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DEPARTMENT OF DEFENSE
MILITARY LIAISON COMMITTEE
to the
ATOMIC ENERGY COMMISSION

21 April 1954

COMMENTS CONCERNING THE H-BOMB DEVELOPMENT

R

Robert LeBaron
Chairman

Ref. (a)

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COMMENTS OF THE CHAIRMAN, MILITARY LIAISON COMMITTEE

The role of the Military Liaison Committee is fixed by Public Law 585 and the following extract from Section 2(c) is descriptive of its purpose:

"The Commission shall advise and consult with the Committee on all atomic energy matters which the Committee deems to relate to military applications, including the development, manufacture, use and storage of bombs ..... shall have authority to make written recommendations to the Commission on matters relating to military applications from time to time as it may deem appropriate. If the Committee at any time concludes that any action, proposed action, or failure to act of the Commission on such matters is adverse to the responsibilities of the Department of Defense ..... the Committee may refer such action, proposed action, or failure to act to the Secretary of Defense. If the Secretary concurs, he may refer the matter to the President, whose decision shall be final."

The mechanism for carrying out this statutory responsibility is primarily a resident staff of military officers within the Atomic Energy Commission - with privileged access to the internal affairs of the Commission. This staff is responsible solely to the Chairman of the Military Liaison Committee.

The Committee members meet regularly twice a month and at other times at the call of the Chairman. The programs and work of the Commission are studied in terms of their probable value to the Department of Defense.

The Committee members also maintain close contact with Atomic Energy Commission activities within the Department of Defense. They hold flag rank positions both in administrative and technical areas of specialized atomic energy work and also in areas of senior military command.

The Committee also has served other agencies of the Department of Defense on occasion, particularly the Joint Chiefs of Staff and the former Research and Development Board of the Department of Defense. Prior to

the administration of President Eisenhower, the Committee acted for the Department of Defense on many matters of atomic energy policy.

The Committee therefore has been in a unique position to evaluate the military applications of atomic energy both within the Commission and the Department of Defense. Much of the work of the Committee has consisted of personal discussions with members of the Commission and its staff, and the views expressed by the Committee have been reflected in subsequent actions of the Commission. Many of the Committee reports have been used by previous Secretaries of Defense as the basis for views before the National Security Council or direct communications to the President.

The basic philosophy of the Committee has been to work closely with the Commission and avoid formal issues wherever possible.

The Committee has no responsibility for managerial decisions within the Commission and has refrained from any formal views relating to management. It has not been a participant in any programs of the Commission, although at various times it has joined with the Commission in studies of mutual interest where a common background was desirable.

In summary, it has been the job of the Military Liaison Committee to be knowledgeable of all atomic energy activities and to see that the interests of the Department of Defense and national security have been protected. This has been done by a steady series of reports with recommended courses of action to the Secretary of Defense, to the Chairman of the Joint Chiefs of Staff, to the Secretaries of the three Services, and through the circulation of the minutes of its meetings to appropriate offices of the military departments and the Atomic Energy Commission.

H-BOMB

The significant documents setting forth the actions and views of the Committee in the hydrogen bomb development are given in the attached appendix.

In reviewing these papers, it is important to understand that H-bombs were an additional program responsibility over and beyond the rapidly expanding A-bomb program to which the Government was already committed. The new problem was, therefore, to keep the growing A-bomb moving at a satisfactory rate while at the same time following the President's directive of January 31, 1950, to proceed with the development of H-bombs on a priority basis.

A brief summary of the main problems in the A-bomb program is given here in order to provide a proper background for the H-bomb effort:

A-Bomb Program.

(1) New atomic weapons pose many of the "which came first, the hen or the egg?" questions. The military services asked "what can you make?" and the Commission replied "what do you want?" Clearly this cycle could only be stabilized by building initial prototypes of weapons which transformed ideas into hardware. This was the first step, and everyone realized that these weapons were only the crude beginning of the ultimate product.

Next came the inevitable question as to whether the customer who would use the weapon would control its design or whether design would be determined by the laboratory which developed it. Again this could

only be answered after the using services had an opportunity to test out prototype weapons (minus nuclears) in military operational tests and various military exercises. Criticism of these weapons and their shortcomings (as learned from operational tests) pointed to the next forward step which was the emergency of a "satisfied customer" design for the product. This step was realized only after a good deal of revision of the first prototypes.

All this activity took sequence time; it could not be done in parallel; and when it is done under national emergency circumstances there is a complex pattern of new development activities moving forward while retrofit activities are moving in the opposite direction. Thus the volume of technical work becomes very large and involves the coordination of many different points of view and interests.

(2) Since these new weapons depended on fissionable materials and other newly discovered elements, the production problem of supply of these new materials was all-important. Actually, a high percentage of the Commission's total effort has been devoted to production problems. This had a large bearing on the weapons design program.

The principal job in the A-bomb operation is the production of fissionable material. This breaks down into raw materials availability and suitable process plants for conversion of the desired ore components into fissionable material end-products (uranium isotope and plutonium).

There have been three major expansions in this field since mid-1949. The first was decided by the National Security Council prior

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to the first Russian explosion. The second was sparked initially by the Military Liaison Committee effort to increase the Commission's activity in ore exploration. This resulted in a revised and larger ore program, and the Commission in turn requested additional processing and conversion plants (in which H-bomb materials were included). The third expansion was initiated by an increased military requirement for atomic weapons which again emerged into an agreed NSC position that we could count on still larger supplies of uranium and that additional processing plants to handle these increased ore facilities should be built.

These expansion programs changed the original Hiroshima weapon from a unique military device into a basic source of military power. This in turn carried far reaching implications as to what type of atomic weapons should be built. The rules of the road that were valid when we were thinking in terms of a limited number of weapons for unique special purposes were no longer valid in the projected era of massive retaliation.

These materials expansions absorbed the major portion of the entire Atomic Energy Commission activity. As it became clear to the weapon design people that these expansions were to become realistic, they adjusted their design concepts accordingly. This started new patterns of weapon developments into the already highly complex weapon technology.

The best example I can give to indicate the size and complexity of the weapons program is that the storage facilities for the atomic weapons now on hand cost $200 million, and the projected weapons inventory in hardware and electronic gear will be substantially in excess of

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$500 million by 1957. This does not include the cost of the nuclear cores of fissionable material. Never before in our history has such a large inventory of highly complex and technical materials been contemplated, especially when one realizes that each component part must always be ready to serve on a military mission whose success or failure may have important consequences on our national security.

Once the decision to proceed with the H-bomb development was made, superimposing that development on an already complex A-bomb program entailed primarily a job of managing resources and personnel. Again there were two parts to this:

(a) Where and how was the weapons design effort to be carried out? It was contended by the Department of Defense that the LASL was fully occupied with A-bomb work and that a new weapons laboratory should be established. The Commission and several civilian scientists argued against this proposal, saying that the introduction of a second laboratory at this time might have disastrous consequences to the entire atomic weapons program. However, the second laboratory was ultimately established at Livermore and was a healthy and stimulating addition to the overall atomic weapons program. Competent scientific personnel to staff it were recruited (not at the expense of Los Alamos).

