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## CHAPTER FIVE: THE SIGNIFICANCE OF THE SUNKEN VESSELS OF OPERATION CROSSROADS

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Ruminating on the nature of nuclear wars after Operation Crossroads, the Joint Chiefs of Staff concluded that with atomic weapons "it is quite possible to depopulate vast areas of the earth's surface, leaving only vestigial remnants of man's material works."<sup>1</sup> Forty-four years after Crossroads, Bikini Atoll stands depopulated. Its people, relocated for the tests, have not permanently resettled Bikini. Efforts to "clean up" Bikini island after a 1968 declaration that it was once again safe for human habitation erased all traces of Operation Crossroads from the surface of the island. Geometrically planted palms and rows of uniform concrete houses for a reestablished Bikinian community brought a new look to the island. Found unsafe for continual habitation in 1978, Bikini was again abandoned, and today hosts a small, transient population of field station support personnel, scientists, and occasional visitors.

Visitors to Bikini seeking to confront the tangible evidence of the world's first nuclear weapons effects tests are therefore disappointed. While the island itself, with all its "reconstruction," is a reflection of nuclear-induced change brought about by the tests, the tall observation towers and concrete foundations erected in 1946 for Operation Crossroads are gone. The only evidence lies beneath the surface of the lagoon, scattered about the rim and inside the now-nearly completely silt-buried crater formed by the Baker test bomb's detonation. The ships of Operation Crossroads, lying where they were sunk by two nuclear blasts, are the last "vestigial" remnants of that time and place. Substantially unchanged, they are the only essentially unmodified museum of the dawn of the era of the atomic bomb--unlike the picked-over, filled-in, and fenced ground zero of the Trinity Site, or the rebuilt Hiroshima and Nagasaki.

The ships assembled at Bikini for Operation Crossroads and sunk in the tests represent 34 years of naval design and development, from the oldest ship, *Arkansas*, built in 1912, to the newest, ARDC-13, which was rushed to completion in March 1946. These vessels, as the tests' planners intended, reflect a range of ship types, construction methods, and hull forms, and in total represent in microcosm many of the elements of a typical naval force, with an aircraft carrier, battleships, cruisers, destroyers, submarines, attack transports, and landing craft. Some of these vessels, such as USS *Anderson*, are the sole surviving intact representatives of specific classes of ships. Many of the ships had long and significant careers, beginning with the Veracruz landings of 1914 and the First World War. Most ships now sunk at Bikini also had significant World War II careers including roles in major engagements and battles--the Bismarck breakout, Pearl Harbor, the Battle of the Coral Sea, Midway, the Aleutians campaign, the Battle of the Solomons, the Battle of the Philippine Sea, and the Battle of Leyte Gulf--and represent some of the better known and significant aspects of the war at sea, such as wolf pack attacks in the submarine war of attrition against Japan, the seaborne line of supply and replenishment, shore bombardment, kamikaze attacks, and the development of the fast carrier task force.

The place of these ships in the history of naval development, their roles in naval history, and their World War II combat records establish their significance only up to the moment they were selected for Operation Crossroads. From that point on, their previous histories become secondary, for the pre-Crossroads significance of the ships is overshadowed by the social, political, and military decisions that brought them to Bikini, and the forces unleashed by the

detonation of two atomic bombs that sent them to the bottom of the atoll's lagoon. Each of these vessels passed over a threshold at the "crossroads" between conventional and nuclear warfare, as did the world that had built and manned them. Regardless of type, age, or career, each vessel that now lies where it was sunk by the Able and Baker test blasts is of equal significance as the only uncompromised material record of the early, formative stages of nuclear weapons design and the development of a nuclear military policy. While the wreck of *Prinz Eugen*, secondarily deposited at Kwajalein as a direct result of the tests is also significant, its value as an artifact of the beginning of the atomic age is less so than the ships in their primary deposition at Bikini; this also follows for the highly contaminated 53 target vessels later scuttled or sunk by conventional weapons in the deep ocean because they were radioactively "too hot to handle."

#### MONUMENTS AND MEMORIALS TO THE DAWN OF THE ATOMIC AGE

The sunken fleet of Operation Crossroads, through its assessment and documentation, now joins other monuments and memorials to the atomic age. There are many such places in the United States and Japan, ranging from the display of mock-up full-scale versions of the "Little Boy" and "Fat Man" atomic bombs to the proud display by the Department of Energy of the Project Sedan crater excavated by nuclear detonation in the Nevada desert. The effort to memorialize and celebrate the impact of the bomb began at the same time the new age dawned. Social historian Paul Boyer has noted, when asked how a people reacts when the entire basis of its existence is fundamentally altered, that usually these changes are more discernable to historians than to those who live through them; however, "the nuclear era was different. It burst upon the world with terrifying suddenness. From the earliest moments, the American people recognized that things would never be the same again."<sup>2</sup>

As early as 1946 two actions were taken to preserve both a site and an artifact of the new

age. On March 5, 1946, Senator Carl Hatch of New Mexico, a staunch supporter of the bomb, introduced a proposal to create an Atomic Bomb National Monument, to be administered by the National Park Service. The memorial, at the Trinity Site in the New Mexico desert near San Antonio, was to include a nearby museum where artifacts of the bomb's development and first test, including the B-29 *Enola Gay*, "from which the first atomic bomb used in warfare was dropped...,"<sup>3</sup> would be displayed. The planned National Monument and museum were never realized; *Enola Gay* was held in reserve for possible use in Operation Crossroads, and the Trinity Site remained in military hands. (It is now included within the White Sands Missile Range.) A stone and bronze monument was erected by the missile range command in 1965 to mark "where the world's first nuclear device was exploded on July 16, 1945." Designated a National Historic Landmark in 1975, the site is open to the public twice each year. In 1990, nearly 6,000 persons visited the site.

Pieces of "Trinitite," the ceramic-like pale green fused sand from ground zero, have been carried off as souvenirs by visitors to the Trinity Site since 1945. Trinitite was fashioned into costume jewelry by "enterprising entrepreneurs" in 1945, and by 1952 concern over the future of the vanishing Trinitite temporarily resurrected National Monument plans, with the National Park Service requesting a 100-lb. box of the fused nuclear slag for retention in its Santa Fe, New Mexico, regional office for a future museum at the Trinity Site.<sup>4</sup> While most of the Trinitite is now gone from Trinity Site, other atomic artifacts were saved. *Enola Gay* was not used for Crossroads because of engine problems and remained in storage until 1949, when it was donated to the Smithsonian Institution. Restoration of the plane began in 1984 and is expected to end in 1994, when *Enola Gay* will be placed on display by the Smithsonian in a facility outside Washington, D.C.<sup>5</sup> *Boek's Car*, the B-29 used to drop an atomic bomb on Nagasaki was preserved after Crossroads and is now on display at the U.S. Air Force Museum at Wright Patterson Air Force Base in Dayton, Ohio.

