Grupo de Investigación

Historia Militar

American Pontoon Lighterage at Normandy

Dr. Frank A. Blazich, Jr. – National Museum of American History

The humble steel boxes known as the T-series of U.S. Navy landing pontoons provided a critical role in the logistical component of Operation Neptune and Operation Overlord. Elegantly simple in form and function, the U.S. Navy's Bureau of Yards and Docks (BuDocks) developed the pontoons on the eve of American entry into World War II. In coordination with the U.S. Army, the Navy's Naval Construction Force – the renowned Seabees – managed to develop a series of innovative pontoon ferries, tugs, and causeways for the Neptune landings and aftermath to ensure a deluge of vehicles and supplies would be landed on the American invasion beaches along the Normandy coast and secure a lodgment in France for the liberation of Western Europe.

T-Series Navy Landing Pontoons

The origins of the pontoons can be traced to U.S. Navy war planning in the 1930s. Planners and strategists working on the "Orange" plan for war with Japan grappled with the size of the Pacific and recognized the need to seize and develop advanced bases to resupply and repair the fleet and secure logistical and communication lines. The Naval War Plans Division tasked the Bureau of Yards and Docks (BuDocks) to develop the procedures and technologies needed for the development of advanced fixed and mobile bases.[1]

BuDocks confronted an array of unresolved questions ranging from personnel to technologies to solve the primary issue: building a naval base in a remote, undeveloped location. From 1932 to 1939, the bureau began contemplating the use of standardized lighterage pontoon units, for the movement of cargo between vessels of differing sizes, for the advanced bases. Around July 1940, Captain John N. Laycock, Civil Engineer Corps, began experimenting with a model constructed from empty cigar boxes to demonstrate the feasibility of connecting individual pontoons using continuous angles to create a well-diaphragmed sectional box girder. Laycock further designed the fasteners to assemble the pontoons to form the

contiguous angles. With the models and designs for the pontoons and the fasteners, deemed "jewelry," complete by December 1940, BuDocks finalized blueprints for the pontoons and contracted in February 1941 for fabrication of two pontoon designs for testing and evaluation.

Two designs were assembled and proved successful in testing in May 1941, entering production thereafter. The five-by-seven-by-five-foot T6 pontoon weighed one ton with various connections adding an additional 800 pounds. They could withstand internal pressures of 25 pounds per square inch and individually had a net buoyancy capacity of about four tons with an ultimate deck load of 25 tons on any 20 inches square. Another variant, the T7, measured seven-by-seven-by-five feet with a curved section at one end of the pontoon for use as a prow on transport barges. By design, the pontoons could be assembled into various floating structures, limited largely by imagination and resources.[2]

[IMAGES 1 and 2]

Causeways and Rhino Ferries

During the Quadrant Conference between American, British, and Canadian representatives in August 1943, civilian and military leaders approved an outline plan from British Lieutenant General Frederick E. Morgan, Chief of Staff to the Supreme Allied Commander (COSSAC), for Operation Overlord, a cross-channel invasion for the coast of Normandy east of the Cotentin Peninsula in France. Discussions at Quadrant touched upon the obvious problem of logistics for this operation. The objective of the naval landings, codenamed Neptune, would carry out an operation from the United Kingdom to secure a lodgement on the European continent, with sufficient port facilities to maintain a force of twenty-six to thirty divisions, augmented by the addition of three to five divisions a month.[3]

Planners had to develop the means to out-supply the German forces fighting to push the invasion force back into the sea. Overlord's overall success required facilities able to handle 6,000 tons of supplies per day by 10-11 June, then 9,000 tons daily by 16-18 June, rising to 12,000 tons by 22-24 June. Recognizing the need for port facilities, but also the challenge of

seizing the port at Cherbourg, British planners hatched on the scheme of building an artificial harbor able to discharge approximately 6,000 tons daily.[4]

