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Firing Point: Patrol Torpedo Boats during World War II

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Abstract

At the beginning of American involvement in the Second World War the United States Navy developed a new class of vessel that had a tremendous impact during World War II. This vessel was the Patrol Torpedo boat. Originally designed to conduct torpedo attacks on enemy surface vessels, the PT boat successfully adapted multiple roles in addition to being a torpedo attack craft. The versatility of the Patrol Torpedo boat during World War II serving in these various roles and as an element of the US Navy has not been recognized by recent scholarship. Using primary sources from the National Archives in College Park, Maryland, and secondary sources this paper demonstrates that the Patrol Torpedo boat was a weapon that exemplified economy of force. A small inexpensive naval vessel was able to replace larger ships and work with different elements of the fleet to deny the use of coastal waters to the enemy.

Patrol Torpedo boat, Motor Torpedo Boat, Torpedo Boat, Naval Warfare, World War II, Coastal Warfare, Higgins, Elco

1: Introduction

On the night of October 22/23, 1943, a division of Patrol Torpedo (PT) Boat Squadron 15 consisting of PTs 206, 212 and 216, under the command of Lieutenant E. A. DuBose departed Maddalena, Sardinia, for a patrol. Since the fall of Palermo in June 1943, the PT boats of Squadron 15 had been conducting offensive patrols of the Italian coastline to deny its use as a route of Axis resupply to the front lines in Italy. Defensive minefields and artillery protected coastal trade routes along southern France and western Italy, limiting the offensive capabilities of larger allied warships. PT boats proved immune to these defensive measures; their shallow draft allowed them to pass over minefields and their high speed proved time and time again that coastal artillery could not find its mark. Night after night PT boats worked past the passive and active defenses of the Italian coastline to engage with torpedoes heavily armed, and armored enemy convoys with great success. This night was no different.

Lieutenant DuBose led his division north to Bastia and began an eastward patrol to the Island of Elba. Even traveling at idling speed of 8-9 knots a PT boat made noise, sounding more like a hotrod than a navy ship. With the entire crew above decks exposed to the elements except for the machinist mate in the engine room, the constant *chug-chug* of the three Packard engines was enough to drown out the sound of most approaching ships or airplanes. PT boats relied on the vision of the gunners and radar to hunt in the dark of the night. At 0023 a radar contact was made at a distance of eight miles. The captains of the three boats gunned their engines, turning up a large white wake in the process, quickly making twenty knots in order to inspect the

contact. After closing the distance Lt. DuBose determined that the target was a 4,000-ton cargo ship escorted by four "E" or "R" boats.[1]

In order to avoid being silhouetted by the moon Lieutenant DuBose led his patrol astern of the convoy to attack it from the landside. As the boats paralleled their target, the crew prepared for the attack. The gunners manning the aft 20mm cannon and the two .50 caliber machineguns checked their weapons for action. Silence was everything in a torpedo attack, but, their guns were constantly trained and ready for instant action. The torpedoman on each boat turned cranks bringing the four torpedo tubes into firing position.[2] The radar operator in the lead boat plotted the southwest course and speed of the target ship using a mooring board, passing the information to Lieutenant DuBose who used the Mark 9 angle solver to determine what lead angle the torpedoes needed in order to hit the cargo ship.[3] With the lead angle determined, Lieutenant DuBose passed the information to the other boats of the division via radio. When the signal was given the boats would turn as a unit to their firing point, release their torpedoes and

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[1] E-boat was the British designation for the German motor torpedo boat called a fast boat (*Schnellboot).* These were fast torpedo firing craft developed by the German navy, capable of speeds in excess of forty-five knots, armed with 20mm cannon and ninety-five feet in length, E-boats were a very formidable escort for PT boats to contend with. The "R" boat was class of coastal gunboats, although lengths and armament varied widely, these craft were usually one-hundred feet long and armed with 20mm and 40mm cannon in addition to various small arms.

[2] The firing procedure for torpedoes on PT boats was much simpler than on larger ships. On early boats (boats built before fall of 1943) Mark 8 torpedoes were launched from tubes. Elco boats used gunpowder tubes and Higgins boats used compressed air. The firing process was the same for each type of boat. When torpedo action was expected the torpedo man went to each tube and turned a hand crank, training the head of the tube outboard to allow the firing torpedo to clear the deck. Torpedoes were preset before being loaded into the tubes to compensate for the angle of the tube. This meant that regardless of the angle of the tube, the torpedo was going to travel in the direction that the PT boat was facing. The launch controls were located next to the wheel on the bridge, allowing the captain to make the decision of when and how many torpedoes to launch. After the fall of 1943, the Mark 13 torpedo became available to PT boats. This changed the firing procedure because the Mark 13 was rolled off the side instead of being fired out of a tube. This change meant that the torpedo man had more work to do. When the order to fire a torpedo was given by the captain, the torpedo man had to pull a lanyard to start the torpedo engine and then pull a tall lever to drop the torpedo over the side. This process did not require special training meaning that an available gunner or ammo passer on deck could pull the lanyard and release the torpedo if the captain wanted to fire multiple torpedoes.

[3] A mooring board is used to determine the course and speed of a ship on paper. Once the speed and course is determined through radar readings, the captain of the PT boat uses the Mark 9 angle solver to determine the lead angle necessary for the torpedo to impact the moving target.

with any luck retire as a unit, undetected, never moving faster than idling speed. All of this preparation was done while idling at nine knots, less than nine-hundred yards from an escorted enemy convoy.

Within minutes of passing astern of the target convoy Lieutenant DuBose gave the order to turn and fire torpedoes. PTs 206, 216 and 212 turned as a unit and released two Mark 13 torpedoes each. Four torpedoes were seen to run hot and straight towards the target while two made erratic runs and disappeared into the night. As the cargo ship steamed ahead she received one torpedo hit on her bow, followed by a second large explosion that caused the ship to disintegrate. Completely undetected, the three PT boats turned away from the target and resumed their patrol. Lieutenant DuBose had executed a perfect torpedo attack. He used radar to track and approach the target undetected, made a successful torpedo attack and retired silently to continue the patrol.[4]

The next night, on the other side of the world along the shoreline of New Guinea, PT-193 under the command of Lieutenant (jg) C. R. Taylor was on its first patrol of the war in company with PT-132.[5] The boats were on a barge hunting patrol led by Lieutenant F. H. McAdoo in PT-132. After Guadalcanal was secured, the US Navy began its march up the Solomon Islands. PT boats first deployed to Guadalcanal in September 1942.[6] For almost a year PT boats engaged in nightly duels with Japanese destroyers that ran supplies down the Solomon Islands to the Imperial Japanese Army on Guadalcanal. Within a year the US Navy was able turn the tide

[4] Action Report No. 16, October 22/23, 1943, Written by Lt. Comdr. Sidney Barnes, commander Squadron 15. Records Relating to Naval Activity During World War II; WWII Action and Operational Reports; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.

[5] Action Report of PTs 132 and 193, night of 23/24 October 1943, written by Cyrus Taylor, Captain of PT-193, Squadron 12. Records Relating to Naval Activity During World War II; WWII Action and Operational Reports; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.

[6] Robert Bulkley, *At Close Quarters: PT Boats in the United States Navy* (Washington D.C.: United States Government Printing Press, 1962), 82.

against Japanese surface combatants. A string of naval victories in the upper Solomons during July and August of 1943 had cost the Japanese three destroyers and a light cruiser. Losses compelled the Japanese to reevaluate how island garrisons could be resupplied without risking valuable destroyers.

The Japanese answer to this problem was the barge. Barges were self-propelled expendable supply craft that traveled at night between islands. The supply barges varied greatly in length. However they were generally around sixty to seventy feet long and heavily armed with infantry machineguns, 20mm anti-aircraft cannon and even 40mm cannon. They were shallow draft, making them unsuitable as torpedo targets and they stayed close to the shoreline to avoid deeper draft warships. These craft became the primary means of supplying Japanese island garrisons and the primary target of PT boats in the Solomon's.[7] PT boats first encountered Japanese barges in July of 1943, off the coast of Rendova. Three months later in October, PTs 193 and 132 continued the nightly barge battles off the coast of New Guinea when they encountered four barges.

PTs 132 and 193 were in dangerous territory. Running blind because both boat's radar malfunctioned, the PTs had to rely on night vision to find targets. Often this meant stumbling into a whole group of Japanese barges before knowing they were there. Running a noisy boat close to enemy occupied beaches often invited fire from shore artillery and machineguns as well. In the lead, PT-132 was three-hundred yards from the shore when her captain sighted multiple barges about 1/2 mile away. What followed was a fierce melee between the PT patrol and Japanese barges. PT-132 increased speed to fifteen knots to close with the barges before they could escape or beach themselves. The Japanese barges and PT-132 opened up simultaneously on each other. Quickly closing to 50 yards, the captain of PT-132 put the wheel hard over to

[7] Bulkley, *At Close Quarters,* 117

starboard to bring the rest of his guns to bear on the barges. The forward .50, aft .50 turret and the aft 20mm cannon opened up on the second and third barges, cutting the latter in half and causing the second to settle into the water. As PT-132 began her turn a fourth barge opened a concentrated barrage of 20mm and 40mm fire on PT-132, in addition to two shore batteries that fired on both boats of the patrol. The first shell from the Japanese shore batteries exploded above PT-193, knocking all topside crew down to the deck. After a quick recovery PT-193 briefly fired on one sinking barge and engaged one shore battery with its newly installed 40mm. Having not experienced a PT boat armed with a 40mm cannon, the Japanese immediately ceased firing after receiving heavy rounds.

The patrol turned out to deeper water and headed north at high speed. The boats had been riddled with bullet holes; and three men had been hit. The bow gunner of PT-132 had the lower half of his leg shot off and another crewman was also hit in the leg. PT-193 was completely riddled with bullet holes; one fuel line had been severed by a 20mm round passing completely through the hull causing momentary loss of engine power; the bow 20mm was put out of action; the officers quarters and head had been ruined by 20mm rounds and one crewmember was hit in the hand. The patrol did not reach base before the bow gunner of PT-132 died from his wounds.[8] This quick, violent action was typical of barge hunting patrols in the Pacific until the end of the war in August 1945.

These actions represent two completely different types of offensive engagements executed by the same class of naval warship. In the Mediterranean the PT boats of Squadrons 15, 22 and 29 operated as they were originally designed, as torpedo attack craft against steel hulled surface targets. In the Pacific the twenty-five squadrons that eventually deployed ran out of consistent torpedo-worthy targets a year into the war. Their mission was still to interrupt enemy

[8] Action Report of PTs 132 and 193, night of 23/24 October 1943, Squadron 12

nighttime supply efforts. When the Japanese switched to an inter-island supply system the PT boats responded by becoming heavy gunboats, engaging in point blank gun battles with supply barges and shore installations.

Originally designed as fast torpedo attack craft, PT boats proved to be capable of all types of operations during the Second World War. In every major theater of war they provided convoy escorts, invasion screening forces, rescue missions, hospital duties, courier duties, shore bombardment and inserting raiding parties or OSS operatives. PT boats deployed to every naval theater of war and effectively carried out any mission given to them, especially offensive actions. PTs provided a versatile and easily adaptable weapons platform, mounting torpedoes, heavy machine guns, 40mm cannon, 5-inch aerial rockets and depth charges.

Patrol Torpedo boats were a fraction of the cost of destroyers and submarines. With an average cost of $120,000 for a 78-foot Higgins boat and $170,000 for an Elco 80-foot boat, and an average crew size of thirteen men, PT boats were extremely cost effective.[9] Cheap to produce, the PT proved to be the best platform for a large number of offensive and defensive missions made necessary by the scale of the Second World War. The shallow draft and high speed of PT boats extended the reach and power of the US Navy into coastal waters and filled the jobs that a number of expensive specialized craft would have required. Because of their torpedo armament and versatility PTs were able to take on jobs that originally were assigned to destroyers and submarines. Lack of long range operating capabilities was the only major limiting factor that kept PTs from replacing destroyers and submarines in coastal waters. The PTs ability to successfully adapt to various missions in almost every naval theater of war demonstrates the success of its design and exemplifies a principal of war, economy of force.

