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COMMENTS ON BETHE'S HISTORY OF THE THERMONUCLEAR PROGRAM

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The memorandum of Dr. Bethe has been prepared with the intention to prove that

(1) Progress in our thermonuclear program has been rapid since the Presidential Directive of 1950, and

(2) We probably are considerably ahead of the Russians in thermonuclear development.

His arguments are summarized on the last page of his memorandum which, for the sake of convenience, I shall quote:

(1) The DELETED DELETED is probably not feasible, certainly impractical.

(2) There are at present only two promising ways to obtain large-scale thermonuclear reactions, DELETED DELETED DELETED

(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.

(4) The invention DELETED 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 probably not have been accelerated by harder work. Since the time the invention was made, work has progressed at maximum speed.

(5) The "Alarm Clock" was invented after Fuchs left, DELETED DELETED DELETED

(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.

My own opinions differ to some extent on all of the above points:

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

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. DELETED DELETED DELETED The

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(b)(3)

present models [DELETED] are very specific examples and more of the kind are likely to be developed. In my opinion [DELETED] has some promise in its present form. but there is no certainty that it will work. Success of the [DELETED] is unlikely. (b)(3) The thermonuclear program in Los Alamos was directed toward the two models mentioned above, and neglected general experimentation on various simple models in which one bomb compresses another.

3. [DELETED] b(3) The main principle of radiation implosion was developed in connection with the thermonuclear program and was stated at a conference on the thermonuclear bomb, in the spring of 1946. Dr. Bethe did not attend this conference but Dr. Fuchs did.

4. It is difficult to argue to what extent an invention is accidental; most difficult for someone who did not make the invention himself. It appears to me [DELETED] was a relatively slight modification of ideas generally known in 1946. [DELETED] (b)(3) [DELETED] Since the invention was made, work has progressed at great speed but in too narrow a direction.

5. The use of Li^6 was proposed in this country in the summer of 1950, that is after the arrest of Fuchs. The decision to produce Li^6 was made in the summer of 1951; thus the idea occurred late and there was further delay in the execution. It is likely that Li^6 will become important in some bomb [DELETED] (b)(3) [DELETED] [DELETED]

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 (Richtmayer 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.) 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 [DELETED] (b)

I believe that we have pursued the thermonuclear development 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.

Some important developments are too recent to be included in the memorandum of Dr. Bethe. In April 1952 component testing of radiation implosion was started at Los Alamos. Shortly afterwards action was taken to establish an independent effort in the thermonuclear field in Livermore. It is to be hoped that, as a consequence of these measures, the work on thermonuclear bombs will now proceed in a more satisfactory way.

Edward Teller

ET:PD