



## Archaeological Survey of the Ex-USS *Independence* (CVL22)

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### Abstract

In August 2016, a multidisciplinary team conducted the first archaeological survey of the deep-water (829 m) wreck of the ex-USS *Independence* (CVL22) using the remotely operated vehicles *Argus* and *Hercules*. The survey provided 34 h of direct observation with video and still camera documentation of the wreck, which the previous year had been initially identified with a limited three-dimensional sonar survey of the site. The 2016 assessment added considerably to an understanding of changes to *Independence* after its use as a target vessel for the 1946 atomic bomb tests at Bikini Atoll, as a radiological laboratory, training facility, and finally as a receptacle for “nuclear waste” prior to its scuttling off California in January 1951. The location and detailed examination of the wreck, along with additional archival research, offers a more nuanced definition of the carrier’s role within the context of the Cold War between the USSR, its adversaries and the race to establish nuclear supremacy, as well as site formation processes and ongoing biological colonization of the wreck site. As well, no evidence of residual radiological contamination was noted during the mission.

**Keywords** World War II · Shipwreck · Operation Crossroads · Cold War · Aircraft carrier

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## Introduction

A shipwreck is commonly viewed as a time capsule, preserving the moment in history at which it sank, including the movement of materials over seaborne routes, the belongings and actions of the sailors, and the conditions that led to the ship's sinking. In the case of maritime battlefields and approaches to harbors, groups of shipwrecks reflect the human actions and events that played out on a featureless sea surface, now represented by the remains on the seabed below. The maritime cultural landscape, therefore, can reflect single moments in time over which a battle took place, or span generations and in some cases millennia as ongoing maritime activity writes itself across the seabed through the discard and accidental loss of ships and other material.

The aftermath of World War II saw a different type of maritime cultural landscape develop as ships from the war were returned to home waters for evaluation and then disposed of offshore, in many cases due to radiation contamination and damage from the Operation Crossroads Bikini Atoll nuclear tests. These warships that survived the war and were sunk off California represent the war's South Pacific battlefields as they had an impact on those landscapes, but without their physical presence represented on the seabed. Today they are part of a broader maritime cultural landscape that took place across the surface of the Pacific, but were uprooted from those areas of significance and redeposited in US waters. Many maritime battlefields are thought of as ship graveyards, but these are more like a cemetery in the literal sense as they were chosen to be sunk as a ritual send-off given their histories and "buried," so to speak, away from their area of life and battle.

Ex-USS *Independence* (CVL-22) is one of the best examples of a shipwreck where the site is not reflective of its area of impact on the historical landscape, but it remains an important wreck in the physical sense, as it exhibits damage from its life, its sinking, and the history of the shipwreck since the time of its sinking to the present day. Over the course of its service, *Independence* had a significant impact on the World War II South Pacific landscape, especially in the naval battles off the Philippines at Leyte Gulf, off Samar, and in the Sibuyan Sea, where planes from *Independence* helped sink the Japanese battleship *Musashi* in October 1944. The locations of and physical remains connected to *Independence* from air battles and sunken aircraft's presence across this landscape is likely unknowable, but extensive. The carrier's second area of historical impact was at Bikini Atoll for the Able and Baker nuclear tests in July 1946. Again, the carrier did not sink, removing it from its area of historical landscape impact, and it was finally scuttled off San Francisco in 1951 following decontamination testing.

Today her wreck lies on the seabed removed from the battlefields where it fought. Its influence upon those maritime cultural landscapes remains to a certain extent, but the bulk of its physical presence lies instead in the Monterey Bay National Marine Sanctuary and while not reflective of the ship's history, the landscape here is impacted today by the shipwreck's presence as it acts as an artificial reef for sponges, corals, and fish to colonize. Our dives on *Independence* from *Nautilus* examined the site to document damage from the Crossroads tests and also the damage from her sinking, corrosion, and other effects of its 65 years in a deep marine environment. Like other Crossroads ships scuttled off the western US after the war, *Independence* reflects the end of a wartime era, the birth of the nuclear age, and a new life today as a hard substrate supporting a deep-sea ecosystem.

## Historical Context of USS *Independence*

As previously noted in the *Journal of Maritime Archaeology* (Delgado 2016a, b; Delgado et al. 2016), *Independence* was the first vessel of a new class of light aircraft carrier designated as CVLs. *Independence* was launched August 22, 1942, and commissioned on January 14, 1943 (Lambert 2015; Wiper 2013). The “Mighty I” had a distinguished career in the Pacific War, earning eight Battle Stars for actions throughout the Pacific. After serving in postwar “Magic Carpet” service ferrying troops back to the United States, *Independence* was selected as one of two aircraft carriers, along with USS *Saratoga* (CV3), to be among the 97 target ships for Operation Crossroads, the 1946 tests of the atomic bomb at Bikini Atoll (Berkhouse et al. 1984; Delgado et al. 1991).

Moored in the target arrays for the tests inside the lagoon at Bikini Atoll, *Independence* was a platform for test instruments, animals and aircraft. Badly damaged by the first blast, “Able,” on July 1, 1946, the carrier was readied for the second test with new instruments and aircraft. That test, “Baker,” did less damage, but irradiated *Independence* as well as most of the other target ships not sunk by the blast. Along with twelve other surviving, radiologically contaminated target ships, *Independence* was towed from Bikini for further study at Hawai’i and the West Coast of the U.S. mainland.

*Independence* arrived at Hunter’s Point Naval Shipyard in San Francisco, on June 16, 1947 (Fig. 1). There it became the platform for the U.S. Navy’s radiological decontamination school, later called the Naval Radiological Defense Laboratory, until December 1950.