[9] Jerry Strahan. *Andrew Jackson Higgins and the Boats that Won World War II*(Baton Rouge LA: Louisiana State University Press, 1994), 83

2: The Ship Killer

The United States Navy developed the patrol torpedo boat to fire the naval torpedo, a weapon that was first developed in the American Revolution. In 1775 an American patriot, David Bushnell, decided to name a new naval weapon he created the "torpedo," after the Electric Rays of the Torpedinidae family. Bushnell's torpedo consisted of a 150-pound charge he hoped to attach to the hull of the British frigate *HMS Eagle* using his submersible *Turtle*. Although his attack was a failure because he could not drill through the copper plating on the underside of the hull, the name survived.[10] From that point onward the word torpedo served to describe any underwater explosive charge intended to sink an enemy ship. Before the late 1860s, torpedoes came in many shapes, sizes and forms, none of which were self-propelled. Due to the static nature of the torpedo, also called a mine, it was often relegated to defensive roles such as obstructing shipping channels.

Converting the torpedo into an offensive weapon required a means of delivering it to the enemy vessel. Bushnell attempted to attach his torpedo to the hull of the *HMS Eagle* from beneath the water. Although he failed to attach the charge, this raid was a step in the right direction. During the American Civil War, torpedoes, still static charges, were pulled, rammed, and attached to enemy vessels by courageous men on near suicidal missions. The US Navy's first successful torpedo attack was made by Lieutenant William Cushing on the Confederate ironclad ram *Albemarle.* On October 27, 1864, Cushing, driving the 45-foot steam launch *Picket Boat No. 1*, rammed a 100-pound spar torpedo into the hull of the C.S.S *Albemarle.*[11] In a violent explosion the spar torpedo did its job, blowing a large section out of the *Albemarle's* hull and

[10] Curtis Nelson, *Hunters in the Shallows: A History of the PT Boat*(Dulles Va, Brassey's Books, 1998), 32

[11] Used in the American Civil War, the spar torpedo consists of an explosive charge mounted on the end of a long pole. The pole has a spear on then end, often very similar to a harpoon. The purpose is to give the explosive enough reach to be attached below the water line and give the attacking craft room to clear the explosion. After the charge is attached to the enemy vessel it is detonated by pulling a lanyard.

sinking her.[12] Although this was a great victory for the Union, Cushing sank his launch and crew. Eleven were captured, two killed and only two made it back to union lines.[13] After Cushing's successful attack, torpedoes were used to sink twenty-one Union and six Confederate vessels before the end of the Civil War. Despite these successes, the torpedo still suffered from one major drawback. It was not self-propelled.

In the early 1860s an unknown Austrian coastal artillery officer took a new approach to the torpedo. He wanted to attack blockading ships with a remote controlled, explosives laden, self-propelled boat.[14] The unused associated paperwork and drawings came into the possession of Fregattenkapitän (Commander) Giovanni de Luppis of the Austrian Navy. Wanting to develop a working prototype, Luppis approached a well-respected British marine engineer named Robert Whitehead. At the time, Whitehead managed the Austrian manufacturing firm Stablimento Tecnico Fiumano, which supplied the expanding Austrian Navy with steam engines.[15] The two men joined together but were unable to perfect the idea, ending their partnership.[16]

Whitehead, however, continued on his own developing the self-propelled torpedo. Looking at the flaws of the original design, Whitehead realized that the concept was sound but a new approach was required. Whitehead agreed that the weapon should be self propelled, but its guidance system needed to be self-contained. By building all the systems into the weapon it could be made to travel beneath the surface. Traveling beneath the surface meant a surprise attack and a strike in the unarmored portion below the ship's waterline.[17]

[12] Nelson, *Hunters in the Shallows*, 9
[13] Ibid, 24
[14] Ibid, 32
[15] Ibid, 32
[16] Ibid, 32
[17] Ibid, 32

In October of 1866, after two years of development, Robert Whitehead launched a prototype self-propelled torpedo that would completely change naval warfare.[18] Since David Bushnell's attack on HMS *Eagle* in 1775, underwater explosives were known as torpedoes or mines.[19] Until October of 1866 torpedoes were not self-propelled and self guided; they consisted mainly of static charges that relegated the torpedo to a defensive role unless it was physically attached or rammed into the target vessel. Whitehead's design changed everything. His tests resulted in a torpedo that could travel at 6½ knots for a range of two-hundred yards and deliver a contact detonated charge to any ship below the waterline.[20] Whitehead's prototype torpedo led to the creation of the torpedo boat.

When Robert Whitehead successfully tested his torpedo design, he managed to change naval warfare. The advent of the self propelled and self-guided torpedo changed its role from defensive to offensive. The modern self-propelled torpedo became such an effective weapon that it sparked its own arms race. Navies around the world began to develop ships to deliver the weapon while naval architects attempted to find ways to defend against it.

The torpedo as a weapon of naval warfare is effective because it strikes the underwater portion of a ship's hull. Unlike air explosions, which allow the force of an explosion to dissipate, water concentrates the blast.[21] This effect makes any underwater explosive device on or next to a ship's hull especially destructive. Explosive strikes on the superstructure of ships generally mangle steel and any sailors within the blast radius. The weapons of surface warfare end up pounding the enemy ship into submission and unless a magazine is struck, it usually takes multiple hits to sink a well-designed warship. The damage from a torpedo allows water

[18] E. W. Jolie, "A Brief History of U.S. Naval Torpedo Development," Historic Naval Ships Asssociation, http://www.hnsa.org/doc/jolie/index.htm (accessed September 9, 2012), 7
[19] Nelson, *Hunters in the Shallows*, 32
[20] Ibid, 7
[21] Ibid, 31

immediate access to the ships hull, complicating damage control procedures and limiting the ability of the ship to successfully employ counter flooding as a means of damage control.

When the torpedo transitioned from a static defensive weapon to a self-guided and self-propelled underwater explosive device it became the first fire-and-forget weapon of naval warfare. The ability of the modern torpedo to travel thousands of yards to the target by itself provided a number of advantages. This would allow torpedo boats to stay out of audible and visual range from the target vessel, the torpedo would continue the attack silently beneath the surface of the water allowing for complete surprise. During daylight attacks the enemy vessel would be so occupied with dodging torpedoes that the launching vessel would escape.

Because of the destructive capabilities of the torpedo and its relatively small size, small cheap vessels had the ability to sink large expensive vessels. This sparked a new class of warships that were not required to conform to the standards of large warships, and a new concept of naval warfare. Torpedo boats would rely on stealth and speed to reach a launching range, deliver their torpedo and exit the area before being detected. The torpedo boat would not need to trade broadsides with larger ships or need armor for prolonged engagements. Torpedo boats could be smaller, lighter and cheaper than other warships while still being a deadly weapon.

3: American Torpedo Development

The stories of the torpedo and the PT boat in the United States Navy follow similar plot lines: neither was properly funded nor developed until the need arose. Following the Civil War the United States Congress was not willing to put large sums of money into weapons development and naval construction. In addition, the general strategic situation of the United States post Civil War did not place a high priority on acquiring the torpedo. The United States Navy was aware of the powerful effect that the Whitehead torpedo would have on naval warfare and ship design, but it was unwilling to pay for the rights to the weapon. Most major European navies acquired the Whitehead torpedo by 1876. With an asking price of $44,000 for manufacturing rights, the Untied States Navy preferred to domestically develop its own version at its own pace.[22] The United States would not have a working deployable torpedo until 1890; developing effective torpedo boats would take even longer.[23]

Between 1870-1900 the Navy watched the underfunded private development of six different types of American torpedoes, none of which were actually deployed in any naval engagement.[24] In the period from 1891 to the beginning of World War I the Navy used two types of torpedoes, finally purchasing the newest Whitehead torpedo in the early 1890s and the American developed Bliss-Leavitt.[25] Development of the torpedo was halted during World War I in favor of improving other weapons the United States Navy had a higher demand for,[26] mainly

[22] Nelson, *Hunters in the Shallows*, 37
[23] Ibid, 39
[24] Jolie, *Torpedo History*, 13
[25] Ibid, 22
[26] Choosing to develop depth charges, mines and aerial bombs rather than torpedoes during World War I was not an indication of the torpedoes tactical or strategic irrelevance. According to *A Brief History of U.S. Navy Torpedo Development* German torpedoes sank 5,408 ships totaling 11,189,000 tons. This proved to the world that the torpedo, deployed in a capable ship, was an extremely effective weapon especially in commerce raiding. The U.S. Navy did not have a great need for the torpedo because the primary concern was with anti-submarine warfare, hence the increased funding for depth charges and mines.

the depth charge for combating submarines.[27] The cutbacks in torpedo research funding during World War I put the Untied States Navy further behind European countries in torpedo development. German submarines proved how the torpedo, properly deployed, was a very effective weapon of naval warfare. Even though the torpedo was a proven weapon, the US Navy had little use for it due to a lack of suitable torpedo targets during World War I.

In the worldwide naval armament cutbacks in 1919-1920, the navy reduced funding to maintain torpedo designs that predated the Bliss-Leavitt Mark 7 and ended all contracts for private manufacture of torpedoes. A reduction in Congressional appropriations for torpedo research and development caused the navy to rely on Newport torpedo station for all future torpedo development.[28] Treaty reductions of world navies during the 1920s, especially numbers of battleships, caused naval planners to look at the roles of all ships and how they would assist the limited number of battleships. The US Navy would develop new tactics for employing various ships such as cruisers and aircraft carriers by modernizing its remaining ships and weapons.

For the first few years of American involvement in World War II the United States Navy equipped PT boats with a torpedo that predated World War I. The Mark 8 torpedo was developed in 1913 to be fired from destroyers. At the time this was the largest torpedo in the US inventory with a 21-inch diameter and a length of 21 feet.[29] The Mark 8 carried a 300-pound Torpex charge at a speed of 27-knots for a range of 10,000 yards.[30] Due to the budgetary constrictions during the 1920s, the navy focused on improving existing torpedo stocks rather than investing in newer models. During the 1930s the Navy began development of a new torpedo (Mark 15) for

[27] Jolie, *Torpedo History*, 29
[28] Ibid, 31
[29] Ibid, 27
[30] Bulkley, *At Close Quarters*, 34

destroyers. This resulted in a large stock of Mark 8 torpedoes at the beginning of World War II. PT boats were originally equipped with the surplus "improved" versions of the Mark 8, the Mark 8c and Mark 8d until 1944.[31] They were too slow, the explosive charge was underpowered and the torpedoes were prone to running erratic.[32]

During the 1930s the Bureau of Ordinance designed and produced the Mark 13 (aircraft), 14 (submarine) and 15 (destroyer) torpedoes.[33] The most notable advancement during the 1930s in relation to PT boats was the Mark 13 aircraft torpedo.[34] Originally designed to be dropped from planes, this weapon fit the PT service perfectly. The Mark 13 had a diameter of 22.5 inches and a length of 13.5 feet. The torpedo was capable of carrying a 600-pound charge at 45 knots, a vast improvement over the Mark 8.[35] Because the Mark 13 was designed to be dropped from aircraft, it had a non-tumbling gyro, eliminating the need for heavy torpedo tubes on PT boats. Due to limited numbers the Mark 13 was not made available to PT boats until the end of 1943.[36]

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[31] "Motor Torpedo Boats Tactical Orders and Doctrine," Historic Naval Ships Association. http://www.hnsa.org/doc/pt/doctrine/index.htm (accessed August 15, 2012), 59

[32] The torpedoes being set for extremely shallow depths caused the majority of the erratic runs. As originally designed, the Mark 8 was meant to run in the open ocean at depths around 20 feet after being fired from a destroyer. PT boats often encountered shallow draft targets requiring a torpedo depth of less than 10 feet. The difference in water pressure between 20 feet and less than 10 feet was enough to reduce the concentration of the explosion against the targets hull and cause the depth setting to be extremely unreliable. The Mark 8 also required torpedo tubes to be fired, any other method of firing could tumble the gyro essentially confusing the torpedo and causing it to run erratic.

[33] Jolie, *Torpedo History*, 31

[34] Production of the newer torpedoes had only begun in the mid to late 1930s. Because these newer torpedoes were only available in limited numbers they were reserved for specific ships. In the case of the Mark 13, there were not enough to arm PT boats at the beginning of the war, these new torpedoes were reserved for carrier based torpedo bombers on the front lines.

