On December 18, 1950, the Joint Chiefs established a new "interim" requirement--"X" plus a certain number--for mid-1953.

No thermonuclear requirements were included.

December 26, 1950

Mr. Dean replied to Senator McMahon's letter of December 4 indicating various reasons why additional piles should not be constructed at Hanford.

December 29, 1950

It will be recalled that on August 18, 1948, the Department of Defense received a study on "Long Range Objectives" in the military use of atomic energy prepared by the Long Range Objectives Panel, Dr. J. R. Oppenheimer, Chairman. This report stated that "The Panel recognizes the importance of work directed toward the development of this thermonuclear weapon, but in view of the magnitude and complexity of the problem, the special personnel re-

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Thermonuclear Program, SARE (Chronology), January, 1953  
Jame Doc # DL XXIV H-Cont Chronology

Chronology of Atomic Bomb sent to  
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quirements, and the uncertainties as to the characteristics of a feasible weapon, it believes that this long-range objective cannot and will not be attacked at this time with the extensive scientific and industrial effort which characterized the wartime Manhattan District developments." The Panel also suggested that review as to substance be undertaken from time to time.

Third major  
policy report  
to the  
military

The next major report following the 1948 Report was that of December 29, 1950. Entitled "Military Objectives in the Use of Atomic Energy," and submitted by Dr. Oppenheimer, as Chairman of the reporting group, to the Atomic Energy Committee of the Research and Development Board of the Department of Defense, the Report contained the following conclusions in pertinent extracts:

"Principal Conclusions

"1. Victory in a general war in the near future is likely to depend on bringing to bear in all aspects of our military operations the maximum application of atomic weapons....

"3. The most urgent requirements for research and development lie in the field of fission weapons....

"12. Intensive study of thermonuclear warheads has established that they are more uncertain and much more difficult of development and, if achievable, much more costly in nuclear materials than was thought a year ago.

"13. The determination of the feasibility of thermonuclear weapons is an important, but very definitely a long range undertaking (more than five years).

"14. Only a timely recognition of the long range character of the thermonuclear program will tend to make available for the basic studies of the fission weapon program the resources of Los Alamos Laboratory...."

January 6, 1951

The General Advisory Committee stated as follows on the long-range objectives Panel Report submitted to the military on December 29, 1950:

"We approve of this statement of objectives and priorities, and hope it will be approved and used by the armed forces and the Atomic Energy Commission as a guide in pursuing their programs."

GAC approves  
3rd major policy  
report to the  
military.

The GAC further commented that the Panel Report stated military objectives with clarity and with "a keen insight into the realities of the present situation." Mr. Whitman and Dr. Oppenheimer, who participated in the Panel Report, abstained in the GAC from taking action on this matter.

Mid-January, 1951

By mid-January Los Alamos had re-run the calculations on the thermonuclear device proposed for the

While these calculations confirmed expectations that the first step in the might be achieved, the available evidence continued to indicate that would require almost prohibitively expensive amounts of tritium. Also Los Alamos had received the December, 1950 Panel Report to the military stressing the long-range nature of the thermonuclear effort.

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February 8, 1951  
Hanford tritium  
decision.

A controversy as to whether the next Eniwetok test series after Greenhouse should take place in 12 months or 18 months was resolved in favor of the later date. Decision on whether or not to recommend testing of the Booster--an A-bomb "boosted" with small quantities of light elements--was deferred.

In a Joint Committee meeting of February 8, Mr. Dean advised that H-pile at Hanford would not be re-loaded with enriched U-235 for further production of tritium.

The Commission also stated that it had decided to build a sixth graphite pile at Hanford.

March 7, 1951

The Joint Committee met with the Commission to discuss the state of the expansion program. At the meeting it was testified that:

"The question of rate and scale (of atomic production requirements) is being now much more jointly worked out at the MIL-Commission level. I would say, with the Joint Chiefs being educated much faster on this subject."

March 9, 1951

Dr. Ulam and Dr. Teller, working at Los Alamos, jointly submitted a report which proposed the use of a conventional A-bomb to compress materials to high densities.

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April 4, 1951

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The crucial  
new H-bomb  
proposal

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Teller modified this to using the radiation, and this was the origin of 'radiation implosion'...when Teller recognized the importance of high densities...he suggested that radiation implosion might be capable of achieving the required extreme densities over large volumes. This led to our present concept of thermonuclear reactions."

The a new type of H-bomb, was formally proposed at Los Alamos by Dr. Edward Teller. This device was successfully tested at Eniwetok on November 1, 1952 with an energy release on the order of 500-600 times that of the Hiroshima A-bomb.

Evolution of the principal ideas from the 1946 proposed by Dr. Teller in 1951--and how difficult or easy it might be for the Russians to be following a similar path--is open to interpretation. Dr. Hans Bethe and Dr. Edward Teller have written memoranda expressing sharply divergent conclusions, set forth at length below. Dr. Bethe states that the key proposals were of "accidental nature" attributable to Dr. Teller's "ingenuity and his persistent belief in thermonuclear reactions." Dr. Teller considers it a "miracle" that the concepts were not conceived sooner.

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Prior to this time, thinking had been directed mainly towards the 1946

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This proposal is not for an H-bomb of the "classical" type since much of its energy would be derived from the combination of fissionable and fusionable materials, rather than purely fusionable materials; and it would not be unlimited in its force, as the 1946 model would be.

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Almost the entire present thermonuclear program revolves around these ideas.

April 4, 1951

Secretary of Defense Marshall and AEC Chairman Dean addressed a joint letter to the President recommending as follows:

"(a) The amounts of tritium to be produced will be determined jointly by the Atomic Energy Commission and the Department of Defense from time to time to meet estimated requirements of the thermonuclear development program rather than to meet a fixed yearly rate.

"(b) Work on the thermonuclear program will be carried on with the objective of determining the feasibility of a thermonuclear weapon at the earliest practicable date. At the same time, promising developments of fission weapons will be carried forward effectively."

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Thermonuclear Program, SCRF (Chemology), January, 1953  
JCRF Doc # DLXXXIV H-Comb Chronology

Chronology of Atomic Bomb and the  
War written by Curzon

SCRF Doc # 54  
Doc # 100



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VII. Sequel to First Test and the New Ideas

May 10, 1951

Secretary of Defense Marshall wrote AEC Chairman Dean in part as follows:

"No statements in the December 29, 1950 Panel Report to the military on long-range objectives are to be considered as modifying the Department of Defense position regarding the thermonuclear program as set forth in our joint letter to the President, 4 April 1951."

May 25, 1951

The boosted A-bomb test (Greenhouse Item) was successfully conducted at Eniwetok. Originally proposed by Dr. Teller at Los Alamos during World War II, this device was re-proposed for test by Dr. Teller in his September 26, 1947 technical report. It was the boosted A-bomb device which, during Fall, 1948, the AEC, the GAC, and the MLC chose in preference to the

When the new H-bomb program started at Los Alamos following the President's 1950 directive to proceed, work upon the "Booster" was completed and the device was "placed on the shelf." However, since it was ready for test, the decision was made after the Greenhouse George explosion to fire it as the last shot in the Spring, 1951 series. The "Booster" test (and a later test at Nevada) established the probable utility of small amounts of tritium in improving the yield of moderate-sized A-bombs.

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May 26, 1951

Project Matterhorn, a group of theoretical physicists headed by Dr. John A. Wheeler, started work on H-bomb calculations at Princeton, New Jersey. The Matterhorn calculations dealt with such matters as propagation of flames in thermonuclear fuels, while Los Alamos worked on general design, implosion and The Matterhorn group also included Dr. Lyman Spitzer, working on the so-called "stellaerator," a project to obtain useful energy, heat and power from the controlled fusion of hydrogen isotopes.

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June 1951

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June 16-17, 1951

A technical report, entitled "Effectiveness of Lithium-6 in Super" was published at Los Alamos by Dr. Edward Teller and Dr. F. de Hoffman.

The famous Greenhouse George shot established at

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The Princeton conference

On June 16 and 17, 1951, a conference on thermonuclear problems was held at Princeton, New Jersey, to discuss the status of the three major models of H-bombs (alarm clock, and proposal) and H-bomb materials.

One key issue before this conference was whether exploration of new prospects opened up by the proposal of the and the "Greenhouse George" shot was within the Presidential directive of January 31, 1950. The anticipated development of the and the Alarm Clock appeared different from the "classical" which had been considered the principal model at the time of the Presidential directive.

