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SOME IDEAS ABOUT THE LASL THERMONUCLEAR PROGRAM

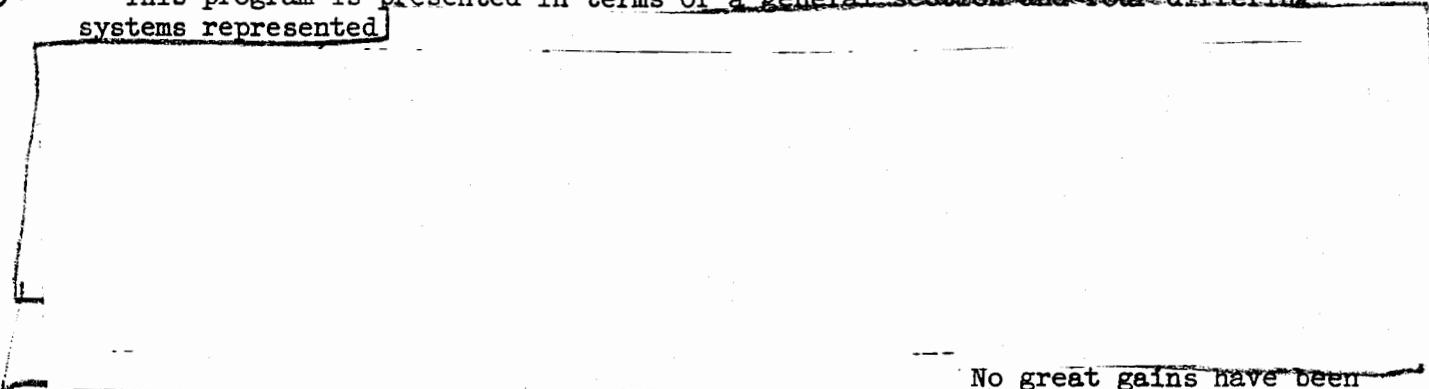
June 1951 (U)

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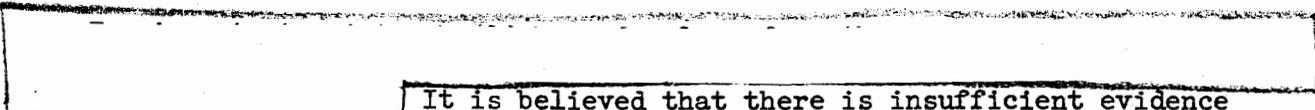
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June 12, 1951

This program is presented in terms of a general section and four differing systems represented



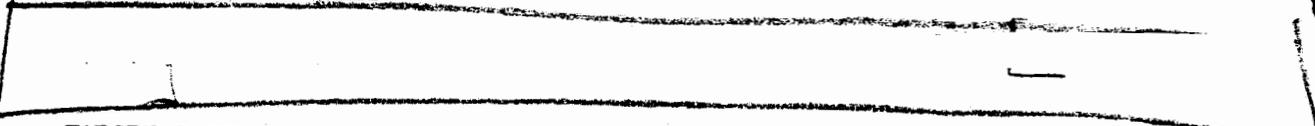
No great gains have been predicted for boosted implosion devices by using thermonuclear reactions over those obtainable by more conventional means using fissionable materials and, in view of the very heavy program of other work, no specific programs in this field are foreseen in the near future.



It is believed that there is insufficient evidence now to assign very different priorities to these systems, but more relevant information will be available in the Fall of 1951 and by that time, or by June 1952 at the latest, meaningful relative priorities can be assigned and the work greatly concentrated. It is also not clear that a system upon which work may be concentrated several months from now is at all accurately represented by the present conception of any of these three devices; it may be a combination object or have presently unimagined features. Second, the target dates given under each of the devices are estimates of the dates at which the development might be at the indicated stage on the assumption that the particular device has a priority over-riding the others after early 1952. In general tests will be limited to the theoretically promising items which appear capable of meeting military worth criteria in the foreseeable future.

GENERAL.

1. Greenhouse Results.



TARGET DATE: Rough draft of report scheduled for August 1, 1951.

PRIORITY: A.

PERSONNEL: LASL theoreticians and groups J-1 and J-7.

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2. Mixing.

Theoretical considerations of the general problem of mixing as applied to any thermonuclear device. Objective is to determine the feasibility of making significant progress toward the solution of this problem by theoretical and calculational means.

TARGET DATE: JANUARY 1952 for review of progress and determination as to whether or not further effort should be expended along these lines.

PRIORITY: C (low priority because the extreme difficulty of the problem makes it seem not very hopeful for valuable results at an early date).

PERSONNEL: Princeton Group.

3. Radiation Implosion.

[Redacted]

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A. Theoretical.

[Redacted] . Appropriate calculations as indicated below under the devices.

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TARGET DATE: January 1, 1952 for basic theoretical and calculational methods.

PRIORITY: B, but changing to A if required for an A priority development.