[35] Bulkley, *At Close Quarters*, 34

[36] Jolie, *Torpedo History*, 31

4: Origins of the Patrol Torpedo Boat

In order to build a motor torpedo boat two things are required, an internal combustion engine adapted to marine use and a specialized version of the planing hull. Previous attempts to create effective torpedo boats using displacement hulls and steam engines failed. Displacement hulls have theoretical limits to the amount of speed they can attain and steam engines produce a low power to weight ratio.[37] The result of this combination was small torpedo boats that were too slow to be effective and large torpedo boats that became full sized ships.[38]

The planing hull was the answer to the lack of speed in a small sized craft. The major difference between displacement hulls and planing hulls is the amount of drag each creates moving through the water. Displacement hulls are generally U shaped, with a large amount of surface area in contact with the water. Planing hulls are flat with a hard chine, causing the boat to rise out of the water while moving forward, reducing drag and greatly increasing speed.[39]

By 1905 internal combustion engines had been adapted to marine use. Joined with the planing hull[40] this combination showed promise in the racing industry. In 1905 British boat builders Yarrow and Thornycroft decided to build experimental torpedo boats powered by internal combustion engines. Though their capabilities and speeds were very limited these were

[37] Nelson, *Hunters in the Shallows*, 51

[38] Ibid, 45. The larger torpedo boats originally were 100-170 feet long. These first-class torpedo boats were an attempt to get the most speed out of the steam engine and displacement hull. The longer and thinner a displacement hull is the faster it can be propelled with the same amount of horsepower. As larger warships began to make above 20-knot the first-class torpedo boats lost their advantage in speed. To get more speed the boats were made larger. Because the boats were larger they added cannon for defense against other torpedo boats. By the 1890s these first-class torpedo boats became so large and well armed they became a part of the fleet, called the torpedo boat destroyer. Eventually the design continued to evolve until it became the modern destroyer.

[39] The chine is the intersection of the side of the hull and the bottom of the hull. Rounded bottom hulls have a chine, it is just curved with the shape of the hull.

[40] The planning hull skims on the surface of the water. This type of hull has no theoretical limit to the speed that it can attain, however it does require a high power to weight ratio to operate.

the first true motor torpedo boats.[41] The Thornycroft and Yarrow boats started a building rush in boat yards in Europe and America. Various designers and boat builders pushed their ideas for motor torpedo boats into the market attempting to get their designs sold to European navies. Because of this race to build fast motor torpedo boats rapid advancements were made in engines, propeller design and hull forms.[42] World War I provided the proving ground for all the advancements in motor torpedo boats since 1905.

World War I would prove that the motor torpedo boat concept could be successful by finally marrying the planing hull, high power internal combustion engines and the torpedo to create an effective motor torpedo boat, the 52-foot Italian (Motoscafo Armato Silurante) MAS boat.[43] The MAS boats patrolled the coasts of the Aegean Sea and sank three Austrian capital ships, one being the 22,200-ton dreadnought *Szent Istvan*.[44] British CMBs[45] of similar length to their Italian counterparts conducted daring raids along the German occupied coast. CMB operations were unable to make high profile sinkings like their Italian counterparts. However, they constantly harassed enemy shipping and penetrated harbor defenses to lay mines.[46] The actions of the British CMB and Italian MAS boats during World War I gave an idea as to what type of weapon motor torpedo boats could become with further development.

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[41] Frank Bennett and Frank Tredinnick. "Administrative history of PT Boats in World War II," http://www.gdinc.com/AN_Admin_History_of_PTs-001.pdf (accessed September 20, 2012), 14

[42] Although higher power engines were immediately developed the real impediments on advancement were the hull form and propellers. The planing hull was just made possible by the horsepower of internal combustion engines however, designers were still learning how to change the shape of planning hulls to maximize their speed. One of the most important advancements from this time period was the redesigned propeller. Steam driven propellers operate at a lower speed and higher torque. Internal combustion engines spin propellers with high speed and low torque. Once boat builders began redesigning the propellers the speed of boats increased.

[43] Italian version of the motor torpedo boat, MAS stands for motobarca armata silurante (torpedo armed motorboat).

[44] Nelson, *Hunters in the Shallows*, 56

[45] British torpedo boats of World War I were referred to as CMB, Coastal Motor Boat. Usually between 40-55 feet long, these were the forerunners to the British motor torpedo boats of World War II.

[46] Nelson, *Hunters in the Shallows*, 57

5: Post WWI American TB Development

During World War I the US Navy showed little interest in developing a motor torpedo boat. With a few experimental exceptions, this trend continued until 1936. In 1915 Admiral Joseph Strauss, Chief of the Bureau of Ordnance, suggested that the Department of the Navy acquire a motor torpedo boat for testing purposes. The Department of the Navy eventually acquired blueprints for a 50-foot boat with military characteristics similar to the British CBM then in use. The planned boat was to make forty-three knots, carry one 16-inch torpedo tube and be armed with rapid firing guns for defense. Small boats such as this proposed one were being used by the British for anti-submarine warfare, for this reason the Department of the Navy was willing to investigate the capabilities of a motor torpedo boat.[47] In 1917 the Navy actually purchased a 40-foot motorboat capable of making forty knots. This boat was immediately written off as unseaworthy when it pounded heavily in very light seas.[48]

In 1920 the US Navy purchased two British CMBs built by Thorneycroft. Two years after purchasing the 40 and 55-foot motor torpedo boats, the Navy conducted tests where the boats achieved speeds in the high 30-knot range. These tests were very limited in nature and by the end of 1922 the 40-foot boat became a torpedo recovery boat and the 55-foot boat was scrapped in 1930.[49]

The US Navy was not the only purchaser of surplus CMBs from the British. In one of the many creative solutions to getting around the constraints of the 18th Amendment to the Untied States Constitution, former CMBs were converted to fast supply runners. With the sale and

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[47] Nelson, *Hunters in the Shallows*, 17

[48] Ibid, 20. Pounding is the action of a boat coming down on waves. It has the feeling of a short drop and a sudden stop. This is common in planing hull types that ride on the surface. Pounding on a boat causes extreme fatigue on the boats hull and added stress on a boats crew, often resulting in injury to crewmembers and structural failures in the boats hull.

[49] Ibid, 20

consumption of alcohol no longer allowed in the United States, liquor laden ships anchored in international waters waiting for fast boats to come out and make purchases. Coves and inlets on the East coast began to fill up with surplus CMBs, which made nightly runs out to international waters. After picking up their load of alcohol these "rumrunners" raced to the shore and unloaded before being stopped by government agents or the United States Coastguard. These actions often resulted in high-speed chases and even gun battles between rumrunners in former CMBs and fast Coast Guard motorboats built to intercept them.

The events that transpired during Prohibition affected the future PT boat service in a number of ways. Enterprising rumrunners during the 1920s successfully adapted the water-cooled liberty engine, which once powered World War I aircraft, to marine use.[50] The adaptation of this lightweight aircraft engine brought a new dimension of horsepower to motorboats, laying the groundwork for adapting the Packard engine to use in future PT boats. In his book *At Close Quarters,* Robert Bulkley states "rumrunner influence most likely passed to the PT program largely in the form of experience gained by America's small-boat manufactures." Converting surplus CMBs for rumrunner use and producing new fast boats for rumrunners and the Coast Guard provided a large amount of experience for American boat builders. Without any official motor torpedo boat research program, captured rumrunners offered interested United States Navy officers a chance to inspect advancements made in small fast motor boats.[51] Officially, the US Navy would not renew its interest in developing a motor torpedo boat service until 1936.

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[50] Bulkley, *At Close Quarters*, 41

[51] Ibid, 65. There is no documentary evidence directly connecting the PT service to the rum running of the 1920's. This does not mean that former rumrunners did not put their skills to use during World War II in the PT service. In his book, Bulkley talks about a former PT service man whose "experience and know-how were valuable to the World War II PT program was frequently known to preface his comments on perplexing technical problems with the remark, "'well when I was a rummie we…"" The only documented transfer of knowledge were the production techniques, engine advancements and hull design gained by American small boat industry during the prohibition era.

6: The Real Beginnings

The real beginning of the motor torpedo boat program in the United States Navy was on the desk of the Rear Admiral Emory S. Land in December of 1936. Appointed as the Chief of the Bureau of Construction and Repair in October of 1932, Rear Admiral Land already had a long career in the navy, especially in dealing with experimental craft. He held a M.S. degree in naval architecture from Massachusetts Institute of Technology, using his degree to assist designing and operating the first submarines for the US Navy in addition to being a specialist in naval aviation.[52] Land sent his letter through the Bureau of Engineering to the outgoing Chief of Naval Operations, Admiral William H. Standley.[53] Although previous attempts had been made by the Bureau of Construction and Repair to start a motor torpedo program, Admiral Land took a different approach than previous proposals.

> December 5 1936
>
> From: The Bureau of Construction and Repair
> To: The Chief of Naval operations
> Via: The Bureau of Engineering
>
> 1. Developments since the War of the motor-torpedo-boat type, then known as Coastal Motor Boats, have been continuous and marked in most European Navies. There has been considerable interest in the fundamentals of the type among the small boat designers and builders in this country based upon patriotic desire to develop pleasure boats which may be of value for naval use in the event of mobilization.
> 2. The results being obtained in the foreign services are such as to indicate that vessels of considerable military effectiveness for the defense of local areas, are being built, the possibilities of which should not be allowed to go unexplored in our service. It is, of course, recognized that the general strategic situation in this country is entirely different from that in Europe, so that motor torpedo boats could not in all probability be used offensively by us. It appears very probable, however, that the type might very well be used to release for offensive service ships otherwise unavoidably assigned to guard important geographic points such as an advanced base, itself.
> 3. If the department concurs, this Bureau suggests the inauguration of an experimental development program of such boats and will endeavor to have included in its appropriations for experimental work, funds for the construction of two such boats each year, preferably one by contract on designs of private naval architects and one from Departmental designs.
> 4. To permit such designs to be prepared or at least outlined, the Bureau requests to be furnished with the military characteristics which are considered desirable in such a type.

[52] Nelson, *Hunters in the Shallows*, 69
[53] Ibid, 71

E.S. Land
Chief of Bureau[54]

This letter was the beginning of the American motor torpedo boat program. The United States Navy had never considered the motor torpedo boat to fit into its naval strategy. When this letter was penned in 1936 there were only a few enthusiasts in the navy that wanted motor torpedo boats. This letter struck the right chords at the right time. Land's proposal created an opening for bureau chiefs that were interested in motor torpedo boat development to show their support, in addition to arriving at the same time Douglas McArthur was attempting to build a Philippine Navy around motor torpedo boats.[55]

Admiral Land's letter addresses the tactical value of motor torpedo boats in the US Navy. The US Navy had never taken motor torpedo boats seriously because it did not see a place for them in fleet actions. As the first motor torpedo boats arrived on the scene in the early 1900s, the Navy was dominated by battleship doctrine. Battle fleets of large warships would sail to defend American colonies, protect lines of commerce and stop any enemy fleets before they reached the US coastline. Although motor torpedo boats were effective during the First World War, the US Navy saw them as a short-range offensive craft, useful in European waters where oceans do not separate belligerents and raids can be conducted over a few hours. The limited operating range of motor torpedo boats made them dependent on bases or tenders if they were to carry out any offensive operations. With the US Navy possessing few forward bases, any motor torpedo boats that were developed had to be either carried with the fleet or deployed in home waters. This relegated any potential US Navy motor torpedo boats to defensive roles, for which an offensive minded navy had no use.

[54] Ibid, 71
[55] Ibid, 74

Land points out that the results of these advancements are "vessels of considerable military effectiveness for the defense of local areas…the possibilities of which should not be allowed to go unexplored in our service." There are two implications in this statement. First, Land agreed with the Navy that these vessels are defensive in nature, especially in regards to the United States strategic situation. However, he goes on to suggest that although these vessels are of no use to the current Navy, in wartime they could be deployed in offensive operations and to guarding forward bases. Secondly, Land pointed out that because this class of vessel had become an effective weapon in European navies and could have actual applications in a prolonged war, the US Navy did not want to be behind in developing its own motor torpedo boat service.