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CONFIDENTIAL PROGRAM, SCHEMATICALLY, JANUARY 1953  
H-BOMB CHARACTERISTICS  
CANDIDATE OF H-BOMB & BOMB DESIGN  
WAS WORKED BY DUTCHMAN  
DOE CONFIDENTIAL  
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At the Princeton conference the decision was in effect made to pursue the new prospects. This decision ended controversy at Los Alamos and in Washington as to whether the President's directive referred only to the or whether it also covered any thermo-nuclear device yielding very great energy. The approach has largely been in abeyance since the Princeton decision.

In addition, the use of lithium-6 in were discussed at Princeton and a need for lithium-6 production recognized.

Proposals were made both to test the several points on which further data would be useful in one full-scale test; and to undertake further tests on each of the steps before an over-all test were made. The first approach was sometimes referred to as the "shoeshine" approach to make three tests in one. The second approach may be referred to as the "components testing" program.

August 21, 1951

In a Committee meeting with the Commission, Senator McMahon remarked that he had not been "satisfied that the Commission has pushed the hydrogen program with as much vigor as possibly it could be."

August 27, 1951

The Commission advised the Joint Committee of lithium-6 plans in the following letter:

"Dear Senator McMahon:

Initial lithium plant plans.

"At a meeting in June at Princeton among members of the Los Alamos Scientific Laboratory, the Commission, the General Advisory Committee and consultants to the Commission, the results of the Eniwetok tests and the thermonuclear weapon development program were discussed. It was agreed that the approach involving the generation of tritium in situ in a weapon was promising enough to warrant immediate provision for quantity production of separated Li<sup>6</sup>. Accordingly, plans for a production plant have been made.

"The Li<sup>6</sup> will be produced by a chemical-exchange isotope separation process being developed at the Y-12 plant in Oak Ridge. Pilot plant studies leading toward full-scale plant design are under way.

"Commencement of engineering design was authorized on August 9. Procurement of equipment and construction of the production plant, which will be located at Oak Ridge, will be initiated upon approval by the Congress of the Commission's 1952 Supplemental Appropriation which includes funds for this project. The preliminary estimate of the cost of this plant is \$4,000,000. The estimate is necessarily preliminary since there are no pilot plant or engineering design data available yet and costs had to be extrapolated from bench-scale data.

"We will be pleased to discuss this matter further with you if you desire."

September 17, 1951

As a technical matter it was necessary to decide whether to study each of the separate steps in an "super" and/or to undertake one test which combined the points to be tested. In addition, there was a technical question over the earliest possible date

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Thermonuclear Program, JCHC Chronology, December 1, 1953  
JCHC Doc # DLXXXIV H-Comb Chronology

Chronology of Atomic Bomb work by  
Loren Winters by Durham

JCHC Chronology  
Doc Box 60

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7 thermoneuclear test. While a majority of the Los Alamos laboratory approved November 1, 1952, a minority felt a date four months earlier was feasible. The Los Alamos decision was to build a full-scale test device which would be tested on November 1, 1952.

On September 17, 1951, responsibility for construction of the test device and meeting this schedule was centralized in Dr. Marshall Holloway.

September 18, 1951

Senator McMahon addressed the Senate and called for an atomic army, an atomic navy and an atomic air force. He asked that \$6 billion per year be devoted to atomic preparedness. S. Con. Res. 46 and H. Con. Res. 164 (the latter by Representative Durham, Vice Chairman) were introduced, resolving: "That the United States must go all-out in atomic development and production."

September 22, 1951

Los Alamos recommended the production of  $^{235}\text{U}$  of lithium-6 for a target date of September 15, 1953 a 2-year lead time. Previously, the expectation had been for the production of lithium-6 to be available by the fall of 1952 and one per day thereafter, but it was now thought that a lesser production rate might result in a more efficient production plant.

It was also recommended that there be no further enriched loading at Hanford for tritium production. The initial loading was expected to be processed by July 1952.

September 28, 1951

The Joint Committee met with the Commission on the thermomolecular program. It was stated that the earliest possible date for the full-scale test in 1952 was July, and that it certainly could be held by December. The Committee was told that the Commission had the alternatives of proceeding [step by step (the so-called components testing program) or combining several technical experiments in one full-scale test.]

A staff paper discussed at the meeting stated that qualified witnesses disagreed on the question of whether enough effort was being devoted to the hydrogen project. In response to this proposition, Chairman Dean noted that progress must be broken down into two periods—one from late 1949 when the program was launched until June 1951, and the second from June 1951 on. As to the first, Mr. Dean said that things went slowly because of discouraging calculations which indicated

As to the second period, Mr. Dean said that when the device was proposed "the atmosphere changed, I would say, even on the part of the General Advisory Committee; and the people who had been reluctant to get behind the 'Super' weapon became rather interested, and some rather enthusiastic about the

As to proposals for a second laboratory, Mr. Dean stated that the Commission had "not come to a conclusion that a second laboratory should not be done." Mr. Dean added that approximately two months earlier the Commission had decided that a second laboratory should not be launched that day. Commissioner Murray reported his dissenting views, he having recommended that a thermonuclear laboratory be established at once. He stated, in part: "...from a practical standpoint and trying to

First state-  
ment of AEC  
views on  
second lab-  
oratory.

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live up to a Presidential directive, it seems very clear to me the Commission should make up its mind today to move the thermonuclear work, and to re-organize and try to recruit personnel; and I feel very confident it can be done. Get a group of men whose sole attention and sole objective and purpose will be to get us the answer to the thermonuclear problem."

October 3, 1951

President Truman announced the explosion of a second atomic bomb within the Soviet Union.

October 5, 1951

The "TMO" was established at Los Alamos as the theoretical group to carry out work on large-scale thermonuclear explosions.

October 5, 1951

Senator McMahon sent the following letter to the Atomic Energy Commission on a second laboratory:

"Gentlemen:

McMahon's  
letter on  
second laboratory.

"In considering hydrogen problems at the Joint Committee meeting last Friday, we discussed the possibility of a second weapons laboratory. The point was made that work upon the H-bomb could not be transferred from Los Alamos to a new location without risking disruptions in the program during a period when you are striving toward a crucial test at the soonest possible date.

"However, it now occurs to me that we did not consider the approach of leaving Los Alamos to press ahead with its present hydrogen program, but immediately starting a second laboratory to supplement Los Alamos efforts in this field and also to furnish the spur of competition. (Neither did we discuss the possible role of a second laboratory in fulfilling simultaneously a like function in the field of fission weapons.)

"Since news of a further Soviet test explosion arrived just after the Committee meeting, this question troubles me: Could you do more than you are doing to speed the hydrogen program and improve chances of ultimate success?

"I am sure the Joint Committee members would be grateful for a succinct report on this question. If it appears the answer must be in the affirmative, I would much appreciate a reply within the very near future. Thank you indeed for your assistance."

October 13, 1951

The General Advisory Committee, with a dissenting opinion, recommended against a second--or thermonuclear--laboratory. The GAC commented in part, as follows:

GAC recommenda-  
tion against a  
second laboratory.

"The new laboratory seems to us unnecessary because the overwhelming proportion of scientists experienced in, qualified for, and interested in development work on weapons are now in fact in one way or another available to Los Alamos. The new laboratory would appear to be hardly feasible unless there were in fact a great many outstanding and specially qualified scientists who could be persuaded to work there, and yet could not be persuaded to contribute to Los Alamos. It is our view that no such situation exists. Circumstances in the future may, of course, call for a reevaluation; but we are convinced that, at the present time, the establishment of a new 'Los Alamos' or a 'thermo-

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Dec # 24 XXIV H- Bomb Chronology, 1953

Chronology of Atomic Bomb and its  
Development by Dickson

SCAF Cons. 14  
Also p. 60

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nuclear laboratory' would tend to impair the effectiveness of Los Alamos, and would not succeed in creating a new facility of comparable promise of achievement."

The dissenting member, Dr. W. F. Libby, stated in part as follows:

Libby dissent  
on second laboratory.

"The prospect of practical thermonuclear weapons makes it a matter of real importance, in my opinion, that we maintain a commanding lead in the thermonuclear field. The possibility that the Russians might avoid many of the difficulties of fission armament such as uranium isotope separation and extensive raw material stocks by moving directly into thermonuclear armament is so serious a consideration that it seems clear we should attack the task with more vigor and energy than Los Alamos can afford with its responsibilities to the fission weapons program. We know that fission weapons are effective and that a great deal of development needs to be done to increase the effectiveness of our present and anticipated fission stockpiles. This work certainly is of prime importance and should not be retarded. The remarkable achievements of the Los Alamos Laboratory in this field prove that it is completely competent to the fission development task. It seems clear that it cannot be expected to discharge both of these tasks, either of which would be a full-time assignment."