**Fig. 1** Aerial photograph of Hunter’s Point Naval Shipyard in San Francisco from 1948 showing USS *Independence* (CVL22) at the pier. National Archives

On January 26, 1951, after being towed out of the Golden Gate, two explosive charges made from torpedo warheads were detonated to sink the carrier off the Farallon Islands.

## Rediscovery

The wreck site of *Independence* was located at a depth of 829 m (2719 ft) during a 1990 U.S. Geological Survey (Karl and Schwab 2000: 66; Chin and Ota 2000: 193, 206). A subsequent cruise by the NOAA ship *Okeanos Explorer* delineated a linear sonar target at the same coordinates in 2009, and that in turn led to a joint NOAA/The Boeing Company mission to assess and map the probable wreck with Coda Octopus Echoscope, a three-dimensional sonar, in March 2015 (Delgado et al. 2016). That survey, constrained by impending bad weather, consisted of a single high-altitude pass 30 m above the wreck that captured the entire flight deck and upper features of the sunken carrier. It did not define the sea floor or provide side profile views of the ship. The first sortie, did, however, verify the location of *Independence* and its orientation on the sea floor, and confirm the identity of the target as *Independence*.

## The 2016 Survey

As a result of the 2015 NOAA/Boeing mission that confirmed the identity, orientation and basic characteristics of the wreck of *Independence*, the site was selected as a target for detailed investigation and documentation during the 2016 field season of E/V *Nautilus*, during a NOAA-funded exploration of Greater Farallones and Monterey Bay National Marine Sanctuaries undertaken in partnership with Ocean Exploration Trust. The cruise took place in August, with dives on *Independence* on August 22–23 and 26, 2016. The dives to the wreck were accomplished using the remotely operated vehicles (ROVs) *Argus* and *Hercules*. The dive commenced on August 22 lasted 24 h, and the dive on August 26 lasted for 10 h for a total of 34 h of observations on site.

Multiple transits were made of the perimeter of the wreck from bow to stern, on both beams (port and starboard), and at varying levels from the hull/seabed interface to the area of the platforms and gun tubs. The fore and aft areas were documented, and multiple passes were made across the flight deck. The island superstructure was examined. Penetration dives were made through large openings in the flight deck into both elevator pits, and into an area amidships that had been cut away, allowing access to the hangar deck (Fig. 2). Detailed examination of key features included an aircraft in the forward elevator pit, an aircraft wing on the port side that lay near the edge of the hangar, the navigation bridge on the superstructure, the aircraft crane base and the crane, which lay inside the aft elevator pit, instrumentation towers, anti-aircraft guns, and the towing bridle at the bow, all of which will be discussed in more detail.

## Results and Observations

The dives confirmed the sonar-based observations made in 2015 that *Independence* rests upright on its keel with a slight list to starboard. The bow is dug in deeper than the rest of hull, buried in sediment to the level of the second deck just below the anchor hawse



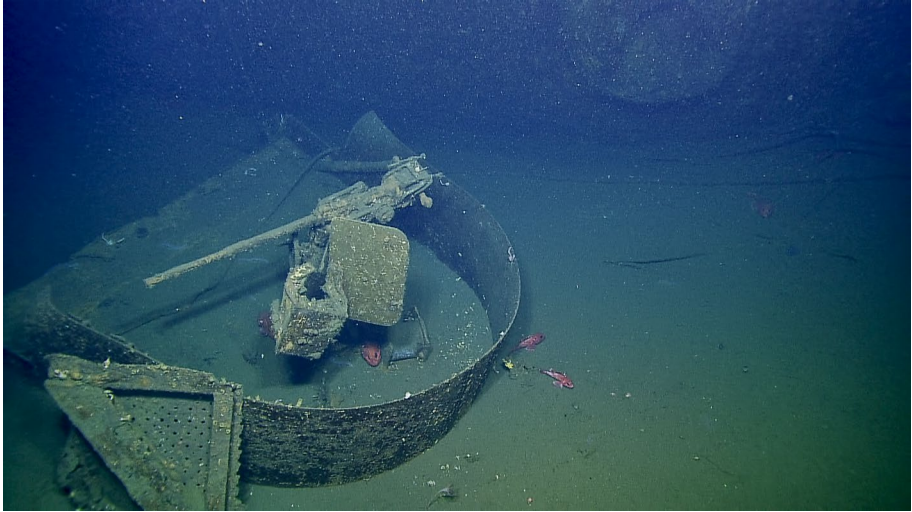
**Fig. 2** Oil painting of the USS *Independence* shipwreck site by Danijel Frka, Russell Matthews Collection

pipes. Aft of the bow, the hull is embedded to the level of the top of torpedo blister, which comes up to the hangar deck on the carrier. The hull is essentially buried deeper than its original waterline except in some areas of scouring at the stern. The lower hull, including the propellers, is buried at an average depth of 22–25 ft (6.7–7.6 m) above the keel.