(b) What were the new production materials requirements of the H-bomb? Initially the principal new element required was tritium. Later a requirement for lithium-6 isotope was established.

It was not known how much tritium would be needed, and this was a crucial problem because its manufacture required very large reactor plants. The Presidential directive of 31 January 1950 stated that enough material for an H-bomb should be produced by the time the weapon design was completed. This requirement resulted in a decision of the Commission to build a new reactor plant at Savannah River. It was to use heavy water as a moderator (instead of graphite) and was built with a substantial flexibility in operating conditions because of the uncertainty in the materials requirements for the H-bomb design. (Note that when the third A-bomb production expansion was decided, the Savannah River reactor plant was identified as a dual purpose facility which could be used either for H-bomb or A-bomb materials.) As the H-bomb development design progressed, the unique value of lithium-6 isotope as a weapon component emerged and the Commission made plans to build large additional plant capacity for this isotope.

not accurate

plans were made before value was established

These were the main factors. In the fall of 1953, after the results of the IVY tests were evaluated, the Joint Chiefs of Staff reviewed their military plans in the light of new possible thermonuclear weapons and submitted a new atomic weapons requirement on 15 December 1953 which called for a very rapid build up of thermonuclear weapons. (Note - The successful Russian test of thermonuclear weapons was announced by the Commission on 20 August 1953.)

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This brief recital will make it clear that the emergence of the H-bomb has been a complex management job in which many people and many different points of view had to be reconciled. It was a very different task from that which confronted the Los Alamos laboratory at the beginning of World War II. Here there was no policy management problem, only a single technical objective in which the entire resources of the country were subject to first call over and above everything else.

In contrast, the situation which faced our Government in January 1950 was very different. Some of the people who had built the A-bomb said that:

a. The development of the H-bomb would be very difficult, if feasible at all.

b. It would call for a drain on our national resources which we could not manage.

c. The military value would be doubtful when compared to A-bombs.

In view of the great emotional heat that was generated on this issue in the Fall of 1949, it is naive to think that all this stopped instantly when the President issued his directive of 31 January 1950. Opposition to the H-bomb program continued for a long time and in a variety of forms. It is just as illogical to label this opposition as sinister as it is naive to say that the strong convictions of American men in science who opposed the program were completely subdued on January 31, 1950.

Atomic scientists undoubtedly are competent to counsel on the feasibility of making H-bombs, the probable material requirements, and the probable physical effects of H-bombs if detonated. It does not follow

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that they have any special competence to judge the military worth of an H-bomb or to forecast the economic and political consequences of developing H-bombs. Men of proven competence in military, political, and economic sciences are the proper source of such counsel in determining governmental policy.

The truth is that the "moral" problem of the weapon and doubt of its relative military value created a mental attitude which did not help the Government team which produced the successful H-bomb.

Now we are in a period when the success of the program requires a substantial rationalization on the part of those who were on the doubting side in order to find ways and means in which they can continue in the program as members in good standing. This is unfortunate; for there is surely no need to alter any of their basic convictions because of the emergence of new knowledge in the thermonuclear weapons field. It is important at this time to realize that a complex problem of this pressing character will always generate strong differences of opinion and judgment.

The impressive thing is that we now have the H-bomb. It is sobering that the Russians also have this weapon. Finally it should be clear that the people who were responsible for the success of the H-bomb program worked in a very different atmosphere from that which existed in the MED. In the H-bomb program, management decisions and mature judgments were the controlling elements of decision. The Hiroshima bomb represented a great technical effort, but of quite a different character. It is important that the American public understand that the present arguments about standards of security will not slow down our efforts in our Government atomic energy program.

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The battle over the H-bomb has shown that this country has adequate resources in management and technical personnel to develop this new weapon in the democratic tradition of free thought. We have no indispensable scientific men any more than we have indispensable civilian or military leaders.

This controversy is leading up to a basic issue of whether or not the Government is entitled to select key personnel to operate its programs who will support wholeheartedly the policy decisions of the Government. No one objects to opposition views, even from within the Government, when policy is being formulated. No one objects to different views even after policy decisions have been made, when they come from outside the Government team as a part of the loyal opposition. However, members of the Government team must support wholeheartedly the policy of the Government after it has been formulated regardless of views held previously.

Robert LeBaron

Attachment:
Appendix: "Historical Narrative - H-Bomb Development," w/"Syllabus" attached.

APPENDIX

HISTORICAL NARRATIVE - H-BOMB DEVELOPMENT

The 1 March 1954 shot produced the biggest man-made explosion in recorded history. At face value, it stands as a tribute to the scientific and industrial skills of this nation and to the judgment of our leaders in directing those skills. It promises to increase the power and effectiveness of our weapons arsenal by many-fold.

This explosion used the so-called "dry" system with lithium as thermonuclear fuel. The Mike device detonated in Operation IVY used the so-called "wet" system. Thermonuclear fuels using the wet system DELETED and require extensive cryogenic equipment. It therefore appears that the wet cryogenic system is less desirable than the dry system used in the DELETED weapon.

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In this light, our own record may not look so good. Within this framework, a review of our record is made to see what mistakes were made in the thermonuclear development so that future courses of action may avoid the pitfalls of the past.

Historical Background

For convenience, the thermonuclear development is broken down into five chronological periods:

The first is the period of Lethargy and includes the period from the Manhattan Engineering District (about 1942) to the first Russian atomic explosion in September 1949.

The second period is called the Argument period and includes the time between the first Russian explosion to the time of President Truman's directive for priority effort (31 January 1950).

The third is the Drag period and runs from Truman's directive to the time of the "George" shot in Operation GREENHOUSE (May 1951).

The fourth period is one of Growing Interest - DELETED Methods - and covers the time from the GREENHOUSE "George" shot to the Mike shot in November 1952.

The fifth period is described as one of Vigorous Activity - Using Dry Methods - and covers the time from Mike shot to Operation CASTLE in March 1954.

Significant developments during these five periods will be discussed in the paragraphs which follow to illustrate the emphasis and rate of development of the thermonuclear program.

Period of Lethargy

The theoretical possibilities of a thermonuclear weapon were recognized in the early days of the Manhattan Engineering District, and some experimental work was included in the programs of the Los Alamos Scientific Laboratory. Theoretical investigations in the fall

of 1943 showed that the thermonuclear reaction could be employed to bring about an explosion if sufficiently high temperatures could be attained.

Dr. Bradbury, in describing the history, organization and ideas of the LASL on 14 Nov 1946, stated his belief that a thermonuclear weapon could be developed, provided an effort equal to the MED were given to it.

