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Memorandum For: Major General L. R. Groves

Subject: Summary of Target Committee Meetings on 10 and 11 May 1945

1. The second meeting of the Target Committee convened at 9:00 AM 10 May in Dr. Oppenheimer's office at Site Y with the following present:

General Farrell	Dr. C. Lauritsen
Colonel Seeman	Dr. Ramsey
Captain Parsons	Dr. Dennison
Major Derry	Dr. Von Neumann
Dr. Stearns	Dr. Wilson
Dr. Tolman	Dr. Penney
Dr. Oppenheimer	

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By ERC NARS, Date 6-4-74

See below

Dr. Bethe and Dr. Brode were brought into the meeting for discussion of Item A of the agenda. During the course of the meeting panels were formed from the committee members and others to meet in the afternoon and develop conclusions to items discussed in the agenda. The concluding meeting was held at 10:00 AM 11 May in Dr. Oppenheimer's office with the following present:

Colonel Seeman	Dr. Stearns
Captain Parsons	Dr. Von Neumann
Major Derry	Dr. Dennison
Dr. Tolman	Dr. Penney
Dr. Oppenheimer	Dr. Ramsey
Dr. Wilson	

2. The agenda for the meetings presented by Dr. Oppenheimer consisted of the following:

A. Height of Detonation

B. Report on Weather and Operations

C. Gadget Jettisoning and Landing

D. Status of Targets

E. Psychological Factors in Target Selection

F. Use Against Military Objectives

G. Radiological Effects

H. Coordinated Air Operations

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2. The agenda for the meetings --- continued

I. Rehearsals

J. Operating Requirements for Safety of Airplanes

K. Coordination with 21st Program

3. Height of Detonation

A. The criteria for determining height selection were discussed. It was agreed that conservative figures should be used in determining the height since it is not possible to predict accurately the magnitude of the explosion and since the bomb can be detonated as much as 40% below the optimum with a reduction of 25% in area of damage whereas a detonation 14% above the optimum will cause the same loss in area. It was agreed that fuses should be prepared to meet the following possibilities:

(1) For the Little Boy the detonation heights should correspond to a pressure of 5 psi, a height of the Mach-stem of 100 feet and a magnitude of detonation of either 5,000 or 15,000 tons of H.E. equivalent. With present knowledge the fuse setting corresponding to 5,000 tons equivalent would be used but fusing for the other should be available in case more is known at the time of delivery. The heights of detonation corresponding to 5,000 and 15,000 tons are 1550 feet and 2400 feet, respectively.

Hiso (gun)

1650

(2) For the Fat Man the detonation heights should correspond to a pressure of 5 psi, a height of the Mach-stem of 100 feet, and a magnitude of explosion of 700, 2,000, or 5,000 tons of H.E. equivalent. With the present information the fuse would be set at 2,000 tons equivalent but fusing for the other values should be available at the time of final delivery. The heights of detonation corresponding to 700, 2,000, and 5,000 tons are 580 feet, 1,000 feet and 1,550 feet, respectively. Trinity data will be used for this gadget.

Vogo (implo)

1800

B. In the case of the Fat Man delay circuits are introduced into the unit for other purposes which make the detonation of the bomb 400 feet below the heig at which the fuse is set. For this reason as far as the Fat Man is concerned the fuse settings should be 980 feet, 1,400 feet, or 1,950 feet.

C. In view of the above it was agreed by all present that fuses should be available at four (4) different height settings. These heights are 1,000 feet, 1,400 feet, 2,000 feet and 2,400 feet. With present information the 1,400 feet fuse would be most likely to be used for both the Fat Man and the Little Boy. (Later data presented by Dr. Brode modify the above conclusions on fusing and detonating heights; the differential height for the Little Boy is 210 feet and for the Fat Man 500 feet. For this reason some of the above figures must be revised).

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4. Report on Weather and Operations

A. Dr. Dennison reported on the above subject. His report essentially covered the materials in his Top Secret memo of 9 May - Subject: "Preliminary Report on Operational Procedures". For this reason his report will not be repeated here but is attached as an appendix. It was agreed by those present that the mission if at all possible should be a visual bombing mission. For this we should be prepared to wait until there is a good weather forecase in one or more of three alternative targets. There is only a 2% chance in this case that we will have to wait over two weeks. When the mission does take place there should be spotter aircraft over each of three alternative targets in order that an alternative target may be selected in the last hour of flight if the weather is unpromising over the highest priority target.

B. In case the aircraft reaches the target and finds, despite these precautions that visual bombing is impossible, it should return to its base provided it is in good operating condition. Only if the aircraft is in sufficiently bad shape that it is unlikely that it can return to base and make a safe landing or if it is essential that the drop be made that day should the drop be made with radar equipment. For this purpose it may be desirable to have an Eagle radar equipped airplane accompany the mission in order that formation bombing with the Eagle plane in the lead can be made to obtain the increased accuracy from Eagle. A final decision as to the desirability of this emergency procedure can only be made after further combat experience is obtained with Eagle aircraft. In any case every effort should be made to have the mission such that blind bombing will be unnecessary.