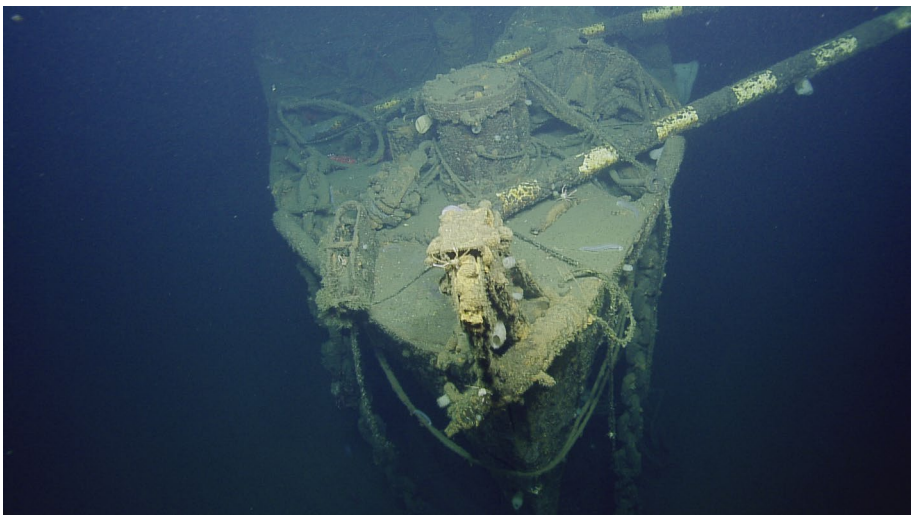
Historic accounts and photographs show *Independence* capsizing to port and then settling and finally sinking by the stern. *Independence*, as it is lying upright on the seabed, appears to have righted after sinking. We hypothesize that the hangar, as a large space opened to the sea through the two sides and the holes in the flight deck, may have acted like a drogue to halt the stern-first plunge after the carrier left the surface. Furthermore, it appears that that the carrier settled more or less on a level keel in the water column as a result of this drogue-effect on the hull, and then took a more acute angle at the bow as it continued to sink. The hull is distorted and broken just forward of the flight deck, abeam of the forward 40 mm mount, and adjacent to closed chocks and a 14-in. bitt at or near frame 12.

The deeper burial of the tip of the bow as compared to the rest of the hull, and the flex and break in the bow close to the tip demonstrates a steep but not acute angle of descent as the 623 foot (189.9 m) long carrier transited through a water column only 4.36 times deeper (829 m) than its length. The angle of impact was perhaps as much as 20%. The bow dug into the sediment, flexed as the unsupported weight of the bulk of the carrier stressed the hull while momentarily suspended in the water column, and then slammed down as it partially broke free of the bow and *Independence* crumpled to the seabed. Immediately off the port bow, adjacent to the hawse, is a single 20 mm mount and gun torn free from its original pre-sinking position at the edge of the flight deck at frame 20 (Fig. 3). Its position indicates that it broke free and was flung toward the bow when the hull hit the seabed.

A prominent feature at the bow is a towing bridle attached to a stud-link anchor chain; the chain runs across the forecastle deck into the deck house below the 40 mm mount at



**Fig. 3** ROV image of the 20 mm gun and mount from frame 20 that fell forward to rest on the seabed near the bow. Image courtesy of Ocean Exploration Trust



**Fig. 4** ROV image of the bow of *Independence* showing the towing bridle and two fallen range poles. Image courtesy of Ocean Exploration Trust

the bow (Fig. 4). The chain is stowed in the same position that it was for *Crossroads*, but at Bikini this was a single strand rigged at the starboard chock that ran out and down to the bow mooring block. This strand, with another added to the port and running through that chock, was shortened and rigged to form the bridle for towing *Independence* from Bikini, and ultimately from Hunter's Point Naval Shipyard to the site of the sinking. The chain formed the bridle legs and prior to their terminal ends, they are connected by what appears to be served and parceled (which provided multi-layer protection) wire-rope



**Fig. 5** ROV image of the block letters of USS *Independence* on the stern. Image courtesy of Ocean Exploration Trust



**Fig. 6** Photomosaic of the full name on the stern. Image by Ian Vaughn, courtesy of Ocean Exploration Trust

span that took the place of a more standard “fish plate” for the attachment of the fore pennant (the actual tow line). A series of loose rope lines attached to and looped near the bridle are likely the pennant and bridle retrieval lines used by the towing crew.

The extensive dives and documentation of *Independence* yielded a wide range of detailed observations too lengthy for this overview, but there are several outstanding overall observations we wish to point out. In many ways, *Independence* still resembles the vessel captured in pre-sinking photographs. While there is scuttling charge and sinking damage, some corrosion, and biological colonization of the wreck, it remains primarily unobscured and retains much of its painted surface. Patches of light-colored paint were observed on the superstructure, dark paint was visible on the hull, and the carrier retained large, painted frame numbers placed along the hull as survey points of reference during Crossroads. Raised letters with some paint continue to spell out the name of the carrier at its stern (Figs. 5, 6). The paint patterns on the superstructure are from the “kill board” that listed the missions and number of ships and aircraft destroyed by *Independence*’s air



**Fig. 7** ROV image of the side of the island superstructure and remnants of the painted “kill board.” Image courtesy of Ocean Exploration Trust

groups and deck force with anti-aircraft guns (Fig. 7). Kill boards were painted on both ships and on the sides of aircraft as a means of keeping score. The *Independence* kill board is documented in wartime photographs (Fig. 8). Its surviving traces consist primarily of the lighter-colored background for the small Japanese flags that depict a kill, as well as the background for lettering denoting air groups. The differential survival of the paint is an archaeological signature of the Test Able atomic blast: “Red paint from the Japanese flags on the “Island” has turned white from the effects of radiant heat” (Bureau of Ships 1946A: 114). The lighter paint reflected the thermal energy of the bomb, while the darker colors that absorbed it either burned away or faded.

Other Test Able-induced atomic bomb damage, meticulously noted and documented by the Navy’s Bureau of Ships Group at Bikini, is also clearly visible with “washboarded” areas of the hull, damage to the superstructure in terms of missing masts, antennas, and upper mast-supported bridge decks, the loss of all four funnels (arranged in dual pairs distinctive of the CVLs), and the “blown” out condition of the hangar deck with its roller-type curtain steel doors (essentially the same as an industrial roll-up door) missing (Fig. 9). Engraved plastic labels for switches are still readable at the navigation bridge level (Fig. 10). What struck the science team as the *Independence* dives were underway, with formerly classified damage drawings and photographs in front of us, was how seven decades beneath the sea had not obscured what the atomic bomb had done to USS *Independence* (Bureau of Ships Group 1946).