Calculations subsequent to the fall of 1946 led most scientists to believe that a thermonuclear reaction based on information then known was not feasible. Notable among those who refused to concede defeat was Dr. Edward Teller whose investigations largely prompted the MLC, the AEC, and the GAC, in the fall of 1948, to support the testing of a booster weapon as a preliminary step toward ascertaining the feasibility of developing the thermonuclear bomb. During this period, the scientific effort was exceedingly small and consisted mainly of calculations by Teller, Richtmyer and Nordheim.

The military professed interest in the possible end use of a thermonuclear weapon at such time as its development appeared reasonably feasible. Studies by the Research and Development Board in 1948 recommended that scientific effort continue on investigations and studies toward determining the feasibility of thermonuclear weapons. The JCS urged continuation of studies in this field so long as there was a reasonable chance of useful discoveries.

In short, there was not very much laboratory effort expended; the AEC had little enthusiasm for the program; the military had little comprehension of its feasibility or usefulness.

Period of Argument

The first Russian atomic explosion occurred long before it was expected in this country. Our complacency was abruptly ended; our reliance on a monopoly of atomic weapons was no longer valid. Within this atmosphere, some of our scientists (notably Dr. Teller) suggested that continued U.S. superiority in the weapons field required a priority effort toward the development of thermonuclear weapons. This view was vigorously supported by military leaders and the Joint Congressional Committee on Atomic Energy. After exhaustive debate with the highest offices of the Government, the President directed that a priority effort be made to develop the thermonuclear weapon, its carrier, and ancillary equipment.

On such a vital issue in which the many and varied forces, for and against the program, were brought into play, it appears - even in retrospect - that not too much time was involved in the resolution of the problem.

Period of Drag

Following the Presidential directive to proceed toward the determination of the feasibility of the thermonuclear explosion, the program of the AEC was altered. The MLC and the AEC reached complete accord on the revised program of the Los Alamos Laboratory.

In early March 1950, the President noted that the thermonuclear program was regarded as a matter of highest urgency, and he directed the AEC to prepare for quantity production of thermonuclear materials. Yet GAC was not too enthusiastic. The minutes of their 1 April meeting

commented upon "sacrifices in the development of more efficient, more flexible, more deliverable, and more useful atomic weapons which the adoption of this program may entail."

On 8 June 1950, the President approved a construction program to produce thermonuclear materials and a program to produce thermonuclear materials from existing facilities, at least until the new facilities were in operation.

However, unfavorable laboratory findings began to dull the interest of the scientists and again caused them to question the feasibility of the thermonuclear explosion. Even so, preparations continued for Operation GREENHOUSE for the spring of 1951. But primary development interest returned to the fission weapon field.

It was the expectation of many of the scientists that the GREENHOUSE test would be inclusive or fail entirely. A report to the President just one month before the test started that "the difficulties of developing the thermonuclear weapon are clearer, the time to carry out the program is believed to be longer, and practical success is less certain." The report recommended: (1) amounts of tritium to be produced will be determined jointly by the AEC and DOD rather than at fixed rates, and (2) thermonuclear developments continue along with fission developments. The President approved the general principles of the report as guidelines for the thermonuclear program.

Noteworthy during this period of discouragement and uncertainty were: (1) the dogged determination of a few scientists (notably Dr. Teller) to prove the feasibility of the thermonuclear reaction, and

(2) the determination at the managerial level to proceed with the "George" experiment at GREENHOUSE. This was most fortunate, since otherwise the program might have relapsed to a position of basic laboratory research with little sense of urgency attached to it.

Period of Growing Interest — DELETED

To the surprise of most of the scientists, the GREENHOUSE experiment in May 1951 was eminently successful; the scientists then changed their attitude. They began showing considerable diligence in preparing for Operation IVY.

The Military Liaison Committee recognized that the planned IVY test device was likely to produce a full-scale thermonuclear explosion and urged that quantity production of thermonuclear materials be initiated promptly in view of the probability that the device might be successful.

In early 1952, the Department of Defense urged that the thermonuclear program be broadened and intensified. Specifically, it urged that a second weapons laboratory be established to give added emphasis to the program and to provide a means of examining alternate approaches to thermonuclear reactions. This idea was resisted by the Los Alamos laboratory and the AEC. However, pressure from the Department of Defense, supported by JCAE, led the Commission to contract for certain thermonuclear investigations with the University of California Radiation Laboratory. Modest at beginning, the laboratory at Livermore has become a mature weapons laboratory.

Two ideas of a thermonuclear device existed during this period:

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Period of Vigorous Activity - Dry Method

"Mike" shot in Operation IVY proved to be three times larger than predicted by Los Alamos. No longer was there a question of the feasibility of a thermonuclear explosion. The job ahead was one of packaging.

Accordingly, the program was pointed toward the development of deliverable weapons, preparations for their production, and perfection of delivery means.

Less than one month after the detonation of the Mike device, the MLC advised the AEC of the number of thermonuclear weapons which should be in stockpile by the end of calendar year 1954.

Not satisfied to have only a weaponized version of the Mike device, the Department of Defense urged the development of small, light-weight

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thermonuclear weapons, an increase in thermonuclear facilities, and the development of weapons which used materials not in short supply. With this urging, the AEC laboratories began designing several thermonuclear weapons for testing in late 1953 or early 1954. Laboratory emphasis began shifting toward the development of dry system weapons (using Teller's idea of Li-6 deuteride).

Originally, four thermonuclear devices were planned to be shot during Operation CASTLE. The test program later was expanded to five or six devices (no doubt due in considerable measure to the laboratory competition afforded by the creation of the Livermore laboratory). Operation CASTLE is still going on. Already two dry system weapons have been detonated, both of which produced results far in excess of that expected. The nuclear and non-nuclear components of one of these weapons already are being produced for stockpiling.

CONCLUSIONS

The historical picture of the thermonuclear program at the present time shows that deliverable weapons were developed and tested some 12 years after their theoretical possibilities were recognized, in just over four years after a really serious attempt was made to develop them. Within this picture are scenes of hope and despair, of optimism and pessimism, of sound decisions and bad ones, of scientists' fears of their own creation.

We know little of the history of the Russian thermonuclear program but we do know that Russia has successfully detonated at least one

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thermonuclear device. We believe that device contained dry thermonuclear fuels. If that is so, Russia detonated a dry device before we did.

In this light, we should ask ourselves why DELETED shot may have been preceded by Russia's development of a dry thermonuclear weapon. Certain conclusions are, therefore, offered:

(1) It seems natural that little was accomplished during the period of Lethargy. Our complacency rested upon a hope for lasting peace, confidence in our atomic stockpile, and a sincere desire for international control of atomic energy.

(2) Considering the normal democratic processes of government, the Argument period, in arriving at a decision for priority development, hardly seems excessive.

