

## Air and Space this Week

### Item of the Week

## HEDGEHOG

*Developed by England; Perfected by the USS England!*

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Mousetrap Weapon Alpha ASROC

*The Hedgehog, an anti-submarine weapon system invented by England in WWII, was a big improvement over standard depth charging. It fired a clutch of heavy mortar shells ahead of an anti-submarine vessel in a pattern that greatly increased the prospect of a hit. Hedgehog was devastatingly-effective, as attested to the action of the destroyer escort USS England, seventy-nine years ago this month. The Hedgehog concept lived on after the War, upgraded for longer ranges by using rocket propulsion.*

### THE NEED

Submarine torpedoes were a great equalizer in naval warfare, circa WWII. Much cheaper than their capital ship prey, subs were a big problem in the Great War and would be much more deadly in WWII. They were difficult to detect and counter. Improvements in sonar helped, but the problem was the basic depth charge most navies were using.

Let's face it, the depth charge of the 1930's was a stupid weapon. The escort ship using them had to place the charges very close to the sub, in all three dimensions (x, y, and depth). The charges were simple cylinders containing an explosive and a depth-trigger; their shape would affect their sinking rate and to some extent, their direction of drop. Many subs escaped because the charges were set to go off too shallow or too deep.

Depth charges exploded at a set depth, whether the sub was there or not. The ensuing explosion turbulence made sonar tracking difficult, if not impossible, for a number of minutes after the explosion, another way subs would evade pursuit.

WWI proved that depth charging required some luck to be successful, even with the advent of ASDIC, the precursor to sonar. The "batting average" was very low, indeed. Anti-sub technology improved little in the Inter-War years. Something had to be done.

### THE PLAYERS

**Walton Barclay Pendleton** was born on November 24, 1897 in Globe, Arizona Territory (AZ did not become a State until 1912). Globe was and still is a copper mining town, so his father was likely engaged in mining or mining supply/support. He entered the U.S. Naval Academy in 1917,

then served in a variety of billets, including a stint at the Naval War College. He was a survivor of the Pearl Harbor attack, was promoted to Lt. Commander in 1942 and assigned to command the *USS England* in 1943. He was awarded the Navy Cross, and the *USS England* would receive a Presidential Unit Citation, for the actions described below. He retired from the Navy in 1947, when he was promoted to Captain.

**John Alexander Williamson** was a native of Birmingham, Alabama. He earned an undergraduate degree in mathematics from Birmingham Southern College in 1939. He was a successful car salesman after graduation, but joined the Navy in 1941. He used his math skills to devise the optimum helm responses for a “man overboard” situation; the resulting distinctive maneuver is to this day known as the “[Williamson Turn](#).” He commanded a sub-chaser in the Caribbean and then was sent to the *USS England* as Executive Officer. His expert understanding of the math behind using Hedgehog against a submarine was an important part of *England*'s success. Williamson assumed command of the *USS England* after its attack on the picket line of submarines described below. After the War, he returned to Birmingham and moved up in the world of automobile sales and management. He enjoyed a long career in automotive management and in business consulting.

The ***USS England (DE-635)*** is a Buckley-class destroyer escort (as were the *USS George* and *USS Roby*), armed with three 3” guns, a triple torpedo tube mount, two conventional depth charge stern racks and 8 side-throwing launchers, and a Mark 10 Hedgehog system. The *England* was named for Ensign John C. England, who was KIA aboard the battleship *Oklahoma* at Pearl Harbor while helping rescue survivors. [Ensign England was also the namesake for a guided missile cruiser (DLG-22/CG-22), which was retired from service in 1994.] Under the command of Pendleton, *England* received a Presidential Unit Citation for the actions described below, and later under the command of Williamson, *England* would be knocked out of the War by a kamikaze off Okinawa. DE-635, proud bearer of 10 battle stars, was sold for scrap in 1946.

## THE ENGLISH INVENT THE HEDGEHOG

When I was a kid, I not only spent a lot of time skipping stones (as related in this [previous Item](#)), I played with friends along a long-abandoned branch of the canal system that linked some of the Finger Lakes and surrounding towns with the Erie Canal. A favorite game was to set a piece of wood floating down the crick and try to hit it with rocks, a difficult toss because your aim, and your timing, had to be just right. Scoring repeated near-misses was quite frustrating, and at times we would grab a hand of gravel and throw many stones at once, greatly increasing our hit rate. Skeet shooters use a shotgun, not a rifle!

The English were thinking along the same lines for anti-submarine warfare. Why not use a “shotgun” to increase the odds of getting a hit, and why not use contact-fused charges that would only explode if they hit their target, leaving sonar unaffected if the charges missed?

