Presentations

America Adapting: Submarine Warfare and Pacific Islands

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Diplomacy and strategy involving the protection of islands can employ a variety of tools and take many forms. Indirect forms of strategy, according to Liddell Hart, can be very effective.[1] There are many ways to deter an opponent in order to protect islands or support diplomacy short of war. Submarines may contribute to an indirect strategy, although primarily conceived of as a traditional military instrument. Furthermore, the seizure of an island can be countered directly by amphibious forces or isolated by blockading submarines. Success in island seizure is generally a contest of naval superiority. Forces approaching islands in amphibious operations present concentrated targets for submarines as in the Falklands, and the sustainment of landing forces requires transports that can be interdicted as they were in the Pacific war around Guadalcanal. Thus, there are numerous roles for submarines in historical campaigns and in future security scenarios involving island protection.

After December 7, 1941, the US Navy had the opportunity to demonstrate that its detailed planning for the anticipated contest of arms in the Pacific were strategically sound and operationally feasible. The American Fleet that was present in the Pacific Ocean was designed to execute a war plan that had been studied and gamed for 40 years. The Fleet was designed and trained based on that plan, but events would show it was not well suited to the actual character of the conflict that emerged in late 1941. In key respects, the US Navy was not nearly as prepared as it should have been, and significant adaptation was needed. This case study presents why and how that adaptation was brought about, and what it might suggest are critical questions today about islands and the role of submarines.

Strategic Context

To appreciate the degree of adaptation that occurred in the Pacific in World War II, one must understand the strategic planning that preceded the war. The strategic planning of the interwar era evolved quite a bit over time, producing a lot of debate and many plans. The one singular constant was the US Navy's focus on countering the empire of Japan. Initially, both before and after World War I, US planning for potential contingencies against possible opponents were contained in a set of formal plans produced and approved by a Joint Board. These are the famous color-coded plans. More than a dozen such plans were worked up, ranging from war against Canada, Britain, Cuba, among others. But from the beginning, the Navy's planning effort focused on iterations of a war against Japan, the so-called War Plan Orange.

For more than three decades, America's best strategic and military minds labored over the tyranny of time and distance of a war against Orange, the empire of Japan. Although their efforts lacked for guidance from the nation's political leadership, they served to make planners

1 B.H. Liddell Hart, *Strategy: The Indirect Approach*, London: Faber and Faber, 1954.

in both the Army and the Navy cognizant of the difficulties of a trans-Pacific test of arms. Planners accurately anticipated Japan's opening moves in a sudden war, as well as the general outline of her advances into Southeast Asia and the Philippines. Much of this naval planning still derived its energy from the US Navy's infatuation with the modern Dreadnought and the belief that eventually the war against Japan would be decided, as Mahan taught, in a titanic clash of battle lines concentrated in line. At the same time, though, planners recognized that setting the stage for such a clash required the development of a major fleet with a capable naval aviation component, as well as the ability to logistically support a long campaign. The need for advanced bases to support the Fleet and to provide necessary logistics via underway replenishment was also well understood, which gave play to the ambitious development of amphibious capabilities that many thought would never occur given the debacle at Gallipoli in World War I.

The outline of War Plan Orange envisioned in three phases. In Phase I, the Navy would rush out to the Western Pacific to seize and defend island bases, for logistical support and sites for land-based air cover. Phase II would involve offensive operations to achieve sea control in the region, and would culminate in battle where "the two battle fleets would meet in a cataclysmic gunnery engagement." The remainder of the war, Phase III, would be "a progressively tightening blockade that would sever Japanese oceanic trade."[2] The end state or conclusion of the plan was always described in terms of a blockade that would choke off Japan's imports and economy.[3]

The submarine component of the American fleet had a limited role in War Plan Orange's early phases. They were auxiliaries or picket ships to scout ahead of the Fleet and extend its range of observation. However, in the culminating phase, subs were expected to contribute in the naval blockade. The submarine would shift from a supporting role of screening and intelligence collection, to a more substantial mission in the blockade of Japan that was the Plan's expected means of war termination.[4]

The possibility of a two-front war, and the prioritization of the Pacific as the economy of force theater, emerged as US policy by 1941. This was not popular with senior Navy strategists. Their preferred offensive strategy for the Pacific, now widely acculturated in their planning staffs and the design of the Fleet, was shelved in order to prioritize Germany as the primary initial opponent, with the Pacific as a strategic defensive theater. It was not the Trafalgar contest that naval planners and wargamers were so familiar with.

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2 Edward S. Miller, *War Plan Orange, The U.S. Strategy to Defeat Japan*, 1897–1945, Annapolis, MD: Naval Institute Press, 1991, p. 151; Louis Morton, "Germany First: The Basic Concept of Allied Strategy in World War II," in Kent Roberts Greenfield, ed., *Command Decisions*, Washington, DC: Army Center of Military History, 2000.

3 Michael Vlahos, *The Blue Sword: The Naval War College and the American Mission, 1919–1941*, Newport, RI: Naval War College Press, 1980, pp. 119–120. E. Miller, *War Plan Orange*, p. 28.

4 See Michael Vlahos, "The Naval War College and the Origins of War-Planning Against Japan," *Naval War College Review*, July–August, 1980, pp. 23–39.