(3) In retrospect, it appears that the greatest delay in the thermonuclear weapon development occurred during the Drag period.

(4) In retrospect, it appears that the orientation toward primary development of a cryogenic device was unwise; but here the basis for judgment rested largely on the scientists' belief that this system was more promising. The military belief that laboratory work would benefit from wholesome competition has proven wise.

(5) The rate of development of the thermonuclear program from the time of Operation IVY to Operation CASTLE is impressive, even by industrial standards of the United States.

(6) The military judgment to prepare for quantity production of thermonuclear materials even at a time of serious doubt of success

of the program has afforded us the capability to deliver thermonuclear weapons at a time when the very existence of our nation may depend on it.

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H-BOMB DEVELOPMENT

Historical Background
(Five Periods)

I. Lethargy

Manhattan Engineering District (1942) to
1st Russian Atomic Explosion (Sept. 1949)

Early days of the MED

The theoretical possibilities of a thermonuclear weapon were recognized even in the early days of the Manhattan Engineering District and some experimental work was included in the programs of the Los Alamos Scientific Laboratory. (From report of the MLC to JCAE, 9 Nov 1950.)

Dr. Bradbury to AEC, 14 Nov 1946

In describing the history, organization and ideas of the LASL, stated his belief that a thermonuclear weapon could be developed provided an effort equal to the MED were given.

Hydrogen Weapons Conference, 12 June 1946

On 12 June 1946, a hydrogen weapons conference at Los Alamos (attended by Klaus Fuchs) concluded that an H-bomb could probably take place within one or two years. A conference report stated: "It is likely that a super bomb can be constructed and will work.

"The detailed design submitted to the conference was judged, on the whole, workable." (From Sen. McMahon's Chronology.)

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Gen. McCormack's memo to Chairman, MLC, 7 Jan 1948

Reports on visit to Los Alamos in December; relates scientific advice concerning the thermonuclear development as follows:

(1) "Our progress to date in this field has been so limited as to indicate only that it will be many years before we can develop the thermonuclear reaction for weapons purposes. Such information could have only limited usefulness to a competitor nation, even if that nation were to succeed in getting a very clear idea of what we have uncovered thus far.

(2) "So long as . . . . we automatically confine this work, [we will] delay further the more difficult work which lies ahead.

(3) "A thermonuclear weapon will presumably have to be built around a bigger and better fission bomb than we have yet developed; any nation which can develop this fission bomb will also be able to do at least as well as we have done on the thermonuclear aspect.

(4) "In effect, the scientists have said to us that if we want this thermonuclear weapon, we had better get more brains at work. . . ."

Support of Booster, Fall 1948

In the fall of 1948 the AEC, the GAC and MLC supported the testing of a booster weapon as a preliminary step toward ascertaining the feasibility of development of a thermonuclear bomb. (From MLC report to JCAE, 9 Nov 1950)

Oppenheimer to Chairman, GAE/RDB, 16 Aug 1948

Forwards draft report on long range military objectives in atomic energy. ". . . . The Panel recognizes the importance of work directed

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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 cannot and will not be attacked at this time with the extensive scientific and industrial effort which characterized the wartime Manhattan District developments. It therefore believes that in recognizing thermonuclear weapons as important long range objectives, it may at the same time point out certain relatively easy problems on which progress may be possible in the near future and as a result of the solution of which there may be greater insight. We list here . . . . several such projects:

(1) ". . . . The details of these phenomena [description of the nuclear and mechanical developments which follow the detonation of the chain reaction] must be understood before the system of the super bomb can be rationally designed.

(2) "In order to detonate a super, the fission 'primer' can almost certainly not be an implosion. . . . .

(3) "The most promising thermonuclear weapon for the short-term would appear to be the 'booster'.

(4) "Since the super bomb proper will certainly involve extraordinarily difficult problems of delivery, as well as of cryogeny, the Panel believes that a long-term objective, design studies for a vehicle capable of delivery of such a bomb should be carried out in parallel with the development of the bomb itself.

(5) "Since no development of thermonuclear bombs seems possible without copious supply of tritium, this material must be added to uranium 235, plutonium, and polonium as an essential military requirement on the production program.

(6) "Although the prospects of success appear meager, the Panel believes that . . . . generating high enough temperatures . . . . by

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. . . . "

Los Alamos program as approved in December 1948

Includes the following comments on thermonuclear weapons:

"Prospects of the booster, as they now appear, are of great interest to the Commission and the Armed Forces. Every effort will be made to assure production of the amount of tritium necessary to the laboratory program.

"The Commission will be prepared to support the fabrication and testing of a multi-crit at such time as it is clear that the testing of such weapon is a bottleneck in the development of a super. Information available to the Commission does not indicate that this is the case at present."

JCS memo to RDB, 7 Feb 1949

Contains JCS comments on the long range objectives report. JCS were impressed with the military importance of possible end uses of thermonuclear weapons and agree that its development should continue so long as there appears to be reasonable possibility of useful discoveries. (These views were forwarded to Chairman, AEC, by Chairman, MLC, on 13 April 1949, as the position of the RMB.)

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AEC to MLC, 27 July 1949

Contains AEC comments to report of Long Range Objectives Panel. States that theoretical studies are continuing at Los Alamos at a pace which does not interfere seriously with more urgent elements of the laboratory program. Research work is in progress on the fundamental nuclear properties of the light elements. States that considerable effort is being expended in developing, for test in 1951, an experimental booster system employing tritium and deuterium along with fissionable materials.

Minutes of the GAC, AEC, MLC meeting of 29 Oct 1949

Indicated that the military had not had sufficient technical information to know:

(a) Whether the fusion reaction could be made to take place,

(b) What the super bomb would do,

(c) What it would cost,

(d) What effect production of super bombs would have on production of other atomic weapons.

II. Argument

1st Russian Explosion to Truman Directive for Priority Effort (Jan 31, 1950)

McMahon Chronology

On 14 Oct 1949, Gen. Bradley testified before JCAE that the military favored a stepped-up hydrogen program.

Letter from Chairman, JCAE, to Chairman, AEC, 17 Oct 1949

Urged all-out effort to develop thermonuclear weapons.

[redacted]

Statement of Fermi and Rabi, 30 Oct 1949

They strongly recommended that the U.S. not develop the super bomb on ethical grounds if the USSR likewise wouldn't develop it.

Report of the GAC, 30 Oct 1949

The GAC recommended against development of super weapon even if Russia does develop it.

Letter from Carl T. Compton to the President, 9 Nov 1949

Dr. Compton recommended to the President that we proceed with increased activity and support to develop the super bomb, but without fanfare or publicity.