Other monuments to the beginning of the atomic age do not reflect historical significance or national pride in a technological achievement. The blasted remains of the Industrial Exhibition Hall in Hiroshima, whose twisted metal dome has become a symbol of the destructive power of the atomic bomb, and is now known as the "A-Bomb Dome," is one such site. Termed both a monument "left behind by the bomb," and a memorial to the city demolished by "Little Boy," the dome is the only tangible remnant of August 6, 1945, apart from the physical and emotional scars of the survivors. The preservation of the dome was controversial as Hiroshima was rebuilt. According to journalist Peter Wyden, many survivors and "peace groups wanted it preserved as a reminder of human vulnerability, especially for American visitors to see." Others found it painful, a constant reminder for those who wanted no reminding. It was left to slowly disintegrate without demolition until 1965, when the Hiroshima City Council voted to preserve the ruin. Money was raised over the next two years throughout Japan as a "national act for peace," and in 1967 work to stabilize the dome began.<sup>8</sup> Today the ruins, part of an atomic peace park, are the backdrop of a museum that offers souvenirs of another sort--the charred, twisted relics of life disrupted or ended by the Bomb--watches, shoes, books, a human hand's bones fused to a melted pane of glass, and other personal items interspersed with photographs of its effects on August 6, 1945, and the days, weeks, and years that followed.

Unlike the Trinity Site, *Enola Gay*, *Bock's Car*, or the A-Bomb Dome, the ships at Bikini are neither monuments to technology's impact nor memorials. They are now, in their isolation from the rest of the world, in a depopulated land, simply evocative artifacts, the material record not only of Operation Crossroads, but of the fundamental human behaviors that inspired and brought Crossroads to fruition.

The Able and Baker blasts were more than the world's first nuclear weapons effects tests. They were a statement by the United States on many fronts, a demonstration of U.S. pride in its great and terrible achievement as well as a

striking material example of U.S. power and wealth. Operation Crossroads was the beginning of an American determination to test and refine the bomb, and at the same time make it more commonplace in order to alleviate American fears that the bomb made them more like "potential victims" rather than being "a potential threat to other peoples..."<sup>7</sup> Crossroads partially succeeded at first by falsely alleviating some fears, not only at home but abroad, yet for the first time it demonstrated that the bomb's greater threat lay in radioactive contamination. More importantly, Bikini was part of a swift and complete absorption of the atomic bomb into the new and vastly altered landscape of American defense, in which vigilance, suspicion, and the concept of the best defense being a strong offense, born of Pearl Harbor and confirmed with the development of the bomb, changed not only America's military but foreign and domestic policy--in large measure moves made in response to the perceived threat of global communism.

#### INSURING THE NAVY'S SURVIVAL IN THE AGE OF THE BOMB

The primary purpose of Operation Crossroads was focused more acutely on its value as a demonstration than as a test. At its simplest level, Operation Crossroads, although billed as a joint exercise, was a key aspect of the postwar struggle between advocates of naval and air power--the latter represented by the Army Air Corps--over control of the United States' military power and national defense. Advocates of air power, using the argument that saturation bombing, particularly the fire-bombing raids in Europe and Japan, was capable of winning a war without pitched sea battles or invasions, felt that the atomic bomb had made the concept of naval power--even naval aviation--obsolete. The Navy, meanwhile, was acutely sensitive to such suggestions, remembering, as historian Lloyd Graybar notes, "how the Army Air Service had usurped the headlines for the 1921 bombing test against the ex-German battleship *Ostfriesland* off the Virginia Capes...."<sup>8</sup> The Navy had previously responded to the threat of air power by

incorporating it--as is demonstrated by the development of the aircraft carrier, the Navy's earliest surviving example of which, *Saratoga*, was sent to Bikini in an ironic role. The Navy moved toward Operation Crossroads in an effort to incorporate the atomic bomb into naval warfare by demonstrating "that ships were not excessively vulnerable to atomic attack...." and "Navy carrier aircraft could be just as useful and valuable as Air Force bombers for the delivery of atomic weapons."<sup>9</sup>

As discussed in Chapter One, the initial plans for Operation Crossroads were laid by the Navy, but were preempted by Brig. Gen. B. M. Giles' provocative suggestion on September 14, 1945, to atomic bomb captured Japanese ships. The Navy, already planning a naval test of the bomb, was quick to assent, in hope of taking the lead, but subsequent demands by the Army Air Force that they be included ultimately led to Presidential intervention and the creation of Joint Task Force One, in large measure because of Air Force fears that the Navy would skew the results of the tests to prove that ships could and would survive the bomb. While



*USS Skate* in the aftermath of *Able*, its superstructure crushed, conning tower bent, and "very radio-active." (National Archives)



*USS Skate* makes its triumphant, yet radioactive return to the fleet after *Able*, as seen from *USS Fulton* (AS-11). (U.S. Naval Institute)

efforts were made to promote a public image of mutual cooperation and interservice amity, a major motivating factor behind Operation Crossroads and the actual conduct of the tests, was interservice rivalry and the strong determination of each service that they be preeminent. Ironically, for each branch Crossroads' results were "inconclusive." The Air Force, citing the fact that only nine of the target vessels escaped sinking, damage, or "unacceptable radioactive contamination," found proof of "what it had argued all along; ships were intolerably vulnerable in the atomic age."<sup>10</sup> More significant, however, was the Navy's response to the inconclusive results. The Navy responded, in large part through the press, that the seeming knockout of its ships stressed by the Army Air Force was the result of unmanned and undefended ships anchored in tight formation. The Navy argued that "modern" ships, "properly dispersed, executing evasive maneuvers and utilizing their own defenses, would be far less vulnerable...than, for instance, fixed air bases."<sup>11</sup> Obliquely noted was the fact that the Army Air Force had missed the target ship by "two miles"; the implication was that dispersed, mobile ships could outmatch a plane-dropped bomb.

The Navy found an ideal proponent of its survival in *New York Times* reporter Hanson W. Baldwin, who, in the aftermath of Able, noted that as terrible as the damage seemed, "the results at Bikini must...be qualified." Baldwin also noted the tight spacing of the ships, their crewless state, and claimed that much of the damage "could have been avoided had there been fire-fighting crews and damage control parties aboard."<sup>12</sup> This argument repeatedly resurfaced, even after Baker, despite the prevailing high levels of radiation on the ships; hence, even when the excessively "hot" *Saratoga* sank, the loss of the ship was attributed less to the bomb by Baldwin, who opined "perhaps she might have been saved, had there been a crew aboard. But she died a lonely death...pumps idle and boilers dead..."<sup>13</sup>

