

The Jaluit Atoll TBD-1 *Devastators*: Archaeological Analysis and Preservation Assessment of a WWII Site.

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ABSTRACT

The topic of the paper, entitled “The Jaluit Atoll TBD-1 *Devastators*: Archaeological Analysis, and Preservation Assessment of a WWII Site,” best fits within the session, *Underwater Cultural Heritage of World War II in the Asia-Pacific Region: Discoveries, Opportunities & Challenges* due to its context and subject matter. Before sunrise on 1 February 1942, aircraft from the USS *Yorktown* (CV-5), sortied as part of Task Force-17’s attack on the Japanese Mandated Islands of Jaluit and Milli, in present day Republic of the Marshall Islands, and Makin, the northernmost island in the Gilbert Islands chain. During the raid, two TBD-1 *Devastator* torpedo bombers [BuNo. 0298 (5-T-7), and BuNo. 1515 (5-T-6)] were forced to ditch in Jaluit Lagoon as each aircraft was low on fuel. The aircrews of both planes survived the water landing, were captured by Imperial Japanese Naval forces, and survived captivity in POW camps in Japan. Since 2004, a group of scientists, engineers and researchers have undertaken seven expeditions to the resting place of these aircraft in a remote section of the lagoon to document and conduct analysis on aspects of the artifacts’ preservation. As part of the monitoring and assessment, plans have been generated to potentially recover one of the aircraft to archaeological and materials conservation standards.

KEYWORDS: World War II, Naval Aviation, TBD-1 *Devastator*, Marshall Islands

INTRODUCTION

Since 1 February 1942, two TBD-1 *Devastators* [BuNo. 0298 (5-T-7), and BuNo. 1515 (5-T-6)] have remained submerged in Jaluit Lagoon, the Republic of the Marshall Islands. Each artifact was the result of a controlled emergency landing on water when the pilots determined that it would not be advisable to try to return to their carrier strike force. The location, on a remote atoll in the central Pacific Ocean, and the even more isolated western side of Jaluit Lagoon, has sheltered them and protected each plane from inadvertent contact or vandalism. The first of the two aircraft was identified during a US National Parks Service sponsored cultural survey in the late 1990s while the second was relocated a few years later following a dedicated search by local divers. Although slightly different, the preservation level of each submerged structure is exceptional. Starting in 2004, a team of scientists and historians have visited the site seven separate times to document and assess their condition. The two aircraft provide a unique opportunity for *in situ* study. One is submerged at an average depth of (-)50 feet and has overwhelmingly been assimilated into the surrounding environment of a coral head. The other is submerged at a depth of (-)110 feet and lying on a coralline sandy plain where there is considerably less biologic activity. Over the course of the seven expeditions to the site, the planes have been thoroughly documented by hand measurements, photomosaic models and one of them, BuNo. 1515, the deeper wreck, was thoroughly laser-scanned with subsea LiDAR. Along with on-site corrosion testing, engineers have assessed the aircraft’s structural integrity, and samples have been exported under permit for metallurgical analysis. The archaeological documentation and preservation analysis have helped guide the formation of plans to potentially archaeologically recover and stabilize one of the submerged structures for future museum installation and display. This conference paper is an overview of the project and draws directly from the Permit Report (2018-1) submitted to the US Navy History and Heritage Command, Underwater Archaeology Branch in 2021.

HISTORICAL BACKGROUND

Shortly after clambering from the wing of their TBD-1 *Devastator* into the small, three-man inflatable life raft, James Dalzell, RM/1c, Radioman/gunner on BuNo. 0298 recalled looking up and seeing “...number 6 hit!” The number six Dalzell referred to was BuNo. 1515. Herbert R. Hein, Jr., as it made an emergency water landing approximately 100 yards from his position. It was down to good fortune, skill, and the experience of pilots LT. Harlan T. (“Dub”) Johnson aboard torpedo bomber