C. It was agreed that Dr. Stearns and Dr. Dennison should keep themselves continuously informed as to radar developments. If at any time new developments are available which show in combat a marked improvement of accuracy the basic plan may be altered.

D. It was agreed that Shoran was a very promising development for the 21st Bomber Command but that we should make no plans to use Shoran until its success is fully confirmed in normal bombing missions in that area.

E. The plan to use the gadget with visual bombing even though this may require a one day to three weeks delay requires that the gadget be such that for a period of at least three weeks it can be held in readiness in such a state that on twelve hours notice it can be prepared for a combat mission. No difficulty in this regard was foreseen by those present.

5. Gadget Jettisoning and Landing

A. It was agreed that if the aircraft has to return to its base with the gadget and if it is in good condition when it has reached there, it should make a normal landing with the greatest possible care and with such precautions as stand-by fire equipment being held in readiness on the ground. This operation will inevitably involve some risks to the base and to the other aircraft parked on the field. However, the chance of a crash when the aircraft is in good condition and the chances of the crash initiating a high order explosion are both sufficiently small that it was the view of those present that the landing operation with the unit under these circumstances was a justifiable risk. Frequent landings with inert and H.E. filled units have been made in the past. Training in landing with the unit should be given to all crews who carry an active unit.

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5. Gadget Jettisoning and Landing - continued

B. In case the aircraft returns to its base and then finds that it cannot make a normal landing it may be necessary to jettison the bomb. In the case of the Fat Man this can probably best be accomplished by dropping the bomb into shallow water from a low altitude. Tests on this will be carried out with both inert and live units. In the case of the Little Boy the situation is considerably more complicated since water leaking into the Little Boy will set off a nuclear reaction, and since the American held territory in the vicinity of the base is so densely filled that no suitable jettisoning ground for the Little Boy has been found which is sufficiently devoid of mositure, which is sufficiently soft that the projectile is sure not to seat from the impact, and which is sufficiently remote from extremely important American installations whose damage by a nuclear explosion would seriously affect the American war effort. The best emergency procedure that has so far been proposed is considered to be the removal of the gun powder from the gun and the execution of a crash landing. In this case there is no danger of fire setting off the gun and the accelerations should be sufficiently small to prevent seating of the projectile by the impact. Tests on the feasibility of unloading the gun powder in flight will be conducted.

C. It was agreed that prior to actual delivery some form of instructions should be prepared as a guide to the senior man on the aircraft as to procedures to be followed in cases of different types of disasters.

6. Status of Targets

A. Dr. Stearns described the work he had done on target selection. He has surveyed possible targets possessing the following qualifications: (1) they be important targets in a large urban area of more than three miles diameter, (2) they be capable of being damaged effectively by a blast, and (3) they are likely to be unattacked by next August. Dr. Stearns had a list of five targets which the Air Forces would be willing to reserve for our use unless unforeseen circumstances arise. These targets are:

(1) Kyoto - This target is an urban industrial area with a population of 1,000,000. It is the former capital of Japan and many people and industries are now being moved there as other areas are being destroyed. From the psychological point of view there is the advantage that Kyoto is an intellectual center for Japan and the people there are more apt to appreciate the significance of such a weapon as the gadget. (Classified as an AA Target)

(2) Hiroshima - This is an important army depot and port of embarkation in the middle of an urban industrial area. It is a good radar target and it is such a size that a large part of the city could be extensively damaged. There are adjacent hills which are likely to produce a focusing effect which would considerably increase the blast damage. Due to rivers it is not a good incendiary target. (Classified as an AA Target)

Only two "AA" Targets!

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6. Status of Targets - continued

(3) Yokohama - This target is an important urban industrial area which has so far been untouched. Industrial activities include aircraft manufacture, machine tools, docks, electrical equipment and oil refineries. As the damage to Tokyo has increased additional industries have moved to Yokohama. It has the disadvantage of the most important target areas being separated by a large body of water and of being in the heaviest anti-aircraft concentration in Japan. For us it has the advantage as an alternative target for use in case of bad weather of being rather far removed from the other targets considered. (Classified as an A Target)

(4) Kokura Arsenal - This is one of the largest arsenals in Japan and is surrounded by urban industrial structures. The arsenal is important for light ordnance, anti-aircraft and beach head defense materials. The dimensions of the arsenal are 4100' x 2000'. The dimensions are such that if the bomb were properly placed full advantage could be taken of the higher pressures immediately underneath the bomb for destroying the more solid structures and at the same time considerable blast damage could be done to more feeble structures further away. (Classified as an A Target)

(5) Niigata - This is a port of embarkation on the N.W. coast of Honshu. Its importance is increasing as other ports are damaged. Machine tool industries are located there and it is a potential center for industrial despersion. It has oil refineries and storage. (Classified as a B Target)

(6) The possibility of bombing the Emperor's palace was discussed. It was agreed that we should not recommend it but that any action for this bombing should come from authorities on military policy. It was agreed that we should obtain information from which we could determine the effectiveness of our weapon against this target.