Baldwin felt that to meet the bomb and survive, "ships must seek safety in dispersion," with redesigned superstructures to better protect radar and radio antennae--the greatest

operational casualties of Able--and that concrete skins be added to armor hulls against radiation because of the "relative success of concrete structures (buildings in Japan, a floating drydock and a small auxiliary craft at Bikini) in withstanding blast, heat and radiation."<sup>14</sup> After Baker, these recommendations, probably more reflective of the Navy's than Hanson Baldwin's opinions, were modified to include protection from radioactive fallout through wash-down systems and greater underwater protection. Baldwin proposed "a reversion to the turtle-back Monitor-type ship, with thick underwater plates and little exposed superstructures.... Shallow draft vessels were less exposed to shock damage.... Naval designers, therefore, may sacrifice draft for security."<sup>15</sup> The Navy emphasized many of the same points, and in the immediate aftermath of Crossroads spoke repeatedly and yet vaguely of redesigning ships to meet the atomic threat. A proposal for redesigned warships surfaced as early as September 1946, when Vice Adm. E. L. Cochrane, chief of the Bureau of Ships, announced that as a result of Crossroads, superstructures would be redesigned; "the results may be emphatically streamlined topside structures designed to reduce the effect of the enormous wide-area pressures produced by atomic bomb blast."<sup>16</sup> As late as 1958, the Navy, in describing USS *Norfolk* (DL-1) claimed that the ship was "designed as a special category of anti-submarine vessel...and incorporates lessons learned at Bikini in her construction."<sup>17</sup> The Navy won its case "to the extent that public and political pressure" to merge as a secondary partner with the Air Force and Army, or even to cease to exist "somewhat eased," giving the Navy time to develop a nuclear capability at sea.<sup>18</sup>

The harsh lessons of the efforts to decontaminate the target ships at Bikini, Kwajalein, and on the mainland, though not stressed at the time, were in fact proof that the Navy, on the surface, was excessively vulnerable to atomic attack. Even with moderate damage and a crew aboard, the radioactivity could not be washed away, despite design changes such as rounded surfaces, steel decks, and wash-down systems. The only

means of dealing with this threat was either avoidance or the harsh reality that "crews doomed to slow death from exposure to lethal radioactivity are nevertheless able the first few days after exposure to continue normal duties. The seamen of tomorrow must be prepared to accept radioactivity as part of the hazards of their living and be ready to work and fight and save their ship even though they know they are doomed to slow death."<sup>18</sup> With no adequate defense against the bomb at sea (as well as on land), the Navy moved firmly into line with the prevalent theory of defense brought about by the atomic age. When defense was impossible, the best means of defending one's territory was through demonstrating a superior ability to inflict damage, namely through a greater nuclear capability.

#### A DEMONSTRATION OF WEALTH AND POWER

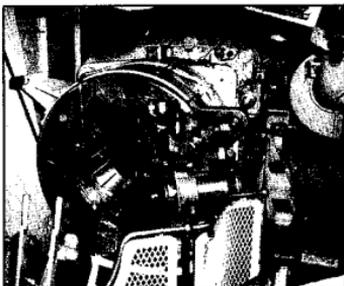
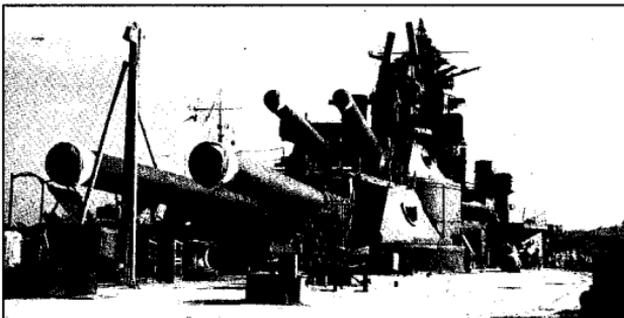
At a similar, but higher level, Crossroads was a demonstration to the world, particularly the Soviet Union, of the United States' wealth and power at a time when the nation, in the aftermath of the war, was assuming the role of the global leader. The Los Alamos National Laboratory's archivist and historian notes that the prevalent attitude of the lab's weapons scientists then, as well as now, was that Crossroads was not a true scientific test. Rather, it was "purely a show."<sup>19</sup> Such a demonstration is critical when a new leader assumes the stage. The demonstration of this fact, given the nuclear apprehension of its own citizens, was of paramount importance to the U.S. government, and as early as April 1946, Admiral Blandy, speaking in a live radio broadcast, stated that Crossroads would "help us to be what the world expects our great, non-aggressive and peace-loving country to be -- the leader of those nations which seek nothing but a just and lasting peace."<sup>21</sup> More bluntly, commentator Raymond Gram Swing noted that Crossroads, "the first of the atomic era war games...is a notice served on the world that we have the power and intend to be heeded."<sup>22</sup> Several factors support this view. The concept of the United States as the richest nation on earth was implicit at Bikini.

Vannevar Bush, writing in 1949, noted that the production of atomic weapons "requires such major expenditures and such major effort that they cannot be afforded at all except by countries that are very strong economically and industrially."<sup>23</sup> Such a nation was the United States, "for we paid the bill" for developing such weapons. By expending two of these extremely expensive and rare weapons at Bikini, the United States was demonstrating its wealth, a fact underscored by the sacrifice of a tremendous fleet of target ships, all in a destructive display that echoed the potlatch ceremonies of Northwest Native Americans who proved their wealth by purposeful destruction of valued and valuable items.<sup>24</sup>

The size of the target fleet at Bikini also underscored the image of a powerful nation, for, as the Crossroads press releases emphasized, this cast-off fleet of target ships represented the world's fourth or fifth largest Navy. The United States, at that time, even if faced with the loss of all its target ships (as indeed was the case) was still the world's greatest naval power, a fact obliquely, and, according to Lloyd Graybar, "disingenuously" mentioned by Admiral Blandy when asked if the tests were "provocative:"

Some people fear that these tests may be construed by other nations as a "martial gesture." But the principal targets are naval ships. Great Britain, the only other country possessing a strong Navy, certainly does not believe that we are planning to use the bomb against her fleet.<sup>25</sup>

The United States also backed up its image as a powerful nation by symbolically emphasizing America as the principal victor in the war. The inclusion of *Prinz Eugen*, *Nagato*, and *Sakawa* as target ships was an echo of the earlier triumphant victory parades of conquering heroes in Republican and Imperial Rome. Particularly indicative of Crossroads as a spectacle were *Nagato* and *Sakawa*, both of which were moored within the so-called "fatal" zone of proximity to the planned detonations. Neither vessel was extensively dived after sinking at Bikini; *Sakawa*, although briefly



Breech and the muzzles of Nagato's 16.1-inch guns, 1946 and muzzles in 1990. The shells from these guns were modified for use in the Pearl Harbor attack. (National Archives and NPS, Larry Murphy)



boarded after Able, was not dived at all and *Nagato* only briefly to assess the causes of its sinking. *Prinz Eugen*, however, was moored well outside the fatal zone, since it was intended that the German warship would survive. Efforts to save the foundering *Sakawa* after Able, balanced against this view, may only be indicative of keeping the ship afloat for its final destruction in the Baker test.

