Expedient Field Modifications of a WWII Amphibious Landing Craft in Saipan

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Abstract

The June 1944 the United States of America's (USA) invasion of Saipan was the largest amphibious invasion of a Pacific island up to that time. Specialized craft constructed specifically for this invasion were utilized in order to deliver American forces across Saipan's fringing reefs and lagoons to shore with relative safety. Although these amphibious craft, known as Landing Vehicles Tracked (LVTs), were designed for this particular incursion, the troops operating these vehicles found it necessary to modify their vessels to better suit anticipated combat needs. Modifications of this sort have been termed field expedient armor modifications (Boal 2006). Field expedient armor modifications to LVTs influenced future production designs following the launch of the first model and can be traced through archaeological and historical records. These modifications are demonstrated in an LVT (A)-4 archaeologically recorded in Saipan and are testament to the ingenuity and survival instincts of the crews that operated these machines.

Introduction

This study focuses on a LVT(A)-4 (Figure 1) located in Tanapag Lagoon, Saipan, Commonwealth of the Northern Mariana Islands (CMNI). The aim of this paper is to further understand the significance of amphibious vehicles used during World War II (WWII), particularly in relation to the Battle of Saipan. The advent of amphibious watercraft such as the LVT for use during WWII is directly responsible for saving numerous USA lives. The ability to drive invasion forces through the water, over shallow reefs and deliver them on shore prevented considerable causalities, as it prohibited the invasion force from having to wade hundreds and sometimes thousands of meters across lagoons under heavy enemy fire (Bailey 1986). Unfortunately, these machines have been nearly forgotten through time and have taken a back seat to other technology such as the planes and tanks of the era.

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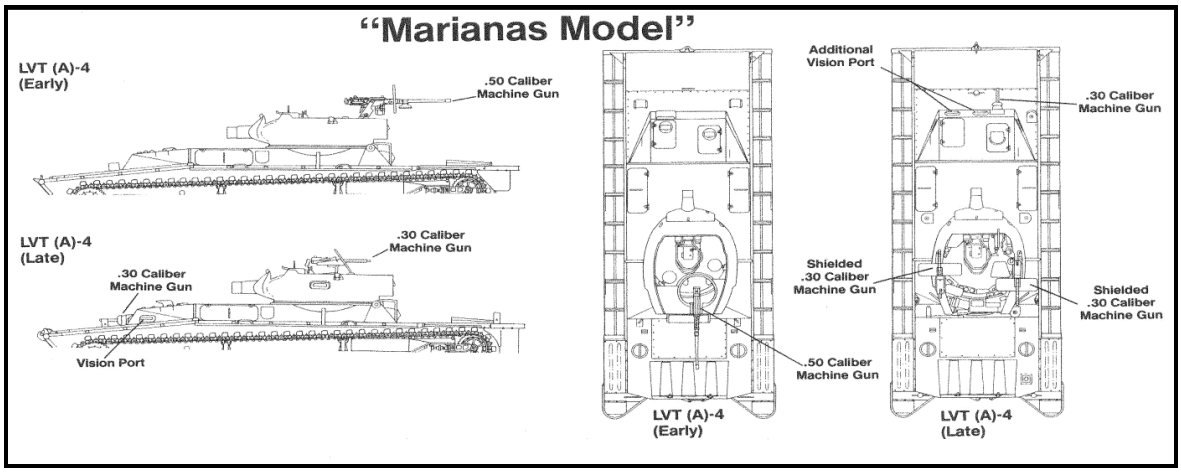

Figure 1. Comparison of an early and late production model LVT(A)-4 (Mesko 1993).

The LVT, also known as the amphibious tractor or Amtrac, was the workhorse for USA forces during WWII in the Pacific region. Their unique ability to travel both in and out of the water provided them an advantage other vehicles lacked. LVTs were called upon to perform a wide array of tasks including delivering assault troops to the beach, evacuating wounded, delivering supplies, and acting as mobile command posts and mobile weapons platforms (Croizat 1953).

The LVT

The acronym LVT and name Amtrac are general terms referring to an amphibious vehicle that is propelled on land and in the water by a tracked propulsion system. Following the military designation LVT is a number, which signifies the production model. An "A" in parenthesis signifies that the LVT is an armored version. The title "armored" can refer to the fact that the LVT in question is covered in armored plates for assault purposes or that it is equipped to operate as a mobile artillery unit. The artillery versions are easily recognizable because they have a large caliber weapon mounted on the top.