Wargames

In the interwar era, the US Naval War College, with its distinguished faculty and students, played a key role in testing Plan Orange's assumptions and parameters. A total of 136 wargames were played at the strategic and operational level on table tops and on the storied floor of the gaming center at Sims Hall at Newport, Rhode Island.[5] Of these games, 127 or 97 percent were played against Orange or Japan. From this focus emerged a clear grasp of the geopolitical and military realities of war in the Pacific. Through many iterations and players, the operational imperatives of regaining sea control and bringing the battle line to bear against the opponent's navy were explored. Over time, that planning and gaming produced a mental model of how such a war would be fought, and what the Navy's role would be. Plan Orange was burned into the corporate memory of the Navy Officer Corps, "genetically encoded" into the US Navy's thought processes and procurement plans.[6]

Part of this encoding was conducted by a series of fleet exercises that served to link strategic vision and innovation with the realities faced by Fleet Commanders. The interaction between the Fleet and the Naval War College also served to cycle innovative ideas between theorists, strategists, and operators. A growing corporate consensus on what worked and what did not emerged from this reciprocal process. The exercises in the Fleet, conceptually framed by the wargames in Newport's famous Sims Hall, became the "enforcers of strategic realism."[7] They also were enforcing and reinforcing the Navy's mental model of what war at sea entailed, and what belief systems the Navy held most dear. This mental model or frame would dictate the roles of various communities in the Navy, as well as the role of the Navy's submarine fleet.

In the 1920's Newport's games pointed to the growing importance of air power and thus the need for large carriers. It should be noted that Newport's simulations examined possibilities years before the US Navy actually had a carrier. Building off of the games and the experiences of World War I, the Navy's General Board had already concluded in 1919 that "Fleet engagements of the future will probably be preceded by air engagements. The advantage will lie with the fleet which wins in the air"[8] While the role of aviation was foreseen, the missions and capabilities of aviation still remained to be worked out. Some saw the carrier as a means of providing aviation surveillance or as scouts for the fleet.

The submarine did not play significantly in Newport war games. Mahan had eschewed war against commerce or guerre de course in his preaching. Newport was haunted by Mahan's ghost and it was certainly imbued with his dogmas about the concentrated battle fleets. Only five games at the Naval War College appear to have played the submarine in any material way, and these used US submarines as scouts to identify the enemy's battle fleet so the modern

5 Germany and Europe is not considered important to U.S. Naval planners, not until 1939–41 does Newport react to changes in the strategic environment with a few Black/Silver (Germany/Italy) games. For details, see Michael Vlahos, *The Blue Sword*; and Michael Vlahos, "Wargaming, an Enforcer of Strategic Realism: 1919–1942," *Naval War College Review*, March–April, 1986, pp. 7–22.

6 Miller, *War Plan Orange*, p. 330.

7 Vlahos, "Wargaming, an Enforcer of Strategic Realism," p. 7.

8 Quoted by George Baer, *One Hundred Years of Sea Power, The U.S. Navy, 1890–1990*, Stanford, CA: Stanford University Press, 1994, p. 141.

Dreadnoughts could be brought to bear.[9] The games there assumed that the forthcoming war would climax in a clash of battleships in the western Pacific in one of Mahan's archetypal "decisive battles."[10]

The emphasis at Newport on the gaming floor in Sims Hall was the destruction of the Japanese fleet. It was the necessary precursor for gaining sea control and for creating the conditions for surrounding and choking the island empire of Japan. The consistency of the overall planning around Orange is notable. It was part of a liturgy that was drummed into the Navy's officer corps and its operational culture.[11]

Fleet Exercises

In addition to the intellectual wargaming contests at Newport, the US Navy continued its investigation into innovative tactics and technologies in an annual series of Fleet Exercises.[12] For an entire generation, from 1922 to 1941, the operational arm of the Navy conducted major exercises. These were both exercises and experiments, conducted with a clear and explicit operational problem, but conducted under free play or unscripted conditions with opposing sides. Rules for evaluating performance and effectiveness were established, and formal Navy umpires assigned to regulate the contest and gauge success at these once-a-year training evolutions. Such events were bounded by supposedly realistic rules, and limited by safety considerations. These were established to make the exercises approximated expected wartime conditions, something that turned out to be illusory. Brutally candid post-exercise critiques were conducted, in open forums and by published reports, in which junior and senior officers examined moves and countermoves.

It was during these fleet problems that the Navy's envisioned way of war was both tested and acculturated onto the officers of the fleet. These fleet problems were essentially a repetitive series of systematic free play battle experiments in which the performance of the Fleet and its components was rigorously explored, routinely critiqued, and ultimately refined.[13] More than the games at Newport, in which senior officers and planners were the predominant participants, these exercises provided the Navy's officers with a realistic laboratory in which steel ships were maneuvered at sea, not cardboard mockups or playing pieces on the floor at Sims Hall. Numerous naval leaders found these valuable exercises ideal in offsetting the Navy's lack of operational experience after its limited role in World War I.

The training exercises were designed to focus on the Navy's principal challenge, a war against Japan. Just as in Newport, Plan Orange was the singular context for the maneuvers. The only adversary or operational problem posed to the Fleet in the annual maneuvers dealt with driving the fleet across the Pacific and meeting the Japanese fleet in a titanic struggle for

9 See Vlahos, *The Blue Sword*, pp. 166–178, for an overview of all the games.

10 Toll, *Pacific Crucible, War at Sea in the Pacific, 1941–1942*, New York: W. Norton, 2012, p. xxxiv.

11 Vlahos, *The Blue Sword*, p. 98.

12 Albert A. Nofi, *To Train the Fleet for War: The U.S. Navy Fleet Problems, 1923–1940*, Newport, RI: Naval War College Press, 2010. Newport Papers 18.