Having dealt with the traditional tendencies of the US Navy's "brass hats" while working on developing naval aviation and submarine forces, Land knew how to approach the Navy with a non-traditional idea. Land knew that American industry was capable of producing a motor torpedo boat, however, the Navy would want a say in how everything was designed. He does not pick a specific class, length or type of motor torpedo boat that the Navy should adopt and test. He suggests that a small program of two boats be started using a Navy Department design for one boat and a private design for the second boat.

Admiral Land's proposal explained motor torpedo boats in a way that the Navy was able to see and understand. The motor torpedo boat had advanced into an effective weapon that could serve a purpose in the United States Navy. Ignoring their potential and not investigating motor torpedo boats would put the Navy behind European Navies in an already proven weapon. Finally, the proposal did not committed to a specific design or ideal, just that motor torpedo boats were effective and the Navy should look into investigating their capabilities.

On the other side of the world at his headquarters in Manila, General Douglas MacArthur was busy preparing the defense of the Philippines. Appointed as the military advisor to the Philippine Commonwealth in 1935, MacArthur's task was to provide for the defense of the Philippines and prepare the islands for self-defense by 1945 when the country would gain its independence. His most important task as military advisor was the role the country played in the various army-navy war plans for the Pacific. In the event of Japanese aggression it was assumed that the Philippines would be among the first islands to be assaulted. The plans called for the Philippines, specifically Manila Bay, to hold out against an attack while the Pacific fleet sailed to its relief.[56] MacArthur did not have enough money to build a large Philippine Navy; instead he planned on creating an off-shore patrol navy made of cheap and effective motor torpedo boats.[57] The Philippine government did not have enough money for a large surface feet. Ten years would pass before the islands became independent, enough time to develop their defensive forces. What MacArthur required immediately was a force capable of defending at least Manila Bay and buying enough time for the Pacific fleet to arrive from the West Coast of the United States. Retired Lieutenant Sidney L. Huff, acting as Macarthur's naval advisor began to investigate European advancements in motor torpedo boats. Not impressed by European boats, Huff approached the United States Navy about developing a motor torpedo boat that could be sold to the Philippine Navy. Conveniently for future PT boats, this proposal arrived around the time that Lands letter began to circulate around the Navy.[58]

Five months later in April of 1937 the General Board responded to MacArthur's proposal for a Philippine motor torpedo boat navy and Rear Admiral Land's calling for a motor

[56] Samuel Eliot Morison, *History of United States Naval Operations In World War II: The Rising Sun in the Pacific* (Chicago IL: University of Illinois Press, 1948), 150
[57] Nelson, *Hunters in the Shallows, 73*
[58] Ibid, 74

torpedo boat program in the United States Navy.[59] The response demonstrated that the Navy was willing and ready to proceed with developing motor torpedo boats and reflects how they saw these boats fitting into the United States Navy.

After discussing the advancements in motor torpedo boat technology in European navies, the letter from the General Board addresses the tactical value of motor torpedo boats in the US Navy. The General Board states that motor torpedo boats are of little immediate value to the United States Navy. With war beginning to become a possibility in Europe and the Pacific, the Navy felt it might be taking part in large overseas operations against Germany or Japan. In the early stages of war the motor torpedo boat would maximize economy of force by being deployed to forward bases. In defending forward bases, such as the Panama Canal Zone or Hawaii, motor torpedo boats would free up larger surface forces for offensive operations. As the Navy secured forward operating bases close to enemy fleets or home waters, motor torpedo boats could be released for offensive operations against the enemy. The idea of incorporating the motor torpedo boat as an element of the fleet changed the Navy's perception of its role from a defensive craft to a versatile weapon of naval warfare.

Although motor torpedo boats are relatively cheap to produce, the US Navy found them expensive to develop. They were a completely new class of craft that the US Navy had little experience with. Time would have to be spent developing a reliable high horsepower engine and learning what hull type produced the desired characteristics. Light, fast hulls would achieve the desired speed, however, they needed to be sturdy to withstand heavy seas. In addition to designing a successful motor torpedo boat, tactics and support chains needed to be established

[59] Ibid, 75

within the structure of the Navy. With the US navy and the American motorboat industry starting from scratch it would take time and money to develop the best motor torpedo boat design.

When the Navy had become interested in motor torpedo boats in the past the two biggest hang-ups were the cost of development and their strategic purpose. Having found a strategic reason for a motor torpedo boat program, the General Board needed to justify the cost. MacArthur's request arrived at the perfect time, providing the justification to request the beginnings of an experimental program. The letter indicates that the General Board wanted to develop two types of motor torpedo boats, large 80-foot boats for off shore patrol and smaller 60-foot boats to be transported with the fleet. The Navy could design and develop the larger 80-foot motor torpedo boat using funds from the Government of the Philippines. The Navy then could spend its own money developing the smaller 60-foot motor torpedo boat. Because there was no immediate need for motor torpedo boats in the US Navy, development could follow a slow pace. Building one or two boats a year would spread the cost out while advancing the technology and preparing it for mass production in a time of need. Soon after the proposal was submitted, the Secretary of the Navy approved the beginning of a small experimental motor torpedo boat program.[60]

[60] Ibid, 79

7: 1938

Now that the experimental program had been approved by the Secretary of the Navy, negotiations began with MacArthur's staff. During this time Dwight D. Eisenhower, who was working on MacArthur's staff in the Philippines, expressed concerns about the cost of the two experimental boats the Navy was trying to get the Philippine government to buy. The total cost was almost 500,000 pesos, which almost equaled the entire first year (1938) budget for the Philippine Navy. Once the staff in the Philippines realized the Navy was going to use its money to fund the development of motor torpedo boats, negotiations broke down.[61] With the Philippines deal falling through the Navy had to look to congress for money if they wanted motor torpedo boats.

Fiscal year 1938 brought hope and funding for the proposed motor torpedo boat program in the US Navy. Events in Europe and Asia began to show more signs of future war. In Europe, a Naval conflict would more than likely become a campaign against U-boats. In the Pacific, war would require even the smallest expeditions to go extremely long distances. The Navy was seeking a more balanced fleet of anti-submarine warfare ships and fleet support ships to facilitate long distance operation, in addition to more frontline combat ships. President Roosevelt responded with the Naval Expansion act of 1938. With an estimated value of $1.1 billion, the Naval Expansion Act of 1938 increased the Navy's budget by twenty percent over previous years.[62] This new commitment was a massive step towards increasing the power of the United States Navy, creating a more balanced fleet and ended up putting $3 million dollars towards motor torpedo boat experimentation.[63]

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[61] Nelson, *Hunters in the Shallows*, 79
[62] Ibid, 83
[63] Ibid, 88

Public Law 528 was signed into official existence on June 7, 1938. It provided $15 million for experimental craft, $3 million of which went towards developing two 70-foot motor torpedo boats, two 54-foot motor torpedo boats and 110-foot sub-chasers.[64] On July 11, 1938, the United States Navy sponsored a design contest for the various types of boats. The larger motor torpedo boats design was to be between 70-80 feet in length, have a trial speed of 40 knots and be able to cruise 550 miles. The smaller boat was to be 60 feet long, weigh no more than 20 tons and be capable of over 40 knots.[65]

Using the money from the experimental funding, the US Navy sponsored a design contest for 54-foot and 70-foot motor torpedo boats. The boats were to be capable of forty knots with a 275-mile range at full speed and a 500-mile range at cruising speed. Armament was to be two 21-inch torpedoes with launchers, at least two .50 caliber machineguns and depth charges. Winning designs won $15,000 while finalists were awarded $1,500.[66]

While the design contest was going on, Elco Co. of Bayonne, New Jersey, began the process of acquiring a 70-foot motor torpedo boat from Hubert Scott-Paine in Britain.[67] Elco felt that any development undertaken in the United States was years behind the work the British were doing. If Elco could acquire the rights to build a British boat, they could sell it to the US Navy and gain the contract for motor torpedo boats. For these reasons the president of Elco, Henry R. Sutphen, made an agreement with the Assistant Secretary of the Navy, Charles Edison, that the Navy would purchase the 70 foot Scott-Paine boat from Elco after the company had time to

[64] Ibid, 88
[65] Bulkley, *At Close Quarters*, 44
[66] Bennett and Tredinnick, *Administrative History of PT Boats*, 25
[67] Ibid, 36

replicate the design.[68] After acquiring the Scott-Paine boat in September 1939, the US Navy commissioned it as PT 9.

Higgins Industries of New Orleans, Louisiana, was awarded the first contract by the US Navy to produce PT boats in May of 1939. Higgins was contracted to build the winning entry in the design contest, a Sparkman and Stephens 70-foot boat, increased up to 80-feet.[69] These two boats became PTs 5 and 6. PTs 1 and 2 were the winning 58-foot boat design, built by the Fogal Boat works of Miami, Florida. PTs 3 and 4 were the same design as 1 and 2. However, they were built with some Navy suggested modifications by a different shipyard, Fischer Boat Works.[70] The US Navy threw its own design into the group of experimental boats by building PTs 7 and 8, both 80-foot boats. PT-8 was the only boat not made out of wood.[71] On December 7, 1939 Elco was awarded a contract to build eleven more boats of the same design as the 70-foot PT-9.[72] The developmental period that started with the design contest in fall of 1938 until the fall of 1940 gave the US Navy PT boats 1-20, of which only the Scott-Paine design (PT-9 through PT-20) had been tested and accepted by the Navy.

[68] Bulkley, *At Close Quarters,* 45

[69] Bennett and Tredinnick, *Administrative History of PT Boats*, 41

[70] Ibid, 42

[71] All PT boats were constructed out of wood except for PT-8. This hull proved to be a complete failure, mainly due to the use of destroyer fittings to strengthen the hull. This excess weight combined with a poorly designed hull form limited its speed to no more than 35 knots. Never used during the war, as of October 3, 2012, PT-8 still exists. The boat is located in Franklin, Louisiana and is currently for sale.

[72] Bennett and Tredinnick, *Administrative History of PT Boats*, 45

8: The Plywood Derby

In 1941, the newly appointed Chief of Naval Operations, Admiral Harold R. Stark, ordered a series of tests of comparative tests to be conducted on the existing PT boat designs. The purpose of the tests was to determine the best designed PT boat and use it as the standard model for mass production.[73] The tests run in July and August 1941 became known as the "Plywood Derbies" after their main event, a 190-mile open water run at full speed.

From July 21-24, 1941, six PT boats were tested in the waters off New London, Connecticut;

1. PT-6: 81-foot boat designed by Sparkman and Stephens, built by Higgins.
2. PT-8: 81-foot boat designed and built by Philadelphia Navy Yard
3. PT-20: 77-foot Elco, scaled up version of Scott-Paine PT-9
4. PT-69: 72-foot Huckins designed and built
5. PT-70: 76-foot Higgins designed and built boat.[74]
6. 70-foot MTB: British designed boat built by Higgins[75]

The first day of tests involved complete inspections of each boat. These inspections assessed the habitability, accessibility and military characteristics of each boat. The second day of tests involved running the boats over a measured mile and testing their turning capabilities. An airship was provided under which each boat made two full circles to port and starboard.

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[73] Letter from Judge Advocate General of the Navy to President, Board of Inspection and Survey July 19, 1941. Board of Inspection & Survey, Patrol Crafts Inspection Reports & Related Documentation; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.

[74] Higgins, while building the design contest winning Sparkman and Stephens boats (PT5 and 6) felt that the boat was poorly designed. At his own cost, Higgins built his own version of a PT boat called PT-6 prime. This boat was completed and inspected in July of 1941 and rushed up to New London so it could take part in the trials.