BuNo. 0298 and ENS. Herbert R. Hein, Jr. in BuNo. 1515 that all six members of the combined aircrews survived their planes' ditching into the lagoon at Jaluit Atoll on 1 February 1942, and that none suffered serious injury during the event. The floatation bags meant to keep each aircraft afloat deployed as designed, allowing time for the aircrews to inflate the rubber life rafts and escape with whatever survival gear that was immediately available. Once the raft was clear of BuNo. 0298, the crew attempted to puncture the floatation bags with .45 caliber bullets from their service pistols so the plane would not fall into enemy hands. Unfortunately, the small bullet holes failed to deflate the bags sufficiently, and the Bombardier, ACMM Charles E. Fosha had to reenter the bobbing plane to retrieve what he called his "sword," a long, dagger-shaped blade that he kept with him in the center cockpit in case the floatation bags unintentionally inflated during flight. The dagger worked and BuNo. 0298 slowly disappeared beneath the surface of the lagoon.

Over on BuNo. 1515, the crew did not have the same trouble sinking the aircraft, however the radio antenna anchor point inadvertently snagged and punctured the life raft during evacuation and it began to deflate. Suddenly, only one rubber boat remained for six men. Taking turns, half the men stayed in the water while the group slowly steered their raft about a mile and a half to Pinglep Islet on the western perimeter of the lagoon. Once safely ashore, they were given shelter, along with food and water by the resident Marshallese. Several days after the incident, both aircrews were captured by marines of the Imperial Japanese Navy, who had been dispatched from the seaplane base located on the eastern side of the lagoon. Taken as some of the earliest American POWs, the six US Naval airmen were transferred to the Japanese home islands where each survived the duration of the war by working as prisoner laborers.

The two TBD-1 *Devastators* and their aircrews were part of combined airstrikes on the Japanese Mandated Islands of the Marshall and Gilbert Islands, by two United States carrier task groups centered around the USS *Enterprise* (CV-6) and the USS *Yorktown* (CV-5). The USS *Enterprise* was at the center of *Task Force 8* under the command of Vice Admiral William "Bull" Halsey Jr., which attacked the northern atolls of Kwajalein, Wotje and Taroa. *Task Force 17*, under the command of Vice Admiral Frank Jack Fletcher and centered around the USS *Yorktown*, attacked Jaluit and Mili Atolls in the Marshall Islands, and Makin Island in the Gilbert Island Chain. On the morning of the launch, heavy squalls and lightning were reported in the direction of Jaluit. Since Jaluit was the furthest target from the carrier, 17 Douglas SBD *Dauntlesses* of Bombing 5, and 11 Douglas TBD-1 *Devastators* of Torpedo 5 were the first to launch from the ship and all were reported clear of the deck by 0517. With the thick, overcast cloud cover and storms nearby, few of the aircrews were in visual contact with each other during the 140-mile journey to Jaluit Atoll. It was not until they broke through the ceiling at approximately 1,000 feet that they could begin to assess their targets around the islet of Jabor. Each plane dropped their bombloads and many continued to strafe targets on land and in the harbor. Shortly after dropping bombs over the target harbor area at Jabor, Jaluit Atoll, the pilot, Lt. Johnson of BuNo. 0298 determined that his plane would not have enough fuel to make it back to the carrier, and they might not even be able to make "Point Truck". "Point Truck" was an area south of the atoll that had been designated as the rendezvous location where a destroyer would be stationed to act as a lifeguard and pick up the crew of any downed aircraft in the event they could not get back to the carrier task force.

The first offensive action by the United States Navy in the World War II Pacific Theater following the surprise attack on Pearl Harbor, the two aircraft's connection to the raids on the Marshall and Gilbert Islands, alone, would elevate each to the classification of "significant" and qualify them for inclusion on the US Secretary of the Interiors' list of National Historic Landmarks. The two aircraft, however, could also be considered "significant" for their revolutionary designs. With an overall length of 35ft and a height of 15ft 1in, the Douglas Aircraft Company's TBD-1 *Devastator* recorded several firsts for any aircraft built for the US Navy. It featured an all-metal structure of semi-monocoque construction. The single low-mounted wing was 50ft across but was fitted with revolutionary power actuated hydraulic folding mechanisms that would cut the wingspan virtually in half (down to 25ft 8in) to better store more aircraft on the crowded hangar decks of fleet aircraft carriers. It also boasted the debut of independent Bendix® wheel brakes on its main landing gear, and completely enclosed the

crew positions (pilot, bombardier, radio operator/gunner) under a glass canopy. Incorporated within the airframe and skin were still more technological advances including the integration of special alloy metals such as Alclad[®] aluminum.