13 Nofi, p. 271.

supremacy. The exercises reinforced the Navy's conception into actual practice.[14]

They may have also enforced some unrealistic conclusions about submarines as well.[15] The exercises convinced some naval leaders that the submarine would only play a minor role in the Pacific. In an operational plan dominated by high speed carrier groups and battleships operating at least at 17 to 20 knots for extended periods, the Navy's early submarines simply didn't have the speed. The boats were only capable of 12 knots on the surface, and were far in the wake of the fleet during extended operations. Since the submarines could not get out in front of the Fleet like Nelson's frigates, they tended to be sent to the sidelines of exercises.

Not only did the Fleet come to negative conclusions about the role of submarines, but the submarine community itself took on a cautious approach and codified that into doctrine. Limitations of command and control, and a widespread belief that submarines were easily detectable from the air, limited an appreciation for what they could contribute. Everyone presumed that aviation made it extremely easy to identify submarines, so that they had to stay deeply submerged. The force learned to "hide" and provide intelligence more than it learned how to attack. In short, the exercises created a false conception of their utility. As one student of the era noted:

> Submarines were to be confined to service as scouts and "ambushers." They were placed under restrictive operating conditions when exercising with surface ships. Years of neglect led to the erosion of tactical expertise and the "calculated recklessness" needed in a successful submarine commander. In its place emerged a pandemic of excessive cautiousness, which spread from the operational realm into the psychology of the submarine community.[16]

The war began with a total of 51 submarines in the Pacific fleet, and 22 were supposed to be based at Pearl Harbor. But only 5 were present during the attack, with many back in the States for overhaul. The Asiatic Fleet, had a total of 29 subs, but six were the older S-class boats and of limited utility. By the end of the war, that number had grown to 252 submarines. In contrast, the Germans had built and deployed four times that number. But the American submarines were ideal for the war in which they were employed, and produced a strategic effect.

The US Navy's fleet had the right platform with a fleet submarine that could log great distances in search of victims, and that submarine was equipped with the various technologies (computers, radar, sonar, diesel engines, etc.) needed to hunt down their targets with confidence. However, they did not have the mindset or weapons needed to be successful as wolves of the sea.

14 Craig C. Felker, *Testing American Sea Power: U.S. Navy Strategic Exercises, 1923–1940*, College Station, TX: Texas A&M University Press, 2007, p. 6.

15 Nofi, p. 307.

16 Felker, p. 62.

Operational Adaptation

In the immediate aftermath of the attack on Pearl Harbor, the United States reacted by initiating a defensive war of attrition against the empire of Japan. The Navy was not able to implement its much rehearsed War Plan Orange with carrier group thrusts across the Central Pacific searching for an American Trafalgar. Instead, the Navy started by ordering unrestricted submarine warfare against Japan's sea lines of communications. The small submarine force was to be the first line of both offense and defense for the US Navy as the war begun. For the past several years, US Navy strategists had begun to think more about what the submarine force might contribute. Strategic requirements and legal precedents were debated, and the Navy's high command accepted the notion that the preponderance of military power in the Pacific would favor the Japanese initially. The employment of the fleet submarine to blunt Japan's expected thrusts towards Southeast Asia offered a potential solution.

The US Navy had spent over two decades preparing for a campaign of its own preference and design against the Japanese. As the war approached, its leadership recognized the increase reliance that America would place upon the submarine to offset potential Japanese military advantages. Nearly 20 years of international law and an equal amount of strategic planning were quietly shelved. Should war break out suddenly in 1941, the Navy's most senior leaders were prepared to operate outside existing international law, and unleash naval and airpower against Japan's extended lines of communication, including its naval might and its merchant shipping.[17]

However, naval planners had not really used the time to operationalize that adjustment beyond the planning stage into the Fleet. The Navy had not thought out the necessary components for such a campaign. It was one thing to debate the strategic merits of a Pacific guerre de course. It was another thing entirely to put it into execution.[18] The poor results in the first year of the campaign bear out this assessment. Campaign pressures and operational realities would force the Navy to adapt.[19]

Strategic adaptation began just a few hours after the report of the attack at Pearl Harbor. Upon hearing about the Japanese strike, Admiral Hart issued an order to his small fleet, "Execute unrestricted air and submarine warfare against Japan."[20] He did so based off of earlier discussions and message traffic between the Chief of Naval Operations and naval planners in the prior year.[21] A few hours later, Admiral Stark, after conferring with President Roosevelt, issued the same order to the entire US Navy. The long planned war in the Pacific

17 Joel Ira Holwitt, *Execute Against Japan: The U.S. Decision to Conduct Unrestricted Submarine Warfare*, College Station, TX: Texas A&M University Press, 2009.

18 An assessment drawn by every historian on this period; Ronald H. Spector, *Eagle Against the Sun: The American War with Japan*, New York: Free Press, p. 985; Nathan Miller, *War at Sea: A Naval History of World War II*, New York: Oxford University Press, 1994, pp. 477–499.

19 Holger H. Herwig, "Innovation ignored: The submarine problem-Germany, Britain and the United States, 1919–1939," pp. 227–264 in Murray and Millett, *Military Innovation in the Interwar Period*.