The two Japanese warships reflect not only the United States' particular enmity towards Japan with underlying racial overtones and bitterness over Pearl Harbor and the brutal war that followed, but a symbolic killing of the enemy's ships with the same weapon that had forced his capitulation. *Nagato* especially fulfilled that role as the onetime flagship of the Imperial Japanese Navy and the scene of operational planning for Pearl Harbor. *Nagato's* "capture" as a derelict on Tokyo Bay after the Japanese surrender had symbolized the surrender of the Imperial Japanese Navy. Sinking the Japanese battleship at Bikini ritually "destroyed" that Navy far better than scrapping or bombarding the already bombed and badly damaged battleship with big guns, torpedoes, or 500-lb. bombs--so-called "conventional weapons." Reminiscent of the Aztec practice of caring for and feeding a captured enemy for inevitable sacrifice was the attention given the Japanese ships. The Navy took quick action against five sailors accused of trying to scuttle *Sakawa* while en route to the Marshalls, and at Bikini, the ships were carefully tended with support vessels alongside since "there was some danger that the captured Japanese ships...might actually sink...if they were left unattended..."<sup>28</sup> The impact of the two ships' loss would be less, if not non-existent, if allowed to simply founder --it was essential that they be "killed." *Nagato*, badly damaged during Baker, was only then left to slowly die, with no attempt made to save the ship over a four-and-a-half day period while the equally radioactive *Hughes* and *Fallon* were beached. There was no moving eulogy for the once mighty warship, simply a notation that the "Jap" BB had disappeared during the night after listing and settling in the water throughout the day. *Nagato's* fate in particular reinforced the concept of America's superiority through atomic power.

## CROSSROADS AS SPECTACLE AND DEMONSTRATION

Crossroads as a spectacle and demonstration is also underscored by the massive publicity and the presence of foreign observers at the tests. Operation Crossroads was heavily publicized, with Joint Task Force One providing special facilities aboard USS *Appalachian* (AGC-1), which became the "press headquarters ship," and the preparation of more than a hundred detailed and lengthy press releases, as well as "open" press conferences during the planning, execution, and aftermath of the tests. Additionally,

to help those correspondents who were starting off "cold," Captain Lee (Crossroads public information officer) arranged, besides press conferences, various orienting schemes. Lectures were arranged; motion picture films were prepared and shown; press packets of pamphlets...were prepared and distributed. No effort was spared in making this the *best*-reported as well as being the *most*-reported technical experiment of all time [original emphasis].<sup>27</sup>

In all, 114 U.S. radio, newspaper, magazine, and news service reporters attended the Able test at Bikini, with 75 attending Baker, while 10 foreign reporters attended Able and eight attended Baker. Able's detonation was even broadcast "live" around the world. Hundreds of articles and features dominated the nation's newspapers, newsmagazines, and newsreels, while two books were published highlighting the non-classified story and images of the "bombs at Bikini." As seen earlier, this not only paid off for the Navy but also provided the U.S. with a world stage for its demonstration of the bomb's effects. Bikini as a world stage for the United States is also reflected by the invitation to foreign observers. Each country having membership in the United Nations Atomic Energy Commission was allowed to send two representatives to Bikini; ten nations accepted, sending 21 observers. Particular attention was paid in the press to the Soviet observers, as was doubtless the case

by the Crossroads staff. While the reason for the invitation to the observers was the stated intent of allaying foreign "suspicion and disapproval of the planned experimental use of the world's most terrible war weapon" because "the atomic bomb is an international concern," another, underlying motivating factor was the demonstration of power the tests represented.<sup>28</sup> The "target" of this demonstration was the Soviet Union, then the U.S.'s primary opponent for global domination.

The tremendous investment the United States had in Operation Crossroads is also reflected by the American attitude that the tests were indicative of a national achievement of tremendous significance and reflective of a uniquely democratic society. As Vannevar Bush noted three years after Crossroads, the U.S. at that time, while expecting that a potential enemy could in time develop the bomb, felt that the time when "two prospective belligerents [would be] frowning at each other over two great piles of atomic bombs" was far off. Reflecting on an unnamed but nonetheless explicit enemy, Bush stated:

The time estimate depends, of course, on how fully we think our adversaries may put their backs into the effort, how much they are willing, or able, to reduce their standard of living in order to accomplish it. They lack men of special skills, plants adapted to making special products, and possibly materials...they lack the resourcefulness of free men, and regimentation is ill-adapted to unconventional efforts. On the other hand, their tight dictatorship can order effort, no matter how much it hurts.<sup>29</sup>

Thus the atomic bomb was perceived more as a product of American democracy than as a product of American intellect, particularly given the large contribution of European scientists to the birth of the concept and the production of results. Colleagues of these great minds who had remained in occupied Europe had failed to succeed where their relocated, newly American compatriots had triumphed. American pride eventually conspired to recast history it

seemed, so that, in the opinion of some foreign observers

even official American publications dealing with the history of the production of the atomic bomb, the British considered, minimized the contributions of British, French, and Canadian scientists. It seems typical of this attitude that in the official American film of the Bikini test the voice of the British scientist Ernest Titterton on the loud-speaker system, counting the seconds that elapsed before the explosion, was cut out and replaced by a voice with an American accent.<sup>30</sup>

The McMahon Act of 1946 excluded foreign participation in further U.S. A-Bomb work. However, Crossroads required the use of many of the British and Canadian scientists from Los Alamos who had worked to develop the bomb. At Bikini, more or less "under the table," their vital participation had to be discounted. Hence the "voice over" Titterton's count down was actually a product of this new law.

The production of the bomb had been accomplished with cooperation and mutual sharing between the United States, Britain, Canada, and to some extent other European countries, during the Manhattan Project. Now, with Operation Crossroads, the stakes of the game were different, and the tests underscored the fact that the United States, which alone had the bomb and the facilities to make it, was the absolute power, even to the point of emphasizing in as many ways as possible that nuclear weapons and tests of them were American. American pride in the bomb, and the tests, was also indicated by the preparation of special certificates for Crossroads participants, similar to those issued for graduations, promotions, awards, and rites of initiation and passage, such as those given to people who "crossed the line" at the equator for the first time.

Finally, the emphasis of the tests as a key demonstration of U.S. power and global leadership was even evinced from those critical of Operation Crossroads. Senator Scott Lucas

of Illinois, one of a handful of Congressional opponents of Crossroads, pointedly asked, "If we are making plans to outlaw the use of the atomic bomb for military purposes, why should we be making plans to display atomic power as an instrument of destruction?"<sup>31</sup> Harsher words were spoken by the Rev. A. Powell Davies of Washington, D.C., a Unitarian pastor, who "thundered" from his pulpit that the widely-reprinted picture of Admirals Blandy and Lowry, cutting a mushroom-cloud-shaped cake with Mrs. Blandy to celebrate the successful dissolution of Joint Task Force One was "utterly loathsome":

Try to imagine yourself for a moment a continental European, wondering, brooding, asking yourself a hundred times a day, will America lead us? Then imagine yourself being shown this picture. If I had the authority of a priest of the Middle Ages, I would call down the wrath of God upon such an obscenity. I would damn to hell...these traitors to humanity who could participate in such a monstrous betrayal of everything for which the brokenhearted of the world are waiting.<sup>32</sup>



*Admiral and Mrs. W. H. P. Blandy and Rear Admiral F. J. Lowry celebrate the end of Operation Crossroads and the dissolution of Joint task Force One at Washington, D.C., in November 1946. The angel food cake drew criticism. (Pictorial Histories)*