The flight deck is largely intact, less the wood that once covered it, with the exception of post-sinking collapse of the deck where it had been weakened by the Able blast, and holes cut to access interior of the hull to remove machinery in 1950 and place “nuclear waste” inside those emptied engineering spaces. The basic nature of the major post-sinking changes to the flight deck was noted in the 2015 sonar survey (Delgado et al. 2016). What the sonar survey did not reveal was the presence of a number of smaller holes, the result of corrosion, which now riddle the flight deck. The sonar survey in 2015 had delineated both elevator pits, with some kind of material evident inside the forward elevator. The





**Fig. 8** Historic photo of sailor painting new entries on the kill board on *Independence's* island superstructure. National Archives

2016 survey with *Argus* and *Hercules* revealed the aft elevator pit was empty except for the boom from the ship's aircraft crane, formerly attached to its base forward of the superstructure and damaged during the Able test. Prior to sinking, the crane was stowed inside the aft elevator pit. It lies up against the port beam, and was either originally stowed there or shifted to that position when *Independence* began to flood and rolled onto its port side. The dives into the forward elevator pit revealed debris, a damaged Hellcat fighter, and a number



**Fig. 9** Historic photo of USS *Independence* following the Able test showing post-blast damage. National Archives

of 55-gallon steel drums, all to be discussed more fully later and in a separate article on the aircraft.

As outfitted in 1943, *Independence* carried two quad 40 mm guns (at the bow and stern) and nine twin 40 mm guns (four on the port side and five to starboard) as well as 16 single 20 mm guns (seven to port, nine to starboard) (Wiper 2013: 23). After repairs and a refit in June 1944, the carrier was fitted with ten twin 40 mm mounts (Wiper 2013: 48). The fore and aft quads, three of the twin 40 mms on the starboard and three of the twin 40 mms on the port side were removed for Crossroads. All of the weapons and their corresponding gun directors (plotting computers) were observed during the dives (Figs. 11, 12). The galleries on each beam of the carrier, just below the level of the flight deck, remained intact and identical to post-Able and pre-sinking photographs other than the collapse of three gun tubs: the previously mentioned port 20 mm mount, a corresponding starboard 20 mm mount, and tub number 5 with a twin 40 mm gun, barrels elevated.

Pre-sinking photographs showed that two welded tubular steel towers for mounting peak-over pressure gauges, known colloquially to Crossroads crews as “Christmas Trees,” remained on *Independence* when it was scuttled. The dives initially noted that one tower, formerly on the flight deck near frame 90, was missing while the other remained in position in the forward 40 mm gun tub at the bow (Fig. 13). Later, the second, which had been placed on the port side of the flight deck aft of the forward elevator, was found lying off the side of the ship on the ocean floor. It may have detached and fallen to the seabed when *Independence* hit bottom, or fallen due to subsequent deterioration of the flight deck. Other effects from the sinking of the carrier include the buckling and collapse of the tubular steel range poles set along the carrier’s centerline for measuring the rate of sinking (Fig. 14), and fire hose that unspooled from reels as *Independence* sank. Post sinking changes to the wreck include fishing trawl nets tangled and caught in the wreck, particularly at the starboard aft quarter and close to the island, on the starboard side (Fig. 15).

As previously noted, after visual survey and documentation of the exterior, *Hercules* was used to make limited interior surveys by dropping the ROV into both elevator bays and through a large access hole cut into the flight deck to examine the hangar spaces below. As well, limited visual access of the hangar deck was made possible from each side of the carrier by looking through the apertures created by the missing roll-up doors. The limited hangar deck reconnaissance revealed small debris, the previously noted aircraft crane, an aircraft wing and what appeared to be a crumpled mass of aluminum, and possibly another wrecked aircraft forward of the “big hole” but we could not approach due to possibility of trapping the ROV beneath the flight deck. The possible presence of a second aircraft inside *Independence* was confirmed when during a seabed level inspection of the port side, the detached and damaged wing of an aircraft was observed jammed against the bulkhead and partially outside the hangar through a missing roll-up door between frames 70 and 80.



Fig. 9 (continued)

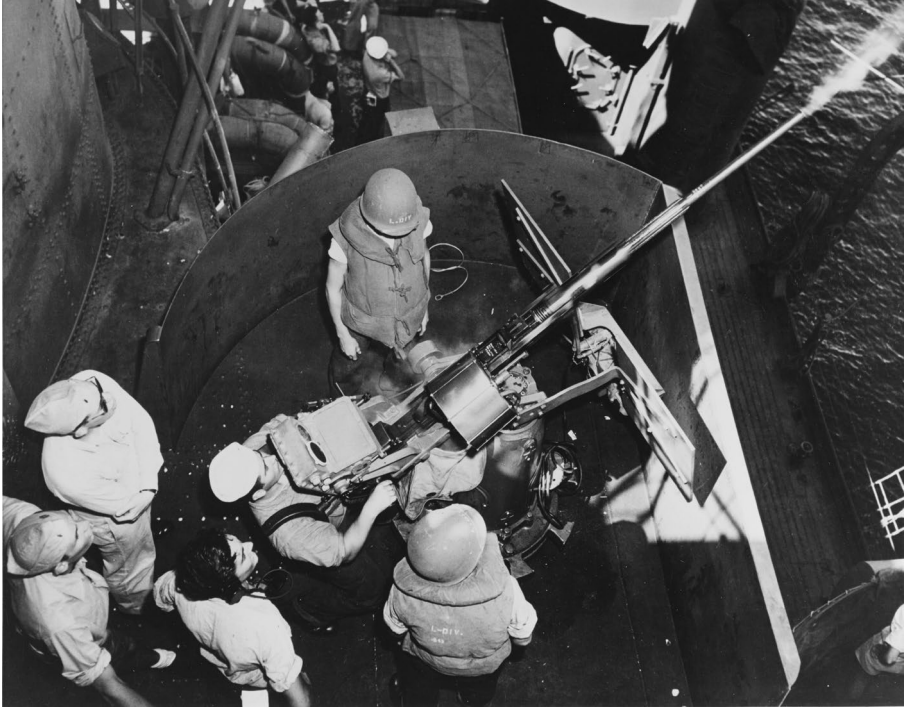


Fig. 10 ROV image of switch panel on the navigation level with plastic labels still readable. Image courtesy of Ocean Exploration Trust