Of the 129 TBD-1 *Devastators* built for the United States Navy, none were preserved in any museum or collection and the location of only eleven wrecks is currently known. Seven are at the bottom of the Coral Sea, approximately 500 miles off the eastern coast of Australia. These *Devastators* are associated with the wreckage of the aircraft carrier USS *Lexington* (CV-2), which was located and documented by the research vessel R/V *Petrel* on 4 March 2018, resting at a depth of approximately 9842 feet. Two other examples lost in stateside training accidents have also been found. One is off the coast of Miami, Florida in approximately 500 feet of water, while the other is off the coast of San Diego, California in approximately 800 feet of water. Of all these aircraft, the two in Jaluit Atoll lagoon, by far, combine the highest level of preservation with the greatest accessibility.

RESEARCH DESIGN

The overlying archaeological research design for this project has sought to study the two planes for both their historical and archaeological value, while monitoring the submerged structures' physical integrity and level of preservation, to determine the best plan to potentially recover and conserve the most promising example. Data collected during the seven individual site visits has been augmented with archival research, oral history interviews, and lab analysis to develop a more complete narrative of the raid on Jaluit, and detailed data on the Douglas Aircraft Co. TBD-1 *Devastator*.

Access to the site for the first four expeditions was through small regional dive boats that had to make the 100 plus nautical mile trip from Majuro to Jaluit. Later trips were from larger live-aboard dive charter boats moored nearly on top of the site. On each trip however, the dive platform was some form of self-contained breathing apparatus. Most divers reached the two sites by diving on compressed air, and strictly adhering to Navy Dive Tables, which limited an individual's bottom time to approximately 10 minutes, but greatly increased the safety factor while working in such an isolated area. In 2013, dive team members Brett Seymour and Brian Kirk dove using a mixed-gas fraction of Nitrox, which allowed Brett to stay on site longer than the rest and gain the images required to assemble a photographic mosaic of the deep wreck BuNo. 1515. During the 2018 site visit, Brett Seymour and Evan Kovacs both dove on a closed-circuit rebreather system, which allowed them considerably greater bottom time on the site, less decompression time, and a shorter surface interval. Throughout all expeditions extensive documentation has been conducted on both sites that include still photography and videography, sketches, written descriptions, hand measurement, LiDAR scanning and the use of several analytical instruments.

ARCHAEOLOGICAL FEATURES AND SITE FORMATION

The two VT-5 *Devastators* ditched into the lagoon at Jaluit on the same day, under the same conditions, and barely 100 yards apart. Each sank to the bottom within minutes of one another and appear to have received only minimal damage in the process. The only notable difference between the two aircraft is that one slid 50 feet down the west side of a reef face, while the other sank to a depth of 110 ft and landed on a relatively flat section of bottom sediments. In the process, both received nearly the exact same overall structural damage. Archaeologically, the two planes provide an excellent opportunity for comparison between the two series of aircraft. BuNo. 0298, the shallow wreck, represents the first batch of 114 aircraft delivered to the US Navy by the Douglas Aircraft Co. BuNo. 1515 was part of a second order of 15 planes that replaced aircraft that had crashed in operational accidents or were considered beyond repair and stricken from the US Navy inventory. While very similar there were slight nuances between the two separate aircraft orders that can only be confirmed by the side-by-side comparison of the two Jaluit TBDs.

A catalog of missing features or damage to the structure of the Jaluit *Devastators* was made by visual observations during the expedition dives, comparison of the two aircraft, and through review of

historic photographic and written resources. Each can be divided into two categories: accident damage incurred during the initial ditching event and damage due to long-term immersion in saltwater.