## LEARNING TO LIVE WITH THE BOMB

Operation Crossroads also was intended to demonstrate U.S. power and the ability to come to terms with the bomb for the citizens of the United States. The basic domestic message of Operation Crossroads was planning for and supporting national defense. The fear, immediately voiced by many Americans, that the bomb would in time be used against the United States, most probably in an unannounced, "sneak attack," required an answer from the military and political leaders of America. Crossroads was the first vehicle for that answer. Admiral Blandy, speaking on the larger issue of why Crossroads would proceed, stated that "the tests stand out clearly as a defensive measure," stressing the operation would determine the how and why of naval survival in the atomic age. "By no stretch of the imagination can such steps of caution and economy be taken as a threat of aggression. If, because of such a false assumption, we failed to carry out these experiments, to learn the lessons which they can teach us," said Blandy, military planners and weapons designers "would be groping their way along a dark road which might well lead to another and worse Pearl Harbor."<sup>33</sup> The fear of a worse Pearl Harbor was, however, not alleviated by Crossroads, but magnified.

In the aftermath of Able and Baker, the government was placed in the difficult position of stressing the potent power of its new weapon to strengthen its global leadership role while at the same time attempting to soothe popular fears. Thus public statements from Joint Task Force One emphasized the terrible effect of the bombs while knocking down the straw man of imagined wide-scale death and destruction as a result of the tests. Admiral Blandy on numerous occasions repeated the fact that some "wags" had stated after Able that Bikini should be renamed "Nothing Atoll," or "No Atoll Atoll." An attitude of business as usual was stressed at Bikini, too. On at least one target vessel, USS *Pensacola*, the ship's painted battle record was augmented with a mushroom cloud and the word "Able," in a place on the record previously reserved for narrow escapes with death, such as kamikaze

attacks. Yet the classified, more sophisticated analysis of Able and Baker, never released to the public, showed far worse results. Assessing "combat readiness," the Bureau of Ships group found many of the "surviving" vessels would be virtually dead in the water, their boilers, radar, radio, and equipment out of commission, and their crews dead or dying from radiation.

The fears of atomic scientists that the bomb's deservedly terrible image would be lessened was also widely reported. William L. Laurence, the "dean of atomic reporters" who had covered the Manhattan Project, Trinity, and the atomic bombing of Japan before going on to report Operation Crossroads, was highly sympathetic to the government's view of the new atomic age since he was the only media representative privileged with an inside view of the top-secret Manhattan Project prior to Hiroshima. A confidante of many of the "fathers" of the bomb and responsible for molding many of the initial public statements about the atomic bomb, Laurence viewed it as the beginning of a new age of hope, perhaps more so than fear. Critical of what he termed an "unreasonable fear" of radiation, Laurence also either overtly participated in knocking down the straw man or firmly believed Navy assertions, noting in a famous dispatch that

Before Bikini the world stood in awe of this new cosmic force.... Since Bikini this feeling of awe has largely evaporated and has been supplanted by a sense of relief unrelated to the grim reality of the situation. Having lived with the nightmare for nearly a year, the average citizen is now only too glad to grasp at the flimsiest means that would enable him to regain his peace of mind. He had expected one bomb to sink the entire Bikini fleet.... He had even been told that everyone participating in the test would die. When none of these things happened, he is only too eager to conclude that the atomic bomb is, after all, just another weapon.<sup>34</sup>

The emphasis to alleviate fear did produce some results. A few foreign observers ridiculed the bomb; Soviet press accounts

"minimized the results," while "an Argentine radio announcer said he would broadcast the sound of the explosion" of Able, and "then gave a ludicrous peep."<sup>336</sup> Public fears, bolstered by the clever manipulation of the straw man by Joint Task Force One, declined, though the major reason for less American concern, at least for a while, was because of what Norman Cousins termed the "standardization of catastrophe" since "after four bombs, the mystery dissolves into a pattern." Paul Boyer notes this was because "there are distinct limits on people's capacity to sustain interest in any issue--even atomic war."<sup>338</sup> Thus, Boyer notes, the "short-term effect" of the tests "was to dampen fears of the atomic bomb.... For government spokesmen and others seeking to mute "excessive" and "hysterical" atomic bomb fears...the apparent "failure" of the Bikini test was a godsend."<sup>337</sup>

#### THE REALITY OF THE BOMB: RADIOACTIVE FEARS

Yet Operation Crossroads did inspire fear, for "relief was not the only reaction...for Bikini became a sort of ideological battleground, as its symbolism was appropriated for different polemical purposes."<sup>338</sup> The issue that ultimately induced fear, even among the military, and which in time reached the public, was not the destructive power of atomic blasts, but of the radiation that followed. The day after Baker, *The New York Times* editorial noted that the test had introduced a new factor in nuclear war--"the huge mass of radioactive water which may fall on a ship."<sup>339</sup> Efforts to keep the true lesson of Crossroads--the virtual destruction of the target fleet by radioactive contamination--failed as the news slowly leaked out, for the Navy could not keep the fate of so



*Surviving the Bomb. A sailor paints a mushroom cloud for Able on *Pensacola's* battle record. (National Archives)*

many capitol ships and lesser vessels out of the public eye, even at far off Kwajalein. As David Bradley noted upon his departure from the ghost fleet of contaminated ships at Kwajalein, leaving the ships behind provided only the "illusion of escape."<sup>40</sup> The accounting of ships "lost" to contamination, first alluded to in Crossroads releases in September 1946, fed a growing fear of radioactivity that was confirmed by color photographs of atom-blasted internal organs and blood-swollen brains of irradiated test animals published in *Life* magazine in August 1947. The selection of goats and pigs for test exposure because of their internal similarities to humans reinforced the grim, if not devastating impact of the photos--these could be the radiation-destroyed remains of people. Boyer has stated, "it was Bikini, rather than Hiroshima and Nagasaki, that first brought the issue of radioactivity compellingly to the nation's consciousness."<sup>41</sup> The 1948 publication of David Bradley's *No Place to Hide* and its grim message that the real story "was not the spectacle but the aftermath," and the 1949 publication of an article by Drew Pearson that added up the various press releases about the sinking of contaminated ships and reported that the sinking of 61 radioactive vessels constituted a "major naval disaster" focused more public attention on the Crossroads radiation problem.<sup>42</sup> One government response to the news was an attempt to focus radiation fears only on bombs detonated in or on the water--1950 Civil Defense handbooks discussed at length the effects of an atomic attack on a harbor, which presumably only then would release a "radioactive mist." Left unemphasized were the ionizing effects of neutron radiation from an air burst, or the possibility of lingering radiation in such a circumstance.