October 17, 1951

The Joint Committee on Atomic Energy unanimously adopted the following resolution:

"Resolved that the Joint Committee on Atomic Energy hereby requests the Atomic Energy Commission and the Department of Defense (after appropriate consultation with other agencies) to jointly transmit to the Joint Committee by January 3, 1952, a definite and concrete report on maximizing the role which atomic energy can and should play in the defense of the United States, including estimates of the amounts of money required, the specific extent and type of new facilities estimated to be required, the priorities in materials and manpower involved, the probable impact upon other defense projects and the national economy as a whole, and the joint views of the Atomic Energy Commission and the Department of Defense as to the precise program which should be carried out in the atomic energy field."

October 19, 1951

The Joint Committee issued a report to Congress, in part, as follows:

Joint Committee  
favors second  
laboratory.

"The Committee specifically suggests that early consideration be given to the possibility of a second weapons development laboratory to supplement Los Alamos at least in certain engineering phases.

"As this suggestion indicates, concern is felt over the increasing burdens imposed upon Los Alamos. That laboratory is to be congratulated upon the results of the tests conducted last winter at the Nevada site and more recently at Eniwetok Atoll in the Pacific. These very results, achieved by Los Alamos, create incentive to pursue so many lines of endeavor simultaneously as to create difficult problems for any single laboratory. The Committee also has in mind the continuing necessity of an imaginative approach and a willingness to assume

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Dec # DLXXXIV  
H-Comb Chron/105  
January 1, 1953  
Chronology of H-Comb Chron/105  
written by Durbin  
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risks, including the risk of test failures, if the stakes appear to be sufficiently high."

The Committee concluded this report as follows:

"If the Committee has a single general comment to offer, it is this: Greater boldness and more scientific and technical daring should be brought to bear upon the program."

October 19, 1951

Mr. Durham, Vice Chairman of the Joint Committee, addressed the House, urging greatly increased atomic production efforts. Among other matters, Mr. Durham stated that an average of under \$500 million a year had been spent for atomic weapons in fiscal years 1946 through 1951; that during these years atomic weapons accounted for only some two and five-eighths cents in the defense dollar.

October 19, 1951

Chairman Dean acknowledged Senator McMahon's letter of October 5, 1951, on the possibility of establishing another laboratory to expand the hydrogen weapons research potential. The letter stated that the problem had been under study and that a report was expected by the Commission within the next three weeks.

October 22, 1951

The third atomic explosion within the Soviet Union was announced.

November 11, 1951

A group at Los Alamos set up equipment for preliminary experiments in the study of controlled thermonuclear reactions. The purpose was to explore the so-called "pinch effect", whereby thermonuclear fuels might possibly be controlled and the energy utilized.

November 12-14,  
1951

The Vista report on the defense of Western Europe--a document largely prepared by civilian scientists under contract to the Defense Department--was reviewed prior to presentation in the final meetings of the Vista group at Pasadena, California. As to the role of thermonuclear weapons, the introduction to the Report, prepared by Dr. J. R. Oppenheimer, found that: "At the present state of the art, the value of thermonuclear weapons cannot be assessed. Therefore, they are not included in the Vista study."

Fourth Major  
Report to  
Military

In the chapter entitled "Atomic Warfare" of the Vista Report, the section on thermonuclear weapons stated in toto as follows:

"The prospects of successful development of a thermonuclear weapon have very greatly improved in the last year. Several proposed models are now under study, all with anticipated yields of several megatons. These models have undergone enough examination to eliminate any obvious reasons for failure, and some tentative designs of working systems have been made. It is now proposed to test fire one of these designs late in 1952.

"It is not possible now to evaluate either the economy or the deliverability of these proposed weapons. They all involve the use of fairly large amounts of fissionable material, and they are all of such weight and size that they would require a carrier probably of the size of the B-36 to deliver by air. The proposed explosion is so large that a piloted carrier is unlikely."

[The Vista Report referred to here is the "second" Vista report. The first version of the report, and the introduction thereto, is unavailable.]

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November 15, 1951

A technical study entitled "Early Stages of a Super Explosion" was issued at Los Alamos.

December 7 and 12, 1951

Commissioner Murray and Dr. Edward Teller presented memoranda to the General Advisory Committee in favor of the establishment of an independent thermonuclear laboratory. Commissioner Murray proposed the establishment of a laboratory gradually to take over the entire thermonuclear weapon research and development program. Dr. Teller's memorandum stated that "The very rapidity of recent progress is evidence of potentialities which have been neglected for years and which will not be fully exploited unless a new laboratory is established."

January 9, 1952

Chairman Dean wrote the Joint Committee the following letter on the thermonuclear program, rejecting proposals for a second laboratory. This letter said, in part:

AEC decision against second laboratory.

"Creation of dual laboratories such as Los Alamos would dilute the scientific talent and introduce difficult problems of coordination. Further, because of disassociation of talent and effort between two laboratories the rate of progress would be reduced.

"We further feel that the division of talent between Los Alamos and a competing laboratory would at this time retard rather than accelerate the development program. Scientists of the caliber necessary to man and administer another laboratory for the prosecution of development programs similar in scope to Los Alamos are limited in number."

The Commission letter quoted extensively from the October 13, 1951 General Advisory Committee report recommending against creation of a thermonuclear laboratory.

January 16, 1952

Military requirements changed in part.

On this date, according to a recent letter from the MLG to the Joint Committee, "minimum production capacity requirement on a 'now' basis and a corresponding bomb requirement to be attained as early as possible were established by the Joint Chiefs of Staff in order to provide the AEC with interim all-out objectives."

No thermonuclear requirements or requirements for thermonuclear materials were established.

January 18, 1952

Los Alamos froze the basic design for the full-scale thermonuclear test shot scheduled for November 1, 1952.

January 29, 1952

Los Alamos issued a technical report, "Interim Report on the 'Alarm Clock'." This optimistic report considered, among other models, an H-bomb model smaller than the stockpile Mark VI A-bomb.

January 29, 1952

Senator McMahon looking toward an early Committee meeting with the Secretary of Defense and the Joint Chiefs of Staff, wrote the Department raising, among others, the following questions on thermonuclear matters:

"Soviet capabilities in the thermonuclear field. Does the defense establishment regard it as probable that the next decade will see the Soviet Union producing thermonuclear weapons with yields in the megaton range? If so, what is our present thinking as to the problem of defending the United States against carriers delivering these weapons?"

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H-Form Chron 1053  
History of Atomic Bomb and its Development by Carlson  
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Dec 1952

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"The place of thermonuclear weapons in our strategy of defense: Should these weapons prove feasible, is it probable that they will constitute a limited supplement to fission weapons? Or does Defense think that we will want to convert major portions of our existing atomic stockpile into hydrogen weapons? If this is the plan, what studies are now under way to assure that such conversion will take place with maximum speed?

The Production  
Issue: Further  
McMahon question.

"Our own present thermonuclear program: I am most anxious to know whether the Defense Department regards present efforts in the hydrogen field as sufficient--particularly whether it is not necessary and desirable to undertake increased developmental work looking toward usable and deliverable weapons and increased production of materials required for hydrogen weapons, on the assumption that planned tests will be successful--so that, at such time, we would immediately possess a significant hydrogen capability in a military sense. I am also anxious to know whether the Defense Department regards the present developmental program as of high or low priority--and whether or not it is considered that emphasis upon the test scheduled for next fall (largely to the exclusion of other approaches) should be supplemented by more intensive parallel developmental efforts."

February 6, 1952

The Joint Committee met with the Secretary of Defense and the Joint Chiefs of Staff to consider the plant expansion program and the thermonuclear program. Secretary Lovett testified as follows on the decision underlying the expansion in fissionable materials for A-bombs:

(A) "Secretary Lovett. As we indicated earlier, I think we have bought five years, or we requested the Congress through AEC for authority to buy five years of advancement /of the date when 'X' number of bombs would be in stockpile/ for approximately \$5 billion; the reason being that that minimum number in the stockpile is a number which would give us a status of security far greater than anything we have previously had in mind."