COSSAC needed two such harbors, codenamed Mulberry, to supply and reinforce the allied forces at the five invasion beaches: Utah, Omaha, Gold, Juno, and Sword. By 18 June, Mulberry A off the American beach Omaha near St. Laurant-sur-Mer, and Mulberry B off the British Gold beach near Arromanches, could handle the daily landing of 5,000 and 7,000 tons of materiel, respectively. Before then, planners foresaw Omaha and Utah beaches handling 10,200 tons and 5,700 tons of supplies daily by 16 June, respectively. Until the Mulberries were fully active, another method of landing of supplies on the Normandy invasion beaches had to be found. Estimates of the necessary supplies for the first 90 days numbered 12,000 tons of supplies and approximately 2,500 vehicles daily.[5]

Coastal geography complicated landing supplies on the beaches. The Bay of the Seine featured flat sandy beaches, with gentle, nearly flat slopes with a gradient of up to 1:150 feet and a tidal range of twenty-one feet, with a high-water duration of three hours and a tidal current of three knots. At low tide with water at a depth of twelve to eighteen feet, a ship would find itself grounded over half a mile from shore. Liberty ships requiring water depths of at least twenty-eight feet would find themselves grounding at 4,000 feet from shore. Landing Ship, Tanks (LSTs), seemed the logical choice to land supplies but the Normandy tidal range, coupled with long, flat beaches risked valuable ships being stranded and “dried out” for hours, large inviting targets vulnerable to enemy artillery or air attack.[6]

Thankfully a solution already existed. Allied planners encountered a similar problem with flat, gradually sloping beaches while planning for Operation Husky, the invasion of Sicily. Through the combined effort of Laycock and Captain Thomas A. Hussey, Royal Navy, Seabees and Civil Engineer Corps personnel designed and constructed a floating pontoon causeway, measuring 2x30 pontoons (14 feet by 175 feet). By using two causeways and overlapping them akin to a slide rule, a maximum length of 325 feet could be safely constructed and thus bridge

the ship to shore problem. Testing off Rhode Island in March 1943 proved the viability of the concept. Causeways could be mated with an LST in only seven minutes to allow vehicles to drive ashore dry. In the early morning hours of July 10, 1943, the amphibious invasion of Sicily commenced and despite five-foot seas, the causeways worked brilliantly unloading LSTs. In 23 days of round-the-clock shifts members of the Naval Construction Force, the famed Seabees, unloaded over 10,000 vehicles using the causeways.[7]

[IMAGE 3 and 4]

For Normandy, these pontoon causeways developed for Sicily provided a solution to a problem. Planners needed a means to manage the supply build-up from D-Day to D+12 when the Mulberries would be finished. Hussey envisioned a large self-propelled shallow draft barge with a ramp to unload vehicles at one end, and a ramp at the other to accept an LST ramp, able to carry half the load of an LST in one trip. Using the basic causeway structure, Laycock created Hussey's barge by merging three causeways together to create a 6x30 pontoon barge measuring 176 feet long by 43 feet wide. The barge could move 500 tons of cargo with a draft of four feet and freeboard of one foot. Able to carry thirty to forty vehicles, the barge was large enough to unload an entire LST in two trips. Tests with a prototype barge in Davisville, Rhode Island in August 1943 confirmed the barge would meet the planners' needs. During the tests of the prototype, a naval aviator flying overhead spied the barge with its outboard motor haunches at one end and the narrow, ramp end on the opposite. Bemused, the aviator referred to the contraption as resembling a rhinoceros. The "rhino ferry" was thus christened.[8]

[IMAGE 5]

Pontoon Build-up for Overlord

With the basic design for the rhino approved, efforts to refine the design shifted from Rhode Island to Falmouth, England. Seabees of the 81st Naval Construction Battalion (NCB) started assembling pontoon strings and Rhino Ferry No. 1 (RHF-1), launched on December 7. The Navy's premier pontoon unit, Construction Battalion Detachment (CBD) 1006, arrived in

England from the Mediterranean to refine the ferry into a craft suitable for the Overlord invasion. Tests and trial operations with the ferry in late December 1943 and early January 1944 found fault with several design aspects resulting in a few changes producing a design ready for operational use.[9]