The LVT was one of the first true amphibious vehicles. These vehicles have a single engine propulsion system consisting of tracks mounted on both the port and starboard sides. The vessel's tracks mount cleats known as grousers (Figure 2). These grousers act as paddles in order to propel the vehicle through the water and provide traction while crossing reef flats and shoreline terrain (United States Marine Corps Air-Ground Museum 1997). LVTs were constructed of steel and kept afloat by air contained in pontoons on both sides of the vehicle.

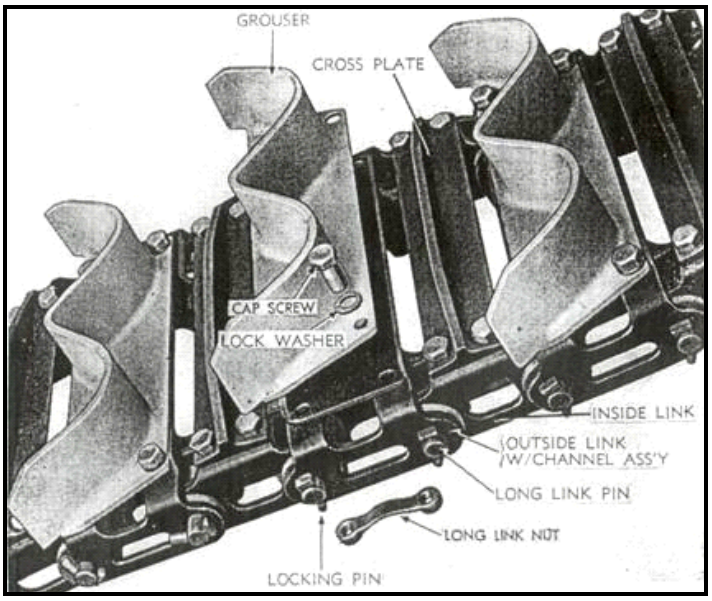

Figure 2. LVT grouser assembly (Department of the Army 1951).

Carrying capacity and the intended mission of the LVT changed through time and design modifications reflect these changes in LVT manufacture. The versatility of the LVT allowed for the easy adaptation of a wide range of roles in amphibious warfare. The first military production model is known as the LVT-1, which saw its first combat action during the Solomon Islands campaign in 1943 (Croizat 1999). LVTs were intended to only carry cargo to the landing zone once the Marines secured a beachhead; however, because the fringing reef was too shallow for the traditional landing craft to deliver the Marines close to shore, LVTs were used to ferry the invading forces to the shoreline (Croizat 1999). Thus began the LVT's life as a troop carrier and assault craft. This change in its role affected military doctrine for the remainder of WWII in the Pacific region.

Military leaders recognized the potential for the implementation of the LVT as an amphibious assault vehicle from its first combat use (Bailey 1986). Invasion forces added additional machine guns to their existing LVTs and placed orders for more LVTs with pre-mounted weapons (Bailey 1986). As the war continued on, it became apparent additional modifications were needed and the production of diverse special purpose designs commenced. As a result, a definite seriation of LVT design exists from cargo carrier (LVT-1) to armored troop delivery systems (LVT (A)-2 and LVT-4 [Armored Cab]) to armored artillery platforms (LVT [A]-1 and LVT [A]-4, also known as Amphibious Tanks or Amtanks).

Interestingly, the people who operated these machines devised ways to improve the LVT with field expedient armor modifications in order to prolong not only their own lives but also the life of their LVTs (Baker 2004). Boal (2006: 5) defines "field expedient armor modifications" as changes made to a vehicle after it has left the production facilities. These improvisations have been documented by historians and are observable on the LVT (A)-4 site in Saipan. Further, these

modifications are the specific focus of this paper in relation to individual and troop action as demonstrated in the archaeological record.

Approach

Utilizing a holistic approach to explore the use of LVT (A)-4s in the Battle of Saipan, archaeologists set out to identify processes that may have affected this site in order to determine the conditions under which it formed. Muckelroy pioneered site process evaluation for maritime archaeological sites in his book *Maritime Archaeology* (1978). Since that time others have expanded the method of process evaluation. Ward, Larcomb and Veth. (1999) expand on Mulckelroy's site formation process model by including environmental, chemical and biological factors. Richards (2002) identifies site signatures that provide researchers with clues to the types of salvage, discard, reuse, scrapping and abandonment behaviors that may have occurred at a site. Gibbs (2006) identifies the importance of the relationships between documentary, archaeological and oral data sets in order to recognize discrepancies. Jung (2009) recognizes WWII wreck site patterns in determining site formation processes on sunken aircraft.