[75] Report of Comparative Service Tests of Motor Torpedo Boats Held July 21-24, 1941 and August 11-12, 1941, Section II . Board of Inspection & Survey, Patrol Crafts Inspection Reports & Related Documentation; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD, 2

Photographs from the airship were used to determine the turning radius of each boat. After the turning test each boat made three full military load runs over a measured mile at seven different engine revolutions per minute(RPM), culminating with a run at full speed. On the third day there was a race to determine sea-keeping abilities of the various PT boat designs. All boats participated in a 190-mile race over open water, maintaining maximum speed over the whole course. During this open water race the destroyer USS *Woolsey* ran the same course at full speed as well.[76]

During the measured mile the Elco PT-20 made the fastest speed of 44.1 knots heavy load. The Huckins PT-69 made 43.8 knots heavy and the Higgins PT-70 made 41.2 knots, these were the only other boats to make above 40 knots. The boat with the smallest turning radius was the Huckins PT-69, followed by Higgins PT-6, Navy Yard PT-8 and last was the Elco PT-20.[77] PT-20 won the "Plywood Derby" with an average speed of 39.72 knots, followed by the Huckins PT-69 at 33.83 knots and Higgins PT-6 at 31.40 knots.[78]

All the boats suffered some sort of structural or mechanical damage during the race, especially the Higgins PT-70. The Elco PT-20 was the only boat with the complete armament installed, including torpedo tubes, torpedoes, machine guns and depth charges. All other boats had ballast weights placed in the approximate location of the missing armament. PT-70 suffered heavy structural damage because the ballast was not properly secured and did not put the same type of stresses on the deck that actual weapons would have. Andrew Higgins, president of

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[76] Comparative Tests of Motor Torpedo Boats, Board of Inspection & Survey, Patrol Crafts Inspection Reports & Related Documentation; Records of the Office of the Chief of Naval Operations, Record Group 38, National Archives at College Park, College Park, MD. 3

[77] Arrangements could not be made to take pictures of the Higgins PT-70 and the Higgins built British boat during the comparative tests.

[78] PT boats Comparative tests, Section IV. Board of Inspection & Survey, Patrol Crafts Inspection Reports & Related Documentation; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD. page 2. PT-70, PT-8, and the British boat had to pull out of the race due to structural damage or engine failure.

Higgins Industries, protested the results as unfair because loads placed on the boat by ballasting instead of properly installed armaments.[79] Because of this protest, a second run of the "Plywood Derby" was run two weeks later on August 11-12, 1941.

The second running of the maximum speed open water run was conducted on August 12, 1941, following the same course as the first. PT-8, PT-69, PT-70, the 70-foot British boat and two 77-foot Elco boats participated in the second open water run. During this run all boats were fitted with their proper armaments. After giving the builders what they wanted in a fair test, the Navy got what it wanted, bad weather to test the capabilities of the boats. The weather for the second running of the "Plywood Derby" was far worse than the first. During the first running the wind was Force 3 with a moderate cross surface chop.[80] During the second running the wind varied between Force 2-6 with swells of 6-8 feet and occasional waves of 10-12 feet.

The results of the second running were very impressive. Of the six boats taking part in the test, only one did not complete the run. The Huckins PT-69 suffered structural damage early in the race and was forced to quit. The Elco PT-21 completed the race first at an average speed of 27.5 knots. Not far behind was the Higgins PT-70 with an average speed of 27.2 knots. PT-8 and Elco PT-29 averaged 25.1 knots and last to cross the line was the 70-foot British boat at 24.8 knots.[81] The destroyer USS *Wilkes DD-441* also participated in the race, running the same course. The captain of the *Wilkes* was informed of the starting line and crossed at full power. The

[79] Letter from Andrew Higgins to Admiral J. W. Wilcox Jr. July 31, 1941. Board of Inspection & Survey, Patrol Crafts Inspection Reports & Related Documentation; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.

[80] This is based on the Beaufort scale 1-12: Force 1=1-3 mph, 2=4-7 mph, 3=8-12 mph, 4=13-17 mph, 5=18-24 mph, 6=25-30, 7=31-38 mph, 8= 36-46 mph, 9=47-54 mph, 10= 55-63 mph, 11= 64-73 mph and 12= greater than 74 mph.

[81] PT-29 was an Elco 77-foot boat. Fully capable of running faster, this Elco boat was ordered to shadow PT-8 during the run to compare the action of each boat in the same seas.

Wilkes made an average speed of 29.3 knots, completing the race only twenty five minutes before the first PT boat.

The Bureau of Inspection and Survey determined that the Elco, Huckins and Higgins PT boats were acceptable for immediate production, provided changes were made. In the suggested changes an emphasis was put on improving the boat's ability to ride in rough seas, specifically the Elco boat whose hull shape created an extremely rough ride. The boats had performed above expectations in the rough seas during the second "Plywood Derby", but they suffered structural damage that needed to be remedied. The tests also concluded that the Packard marine engine was satisfactory for use in all PT boat designs.

One of the most important lessons learned from the comparative tests was the PT boat's capability to run in rough seas. The board now believed that the boats could last longer in rough weather than their crews would be able to. The board concluded that "it appears…that for the assigned mission modern destroyers possess no sensible advantage over the motor boats even under sea conditions highly unfavorable for the latter, and that in the areas where limited visibility is not unusual the motor boats might readily prove much more adaptable than the larger vessels within the limitations of their operations range."[82]

The comparative tests showed the Navy what it needed in a motor torpedo boat with their capabilities compared to a deep draft warship. Based on the observations made during the trials and the experience with the Elco, Huckins and Higgins boat builders, the Navy decided that these companies had designed the best boats and were capable of mass producing them. The Navy had also decided that the over-all length of the boats needed to be increased in order to carry the loads the Navy required and provide the performance they desired. In the fall of 1941

[82] PT Boats Comparative Tests, Section IV. Board of Inspection & Survey, Patrol Crafts Inspection Reports & Related Documentation; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD. page 5

Bureau of Ships representatives met with the leaders of Elco, Huckins and Higgins and delivered the new requirements. The results of this meeting were the three types of PT boats that the US Navy used to fight the Second World War, the 80-foot Elco, 78-foot Huckins and the 78-foot Higgins.[83]

[83] Bennett and Tredinnick, *Administrative History of PT Boats*, 74. The Huckins 78-foot boat was accepted by the Navy and put into production. Over the course of the war only 18 were ordered and none of them were used in combat.

9: PTs Go to War

While the three major companies Elco, Huckins and Higgins were completing their contracts with the US Navy, there were enough PT boats in service to form three squadrons. On December 7, 1941, Squadron 1, comprised of twelve Elco 77-foot boats, under command of Lt. Comd. William C. Specht was based at Pearl Harbor. Squadron 2, Elco 77-footers, under the command of Lt. Commander Earl S. Caldwell was fitting out in New York for shipment to the Panama Canal Zone. Squadron 3, Elco 77-footers, under the command of John D. Bulkeley was split in half. Six of Bulkeley's boats and crews, including Bulkeley himself, had been in Manila Bay, Philippines, since September 1941. The other six boats were in cradles awaiting shipment from Pearl Harbor when the Japanese struck.[84]

Ironically, after years of developing PT boats as anti-ship weapons, the first PT boat kill was a Japanese torpedo bomber. On Sunday morning December 7, 1941, the squadron duty officer, Ensign N. E. Ball, stood on the edge of the covered barge YR-20, the tender for Squadron 1. He saw what he thought was a Japanese plane. The plane confirmed his sighting when it dropped a bomb into the Navy yard. While Ensign Ball was shouting "man the guns" through the mess hall of YR-20, GM1c Joy Van Zyll de Jong and TM1c George Huffman were already jumping into the two .50 caliber machinegun turrets and fired on a low flying torpedo bomber. Seconds later the other boats joined in shooting down another torpedo bomber and damaging several passing planes.[85]

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[84] Bulkley, *At Close Quarters,* 1. PT squadrons consisted of 12 boats commissioned as a squadron, individual boats were not commissioned into the Navy. Commissioning the squadron as a unit rather than commissioning individual boats saved a large amount of administrative paperwork. As squadrons would be operating as a unit from the same base, the individual squadron with a commanding officer drew the necessary supplies rather than twelve different captains from twelve different boats. This also meant that the PT boats in each squadron did not have commanding officers, they were technically just boat captains.

[85] Ibid, 3

December 10, 1941, the Japanese made their first heavy air attack on Manila Bay and its military installations. These installations included the home base of Squadron 3, the Cavite Navy Yard. Air raid sirens gave the six boats of Squadron 3 enough warning time to get underway and out into the open water of Manila Bay. As bombs started to fall on shipping in the bay, five bombers peeled off the formation and directly attacked the zigzagging PT boats. As each plane dove, the captain of the targeted boat waited until it released its bomb, then put the wheel hard over. Not a single bomb fell near enough to damage any PT boats. The boats downed three of the attacking bombers. When the boats returned to the dock they found almost everything had been ruined. Spare engines, spare parts, torpedoes, 1000 drums of 100-octane gasoline, repair shops and the squadron offices had all been destroyed in the first bombing raid. The squadron moved to Sisiman Bay near the tip of the Bataan Peninsula in an effort to avoid damage from further air raids.[86]

When the boats of Squadron 3 deployed to Manila Bay in September of 1941, there was no official PT tactical doctrine. A pre-war conference between the Chief of Naval Operations and the commanders of motor torpedo boat squadrons one, Lt. William C. Specht, and two, Lt. Comdr. Earl S Caldwell, in May 1941 laid out the beginnings of tactics; however, the decisions made were geared more towards specifications of the boats, production goals and overseas transportation. The conference had determined that PT boats were to be operated from well-supplied shore bases in Hawaii, Panama Canal Zone and the Philippines.[87] By December of 1941 the Navy had achieved all of its goals laid down by this conference. Squadrons were being

[86] Ibid, 5

[87] Report of Conference on Motor Torpedo Boats May 19, 1941.Board of Inspection & Survey, Patrol Crafts Inspection Reports & Related Documentation; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.

deployed to bases that were well supplied and could be defended. The Navy put PT boats where they thought they would work well; the tactics were up to the squadrons to develop.

During the four months from the first Japanese attack on Manila Bay to the fall of Battan, Lieutenant John Bulkeley and the men of Squadron 3 wrote the book on PT boat operations. The experience they gained formed the base for all future PT boat operations by setting examples of missions PT boats were appropriate for. They demonstrated the diverse capabilities of PT boats and for almost three months represented the only ship-killing offensive power defending the Philippines.

The first few weeks of the war disappointed the PT crews of Squadron 3. The commander of naval forces in the Manila area, Rear Admiral Francis Rockwell, had no experience with employing PT boats. Rockwell's inexperience with PT boats resulted in weeks of routine patrols of the Battan coast north of Manila Bay, courier duties and ambulance duties within Manila Bay. As lack of gasoline and proper maintenance took their toll on the boats, patrols were reduced to just Manila Bay. PTs were not being employed in their intended role, but this changed a month into the campaign.

On January 18, 1942, Lieutenant Bulkeley finally received the order he had been hoping for. "Army reports four enemy ships in or lying off Binanga Bay (4 miles north of Moron). Force may include one destroyer, one large transport. Send two boats attack between dusk and dawn."[88] Bulkeley, in command of the patrol, led PTs 31 and 34 to the entrance of Subic Bay.[89] From there the two boats split up. Commanded by Lieutenant Edward DeLong, PT-31 moved along the eastern shore of Subic Bay while Bulkeley took PT-34 down the western side. The plan

[88] Ibid, 9

[89] Binanga Bay is located on the eastern side of Subic Bay. Binanga Bay indents the Bataan Peninsula on its western side.

was to have each boat sneak in down opposite sides of the bay, meeting at the head of Binanga Bay. PT-31 never made it to the rendezvous. Just as the boats split up, PT-31 experienced engine problems, wax in sabotaged fuel clogged the fuel strainers.[90] Dead in the water, PT-31 ran aground; three hours of effort could not budge the PT boat. Soon a 3-inch gun started firing at the stricken boat, causing Lieutenant DeLong to abandon and destroy PT-31.[91]

After avoiding a small vessel and observing distant cannon fire, PT-34 made it to the rendezvous point. Waiting half an hour at the rendezvous, Bulkeley decided to make the attack without PT-31. 500 yards into the bay Bulkeley came upon a two-masted freighter, which challenged his presence. Bulkeley's response was two torpedoes; the first torpedo shot hot straight and normal. The second was a hot run.[92] Bulkeley did not stay to see the results of his torpedo shot, immediately under fire from shore batteries, PT-34 retired at full speed guns blazing. The next day Bulkeley reported to Admiral Rockwell that the Army had confirmed he

[90] What remained of the 100-octane gasoline for the PT boats had been sabotaged at some point. Lieutenant Bulkeley reported that the gas "was found to contain a soluble wax deposit in large quantities. This foreign substance clogged gas strainers and carburetor jets to such extent as to cause most unreliable operating, necessitating the cleaning of carburetors and strainers hourly…it eventually became necessary to open the gas tanks and clean with the limited means available. The lubricating oil contained sand." Over the course of the campaign the PTs would never receive a clean supply of gasoline. Bulkley, *At Close Quarters*, 9.