B. It was the recommendation of those present at the meeting that the first four choices of targets for our weapon should be the following:

a. Kyoto
b. Hiroshima
c. Yokohama
d. Kokura Arsenal

great terminology

C. Dr. Stearns agreed to do the following: (1) brief Colonel Fisher thoroughly on these matters, (2) request reservations for these targets, (3) find out more about the target area including exact locations of the strategic industries there, (4) obtain further photo information on the targets, and (5) to determine the nature of the construction, the area, heights, contents and roof coverage of buildings. He also agreed to keep in touch with the target data as it develops and to keep the committee advised of other possible target areas. He will also check on locations of small military targets and obtain further details on the Emperor's palace.

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7. Psychological Factors in Target Selection

A. It was agreed that psychological factors in the target selection were of great importance. Two aspects of this are (1) obtaining the greatest psychological effect against Japan and (2) making the initial use sufficiently spectacular for the importance of the weapon to be internationally recognized when publicity on it is released.

B. In this respect Kyoto has the advantage of the people being more highly intelligent and hence better able to appreciate the significance of the weapon. Hiroshima has the advantage of being such a size and with possible focusing from nearby mountains that a large fraction of the city may be destroyed. The Emperor's palace in Tokyo has a greater fame than any other target but is of least strategic value.

ask?

8. Use Against "Military" Objectives

Use!!! A-1!

A. It was agreed that for the initial use of the weapon any small and strictly military objective should be located in a much larger area subject to blast damage in order to avoid undue risks of the weapon being lost due to bad placing of the bomb.

9. Radiological Effect

A. Dr. Oppenheimer presented a memo he had prepared on the radiological effec of the gadget. This memo will not be repeated in this summary but is being sent to General Groves as a separate exhibit. The basic recommendations of this memo are (1) for radiological reasons no aircraft should be closer than 2-1/2 miles to the point of detonation (for blast reasons the distance should be greater) and (2) aircraft must avoid the cloud of radio-active materials. If other aircraft are to conduct missions shortly after the detonation a monitoring plane should determine the areas to be avoided.

No

10. Coordinated Air Operations

A. The feasibility of following the raid by an incendiary mission was discussed. This has the great advantage that the enemies' fire fighting ability will probably be paralyzed by the gadget so that a very serious conflagration should be capable of being started. However, until more is learned about the phenomena associated with a detonation of the gadget, such as the extent to which there will be radio-active clouds, an incendiary mission immediately after the delivery of the gadget should be avoided. A coordinated incendiary raid should be feasible on the following day at which time the fire raid should still be quite effective. By delaying the coordinated raid to the following day, the scheduling of our already contemplated operations will not be made even more difficult, photo reconnaissance of the actual damage directly caused by our device can be obtained without confusion from the subsequent fire raid, and dangers from radio-active clouds can be avoided.

No

B. Fighter cover should be used for the operation as directed by the 21st Bomber Command.

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11. Rehearsals

A. It was agreed by all that very complete rehearsals of the entire operation are essential to its success. It is possible for thirty (30) pumpkin units for this purpose to be shipped from this country in June with perhaps sixty (60) being shipped in July. These rehearsals overseas should take place beginning in July. At least some of the rehearsals should be very complete including the placing of spotter aircraft over the alternative targets, use of fighter cover, etc. Even though it is hoped that radar will not be used some rehearsals of radar operations are required in order that the operations may be carried out successfully if emergency arises for which they are required.

12. Operating Requirements for Safety of Aircraft

A. Dr. Penney reported some very encouraging information he had just received from England in this respect. His previous information was that no one could guarantee the safety of a large aircraft at blast pressures greater than 1/2 lb. per square inch. However, in some recent experiments in England large aircraft have been flown over detonations of 2,000 lbs. of TNT and pilots have not objected to going as low as 900 feet. On this basis with a 100,000 ton total equivalent energy release or a 64,000 ton equivalent blast energy 23,000 feet would be a safe altitude on the basis of these experiments if allowance is made for the rarefaction of the atmosphere at high altitudes. However, due to the greater duration of the blast in our case, the safe height will probably be somewhat greater.

13. Coordination with 21st Program

A. This matter was included as part of the other discussion and is included in previous paragraphs of this summary.

14. It was agreed that the next meeting of the Target Committee should take place at 9:00 AM EWT on 28 May in Room 4E200 of the Pentagon Building in Washington. Dr. Oppenheimer recommended and others agreed that either Captain Parsons and/or Dr. Ramsey should attend this meeting.

15. In view of the high classification of the minutes of this meeting it was agreed that copies should not be sent to those present but that instead one copy should be kept on file in General Groves' office, one copy in Dr. Oppenheimer's office, and one copy in Captain Parsons' office.

J. A. Derry, Maj. C.E.
N. F. Ramsey

Major J. A. Derry
Dr. N. F. Ramsey

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Distribution:
Copy 1: Maj Gen L. R. Groves
Copy 2: Capt. Parsons
Copies 3 & 4: J. R. Oppenheimer

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