THE KALAMITY CLASS

A Failed Experiment in Steam-Powered Submarines

Synopsis: In the early part of the 20th century, Great Britain's Royal Navy created a unique class of submarines. Unique because of their propulsion system, speed and sheer size. But also unique for their woeful inability to perform as expected and for a rash of often fatal accidents that plagued them.

Officially designated as the K-class, a total of 18 steam-powered submersibles were built. None were lost in enemy action. In fact, only one of them ever attacked an enemy vessel, but the torpedoes she fired missed their mark.

Six of the K-class sank due to operational accidents, and several others were involved in mishaps of varying severity. Hundreds of sailors were killed or injured as a result. Understandably this group of subs became derisively known throughout the Royal Navy as the Kalamity Class.

The Grand Plan: In 1913, strategists in the Royal Navy proposed developing a class of submarines that could operate with Great Britain's surface fleet. The intent was to create submarines fast enough to sail with the British Grand Fleet into battle. In addition to scouting ahead of the fleet, it was also anticipated that such submarines could maneuver behind any enemy fleet undetected and then attack their ships from the rear while they were being conventionally engaged by British surface ships.

The concept quickly found favor with many in the British Admiralty. However, no conventionally propelled sub of that era was fast enough to operate with the fleet. The solution proposed by Britain's ranking naval architect was to install oil-fired boilers and steam-driven turbines in a new class of submarines to accomplish the desired goal. It was an idea that had been tried by others with little success.

One British Admiral opposed the idea: *"The most fatal error imaginable would be to put steam engines in submarines."* The other admirals should have listened...

K-class Design Development: The idea of the Royal Navy building steam-powered submarines languished for a couple of years as the British tried to develop a diesel/electric power plant sufficient to drive a submarine at surface fleet speed. When that effort proved unsuccessful, the original design for the K-class was resurrected, driven in part by World War I activities on the high seas as British and German battleships fought one another.

During 1915 and 1916, 21 submarines of this class were ordered, at a cost of £340,000 each. Of this number, 17 were actually completed. In October of 1917, an additional six 'improved' K-class boats were ordered, but because World War I ended the next year, only one of them was completed. Following Royal Navy tradition of the early 20th century, none of the K-class boats were given proper names.

Each K-class submarine was 339 feet long with a beam of 26.5 feet. Their displacement when submerged, was 2,607 tons, which was more than that of contemporary British destroyers.

The subs' propulsion system for surface operation consisted of two oil-fired boilers and two geared steam turbines that could deliver a total of 10,500 shaft horsepower to twin propellers. The boilers, arranged in line, fore and aft, exhausted through stubby funnels that protruded out of a superstructure placed on the pressure hull aft of the conning tower; adding to an already quite unconventional submarine profile.

For submerged operation, each K-class sub was fitted with four electric motors with a total horsepower rating was 5,760. Each boat was also provided with an 800 horsepower diesel generator for charging batteries while on the surface, or for providing some measure of propulsion for limping home on the surface if the steam plant became disabled...which occurred, on several occasions.

Maximum design speed, surfaced, was 24 knots; more than enough to keep up with the British Grand Fleet's battleships, cruisers and destroyers. But the maximum submerged speed of the K-class was just eight knots and their maximum diving depth was only 200 feet.

Their armament was impressive. Each sub was initially fitted with ten 18-inch torpedo tubes. Two of these were deck mounted on swivels. In practice, these novel weapons proved ineffective and were later removed.

Two 4-inch deck guns were initially installed, plus one 3-inch weapon mounted on the superstructure of each submersible. Over time this configuration was modified. Each sub's crew consisted of six officers and 53 enlisted men.

Adding to their unusual profile, the K-class submarines were fitted with a deckhouse that was constructed over and around the traditional conning tower. This feature provided better protection in rough seas for crew members during surface operations than was afforded the crews of other Royal Navy submarines of that era.