[91] Of the sixty nine PT boats destroyed by all causes during World War II, eighteen were lost in this same manner, grounded in enemy waters and destroyed to prevent capture.

[92] A hot run was a common problem with PT boats that used torpedo tubes. The tubes on these boats were powered by a gunpowder charge that launched the torpedo out of the tube. Sometimes the torpedo would only make it halfway out of the tube. This was called a "hot run" because the torpedoes engine would be running. There are two major problems with a hot run: first the propellers rely on water to keep them cool, spinning at a very high velocity while still in the tube will cause them to overheat and break apart, damaging the tube and personnel. This is stopped by reaching the cutoff valve on the torpedo. The second major problem is the torpedo warhead. A small propeller on the head of the torpedo controls arming the warhead, after a certain number of revolutions the warhead becomes armed and an 8lb force impact will set it off. In order to stop this from happening a crew member must crawl out on the torpedo, as it hangs out of the tube, and jam the propeller with a rag. This is often made extremely difficult because once torpedoes are fired the boats are usually under machinegun and cannon fire. This problem was ultimately solved with the introduction of the Mark 13 torpedo and roll off racks. In the case of this action CTM John Martino climbed out on the torpedo and stuffed toilet paper into the impeller.

sank a 5,000-ton merchant vessel with 5-inch guns that was shelling army positions. Bulkeley had executed the first ever PT boat torpedo attack, and it was a success.[93]

That same night, foreshadowing future Pacific PT boat campaigns, Ensign George Cox Jr., commanding PT-41, fired on groups of Japanese troops on the beach during his patrol of the south shore of Manila Bay. His gunners killed eight and wounded more than a dozen. Four nights later PT-34 under the command of Bulkeley sank two 40-foot Japanese landing barges with gunfire. Bulkeley boarded the second barge by himself, hoisted two wounded Japanese onto the deck of PT-34 and removed documents as the barge sank beneath him.[94]

Seven days after his first successful torpedo attack, Bulkeley again went into Subic Bay, this time in PT-41. Sighting a 4-6,000-ton merchant ship, Bulkeley closed to 800 yards before firing two torpedoes. When one torpedo struck the ship, the .50 caliber machineguns of PT-41 opened up on the ship, shoreline and shore batteries that had begun to shell them.[95] Racing out of the bay under heavy fire, Bulkeley returned again to Subic on February 17, 1942 in a failed attack on a 2-400-ton merchant ship.

After weeks of keeping PT boats on patrols within Manila Bay and having them carry couriers and casualties, Admiral Rockwell finally released them for offensive action. Once released for offensive operations, PT boats proved their worth. With no spare parts and tired crews, Squadron 3 boats were able to sink one large merchant ship, score hits on a cruiser and merchant ship, kill Japanese on the beaches and sink Japanese landing barges. These boats had almost no support of any kind, but were still able to impress skeptics and convince the Navy of their worth as an offensive craft.

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[93] Report of Conference on Motor Torpedo Boats May 19, 1941, 10
[94] Bulkley, *At Close Quarters*, 13
[95] Ibid,14

The end of Squadron 3 was fast approaching. Lack of spare parts, wear and enemy action had reduced the squadron to four boats, which were not operating anywhere near peak efficiency. When MacArthur was ordered to leave the Philippines in March of 1942, he had selected to be taken out by the PT boats of Squadron 3. Increased Japanese mine laying activity and patrols made escape by submarine too risky. On March 10, 1942, Bulkeley received his orders and was ready to go the next night.

The journey was not glorious in any respects. The boats became separated through the night encountering heavy seas and constantly stopping to clean wax out of their fuel strainers. Almost all of the passengers, except Admiral Rockwell, were below decks too seasick to stand. Eventually after a journey of 560 miles through Japanese waters the PTs dropped their passengers at Cagayan, Mindanao on time and in safe condition.[96]

By April 1942 the remaining boats of Squadron 3 had been lost to grounding, enemy action, and self-destruction. Although all the boats of Squadron 3 were lost, the most important elements of the first Philippine campaign survived. The experience gained by the squadron. A number of officers, including Bulkeley, were able to escape to Australia. These men eventually made it back to the United States where they would be able to share their experience and assist in creating tactical doctrine for PT boats at the newly established Motor Torpedo Boat Squadron Training Center, Melville, Rhode Island.

[96] Ibid, 16

10: Motor Torpedo Boats Tactical Orders and Doctrine

Established on March 16, 1942, the Motor Torpedo Boat Squadron Training Center at Melville, Rhode Island, provided "instruction and shore facilities for the preparation, indoctrination, and training of officer and enlisted personnel in the fundamentals of sound motor torpedo boat operations, maintenance and upkeep…"[97] The actions of Squadron 3 in the Philippines cemented the place of PT boats in the Navy. Now training and indoctrination would refine PT operations. Out of necessity, individual boats were able to perform successful attacks during the defense of the Philippines. The purpose of the training center was to build squadrons around efficient officers and well-trained crews with knowledge gained by experience.

There were a number of lessons learned from Squadron 3. First, PT boats needed to be properly supplied and maintained. When the Cavite Navy Yard was bombed on December 10, 1941, almost all of the spare parts and fuel for the boats were destroyed, in addition to dry-dock facilities. The loss of spare parts and maintenance facilities caused the boats to deteriorate quickly. Early in the campaign PT-32 suffered an accidental explosion and was out of commission for weeks because it could not be repaired. When it was repaired, the boat was held together with bracing wire and barely able to make 22 knots.[98] In addition to engines constantly breaking, fuel was a constant problem. When the Navy Yard was bombed, the squadron lost a large amount of 100-octane fuel. The remaining supplies had been sabotaged; wax was put into each drum of fuel causing it to build up in the strainers while the boats were operating. Every few hours the boats had to shut off their engines and clean the wax out. The wax directly caused the loss of PT-31 when she ran aground in enemy waters after losing engine power. Due to supply shortages the boats had limited speed, capabilities and could not afford to send more than

[97] Bennett and Tredinnick, *Administrative History of PT Boats,* 97
[98] Bulkley, *At Close Quarters,* 14

one boat out on patrols. The lesson learned was if PT boats were to operate, they needed to be well supplied and maintained.

Second, the campaign demonstrated that in addition to being capable torpedo boats, PTs could serve multiple offensive roles. Armed with two sets of twin .50 caliber Browning machineguns and with added .30 caliber Lewis guns, the boats of Squadron 3 could operate as shallow water gun boats, successfully engaging troops on the beach, landing parties, artillery batteries and landing barges. The PTs were involved in a number of rescue missions, picking up survivors from ships sunk in Manila Bay. While evacuating MacArthur and his staff from the Philippines the PTs accomplished an impressive feat, successfully traveling through over 500 miles of enemy patrolled waters to deliver personnel. Born out of desperation, the actions of Squadron 3 showed that the PT could function in every aspect of coastal warfare from sinking large ships to attacking targets on the shore to covertly moving personnel.

The squadron training center provided a faculty of experienced officers from Squadrons 1 and 2. Although these officers had not seen combat, other than Squadron 1 during the attack on Pearl Harbor, they were the most experienced officers available. As combat veterans began to make it back to the United States from Squadron 3 in the summer of 1942, they were rotated into the training center as instructors. This rotation continued for the remainder of the war. Once an officer or enlisted man finished a tour of duty, about one year in duration, he was sent home for a 30-day leave. After leave the sailors were posted for three months to the squadron training center as instructors or enrolled in refresher courses before being deployed for a second tour. Only department heads and a few assistants were permanently posted to the training center.[99] This

[99] Bennett and Tredinnick, *Administrative History of PT Boats*, 102

system allowed officers and men to share their combat experiences with new recruits and assisted in developing realistic modifications and maintenance procedures.

Following the establishment of the squadron school in Melville and the return of the Squadron 3 veterans, the PT service began to codify operational procedures. In July of 1942 the training center issued the first *Motor Torpedo Boats Tactical Orders and Doctrine* manual. This was the first tactical manual written for PT boats by PT boaters. Although a number of modifications to tactical doctrine took place over the course of the war, this manual states the intended purposes of PT boat operations and how to execute them. The new lessons learned by the PT service were put to the test in August of 1942 in the waters off Guadalcanal.

11: Guadalcanal

In June of 1942 Squadron 2, based in Panama, redeployed to a combat area. Its ultimate destination was the island of Tulagi north of Guadalcanal. Before deployment, Squadron 2 was ordered to remain in Panama and to detach eight boats and form a new Squadron 3 for deployment to Guadalcanal.[100] The boats and crews that formed the new Squadron 3 arrived in the same state that the original squadron 3 did in the Philippines. The crews and boats were from the pre-war class. The 77-foot Elco PT boats were of an old design; soon the new 80-foot Elcos were going to fill new squadrons. The crews were not able to benefit from the experience brought back by the survivors of the original Squadron 3 or enhanced training courses at the squadron training center. They made similar mistakes at the operational level as the boats of Squadron 3. Even though some mistakes were repeated, thanks to the actions of Squadron 3 in the Philippines the PT boat was incorporated into the Navy's surface fleet with great effect.

The first PTs deployed to Guadalcanal did not have to wait long for action. On the night of October 14, hours after arriving at their new base on Tulagi, Lieutenant Commander Alan R. Montgomery and the captains of PTs 60, 38, 46 and 48 were awaked by the terrible noise of Japanese battleships *Kongo* and *Haruna* shelling Henderson Field on Guadalcanal.[101] Montgomery immediately ordered his boats to get underway and stop the bombardment. The confused action that followed was the first of many until the Japanese finally gave up Guadalcanal five months later.

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[100] According to Bulkley's book, *At Close Quarters,* the reformation of Squadron 3 was very unfortunate for the new squadron commanders. Although all boats from the original Squadron 3 were lost in the defense of the Philippines official navy records still held it as a commissioned squadron. When the newly formed Squadron 3 requested their commissioning allotment of spare parts the navy responded that they had already received them and they would not grand a second allotment. When Squadron 3 was reformed and deployed it took all available spare parts from the base at Panama and left the remaining squadrons very short on supplies.

[101] Samuel Eliot Morison, *History of United States Naval Operations in World War II: Struggle for Guadalcanal* (Chicago IL: University of Illinois Press, 1949) , 174

The captains of the first four PT boats to arrive in Guadalcanal rushed to their boats and shoved off to stop the bombardment. As the four boats made for the flashes of gunfire, PT-38 became separated from the group and stumbled upon a Japanese light cruiser. Lieutenant jg. Bob Searles immediately slowed PT-38 to 10 knots and made a torpedo attack. Firing two torpedoes from 400 yards and two more from 200 yards, Searles claimed two solid hits as he retired from the action undetected.

PT-60 was making directly for one of the ships shelling Guadalcanal when suddenly a destroyer's searchlight silhouetted it and brought it under fire from another destroyer. PT-60 held its course just long enough to fire two torpedoes and retire, using its smoke screen generator to hide and depth charges to discourage pursuit. While PT-60 was attempting to avoid the encircling destroyers, she went hard aground on the western shores of Florida Island and was out of the fight.

Lieutenant (jg.) Henry Taylor realized he was on a collision course with the destroyer that put its searchlight on PT-60. In his attempt to break the collision course, Taylor cut across PT-48's bow, forcing its commander, Lieutenant jg. Robert Wark, to take extreme evasive action. These evasive actions took both boats off their intended torpedo courses, leaving PT-46 with no torpedo target. The evasive action PT-48 was forced to take brought it directly into the searchlight of yet another destroyer. Five inch shells began to drop around PT-48 as she commenced firing upon the destroyer from 200 yards, knocking out her searchlights and ending the gunfire.[102]

Squadron 3 claimed to have probably sunk one cruiser and damaged another. As would be the case with almost all further action over the next four months, confused night fighting led

[102] Bulkley, *At Close Quarters,* 85

to PT claims that could not be confirmed during or even after the war. That being said, the four PT boats accomplished their mission. Their attack caused damage to the enemy and stopped the bombardment of Guadalcanal. PTs once again proved they were capable of disrupting and damaging powerful surface combatants. Now it was time to integrate them into the surface navy.

