PRELIMINARY REPORT FOLLOWING THE SECOND ATOMIC BOMB TEST

Prepared by the Chief of Staff Evaluation Board
For the Second Bomb Test

30 July 1946

To: The President

Subject: Preliminary Report on Test AB

In compliance with your directive of 27 February 1946, the
Evaluation Board presents a second preliminary report of the stands
bomb test held at Bikini Atoll.

Section I

Supplement to Preliminary Report on Test AB

In general, the observations on ship damage presented by this
board in its first report were confirmed by engineering surveys. The
location of the bomb burst, accurately determined from photographs, was
such that only one ship was within 1,000 feet of the surface point over
which the bomb exploded. There were about 50 ships within half a mile,
all of which were badly damaged, many being put out of action and five
sunk. It required up to 12 days to repair all of the ships hit by
attack sufficiently so that they could have steamed under their own
power to a major base for repairs.

It is not possible to make many estimates of the radiological
injuries which crews would have suffered had they been aboard
Test AB target vessels. Measurements of radiation obtained and a
study of attacks exposed to ships show that the initial field of prin-
cipal lethal radiation, which was paramount and immediate, would have
killed almost all personnel normally stationed aboard the ships con-
tinued around the air burst and many others at greater distances.

Personal protection by mask, water, or other damage materials would
have been relatively safe in the adjacent target vessels. The effects
of radiation upon personnel would not have been eliminated all victims immediately, even some of the most severely hit
might have survived at their stations several hours. Thus it is possible
t hat effects of damage control might have kept ships operating, but it
is clear that vessels within a mile of an atomic bomb air burst would
evitably become inoperable due to crew casualties.

Section II

Observations on Test AB

The Board divided into two groups for the observation of Test AB.
Four members observed the target area from the air, launched
the explosions from an airplane eighty miles away at an altitude of 15,000
feet. The other three members inspected the target area from a small
boat two days before the test and observed the bursts explosion. The
boat of the USS HAYDEN, 11 miles at sea to the west of the burst.
The bomb reassembled on the KSPH on 26 July, and the members have since examined photographs, data on radiocative, and reports of other phenomena, and have inspected some of the target vessels. They have also discussed with members of the Task Force Technical Staff.

As scheduled, at 0705 initial time on 27 July, a bomb was detonated within the barrier of the target. This bomb was suspended from 00006, near the center of the target array. The explosion was of a predicted violence and is estimated to have been at least as destructive as 20,000 tons of TNT.

To a degree which the bomb finds remarkable, the visible phenomena of explosion followed the predictions made by civilian and service physicists attached to the Task Force in advance. At the moment of explosion, a dome, which shored the light of incandescent material within, rose upon the surface of the target. The blast was followed by a spray cloud which rapidly enveloped about half of the target array. The cloud retained its characteristic form for about an hour, in accordance with predictions.

From some of the photographs it appears that the column lifted the 25,000-ton battleship ORPEN for a brief instant before the vessel plunged to the bottom of the lagoon. Confirmation of this occurrence may await the analysis of high-speed photographs which are not yet available.

The diameter of the column of water was about 2200 feet, and it rose to a height of about 9500 feet. Spray was to a much lesser height. The column contained roughly ten million tons of water. For several minutes after the column reached maximum height, water fell back, forming an expanding cloud of spray which enveloped about half of the target array. Scouring the base of the column was a wall of foaming water several hundred feet high.

Waves outside the water column, about 1000 feet from the center of explosion, were 80 to 125 feet in height. These waves rapidly dissipated in size as they proceeded outward, the highest waves reaching the outer barrier about seven feet. These did not pass over the island, and no material damage occurred there. Measurements of the underwater shock wave are not yet available. There were no seismic phenomena of significant magnitude.

The explosion produced intense radioactivity in the waters of the lagoon. Radioactivity incidentally after the event is estimated to have been the equivalent of any hundred tons of radium. A few minutes exposure to this intense radiation at the peak would result in a brief illness, hence occupational hazard being over 200 feet in their deaths within days or weeks.

Great quantities of radioactive water descended upon the ships from the column of water thrown over them by waves. This highly lethal radioactive water constituted such a hazard that for four days it was still unsafe for landing parties, operating within a well-established safety margin, to spend more than one hour at the center of the target area or to board ships obscured therein.

As in Test 'A', the array of target ships for Test 'B' did not represent a normal occurrence but was designed instead to test the methods data from a single explosion. At the 11 ship end of small array in the group, 15 were damaged within one mile and 20 within about three miles. The major ships were sunk, the battleships ARMADILLO and the heavy-cruiser aircraft carrier MAHONA after 72 hours. A landing ship, a landing craft, and an after sine sunk immediately. The destroyer HUGGINS, in sinking condition, and the transport VICTOR, body listing, were later hunted. The submarine AGASSIZ was sunk to the bottom without air bubbles and fuel oil, and one to three other submerged submarines were believed to have sunk. Fifty days after the burst, the partly damaged Japanese battleship MARETSU was sunk. It was found impossible even to examine damage to hulls, propeller shafts and machinery of the target.
Section III
Observation of Concluding, Both Tests

The operation of the bomb from the deck was conducted that tests have set a pattern for size, an effective separation of the bomb from the deck, and a civilian population in the planning and execution of the highly hazardous operation. Moreover, the tests have provided valuable training of personnel in joint operations requiring great precision and coordination of effort.

It is impossible to evaluate the shock wave in terms of conventional explosions, as to detonation and blast effects, there is no statistical basis for such an evaluation. The shock wave is, in fact, a wave of air quickly propagated by the bomb, with little or no effect on adjacent structures. It is necessary that a conventional bomb have a direct hit or a near miss of not more than a few feet to cause significant damage to a building. At 1000 the second bomb, burning under water, was a bottleneck immediately at a distance of 250 feet over 300 feet. It changed an airplane workshop at 300 feet and a few miles, while another bottleneck was over five days. The first bomb, burning in air, did give rise to the possibilities of major ships within a few miles radius, but did only minor damage to their hulls. No ship within a mile of either bomb could have escaped without some damage to itself and serious injury to a large number of the crew.

Although initial results might have been more or less equivocal, the psychological phenomena accompanying the two -barred were markedly different. In the case of the side -barred bomb, it seems certain that unprepared personnel within a mile would have suffered high casualties by intense nausea and given radiation as well as by blast and wave. These surviving personnel would not have been harmed by radiation but might have perished from the blast and wave.

In the case of the underwater explosion, the air -barred were very few and infrequent and there were no hard core of significance. Recovery, however, of the shock wave of weakness and power and by other, the shock wave of the first line of radiation was not of high order, but the second bomb, twice the size, had much more highly explosive wave due to the depth of the bomb. These uncontrolled ships became radioactive stores, and would be much more likely to have caused further and greater destruction.

It is too soon to stamp an analysis of all of the implications of the Bribec test, but it is not too soon to prepare the necessary Italian and Italian manpower into several major problems of the bomb. The planning of large volumes of water provides such a problem. They must be given to procedures for protecting not only edge areas but also the population of cities against such radiological effects as were demonstrated in -Bribec tests.

Observations during the two tests have established the ground types and range of effects and have allowed under -water tests on small vessels, new equipment, including a wide variety of experimental doses, and personnel. From these observations on from instrumental data it will now be possible to utilize such devices, not only in a manner more consistent with strategy and tactics, as future events may indicate.