Crews for the rhino ferries came from among Seabees of the 28th, 81st, and 111th NCBs. The Americans chose shore locations resembling the conditions at Omaha and Utah beaches. Seabees manhandled the rhinos at Fowey, Falmouth, Dartmouth, Torquay, and Plymouth while others beached and repositioned causeways at Par Sands and Fowey. The Navy provided LSTs and the Army's 29th Infantry Division loaned vehicles for training. Due to the priority placed on pontoon assembly, however, most American crews received only two to three days of training on the ferries on the relatively quiet waters at Dartmouth.[10]

As work progressed on the ferries and tugs, engineers at Supreme Headquarters Allied Expeditionary Force (SHAEF) recommended installation of pontoon causeways on the invasion beaches. These would provide another means to bridge the ship-to-shore offloading requirements until the Mulberries were operational, able to handle half of the daily total of ferry cargo discharged. From conception, Laycock's pontoons had incorporated fittings to flood and drain the boxes for use in sectional drydocks. Leveraging the 2x30 pontoon structure or "string" as the base element, the causeways would be assembled and sunk in place to extend from the high-water line to just beyond the line of minimum low water.

A total of fourteen strings would be connected end to end, producing a 2,450-foot-long pontoon roadway. Each of the American invasion beaches would have two of these causeways installed to serve smaller vessels, predominantly the LCT. These craft could handle four to five tanks or heavy trucks in an open cargo bay and featured large bow doors and a ramp for the vehicles to drive out from the cargo bay onto the beach. For the latter, engineers mounted 4x12 pontoon blisters to the causeway, spaced intermittently from 250-350 feet apart along both sides. This arrangement ensured one blister would always be available for unloading LCTs

regardless of the tidal conditions. The causeway pioneers of Sicily and Salerno, CBD 1006, would assemble and man the causeways which would allow un-waterproofed vehicles and men to come ashore with dry wheels and feet, 24 hours a day.[11]

On the eve of D-Day, the final assembly figures of rhino ferries and causeways came into view. For the Western Task Force assigned to land on Omaha and Utah, SHAEF planners soon issued orders for construction of fifty-six two-by-thirty causeway sections, thirty-two four-by-twelve blisters, twelve two-by-seven pontoon causeway tugs, and twelve warping tugs. A total of 31 rhino ferries would serve Omaha and Utah, with five rhinos held in reserve. For the Western Task Force landings, the U.S. Navy Task Force 127 and the 25th NCR organized the pontoon barges and causeways to arrive between D-Day to 9 June. The first tide would deliver eight rhinos to Omaha and four to Utah, with the second tide bringing eleven and eight rhinos to each beach, respectively. Seabees of the 111th NCB manned the Omaha force rhinos; Seabees of the 81st NCB manned the Utah rhinos. Seabees of the CBD 1006 would man the causeways, blisters, and tugs for both beaches. The causeway sections, blisters, tugs, and warping tugs would begin to arrive on 7 June with installation commencing on the causeways no later than 9 June.[12]

Neptune and Beyond

By the morning hours of 5 June, the vast armada was on the move. With four-foot seas on pontoon ferries enjoying only two feet of freeboard, the Seabees aboard the craft endured miserable conditions. Some Seabees opened individual pontoons to find some shelter inside while others made fires on the ferry decks to heat rations or used acetylene torches to make coffee. The towing of the ferries and tugs occurred without serious incidents, although some of the craft broke free due to insufficient one and a half-inch wire rope for tow lines. At 0530 on D-Day, the rhino ferries and tugs arrived off Omaha and cast off the lines to commence marrying up with the LSTs. Heavy seas with six-foot wave crests complicated the “marriage arrangements” and some ferries lost their timber knee braces. Once loaded, the five ferries

moved to the beach twelve miles distant between 0700 and 0800. Force U's rhinos arrived off Utah at 0300. Rough seas resulted in only four of the five rhinos mating with the LSTs, which then headed to the beach ten miles distant.[13]