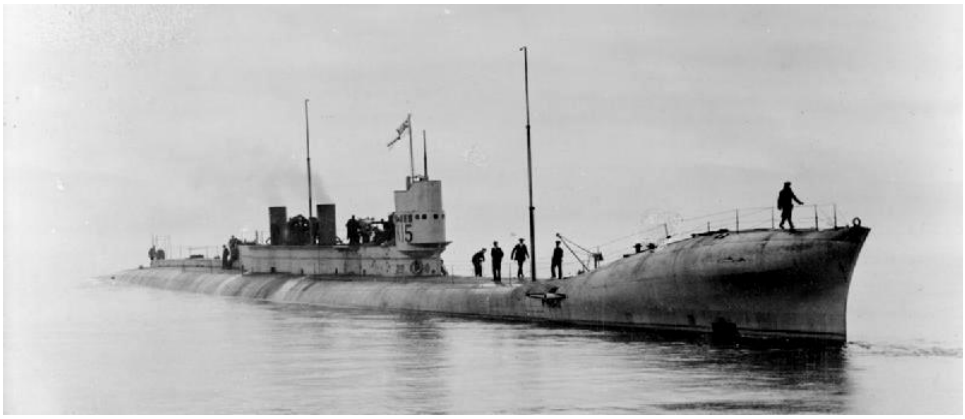
However, the most distinctive features of the K-class derived directly from their steam power plants. Located aft of the Control Room were the boiler, turbine and motor rooms. Above the boilers were a pair of exhaust trunks and funnels, and four air intakes, which were opened or sealed closed by motor-operated valves before diving. Each of the air intakes was 37 inches in diameter.

The five-foot tall funnels, located aft of the conning tower, protruded above a substantial superstructure. The funnels were hinged to permit their being tilted downward using geared electric motors and stowed in the superstructure prior to submerging. This evolution resulted in one of the most unusual images of a submarine preparing to dive that has ever been seen.

Trials of the K-class: The submarine designated as HMS K3 was the first of her class to be completed. To say that her sea trials did not go smoothly would be quite an understatement.

The Royal Navy quickly discovered that the K3 exhibited a strong tendency to plow into oncoming seas while running on the surface, forcing her bow underwater. Tons of sea water deposited on the sub's flat foredeck caused the bow to go even deeper and resulting in a sharp decline in speed.

The entire class was later back-fitted with huge bulbous bows, depicted below, which their crew referred to as 'Swan Bows' to counteract this undesirable trait. Nevertheless units of the K-class was still only able to keep up with the British Grand Fleet under the most favorable weather conditions...the likes of which are seldom seen in the North Sea.



In addition, when operating in a following sea, the K-class boats were prone to having salt water spray and sometimes even solid water enter the squat funnels. This often resulted in the extinguishing of a K-class submarine's boilers' fires, leaving the boats without propulsion, wallowing in the waves.

Worst of all, the K-class proved difficult to control when diving. Due to their length, weight and rudimentary diving control systems, once they started down, they were hard to stop. Striking the bottom was a regular occurrence. Adding to this dangerous condition, when diving in deep water, a K-class sub's bow could exceed the maximum diving depth of 200 feet while its stern...over three hundred feet from the bow...would still stick out of the water; propellers whirling uselessly in the air.

In December of 1916, the K-3 suffered an uncontrolled dive and buried her bow in sea bed mud over 240 below the water's surface. Although exceeding her design depth limit, she was undamaged. After twenty minutes of frantic activity, her crew was able to free their vessel and successfully surface.

No one was hurt in the incident, but the Royal Navy was thoroughly shaken up...and no wonder.

One of the crew members in K-3 that day was a 21 year-old sub-lieutenant. This lad, depicted on the right, was the second son of King George V...destined to become King George VI twenty years after surviving the K3 incident. If royals tell sea stories, surely this is one that King George VI recounted to his daughter...Great Britain's present monarch, Queen Elizabeth II.

"Too Many Damned Holes": That phrase summarized one Royal Navy submariner's experience with diving a K-class submarine. In order for one of these vessels to dive, it was first necessary to shut down both boilers and shift propulsion from the steam turbines to the battery-operated electric motors.

In parallel, the funnels had to be retracted and stored, using a complicated system of motors, gears and levers. Numerous pressure hull penetrations had to be tightly closed. These included the unusually large...for a submarine...supply air inlets for the boiler room and the still hot and smoking boiler uptakes.

Blowing ballast and praying for a controlled dive followed. All this activity took, on average five minutes, which is an intolerable eternity when a submarine is in danger of attack and is seeking the safety of the deep.

Once under the surface, residual heat built up in the still red hot boilers, rendered the boiler room uninhabitable. In order for crew members to move from one end of the boat to another, they had to pass through a cramped longitudinal passageway. It was positioned along one side of the boiler room. Fore and aft access in the vicinity of the boiler room was probably pretty warm.

Operational Accidents, Incidents and Fatalities: Although shortcomings in the design of the K-class undoubtedly contributed to an abnormally large number of problems, the eighteen boats also suffered more misfortunes than anyone might reasonably imagine could befall a single class of submarines. The following grim summary documents the tragedies and other major difficulties that the K-class experienced that were due either to bad design or bad luck...or both.