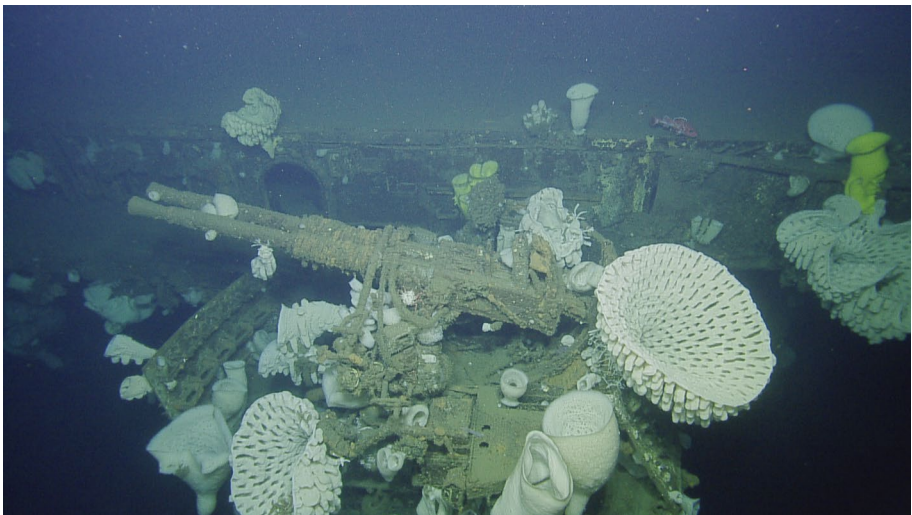
## Barrels/"Nuclear Waste"

We also noted the remains of three steel 55-gallon drums inside the forward hangar adjacent to the aircraft and one inside the hangar midships. There has been much media since the initial 1990 rediscovery of *Independence's* role as a receptacle for "waste." As noted from the 2015 survey (Delgado et al. 2016), declassified records at the National Archives discussed how low-level waste such as gloves, clothes, and equipment were all placed "inside" *Independence*. The archival record notes the preparation of a compartment for the storage of the "waste" in what had been the aft engine compartment. The cutting of the large hole in the flight deck to facilitate the removal of that machinery remains evident on the wreck. We also observed an access door cut into the starboard side of the hull, which will be discussed in more detail later. This, we suggest, indicates that nearly all of the "waste" was indeed stowed as indicated in the archival record.

The four barrels sighted may represent a "last minute" placement prior to the scuttling voyage. The contents could only be discerned from one barrel, which lay inside the elevator pit on its side, partially corroded and collapsed. Lying in it was a pile of latex gloves (Fig. 16). A concrete "cap" or lid used to seal the top was lying adjacent to it. The cap, approximately three inches (7.62 cm) thick, was not what we expected to find based on



**Fig. 11** Historic photo of *Independence* crew in a 20 mm gun tub. National Archives

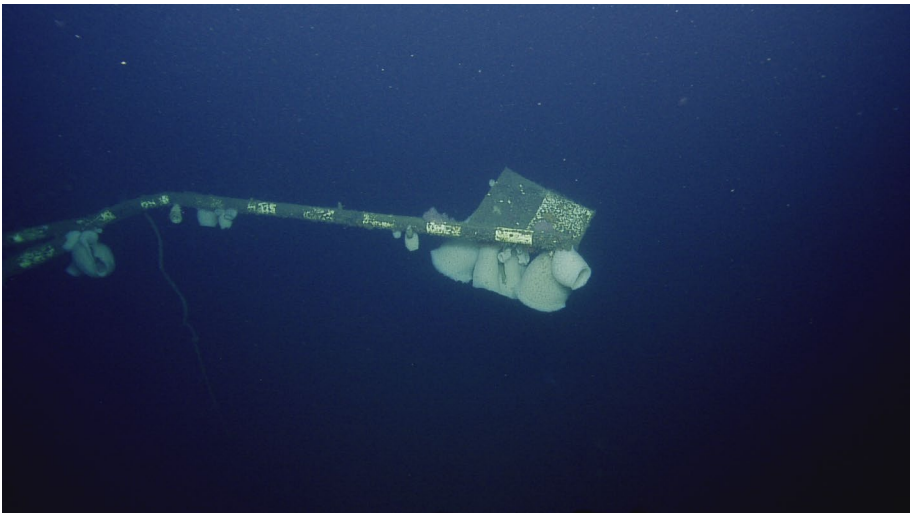


**Fig. 12** ROV image of gun tub and 40 mm gun covered in large sponges. Image courtesy of Ocean Exploration Trust

reports of “concrete-filled 55-gallon drums” (Fidler 1950; Bird 1950a). That being said, it makes perfect sense that if a barrel filled with densely packed material such as the gloves was “filled,” that involved pouring liquid concrete into the top of the barrel.