Mr. LeBaron's Memo for Record, 10 Nov 1949

Mr. LeBaron summarized military views from conversations with Generals Madden and Ramey, Adm. Robbins, Col. Kross, and Commander Thompson:

(1) The super bomb is not a new theoretical approach but a logical culmination of the present program. The booster bomb contains elements of the super bomb project and is a logical steppingstone to a full-scale super bomb in the absence of an overriding priority.

(2) The super bomb program should not be viewed in necessary conflict with the present accelerated program.

Memo from Mr. LeBaron to Dep. Secretary of Defense, 14 Nov 1949

Mr. LeBaron commented on Mr. Lilienthal's position regarding the super program. Mr. LeBaron's comments are:

(1) The premise that publicity is necessary is highly questionable.

(2) The premise that equivalent effort in conventional bombs will serve military needs equally well is far from obvious.

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(3) The premise that radiation from 10 supers would poison the atmosphere and endanger the national health is open to very serious question.

(4) The statement that there is no peacetime future for thermonuclear reactions is misleading.

(5) The chances for success in developing the super are much brighter than previously assumed.

(6) Our concept of peace through power would be jeopardized if Russia made a super and we did not.

Dr. Teller's conversation with Sen. McMahon and Mr. LeBaron on 15 Nov 1949 as reported by Dr. Teller & Dr. Hamlin of GAC on 13 Dec.

Dr. Teller thought chances of success for developing the super are good and that test of an appropriate booster with supplementary mathematical work would provide an almost complete proof of the super feasibility and at the same time would accomplish the major engineering development of the super.

Letter from the President to Sidney W. Souers, Ex. Sec., NSC, 19 Nov 1949

The president designated the Secretary of State, Secretary of Defense, and Chairman, AEC, as a special committee to advise him whether to proceed with the thermonuclear development.

Letter from Sen McMahon to the President, 21 Nov 1949

This is a long letter urging a crash program along the lines of the MED to develop the super bomb.

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Gen. Bradley's memo to Secretary of Defense, 23 Nov 1949

Memo concludes:

(1) Possession of thermonuclear weapons by Russia without their possession by the U.S. would be intolerable.

(2) There is an imperative necessity for determining the feasibility of a thermonuclear explosion and its characteristics.

Memo from Mr. LeBaron to Secretary of Defense, 23 Nov 1949

Gives background information as follows:

(1) JCAE is for thermonuclear development on a high priority basis.

(2) GAC is against developing the super.

(3) Atomic Energy Commissioners are split.

(4) The JCS believes that the super could and probably would be developed by the USSR, and the U.S. must.

MLC Memo to Members, 23 Nov 1949

Forwards MLC staff study concerning the development and production of super weapons. Concludes that weapon is probably feasible and that laboratory effort should be expanded to develop the super weapon.

Letter from Oliver E. Buckley, GAC, to Dr. Oppenheimer, 3 Dec 1949

Restated his opposition to developing the thermonuclear weapon.

Letter from Fermi to Oppenheimer, 3 Dec 1949

Does not think it really worth while to develop the super.

Report of the GAC, 3 Dec 1949

Reaffirms the October 30 views of the GAC in opposition to the super program.

[redacted]

Letter from Chairman, JCS, to Secretary of Defense, 13 Jan 1950

Gives JCS views which are that the super should be developed, should be kept secret, but a crash program is not necessary.

Memo from JCS to Mr. LeBaron, 25 Jan 1950

Gives JCS views on WSEG study on the military use of the thermonuclear weapon. JCS believes that the final statement in the subject study may be interpreted as proposing at this time a program leading to quantity production of thermonuclear weapons. JCS views are: (1) the determination of the feasibility of a thermonuclear explosion should be done at top priority, (2) studies of delivery and ordnance problems should proceed concurrently, and (3) decisions pertaining to thermonuclear production in any quantity should be deferred, pending determination of feasibility of thermonuclear explosion and of appropriate weapon carrier.

Memo for Record of H-bomb discussion with Dr. C. E. Gilfillan by Lt. Col. Burke, 26 Jan 1950

Dr. Gilfillan thinks feasibility of developing the H-bomb is 100% sure shot and that rough cost estimates are in the neighborhood of $100 million.

Oral recommendation by NSC Special Committee, 31 Jan 1950

On 31 Jan 1950 the NSC Special Committee orally recommended to the President that he direct the super bomb development.

Presidential directive to AEC, 31 Jan 1950

On 31 Jan 1950 the President directed the AEC to determine the feasibility of a thermonuclear explosion.

[redacted]

III. Drag

Truman Directive to "George" Shot - Operation GREENHOUSE (May 1951)

Letter from Oppenheimer to Lilienthal

Report on the 31 January and 1 February 1950 meeting of the GAC.

States that with super development approved, Los Alamos program should include a study of the propagation of the detonation into pure deuterium to such an extent as to provide a valid test of feasibility of a super weapon; comments on means of producing the DELETED of tritium believed by Los Alamos to be necessary in two years to meet the proposed test schedule.

Lilienthal's letter to Ex. Secretary, ESC, 2 Feb 1950

Lilienthal thought that our objectives in peace and war and the effect of these objectives on our logistic plans should be re-examined before we proceed with the development of the thermonuclear bomb.

Letter from GAC to Chairman, AEC (giving mainly Oppenheimer's view) 5 Feb 50

States that most hopeful method of obtaining required tritium appears to be the conversion of one Hanford reactor to enriched operation.

Letter from Gen. Mgr., AEC, to Chairman, MLC, 13 Feb 1950

States that AEC has explored the question of producing, as the first step, DELETED of tritium by 31 Dec 1951. The amount proposed by LASL program for calendar year 1950 is being required for an initial test of a thermonuclear reaction (contemplated for 1952). States that the only foreseeable way to meet that requirement is through the enrichment of one or more of the Hanford reactors.

Letter from Secretary of Defense to President, 24 Feb 1950

Urgently recommended an expansion of the atomic energy program within strict secrecy limitations. He urged an all-out development of the super weapon and of means for its production and delivery.

Letter from Chairman, AEC, to Secretary of Defense, 3 March 1950

Requests aid of NEL in certain experiments regarding the thermonuclear program.

Smyth letter to Special Committee, NSC, 6 March 1950

Comments on AEC preparations for test and production of thermonuclear bombs. States that no one in the Commission nor its staff nor any member of the MLC has suggested any way to speed up super development further than is being done.

Memo from Chairman, MLC, to AEC, 6 March 1950

Refers to request of 3 March 1950, AEC letter to Secretary of Defense, and proposes procedures in handling such requests.

Memo from NSC to Secretary of State, Secretary of Defense, and Chairman, AEC, 10 March 1950

Advises that the President had approved NSC report which recommended that the President (1) note the thermonuclear program is regarded as a matter of highest urgency and that additional funds for the feasibility test are not needed, and (2) direct the AEC to prepare for quantity production of thermonuclear materials.