20 Clay Blair, *Silent Victory: The U.S. Submarine War Against Japan*, New York: Lippincott, 1975; Theodore Roscoe, *United States Submarine Operations in World War II*. Annapolis, MD: U. S. Naval Institute, 1949, p. 33.

21 Holwitt, *op passim*.

was no longer a war game. The process of strategic adaptation began immediately, but the tactical adaptation required to implement Unrestricted Warfare effectively would take far longer. Numerous shortfalls that might have been identified and corrected in peacetime arose immediately, and the poor readiness of the US Navy was evident.

For the first six months of the war, the US Navy submarines did not meet expectations for taking the war to the enemy. Many captains evidenced a very cautious approach to making attacks, unwilling to risk any chance of detection by airplane, and certainly not by a destroyer escort.[22] The tactics employed by American submarines were employing the wrong doctrine and had faulty torpedoes. It took the Americans nearly 7 months to find out that they had faulty depth setting mechanisms on their torpedoes. The fleet conducted its own test, ordered by Rear Admiral Charles A. Lockwood at Frenchman Bay, Australia on June 20, 1942.[23] This test showed that the American torpedoes ran at least 11 feet deeper than the depth at which they were set.

However, the other components for submarine operations were lacking. The Navy lacked the doctrine, tactics, and training for offensive submarine warfare.[24] The wargames and fleet exercises had not enforced operational or tactical realism for the sub crews. In fact, a generation of crews had been trained without having ever heard a live torpedo detonated, proving to be a perfect match for a generation of torpedoes that were never tested.[25] Nor had the Navy practiced night attacks in peacetime, although it was not quite evident that the German practice of night surface attacks was both easy and effective.[26] The results were predictable.

The failure to learn from the Atlantic campaign was evident, and the low utility of submerged sonar targeting proved obvious in short order. The submarine command's official wartime history notes, "Contrary to accepted professional opinion prior to the war, sound attacks conducted from deep submergence proved to be of negligible importance."[27] More aggressive tactics and more night surface attacks gradually became part of a successful boat's skill set.

For example, the Pac Fleet endorsement on Gudeon completely criticized that boat for its slow pace underwater during the day and for not making aggressive night attacks on the surface. But the Gudeon was actually complying with existing submarine doctrine and its pre-deployment training which was designed and conducted by Pacific Fleet. "Here is an indication of the rapidity with which tactical concepts can shed peacetime theory for wartime practice. Within 51 days, COMSUBPAC was able to criticize adversely a patrol carried out in

22 Blair, p. 175.

23 Roscoe, pp. 145–146.

24 More than 30 percent were relieved for cause in 1942, "products of an unrealistic peacetime operations and training system whose insidious effect was not recognized until the realities of combat disclosed it." See I. J. Galantin, *Submarine Admiral*, Chicago, IL: University of Illinois Press, 1995, p. 77; Stephen Rosen, *Winning the Next War; Innovation and the Modern Military*, Ithaca, NY: Cornell University Press, 1991, pp. 130–147.

25 Blair, p. 41, Spector, p. 484.

26 Lockwood, *Sink 'Em All*, p. 52.

27 NARA, RG 38, Box 358, U.S. Navy World War II Command Files, *Submarine Operations of World War II*, Vol. 2, 1947, p. ii–587.

conformance with original operational instructions."[28] Again, in the Pacific force's operational history, the speed of learning is noted, "By late summer of 1942, a submarine commander who conducted his patrol in accordance with the accepted late 1941 doctrine would undoubtedly have been relieved of his command."[29] The Submarine Force was learning to learn.

In 1942, combat experience was processed from the bottom up to a large community and higher commands. Here the process of learning and the politics of adaptation came into clash for a period. Peacetime doctrine developed in an artificial context gave way to what really worked in wartime; commanders learned how to change their routines and practices. Cautious boat commanders were relieved, and an aggressive generation took over. Lessons learned were shared and absorbed. Incentives for success were generously applied to induce positive results commensurate with the risks being taken by independent captains operating in contested waters. Equipment was slowly altered to account for sloppy peacetime design and development. In this first phase, strategic adaptation was directed and implemented but desired results were not achieved. Changes in both weapons and tactics were required, and old practices had to be unlearned. Not every Navy officer could step up the learning curve and meet the pressure. Material challenges were not the only shortfall, in the first year of the war, the Navy fired 40 of 145 captains, many at their own request.[30]

By the end of 1942, the Pacific Fleet had sent out a total of 350 patrols. Not all of these patrols were offensively oriented; some were required for intelligence and security of the fleet or the defense of Australia. Post-war analyses credit these patrols with 180 ships sunk (725,000 tons).[31] The US Navy had in the course of 12 months only sunk the same amount as the German U-boats bagged in 2 months in their North Atlantic forays. Since this level of damage had no impact on Japan's import of critical resources and commodities, the campaign could not be seen as a success. Lockwood himself admitted that the Sub force operated at their nadir in 1942.[32] If the goal was a tonnage competition or the constriction of Japan's ability to operate its economy on a war footing, the American submarine effort in 1942 was a failure.

The post-war assessment from inside the submarine community was telling, "Neither by training nor indoctrination was the US Submarine Force readied for unrestricted warfare."[33] By the end of this cycle of adaptation that assessment had been rectified.