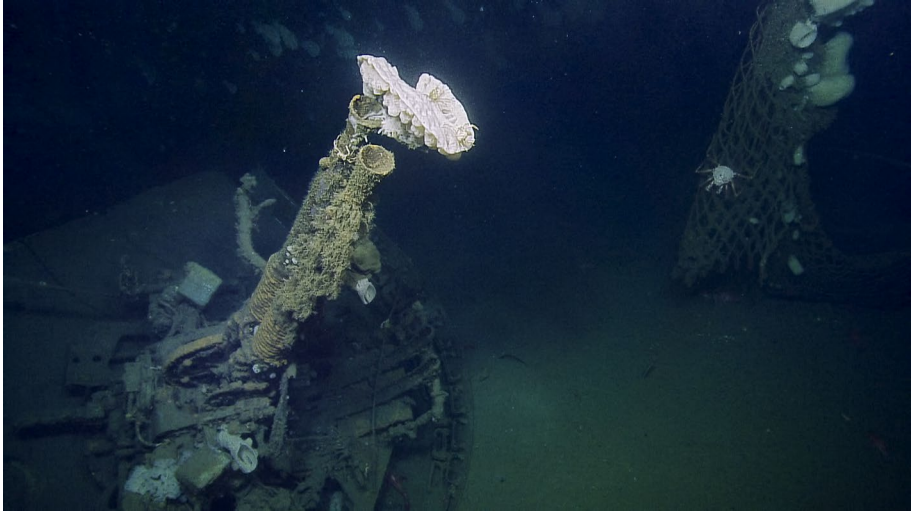
**Fig. 13** ROV image of “Christmas tree” blast gauge tower still in position in the forward 40 mm gun tub at the bow. Image courtesy of Ocean Exploration Trust



**Fig. 14** ROV image of fallen range pole, now a surface for sponge colonization. Image courtesy of Ocean Exploration Trust

### Post-Bikini Hunter’s Point Modifications

As previously noted, the survey documented alterations made to *Independence* at Hunter’s Point. One was the cutting of holes in the flight deck to facilitate the removal of machinery from the aft engine room, as noted in the archival record (Fidler 1950; Bird 1950a, b). The other was an access door cut through a pre-existing hatch on the starboard side above the torpedo blister near frame 130. The location of this door places it in position to enter the



**Fig. 15** ROV image of 40 mm gun with snagged trawl net in the background. Image courtesy of Ocean Exploration Trust



**Fig. 16** ROV image of corroded barrels and disposed latex gloves visible inside. Image courtesy of Ocean Exploration Trust

aft starboard engine room. It may have been installed in 1950 to provide access for waste storage in the engine room (Fidler 1950; Bird 1950a, b). Instructions for access called for a “watertight door” on the starboard side at the third deck level between frames 26–29, with instructions to cut out an existing hatch to do so, according to a July 6, 1949 memorandum from the Director of the Naval Radiological Defense Laboratory to the Planning Officer of the San Francisco Naval Shipyard (reproduced in Delgado 2016b: 74). As the door we



**Fig. 17** ROV image of an access door cut through a hatch on the starboard side of *Independence*, above the torpedo blister near frame 130. Image courtesy of Ocean Exploration Trust

noted in 2016 was the only such feature we observed, the location outlined in the plan was shifted to the location we documented (Fig. 17).

### **Factors Leading to the Final Disposition of *Independence***

During the time *Independence* underwent contamination/decontamination studies, the intensity of radioactive levels acquired at Bikini had decreased in many parts of the vessel “below the tolerance level established for peacetime industrial operations. Other parts however, remain above this level.” “Large quantities of fresh fissionable product mixtures were introduced on board” during these experiments and subsequently were “drained into tanks aboard this ship for stowage” (location not noted). This, in addition to other contaminated materials being placed on board (as we note in this article) was a factor in the final decision to scuttle the ship. Another reason to sink rather than scrap was the determination that the cost to decontaminate the vessel would exceed its scrap value (compounded by the depressed value of scrap in 1951). If decontaminated, unsafe materials would create the need for costly re-disposition for storage or disposal by other means.

The added perceived benefit of use for studies in the sinking to enhance the design of future ships and weapons was also included in the recommendation that “It is considered that disposition of INDEPENDENCE by sinking incident to the underwater explosion tests proposed in reference (b) will serve the best interest of the Navy” (Brown 1949). “Weapons testing” would further provide cover for classified radiological aspects connected to the vessel with the media/public during this era.

## Preparations for Disposal

As noted previously, the preparations for disposing of *Independence* included the final stowage of nuclear waste, including the likely last-minute addition of a few loose barrels. Tubular steel painted range poles were placed along the entire centerline of the carrier. These poles rose above the height of the island and were topped with a rectangular metal “flag.” The installation of these poles demonstrates that the sinking of *Independence* was more than a simple scuttling. The secret orders to sink the carrier stipulated that a group from the Explosive Ordnance Disposal Team from the Naval Powder Factory in Indian Head, Maryland (now the Indian Head Naval Surface Warfare Center) would set two torpedo warheads as charges near the ship’s keel (ComWestSeaFron 1951).

Following World War II, the Navy began developing new torpedoes with an eye to portability, universal use from a variety of firing platforms, and greater yield. The secrecy surrounding the use of torpedo warheads in the sinking is highlighted in the nationwide publication of an Associated Press article headlined “Navy Mum on Secret Weapons Sinking A-Bombed Carrier *Independence*” (Associated Press, January 31, 1951). The article noted that naval officers would not confirm that “bombers” had been used to sink *Independence*, likely because the fact that two experimental and powerful torpedo warheads had done the job quickly and efficiently. *Independence* sank in 34 min.

Simply sinking the ship fast was only part of the objective. Quantifiable data on the movement of the ship and the rate of sinking was essential. The range poles were therefore installed to provide the means to measure the characteristics of the sinking as the carrier settled. In 2016, we noted that the fate of these poles was unknown as the sonar could not delineate them. All of the poles were located, still in place. Each pole was bent, often multiple times, probably from the ship moving through the water column, with some partially collapsed, in some cases it seems by being washed into the hangar deck through the openings in the flight deck and the elevators. The poles are direct archaeological evidence that even at the end, *Independence* was serving an experimental, military purpose in addition to its disposal.