Mr. LeBaron's Memo for Record, 28 April 1950

Notes the minutes of the 1 April GAC meeting, comments upon "sacrifices in the development of more efficient, more flexible, more

deliverable, and more useful atomic weapons which the adoption of this program may entail. . . . that this is also fully understood by the National Military Establishment and is accepted by them." Mr. LeBaron comments that (1) above statement is too broad to mean anything, (2) no military members participated in the meeting, and (3) there was complete accord between the MLC and AEC on the Los Alamos program.

Memo from Secretary of Defense to JCS, 17 May 1950

Forwards draft letter to the President from Secretary of Defense and Chairman, AEC, outlining the scale of operation for production of tritium needed for thermonuclear weapons and requested comments and recommendations.

JCS memo for Secretary of Defense, 22 May 1950

Concurs in above letter to the President.

Letter from Secretary of Defense and Action Chairman, AEC, to the President, 25 May 1950

Recommended Presidential approval of: (1) construction program for a new tritium production facility designed to produce DELETED of tritium a year and costing $250 million, (2) at least until the above facility is in operation, Hanford reactors be used to produce DELETED of tritium per year and, in addition, preparations be made for the production of DELETED of tritium per year at the earliest date, and (3) production at that rate be instituted if required.

NSC letter to Secretary of Defense and AEC, 12 June 1950

Announced that on 8 June 1950 the President approved the tritium production program.

[redacted]

Mr. LeBaron's memo to Mr. Webster, Chairman, RUB, 2 Nov 1950

Recommended that a review be made of the report of the Long Range Objectives Panel (concurred in by Mr. Webster).

Mr. LeBaron's Memo for Chairman, Ad Hoc Panel on Technical Estimates, CAB/RUB, 21 Nov 1950

Is directive to Panel to review or rewrite report on long range objectives of atomic energy. The members are:

Dr. Oppenheimer, Chairman
Dr. Bacher
Dr. Alvarez
Dr. Lauritzen
Dr. Kelly
Prof. Whitman
Gen. Nichols
Adm. Parsons
Gen. Wilson
Gen McCormack, Secretary

Memo from Mr. LeBaron to Secretary of Defense, 27 Nov 1950

Advises that Dupont, expected to contract for construction and operation of expanded tritium production facility, had recommended the Savannah River site. The JCS offered no objection from the standpoint of vulnerability.

Oppenheimer letter to Mr. LeBaron, 29 Dec 1950

Contains report of the Ad Hoc Committee on Long Range Objectives. Principal conclusions are:

". . . .

"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.

[redacted]

[redacted]

"13. The determination of the feasibility of thermonuclear weapons is an important, but very definitely a long range undertaking (more than 5 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.

"15. Military objectives for the use of atomic energy should be critically re-examined within a year."

Letter from Gen. Mgr., AEC, to Chairman, MLC, 22 Jan 1951

Advised that ". . . . in light of the diminished prospects of early success in developing a hydrogen weapon, the AEC is of the opinion that we should not now prepare a second charge for the pile at Hanford. In doing so, we would incur the result of interrupting the present tritium production program. It should be clear, however, that taking this step will not slow down the tempo of the hydrogen weapon research program at this time . . . ." (On 25 Jan 1951 the MLC notified the AEC of its concurrence.)

JCS memo for RDB, 16 Feb 1951

Concurs in the report of the military objectives in the field of atomic energy but commented that ". . . . The JCS recognize that a long range program may be necessary to determine the feasibility of a thermonuclear weapon, and consider that the answer to this question must be reached at the earliest feasible date."

[redacted]

[redacted]

[redacted]

WSEG memo for NSB, 21 Feb 1951

"The Weapons Systems Evaluation Group feels that subject report [LROP] is very realistic and that it appears to be a sound basis for policy in the field of military applications of atomic energy."

Letter from Secretary of Defense and Chairman, AEC, to the President, 4 April 1951

This report states that the difficulties of developing the thermonuclear weapon are clearer. The time to carry out the program is believed to be longer and practical success is less certain. Tritium requirements are believed to be very much greater than previously supposed DELETED now believed to be necessary). The report recommended (1) the amounts of tritium to be produced will be determined jointly by the AEC and DOD rather than at fixed rates, and (2) thermonuclear developments continue along with fission developments.

NSC memo to AEC, 9 April 1951

Advised that the President approved the general principles to guide the thermonuclear program as recommended above.

Secretary of Defense letter to AEC, 10 May 1951

Forwards a copy of the report "Military Objectives in the Use of Atomic Energy."

"Although the Department of Defense endorsed the Panel's conclusions in general, this transmission is not to be regarded as formal DOD request for implementation of any of the conclusions or recommendations. Rather, this is to acquaint you with present DOD thinking. No statements in this report are to be construed as modifying the DOD position regarding the thermonuclear program as set forth in our joint letter to the President on 4 April 1951.

[redacted]

[redacted]

IV. Growing Interest -

— DELETED

GREENHOUSE to IVY "Mike" Shot (Nov 1952)

Mr. LeBaron's memo of conversation with Commissioner Smyth, 10 July 1951

Reported on the summary of the Commission meeting at Princeton relative to the thermonuclear program as reported by Commissioner Smyth. Mr. LeBaron remarked: "I did not sense any unique feeling of urgency about getting ahead with the thermonuclear program in this report of the Princeton meeting. This should not be construed as a critical observation because the natural initial reaction of the scientists to these tests is one of substantial orientation of their previous thinking. . . . . What I am trying to convey to the members is that the idea of concentration on thermonuclear research as a matter of priority did not appear in the course of Dr. Smyth's report. . . . "

Letter from Chairman, AEC, to Chairman, MLC, 27 Aug 1951

Advises that the AEC had authorized the test and construction of a plant capable of producing 1 pound per day of 95% Li-6.

Letter from AEC to MLC, 13 Feb 1952

Requests views of MLC on the rate and scale of lithium-6 production.

On 19 February, MLC advised the AEC that the urgency in the development of thermonuclear weapon requires urgency and emphasis on the production of lithium-6. Recommended that construction of a lithium-6 separation plant should be begun promptly and aimed at producing 2 pounds of lithium-6 per day starting in April 1953.

[redacted]

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Letter from Chairman, MLC, to Chairman, AEC, 19 Feb 1952

Recommends prompt construction of Li-6 plant.

Memo from Members, MLC, to Chairman, MLC, 28 Feb 1952

Comments on the thermonuclear program; states that the GREENHOUSE test was very encouraging; that the principle of radiation implosion has put new life into the thermonuclear development; that Li-6 production may be the limiting factor timewise in production of thermonuclear weapons.

Letter from Secretary of Defense to Sen. McMahon, 9 March 1952

The Secretary of Defense stated that progress in the thermonuclear program is satisfactory but that we need a second weapons laboratory.

Memo from Sec. of Army, Sec. of Navy, and Sec. of Air Force, to Secretary of Defense, 27 March 1952

Recommended that the effort in the thermonuclear program be intensified.