[IMAGES 6, 7, and 8]

Combat conditions on the invasion beaches varied considerably and affected initial rhino landings. At Omaha, the ferries received orders to stand off until beach obstacles were cleared, a tall order considering the horrible losses suffered by the Gap Assault Teams composed of trained Army Combat Engineers and Navy Combat Demolition Units tasked to destroy beach obstacles at low tide and open gaps in the defense before infantry and armor came ashore. Unaware of the order to stand by, RHF-10 chugged to the beachhead despite the risks and reached the shore at noon, managing to beach itself in a gap between the obstacles, although the ferry remained in place for the remainder of the day until mines astern of the rhino were removed. At Utah, the assault forces fortuitously landed half a mile south of their objectives in an area of weaker German defenses. The first of the four rhinos, RHF-21, landed at 1400 hours followed by the other three; by midnight all had unloaded a combined total of 175 vehicles.[14]

On 7 June with the beaches secure, the American rhino force expanded operations. Six additional rhinos arrived at Utah in the early hours and all eleven operated throughout the day despite enemy artillery fire and air attack. One attack by enemy aircraft destroyed one rhino tug and inflicted a dozen Seabee casualties. The fifteen additional rhinos arrived at Omaha and those held offshore on 6 June landed at 1130 and discharged cargoes of varying mass. One rhino from *LST-350* came ashore at Omaha with a load of twelve M4A1 Sherman medium tanks which left the ferry with a freeboard at places of mere inches. Two ferries struck mines, resulting in the destruction of one complete pontoon and the puncturing of adjacent units. One rhino tug struck a mine which blew its inboard engine on deck, knocking the vessel out of action. The rhino repair barges arrived off Utah and Omaha the same day, the latter effecting immediate repairs to the damaged craft, helping quickly place the ferries back in operation. The repair

barge crew off Omaha worked seventeen-hour days, repairing not only pontoons but practically every watercraft in need. Enemy fire began to range on the rhinos at Omaha inflicting several causalities to the Seabees. Undeterred, the rhino crews proved invaluable on the seventh by landing an urgently needed load of artillery pieces for the infantry divisions ashore.[15]

[IMAGE 9]

The rhino forces commenced 24-hour operations to meet the pressing supply demand. Omaha remained in shambles after the initial landings, with a total of only 4,581 tons of supplies landed by D+3, rather than the planned 8,000 tons daily. On June 7, Admiral Sir Bertram Ramsey, Naval Commander-in-Chief of the Allied Expeditionary Force, authorized the beaching of LSTs at all but Omaha. At Omaha with enemy artillery still a threat, the rhino ferries and smaller craft carried the bulk of material ashore until 10 June, when Ramsay authorized LSTs to beach themselves to offload. Rhinos thus provided the only means to land large numbers of vehicles at Omaha. Following Ramsay's order, the American and British rhinos switched from unloading LSTs to serving as lighters for MT ships. By 12 June, a total of 8,529 tons of cargo landed at Omaha, finally surpassing the planned daily tonnage.[16]

[IMAGES 10 and 11]

The pontoon causeways also began to arrive off the American beaches throughout 7 June. LSTs either towed two two-by-thirty causeway sections, or one section with a blister or a three-by-seven causeway tug. The causeway team at Omaha received orders to hold off installation until 9 June. When the Seabees commenced installation of Easterly Causeway No. 1, beach examinations revealed a shorter length would be sufficient for unloading, resulting in a doubled causeway width of 28 feet. From 11-17 June, Causeway No. 1 unloaded twelve LCTs, fourteen rhino ferries, and ninety-five miscellaneous craft totaling 746 vehicles, 3,500 tons of bulk cargo, and 8,695 personnel. Causeway No. 2 unloaded a further forty-nine LCTs and 139 smaller craft, delivering approximately 4,700 personnel ashore between 16-17 June.[17]

[IMAGES 11 and 12]

