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May 19, 1944.

Major General L. R. Groves  
P. O. Box 2610  
Washington, D. C.

Dear General Groves:

Consideration of the delivery problem in its broad aspects has highlighted many questions, which one might assume could be taken up later or are being handled by other mechanisms unknown to Ramsey and myself. However, as I emphasized to you, Dr. Oppenheimer, Dr. Bush, and Dr. Conant, the isolation of this project, while justified for security reasons, also imposes a duty on those connected with it, which would not exist with projects channeled normally through the High Command. For this reason, I believe that it is necessary to start action along certain lines fairly soon, because unless plans have been made which will permit certain highly desirable delivery conditions to be met, we may find, perhaps this Christmas, that these conditions cannot be met either by us or by the High Command; in which case a much less positive gadget or method of delivery will have to be accepted.

You are better qualified than we to make an "exact" prediction from a production standpoint, as to the first date at which the delivery problem should be solved. An estimate that it could not be before this Thanksgiving and might well be before Easter, 1945, is about as close as I could guess.

This time consideration is linked with other considerations when it comes to setting a date at which the military delivering group should be ready in a material sense. One such consideration concerns the necessity for an overall test of the gadget before its use against the enemy. There is also the decision as to whether a single gadget, not to be followed by a second and third model for a period of several months, would be used as soon as ready. If a military requirement of a minimum of three gadgets were set up, then the date of first use against the enemy would naturally be months later. A further consideration which has a bearing on the time scale, is the directive now in effect that a minimum of 1,000 tons TNT equivalent is required. If there should be a possibility of producing three or more 500 ton equivalent gadgets by the same date as one probable 10,000 ton equivalent gadget, the directive would require modification.

It is desirable to state the assumptions under which the design and delivery problem is now being attacked. These assumptions should be critically considered by the Military Use Committee.

- (a) The implosion method is definitely possible of accomplishment and may, with good breaks, permit construction of a 1,000 or more ton equivalent gadget by the end of 1944.

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- (b) The most probable size and shape of the implosion gadget is a large sphere, probably about 60" O.D., stabilized with a box tail. The total weight of this assembly will be about 10,000 lbs., and its overall length will be less than 130".
- (c) The only known airplanes which can carry a gadget of the above overall dimensions without major modification, are the B-29 and the British Lancaster. It is believed that the present production B-29s with the bomb rails removed from the forward bomb bay, can accept a sphere up to 65" diameter, but the box tail could not be more than 60" on a side.
- (d) Detailed planning and tests looking toward military use, have been conducted only with a B-29 plane. Undoubtedly, a long period, in terms of months, would elapse if any other airplane (Lancaster) were ordered made ready for this delivery.
- (e) The primary and, so far, only contemplated method of delivery toward which the testing program is oriented, is high altitude (about 30,000 feet above sea level), horizontal bombing, with provision for detonating the bomb well above ground, relying primarily on blast effect to do material damage. In this connection, the present thought is to use a height of detonation such that with the minimum probable efficiency, there will be the maximum number of structures (dwellings and factories) damaged beyond repair.
- (f) Delivery should be able to be accomplished either by day or by night.
- (g) The fact that the power of the contemplated gadget could only be equaled by normal bombs carried by 2,500 bombers, requires a degree of reliability in functioning of the airplane selected for this task, which is well beyond that now acceptable in military aircraft. To accomplish this, extraordinary precautions are being taken in the design and acceptance tests of suspension and release equipment, and the fuzing, including safety control, of the gadget. It is now planned to protect the spherical high explosive charge with armor, probably in the outer shell surrounding the charge. Electric circuits will be required in the release system and in the gadget, and these will be duplicated and power supplied by batteries which can operate down to very low temperatures (minimum not yet determined).
- (h) In line with paragraph (g) above, it is planned to install additional armor to protect vital personnel, radar, and engine positions.

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(h) continued

The weight devoted to this will naturally reduce the effective range of the airplane. Therefore, the amount of armor which can be so used, will be determined by the tactical range which must be available from take-off to target.

- (i) For positive delivery it is planned that the airplane be equipped with APQ-13 navigational and bombing radar. This is on the assumption that delivery may be required in 1944. Better equipment might be available in 1945.
- (j) Availability of S. S. Loran equipment in the airplane, with corresponding transmitters located to permit navigation to the point of delivery by this method, is highly desirable in order to give assurance of successful completion of such a crucial mission. In a later paragraph, the implications of this statement will be discussed.
- (k) Since the assembled gadget is heavy and awkward to handle, and also includes two tons of ordinary high explosive which would completely destroy the active material even under conditions which insure a nuclear dud, it is planned to develop a gadget which will be assembled near enough to the point of take-off so that transportation and unloading operations can be minimized.

The above paragraphs outline assumptions under which the Ordnance Division of this project is now operating, the above developments being to some extent under the control of this project. There will be outlined below certain actions which may control the date of use or theatre of use, or the reliability and positiveness of delivery:

- (1) The minimum number of B-29 planes which should be fully modified and prepared to carry out the delivery mission. This includes trained and specially selected crews. The method of organization of the delivering unit and the time required to activate such an organization.
- (2) Fighter protection throughout the critical stage of delivery.
- (3) Availability of B-29 planes, perhaps specially armored and armed, to act as escorts for the B-29 plane carrying the gadget.
- (4) Sub-paragraphs (1) and (3) above are critically affected by the assignment of B-29 operating theatres.
- (5) Maximum operating range which will be required of the delivering B-29.

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- (6) Recognition of the fact that proper anticipation of earliest date of readiness of the gadget will probably result in a period of waiting by highly trained and keyed-up military personnel, with attendant loss of morale.

It is not known here what the present plans are for making S. S. Loran available for navigation in the vicinity of primary targets in the Pacific. If present plans do not now include making S. S. Loran available near all targets where this gadget may be used by the end of 1944, these plans should be reconsidered in view of the marked increase in reliability of navigation which this development affords.

The above paragraphs have presented the situation as seen here in May, 1944. It is believed that considerations given above require certain specific actions, namely:

- (a) Full consideration by the Military Use Committee of the assumptions under which the gadget is being developed by this project.
- (b) Consideration by the Military Use Committee and by the High Command of strategic and tactical preparations which should be made in the light of probable developments.
- (c) A relatively minor point - by July, 1944, making available one of the "battle delivery" B-29s in addition to the experimental B-29 now in use. Availability of this additional B-29 will permit modification of its bomb bay and other equipment while the present B-29 is retained in its present condition.

Sincerely,

WSP/hg

*W. S. Parsons*  
W. S. Parsons  
Captain, USN