The RN research lab that helped develop ASDIC was located at Fairlie, North Ayrshire. They also came up with the “Fairlie Mortar,” a launching system that could fire depth bombs ahead of the anti-submarine ship. The initial model used larger projectiles and could not fire enough to

make a wide pattern. The revised thinking was to use more, smaller projectiles, since a submarine, holed but once, was likely to sink since it had little reserve buoyancy. The name, "Hedgehog," came from the bristling appearance of the launcher's rows of mounting pegs that held the Hedgehog projectiles. The capacity of each Hedgehog bomb was increased to 36 pounds of Torpex (an improved version of TNT). Twenty-four could be launched in a pattern that covered a circular pattern of ~100-foot diameter.

The prototype launcher was first tested in 1941, but did not enter service until some months later. Development of Hedgehog was hampered by a number of electrical problems with its launching system and the fact that many sailors did not fully trust the Hedgehog system, in large part because of an accident with them aboard the [HMS Escapade](#) in September, 1943, when a Hedgehog exploded in the launcher, killing 16 of the crew and causing serious damage to the ship. But the problems were worked out and the British began equipping escort ships with Hedgehog, to the detriment of German U-boats.

The Americans were slow to take advantage of this technological advance by one of their close allies, but by the start of 1944, broader adoption of Hedgehog meant that there would soon be a big change in the effectiveness of U.S. anti-submarine vessels.

### **WAR SITUATION, SPRING 1944**

The Japanese were on the defensive in both the southwest and central Pacific theaters by the start of 1944. They had lost the cream of the strike carrier force at Midway in June, 1942, and began losing captured territory with Guadalcanal in August, 1942. The counter-offensive in 1943 was hampered in large part by seriously-defective Navy torpedoes in 1943, but those problems were finally solved, and 1944 dawned with Japanese shipping taking increasing losses in civilian and support ships, especially fuel tankers. By the start of May, the U.S. Navy was conducting attacks against major bases on the periphery of Japan's perimeter, such as the bombing mission against Truk where [USS Tang](#) was life-guarding. Any further advances by the Allies would threaten both the Philippines and the Marianas Island groups, which would put the Japanese home islands within range of U.S. bombers.

The U-boat threat in the Atlantic properly attracted the bulk of the Allies' anti-submarine effort. Many merchant ships were lost in what the Germans called the "Happy Time," but advances in ASDIC and convoy tactics, along with the Hedgehog, were turning the tide. By spring, 1944, there were enough resources for the Pacific Theater to start upgrading the ASW there. Three Hedgehog-equipped destroyer escorts had arrived at Tulagi, and the ASW command at Pearl was chomping at the bit to try them in action.

Japanese reconnaissance showed a massive build-up of U.S. forces throughout the Marshall and Solomon Islands, signaling an upcoming attack on vital Japanese bases. The danger posed by the possible loss of the Marianas was particularly felt, and the Japanese planners devised Operation A-Go to protect them. Part of the plan involved placing a picket line of submarines athwart the path of likely approach to attack Guam and its neighbors. A number of subs were already patrolling in the general vicinity, and the subs assigned to the picket line (dubbed "NA")

sailed from Truck on May 15. The very next day a unit of U.S. destroyers equipped with conventional depth charges encountered the Japanese submarine *I-176*, which was running supplies into the bastion on Buka Island, and sank it. Japanese monitoring of the radio chatter from the destroyers revealed *I-176*'s fate, and when other radio intelligence showed that the Americans had detected NA-line sub *RO-104*, they decided to move the NA-line by 60 miles. The Navy code-breakers intercepted that message; now we knew *where* the picket subs were going to be.

U.S. code-breakers also intercepted a message from submarine *I-16* that gave its estimated arrival time at Bougainville Island at the top of the Solomons chain (2200 22 May), which gave the Navy a good idea of *when* the picket subs were going to be in place.

The vital place/time estimate was relayed to the U.S. naval base at Tulagi in the Solomons, where the three Hedgehog-equipped U.S. destroyer escorts were available. Commander Hamilton Haines was in charge of Escort Division 39, comprising the *USS George* (DE-697), *USS Raby* (DE-698), and *USS England* (DE-635). Haines sailed in the *George*, and led his three-ship flotilla out of Tulagi's Purvis Bay on May 18, 1944 to intercept.

### **THE *USS ENGLAND* USES HEDGEHOG TO PERFECTION**

The code-breakers intercepted and decoded another message that very same day that ED-39 left Tulagi, ordering the *I-16* into its location on the NA line. It was a veteran sub, with a record of nine war patrols, including serving as one of the mother ships for the mini subs used at the Pearl Harbor attack. It was pressed into running supplies and had been engaged as a food transport *en route* to the isolated garrison on Buin, on the south shore of Bougainville, when the call to form a picket line came.

American aircraft were patrolling the seas around Bougainville and sighted the *I-16* on May 19, confirming the accuracy of the code-breakers. ED-39 swept into attack, and *England* picked up a submerged *I-16* on active sonar. *England*'s first two Hedgehog salvos missed, but the third salvo produced a hit. It wasn't enough to sink the sub. The fourth salvo missed, but the fifth was decisive. Numerous hits were heard, followed a bit later by a large underwater explosion. *I-16* was definitely sunk, with all 107 hands. *I-16* was the best and most experienced in the picket line; the others were from an earlier class, smaller and less capable.