At Utah, CBD 1006's causeway detachment managed to install most of Easterly Causeway No. 1 on 8 June and complete it the following day. Pontoon causeway sections for the Westerly Causeway No. 2 arrived on 11 June and the entire causeway was completed in four days. At Utah, from 6-13 June, eighty-five percent of all vehicles and cargo came ashore thanks to Laycock's pontoons, either as ferries or causeways. Causeway crews managed to unload from 20,000 to 30,000 troops without interfering with the unloading of vehicles. For the latter, Seabees would occasionally handle the trucks themselves to make up for Army shortages of drivers.[18]

Construction of the massive mulberry harbors loomed in the water behind the causeway construction. Work began on both mulberries on 7 June, with the Seabees of the 25th NCR worked furiously to install Mulberry A off Omaha, an effort rewarded when, on 16 June, *LST-342* became the first vessel to unload at one of the specialized Lobnitz pierheads. A second pier came online at Mulberry A by 18 June, with 11 LSTs discharging vehicles at a rate of one every 1.6 minutes. By 18 June, the U.S. Navy had landed 116,000 tons of supplies, 41,000 vehicles, and 314,514 personnel at Omaha and Utah. Arguably at least a third, perhaps as much as a half of the supplies and vehicles came ashore via Laycock's pontoons.[19]

Then Mother Nature struck back. On 19 June, a Channel storm turned Omaha and Utah into steel junkyards. A surprisingly fierce summer gale brought winds of thirty knots and waves of eight to ten feet on the exposed beaches and six to eight feet inside the harbor shelter. The rhinos and tugs were beached at the onset of the rising gale and the warping tugs anchored in the harbor area. The storm continued for days until winds began to lessen in the afternoon and evening of 22 June. The morning light of 23 June revealed the extent of the damages to the artificial harbors. Mulberry A had all its piers damaged, two-thirds of the breakwater destroyed, and the blockship breakwater damaged.

At Mulberry A, 286 odd ships and landing craft littered the beach. All twenty rhinos at Omaha suffered damage when other craft and wreckage collided with the ferries, with damage

to the outboard pontoons, angles, and the outboard motors. Both causeways experienced considerable scouring and silting of sand along the pontoons, although Westerly Causeway No. 2 suffered no physical damage thanks to its location inside the Mulberry breakwaters. Easterly Causeway No. 1, however, suffered broken angles at the first and second blisters when floating breakwaters broke free and collided with the causeway. The storm drove the pontoon drydock positioned in the harbor up on the beach and damaged the pontoons and flooding pipes.

Despite the destruction, the Seabees kept working. By 23 June at Omaha the men managed to get seven rhinos and Westerly Causeway No. 2 back in service to commence unloading of troops and cargo. At Utah, Seabees counted 212 craft piled up on the beach by 22 June. The next day three rhinos resumed unloading MT ships. The two causeways suffered considerable damage from craft broaching and the underwater currents severely canted Easterly Causeway No. 1. After repairing the individual pontoon units, the Seabees refloated, relocated, and doubled the width of both causeways. Engineers removed the blisters, and the doubled width reduced the causeways in length to approximately 1,400 feet. The build-up of forces resumed unabated.[20]

The storm hampered but did not halt landing operations. From 8-15 July, the twenty rhinos at Omaha landed 4,500 vehicles and 20,000 tons of bulk cargo, while Utah reached a peak between 22-29 July of 3,500 vehicles ashore with its eleven rhinos. Army divisions continued to march ashore over the causeways which CBD 1006 faithfully maintained until 10 July when Army engineers took over all operation and maintenance. The ferries eventually shifted to other locations, with six towed to Cherbourg and twenty-one relocated to Le Havre where ten served as floats in the harbor development program. As the war moved across France from late summer into winter, additional port facilities came online, negating the need for Utah and Omaha. The former decommissioned on 31 October and the latter on 19 November 1944, with the causeways and all equipment moved to U.S. Naval Advance Bases at Le Havre and Cherbourg.[21]