## Deliberate Sinking Damage

One of our research questions prior to the dive was where the sinking charges had been placed. The orders to place them “near the keel” led to a discussion as to whether they were rigged under the hull, or, given that the EOD team had been on board *Independence* just prior to sinking, whether they had been placed inside the carrier. Photographs of the sinking show the blasts took place amidships, with shock and displacement at the waterline, and with smoke and debris erupting from the flight deck. This is the area with the greatest flight deck damage, which we noted in 2016 might reflect explosives damage and possibly, as the expansion joint there appeared wider than in post-Able damage assessments and pre-sinking photographs, might indicate a break in the hull caused by the scuttling charges and/or the impact with the sea floor. Visual inspection by *Hercules* revealed hull distortion and the edges of hull plate pushed outward near the mudline amidships on the starboard side, and a hole in the hangar deck beneath the damaged flight deck area that descended deeper into *Independence*. This leads us to conclude that the charges were set inside the ship.





**Fig. 18** Photo of *Nautilus* science team recovering sponges from the bio-boxes aboard the *Hercules* ROV. Image courtesy of Ocean Exploration Trust

## Biological Colonization and the Issue of Radiological “Contamination”

On an otherwise featureless sediment bottom with few rocks, *Independence* forms an ideal habitat for sponges. Well-fed by ocean nutrients anchored to hard structure, a variety of sponges were observed (e.g. Fig. 12).

The science team’s biology group used *Hercules* to collect a variety of sponges for analysis and as an ideal means to determine the presence of radionuclides (Fig. 18). A key aspect of the survey was determining if, after 70 years since its exposure to two atomic blasts, *Independence* remained radioactive. We did not suspect so, given the normal rate of radioactive decline of isotopes, and the low levels recorded on *Independence* just prior to sinking. Under the guidance of Professor Kai Vetter, students of the University

of California, Berkeley, RadWatch team collected eight sponge samples from the hull of *Independence* and two from Pioneer Canyon (on a subsequent dive) as controls for radiation measurements. The sponges were dried and examined with a high purity germanium detector for 24 h. The measurements did not show any  $^{137}\text{Cs}$  or  $^{60}\text{Co}$  that could be attributed to Operation Crossroads or nuclear waste. They indicated only trace amounts of naturally occurring radioisotopes in concentrations comparable to samples from the California mainland.

We noted in 2016 that the “importance of *Independence* resides not only in the context and social conditions leading to her construction and conversion, but extends to changing use and method of disposal, and how we view the wreck today” (Delgado et al. 2016: 23). At the time of its rediscovery in 1990, and throughout our missions in 2015 and 2016, the wreck was frequently referred to as “radioactively polluted.” When the results from 2015 were released and noted we had not measured radioactivity, a telling comment (one of hundreds) in one newspaper article alone spoke to ongoing fear and stated that we were lying, noting, “And what scientific PROOF do you have, since WE KNOW there IS HIGH RADIATION on the ship” [emphasis is original] ([http://www.mercurynews.com/breaking-news/ci\\_27931161/scientists-find-radioactive-aircraft-carrieroff-san-francisco?source=infinite](http://www.mercurynews.com/breaking-news/ci_27931161/scientists-find-radioactive-aircraft-carrieroff-san-francisco?source=infinite)). The sponges, collected from a variety of places after decades of growing on the ship, in direct contact with the metal, had no traces of the Crossroads radionuclides—nor any others. We can now assert, with scientific proof, that USS *Independence* is no longer radioactive. We cannot address, however, what rests inside the machinery compartments and what levels may be present there, deep inside the ship.

## Conclusions

This survey was more than a characterization of the resource, or of showing yet again that archaeological examination points out errors and omissions in the archival record. Hanson (2016b) aptly notes that USS *Independence* was never lost:

In the Cold War context, “lost” is a slippery concept as its meaning may range from something whose location is genuinely unknown to a location that is known, but closely guarded by national security secrecy. In the case of the USS *Independence*, it was the latter (Hanson 2016b: 8).

Through careful inspection of the entire wreck site, the team on board coordinated with experts participating from locations on shore via telepresence (Fig. 19). As a group, we noted Cold War-era secrecy and an apparent policy of deep-water disposal as a means of effectively ensuring a hostile power would not gain access to any “secrets” in or on the carrier in reporting the 2015 survey results, but we wanted to draw a closer connection. There was a heightened sense of vulnerability following the unexpected Soviet detonation of its first atomic bomb (code-named *Первая молния* “First Lightning” by the Soviets and “Joe 1” by the United States) at Semipalatinsk on August 28, 1949, years before Manhattan Project scientists predicted the Soviets would be able to make a bomb (Szilard 1949: 262–264; also see Herken 1988: 26, 230 and 313; Rhodes 1988: 767). This was followed, less than a year later, by the passage of the McCarran Internal Security Act (also known as the Subversive Activities Control Act) and the start of the Korean War at the end of June 1950. Engaged in an active Cold War, with a smaller hot war in Asia, the United States government and its military faced a real threat.



**Fig. 19** Photo of science team in the control van aboard *Nautilus* directing the reconnaissance of *Independence* and interacting with shore-side participants. Image courtesy of Ocean Exploration Trust

One of those threats was espionage, which the U.S. Government knew to be a valid concern. Sinking *Independence* not only resolved the issue of getting rid of an aging, no longer needed hulk. Sinking it deep, and at a deliberately misleading location, took it and whatever secrets it and its contents might reveal, beyond the reach of possible Communist traitors and spies, which at that time was a major public and political concern in the United States. The “Great Fear” of Communism at that time cannot be underestimated (Caute 1978). To further place the scuttling in context, plans to sink *Independence* in deep water were formulated during the same time the House Un-American Activities Committee sat in session, and Wisconsin Senator Joseph R. McCarthy made a February 1950 speech denouncing Communist infiltration of the U.S. Government (Boyer 1985: 103, 326). In such a context, *Independence* was ostensibly not safe from espionage even on a secure naval base.