The next sub in line was *RO-106*. It, too, was a veteran crew, with 11 war patrols under their belt, including one in which it sank a large landing craft (*LST-342*), near Tulagi, killing 121 of 279 on board, including famed combat artist [McClelland Barclay](#). *USS George* detected it on the surface in the wee hours of May 22, and went in to attack with the *Raby*. *England* would block its escape. *George*'s Hedgehog salvo missed, and *RO-106* ran straight at *England*, whose second salvo scored three hits and a certain sinking.

A patrol aircraft found the next sub in line, the *RO-104*. *Raby* went in to attack, missing with four Hedgehog salvos; *RO-104* had used radical maneuvers and tried to jam *Raby*'s sonar. Its luck held as five salvos from *George* all missed. *England* again backed up the attack with two of its own. The first missed, but the second was spot-on, with at least ten Hedgehog hits. A

strong secondary explosion no doubt marked a sinking, but no debris was immediately forthcoming, so *England* attacked with conventional depth charges anyway.

Sub 4 of 6 was the *RO-116*, a newer boat on its second patrol. *George's* radar found it in the early morning of 5/24, but this sub, too, proved difficult to pin down. *England* took over and had two approaches spoiled by *RO-116's* abrupt direction changes, but the third led to a salvo that scored three hits and a sinking.

*RO-108* had the best record of all the picket subs. It had sunk the destroyer *USS Smith* (DD-378) in the Huon Gulf of New Guinea on October 3, 1943. But that was then, and *Raby* was now. Radar detected *RO-108* on the surface just before midnight on May 26, and both *Raby* and *England* moved in. *England* tried to vector *Raby* onto the target, but its salvo missed. *England* fired a salvo, scored several hits, and sank yet another sub.

ED-39 had expended almost all of their Hedgehog projectiles in sinking five subs, so they headed into nearby Seeadler Harbor for a quick re-supply. Meanwhile, the Japanese were aware of the successful anti-submarine campaign and warned subs away from the NA line area; two escaped, but for whatever reason, *RO-105* stayed. ED-39, re-armed, left harbor, and joined up with a larger anti-sub group comprising an escort carrier, two destroyers, and a destroyer escort. Commander Thorwall, who had come aboard *England* during re-supply, was in charge of the entire task force, while Haines still managed ED-39.

One of the destroyers detected *RO-105* with its radar on the night of May 30/31. Its skipper was also adept at evasive action, thwarting the destroyer's attacks with conventional depth charges. *George* came in and fired three Hedgehog salvos with indifferent results. Commander Haines then radioed, "Oh Hell, go ahead *England*." Its first Hedgehog salvo scored several hits and sank the *RO-108*.

The NA line's sacrifice was to no avail. The U.S. Navy invaded the Mariana Islands less than two weeks later.

*England's* exploits received much acclaim. Admiral Ernest King (Navy Commander-in-Chief) proclaimed, "There will always be an *England* in the U.S. Navy." There was, at least until 1994.

American subs were running wild by mid-1944, sinking ships right and left. Leaders [like Dick O'Kane](#) and [Eugene Fluckey](#) racked up large scores, but no ship of any type was tougher on opposing subs than the *USS England*.

## POST-WAR

The Hedgehog system was mounted on a lot of types of ships, including the specialized landing assault boats with phalanxes of Hedgehog launchers used in the support of the D-Day landings. The Royal Navy then developed the Squid and Double Squid launcher, followed by the Limbo system.

The U.S. Navy followed up Hedgehog's success, too. A rocket-powered version called Mousetrap was developed, then a system called Weapon Alpha. Mousetrap and Hedgehog remained in service until the development of the ASROC system.

Submarine torpedoes became much more sophisticated in the decade following WWII. Keeping an attacking sub away from the fleet became more important, and more difficult. A ship-launched ASW weapon with a much longer range than the Hedgehog or any other mortar-type system was required. Mousetrap pointed the way.

The solution was the marriage of the **torpedo** with the **rocket**, presided over by sonar, producing the Anti-Submarine ROcket, or ASROC.

The initial conceptualization of ASROC began at the Navy's China Lake Naval Air Weapons Center in the 1950s, with the start of the Rocket-Assisted Torpedo program. RAT had three components, two for stand-off weapons for use by escort ships and the third for the delivery of nuclear depth charges. The technology for the first two was not adequate for success, and the third needed a technology with a much longer range, more research was conducted and proved rocket boosters of sufficient size and power to launch a nuke or a conventional homing torpedo the required distance. The weapon's name was then changed to ASROC, and the weapon system reached the fleet beginning in 1961.

ASROC went through several upgrades, and the Vertical-Launch ASROC is still in service, and successors such as Harpoon and Tomahawks are now also in wide use. The strategy behind Hedgehog and ASROC has gone full-circle, from a shotgun-like scattershot to a single precision guided weapon. If I only had had one as a kid...

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