Making Weapons Work—Second Adaptation

Having altered the orientation of the submarine force towards a more offensive strategic approach mandating more aggressive tactics to generate greater attrition of the opponent's lines of communication, the next adaptation cycle involved an adjustment of weapons to fit the task. At this point in the war, there were many suspicions about the Mark 6 exploder device

28 Roscoe, p. 58.

29 NARA, RG 38, Box 358, U.S. Navy World War II Command Files, *Submarine Operations of World War II*, Vol. 2, 1947, p. ii–589.

30 Blair, p. 335.

31 Blair, pp. 334–345.

32 Lockwood, *Sink 'Em All*, p. 27.

33 Roscoe, p. 18.

in the US torpedo warheads, and many disgruntled skippers, but there were many conflicting data points. Lockwood was named as Commander, US Submarines Pacific, and arrived in Hawaii in mid-February of 1943. He would remain in this post until the war ended. He needed some time to familiarize himself with his command, and faulty torpedoes were only part of his headaches.

Lockwood and the entire submarine force had to face up to the fact that torpedo deficiencies still plagued the effectiveness of the force. Only in May 1943, after his favorite "ace" Commander "Mush" Morton had finished an unsatisfactory patrol with a blank sheet and no sinkings, did COMSUBPAC begin to question whether or not the Mark 6 device was inherently faulty and should be deactivated. Lockwood hesitated to take action himself despite his well-known reputation for both problem solving. He wrote to the Bureau of Ordnance, led by Admiral William "Spike" Blandy, to find a fix for the defect, and salvage the potential in magnetic influence devices. This proved a vain hope. Lockwood seems not to have been aware that the Germans and British submarine forces had found their magnetic influence exploders to be seriously flawed and had reverted back to contact devices. Perhaps they believed, arrogantly, that Yankee ingenuity would prove itself where others had failed.

Lockwood realized that his force was not operating at maximum effectiveness but appeared reluctant to adapt to the contact exploder. He also seems to have had a strongly embedded conception that the Japanese had developed a countermeasure against a magnetic exploder which caused the premature detonations.[34]

Reluctantly, Lockwood decided that he must act. Armed with all this information, Lockwood still felt that he needed approval from higher headquarters. Lockwood went to Nimitz to ask permission to deactivate his magnetic exploders.[35] Nimitz concurred with the deactivation order and issued it on July 24, 1943. Admiral Lockwood reissued the command to direct his boats to deactivate the Mark 6 magnetic influence device and use only its contact pistol.[36] But he took this step only after he had a year's worth of evidence, four months in command at Pearl, and only after a satisfactory investigation had been conducted. It took 18 months for the Admiral to come to the same conclusion that younger officers had found based on their own experiences in 1941.

Now that the fleet boats were past the exploder problem, they expected a greater number of sinkings. However some boats were still reporting many duds even under attacks against stationary or slow moving targets under nearly ideal conditions. So much attention had been given to the depth setting problem and the magnetic influence exploder, that another critical design flaw had been overlooked. The battle proven basic contact exploder seemed to be malfunctioning, and the US Navy had fired some 2,000 torpedoes without finding out. This was perplexing since the essence of the design was the same as the combat tested Mark 3 exploder that had been deployed since World War I.

Here again, input from the bottom up fed into the middle of the organization, where

34 Lockwood, *Sink Em All*, pp. 103–104; Blair, p. 386; Newpower, p. 137.

35 Newpower, p. 153; Lockwood, *Sink 'Em All*, p. 114.

36 Lockwood, *Sink Em All*, pp. 104–105; Wilfred Jay Holmes, *Undersea Victory: The Influence of Submarine Operations on the War in the Pacific*. Garden City, NY: Doubleday, 1966, p. 237; Blair, p. 403.

some formal investigatory testing was conducted. Lockwood ordered up tests with nets and cliff shots to follow up on contact problems in late August.[37] These tests were carried out by Lockwood's staff.[38] They fired a number of live torpedoes into the cliffs of Kahoolawe in Hawaii, on August 31. One of the shots was a dud, and a brave Navy diver dove down to the torpedo and attached a wire to the live weapon so it could be raised. Its warhead was deactivated and examined closely. It appeared that the contact housing was collapsing faster than the firing pin could activate and drive a charge into the explosive warhead.

The mechanics at Pearl Harbor came up with a quick fix to build a stronger firing pin, which was easier than reconfiguring the contact housing. The firing pin adjustments were tested at Pearl Harbor, and Newport's Torpedo Station informed.[39] The institutionalization of adaptation outside the Pacific went better this time. Newport swiftly incorporated the firing pin alternations into American models. The newly improved contact pistols were delivered to the fleet by October 1943. The Fleet could now deploy with weapons worthy of their valor. They were no longer toothless wolves.

The adaptations directed by Lockwood enhanced US submarine operations in the second full year of the war. Submarine performance was improved by the natural increase in the experience of the boat crews and their skippers, by the introduction of radar to increase surveillance range, better intelligence, and more focused efforts on chokepoints where Japanese shipping could be interdicted. A higher percentage of the fleet was now using the Gato-class fleet boat, and roughly 350 patrols in this year nearly doubled the production levels of the previous year. A total of 335 ships and over 1.5 million tons went to the bottom. Commodity imports into the Japanese main islands decreased by 15 percent, and her total tonnage had been trimmed by 20 percent to just 4.1 million tons.[40] In the last four months of 1943, Japan lost 15 tankers, more than she had lost in the prior two years, and lost another 8 just in January of 1944.[41] This level of success was not free, as the American Navy lost 15 boats itself, double the number lost the prior year.