At Guadalcanal the Navy was finally able to deploy PT boats in the way it had envisioned before the war. After the second section of boats arrived in late October, Squadron 3 was able to take over more missions, usually courier and convoy escort freeing up valuable destroyers, in addition to their primary task of intercepting the Tokyo Express. Operating from the tender *Jamestown* anchored in Tulagi harbor, PT boats were fed a constant stream of information from coast watchers and aerial reconnaissance, which gave them advance warning of a Tokyo Express run to resupply the Japanese forces on Guadalcanal. Intelligence allowed the PT boats to be deployed as a squadron before actions, with scout boats giving warning and courses to the attack groups. Over the next few months PT boats once again proved very valuable despite being hampered by squadron level breakdowns in confusing nighttime actions even after being put in the right place at the right time.

Although the PT boats of Squadron 3 were not able to sink large numbers of surface ships, they were successful in intercepting the Tokyo Express, defending Guadalcanal and freeing up warships for further offensive operations. After months of tangling with destroyers, February 1, 1943 was the last and most violent battle during the PT campaign for Guadalcanal. Three of eleven boats were lost around Guadalcanal, most notably PT-37 which took a direct hit in the fuel tanks and disappeared in a blinding flash that light the whole area up. PTs claimed

two destroyers sunk and two damaged. A few days later the Japanese finished their evacuation of Guadalcanal.[103]

The next four months brought a lull in the fighting that provided PT forces a chance to organize and train in preparation for the push up the Solomon Islands. Squadron 6 had arrived at the end of December, taking part in the last actions against the Tokyo Express. Suffering from crippling supply and maintenance problems, similar to Squadron 3 in the Philippines, all squadrons were brought under the same command. Now that PT boats were becoming part of regular fleet operations they needed a dedicated command structure. Squadron leaders overwhelmed with nightly operations could not watch after supply and base issues. To fill this need two positions were created. Commander Allen P. Calvert took command of the newly created Motor Torpedo Boat Flotilla 1 on December 15, 1942, and Captain M. M. Dupre Jr. was given administrative command of motor torpedo boat squadrons in the South Pacific. These newly created commands created a proper administrative and logistics system to support PT boat operations.[104]

Near the end of the Guadalcanal campaign radar began to appear in new PT boats arriving from the United States. Aircraft SO type radar gave PT squadrons exactly what they needed at the tactical level. During the fight with the Tokyo Express group attacks broke down as individual boats found targets or were attacked by undetected destroyers. Radar gave boats size and composition of enemy forces; better enabling them execute mass attacks from

[103] Ibid, 103
[104] Ibid, 106

advantageous positions as groups rather than individual boats. Newly installed radar and joint operations with "Black Cats"[105] at night proved decisive in the next campaign.

In May of 1943 the PT squadrons began their move up the Solomon Islands to New Georgia.[106] It was a month later that PT boats patrolling around New Georgia would have their last actions with destroyers and their first with barges. From July 1943 to October 1943 PT boats from six squadrons based on Rendova battled Japanese float planes and inter-island supply barges. After the first encounters with PT boats, the Japanese began to arm their barges with heavier cannon, up to 40mm, and provide more coastal artillery to cover barge routes. PT boats adapted to this challenge in August 1943 by mounting larger weapons. Soon 37mm and 40mm cannon became standard armament for PT boats.[107]

In August of 1943, after the last engagements with Japanese destroyers and the first engagements with Japanese barges, it became the mission of PT boats to move up the Solomon Islands and stop all supply attempts. Motor Torpedo Boat Flotilla 1 became a blockading force, completely cutting off New Georgia, Treasury Islands and Bougainville. PTs waged such an effective campaign that on November 24, 1944, Commander of Motor Torpedo Boat Flotilla 1, Commodore Moran, ceased all patrols in the Northern Solomon Islands.[108]

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[105] PBY Catalina reconnaissance planes that operated at night were called "black cats". These planes worked in conjunction with PT boats by locating, bombing, strafing and illuminating landing barges for PT boats to attack.
[106] Bulkley, *At Close Quarters,* 109
[107] Ibid, 131.Most of these weapons were mounted in the field; within a few weeks the message had reached the United States that more guns were needed on PT boats. This resulted in a design change where the 40mm cannon was made a standard installation on all future PT boats from the factory.
[108] Ibid, 165

12: New Guinea

On the night of December 18/19 PTs 121 and 122 conducted their first patrol off the coast of New Guinea. They torpedoed but failed to sink a surfaced submarine.[109] Within a year the Southwest Pacific PT force grew to fourteen squadrons and eight tenders. The yearlong blockading campaign waged by PT boats along the coast of New Guinea resulted in the destruction of hundreds of barges and the starvation of thousands of Japanese troops. This was the most effective blockading campaign waged by PT boats during World War II.[110] The campaign in New Guinea started in a similar manner to Guadalcanal. Japanese surface ships and submarines made supply runs until PT boats made these runs to costly, then the Japanese switched to barge supply system.

The action on July 20/21, 1943, by PTs 151 and 150 was typical of almost all PT actions for a year in New Guinea. Lieutenant jg. Barry Atkins in command of PT-151 departed Morobe, New Guinea, on patrol with PT-150 and PT-114. Soon PT-114 developed engine problems and returned to base, leaving the other boats to continue the patrol. While cruising along the northern coast of New Guinea at twenty seven knots, the patrol made visual contact with five barges running half a mile off the beach. Lieutenant jg. Hamachek slowed to nineteen knots to allow PT-151 to close formation. Once the barges were within range both boats gunned their engines to full speed, running between the barges and the shoreline as they opened fire. Within seconds two barges were sinking and a third was on fire, with limited return fire from the helpless barges. In his after-action report, Lieutenant Atkins remarked that enough rounds had been pumped into the barges during the first run that the barrels his machineguns glowed red. Not satisfied with only

[109] Bulkley, *At Close Quarters*, 173. Each boat fired one torpedo, the captains claimed that their shots ran hot, straight and normal but failed to explode.
[110] Ibid, 259

sinking three barges the patrol immediately returned for a second gunnery run, sinking the remaining two barges. After the action the PTs completed their patrol and returned to base.[111]

The geography of New Guinea made resupply of Japanese troops by sea a necessity. The island lacked an internal system of roads or railroads that made resupply by land possible. As in the Solomons, New Guinea PT squadrons pushed up the northern coast and destroyed the Japanese system of resupply.

[111] Action Report of PT-150 and PT-151 morning of July 21, 1943. Records Relating to Naval Activity During World War II; WWII Action and Operational Reports; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.

13: Invasion of the Philippines

As a prelude to the 1944 invasion of the Philippines US forces landed on the island of Morotai in order to establish a support base for future operations. On September 16, 1944, the day after the initial landings on Morotai, Comdr. Selman S. Bowling arrived with two PT tenders and 41 boats of Squadrons 9, 10, 18 and 33.[112] These veteran squadrons from New Guinea and the Solomons immediately went to work fulfilling their primary mission of isolating Japanese forces on Morotai and the neighboring island of Halmahera. With Japanese forces on Halmahera constantly attempting to reinforce the garrison on Morotai, PT boats were in action until the end of hostilities in August of 1945. When Japanese forces began the process of surrendering at the end of the war it was discovered that PT boats had cut off and starved 37,000 Japanese troops on Halmahera for eleven months.[113]

PT boats of the Seventh Fleet were able to cut off and isolate the island garrisons of Morotai and Halmahera by carrying out a number of different missions. Normal barge hunting patrols similar to actions around New Guinea and the Solomon islands were common until the end of the war. These missions prevented Japanese troops from reinforcing, supplying or evacuating Morotai. By February 1945, PT patrols were effective enough to only require two squadrons to block reinforcement of Morotai for the remainder of the war.

While nightly missions were run between the islands, beginning in April of 1945, daylight sweeps of the Halmahera coast and harassing raids were conducted by PT crews with the help of native scouts. During daylight hours PT patrols operated under fighter cover, from the Royal Australian Air Force, or with the assistance of spotter planes. Assisting fighters or spotters

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[112] War diaries squadron 9, September 1-30, 1944. Records Relating to Naval Activity During World War II; WWII Action and Operational Reports; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.

[113] Bulkley, *At Close Quarters*, 368

directed PT gunfire onto hidden barges and suppressed Japanese fire to allow PTs to make firing runs.[114] PT boats carried out raids on the small islands south and west of Halmahera, in addition to Halmahera itself, causing a complete breakdown in the Japanese supply system by sending parties ashore to burn warehouses and transport barges.[115]

On October 21, 1944, 45 PT boats and three tenders under Comdr. Bowling arrived off the invasion beaches in Leyte Gulf. That night PT patrols began on the western and southern sides of Leyte Island.[116] After three nights of patrols PTs claimed seven barges and a small freighter sunk before they were deployed to the southern approach to Leyte Gulf.[117] On the night of October 22/23 Squadron 12, with five boats attached from Squadron 7 and the tender USS *Wachapreague,* moved to Panaon Island to protect the southern approach to the invasion fleet. It was from this advanced base that PT boats went into action in the last great naval battle of World War II.

In the early morning hours of October 23, 1944 while Squadron 12 boats were establishing an advanced base at Panaon Island, the submarines USS *Darter* and USS *Dace* made contact with a large Japanese surface force southwest of Leyte. It quickly became apparent that this large force intended to contest the American landings on Leyte. Soon the force of battleships, cruisers and destroyers split in two. The center force heading towards the San Bernardino Strait and the southern force heading towards the PTs of Squadron 12 and 7 guarding the Surigao Strait. If the southern force of two battleships, four cruisers and eight destroyers

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[114] Ibid, 373

[115] Ibid, 374

[116] War diary Squadron 12, 10/1-10/31 1944. Records Relating to Naval Activity During World War II; WWII Action and Operational Reports; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.

[117] Bulkley, *At Close Quarters,* 378

survived daylight attacks by Admiral Marc Mitschers carrier biased planes, it would be greeted by a American surface force of battleships, cruisers, destroyers and PT boats.[118]

The primary mission of PT boats in the battle of Surigao Strait was to scout for the main battle line, giving the location, course and speed of the Japanese taskforce. Once the PT had reported the positions they could attack. Thirty nine PT boats were deployed in thirteen sections three in the approaches of and within the Surigao Strait. On the night of October 24, 1944, the southern most section consisting of PTs 152, 130 and 131 made the first radar contact in the Mindanao Sea. Before reaching torpedo range an eight-inch shell grazed the port foreword torpedo of PT-130, passed through the boat and into the water. As PT-130 was being hit, a Japanese destroyer planted a shell on the bow of PT-152, killing the bow gunner and setting the boat on fire.[119] Unable to radio friendly forces because their radios were knocked out by shell concussions, PTs 130 and 131 met up with PT-127 and passed the word on.[120]

As the Japanese task force pushed north through Surigao Strait, sections of three PT boats made reports of their positions and attacked. The confused actions were reminiscent of the battles with Japanese destroyers around Guadalcanal two years earlier. Single boats were caught in searchlights and chased off by destroyers as they fired torpedoes. Japanese destroyers escorting the force worked overtime chasing and taking pot shots at individual boats and sections as they made torpedo attacks. In the end only nine PT boats escaped action. Thirty boats were under direct fire during the battle. Three men were killed and twenty were wounded. Despite hits on ten boats only one, PT-493, was lost when it was hit three ties by a Japanese destroyer.

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[118] Ibid, *378*

[119] War diary Squadron 12, October 1944.

[120] Bulkley, *At Close Quarters, 381*

During the battle of Surigao Strait PTs accomplished their primary and secondary missions. Their primary mission of reporting Japanese fleet positions was done with such accuracy that the battle line was able to estimate within three minutes the arrival of Japanese forces.[121] PT attacks during the battle register two confirmed torpedo hits, one on the cruiser *Abukuma* and the destroyer *Asagumo.*[122] In addition to making torpedo hits, the attacks served to disrupt the Japanese formation and forced it to give its position away.

