PRELIMINARY REPORT FOLLOWING THE SECOND ATOMIC BOMB TEST

Report by the Joint Chiefs of Staff Evaluation Board
For the Second Bomb Test

30 July 1946

In compliance with your directive of 27 February 1946, the Evaluation Board presents a second preliminary report of the stand-off test conducted at Bikini Atoll.

Section I
Supplement to Preliminary Report on Test 262

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 photography, was such that only one ship was within 1,000 feet of the surface point over the bomb explosion. 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 these ships hit by the blast sufficiently so that they could have been steamed under their own power to a major base for repairs.

It is now possible to make some estimates of the radiological injuries which crews would have suffered had they been aboard Test 262 target vessels. Measurements of radiation intensity and a study of attitude exposed to ships show that the initial flash of principal beta radiation, which are penetrating and intense, would have killed almost all personnel normally stationed aboard the ships concerned around the air burst and many others at greater distances. Personnel protected by steel, water, or other dense materials would have been relatively safe in the vicinity of target vessels. The effects of radiation exposure would not have been isolated; all personnel immediately, even some of the next immediately, might have received of their stations normal hours. Thus it is possible that initial effects of damage control might have kept some surviving, but it is clear that vessels within a mile of an atomic bomb air burst would eventually become inoperable due to crew casualties.

Section II
Observations on Test 262

The Board divided into two groups for the observation of Test 262. Four members, after surveying the target area from the air, witnessed the explosion from an airplane eight miles away at an altitude of 5,000 feet. The other three members observed the target area from a small boat immediately before the test and observed the effects of damage.
The Board reconvened on the HHFBN on 26 July, and the members now also examined photographs, data on radioactivity, and reports of other phenomena, and were inspected some of the target vessels. They have also conferred with members of the Task Force Technical Staff.

As scheduled, at 0855 hours, on 26 July, a bomb was detonated well below the surface of the lagoon. This bomb was suspended from a M30, near the center of the target array. The explosion was of predicted violence and is estimated to have been at least as destructive as 20,000 tons of TNT.

To a degree, the bomb finds remarkable, the visible, phenomena of explosion followed the predictions made by civilian and service physicists attached to Task Force for one. At the moment of explosion, a dome, which split the light of incandescent material within, rose upon the surface of the lagoon. The blast was followed by an eruption which rapidly enveloped almost half of the target array. The cloud vanished in about two seconds to reveal, as predicted, a column of accreting water. From most of the photographs it appears that this column lifted the 35,000-ton battleship BAYARD for a brief instant before the vessel plunged to the bottom of the lagoon. Confirmation of this occurrence can be seen in the analyses 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 9000 feet. Smoke was a much greater 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 engulfed about half of the target array. Escalating 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 120 feet in height. These were rapidly dissipated in air as they proceeded outward. The height wave reaching the beach of the island was being seen fast. These did not pass over the island, and no external damage occurred there. Measurements of the underwater shock waves are not yet available. There were no seismic phenomena of significant magnitude.

The explosion produced intense radioactivity in the waters of the lagoon. Activity immediately after the burst is estimated to have been the equivalent of about 200 tons of radium. A few minutes exposure to this intense radiation at the point would result in a brief interval, from insensitivity to burns being not even possible in their death within days or weeks.

Great quantities of radioactive material descended upon the ships from the column, and some were thrown over them by waves. This highly lethal radioactive material constituted such a hazard that for four days it was still unsafe for landing parties, operating within a well-established safety margin, to step upon the beach within days or weeks.

As to Test '48,' the array of target ships for Test '48' did not represent normal discharge of the target vessel data from a single explosion. Of the 56 ships and small vessels in the array, 46 were neutralized within one mile and 20 within about one and a half miles. The major ships were sunk, the battleships AMERICA and the heavy-nuclear aircraft carrier BARATON after 78 hours. A landing ship, a landing craft, and an armor-crossed vessel immediately. The destroyers SHIDDY and KING, in sinking condition, and the heavy-nuclear vessel, body listing, were later burned. The submerged submarine AGILIS was sunk to the bottom waiting air bubbles and fuel oil and on to three other submerged submarines were ordered to leave the array ten days after the burst, the other damaged submarine BARATON sunk. It was found impossible immediately to examine damage to hulls, propellers and auxiliary of the target.
### Observation and Concluding, Both Tests

The operation of the ABT Test from one to conducting that test have set a pattern for those, occurring in the execution of the sound structural and testing reports and the direction of the engineers’ operation. On the other, the tests have provided valuable knowledge in the field of structural engineering and the role of concrete in blast phenomena requiring post-blast analysis and modification of the tests.

It is impossible to evaluate an explosion in terms of conventional explosions. As to destruction and blast effects, there, the largest bomb of the type was effective within a radius of a few hundred feet, and the wave of destruction are measured in thousands of feet. However, the blast effects have no parallel in conventional explosions. It is necessary that a conventional bomb cause a direct hit of a much larger effect than a bomb of the same size.

According to the bomb, burning under water, even a battleship immediately at a distance of well over 500 feet. It changed an aircraft carrier or that it went in a few hours, while another battleship sank after five days. The first bomb, burning in air, did not burn to the superstructure of major ships within a half-mile 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 equivalent, the results obtained by the USN were vastly different. In the test of the ABT 500, it was certain that when ships were put into the test and these were not set on fire or set a building of the same size as the bomb, the most effective systems of delayed explosion were not of high order. But the actual bomb threw large masses of highly radioactive material into the water close to the hulls of vessels. These contaminated ships became radioactive sources, and would have burned all living things aboard them with terrible and painful but deadly radiations.

It is too soon to stamp as analysis of all of the implications of the ABT tests. But it is not too soon to print in the necessity for immediate and intensive research into several unique problems posed by the atomic bomb. The peacetime volume of water provides such a problem. It must be given to procedures for protecting not only the ships but also the populations of cities against such radiological effects as were demonstrated in Bikini Lagoon.

Observations during the two tests have established the general type and range of effectiveness of air and nuclear underground weapons both on naval vessels, carry nuclear, including a wide variety of nuclear, chemical, and biological agents and personnel. From these observations and from instrumental data it will now be possible to utilize such sources, not only in military and naval design but also in strategy and tactics, as future events may indicate.

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