P. M. S. Blackett, writing in 1948 in an attempt to alleviate the "nuclear neurosis," drove home the point that the government was stressing, namely that

at Hiroshima and Nagasaki, where the bombs were exploded well up in the air, it has been stated that very little radioactivity remained.... On the other hand, after the underwater test



*Independence* at San Francisco in January 1951, ready for sinking as a target off the Farallones after three years of radiological testing and use as a training ship for radiation monitoring and decontamination. The hulk was recently discovered in 3,000 feet of water. (San Francisco Maritime National Historical Park)

explosion at Bikini, intense radioactivity remained for several months in the water and on the ships which had been deluged with active water, and would have killed all living things remaining there for any length of time.<sup>43</sup>

This message muted the fact that the deadly radioactivity remained for more than several months, leading to the sinking of nearly every target ship within a four-year period after the tests, and no mention was made, nor was the danger fully apprehended of the initial burst of radioactivity during a detonation and its effects.

In the end, Crossroads had a tremendous impact, in its time, in refocusing nuclear apprehension from the blast effect to the real, more potent danger of the radioactive "toxins" left by the bomb. The significance of this lesson has been forgotten, however, in the era of the subsequent development of the hydrogen bomb, which introduced not only the capacity to vaporize fleets and devastate vast regions, but destroy nations and dust the globe with highly radioactive fallout. In an age of megatonnage, the pre-1954 "simpler" age of

kilotonnage has faded from memory with the exception of "key" dates, such as the Trinity explosion, or the wartime use of the bomb. As Lloyd Graybar notes, Operation Crossroads is now obscure, its role in the nuclear arms race for the most part forgotten, scarcely cited in standard histories of the bomb or of the Cold War, and its role in accelerating the Cold War still the topic of debate.

Bikini Atoll is better remembered for the Bravo test shot of 1954 that ushered in the new, more terrible era of the H-Bomb, and for the French-named bathing suit that characterized both the sexual imagery of the

bomb and an attempt to find some element of humanity in a weapon that aroused another primal instinct—the fear of racial annihilation. The linkage is more than symbolic, for the response to the threat of extinction is increased efforts to reproduce.

For a few, Bikini and Operation Crossroads represented a crossroads in their own lives—particularly for the now exiled Bikinians, the "nuclear nomads" of the Pacific, and surviving Crossroads veterans, some of whom are battling crippling and fatal diseases traced to their exposure to the contaminated ships and the fallout of Able and Baker.



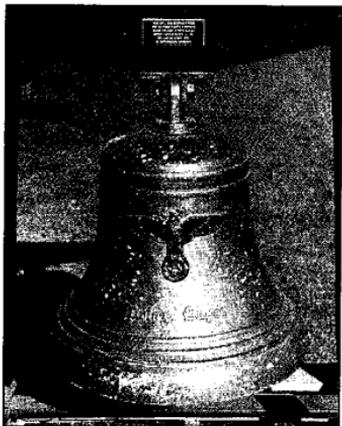
Certificate issued to the 42,000 participants in Operation Crossroads. (National Archives)

## CROSSROADS AT THE BOTTOM OF THE SEA

The sunken ships of Operation Crossroads, now brought out of obscurity by their archeological assessment, not only join the sites, memorials, monuments, and places that commemorate the dawn of the atomic age, but also provide the material means to explore the motivating factors and results of the Able and Baker tests. What do the ships represent? At one level, they embody the first human attempts to grapple with the bomb, at first by confronting it, as represented at one stage by the "can-do" attitude of the crew of the battered, radioactive USS *Skate*, who boarded their beached sub, pumped it out, ran up the flag on a bent periscope, fired up the diesels, backed off the reef, and anchored with the fleet as a "live ship."<sup>44</sup> At a later stage, the ships represent in a very real sense, in their most compelling role, the ultimate dilemma, when the problem of contamination and hence "living with the bomb" was found insurmountable and the option taken was the "illusion of escape"--leaving them at Bikini as wrecks, or taking them to Kwajalein to rust and eventually be sunk out of sight and out of mind.

The ships are also artifacts of the key factors motivating Crossroads, represented in part by the selective stripping of the vessels. The spectacle of destruction, a demonstration of wealth and power, had to be reconciled with thrifty American public opinion despite the intention of the message to foreign audiences. Thus an emphasis was placed upon "obsolete" ships, scrap costs vs. replacement costs, and the removal of certain "valuable" objects and equipment from the target ships. Archeological examination of the target ships at Bikini shows selective stripping of some weapons, but not all, such as two of *Saratoga's* 5-inch gun houses, and the retention of many of the 40mm, 20mm, and single 5-inch guns and gun directors, as well as the removal of Pelorus from their stands on the exposed areas of the bridge and the removal of only the clocks from target aircraft.

The periscopes of *Apogon* and *Pilotfish* were removed along with *Pilotfish's* target-bearing



*Prinz Eugen's* bell, removed prior to Crossroads, like those of the other targets. For most of these vessels, the bells are the major tangible reminder of the ships. (NPS, Candace Clifford)

transmitters. Yet *Apogon's* TBT was left behind. Clearly the stripping was insufficient, if not token, as demonstrated by the retention of many valuable items, and the subsequent problems with the pilfering of medical supplies, linen, and food from the target ships during Operation Crossroads by the crews of lesser-supplied support ships. The argument that the ships were not intended to be lost must be balanced with the fact that a special emphasis was placed on the removal of all ceremonial, ornamental, and "historically significant" artifacts from the ships, such as commemorative plaques and bells.

The presence of the Japanese ships is material proof--along with the ships' mooring in the fatal zone, and the undocumented sinking of the scarcely assessed *Nagato*--of the significant symbolic role of the battleship. *Nagato* alone stands apart from the other ships as being a vessel whose pre-Crossroads history establishes its Crossroads significance. *Nagato*, like

*Sakawa*, was brought to Bikini to die under the fatal blow of the atomic bomb.

The large number of test gauges and other instruments observed on *Saratoga* are indicative of two human phenomena. The first is the adaptation of technology to comprehend the incomprehensible—namely measuring the force and actions of an atomic blast. The instruments, as sophisticated as the inclinometer gauges that still rest on *Saratoga*'s bridge, and as simple as tin cans and the ruptured foil peak pressure gauges on the ubiquitous "Christmas trees" and the indentation pressure gauges that litter the flight deck and aftermost 5-inch gun mount on the carrier, are compelling micro-artifacts of humanity's attempts to grapple with the bomb, just as the ships themselves are the larger, macro-artifacts. The second phenomenon is the abandonment of the gauges, reflective of the radionuclide contamination of the ships and the water which brought about the decision to abandon the

project, leave the wrecks, and sink the contaminated ships left afloat.

### CONFRONTING THE ATOMIC AGE

In viewing and visiting the wrecks of Operation Crossroads, and trying to prognosticate a probable future for them, a few thoughts come to mind. People have an attraction to horror, and a human need, at least for some, to confront their fears. Bikini offers the opportunity to face the ultimate horror of our society--nuclear destruction--at a time when the unleashed atom was sufficiently powerful to rend steel, vaporize water, and sink capital ships. At the same time, the power was not so great as to leave no trace at all but a dark blue, deep crater in the atoll, as was the case with Bravo's hydrogen burst in 1954. The ships provide a human scale of reference, a checkpoint from which to begin to comprehend, at its now minor scale, what Able and Baker's



*No souvenirs is the order of the day as journalists inspect burned test materials on the foredeck of Pensacola. (National Archives)*

progeny can reap. The power of these "small" bombs to sink and maim a ship are represented in the mangled, "stomped flat" *Gilliam*, the twisted, half-smashed *Arkansas*, the split bottom, toppled stack, and dented flight deck of *Saratoga*, and the abandoned, irradiated, capsized hulk of *Prinz Eugen*.