However, the sinking should not be assessed as a decision made in panic but as a more complex, prudent reaction. A recently declassified program of the National Security Agency, “Project Venona” intercepted some 2200 Soviet coded messages from 1942 to 1945. Efforts to break the codes involved many codebreakers, all of whom contributed much to the final effort. The breakthrough came in December 1946 thanks to crypto-analyst Meredith Gardner. As the coded messages were painstakingly decoded, the intelligence gained was made available to senior officials. That effort continued through Venona’s end in 1980. Project Venona detailed a vast Soviet espionage apparatus in the United States that included some 349 U.S. citizens. Some of them were highly placed in the Manhattan Project, then developing the atomic bomb. Others were in the State and Treasury Departments, at the White House and within the Office of Strategic Services (OSS), the predecessor to the CIA. Other spies worked at other agencies

(Haynes and Klehr 1999; also see Haynes et al. 2009). While the source of the intelligence (Project Venona was not revealed until 1995) the decoded messages exposed spies and led to prosecutions such as the famous Sobell and Rosenberg espionage cases of 1950–1951 in which the passing of atomic secrets to the Soviets was proven.

The arrests of the Rosenbergs and the allegations against them were headline news throughout the end of 1950 at the same time as the Navy made final decisions about USS *Independence*. It is probable that in this environment, the issue of atomic security was underscored by a sense of vulnerability in the face of classified and public knowledge of atomic espionage. The placing of materials inside *Independence*, as well as the scuttling of the hulk in deep water can be seen as a logical, human response to fear of losing more “atomic secrets.” Two months after the sinking of *Independence*, the Rosenberg case concluded with Judge Irving Kaufman’s imposition of the death penalty. His statement at sentencing is particularly pertinent:

I believe your conduct in putting into the hands of the Russians the A-Bomb years before our best scientists predicted Russia would perfect the bomb has already caused, in my opinion, the Communist aggression in Korea, with the resultant casualties exceeding 50,000 and who knows but that millions more of innocent people may pay the price of your treason. Indeed, by your betrayal you undoubtedly have altered the course of history to the disadvantage of our country. No one can say that we do not live in a constant state of tension. We have evidence of your treachery all around us every day for the civilian defense activities throughout the nation are aimed at preparing us for an atom bomb attack (Kaufman 1951).

At the same time these actions were taken, the passing of atomic secrets took on new urgency. The United States was actively pursuing a new weapon, the “super” or hydrogen bomb. The Joint Chiefs of Staff issued a document, NS-68, that warned of a surprise atomic attack by the Soviet Union “once it has sufficient atomic capacity,” and that view had been incorporated into U.S. foreign and domestic policy. Developing a stronger nuclear capacity for the United States began in earnest. On January 27, 1951, 1 day after *Independence* went to the bottom, the United States conducted its first test detonation of a nuclear device at the newly designated Nevada Proving Grounds during Operation Ranger (United States Department of Energy 2000: 2).

Therefore, when the 1990 survey and the subsequent 2009, 2015 and now the 2016 survey placed the wreck of USS *Independence* far from locations surmised or reported in 1951, this reflects no mistake in navigation or position plotting. Nationwide articles at the time of the scuttling, as previously noted, were headlined “Navy Mum on Secret Weapons Sinking A-Bombed Carrier *Independence*” (Associated Press, January 31, 1951). The articles placed the wreck more or less correctly in 3000 ft of water (it is in 2720 ft) but noted that was 215 miles out to sea. It is actually only 30 miles from shore. The position of *Independence* as we found and documented it is in itself an artifact of the times and behaviors inherent in the early atomic age and political climate of that era. The Navy crews who disposed of *Independence* knew exactly where they sank it, as the formerly classified logs of the tugs and destroyer that towed her out show. They just did not want the Soviets to know and try to reach it.

This all clearly shows that the archaeology of the Cold War, as demonstrated overall by Hanson (2016a) is of importance (Hanson 2016b; Delgado et al. 2016; Neyland 2016). The perceived need to get rid of sensitive material in a time of suspicion of espionage drove the decision to scuttle *Independence*, the last of the “contaminated” Crossroads target ships afloat, in the deep.

Adding to the statements of archaeological significance we made in 2016 (Delgado et al. 2016), we close by noting that *Independence* is more than a solitary site. It remains part of a fleet, now dispersed, that assembled for a world-changing event at Bikini Atoll in 1946. “The Crossroads fleet is more than a collection of historically important ships from World War II. It is a significant collection of sites that speaks to the archaeology of the recent past, the Cold War, the effects of nuclear weapons, and the behaviors inherent in discard and abandonment” (Delgado et al. 2016; also see Neyland 2016; Hanson 2016b). To that we add as a postscript to an earlier observation made by the senior author in 1991, as senior author on the first archaeological report on the wrecks at Bikini, in which it was suggested that those vessels of Crossroads removed from Bikini and lying in other waters were less significant because they were removed from the primary loci (Delgado et al. 1991: 157).

That is not the case, especially when parsed through the lens of maritime cultural landscape theory. Despite removal from primary loci of tests, as we see with *Independence*, post-test activities with these vessels, and the record each of these sites encompasses, is also significant (Delgado 2016b). The maritime cultural landscape of Crossroads spans the Pacific. That landscape, much like the multi-layered and diverse cultural landscape of the Nevada Test Grounds, are powerful places associated with the archaeology of The Bomb, and its role and context within the Cold War.

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