Evaluation and Conclusion

Operation Overlord and the accompanying naval component, Operation Neptune, made ample use Navy landing pontoons. In the area of statistics, the pontoon numbers for use in Normandy are remarkable. Seabees used 22,806 pontoons – a dead weight of 35,218 tons and displacement of 91,225 tons – to assemble rhino ferries and tugs, warping tugs, miles of causeway section, repair and fuel barges, wharfs and drydocks. In the summary report of the 25th NCR, the rhino ferries at the two American beaches from June 6 – October 21 collectively transported 91,495 vehicles and 422,195 tons of bulk cargo, with a peak daily average during the invasion period of 2,382 vehicles and 8,084 tons of cargo. Although data for all four American causeways is not known, a report for Western Causeway No. 2 at Omaha, covering the period from July 22 to August 21, records the discharge of 84,101 personnel, 5,757 trucks and trailers, 44 towed guns and 23 motorcycles. A further 2,250 German prisoners of war also used this causeway on the way out of France to prison camps in England.[22]

Daily supply tonnage figures for the Western Task Force allows a statistical evaluation of the value of the pontoon structures. The figures, taken from a U.S. Army logistical study, indicate that the rhinos handled most of the supplies landed at Omaha until D+4 when LSTs began to beach themselves. A significant jump in the daily tonnage at Omaha next occurred on D+5 when Causeway No. 1 began unloading craft, likewise on D+9 with the completion of Causeway No. 2. Curiously, the tonnage figures at Omaha on June 23, the day after the Channel storm, are the highest of the entire operation to date despite the damage to Mulberry A. For Utah, the figures are less clear with fluctuating figures, although by D+9 with completion of Causeway No. 2 a notable uptick is obvious compared to D+8.[23]

A report of the 25th NCR provides cumulative figures from which averages can be computed for comparison. From the period of June 8-16, D+2 to D+10, the rhinos at Omaha safely delivered 14,749 vehicles and 33,901 tons of bulk cargo while at Utah the rhinos delivered 4,307 vehicles and 31,580 tons of bulk cargo. Compared to the Army figures, this

equates to rhinos accounting for 66 percent of the bulk cargo at Omaha and 86 percent at Utah. The figures seem exceptionally high considering the movement of supplies by the smaller Army DUKWs able to carry 5,000 pounds apiece, LCTs, and the role of the causeways. If the latter predominantly moved vehicles and personnel, then perhaps the figures are not too far removed from reality.[24]

Leadership found several faults with the untried pontoon craft at Normandy. Admiral Ramsay's report on Neptune declared the rhino performance disappointing in the open waters of the English Channel but noted with experience and modification the ferries might prove an effective method of ship to shore ferrying. Navy Captain W.D. Wright, Deputy Commander of Assault Force O-2, wrote to Admiral Ernest J. King, Chief of Naval Operations, about Neptune. Wright considered the rhinos too delicate for moderate surf and too unwieldy to maneuver among beach obstacles, but he praised their ease in repair and proven ability as the most successful ferry craft for unloading MT ships. He considered the sunken causeways a partial success for being dangerous in high tides for unloading LCTs which could be easily pushed over the causeways and damaged. In reply to Wright's assessment, Rear Admiral John L. Hall, Force O's commander, deemed the rhino ferry as an exceedingly valuable craft for transportation of vehicles from ship to shore.[25]

Problems aside, the pontoon structures provided American forces with a reliable logistical capability throughout the establishment of the invasion beaches. The rhino ferries – and especially the causeways – provided considerable return on investment for the offloading of supplies within the shelter of the mulberry breakwaters. The humble pontoons arguably endeared themselves to the thousands of soldiers who came ashore with dry feet at Omaha and Utah, marching across steel roadways onto France and victory. While the floating piers of the mulberries proved vulnerable to the Channel storm, the simplicity and flexibility of the sunken pontoon causeway meant they could be more quickly restored to operation on site. Although the pontoons exhibited a few faults, none inhibited their foundational purpose of moving personnel,

supplies, and vehicles ashore twenty-four hours a day to build up the lodgement on the continent. [IMAGE 14]

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