Memo from Secretary of Defense to Sec. of State and Chairman, AEC, 28 March 1952

States that ". . . . There is a growing feeling in the DOD that intensification and broadening of effort should be initiated now in view of the probability that the present approach to thermonuclear weapons may succeed."

Mr. LeBaron's memo to Secretary of Defense, 31 March 1952

Believes that we should organize now the means to double or triple developmental work in thermonuclear weapons if and when the IVY device is successful. Urges intensification of second laboratory effort.

[redacted]

AFSWP Staff Paper on Military Requirements for Thermonuclear Weapons, 31 March 1952

Concludes:

(1) That deliverable thermonuclear weapons with yields from 1 to 10 MT probably can be produced by 1954; (2) DOD should establish requirements for such weapons; (3) DOD should urge the AEC to expand and intensify investigation of thermonuclear reactions to apply its principles to smaller and lighter weapons in the medium and high yield ranges.

(On 2 May 1952, the MLC recommended to JCS that they establish such requirements and analyse targets and target systems to determine the effectiveness of high yield weapons.)

JCS memo to Secretary of Defense, 14 April 1952

Suggests that the 23 Nov 1949 JCS paper be sent to the AEC as their views on the thermonuclear program. The JCS reaffirmed the 23 Nov 1949 views.

Letter from Secretary of Defense to Chairman, AEC, 25 April 1952

Forwards the 23 Nov 1949 JCS paper to the AEC and urges the AEC to be ready to exploit to the fullest possible extent information gained in the forthcoming thermonuclear test (IVY).

W. A. M. Burden memo to Sec. of Air Force, 21 May 1952

Recommends that (1) NSC recommend to the President that the thermonuclear program be intensifed, and (2) that the Secretary of Defense should give full support to Mr. LeBaron who is under fire from opponents of the thermonuclear program (some members of the State Department who believe that the thermonuclear program is having an adverse effect on chances for world peace).

[redacted]

Memorandum on the History of the Thermonuclear Program by Hans A. Bethe, 28 May 1952

Reviews the history of the thermonuclear program as follows:

In the summer of 1946, Teller's group, during and after the war, had established:

(1) DELETED

(2) A sustaining and propagating reaction in pure liquid deuterium seemed a likely possibility.

(3) To initiate a reaction in DELETED might be sufficient. A problem DELETED DELETED DELETED

This was the status when Fuchs left Los Alamos on 15 June 1946. From then until the end of 1947, extensive work was done by Teller, Richtmyer and Nordheim in which the DELETED ". . . was invented and investigated."

After the summer of 1947, work on large scale thermonuclear reaction was curtailed because no promising idea existed for a thermonuclear weapon and Los Alamos could not carry this work in addition to its responsibilities for improving fission weapons.

However, by the middle of 1948, Teller had invented the booster and in the fall of 1948, it was proposed to include this in the next test series.

Upon the Russian explosion, Dr. Teller recommended an acceleration of the thermonuclear program, and the laboratory " . . . . accepted Teller's suggestion immediately and enthusiastically."

The theoretical work of 1950 showed that every important point of the 1946 program had been wrong and led many scientists to question the economic soundness of the H-bomb program, even if the thermonuclear reactions could be made to take place.

Operation GREENHOUSE tested Teller's scheme to conduct energy by radiation DELETED

DELETED DELETED

Teller applied the idea to the thermonuclear program which led to our present concept of thermonuclear reactions.

(Bethe says these steps were discovered accidentally and that it would have been most unusual if the Russians should have found the same results.)

The DELETED device was invented on 31 August 1946, two and one-half months after Fuchs left Los Alamos. By the end of 1947, the results were not promising and calculations were stopped. In late summer 1950, Teller revived the DELETED by suggesting the use of Li-6D rather than pure D. (Bethe believed this device had a far smaller probability of success than the DELETED

JCS memo to Chairman, MLC, 4 June 1952

States that an immediate production requirement exists for very high yield weapons and that the magnitude of this requirement is such to justify the currently planned production of lithium-6; that it is estimated that requirements for these weapons may be considerably greater than currently planned facilities.

JCS believed that a possible prior production of a deliverable thermonuclear weapon by the USSR justifies a U.S. approach representing considerable technical risk and large expenditure of funds.

(This information was provided to the AEC on 13 June 1952.)

Letter from Chairman, AEC, to Secretary of Defense, 9 June 1952

Reports steps taken to intensify efforts in the thermonuclear program: additional personnel for Los Alamos, higher consultant fees, continuation of work at Princeton, and use of UCRL in thermonuclear work.

Letter from Chairman, MLC, to Chairman, AEC, 3 July 1952

Advises that the DOD concurs in the AEC decision to provide an emergency capability with the DELETED The Air Force was given responsibility for development of carrier and ancillary equipment.

Mr. LeBaron's memo to Foster, 13 Aug 1952

Reports on the progress made in setting up Livermore Laboratory. Comments that efforts of LASL to develop thermonuclear weapons had not been all that it should have been and that a forthright statement of charter and purpose of Livermore Laboratory should be made.

V. Vigorous Activity - Dry Method

Operation IVY (Nov 1952) to CASTLE (March 1954)

Mr. LeBaron's memo to Secretary of Defense, 28 Nov 1952

Reports on the MLC-AEC meeting of 25 Nov 1952 to discuss plans for tritium production. States that MLC had advised the AEC on 20 Nov 1952 that thermonuclear requirements, based upon estimated approved Li-6 production, is between _____ and _____ weapons of the DELETED type by the end of calendar year 1954. Comments on the difficulties of making decisions relative to numbers of thermonuclear weapons required but that many decisions must be made even though there is insufficient knowledge on which to base those decisions. Believes another Jumbo reactor should be constructed to back up the narrow margin of thermonuclear production facilities.

MLC letter to AEC, 23 April 1953

Asks the AEC to study the possibilities of developing a small, light-weight thermonuclear weapon with a yield of DELETED and a diameter of about 30 inches. This request was to support the Services' desire to be able to deliver high yield weapons by high performance aircraft and guided missiles.

Secretary of Defense to NSC, 23 June 1953

The Secretary of Defense advised the NSC that the assumptions used by the JCS in arriving at weapons requirements were valid; that noteworthy weapons availability during the next three years must come from: (a) . . . (b) . . . , (c) new requirements for thermonuclear weapons after Operation CASTLE, if it is then possible to use certain materials not in short supply as essential thermonuclear weapon components.

AEC letter to MLC, June 1953

Advises that the number of thermonuclear weapons on 1 July 1954 as stated by the MLC is a realistic estimate and should be met.

Mr. LeBaron to Secretary of Defense, 27 July 1953

Submitted an analysis of stockpile as of 1 July 1953 and pointed out that:

(1) Most stated goals of the JCS have been met. The few deficiencies in nuclear components were due to . . . . and diversions of significant quantities of enriched uranium to reactor research and reactor loadings for tritium production.