Process analysis has not been used previously to evaluate an archaeological site involving an amphibious vehicle. Thus, there is no model for what a salvaged versus un-salvaged LVT should look like, or the signature of a site lost in battle opposed to one deposited in the water post-battle. The amphibious nature of LVTs yields the possibility that the craft my have been catastrophically lost on shore and then discarded in the water. Process analysis has been particularly useful to maritime archaeologists studying historic period sites who often use this method for the purpose of determining site formation where historic records are conflicting or non-existent (Gibbs 2006; Jung 2009).

Understanding the various cultural and environmental processes that may have influenced the formation of this archaeological site is key to determining the reason for its location. Site signatures presented in the work of Muckelroy, Ward *et al*., Richards, Gibbs and Jung were used to determine the nature of the site and the extent of salvage efforts conducted on it. Gibbs's process model is also useful in relation to pre-impact questions of modification and behavior. The works of Muckelroy, Ward, Richards, Gibbs and Jung as they apply to loss and salvage were used to create a process model (Figure 3) for better understanding the site formation of amphibious vessels.

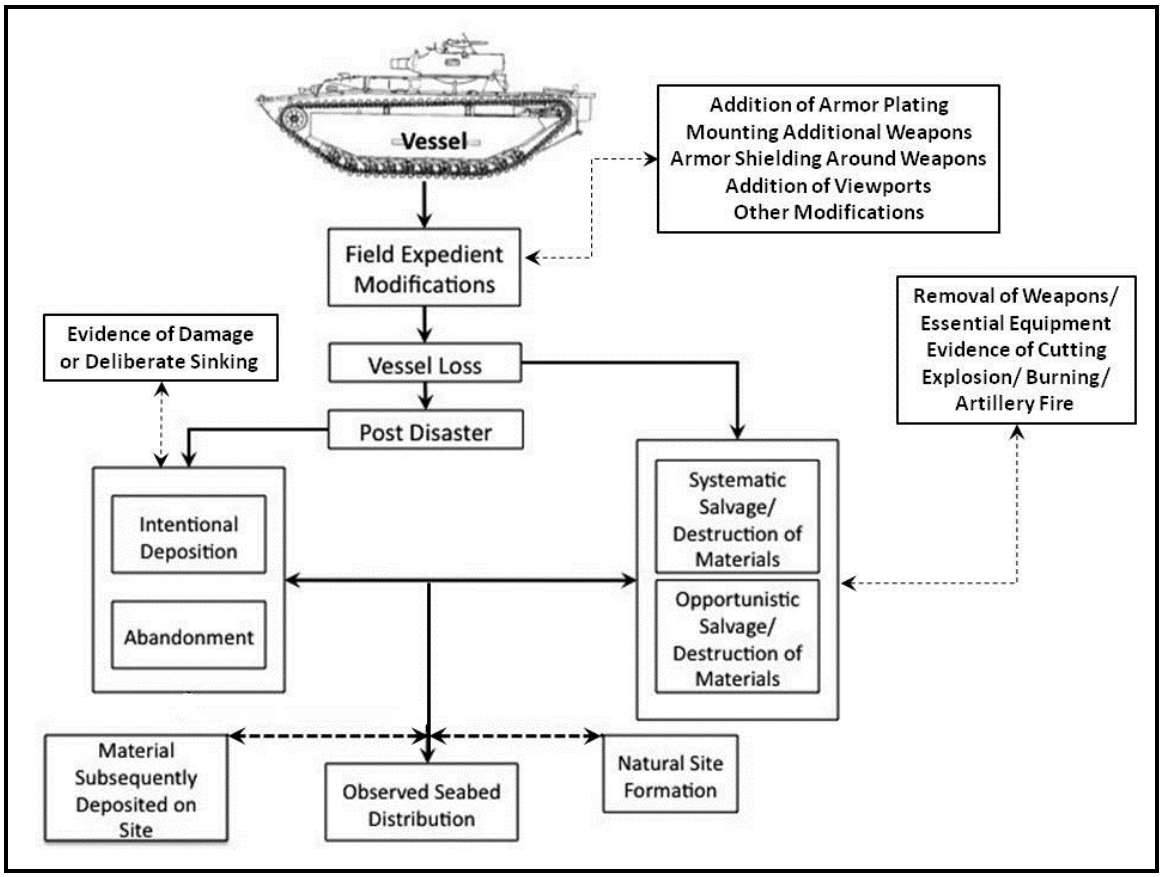

Figure 3. Process model for Evaluating LVT Sites (Arnold 2010).