The significance of the bomb and what it had done was not lost on contemporary observers and participants, and is materially represented by the taking of souvenirs from the ships after each test. Thus painted signs that command visitors to take "No Souvenirs" occasionally appear in the photographs of scorched and mangled ships. Reflective of the pilfering of the radioactive Trinitite, the collection of souvenirs from Bikini was done without apparent concern over the possible risk. David Bradley reports that one man "collected a chunk of metal from the ship considered to have been nearest to the blast" after Able. "He had it stowed away in a locker beside the bed. Then one day somebody was checking a geiger counter in the vicinity and began to pick up a strong emission. At once he tracked down and located the loot and showed its anxious owner that he'd been sleeping in a shower of gamma rays."<sup>45</sup> Reports of looting artifacts from the ships, notably running lights from *Saratoga* in recent years reflect the compulsion for souvenirs from this atomic graveyard, as does the removal of shells and wave-washed dead coral by visitors to the Bikini field station, including the archeological assessment team and the media representatives there at the same time.

Yet the implications and reality of the bombs at Bikini is too much for some people. While some confront their fears, others deny them. This is found in the need by some to focus on the non-nuclear history of the ships, a phenomena that began before and during the tests as war records and the symbolic value of "great" and famous ships were touted. *Saratoga* is perhaps most reflective of this, for it was the most eulogized of Crossroads' victims. It can be argued that *Saratoga* at Bikini was to a great extent not the same ship commissioned in 1927, nor the ship that had fought pitched battles at sea during the war. To be those

things, the ship would have to have sunk during those times and in those roles. Changed and modified for Crossroads, the carrier was reflective of a new reality and a new role.

Oceanographer Willard Bascom, working at Bikini during the various nuclear tests of the early 1950s, wrote in his memoirs of how he and others sought to dive *Saratoga*, "famous for its exploits in World War II." This telling comment demonstrates the human preoccupation with the "great," or as Bascom termed the carrier, the "wonderful." The need to dive the ship was to see *Saratoga*, not to assess what the bomb had done, and in this Bascom was and is no different from anyone else who has ever dived at Bikini, including the National Park Service team, as well as those who have focused submerged archeological efforts on famous ships like *Monitor* or *Titanic*. We too at times succumb to the historical aura of a famous ship. The need to confront and touch the ship was powerful for Bascom and his colleagues; "Most important, we walked, or at least touched down, on the flight deck, stirring up wisps of dust." The images that the ship evoked were not of Crossroads or of the bomb. Rather,

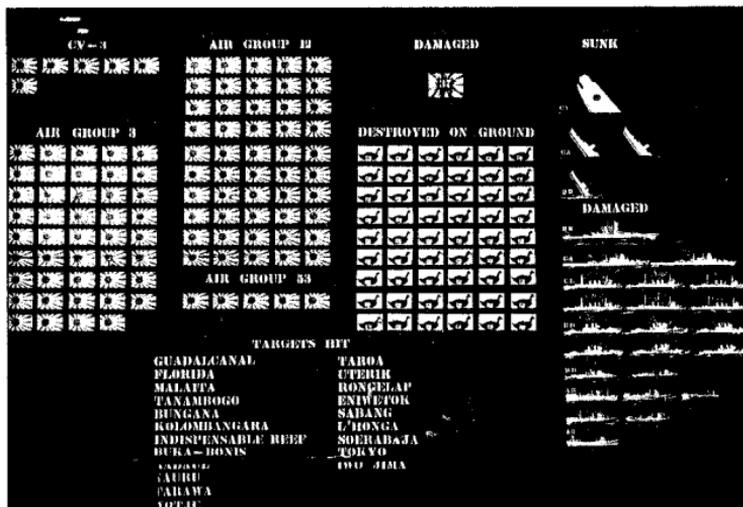
Back aboard our LCM the four divers were unusually pensive, our minds still communicating with the spirits of the *Saratoga's* long-gone pilots and crew. Having visited their old haunts, our minds reconstructed the ship as it had been in its glory days. We could see the uniformed figures on the rail of the bridge and A-5s on the deck, as the ghost ship streamed through the fourth dimension, running into the wind like the Flying Dutchman to launch phantom aircraft.<sup>46</sup>

The need to deny the bomb's impact on the ships, and by extension into our lives, is also reflected by the reaction of some of USS *Arkansas'* crew. The 26,100-ton battleship, popularly but incorrectly thought to have been lifted up, end on end, in the Baker blast column, was nonetheless battered, smashed half flat, and capsized to lie bottom-up in 180 feet

of water. Viewing color slides and video of the wreck, some of *Arkansas'* crew at the 4th annual reunion in 1990 questioned the ship's identity, one man mistakenly stating that he had seen previous footage of the battleship upright, its guns pointing forward in their turrets. Another wrote that he was "amazed and spellbound," because "somehow, I had always imagined that our Grand Old Lady...was sitting upright on the bottom of the ocean floor still looking as gallant as she did the day I last went ashore in 1946."<sup>47</sup>

The future of the ships at Operation Crossroads might be more secure if advertised as a collection of great and famous ships of World War II and a museum of wartime ship types. Yet tourism of the site may hinge more in the long run on its role as monument to the dawn of the atomic age and as a museum of material remains of the attitudes, thoughts, and actions of that time. The human need to

confront the past, even its unpleasant aspects, is ingrained in our culture, as shown by tourism of battlegrounds and other "sacred" sites sanctified by great loss of life in war or visiting scenes of disaster, such as the Johnstown, Pennsylvania, flood, now a unit in the National Park System. The tourists at Pearl Harbor, Custer Battlefield, Johnstown, Dachau, and Hiroshima confront their human mortality and perhaps reaffirm their joy in personal survival. Bikini, without loss of life, faces a difficult challenge in that people might have difficulty in making that same association. Yet the spectre of the extinction of all life clings only to nuclear weapons sites. As a member of the first generation to live completely under the nuclear sword of Damocles that was slung at Trinity, Hiroshima, Nagasaki, and Bikini, the ships at Crossroads, more so than any other site or battlefield, gave me the first true opportunity to assess my mortality, as well as the world's.