The ensuing testimony makes it clear that the Department of Defense did not choose the year 1960 as a date of potential conflict, but merely considered that five years of time were worth the \$5 billion, insofar as A-bombs were concerned.

The following testimony occurred:

"The Chairman. Have you any recommendations to make to the Committee as to the speeding up of the hydrogen program?

"General Bradley. No sir, we don't know of any."

The following testimony also was given:

"General Bradley. ... We don't think /the H-bomb/ will ever supplant our present stockpile of /A/ bombs, but it would be an important supplement to it because, ... it would be used on larger targets, targets requiring a larger /weapon/ effect than what a small bomb might accomplish."

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"The Chairman. Well, General, on the assumption that the test is successful this fall, at

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Defense Program, JSCF (Security), January, 1953  
Doc # DLXXXIV H Bomb Chron 1953

Chronology of Atomic Bomb and its  
Development by Erickson

JSCF Security  
Doc # 71-00

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that time will the Joint Chiefs be ready with their determination, based upon the success of that test, as to the percentage that should be immediately converted to H's?

"General Bradley. I wouldn't say be ready with percentage, but would certainly get busy and figure out a percentage. We would have to find out just what the results are....

The production  
issue: McInahon  
views.

"The Chairman. General, I don't wish to seem unreasonable, sir...but if this test comes off.... it is going to have an explosive equivalent to at least a million tons of TNT. So they tell us.

"Based upon that figure, it would seem to be wise if there were studies made as quickly as you can make them with the idea of translating those things into stockpile ... because it would be unfortunate if there was any great delay there between the successful test and the implementation.

"General Bradley. ...We are continually studying this, and I imagine could come up with an answer fairly fast, because we know the targets now that require 2, 3, 4 or more bombs, according to the present effect, as we know it, of our present bombs."

At the conclusion of this meeting, Senator McInahon requested of the Department of Defense a report reviewing and evaluating the thermonuclear program and specifically covering the question whether a second laboratory should be devoted to H-bombs.

February 11, 1952

Senator McInahon wrote the Atomic Energy Commission, in part, as follows, raising questions on which the Commission was asked to comment in its next meeting with the Committee:

"1. I wonder whether it can now be anticipated that the fusion field, generally speaking, may prove as varied in development and as broad in prospect as the fission field. Present prospects, for example, appear to range widely, from devices deriving their yield primarily from thermonuclear reactions, through mixed fusion-fission devices, to fusion-boosted fission weapons. This raises the questions whether we are approaching not only achievements of a new dimension, but also requirements for development of major and new dimensions.

"Furthermore, the question may also be posed whether it is not time to determine whether the scope and scale of our thermonuclear development, particularly the development and actual production of usable and deliverable weapons, is not largely dependent upon the effort that is expended. I am deeply convinced that United States development--to the maximum extent, in maximum scope, and within the shortest period of time--is not only of vital but unique importance. I remain apprehensive that the Soviet Union will be first to produce a large-scale thermonuclear reaction or first to produce usable and deliverable thermonuclear weapons.

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The GAC also took note of the possibility of controlled thermonuclear reactions for peacetime uses, stating that the "prospects, however remote and obscure, are not without interest...." The GAC stated its opinion that work on controlled thermonuclear reactions should be declassified as had been recommended by the Senior Responsible Reviewers to the Atomic Energy Commission. The GAC noted that "we hope that by declassifying work in this field and by encouraging participation wherever qualified workers may be interested, a larger group of investigators may be led to address themselves to the problems."

February 21, 1952

The Committee met with the Commission to review the hydrogen program. Discussion in the meeting related to a staff memorandum which stated, in part, that "the present hydrogen program is too little and too late in the following respects:

"(1) Of five promising types of H-bombs, only one is being vigorously developed today.

"(2) There is today little or no effort to reduce the time lag between a successful experimental test and the achievement of a practical weapon--years may elapse between the two.

"(3) The sole material now deemed crucial (lithium 6) is to be produced in limited test quantities only. Again, years may elapse between a successful experimental test and stockpiling of H-bombs in quantity.

"(4) Not nearly enough scientific manpower is being applied to the hydrogen program. Example: Of 12,000 Ph.D. physicists today working in the United States, less than one in 200 is working full time upon H-bomb problems.

"(5) In a word, although the situation has gradually improved since 1949, there is still no real sense of urgency about the hydrogen program.

"...The Committee staff is firmly convinced that the minority in this /the second laboratory/ controversy is right and that establishment of a second laboratory is the greatest single step which could be taken to hasten the H-bomb effort."

In response to the comment on sense of urgency, Chairman Dean stated that progress in the last two years had been "sudden" and "remarkable." Senator Hickenlooper stated as follows:

"Senator Hickenlooper. I might tend to agree with your statement that you made some substantial progress. I mean I may be restless for not going faster, but the General Advisory Committee in 1949 was against the hydrogen project. A majority of the Commission was against the hydrogen project.

"If you will read the minutes, which you probably have, you will find it stopped on dead center there, and it never even got started until late 1949 or perhaps I think the Chairman went after them and raised the devil, and the Committee expressed its thinking we ought to move on that project.

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Doc # DL XXXIV H-Bomb Chronology, January, 1953  
Chronology of H-Bomb & H-Bomb  
Development by D. H. Brown

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"But I do think there was an inertia there for a long period of time, which, to say the least, has not been picked up except in the last couple of years.

"Mr. Dean. That is true.

Senator Hickenlooper comments on sense of urgency.

"Senator Hickenlooper. So the whole hydrogen project has suffered from an inertia since 1946. Based upon the limitations of the experiments and the knowledge at that time in 1946 we had two or three expositions of the feasibility of this hydrogen project and flat statements from reliable people that in their opinion a hydrogen explosion was feasible based upon what they had learned up to that time.

"They said there were things that they had to prove. That is very true. But there was a complete inertia, and the General Advisory Committee was partly responsible for that and the Commission was partly responsible for that because both of them by majority vote advised against going into the hydrogen project.

"Some of the reasons were put on moral grounds; others were put on a question of the feasibility; but there was that inertia, and I think that has contributed to not being farther along than we are at the moment...."

"Dr. Smyth: ...I would like to go back, if I may, to Senator Hickenlooper's statement about the attitude of the Commission in 1949. I don't want to go into details now, but I would like to perhaps send you a letter covering it. I think it is not quite as clear cut as you suggested, Senator Hickenlooper."

The possibility of a second laboratory was discussed at length. Commissioner Murray, who favored a second laboratory, stated his position. Chairman Dean commented for the majority of Commissioners who took the other view. He particularly stressed the disruption at Los Alamos that a second laboratory would cause, the bitterness that might be created at Los Alamos, were a second laboratory to be established, and the unavailability of people to staff a further effort at a separate site.

At the conclusion of the meeting, Senator McMahon and Senator Hickenlooper made statements indicating their own belief in the desirability of a second laboratory.

March 9, 1952

On February 6, 1952, Senator McMahon had requested a report on the thermonuclear program and the second laboratory issue from the Department of Defense. On March 9, 1952, Secretary Lovett reported that, accepting results accomplished to date and plans for the future as a basis for appraising effort and progress in the thermonuclear program, "I find no reason for adverse criticism of the immediate effort."

On the question of a second laboratory, the Secretary stated:

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Thermonuclear Program, SENE Hickenlooper, January 1, 1953  
JONE Doc # DLXXIV H-Font Chrono 1953

Chronology of H-Font & SENE sent to  
Commissioner by Ruckman

JONE Chrono sent to  
H-Font 1953

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Secretary Lovett's  
views on Second  
Laboratory.

"Any movement to break the thermonuclear program away from the Los Alamos Scientific Laboratory at this time would certainly be in the wrong direction. It seems clear, however, that there are many aspects of atomic weapon research and development now assigned to the Laboratory which could be pursued profitably elsewhere and under separate management. The development of a scientific and managerial staff for that purpose will take time. We cannot afford to delay until some more convenient time because such a time will never arrive. In my opinion, therefore, the foundation of a second laboratory should be established without delay."

March 19, 1952

The Secretary and Under Secretary of Defense and other key Defense Department officials were briefed by Dr. Teller and by Rand Corporation on the thermonuclear program, views as to a second laboratory, and implications of H-bomb information passed by Fuchs to the Russians. This briefing had been given to the Secretary of the Air Force on March 6 and to the Air Council on March 11, 1952.

March 24, 1952

Secretary Lovett wrote Chairman Dean and Secretary Acheson, the other two members of the Special Committee on Atomic Energy of the National Security Council, proposing that immediate consideration be given to the scale of the hydrogen development program and to a second weapons laboratory.