Historic Research

In-depth historical research was conducted concerning WWII in the Pacific islands campaign, and more specifically, amphibious warfare and the use of LVTs. Primary documents concerning the Battle of Saipan describe in detail how forces fought the battle and the terrain troops encountered. Troop movements and obstacles that hindered them are described in numerous historic accounts and in some cases are supplemented by detailed maps (Headquarters Fourth Marine Division 1944; Gugeler 1945; Bartholomees 1948; Adams 1950; Bailey 1976; Croizat 1992). These maps were used to demonstrate the dynamics of the battlefield and how terrain influenced the use of LVTs. This information was used to evaluate possible battle locations near the LVT (A)-4 site in Tanapag Lagoon.

Perhaps the most important primary source for understanding potential processes that may have affected this site is the Department of the Army's *Technical Manual for LVT (A)-4s* (1951). This manual provides instructions for the LVT's operation, maintenance, armament and storage, as well as its destruction to prevent it falling into the hands of an enemy. Of particular interest are guidelines for the evacuation and/or destruction of essential parts once an LVT is disabled in combat. After all usable items have been evacuated from the

vessel these procedures go on to include descriptions of how to dispose of the LVT by means of sinking, burning, demolition and gunfire.

Works by Alfred Bailey (1976) and Dale Barker (2004) give firsthand accounts of LVT crews conducting field expedient armor modifications to LVTs as preparations before engaging in battles in the Gilbert Islands, the Marshall Islands, and the Mariana Islands. This information facilitated creation of a list of items to be investigated on the Tanapag Lagoon LVT (A)-4.

Pre-Impact Threats, Strategies and Assessments As Identified in the Historic Record

In order to clearly demonstrate the need for and use of amphibious landing craft in the Battle of Saipan, it is necessary to first identify the pre-impact threats, strategies and assessments of USA forces. The USA invaded Saipan from the western side of the island (Ministry of Defence 1995), and in doing so positioned itself to intercept Japanese counter attacks and resupply efforts. This decision was based on intelligence reports which gave a good indication that the Japanese fleet was near the Philippines, west of Saipan (Ministry of Defence 1995). Additionally, the USA learned through aerial reconnaissance that Saipan's western beaches were not as heavily fortified as the rest of the island (Goldberg 2007). Earlier air and naval bombardments eliminated the threat from key areas on the western side of Saipan, such as aircraft standing by on airstrips and large caliber weapons located on Managaha Island. However, the beaches chosen for the invasion possessed a fringing reef roughly 1500 meters offshore of the chosen landing sites. This reef was far too shallow for traditional landing boats to cross and would have left the invading troops completely exposed while walking toward the beach under concentrated enemy fire.

The fringing reef and lagoon were not the only challenging features of the terrain. The western beaches contained Japanese fortifications in the form of reinforced concrete bunkers containing artillery and machine guns, as well as dense vegetation further inland. Additionally, range markers were located throughout the lagoon allowing Japanese artillery and mortar crews the ability to rapidly and effectively fire on the arriving USA forces (Adams 1950; Goldberg 2007). These factors obviously influenced the decision to modify LVTs by means of field expedient modifications.

Overcoming Threats and Creating Strategies through Technology and Modification

The Landing Vehicle Tracked (Armored)-4 (LVT [A]-4) was designed specifically to destroy Japanese reinforced bunkers in response to the pre-impact threat phase of planning the operation (Mesko 1993). The USA air and naval bombardment ceased once the landing vehicles neared the beach. The LVT (A)-4s provided the only close-in, large calibre weapons support for troops arriving

behind them (Barker 2004). These amphibious tanks led the way for the waves of landing forces coming ashore.

These vehicles had the job of being the first in the line of enemy fire, it is no wonder that the crews operating them chose to modify their vehicles for better protection. Crews learned from previous battles that LVT armor is relatively thin. However, the manufacturer never corrected this weakness due to buoyancy requirements at sea and speed requirements on land set forth by the USA Department of the Navy. It is noted historically that the LVT crews regularly added sheets of steel boilerplate to the bows of their craft because the armor was so thin that coral would often puncture it while crossing shallow reefs (Barker 2004; Mesko 2004). Also documented is the fact that the armor was incapable of preventing small caliber rounds from penetrating to the interior of the vehicle (Bailey 1976). This fact is acknowledged by the adoption of a policy to carry wooden plugs for the purpose of plugging any holes while the vessel was underway (Bailey 1976). The addition of sandbags across the deck added a layer of extra protection for the men inside (Barker 2004). Vehicle modifications were not just limited to the exterior; some crews covered their radios with ponchos and rolled condoms over the microphones as makeshift waterproofing (Barker 2004).