After the great naval battle of the Philippines, Squadrons 7, 12, 21, 33 and 36 followed their normal pattern of isolating islands. Patrols were conducted around Leyte and the surrounding islands against barges, supply ships and even destroyers until Leyte was overrun. After Leyte was taken PTs began to move northwest to Mindoro where island isolation and anti-barge patrols continued until the invasion of Luzon. By spring of 1945 the Philippine campaign had wrapped up. PTs helped isolate and destroy isolated Japanese garrisons on islands such as Palawan and Mindanao. With fewer islands to resupply and even fewer navy ships to do it with, Japanese shipping traffic began to drop off giving PT boats fewer and fewer targets.

After the Philippines the PT war ended in the Pacific. PTs had fought in the defense of the Philippines, battle for Guadalcanal, Solomon islands, New Guinea, Morotai and back through the Philippines. By the summer of 1945 PT boats had isolated thousands of Japanese troops on islands and ruined their inter-island supply chain, now there were too few targets. Their campaign in the Pacific was over. Six boats of Squadron 37 made it to Okinawa but never saw action before the end of the war. No solid plans were ever made for PT participation in the final invasion of the Japanese home islands.[123]

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[121] Ibid, 389
[122] Ibid, 390
[123] Ibid, 441

14: PT Boats in the Mediterranean

The first division of Squadron 15 arrived in Gibraltar on April 13, 1943, onboard fleet oilers *Housatonic* and *Enoree.*[124] The boats of Squadron 15 were the first of three squadrons eventually deployed for a two-year stretch in the Mediterranean theater. The PT war fought in the Mediterranean was a much different conflict than the Pacific. By the time the first boats of squadron 15 were arriving in Gibraltar, PTs had been fighting in Guadalcanal for nine months. The men of squadrons 15, 22 and 29 had the advantage of training at a fully established Squadron Training Center and being equipped with the newest boats and radar.

The circumstances in the Mediterranean were completely different than the Pacific. The distances in the Mediterranean were tiny in comparison to the vast expanses of the Pacific. In the Solomons and New Guinea, PTs were integrated as part of the fleet. During actions PT boats worked in conjunction with destroyers and nighttime patrol aircraft to find and destroy Japanese shipping and landing barges. In the Mediterranean PT squadrons were much more autonomous, waging their own coastal war and joining in fleet actions only in support of landing operations.

Mediterranean PT boats had three primary missions; prevent German evacuation of abandoned positions by night, support allied landings and intercept coastal convoys carrying supplies to the front lines. In all of these missions, except for supporting allied landings, PTs specifically avoided working with aircraft and destroyers in order to avoid friendly fire incidents. Also, due to the nature of these campaigns the three squadrons deployed to the Mediterranean fired more torpedoes than all the boats sent to the Pacific and English Channel combined. This prolonged torpedo war started with Squadron 15's first patrol on the night of May 8/9, 1943.

[124] Bulkley, *At Close Quarters,* 278

After unloading his boats at Gibraltar on April 13th, Lieutenant Commander Sidney Barnes took them down the coast to Bone on April 27, 1943, and immediately began patrolling with British Coastal Forces.[125] British Coastal Forces Motor Torpedo Boats and Motor Gun Boats patrolled with divisions of Squadron 15 boats to allow them to benefit from their experience. After 11 nights of uneventful patrols PT-206 drew first blood for Squadron 15 by sinking a 3,000-ton merchant ship in Ras Idda Bay, Tunisia.[126] This was the only enemy action Squadron 15 boats had in North Africa before providing support for the invasion of Sicily.

Over the course of the war in the Mediterranean PT boats supported six landings from the invasion of Sicily in July of 1943 to the invasion of Southern France in August of 1944. The primary missions of PTs in support of amphibious landings were as screening forces, escorts for groups of landing craft and demonstrations of false landings intended to deceive the enemy. In all of these roles PTs performed extremely well. Their shallow draft enabled them to pass over coastal mine fields, an area that destroyers and other larger screening vessels could not travel. In addition, radar equipped PT boats making a very tight screen miles out from the beaches. Demonstrations of false landings usually involved PTs laying smoke and firing all guns while running a parallel course to the beach.

From North Africa PTs began operations to capture the island of Pantelleria on June 11, 1943, and the first patrols of the Sicilian Coast. These patrols were intended to cut off any attempts at resupply and escape from Pantelleria or Sicily. PT boats screened the Sicilian landings, provided diversionary operations and maintained patrols on the Sicilian coast to

[125] Ibid, 279

[126] Action Report No.1 May 8/9 1943, written by Lt. Comdr. Sidney Barnes, commander Squadron 15. Records Relating to Naval Activity During World War II; WWII Action and Operational Reports; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.

prevent resupply efforts.[127] As soon as Palermo fell the first advance PT base was set up in order shorten the trip to the new patrol zone, the Straight of Messina. In late July 1943 while patrolling the northern approaches to the Straight of Messina, the PT boats of Squadron 15 encountered their first F-lighters.[128]

After assisting allied forces in the invasion of Italy, in October 1943 Squadron 15 began to operate out of Maddalena, Sardinia, and Bastia, Corsica. The next six months were marked by a series of tough engagements with German Torpedo Boat destroyers and occasional coastal convoys. Bad winter weather only made this time worse, few torpedoes hit home and few convoys were successfully intercepted due to bad weather and poor luck.

With the addition of two new squadrons in April of 1944 and summer weather arriving, Mediterranean PT boats began to rack up the score against coastal convoys. PT boats constituted the majority of surface support vessels in the invasion of Elba. Allied heavy guns were emplaced on Elba denying the use of the coastline to the south for Axis resupply.[129] Now PT boats of multiple squadrons were able to operate against the southern coast of France and the western coast of Italy.

After assisting with the invasion of Southern France, in September of 1944, the squadrons set up a new advance base in Leghorn, Italy. This base gave boats better access to the Gulf of Genoa.[130] PTs operated from Leghorn and Gulf Juan, Southern France for the remainder of the war until the last patrol on April 28/29 1945.[131] From the beginning of American PT boat deployment in the Mediterranean, the squadrons worked closely with British Coastal forces.

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[127] Bulkley, *At Close Quarters*, 285
[128] Ibid, 288
[129] Ibid, 315
[130] Ibid, 339
[131] Ibid, 346

The last enemy action PT boats saw in the Mediterranean was on the night of April 23/24, 1945. PTs 305 and 307 under the overall command of Lieutenant R. Nagle intercepted and destroyed, in a running gun battle, an Italian MAS boat.[132] Between May of 1943 and April of 1945 PT boats in the Mediterranean fired a total of 354 torpedoes.[133] "Four boats were destroyed by mines; 5 officers and 19 men killed in action; 7 officers and 28 men wounded in action." The boats of Squadrons 15, 22 and 29 claimed sinking 38 vessels totaling 23,700 tons and damaging 49 totaling 22,600 tons. In joint patrols with British MTBs and MGBs claims of 15 sunk totaling 13,000 tons and 17 damaged totaling 5,650 tons.[134] This was the most prolonged torpedo firing campaign undertaken by any PT boats during World War II.

It was not until the invasion of France in June 1944 that American PT boats were needed in the English Channel. Since the beginning of the war British coastal forces had used motor torpedo boats and motor gun boats to attack German coastal convoys and defend British convoys from similar German attacks. There was no need for American PT boats until the Office of Strategic Services requested PT boats for inserting agents into occupied France. A new Squadron 2 was commissioned on March 23, 1944, fitted out with advanced navigational equipment and trained to land men and equipment on a beach silently. These boats crossed German minefields and convoy lanes, landed operatives and equipment on enemy occupied beaches nineteen times between May and November 1944. Not a single mission was discovered or taken under fire.[135]

Although the navy planned to have three additional PT squadrons available for the invasion of France, only Squadron 34 made it in time to participate. The responsibilities of the

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[132] Action Report No. 30, 23/24 April 1945, written by Lt. Comdr. Richard Dressling, commander Squadron 22. Records Relating to Naval Activity During World War II; WWII Action and Operational Reports; Records of the Office of the Chief of Naval Operations, Record Group 38: National Archives at College Park, College Park, MD.
[133] Nelson, *Hunters in the Shallows*, 206
[134] Bulkley, *At Close Quarters*, 346
[135] Ibid, 349

Squadron 34 boats were to escort the minesweepers that cleared the channel for the invasion forces and then join destroyers screening the western approaches to the beaches against E-boat infiltrations. The boats of Squadron 2 were attached to various command vessels to serve as high-speed dispatch boats.[136]

In August PT boats were pulled from the invasion area in order to form patrols on the western and eastern flanks of the invasion. During these patrols PTs learned a new technique courtesy of British coastal forces. Groups of three to four PT boats were stationed at the end of a patrol line that a destroyer would run. Because their radar was much better, the destroyers could vector PT boats onto targets until their own radar could pick them up.[137] This tactic led to a number of engagements with German E-boats and coastal craft. However, following the capture of LeHavre in the first week of September 1944 PTs no longer had an enemy to fight in the Channel.[138] Squadron 2 carried out missions for the Office of Strategic Services until it ran out of occupied coastline. Following the German surrender the remaining PT boats in the English Channel were either lend-leased to the Russians or sent back to the United States for shipment to the Pacific.

[136] Ibid, 350

[137] The British developed this tactic because their motor torpedo boats and motor gun boats were not equipped with radar.

[138] Bulkley, *At Close Quarters,* 364

15: Conclusion

In December of 1936 Rear Admiral Emory Land sent a letter to the Chief of Naval Operations proposing that the US Navy look into starting a motor torpedo boat program. He stated that advancements were being made in Europe making the motor torpedo boat a powerful weapon. Land suggested that although motor torpedo boats did not fit into current Navy strategy they could have considerable value in defense of advanced bases and could conduct offensive operations from advanced bases once a war started. What Land suggested eventually became one of the most versatile vessels of the United States Navy during World War II.

After witnessing developing world events and the comments made by Land, the Navy took his proposal seriously. Within two years designs were already being constructed and tested. By 1941, after gaining two years of experience operating various sizes of motor torpedo boats, the Navy determined what it was looking for. It wanted a craft between 75-80 feet in length, capable of doing over 40-knots, armed with torpedoes, defensive machineguns and depth charges for attacking submarines. By the fall of 1941 enough boats existed to commission three squadrons with 12 boats in each. These were immediately deployed to Hawaii, Panama and the Philippines without the Navy developing any sort of PT tactical doctrine.

When the Japanese attacked Pearl Harbor, there were only six PT boats on the front lines, the boats of Squadron 3 in the Philippines. Over the next four months these six boats performed amazing feats of courage and capability, solidifying the place of the PT boat in the US Navy. After the fall of the Philippines the call went out for more boats.

Over the course of the war PT squadrons deployed to every major theater successfully engaging in different types of offensive operations. PTs operated as torpedo boats, gunboats, landing craft, convoy escorts, invasion-screening forces, scouting craft, lifeguards and couriers.

They were able to successfully adapt to every major theater of war even though they undertook missions they were not originally designed for. The PT boat exemplifies the principle of economy of force and provided to be one of the most valuable vessels of the US Navy.

The PT boats of World War II re-established the presence of the US Navy in inshore operations that had not existed since the monitors of the mid to late 1800s. Their ability to sink large ocean going ships, bring heavy firepower to bear on shore targets, operate in conjunction with other elements of the fleet and land raiding parties brought the US Navy back into coastal warfare. War against enemy supply lines was no longer restricted to sinking ocean going freighters, breaking down supply chains at the lowest levels caused their complete breakdown. The achievements of PT boats were not forgotten. Eventually the two greatest capabilities, their firepower and ship killing ability, were divided into two different types of craft. The brown water navy of Vietnam made extensive use of fast boats armed with machineguns to operate in inshore and river waters. Acting as gunboats, PBRs and Swift boats engaged the enemy at close quarters and inserted Special Forces teams. The ship killing capabilities were not forgotten either. Modern versions of PT boats exist as large missile boats, often used by the Iranian Navy. These fast boats carry anti-ship missiles, the modern torpedo, and pose a threat to any surface vessel that comes within range. These are the newest version of PT boats that first started mounting five-inch barrage rockets on their decks to attack shipping convoys in 1943. The firepower and mission capabilities that PT boats pioneered during World War II and their continuing legacy in coastal warfare demonstrate the importance of the Patrol Torpedo Boat as a weapon of naval warfare.

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