March 25, 1952

The Air Force received on this date a formal and detailed proposal in behalf of a second laboratory to be established in Chicago for intensive work on thermonuclear matters. A program including tests was advocated for the new laboratory, and a statement made of the background of personnel who could assist in its achievement. The list included some of the country's most eminent names in nuclear physics.

April 3, 1952

The thermonuclear and second laboratory issues put before the National Security Council by Secretary Lovett were referred back to the Atomic Energy Commission and to the Department of Defense for joint determination by these two agencies.

April 14, 1952

In a letter to the Atomic Energy Commission, Senator McMahon requested, in part, the views of the Commission on the "second laboratory issues recently raised with the National Security Council."

April 15, 1952

The Teller-Rand thermonuclear briefing was given to the Policy Planning Group of the State Department. The Joint Chiefs and the NSC had previously been briefed on March 31, and also some members of the State Department and National Security Council; members of the Atomic Energy Subcommittee of the NSC were briefed April 1, 1952.

April 28, 1952

A panel was established to assist the State Department and other government agencies in connection with work of the United Nations Disarmament Commission. The Panel elected Dr. J. R. Oppenheimer chairman.

April 30, 1952

It will be remembered that on October 13, 1951, and on February 17, the General Advisory Committee had recommended against the establishment of a second laboratory to work on thermonuclear problems. In the report of April 30, 1952, the GAC re-stated its position, as follows:

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"We had the benefit of a detailed and current report of the thermonuclear program from Dr. Bethe of the Los Alamos Laboratory, and in more general discussion with the Director of the Laboratory and the Director of the Division of Military Application. We also had occasion to examine the correspondence addressed to the Commission by the Secretary of Defense and by the Acting Secretary of Defense, expressing a strong dissatisfaction with the scope and adequacy of the thermonuclear weapons development program. We have, in the past, expressed concern lest any steps taken to increase the level of activity in this field impair or destroy the effectiveness of Los Alamos, which has at this time a sound, varied, constructive program very likely indeed to lead to success. This consideration is still for us determining. We reiterate our conviction that the work of Los Alamos itself should be broadened, and our impression that this can best be done by creation of an advanced development activity. We do not believe the steps toward this end being taken at Los Alamos are either as rapid or as far-reaching as is called for, and we hope that the Commission will find ways to improve the situation. We further believe that our earlier recommendations for removing from Los Alamos as much of the routine work in fission weapon development as possible need further effort.

GAC comments on  
Radiation Laboratory  
as site for thermo-  
nuclear work.

"We should like to supplement these suggestions with another. During the GREENHOUSE tests a year ago, the Radiation Laboratory of the University of California made very important contributions to the difficult and subtle instrumentation of the tests of thermonuclear devices. We understand that Dr. York of this Laboratory is interested in continuing and extending this effort, and that he has a specific interest in the so-called componentry tests for thermonuclear development and radiation implosion, and in other aspects of the thermonuclear weapons development. We recommend to the Commission that the University of California Radiation Laboratory be asked to undertake this work and that the Commission support it to the full. We further recommend that the University of California Radiation Laboratory be encouraged to devote its attention to broader problems in the field of thermonuclear weapons and to assemble those scientists who are competent in, and interested in this work, PROVIDED ONLY THAT THESE STEPS SHOULD NOT DEPRIVE THE LOS ALAMOS LABORATORY OF THE SERVICES OF ITS PRESENT PERSONNEL, CONSULTANTS AND SUBCONTRACTORS. Should these steps lead, as we believe they probably will, to proposals on the part of the University of California Radiation Laboratory for undertaking further specific development programs in the field of thermonuclear weapons, these, upon proper discussion with the Commission and the Los Alamos Laboratory, should be encouraged."

May 1, 1952  
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May 5, 1952

Construction was started on a Lithium-6 Separation Plant at Oak Ridge, Tennessee. Construction time was estimated at approximately one year, with design output of high enrichment Lithium-6 per day.

The "Super Effects Handbook," a major study on H-bomb weapon effects, was issued by AFSSHP.

May 28, 1952

On this date Dr. Hans Bethe submitted to the Commission a Memorandum on the History of the Thermonuclear Program.

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"It seems appropriate at this time to review the history..." Dr. Bethe states, "in order to correct two apparently widespread impressions which I consider erroneous. These are (1) that the progress of this program, since the Presidential directive of January, 1950, has been slower than was technically feasible, and (2) that the Russians may have been able to arrive at a usable thermonuclear weapon by straightforward development from the information they received from Fuchs in 1946."

In a memorandum dated August 14, 1952, Dr. Edward Teller commented on Dr. Bethe's memorandum. The Teller memorandum reached different conclusions and differed on technical analysis. Because of the importance of the issues raised and because of the pre-eminent position of both scientists in the field of thermonuclear reactions, the conclusions reached by Dr. Bethe and the comments of Dr. Teller are set forth below in contrast: Dr. Bethe's summary of the history of our program is taken from the conclusion of his memorandum, and Dr. Teller's different views are taken from his memorandum which comments specifically on each of Dr. Bethe's concluding points:

Dr. Bethe. "(1) The \_\_\_\_\_ as conceived in 1946 is probably not feasible, certainly impractical."

Dr. Teller. "1. It is true that the detailed design of the \_\_\_\_\_ as conceived in 1946, is in all probability impractical. It is, however, unclear whether or not some minor modifications, \_\_\_\_\_ may alter this situation."

Dr. Bethe. "(2) There are at present only two promising ways to obtain large-scale thermonuclear reactions, \_\_\_\_\_"

Dr. Teller. "2. Many and varied models of thermonuclear bombs are likely to become feasible and practical by using a fission bomb to compress the thermonuclear bomb. Compression by radiation implosion is only one of the possible procedures. The present models of the \_\_\_\_\_ and \_\_\_\_\_ are very specific examples and more of the kind are likely to be developed. In my opinion the \_\_\_\_\_ has some promise in its present form, but there is no certainty that it will work. Success of the \_\_\_\_\_ in its present form is unlikely. The thermonuclear program at Los Alamos was directed toward the two models mentioned above, and neglected general experimentation on various simple models in which one bomb compresses another."

Dr. Bethe. "(3) Development of a possibly practicable device could begin in earnest only after the invention of the radiation implosion which originated outside the thermonuclear program."

Dr. Teller. "3. Radiation implosion is an important but not a unique device in constructing thermonuclear bombs. The main principle of radiation implosion was developed in connection with the thermonuclear program and was stated in a conference on the thermonuclear bomb, in the spring of 1946. Dr. Bethe did not attend this conference but Dr. Fuchs did."

Dr. Bethe. "(4) The invention of the \_\_\_\_\_ in 1951 was largely accidental. It is unpredictable whether and when a similar invention was made or will be made by the Russian project. The invention in our project could \_\_\_\_\_"

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probably not have been accelerated by harder work. Since the time the invention was made, work has progressed at maximum speed."

Dr. Teller. "4. It is difficult to argue to what an extent an invention is accidental. Most difficult for someone who did not make the invention himself. It appears to me that the idea of the <sup>Li6</sup> was a relatively slight modification of ideas generally known in 1946. Essentially only two elements had to be added:

Since the invention has been made, work has progressed at greater speed by not too narrow a direction."

Dr. Bethe. "(5) The 'Alarm Clock' was invented after Fuchs left, and became practical only by the inclusion of (in 1950) and its combination with the

Dr. Teller. "5. The use of <sup>Li6</sup> was proposed in this country in the summer of 1950, that is after the arrest of Fuchs. The decision to produce <sup>Li6</sup> was made in the summer of 1951. Thus the idea occurred late and there was further delay in the execution. It is likely that <sup>Li6</sup> will become important in some bomb but its present use in the is open to serious doubt. This development was slow along the only lines on which the Russians had no early notice about our thinking." The first actual proposal for lithium 6 in an was the September 26, 1947 H-bomb memorandum by Dr. Teller. The text on this point is quoted above.

Dr. Bethe. "(6) The thermonuclear work at Los Alamos was never really interrupted. Between Fall 1947 and Fall 1949, the booster was developed which proved very important in its own right and proved closer to present design than the 1946 version of a full-scale thermonuclear reaction."