Archaeological Investigations

The LVT(A)-4 site in Tanapag Lagoon was originaly noted by Southeastern Archaeological Research, Inc. (SEARCH) in a survey report in 2008 (Burns 2008). No further archaeological investigation was conducted by SEARCH beyond positive target identification. In July 2009 Students and staff from Flinders University conducted initial site investigations on the LVT (A)-4 to assess the feasibility of including it in a WWII maritime heritage trail. This work was conducted in partnership with not-for-profit organization Ships of Exploration and Discovery (SHIPS), to which the USA National Park Service provided funding through a grant under the American Battlefield Protection Program. Saipan's Historic Preservation Office (HPO), Coastal Resource Management (CRM), and Department of Environmental Quality (DEQ) provided support in the form of survey equipment, boats and personnel. The remainder of equipment and staff were provided through Flinders University.

In February 2010 students and staff from Flinders University and SHIPS conducted further investigations at the site. The purpose of this survey was to record the site in detail in order to complete an accurate site plan (Figure 4), record field expedient modifications and possible evidence of salvage as well as gather any additional data that may yield clues as to why this LVT is in its present location. In order to expedite this process, scaled drawings of a LVT (A)-4 were scanned from *World War II AFV Plans: American Armored Fighting Vehicles* (Bradford 2007). The existing portions of the site were then traced from the images on to Mylar™ and attached to slates so divers could more easily and accurately record what they were seeing. This information was intended to not only record the site in its present condition but also aid with monitoring changes

to the site and its environment in the future. No cultural material was removed or disturbed.