Damage or missing features attributed to the ditching:

1. The two floatation bag cover plates on each aircraft are not on the site.
2. The tail wheel for each aircraft is missing and not on site.
3. The engine on each aircraft is either disassociated from the structure or the engine bolts originally holding the engine in place have fractured.
4. A small section of the skin on the underside of the fuselage aft of the recess for the torpedo has been ripped and folded back.
5. The outboard end of the port aileron frame (“shallow wreck”) is bent and folded from contact with a coral head after sliding down the reef face.
6. The port bombsight door is open on the “deep wreck.”
7. The port wing of “deep wreck” may be slightly bent aft.
8. The upper skins on the horizontal tail surfaces (most evident on the port side of the “deep wreck”) are deformed inwards, presumably due to water pressure acting on the still air-filled watertight compartments within as the planes sank.
9. Port leading edge landing light on the “shallow plane” is hanging loose.
10. Pilot’s seat in the “deep wreck” is out of alignment (twisted to the left) and possibly broke loose during the ditching.

Missing or Damaged Features

1. .30 Caliber M-2 Flexible Mounted Machine Gun from the “shallow wreck” is missing.
2. The Pilot’s map case from the “deep wreck” (the same could not be verified on the “shallow wreck” because of coral intrusion).
3. Norden Bombsights on both wrecks are missing.
4. The fuel tank filler plate on each wing from both planes is missing.
5. The port side of BuNo. 0298’s top canopy has shattered.
6. The starboard horizontal stabilizer on BuNo. 0298 has recently separated from the tail structure and now hangs from its internal control linkages with the outboard edge resting on the seabed.

Undisturbed Features

1. Pilot’s cockpit
2. Bombardier’s cockpit
3. Gunner’s cockpit

PRESERVATION ASSESSMENT

By the time the first group of project researchers dove onto the site in 2004, the two submerged structures had already been subjected to a little over 62 years of immersion in salt water. Corrosion had been, and remained, active in several notable places, but the overall condition of the aircraft was exceptional considering the environment. Engineers that assisted in the project frequently noted how much strength and integrity the structures appeared to hold. Part of the challenge of assessing the level of preservation for any aircraft is the number of different types of metals that were incorporated into the aircraft. For the Aluminum and steel categories, there are approximately twenty to twenty-five additional variations of metal created through alloying or plating. Finishing processes also change the material properties of a metal, which in turn alters its corrosion resistance. The TBD-1 metals were cast and wrought, heat treated and cold worked, annealed, and quenched by different mediums.

On site, observers specifically searched for visual evidence of active corrosion of the structural metals.

1. Signs of galvanic action, or dissimilar metal contact.
2. Signs of stress corrosion (especially on extruded pieces).
3. Signs of pitting corrosion or copper deposition.
4. Signs of accelerated corrosion due to differential aeration cells, including crevice corrosion.

Visual observations and documentation of metals deterioration has been undertaken on each trip through written descriptions and a photographic record. This has allowed for monitoring and comparison analysis over the duration of the project. In addition, corrosion potentials (E_{corr}) have been taken on several trips and one trip employed ultrasound to determine the overall thickness of the aircraft skin. Disarticulated samples from each aircraft were collected during the 2006 site visit and exported under permit to laboratories at Texas A&M University, College Station, TX for metallographic analysis and to determine if microbial influenced corrosion could be playing a role in the deterioration of the metal structure.

CONCLUSIONS

Both TBD-1 Devastators in Jaluit Lagoon are historic and hold considerable archaeological information. Information that can be found nowhere else, but on these two sites. Galvanic corrosion and differential aeration cells resulting in crevice corrosion, and the growth of soft corals and sponges across the surfaces of the planes, which is presumed to be forming new differential aeration cells, are beginning to accelerate the deterioration rate of both planes. Since it is closer to the surface and affixed to a coral head, BuNo. 0298's assimilation into the environment is far more extensive and coral growth on top of the plane's engine and pilot's cockpit is flourishing. Because removing it from this environment would undoubtedly cause irrevocable harm to the ecosystem, and since BuNo. 1515 offers additional information not available in the original drawings or blueprints of the plane type, the Devastator Project scientific team has moved forward with developing plans to recover the deeper wreck. The engineering team is currently working out some final aspects of the initial lift off the bottom. Considerable logistical planning remains, but when completed the proposal will be submitted to the US Navy History and Heritage Command, Underwater Archaeology Branch for approval and permission to move forward. The Devastator Project team is likewise consulting regularly with the RMI Historic Preservation Office as well as the local and traditional leaders of Jaluit Atoll, working together to determine the best path to protect and preserve these unique cultural heritage resources.

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