Dr. Teller. "6. The thermonuclear work at Los Alamos was at an almost complete standstill between the spring of 1946 and January 1950. Only one big scale device, the 'Alarm Clock,' was considered in that period, and the work of only three senior people was involved (Richtmeyer for approximately 8 months, Nordheim for approximately a month, Teller approximately two months and, in addition, the work of perhaps two or three computers for a full year.) The booster was proposed in the fall of 1947. Reasonably intensive work was carried out on that device in the second half of 1949. It took four years from the first proposal to make a test of the booster and five years to arrive at a model of some military value."

Dr. Bethe concludes in a letter transmitting his memorandum, that it was his opinion "that a continuation of our efforts at the present rate would assure us of a safe margin over the Russians...progress of our work on thermonuclear weapons, since the first Russian bomb explosion and especially since Teller's discovery of the new approach, has been about as rapid as was technically feasible... Clearly, no amount of work can assure us of a lasting monopoly in this field. On the contrary, if we now publicly intensify our efforts we shall force the Russians even more into developing this weapon which we have every reason to dread."

Dr. Teller concludes his comments as follows: "I believe that we have pursued the thermonuclear development

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throughout the past seven years at much too slow a rate; and even since the Presidential Directive progress has been slower and certainly narrower than is consistent with national security. Our only comfort seems to be that the Russians have not as yet given any evidence of possessing an effective thermonuclear weapon. It is my opinion that we have excellent indications to the effect that thermonuclear weapons are feasible and practical. There is no assurance, however, that present plans will lead to a successful big scale explosion and there is even less certainty that the present early plans for a deliverable weapon will work out satisfactorily. We may, therefore, be at the beginning of an arduous program and it is quite possible that the Russians have advanced much farther along that road than we have."

May 30, 1952

Senator McMahon, Chairman of the Joint Committee,  
sent the following letter to the President:

"Dear Mr. President:

"More than two years ago you directed that the H-bomb program go forward. The historic rightness of your decision, in the defense of our country and in the defense of peace, cannot be questioned. I write you today because I believe that further action is necessary by way of laying down requirements for H-bombs in quantity. Only the President of the United States should decide this issue.

"It now seems likely that not merely one but several types of H-bombs can be constructed. The explosive power of each of these weapon types is expected to be equivalent to some millions of tons of TNT and very possibly tens of millions of tons of TNT. The early doubt whether this weapon could be made at all has almost disappeared. Likewise it seems that the weapon will be of manageable proportions from a delivery viewpoint, such that it could be carried in existing-type aircraft. A deliverable prototype H-bomb is anticipated by 1954 or sooner. The first A-bombs cost our nation about \$2 billion; I estimate the first H-bombs may cost less than one tenth of this sum."

"Since your original instructions two years ago had to do mainly with development efforts, my specific purpose in writing you is to recommend a new directive covering production efforts--how many H-bombs we need and how soon. As you know, certain questions on the scope and scale of the hydrogen program are now pending before the National Security Council, and some studies are underway. I very much hope that the problem will be met squarely in all of its implications for our defense.

"A basic element in this problem is tactical uses. If the H-bomb is only a strategic weapon, then the number that could profitably be employed against an aggressor may be comparatively limited. If, however, this weapon is to have sweeping tactical applications against enemy military targets in case of war, then the number which we could profitably employ is apt to be very great.

"A related question is the percentage of our existing and anticipated atomic stockpile that should be made available for hydrogen weapons. Ordinary A-bombs, of course, may be used to produce

The 1952 McMahon  
letter to the  
President.

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atomic explosions or else to set off vastly more powerful hydrogen explosions. Should 10%, or 50%, or 90% of the atomic stockpile be assigned to the accumulation of a hydrogen stockpile? A third basic element in the problem is the estimated costs—over and above funds we already plan to spend on the atomic program—for manufacturing various numbers of H-bombs: For example, 100, 500, 1000, 1500, etc.

"In other words, the fundamental issue is to what extent the H-bomb will be our primary nuclear weapon and the A-bomb a secondary or special-purpose weapon. I would not be of most help to you, as you confront the momentous problem of hydrogen requirements, unless I stated frankly my own belief that H-bombs can and must rapidly be made the primary weapon.

"There are those who hesitate even to estimate military requirements until a specific hydrogen weapon type has been field-tested. It is true that we do not know today whether a particular H-bomb model will take out, for example, a circular area which has a radius of seven miles or only six miles. But, as I have noted, we have every expectation of achieving a deliverable prototype by 1954 that will introduce a new order of magnitude in firepower. To wait upon a prototype perfect in the last details before laying down quantity goals for H-bombs may well delay us two or three years.

"I do not think anyone familiar with the technical facts can say that mass production of H-bombs within the next few years is beyond our capability. Cost figures of course contain a number of variables and uncertainties at the present time. I estimate, however, that a program designed to make the H-bomb our primary nuclear weapon would add perhaps \$200 to \$300 million annually to the expenditures we already contemplate for the Atomic Energy Commission. The important point is that the cost—relative to guns or tanks or planes or even to our present outlays for A-bombs—would be small. In my sincere judgment, the need is not huge funds—it is a bold decision to attain H-bombs in real quantity as quickly as possible.

"It seems to me self-evident that, so long as the arms race continues, the ineluctable logic of our position leaves us without choice except to acquire the greatest possible firepower in the shortest possible time. It seems to me equally self-evident that the basic decisions on H-bomb requirements must be reached now.

"Attached to this letter is a chronology which I had prepared on the leading events in the formulation of our atomic production policy over the past six years. The chronology is a long one, and some parts of it do not make for happy reading. In case you find it difficult to agree with the views expressed in this letter, I hope that you will not think it presumptuous of me to request that you and your highest counsellors read the attached paper. I profoundly hope that, six years hence, our military planners will be able to look back upon their recommendations in the hydrogen program and find satisfaction in the fact that some of the early delays encountered in the atomic program were not repeated.

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Executive Program, JCRF Chronology, January 1, 1953  
Doc # DLXXXIV H- Bomb Chronology

Chronology of Atomic Bomb and its  
Development by Durrant

JCRF, Gen Sec  
Dec 60

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"I am sure I do not need to say that I write this letter with intense personal anguish. I share what I know are your own feelings of horror at the thought of these hideous weapons entering into the arsenals of the world. Yet overwhelming American superiority in H-bombs may well be the decisive means of keeping open the future for peace. It is one of the paradoxes of history that the President, who has worked harder and done more for world peace than any of his predecessors, has also been required--in behalf of peace--to meet the issue of hydrogen weapons.

"If we carry on the fight for peace which you have launched, I remain convinced that we will yet win through to victory without war."

June, 1952

On May 22, 1952, Dr. Bradbury, Director of the Los Alamos laboratory, had written the AEC Director of Military Applications to suggest that the hardware for devices be developed as an "emergency capability"--i.e., a capability to be in being as soon as the necessary lithium-6 were available to insert in the hardware. Dr. Bradbury further proposed that the hardware be such that devices could be delivered in existing-type aircraft.]

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First statement  
of military  
requirements.

On June 23, 1952, Mr. Dean, as AEC Chairman, wrote the MLC suggesting that this effort toward an "emergency capability" be undertaken, with Los Alamos, Sandia Base, and the military to cooperate in hardware development. On July 3, 1952, by letter from Mr. LeBaron, the MLC concurred in this suggestion. The letter noted that the limiting factor was not hardware but materials to be used in the hardware. This appears to be the first statement of military need from the Defense Department to the AEC in the thermonuclear weapons field.]

June 5, 1952

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June 5, 1952

The test shot at Las Vegas, was carried out. The results were favorable.]

In an address to the House, Representative Jackson discussed the scale and scope of our atomic program in part as follows:

"If Stalin attaches higher priority to achieving the hydrogen bomb than we do, if he assigns his program more men and more resources than we are assigning ours, he may conceivably get there first and get there first with more. It is as simple as that...."

June 10, 1952

Chairman Dean replied to Senator McMahon's letter of April 14, 1952, requesting information on H-bomb issues and second laboratory issues before the National Security Council, as follows:

AEC second  
laboratory views  
as of June, 1952.

"We have proposed to the University of California Radiation Laboratory the possibility of the Rad Lab participating in the weapons program to the extent of developing and experimenting in methods and equipment for securing diagnostic information on behavior of thermonuclear devices and the conduct of such instrumentation programs in support of tests of thermonuclear devices in close collaboration with the Los Alamos Scientific Laboratory. This matter is currently under negotiation but an acceptance by UCRL is expected. After UCRL is established in

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JUN # 24 XXIV  
H Bomb Chronology  
January, 1953  
unwritten by DeBaron

See box 60

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diagnostic work, they will be encouraged to submit for AEC consideration proposals of further areas of thermonuclear research.