Battle record painted on *Saratoga's* island, 1945. (Joe Fetherson)

## NOTES

- 1 "The Evaluation of the Atomic Bomb as a Military Weapon: The Final Report of the Joint Chiefs of Staff Evaluation Board for Operation Crossroads," (June 30, 1947), CCS 471.6, 10-15-46, Section 9, Part 1, p. 60. National Archives Record Group 218.
- 2 Boyer, *By the Bomb's Early Light*, p. 4.
- 3 "Atomic Bomb National Monument, Proposed," S.2054, 79th Cong., 2d Sess., March 5, 1946.
- 4 "First A-Bomb Blast Site to be National Monument," *Washington Daily News*, April 3, 1952. The National Park Service's Chief of its Museum Division urged collection of Trinity Site artifacts and "material evidence of the bomb explosion" on March 15, 1946. On October 7, 1947, the Service's Chief Historian urged the same after a tour of the site, including saving the rapidly dispersing "atomite" in the blast crater. The Director of the NPS wrote to the Atomic Energy Commission on January 7, 1952, requesting the 100-lbs. of Trinityite. This correspondence is on file in the Trinity Site National Historic Landmark (NHL) file, Division of History, National Park Service, Washington, D.C.
- 5 "Enola Gay Resurrected: Craftsmen Restore First Atom Bomber," *Washington Times*, April 28, 1989, p. B6. Also see the *Bock's Car* National Historic Landmark (NHL) file, Division of History, National Park Service, Washington, D.C.
- 6 Peter Wyden, *Day One: Before Hiroshima and After* (New York: Simon and Schuster, 1984), pp. 342-343.
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- 8 Lloyd J. Graybar, "Bikini Revisited," *Military Affairs* (October 1980), p. 118. Ironically, the wreck of *Oostfriesland*, recently located by sport divers, is now also the subject of investigation.
- 9 Vincent Davis, *Postwar Defense Policy and the U.S. Navy, 1943-1946*. (Chapel Hill: The University of North Carolina Press, 1966), p. 243.
- 10 *Ibid.*, p. 246.
- 11 *Ibid.*
- 12 Hanson W. Baldwin, "Atom Bomb is Proved Most Terrible Weapon: Surveys in Japan and Bikini Test Are Enough to Change Concepts of War," *The New York Times*, July 7, 1946.
- 13 Hanson W. Baldwin, dispatch of 22:02 to *The New York Times*, July 25, 1946, on board USS *Appalachian*. Press dispatches, July 25, 1946, from nos. 2543 to 2644, National Archives Record Group 374, Records of the Defense Atomic Support Agency, National Archives.
- 14 Baldwin, "Atom Bomb is Proved Most Terrible Weapon," *The New York Times*, July 7, 1946.
- 15 Hanson W. Baldwin, "Lessons Learned in Bikini Tests," *The New York Times*, August 1, 1946.
- 16 "Guided Missile Warships on Way for Redesigned Atomic-Age Navy," *The New York Times*, September 8, 1946.
- 17 *Jane's Fighting Ships, 1958-1959*, (1958), p. 366. USS *Norfolk* was the first of the Destroyer Leaders, later reclassified as frigates. The ship featured rounded gun mounts and steel decks for passive defense against fallout. "Far too expensive to duplicate," *Norfolk* spent most her career as an experimental prototype." See *Destroyers*, pp. 258-259. Friedman, interestingly, does not mention Bikini-induced changes to warships in his book *The Postwar Naval Revolution* (Annapolis: Naval Institute Press, 1986), citing only tactical and strategic changes as the result of the development of the atomic bomb—for example the dispersion at sea of carrier task groups (see p. 51).
- 18 Davis, *Postwar Defense Policy*, p. 246. Also see Graybar, "Bikini Revisited," p. 121.
- 19 Baldwin, "Lessons Learned in Bikini Tests," *The New York Times*, August 1, 1946.
- 20 Interview with Roger Meade, LANL, Los Alamos, New Mexico, December 19, 1990.
- 21 Address by Vice Admiral W. H. P. Blandy, U.S.N., Commander Joint Task Force One, on New York Herald-Tribune Youth Forum, over Columbia Broadcasting System, Waldorf-Astoria Hotel, New York City, April 13, 1946. "Why Test the Atom Bomb?" Joint Army-Navy Task Force One, Crossroads Release No. 36, Department of Energy Archives, Las Vegas, document #101008. Hereafter cited as Blandy, "Why Test the Atom Bomb?"
- 22 As cited in Boyer, *By the Bomb's Early Light*, p. 83.
- 23 Vannevar Bush, *Modern Arms and Free Men: A Discussion of the Role of Science in Preserving Democracy* (New York: Simon and Schuster), p. 92.
- 24 All of this had to be rectified with postwar budget cuts, swords-to-plowshares ideology, and a thrifty American taxpayer. See the discussion of this concept at the end of the chapter.

- 25 "Statement of Vice Admiral Blandy, U.S.N., Commander Joint Army-Navy Task Force Number One on Purposes of Atomic Bomb Tests," Joint Army-Navy Task Force Number One, Crossroads Release No. 37, Department of Energy Archives, Las Vegas, Document No. 101007.
- 26 "Cruiser Sabotage Alleged," *The New York Times*, May 8, 1946, and Shureliff, *Bombs at Bikini*, p. 52.
- 27 *Ibid.*, pp. 36-38, *passim*.
- 28 "Bikini Observers," *The New York Times*, May 9, 1946.
- 29 Bush, *Modern Arms and Free Men*, pp. 93-94.
- 30 Robert Jungk, *Brighter Than a Thousand Suns: A Personal History of the Atomic Scientists* (New York: Harcourt, Brace and Co., 1956), p. 251.
- 31 Graybar, "Bikini Revisited," p. 120.
- 32 "Atomic Age Angel Food," *Time Magazine*, November 18, 1946, p. 31.
- 33 Blandy, "Why Test the Atom Bomb?"
- 34 William L. Laurence, "Bikini 'Dud' Decried for Lifting Fears," *The New York Times*, August 4, 1946. Laurence's seminal and sympathetic role in introducing the bomb is discussed in Spencer R. Weart, *Nuclear Fear: A History of Images* (Cambridge: Harvard University Press, 1988), pp. 98-102, *passim*.
- 35 Weart, *Nuclear Fear*, p. 109.
- 36 Norman Cousins, "The Standardization of Catastrophe," *Saturday Review of Literature*, August 10, 1946, p. 10, as cited in Boyer, *By the Bomb's Early Light*, p. 293.
- 37 Boyer, *By the Bomb's Early Light*, p. 84.
- 38 *Ibid.*
- 39 "The Underwater Test," *The New York Times*, July 26, 1946.
- 40 Bradley, *No Place To Hide*, p. 166.
- 41 Boyer, *By the Bomb's Early Light*, p. 90.
- 42 Drew Pearson, "Bikini Losses Naval Disaster," *Washington Post*, February 18, 1949.
- 43 P. M. S. Blackett, *Fear, War, and the Bomb: Military and Political Consequences of Atomic Energy* (New York: McGraw-Hill Book Co., Inc., 1949), p. 71.
- 44 Bradley, *No Place to Hide*, pp. 66-69, *passim*.
- 45 *Ibid.*, p. 70.
- 46 Willard Bascom, *The Crest of the Wave: Adventures in Oceanography* (New York: Harper & Row, 1988), p. 169.
- 47 Roy L. Alton, President, USS *Arkansas* (BB-33) Association, to James P. Delgado, June 4, 1990. Letter in the author's files.