HMS K1 collided with K4 in November of 1917 while patrolling off the Danish coast. The crew of K1 all survived, but the badly damaged submarine was scuttled to prevent capture by enemy forces.

During her first diving trials in January of 1917. HMS K2 was damaged by an explosion. After World War I, she was involved in two collisions...one of them with her sister sub K12...and sustained additional damage from both incidents.

HMS K3 is depicted on the right, passing interned German battleships following the end of World War I. In addition to the previously detailed incident involving K3 and the future king of Great Britain, she was damaged in 1918 when a routine dive resulted in her going too deep and crushing part of her hull.

In January of 1917, HMS K4 ran aground at high tide and was stranded...truly high and dry...for days, as shown on the right. Eventually she was refloated, only to first be involved in the aforementioned collision with K1 and then lost with all hands during night time fleet exercises when she was sliced in half by HMS K6.

During training exercises in the Bay of Biscay in 1921, the K5 and all 57 souls embarked in her were lost when the sub routinely submerged...but never returned to the surface. Debris later recovered at the scene seemed to indicate that HMS K5 has gone below her maximum depth and broken up.

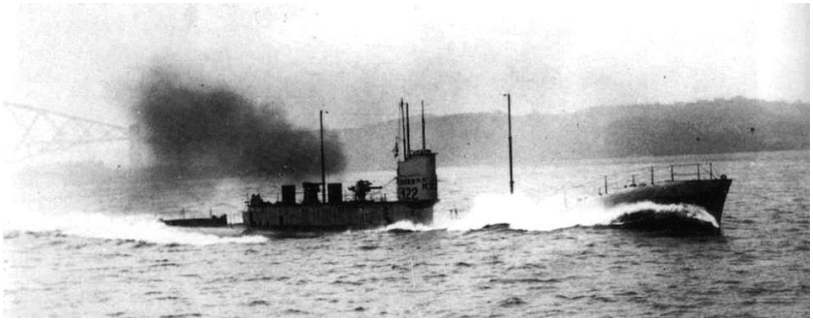
While conducting a static test dive alongside a pier, shipyard civilian test personnel were unable to surface HMS K6. Subsequent salvage efforts did raise her, but several shipbuilders perished before this could be accomplished.

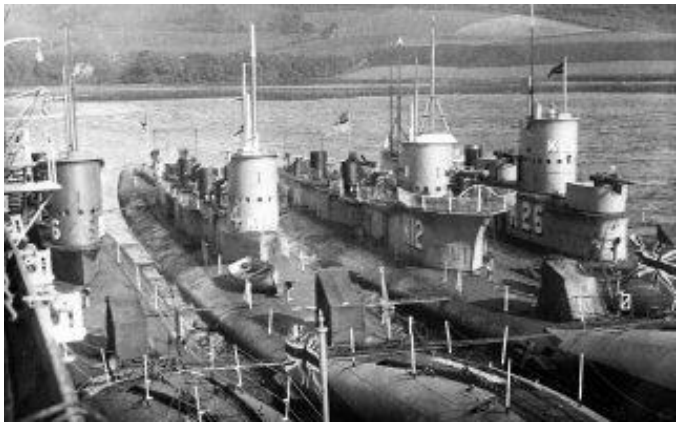
The Royal Navy submarines numbered K7 through K12...and K14 through 16... managed to escape any serious accidents or operational misfortunes during their relatively short service lives. But HMS K13 was not so lucky...far from it.

In January of 1917, K13 left her builders' yard in Glasgow, Scotland to conduct sea trials. In addition to her navy crew of 53, an additional 27 men were onboard, including shipbuilders, sub-contractors, and other naval personnel.

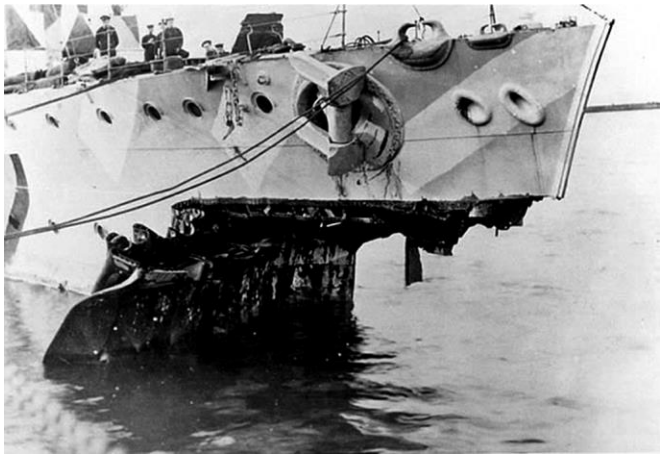
As she went beneath the waves, seemingly routinely, sea water entered her stern section through multiple openings that had been assumed closed. The K-13 sank in fifty feet of water near shore, and rescue efforts were quickly mounted when the crew of an escorting vessel raised the alarm. Although 48 of those onboard were saved, 32 drowned during this tragic incident.