PERSONNEL: Teller and staff and T Division.

B. Experimental.

Covered under appropriate device below.

[Redacted] it is not thought necessary to perform a nuclear explosion test for the sole purpose of demonstrating implosion by radiation effects even though the object to be imploded and its surroundings may be quite different from those associated with the cylinder.

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4. Boulder Cryogenic Facility.

[Redacted] Apart from testing the large hydrogen liquefiers now under construction at NBS and installing one of the plants at Eniwetok, probably the first job to be undertaken is to solve the problem of storage and transportation of liquid hydrogen by trucks or tank car.

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TARGET DATE: Work in the near future is being planned to meet a requirement for large or complicated dewars to be used in a test in the spring of 1954.

PRIORITY: Different for different phases and dependent upon the priorities of the different systems.

PERSONNEL: National Bureau of Standards with advice from LASL.

5. Military Worth.

A continuing study and intercomparison of the economics, deliverability and military worth of each thermonuclear device as envisaged at all times during its development. Criteria are to be developed to be used, in part, to determine at appropriate times whether or not to proceed with further theoretical and calculational work or with a test relating to a particular device. It will be a general principle not to make an early test of a device whose development into a deliverable weapon having acceptable military and economic characteristics cannot be foreseen as practicable. The point of the whole program is to produce a weapon, not merely to demonstrate the feasibility of a large scale thermonuclear reaction.

Personnel carrying out this study will necessarily have to be conversant with the economics and military worth of fission weapons. It is proposed that this group have the responsibility for evaluating military worth for both fission and thermonuclear weapons, and, thus, perform a needed function in the fission weapon field. It is not intended that this group undertake the theoretical work in the field of weapon effects and phenomenology.

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TARGET DATES:



PRIORITY: A.

PERSONNEL: A new LASL group (to be formed).

6. Cross Section Measurements.

Improved measurements of the (D,D), (D,T), Li⁶ and similar cross sections at relevant energies.

TARGET DATE: June 1952.

PRIORITY: A.

PERSONNEL: P Division, C. I. T., and other laboratories.

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7. Lithium-Hydrogen Fabrication Studies.

At any time at which it appears very likely that Li^6D and Li^6T may be used in one of the devices put on high priority (for example, at the time a decision is made to build a lithium isotopic separation plant) studies will be undertaken of fabrication methods for these compounds. A certain amount of fundamental work upon the physical properties of these compounds is presently under consideration.

TARGET DATE: Acceptable fabrication methods by the time the separation plant is in production, possibly November 1952.

PRIORITY: To conform with that of the device in which its use is contemplated.

PERSONNEL: CMR Division.

8. Opacities.

The calculation and tabulation of opacities will be continued, at least throughout the next year, upon substances of interest to the thermonuclear program.

TARGET DATE: July 1952.

PRIORITY: A.

PERSONNEL: Argonne National Laboratory.

II. The Super.

A. Theoretical.

1.

Preparation for and calculation on the Maniac under the following conditions:

These calculations are designed to determine allowable initial conditions, effect of variation of radius, estimates of the amount of tritium required and fission bomb yield required to ignite the deuterium etc.

The coding for the super problem is now nearly completed.

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TARGET DATE: Coding to be ready when a Maniac is ready to take the problem. Completion of several Maniac runs by January 1, 1952.

PRIORITY: A.

PERSONNEL: T Division and von Neumann (Rand).

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2. Advanced Considerations

[Redacted]

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These calculations follow A.1. above and are designed to go a long way toward determining the feasibility of the super if A.1. has not already done so.

TARGET DATE: To cover the field may be a long job, but the objective is to be prepared to make Maniac calculations including significant improvements and variations over the preliminary calculations during the spring of 1952.

PRIORITY: B, for the present. This priority may be altered either direction depending upon results of the preliminary calculation and military worth studies.

PERSONNEL: Theory by Princeton Group, Breit and Bethe (problems distributed) calculations by T Division and von Neumann.

3.

[Redacted]

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Theoretical work leading to the design

[Redacted]. Decision whether or not to undertake this work seriously is to be made by June 1952 and will depend upon the results of Maniac calculations on propagation and of military worth studies.

TARGET DATE: Completion by January 1953 of the theoretical work upon which to base the design of primer and booster.

PERSONNEL: T Division with probable request for Princeton Group to assist in certain phases.

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B. Experimental.

1.

[Redacted]

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If the former, experimental studies will be required (possibly some experimental work in either case). This work will be closely tied in with A.3. above, possibly lagging somewhat.

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TARGET DATE: Completion of experimental study required for design of test object, April 1953.

PERSONNEL: GMX Division.

2. Experimental studies on equation of state of liquid hydrogen and deuterium if results of calculations indicate by June 1952 that the uncertainties in our knowledge in this field are determining or very important factors.

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[redacted] No specific programs in this field are planned for the near future but some preliminary experiments are under consideration.