(2) It pointed out that production of non-nuclear components has been hampered considerably by programs of emergency capability and . . .

MLC to AEC, Aug 1953

MLC recommended to the AEC that the DELETED remain under active study pending analysis of Operation CASTLE results.

(There was some tendency on the part of LASL and the Commission to view the DELETED as a principle rather than a weapon and to not give very much emphasis to this development.) Wrong

Chairman, MLC, letter to AEC, 28 Sept 1953

Forwards the JCS requirements for thermonuclear weapons which appear to be proper production guidance to the AEC; also advises the AEC that more than twice that number of thermonuclear weapons of the type to be tested at CASTLE could be delivered with carriers existing at the time the weapons would be in stockpile.

AEC letter to MLC, 7 Oct 1953

The AEC submitted the test program for CASTLE and requested DOD support.

On 14 Oct 1953, the MLC informed the AEC that the Secretary of Defense had given his support to this program.

(As a result of the insistence of the MLC, the [DELETED] was included in the test program.)

AEC memo to MLC, 17 Nov 1953

Requested formal guidance from the DOD in size, weight, and yield areas of the thermonuclear weapon field.

This request was forwarded to JCS and the Military Services.

Mr. LeBaron's memo to Secretary of Defense, 11 Dec. 1953

Advised the Secretary of Defense of AEC estimates of capital facilities and costs needed for the thermonuclear program between now and 1 July 1957 as furnished to the JCAE.

JCS to Secretary of Defense, 15 Dec 1953

Submitted to the Secretary the JCS statement of requirements which involved a major redirection to incorporate thermonuclear weapons into military planning. This statement of requirements raised the number of thermonuclear weapons on 1 July 1957 by a factor of approximately three above that previously assumed by the AEC.

The Chairman, MLC, submitted the information to the Chairman, AEC, on 16 Dec 1953, and on 22 Dec 1953 advised the AEC that the Secretary of Defense had approved the JCS statement of requirements.

Dep. Secretary of Defense letter to JCAE, 5 Feb 1954

Advised the JCAE of the factors on which the JCS based their requirements for thermonuclear weapons, which are (1) the capability of the USSR to produce thermonuclear weapons, (2) the capability of thermonuclear weapons to increase the destructive power of a stockpile of weapons, (3) the types of targets against which thermonuclear weapons can be more profitably employed, (4) possible configurations and yields of thermonuclear weapons, (5) the availability of delivery of vehicles for thermonuclear weapons, (6) the military requirement for an expanded thermonuclear program and still maintaining a fission weapon program, (7) the production capacity of the AEC.

The JCAE was further advised that the stockpile desired by the JCS represents the greatest feasible increase in available stockpile power without major expansions of AEC facilities, but was not intended to fulfill all military requirements; the JCS recommendations will require a major revision of the present production program of the AEC, but the JCS believe this change is necessary.

AEC letter to MLC, 5 Feb 1954

Forwarded the results of the Commission's examination of the technical feasibility of meeting the JCS stockpile requirements for 1 July 1955, 1 July 1956, and 1 July 1957. Conclusions are:

(1) The AEC will not be able to meet the 1 July 1955 requirements as stated by the JCS. The deficiencies in meeting thermonuclear requirements may be as much as 40% (assuming some unfavorable results from CASTLE); if CASTLE results are favorable and certain optimistic

[redacted]

assumptions are used, the AEC may be able to meet the thermonuclear requirement for 1 July 1955 (in which case deficiency in fission weapons would be 15% to 20% in terms of fissionable material).

(2) Tentative thermonuclear requirements for 1 July 1956 are technically feasible, but there may be a deficiency of 5% to 12% in fissionable material available for fission weapons.

The AEC indicated that subject to the direction of the President as required, action had been taken by the Commission to: (1) increase Li-6 production, (2) increase tritium production, and (3) produce high grade plutonium (200 g/t) at Hanford and Savannah River for use in primary bombs.

The Chairman, MLC, transmitted this information to the JCS on 8 Feb 1954 and requested the JCS to examine the impact of the possible AEC failure to meet stated requirements. To further assist the JCS, the Chairman, MLC, forwarded on 12 Feb 1954, for confirmation or correction, possible numbers of weapons which could be available under the two conditions stated by the AEC.

MLC letter to AEC, Feb 1954

Forwarded the developmental requirements for four very high yield weapons as stated by the JCS:

(1) A thermonuclear weapon with the maximum practical yield but not less than DELETED to be compatible in B-36 and B-52 aircraft.

(2) A thermonuclear weapon with a yield of at least DELETED and maximum weight of 23,000 lbs. If design factors can be improved the weapon should be reduced in weight to 15,000 lbs., while keeping the yield at DELETED than hold the weight at 15,000 lbs. and increasing its yield to [redacted]

[redacted]

(3) A thermonuclear weapon with a yield of DELETED and weighing not more than 8500 lbs.

(4) A weapon with a yield from DELETED and weighing not more than 3000 lbs.

Guidance was provided on the ratios of the four types listed above.

Secretary of Defense and Chairman, AEC, to the President, 5 Feb 1954

Jointly recommended approval of an AEC expansion program to meet revised requirements of the DOD.

Expanded program increased AEC appropriations for FY 1955 by $240 million, and AEC expenditures in FY 1955 are $150 million.

The President approved the expanded program on 6 Feb 1954.

AEC to MLC, 17 Feb 1954

In response to a request by the Chief of Naval Operations, the AEC provided the latest comparative information on the wet versus dry thermonuclear weapons systems as follows:

(1) Both systems require the use of tritium containing lithium hydriside.

(2) The dry system requires storage in controlled temperature and humidity. Practically no problems will be met during stockpile to target sequence.

(3) The wet system requires extensive refrigeration during storage. Stockpile to target problems are more complicated than those of the dry system.

FORCES FOR AND AGAINST THE DEVELOPMENT OF THERMONUCLEAR WEAPONS

FOR	AGAINST
Military view that U.S. must stay out in front supported by:	Civilian scientists view that: (1) Weapon would not work. (2) Weapon would be too expensive if it did work. (3) Weapon would have no real military value that atomic bombs could not do easier and better:
Strauss Teller Carl Compton E. O. Lawrence Alvarez Lattimore Geranson de Hoffmann Landshoff	Lilienthal Oppenheimer Bacher Bethe Pike Smyth Conant Rowe C. J. Smith Dubridge Fermi Buckley Rabi

The underlying forces against the development took two primary directions: (1) There was a failure or unwillingness to recognize the new boundaries of potential discovery; (2) There was a determination to keep the "atom" within the confines of the Los Alamos family. Competition was not welcomed.

The arguments were many and diverse, and can be developed in detail at a later time, if desired.