Operational Adaptation #3—Wolf Packs

With a sufficient amount of now functional torpedoes, the American submarines could now focus on the elimination of Japanese shipping. However, Lockwood's fleet was not producing results fast enough, and higher headquarters directed a new approach. This third adaptation is tactical in nature, and unlike previous aspects of this case study, did not emanate from the bottom. Instead it was directed from 6,000 miles away in a message from the U.S Navy's top leadership. Admiral Ernest King wrote to Admiral Nimitz at Pearl Harbor noting that he believed that the "Effectiveness of operations and availability of submarines indicate desirability, even necessity, to form a tactical group of 4 to 6 submarines trained and indoctrinated in coordinated action for operations such as now set up in the Solomon's, to be stationed singly or in groups

37 Lockwood Papers, Box 13, Folder 72, Lockwood to Edwards, August 27, 1943.
38 Lockwood, *Sink 'Em All*, pp. 112–113; Newpower, p. 173.
39 Holmes, p. 247.
40 Roscoe, p. 298; Blair, p. 522.
41 Roscoe, pp. 328–331.

in enemy ship approaches to critical areas..." [42]

Nimitz agreed with the "suggestion" from King and directed its implementation.[43] At this point in 1943, King was aware that the US Navy was not generating the same aggregate tonnage results that the German Navy was getting.[44]

The notion of collective action was not unknown to the Americans. Just before the war, experimental practices were held which attempted simultaneous attacks by several submarines, but communications were not good enough to insure safety. Now conditions were different, radar had been perfected, and high frequency radio phones had been installed that made ship to ship coordination so much easier.[45] Coordination could be achieved, but the Americans had little practice at it, and a year and half of operating as individual hunter-killers in their own isolated patrol areas reinforced a culture of independence at sea that was a hallmark of US Navy culture.

However, the American Navy did not eventually employ the exact same approach as the Germans. U-boat wolf packs in the Kriegsmarine were ad hoc and fluid. They had a common doctrinal approach but the wolf packs themselves were not trained or organized. They formed on the fly after the boats had deployed. When Admiral Karl Dönitz received intelligence about the location of a convoy, he would direct a number of boats via radio communication to converge on a general area. He would direct the assembly of the wolf pack, and coordinate its attack from long distance. There was no on scene commander, and there was rarely a collective attack.[46] [47] While convoys in the Pacific were much smaller, effective Japanese anti-submarine tactics were affecting American operations. If several boats could operate against an escorted convoy, and mass their firepower on targets in the Pacific, they could distract its protective screen and enhance their chances of mission success.

The US Navy did not openly embrace German wolf pack doctrine or terminology. The accepted term was coordinated attack groups (CAGs) to preclude association with the Nazis. One of the senior and most innovative submariners, Captain "Swede" Momsen, developed the original tactics and commanded the initial American wolf pack in the early fall of 1943.[48] The tactics and required communication techniques were tediously developed over several months. The officers who would conduct these patrols developed their own doctrine and tactics.[49] The staff and prospective boat captains gamed various ways to both scout and assemble into a fighting force once a convoy was detected. Wargames, drills, and ultimately some at sea trials

42 Steven Trent Smith, *Wolf Pack: The American Submarine Strategy That Helped Defeat Japan*. Hoboken, NJ: John Wiley, 2003, p. 50. Lockwood's memoirs noted in a single sentence that he was directed to conduct wolf pack tactics by King. Lockwood, *Sink 'Em All*, p. 87.

43 Smith, *Wolf Pack*, p. 51.

44 Admiral Galantin's memoirs make the same case, *Take Her Deep!, Submarine Admiral*, Chicago, IL: University of Illinois Press, 1995, p. 126.

45 Lockwood, *Sink 'Em All*, p. 88.

46 Blair, p. 360.

47 On U-boat tactics, see Clay Blair's history of the Battle of the Atlantic, *The Hunters, 1939–1942*, New York: Random House, 1998; Michael Gannon, *Operation Drumbeat*, New York: Harper & Row, 1990, 89–90.

48 Blair, *Silent Victory*, 511–516; Roscoe, p. 240.

49 Galantin, *Take Her Deep!*, pp. 124–129.

were conducted to refine a formal doctrine.

The American approach rejected the rigid or centralized command philosophy and flexible structure of German Wolf packs. They took the opposite approach consistent with the Navy's culture. CAGs were comprised of three to four boats that were under a common tactical commander who was present on the scene and from within the group. Unlike the Germans, these attack groups were organized, trained, and deployed together as a distinctive element. They patrolled in a designated area by the senior commander, and followed a generic attack plan. This tactical doctrine called for successive rather than swarming attacks.[50] Orders to the submarines came from the tactical commander on the scene and not from the fleet commander like the U-Boats.

Lockwood and Momsen took a long time to work out their tactics and to train the crews. The first attack group was not formed until the summer of 1943. This attack group was comprised of the Cero (SS-225, LtCdr David White), Shad (SS-235, LtCdr Edgar McGregor), and Grayback (SS-208, CDR John Moore). The Momsen CAG departed from Midway on October 1, 1943 six months to the day from King's message. The careful culture and resistance to the notion of collective attacks can be seen in the delayed implementation of King's directive. This is not indicative of rapid learning or adaptation, given both the German success story in the Atlantic and the lack of success in the Pacific.