TARGET DATE: JANUARY 1953.

PERSONNEL: GMX and CMR Divisions.

3. Nuclear detonation tests as may be required for significant further progress. At the present time no test other than one of a real super, although possibly one of low yield, appears to be required.

TARGET DATES: Completion of design of super for test, May 1953. Test of super if it meets the various criteria, Spring 1954.

[redacted]

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PRIORITY: High, if decision is made to test the super.

PERSONNEL: T, W, CMR, GMX, and J Divisions.

III.

[redacted]

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A. Theoretical.

1. Machine Calculations

[redacted]

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It appears that the NBS SEAC can handle this problem. Coding is in process and an implosion calculation is scheduled to begin in June or July 1951. [redacted] Probably several runs will be made with the general objective of determining minimum acceptable values for compression, tritium content, and initiating fission bomb yield and the relations between these quantities. It is hoped that these calculations will be sufficient to determine whether H. E. implosion is adequate or other means such as radiation implosion are required and to supply reasonably good data for considerations of military worth.

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TARGET DATE: November 1, 1951.

PRIORITY: A.

PERSONNEL: Nordheim, Richtmyer and other LASL theorists.

2. Advanced and Design Calculations

[Redacted]

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If the results of calculations [Redacted] are encouraging, calculations relating to actual designs including lattice effects, fission bomb core, and specified implosion systems will be undertaken in November 1951.

TARGET DATE: June 1, 1952 for completion of calculations relevant to designing a test object.

PRIORITY: High

[Redacted]

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PERSONNEL: Nordheim, Richtmyer, and other LASL theorists.

B. Experimental.

1. By November 1951 a decision will be made whether [Redacted] warrants continued study at high priority. If so, construction of a lithium isotopic separation plant will be requested. A pilot plant is already being constructed. The large plant is predicted to be in production of 95% Li⁶ at the rate of 1 lb/day within 12 months of the time it is authorized.

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[Redacted]

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TARGET DATE: In production at 1 lb/day November 1952.

PRIORITY: High if undertaken at all.

PERSONNEL: ORNL.

2. Certain implosion-type experiments using H. E. may be required during design phases.

TARGET DATE: Fall 1952.

PRIORITY: Dependent upon results of calculations.

PERSONNEL: GMX Division assisted by CMR.

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3. Nuclear detonation tests as may be required for further progress.

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[Redacted]

TARGET DATES:

[Redacted]

PRIORITY: High if decision is made to test [Redacted]

DOE
b3

PERSONNEL: T, W, CMR, GMX, and J Divisions.

IV.

[Redacted]

A. Theoretical.

1. General Feasibility Study.

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[Redacted]

TARGET DATE: October 1951.

PRIORITY: A.

PERSONNEL: Teller and staff with the aid on specific problem by T Division and the Princeton group. The latter may carry a large part of this work.

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[Redacted]

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A study covering this point is in progress and a report is expected early in July 1951.

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It is conceivable that there may be sufficient confidence [redacted] that it will be deemed unnecessary to proof-test the device in advance of stockpiling. A decision on this point will be made about June 1952.

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[Redacted]

No such test is being planned at present. The end of the development phase of the TX-11 program is presently scheduled for April 1954 and a final evaluation report is planned for issue January 1, 1955.

PRIORITY: A.

PERSONNEL: W, CMR, and T Divisions (J Division for testing.)

Comments on the Proposed Program.

(a). Target dates for nuclear detonation tests lead to the schedule given below. These dates are mutually exclusive in the sense that each represents the earliest conceivable date for a well planned test if the priority and effort expended on the other devices is relatively small.

Spring 1953

Fall 1953

[Redacted]

Spring 1954 - a super

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A test date [redacted] at this time and its choice would not affect the above dates appreciably in any case.

No nuclear detonation tests are planned for auxiliary purposes [redacted]

[redacted] The reason is that such tests would cost roughly as much effort as the test of a final device and their inclusion would delay development of these devices.

(b). A greatly reduced emphasis is to be placed upon complicated experimental techniques for tests (like Dinex, the X-ray measurements, etc.) because the important experimental results desired from the proposed thermonuclear test shots are obtainable directly from the yield, although certain, possibly simple, diagnostic experiments will be desirable. Thus, the groups which performed these complicated experiments on Operation Greenhouse need not be held intact but should be built up again only when and if it becomes obvious that such measurements must be made in future tests.

(c). Although the criteria set up by the economics and military worth studies will limit the amount of tritium in each device, if used as a weapon, [redacted]

[redacted] It is believed that the amount of tritium scheduled for delivery by the end of 1952 from the present enriched loading of H pile and the Hanford excess reactivity [redacted] This will be sufficient to allow a test of whichever thermonuclear system it is decided to carry to the test stage. Thus, no additional tritium production is requested at this time.

DF:b

Darol Froman
June 12, ~~xix~~ 1951

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