SOVIET SUBMARINES

Design, Development and Tactics

Jan Breemer

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Introduction

The Soviet Union has owned the world's largest submarine fleet in peacetime since the late 1930s. Since then, its numbers have never dipped below 200. The Soviet Navy, through its Tsarist predecessor, can also lay claim to being among the first of the world's navies to explore the potentialities of the 'submarine torpedo-boat.' Russia's early submarine inventors, notably S K Dzhevetsky and I G Bubnov, rank with Western pioneers such as the Americans John P Holland and Simon S Lake, and the Frenchman Gustave Zede. Notable Russian submarine inventions and experiments at the turn of the century included Dzhevetsky's famous torpedo 'drop collar', the periscope (about 20 years before its general introduction elsewhere), a chemical air purification system, sectional hull construction for rapid disassembly and reassembly, and an early form of 'closed-cycle' propulsion.

A few years ago, American Secretary of State for Defense James R Schlesinger paraphrased Winston Churchill's characterisation of Stalinist USSR to portray the Soviet Navy as 'a force . . . that is to some degree a riddle wrapped in a mystery inside an enigma.' The core of the Soviet naval 'enigma' is the submarine fleet. Its potential wartime strategy, roles and missions, and capabilities have been a riddle for the West since the day the Soviet state was created in 1917. Indeed, even before, Tsarist secrecy commonly prevented Western observers from knowing the exact size of the Imperial submarine flotillas, which boats were still on the active Admiralty list, and which not.

Looking back over the past 75 years or so of Russian submarine building, a few traditions stand out. One, the Imperial Russian and Soviet submarine fleets have habitually operated more different classes and types than have other navies. Today, in the 1980s, there are as many different operating classes as there are letters in the alphabet. One can only guess what the effect might be on repair and maintenance. A second and related phenomenon has been the tendency to operate, side by side, very new and very old submarines. During the First World War, the 'Leopard' class was the technological equal to the best submarines produced by the United States and Great Britain. At the same time, the Imperial submarine 'brigades' went to sea with submarines that were already obsolete when first delivered during the Russo-Japanese war. The pattern was repeated in the 'Great Patriotic War'. The *Stalinetz*, or 'S' class, was as good a seaboat as the German Type VII (in fact, the *Stalinetz* was a German design). Fighting alongside the *Stalinetz* was the 'Dekabrist' group, the Soviet Union's first post-First World War design and embodying the state of the art of that period. Forty-five years later, the Soviet fleet combines the high technology 'Typhoons' and *Akulas* with the anachronistic 'Whiskeys' built in the early 1950s.

A third historical tendency has been the building of *specialised* or 'mission-specific' submarines. Already before and during the First World War, the Russians designed and built

a range of submarine capabilities – from two-man harbour defence craft, to plans for submarine 'cruisers' with a range of 18 500 nautical miles. The Imperial Navy was also the first, of course, to deploy a submarine (*Krab*) for the specific purpose of minelaying. Between the wars, too, a 'family' of submarines, each designed with specific capabilities and for specific purposes, was built. The diminutive *Malodki* with two torpedoes was charged with near-shore defence; next, the medium-size *Shchuka* group was planned for forward offensive operations in the contiguous seas. The top-of-the-line, ocean patrol boats were the 'K' class cruisers. They were armed with two 100 mm guns, and were initially intended to carry a folding-wing spotter aircraft as well.

The functional balance of the Soviet submarine fleet is particularly striking today. Whereas the United States has tended to build single classes of multi-purpose attack boats, the Soviet Union has laid down multiple classes to apparently suit different missions and weapon systems. Thus, the Soviet Navy has built different types depending on whether the main armament is cruise missiles or torpedoes. Within the missile carrying category it has constructed different classes to fit short versus long-range missiles. At the same time, the design of both (diesel-powered) coastal and (nuclear-powered) ocean-going submarines has continued.

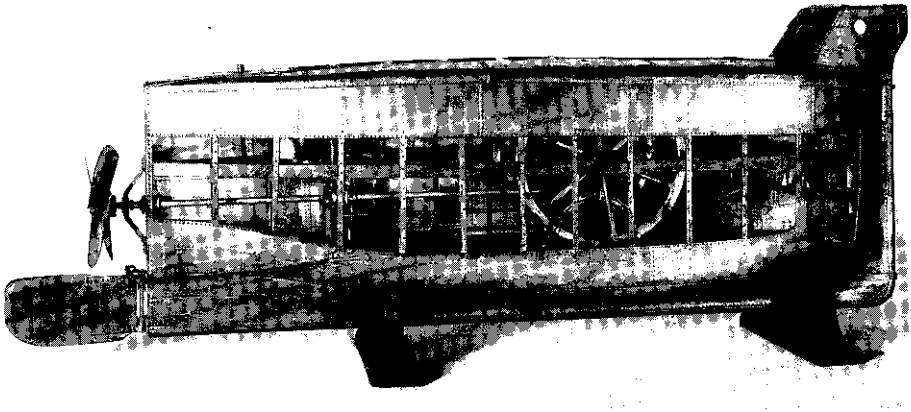
This book hopes to contribute to a better understanding of why the Soviet Union has built the kind and numbers of submarines it has, and what their military purposes may be. It is in the nature of the subject that relatively little is known with absolute certainty, especially after the Second World War. Most of the problem has to do with the Soviet refusal to expand Mr Gorbachov's celebrated *glasnost* to even the relatively 'old' history of Soviet submarine design and operations. As an example, the Soviets have yet to provide a detailed accounting of their submarine losses in the Second World War.