HMS K13 was salvaged, rebuilt and eventually commissioned. Her 'unlucky 13 name' became HMS K22. The following image shows her steaming proudly in calm waters with the proverbial 'bone in her teeth' and trailing thick black smoke.





K-17, the last of the original group of seventeen K-class boats, like several of her sister subs, was assigned to the Royal Navy's 13th Submarine Flotilla during World War I. On the night of January 31, 1918, HMS K17 was at the head of a line of surfaced K-class submarines, participating in fleet exercises.

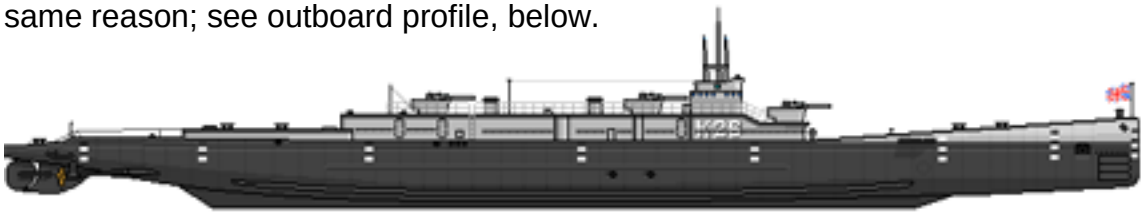


As subs and surface ships maneuvered in darkness, a British cruiser, HMS FEARLESS, ploughed into K17 at high speed. The submarine sank in eight minutes, with the loss of all hands. The cruiser, whose bow was badly damaged [right], managed to limp back to port.

Despite this horrendous record, the Royal Navy continued to stoically operate K-class submarines for a time after World War I ended. The surviving units of this class continued to have operational problems, but fortunately no additional units of the K-class were lost at sea. Between 1921 and 1926, the surviving K-class subs were scrapped, with one exception.

Last of the K-Class: A single unit of the improved K-class design was completed in 1923. Called the K-26, she was slighter longer and had a greater beam and displacement than her older sister submarines, resulting in a slight decrease in top speed. Her maximum diving depth was increased to 250 feet.

Her superstructure was modified in an effort to prevent water from entering her funnels during bad weather, and her forward gun was positioned higher for the same reason; see outboard profile, below.



K26 was fitted with a much improved diving capability, resulting in no incidents during her relatively short service life. These improvements led to a reduced diving time, which was still far too long by current day standards.

By 1931, it had become apparent to the British Admiralty that operating submarines with the battle fleet was not a viable strategy. Also, since stealth and rapid submerging had become an integral part of submarine operations, steam-powered boats belching black smoke and which took far too long to dive were clearly obsolete.

Accordingly, K26 was taken out of service in April of that year and scrapped shortly afterwards. Morale amongst the ranks of the all-volunteer Royal Navy submarine force, which had declined greatly while the K-class was in service, took an immediate and positive turn.

HMS K26, seen on the right, looking aft from her conning tower was the last steam-propelled submarine built anywhere in the world until the nuclear-powered USS NAUTILUS was launched in 1954.

The Lessons of History: It is easy, in hindsight, to criticize the Royal Navy for creating the Kalamity Class and placing trust in what is now obviously an immature and impractical technology. The subsequent and stubborn persistence in pursuing a flawed tactical concept in the face of multiple submarine disasters can only be attributed to the pressures of war...and to egotism.

In the British Admiralty's defense, in the first decades of the 20th century, submarine technology was still in its infancy. In fact, there were other ideas also pursued in that era that were even more illogical...when viewed today.

On paper, the idea of maneuvering large steam-powered submarines on the surface at high speed in close proximity to the British Grand Fleet and then to have the subs dash behind enemy battleships to attack seemed to make sense. But in practice, on the open sea, such an operation was proven to be a risky proposition and devoid of any real benefit.

Eventually, experience with such operations...and the harsh reality of losing several subs and many members of their crews...resulted in the Royal Navy's abandonment of the concept of steam-powered submarines. At least until the development of nuclear propulsion resurrected the steam-driven submarine concept as we know it today.

Bill Lee

November 2018