"In addition to the increased effort planned for LASL and UCRL, the Commission has farmed out specific assignments from within the thermonuclear program.

(1) Princeton University is now engaged in computing theoretical thermonuclear problems (Project Matterhorn) and this effort will be continued; (2) The Bureau of Standards has constructed for AEC a cryogenics plant and is now producing liquid hydrogen at Boulder, Colorado; (3) The Cambridge Corporation has designed and constructed large capacity mobile receptacles (devars) for transporting liquid hydrogen while maintaining its refrigeration; (4) Ohio State University has installed and will operate the hydrogen liquification plant at Eniwetok for operation IWV; (5) American Car and Foundry is responsible for the major portion of the engineering design and construction of the non-nuclear components of the PANDA experiment.

"As explained in the Hearing before the Joint Committee last Fall, the Commission is of the opinion that to establish a second weapons laboratory would dilute the efforts of Los Alamos and would have no compensating advantages for many years. It is becoming increasingly clear that thermonuclear and fission weapons have become more closely related in design and planning and that separation of these two fields of activity would be disadvantageous. We are of the opinion that it will be more effective to bring additional efforts to bear on the increasingly important thermonuclear program along the lines indicated above...."

June 10, 1952

President Truman acknowledged Senator McMahon's letter of May 30, 1952, and stated he had referred it to the Atomic Energy Subcommittee of the National Security Council.

June 11, 1952

In a Joint Committee letter to the Military Liaison Committee, the two paragraphs quoted above of the Commission's letter, dated June 10, 1952, were cited. The MLC was requested to state whether or not the second laboratory issue required the use of the Military Liaison Committee's Statutory Appeal Procedure to the President under the Atomic Energy Act.

June 13, 1952

On this date the Department of Defense gave to the AEC a further statement of military requirements in the thermonuclear field. In a letter from Mr. LeBaron, MLC Chairman, to Mr. Dean, AEC Chairman, the following appears:

Second statement of military requirements.

[ "A military requirement exists for the development of thermonuclear weapons giving yields of one megaton upward; a military requirement exists for the production of such weapons provided they are compatible in size, shape, and weight with delivery systems that will be available in 1954." ]

June 14, 1952

Last McMahon speech.

In his last major address Senator McMahon called for production of hydrogen weapons "numbered in four figures" and the substitution of "cheap atomic and hydrogen firepower for expensive conventional firepower."

June 16, 1952

A Rand Corporation study entitled "Thermonuclear Attack on an Army Group" was issued.

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Doc # 24LXXIV  
H-Comp Chem 105  
1953  
unavailable by Dickson  
JAF  
GSA  
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June 24, 25, 1952

Following instructions of the Joint Committee Chairman to obtain informal thinking of the Service Secretaries as to numbers of hydrogen weapons, the staff called on the Secretaries of the Army, Navy, and Air Force. Secretary Finletter stated that so far as the Air Force was concerned, it wished major conversion from A-weapons to H-weapons.

Secretary Pace indicated that H-bombs were a problem for the Air Force primarily and for the Navy secondarily, affecting the Army the least of the Services. He stated that too little was known to enable the Army to make a recommendation of value about numbers of hydrogen weapons and viewed questions on tactical use of H-weapons as premature.

Secretary Kimball indicated that no studies as to either tactical or strategic uses of H-bombs were underway in the Navy on which he had knowledge.

June 28, 1952

A meeting was held in Denver, Colorado, to discuss controlled thermonuclear reactions. The conference discussed at some length all aspects of controlled thermonuclear reactions and also discussed whether projects in this field should be declassified.

June 28, 1952

In a major address delivered at Ann Arbor, Michigan, Representative Jackson discussed the role of the Joint Committee, in part, as follows:

"To cite yet another example, certain high-ranking military men gave us to understand that we were building enough atomic weapons to defend our country--this at a time when our average outlay per year for atomic preparedness was well under a half billion dollars, a time when this outlay represented hardly two cents in every dollar we spent for defense, and at a time when a single corporation (General Motors) paid more in income taxes than the United States of America paid to build an atomic arsenal. Once more, no member of the Joint Committee has attended West Point, and neither had any member, so far as I know, ever made a study of Clausewitz. But some of us had gone to see an atomic test explosion on Eniwetok Atoll in the far Pacific. After experiencing all the awe for which we were well prepared in advance, we experienced something else for which we were less well prepared. After the explosion we looked around at the vast expanses about us, and then we looked back at the comparatively limited area affected by the atomic blast. What the more studious among us had sensed from their reading of history--and what the war veterans among us had suspected from their own combat services--was now confirmed with our eyes and ears. From the simple experience of watching a test explosion we understood that the atomic bomb, for all its unique power, is not an absolute weapon but a finite weapon. We saw that our country would need and could profitably use, if attacked, this weapon in huge numbers--indeed, that there is no such thing as having 'enough' atomic bombs.

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"The Military Liaison Committee recognizes the fine and outstanding job which the Los Alamos Scientific Laboratory has done in the weapons development field. There is nothing inconsistent between our high regard for Los Alamos and our belief that a second laboratory is essential."

July 1, 1952

Start of  
second  
laboratory.

Project Whitney, an independent laboratory devoted to development of thermonuclear weapons, can be considered to date from July 1, 1952 when the Regents of the University of California accepted the proposals of the Atomic Energy Commission for a thermonuclear program. The project was to undertake diagnostic work for thermonuclear tests. Beyond this the laboratory was to propose and undertake broad thermonuclear research programs. The laboratory planned to develop a working force of approximately 800 men by the end of fiscal 1953 and expected to be approximately one-half the size of Los Alamos by the end of fiscal 1954.

July 3, 1952

Senator Bricker introduced an amendment to the Supplemental Appropriations Bill (which contained monies for the new atomic energy expansion program) as follows:

"Provided further, that appropriations for the fiscal year ending June 30, 1953, may be used, any other law to the contrary notwithstanding, to start new construction projects directly and primarily related to thermonuclear matters."

This amendment would have exempted new lithium 6 production facilities from restrictions contained in a rider to the Appropriations Bill. Senator Bricker commented, in introducing the amendment, that "I have in mind specific steps that might be taken under my amendment. These steps, I think, are of highest importance. They would not involve large sums of money relative to the appropriation as a whole."

The Executive Branch had not requested the proposed amendment. It passed the Senate unanimously, but was not adopted in the Senate-House conference on the supplemental appropriation.

July 7, 1952

Following an all night July 6-7 Senate debate in which Senator Hickenlooper led a successful effort to modify a highly restrictive rider in the Appropriations Bill, Congress approved a supplemental appropriation in the amount of \$2,899 million for the expansion in production facilities for fissionable material. This was the major legislative step in what Secretary Lovett, testifying before the Joint Committee on February 7, 1952, had termed the spending of \$5 billion to gain five years in the realization of stockpile A-bomb requirements. By this program, achievement of the minimum requirement number was to be realized in 1960 rather than in 1965.

July 10, 1952

Two Rand Corporation studies were issued, "Thermal Radiation and Aircraft Escape Problems for large Yield Bombs" and "Implications of Potential Weapons Developments for Strategic Bombing and Air Defense."

August, 1952

[The so-called

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and was conceived as having a 32" diameter, making it potentially deliverable by fighter planes. Other recent

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September 13, 1952

proposals for H-bomb models include:

Mr. LeBaron, Chairman of the MLC, wrote the Joint Committee in part as follows regarding the second laboratory:

"2. Our reply of 30 June 1952 indicated that we proposed to explore this matter in sufficient detail to be able to assess the 9 June 1952 proposal of the Atomic Energy Commission to the University of California in terms of the nature and scope of the specific work programs developed by the University of California. As you recall, our reason for this action was your concern about the apparent conflict with the formal views of the Commission outlined in their letter to you of 11 June 1952.

"3. Subsequent information is summarized as follows:

"a. The new project at Livermore under the supervision of the Radiation Laboratory of the University of California is rapidly expanding into a large experimental program. The Commission has budgeted for ample funds to undertake the work on a vigorous scale. The recruiting problem for the necessary technical personnel seems to be well in hand and earlier concern that adequate staff could not be available no longer exists.