Whatever reservations they might have held, nevertheless, wolf packs continued during the remainder of the year and became a common tactic during 1944. Lockwood carefully planned larger combinations of wolf packs in an attempt to infiltrate into the Sea of Japan and strike inside a vital trade artery.[51] A total of 65 different wolf packs would eventually deploy from Hawaii, and additional groups patrolled out of Australia as well.[52] In practice, the wolf packs rarely attacked in groups or in a coordinated manner, they generally became collective search groups, and resorted to individual attacks rather than collective actions. They did not achieve the level of success of German wolf packs, but neither did they succumb to the grievous losses those crews absorbed.

From Adaptation to Ruthless Application

By mid-1944, there were no major adaptations in submarine warfare during the remainder of the Pacific campaign. Clay Blair, a critical analyst of the US submarine campaign, notes that in one sense it can be said that the US submarine war did not truly begin until 1944. Up until then it "had been a learning period, a time of testing, of weeding out, of fixing defects in weapons, strategy, and tactics, of waiting for sufficient numbers of submarines and workable torpedoes."[53] By the end of the summer, Japan's economic lifeline was in tatters. The submarine force had perfected its doctrine, the Captains were relentlessly aggressive, and more importantly, their weapons worked reliably. The period of learning and adaptation was over at this point. The sea wolves were numerous, trained, and well-armed. In 1944, the full

50 Galantin, *Take Her Deep!*, p. 129.

51 Holmes, *Undersea Victory*, pp. 459–461.

52 See the list at http://www.valoratsea.com/wolfpacks.htm

53 Blair, p. 524; Roscoe, pp. 432–433.

force of the American sub fleet was applied.

The results for 1944 were impressive. Exploiting an increased number of boats, and the shorter patrols distances afforded by advanced bases in Guam and Saipan, US patrol numbers increased by 50 percent, to 520 patrols. These patrols fired over 6,000 torpedoes, which were now both functional and plentiful. They sunk over 600 ships for nearly 3 million tons of shipping. They reduced Japan's critical imports by 36 percent, by cutting the merchant fleet in half (from 4.1 to 2 million tons). While oil tanker production kept up with a high rate of destruction, oil imports were down severely.[54]

There was little for US submarines to achieve in 1945 as the target set had been largely eliminated. They now had over 120 operational boats at this time in the Pacific, and their effectiveness was improved by new operating bases at Subic Bay in the Philippines and Lockwood's force operating out of Guam. The shorter distances into hostile waters gave each boat extra days to patiently await traffic along coastal trade lanes. Lockwood kept sending his boats into harm's way inside the Sea of Japan to ensure that the Empire's economic activity was cut off. These boats used the latest in "pro-submarine" technology including improved sonar systems to avoid Japanese mine fields and devices designed to throw off improved Japanese ASW efforts. Before the end of World War II, American torpedoes had become a reliable weapon, and highly innovative wakeless, homing, and acoustic weapons were entering the inventory.[55]

In what became the culminating year, a total of 300 patrols were initiated, but they sunk "only" 190 ships for 1,200,000 tons. Japan had lost 88 percent of its merchant fleet by this point, and had only 650,000 tons of capacity left, well below that needed merely for civilian consumption, much less a continued defense of the imperial islands.[56]

By the end of the war, the role of the submarine as an offensive weapon was evident. The boats had served as the principal source of attrition for the Japanese economy, targeting its commerce, especially its oil tanker fleet which was an Achilles' heel to its economy and war production. By the end of the war, oil stocks were severely constrained, limiting the ability of the Japanese Navy to train pilots or conduct naval operations. Likewise, the economic productivity of the Japanese Empire was grinding to a halt. Lockwood could brag at the end of the war that they had sunk 116 oil tankers.[57] Japanese tankers delivered only one tenth of the oil produced during 1944-45.[58] Oil dependency spelled Japan's defeat, because its industry and armed forces moved on fossil fuel. Had the US Navy sunk that total by the end of 1945, they could have achieved a more strategic impact and saved many lives. Here again is why adaptation is important, and where the speed of learning and change confers military advantage.

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54 Blair, pp. 791–793; Roscoe, pp. 432–433.

55 On the development of these technologies see Blair, *Silent Victory*, Vol. 2, pp. 762–765.

56 Roscoe, p. 491.

57 Charles A. Lockwood and Hans C. Adamson, *Hellcats of the Sea*, Sykesville, MD: Greenberg, 1955, p. 351.

58 Williamson Murray and Allan R. Millett, *A War to Be Won: Fighting the Second World War*, Cambridge, MA: Belknap/Harvard, 2000, p. 227.

These represent three overlapping and almost concurrent adaptation cycles, all pressurized by the contingencies of conflict against a thinking adversary. The adaptation was directed from the top, but the doctrine, tactics and command techniques were all derived by operators at the tactical level. Here again, in this segment of the campaign, the hard-earned information derived by combat is pushed forward from the bottom up, to higher headquarters who can provide the necessary equipment at the institutional level. However, we continue to see how "learning" can be blocked in the transition from lower levels by command levels and force generation agencies (schools, research centers) that are detached from the battlespace.