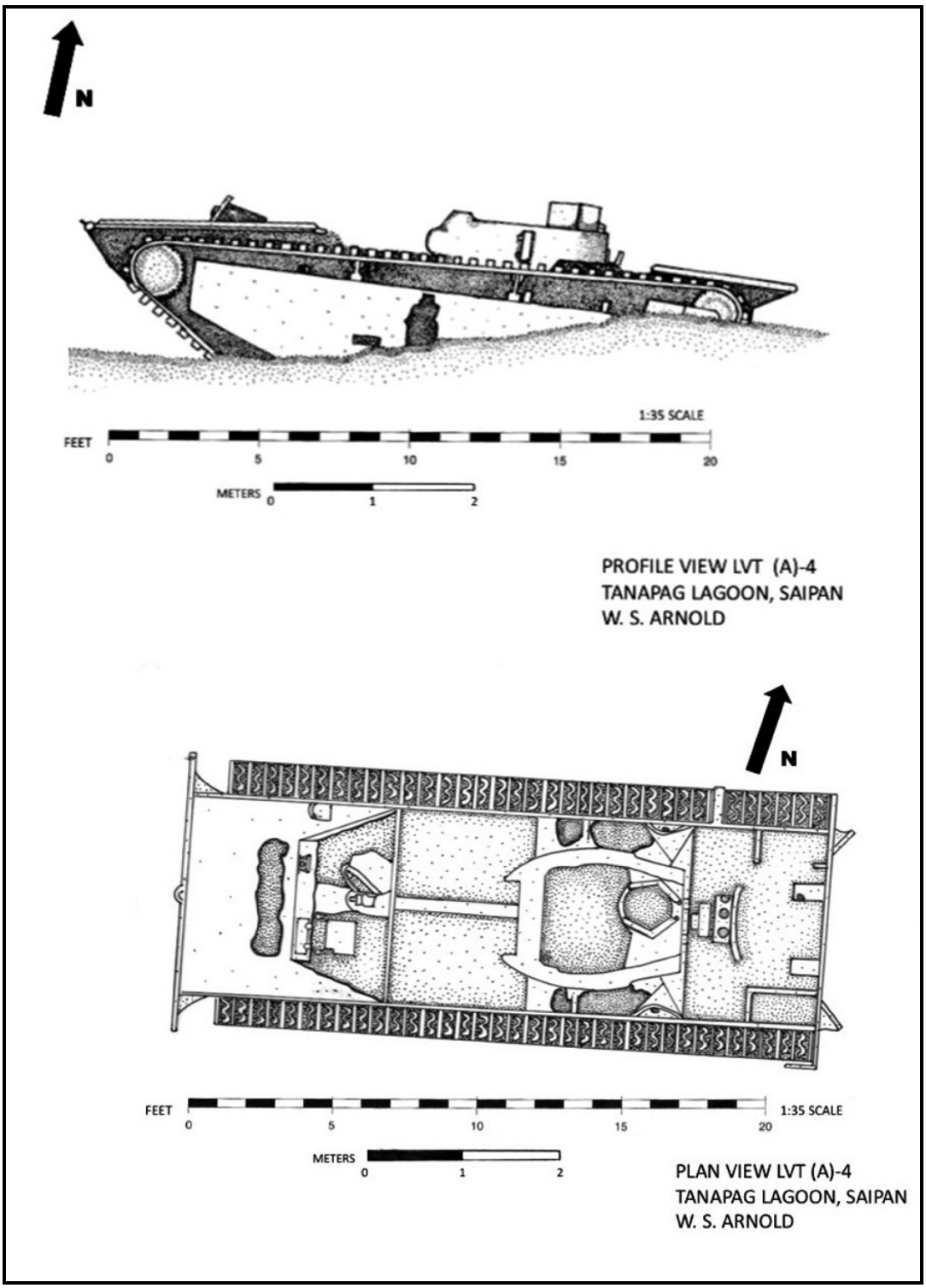

Figure 4. Profile and plan view of LVT (A)-4 site. (Arnold 2010).

The LVT (A)-4 is resting at a slight angle in a depth of between 0.6 meters (m) and 3.1m of water on a sandy area between patch reefs in Tanapag Harbour, Saipan. The lower superstructure is mostly intact however the majority of exterior armor plating and superstructure is missing from the upper portion of the craft around the turret. Also missing are the armor track covers and the armor covering of the cab as well as some engine components. Other notable damage includes large, jagged holes in the bow armor and in the ballast area (pontoons) on both sides of the LVT (A)-4. Researchers also noted that modifications were made to this vessel.

Archaeological Evidence of Field Expedient Armor Modifications

It is reasonable to assume that the crews operating these machines were the first to notice design flaws and set about modifying the LVTs in order to compensate for the lack of armor and armament prior to the amphibious assault on Saipan. These features undoubtedly influenced the design of later production models of LVT (A)-4s.

In-depth analysis revealed this LVT possessed many field expedient armor modifications. Both the upper and lower bow had been reinforced with 3/8 inch(inch?) boilerplate. A 0.30 calibre machine gun was added to the cabin at the radio operator's seat. A steel shield had been welded around the commander's turret and a pintle machine gun mount was added to the port side of the turret.

The modifications of this particular LVT are significant because they reflect the mindset of individuals responding to pre-impact threat processes during WWII. The crews of these vehicles were confronted with difficult missions and design limitations that are reflected in the archaeological record. Extensive field expedient armor modifications for the sake of self-preservation were deemed necessary by LVT crews in order to accomplish the many tasks they faced.

Conclusion

Following the process model established by Muckelroy (1978) and Richards (2002), the archaeological signature of this site demonstrates that it has been heavily salvaged. There are no loose materials in or around the site and no ammunition of any kind (spent or unspent) was located. The site appears to have been subjected to primary salvage due to the lack of howitzer, machine guns, turret elevation machinery, optical sights, electronic devices and weapons as outlined in the USA Army's technical manual for LVTs. It is unclear how much, if any, secondary salvage has occurred. To date no historic records have been located that tie this site to any actions of use, disposal or loss. It is reasonable to assume that this LVT was damaged in battle; however the lack of any debris field(s) suggests that this LVT (A)-4 was not damaged at its current location but discarded after salvage efforts occurred elsewhere.

The 1951 Army technical manual (USA Department of the Army 1951) describing the proper disposal of LVTs appears to have been followed. All sensitive equipment and weapons were removed and the vessel was sunk. Although this manual is dated after WWII there was likely to have been an earlier version. The inability to acquire an LVT technical manual preceding 1951 makes it unclear if the disposal methods were set forth prior to, or established as a result of, the Battle of Saipan.

The study of field expedient armor modifications, as they relate to the process of pre-impact threat assessments, presents the basis for understanding the degree of modification standardization between units and services, by both the USA and other nations. These modifications have provided insight into the mindset of those operating LVTs and have illustrated a direct influence on the seriation of later production LVT models.

A process model for LVT sites enables researchers to quickly and more accurately interpret LVT site formation). Further study of LVT sites will allow archaeologists to develop a site signature for both the catastrophic loss and the deliberate disposal of LVTs.

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