"b. In order to completely confirm our observations, Secretary Foster arranged for the discussion of this second laboratory project as an agenda item in a recent meeting of the Joint Secretaries of the Department of Defense, at which meeting Commissioner Glennan, AEC, and myself were present. The subject was reviewed at length and Commissioner Glennan agreed to present the problem of interpretation of the Commission policy stated to the Joint Committee on Atomic Energy to his associates. Subsequently, he informed Secretary Foster by telephone that the position of the Commission is clear cut; that they are distinctly in favor of the thermonuclear laboratory; that there is no murkiness in the situation as far as they are concerned; and that they would do all that they could to further the project.

"c. Secretary Foster has reported this conversation to the Service Secretaries.

"4. I think this course of action discharges the current responsibility of the Military Liaison Committee to assess the nature and scope of the Commission's effort with respect to the interest of the Department of Defense. The Joint Secretaries feel that the project supports our military interest adequately at this time. The Military Liaison Committee will, of course, review the work of this laboratory at periodic intervals."

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September 22, 1952

The President announced the appointment of three new members to the General Advisory Committee. The new members were: Dr. E. P. Wigner, J. B. Fluke, and Dr. John C. Warner. These appointments filled the vacancies created by the expiration of the terms of Drs. J. R. Oppenheimer, Chairman, James B. Conant, and Lee DuBridge. Subsequently, Dr. I. I. Rabi was elected Chairman of the General Advisory Committee.

September-October  
1952

In a major early September communication to the Commission the Los Alamos Laboratory raised questions and made recommendations in connection with quantity production of both lithium-6 and tritium.

At Princeton, at Los Alamos, and at the new second laboratory in Livermore, California, studies were under way on the possibility of using H-bomb materials other than liquid deuterium and lithium-6--

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Meanwhile, proposals in part originating with members of the State Department Panel on Disarmament were being made that the Fall, 1952 thermonuclear test of the [ ] be deferred in light of non-technical and international considerations. For example, one proposal was to the effect that the United States invite Russia to agree that neither nation ever conduct further thermonuclear tests--with the United States to rely upon long-range detection for notice of violation of any such agreement. Fears were also expressed as to Soviet reactions were the United States to test without an immediate and concurrent H-bomb capability. After careful consideration of all proposals for test deferment, it was decided to proceed to test on schedule.

November 1, 1952

First full-scale  
test.

The "Mike" test shot--the [ ] H-bomb test device--was conducted at Eniwetok with outstanding success. The energy release is still not fully determined. It was at least 6 megatons and may have been as high as 11 megatons (6 to 11 million tons of TNT equivalent).

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The "Mike" energy release was 300-550 times as great as that of the first atomic test at Alamogordo, New Mexico, July 16, 1945. [The materials used in the 1952 "Mike" shot cost on the order of

Two new elements--number 99 and 100 in the periodic table--were created in the "Mike" explosion and captured for analysis in laboratory quantities.

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VIII. Aftermath of the Mike Shot

November 1, 1952

By seismograph scientists in California estimated the energy release of the Mike Shot to be on the order of several megatons. The nature of the trace on the seismograph instrument was distinguishable from that of an earthquake.

Test personnel re-entered the Eniwetok Atoll area and found that, while installations on most Atoll islands were undamaged, the H-bomb device had destroyed the small island on which it was set off and had dug a crater four-fifths of one mile in diameter.

November 20, 1952

A letter to the AEC from Mr. LeBaron, Chairman of the MCO, established certain requirements for H-weapons to be fulfilled by the end of 1954 or the start of 1955. [This letter indicated that since the tests planned for Spring, 1954 would consume most of the lithium 6 expected to be produced beforehand, a military need exists for such H-weapons as could be made from lithium 6 produced from the time of the tests to the end of 1954. The letter further stated that tritium production should be on a scale such that this material would not limit the number of weapons which could be made with the available lithium 6.]

In addition, the letter referred to "potential requirements" for H-bombs as follows:

"Potential  
Requirements"

"It seems possible that in choosing a course of action to meet the early (1954-1955) requirements for tritium production, information as to the Defense Department's potential requirements for thermonuclear weapons may be useful. The Joint Chiefs of Staff have not as yet completed their analysis of high yield weapon requirements, to which reference was made in our letter of 13 June, 1952. Meanwhile, production plans should assume that a military requirement exists now for \_\_\_\_\_ thermonuclear weapons."

December, 1952

The next Eniwetok operation for H-bomb testing had been scheduled (since 1951) for Fall, 1953; but principally due to the shortage of lithium 6 required in this test series, it was re-scheduled for Spring, 1954. [Plans were made to shoot three H-bomb models. However, the possibility was left open that one model might still be tested, "on an emergency basis," in late 1953.]

December 30, 1952

Decision against  
new lithium 6  
plant

Mr. Lawton, Director of the Bureau of the Budget, confirmed to Joint Committee representatives that the Budget for fiscal year 1954 would not contain funds for construction of a second lithium 6 production plant of improved design. Funds for this purpose had originally been inserted in the Budget by the AEO but were removed by the Bureau of the Budget with the approval of the President. Mr. Lawton indicated that, while this action would delay a second lithium 6 plant for one year, no military requirements had been laid down that would justify such a plant.

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December 31, 1952

A Joint Committee letter, dispatched after the Mike shot, had requested the comment of officials and scientists connected with the atomic energy program on the following question:

"How much of a time lead (in months or years) do you personally estimate we possess in our thermonuclear program over that of the U.S.S.R.?"

Responses to the letter contained a wide range of comment and most were carefully qualified. Of some 22 answers giving an estimate in terms of months and years, three replies estimated from 3 to 6 years lead time; 7 replies estimated from 2 to 3 years; 8 estimated from 1 to 2 years; and 4 estimated zero lead time to 1 year.

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Conclusion: Some Policy Issues as of January 1, 1953

By the start of 1953 it had been demonstrated that an H-bomb is possible. Historically, the H-bomb was considered expensive and exquisitely difficult of construction. The full-scale test explosion of Fall, 1952 was achieved in less than three years after the President instructed the AEC to proceed. A portion of the Los Alamos effort sufficed for this achievement; and the new second laboratory did not contribute, having been started four months prior to the test. Materials used in the test device cost less in dollars and resources than the materials used for certain A-bomb models in stockpile. These factors, considered with late 1952 proposals for H-bomb models to be constructed from cheap materials, raised the possibility that this weapon could be made in quantity from plentiful materials.

While the question of whether the H-bomb is possible at all had been decisively answered by the start of 1953, a further question remained open: Is the H-bomb costly and exquisite, as was supposed historically, or is it cheap and comparatively easy to make in large numbers?

A related question that remained open by January 1, 1953 was whether the Soviet Union would find its own hydrogen development "straight-forward," or whether Russian scientists might lose substantial time before hitting upon the approach which the United States found to be successful.

Whatever the outcome of the debate between Dr. Teller and Dr. Bethe on this point, there was also the question of whether Russia--after having achieved the H-bomb--would find it comparatively difficult or comparatively easy to make in quantity.

These questions led to other questions by the start of 1953: At such time as Russia came to possess the hydrogen weapon, would the United States seek to offset this Soviet attainment by continually having more H-bombs in stockpile than the Soviets? Should large-scale United States production efforts, if undertaken, be started before or after the Russian accomplishment?

A closely related question had to do with how much effort, how soon, should be devoted to strengthening United States continental air and sea defenses and also civil defenses.

The question of defenses in turn involved the military value of the H-bomb. By January 1, 1953, proposals had been advanced that H-bombs be made this nation's principal weapon for use upon the enemy airfields and naval bases from which atomic or hydrogen attacks were being launched against the United States.

Two other specific proposals had also been advanced: (1) That an urgent effort be made to have H-bombs ready in time for tactical use against troops as part of an attempt to end the Korean war; and (2) that the H-bomb be made the central weapon of the NATO allies in the defense of Western Europe.

These specific proposals raised the larger question of whether H-bombs would be a secondary nuclear weapon for special purposes or whether they would be made the primary nuclear weapon.

The status of national policy on the H-bomb, as of January 1, 1953 could be summarized as follows: (1) Testing of prototype H-bomb models was rescheduled from Fall, 1953 to Spring, 1954; (2) such H-bombs as could be made from the \$35-million-dollar lithium-6 plant under construction at Oak Ridge were required to be in stockpile by January 1, 1955; (3) no quantity requirements for H-bombs had been fixed; and (4) a decision had been reached, with the approval of the President, that the United States program for reducing the lead time between testing of H-bomb prototypes and stockpiling of the weapon itself would not include early construction of additional lithium-6 plants.

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