Conclusion

Looking back many Navy officers believed that their pre-war planning was superb. "War Plan Orange persevered for forty years and eventually won the war," notes Miller, "What more can one ask of a great plan."[59] Well, a bit of brutal honesty must attend an answer to that question. There is no doubt that the American Navy was effective, eventually. But the ultimate victory was not due entirely to the strategic planning of War Plan Orange and the fleet design that it justified. Some success must be credited to the spirit and adaptation of the small submarine community. The attrition and blockade that War Plan Orange envisioned began much earlier than originally designed. It preceded rather than followed the Mahanian clashes long sought by the American Navy.

Well after the war, after some distance and reflection in retirement, Nimitz had this to say: "During the dark, early months of World War II, it was only the tiny American submarine force that held off the Japanese Empire and enabled our fleet to replace their losses and repair their wounds. The spirit and courage of the Submarine Force shall never be forgotten."[60] Nimitz was not alone. Speaking well after the war, Admiral "Bull" Halsey observed, "If I had to give credit to the instruments and machines that won us the war in the Pacific, I would rank them in this order; submarines, first, radar second, planes third, and bulldozers fourth."[61]

War Plan Orange never asked the Submarine Force to hold off the Empire and serve as its sole offensive weapon for any period of time. But this did not stop submariners from increasing the technological and overall combat capability of their force. The Navy's planning deserves much credit for understanding the strategic framework and operating requirements for a major war in the Pacific, and specifically for its development of carrier aviation into a great offensive weapon. However, this does not excuse them for overlooking the submarine's potential, or for failing to work through the employment of submarines under more realistic conditions (night attacks, working weapons, better communications). Despite the great wargames and exercises, the US Navy also failed to foresee and develop the submarine as an offensive weapon.

"Had submarines concentrated more effectively in the areas where tankers were in predominated use after mid-1942," the historian Clay Blair claims, "oil imports probably

59 Edward Miller, on War Plan Orange, cited by George Baer, *One Hundred Years of Sea Power, The U.S. Navy, 1890–1990*, Stanford, CA: Stanford University Press, 1994, p. 128.

60 Nimitz, cited in Roscoe, p. v.

61 Bill Halsey, quoted by Walter R. Borneman, *The Admirals: Nimitz, Halsey, Leahy and King-The Five Star Admirals Who Won the War at Sea*, New York: Little, Brown and Co, 2012, p. 369.

could have been reduced sooner and the collapse of the fleet, the air arm, merchant shipping, and all other activities dependent upon fuel oil hastened."[62] One historian concluded that inexplicably, "There was no serious planning for an offensive submarine campaign of attrition of merchantmen, even though starving Japan's island empire was the final phase of Orange..."[63]

Overall, the statistical and strategic results are impressive. While the sailors of the submarine fleet only comprised 2 percent of U.S naval manpower, their boats sunk 55 percent of all Japanese shipping losses in the war. The American subs sunk 1,300 ships including 20 major naval combatants (8 carriers, 1 battleship, and 11 cruisers). Japanese merchant shipping losses included 5.5 million tons of shipping or about 85 percent of its total tonnage.[64] This exceeds the total sunk by the Navy's surface forces and Army Air Corps bombers combined. By August of 1944, the Japanese merchant marine was in tatters, and unable to fulfill its minimum requirements in support of the civilian economy.[65]

The submarine dominated what should be recognized as a successful guerre de course despite Mahan, and despite Japan's own estimates of submarine effectiveness.[66] Had the US began the war with a working torpedo (equal to the superb Japanese Long Lance), and realistic doctrine, a lot of damage might have been generated earlier in the war. Because they did not anticipate the future with great foresight, the Americans had to learn under fire. They did eventually learn. Ultimately, the US submarine force made a major contribution that it was not originally designed for. Thus it might be said that the US Navy was inferior in many respects relative to its opponent, but that it learned faster.

Whether it was bottom up learning from the submarines, or top down direction from Washington or Pearl Harbor, the US submarine force was required to learn and adapt, across all levels of the organization. In many respects it was a war of problem solving and adaptation. As Paul Kennedy notes in his latest book on the Second World War:

The most important variable of all, the creation of war-making systems that contained impressive feedback loops, flexibility, a capacity to learn from mistakes, and a "culture of encouragement" that permitted the middlemen in this grinding conflict the freedom to experiment, to offer ideas and opinions and to cross traditional institutional boundaries.[67]

While at odds with the American Way of War, as Dr. Wawro noted in 2011, the Pacific conflict was the ultimate expression of the indirect approach.[68] By overruling Mahan's ideology and seeking a more indirect approach, by exploiting the feedback loops in their patrol reports,

62 Blair, p. 474.

63 George Baer, *One Hundred Years of Sea Power*, p. 138.

64 Roscoe, p. 479.

65 Holmes, p. 351.

66 Geoffrey D. W. Waro, "The 'American Way of War' and the U.S. War with Japan, 1941-45," in *NIDS International Forum on War History Proceedings*, "The Legacy and Implications of the Pacific War," March 2013, pp. 138, 141.

67 Paul Kennedy, *Engineers of Victory, The Problem Solvers Who Turned the Tide in the Second World War*, New York: Random House, 2013.

68 H.P. Willmott, "The Influence and Meaning of the Pacific War in Global History," in *NIDS International Forum on War History Proceedings*, "The Pacific War as Total War," March 2012, pp. 15–23.

and by experimenting, the US submarines learned how to learn. That capacity to learn remains as important to victory today as it did 75 years ago.