Declassified intelligence reports of the 1950s and early 1960s provide a partial remedy, but it is important to remember that these were *estimates;* especially the reports of the early 1950s later frequently turned out to be inaccurate. From the late 1960s onward, reliable information becomes very difficult to come by. Part of the problem in this case is that a large number of intelligence estimates that are legally qualified for declassification remain closed because of cuts in funding for the declassification teams. It is for this reason that the modern history of the Soviet submarine fleet becomes largely a matter of inference and speculation.

This book does not skirt speculation; some of it will be found quite different to prevailing judgements and opinions. If the result is controversy and debate, the book will have served an even more important purpose than a mere outline of history.

1 Imperial beginnings

The birth of the Russian submarine fleet is invariably linked with Wilhelm Valentin Bauer. An artillery officer of Bavarian origin, Bauer had made a name for himself with submarine experiments in 1850, when according to his own account of events, the mere presence of his first 'submarine', *Brandtaucher* ('Diving Incendiary'), was instrumental in lifting the Danish



Model of Wilhelm Bauer's *Brandtaucher* on display in the Deutsches Museum, Munich (Deutsches Museum)

naval blockade of Kiel. The next year, he and his crew earned the reputation of being the first to survive a submarine disaster. During a diving experiment in February, *Brandtaucher* collapsed and sank along with her crew of three, including Bauer himself, beneath 15 m (45 ft) of water. The inventor's presence of mind saved the occupants' lives; after a wait of six and one-half hours, the pressure of the water that had flooded inside had become equal to that outside, allowing Bauer to open the hatch for the three men to float safely to the surface. When the war between Denmark and Prussia had come to an end, Bauer set out to market his invention to the various courts of Europe. The Austro-Hungarian emperor was interested, as was King Ludwig I of Bavaria, but neither monarch was prepared to back his fascination with Bauer's scale model with the funding necessary to construct a full-size submarine vessel. Better luck was had in England. At the invitation of Prince Albert, construction of Bauer's next submarine went underway at the Millwall Yard in London in 1853. A dispute over the financial terms of the contract, possibly exacerbated by the Bavarian's mercurial temperament, soon led to difficulties, however, and Bauer left England to next appear in Russia.

England and Russia had meanwhile gone to war in the Crimea, and the Russians were casting about for means to strengthen their coastal defences in the Black Sea against the opponent's much superior fleet. In May 1855, Bauer was commissioned to build the *Diable*

Marin ('Sea Devil') at the Leuchtenberg Yard in St Petersburg. The dolphin-shaped vessel was completed on 1 November of the same year and turned over to the Russian Admiralty for trials in Kronshtadt harbour.

Built around an iron-framed hull with a thickness of about 13 mm (half an inch), *Diable Marin* was designed to withstand submersion to 46 m (150 ft). Propulsion was by means of a stern propeller driven by two treadmill-like wheels each about 2 m (nearly seven feet) in diameter. One hundred and thirty-three trials had been completed without mishap since May 1856 when, on 2 October of that year near-disaster struck. On her 134th trial and while slowly submerging to prepare a mine-laying experiment, *Diable Marin*'s propeller became entangled in seaweed. Water entered the craft through the conning tower, but the Russian Navy crew managed to escape. The boat was subsequently refloated, but she later sank again, this time for good, off Ochda in the Baltic Sea. Bauer attempted to interest the Admiralty in his next designs, including a 24-gun submarine corvette, but by the spring of 1858 the uncertain relationship between the two parties had become such that Bauer thought it best to leave Russia.

The main characteristics of the *Diable Marin* were as follows:

Displacement	unknown
Length	about 16.0 m (52.5 ft)
Beam	about 3.4 m (11.2 ft)
Draught	about 3.3 m (11.0 ft)
Propulsion	human muscle power with auxiliary sail for surface navigation
Speed	199 m (330 ft) in 17 minutes while in submerged condition (limited by crew endurance)
Armament	explosive charges
Diving depth	about 15 m (49.5 ft)
Diving speed	30 minutes for each metre
Complement	one helmsman plus 12 crew

The first indigenous Russian submarine design was an all-metal boat built by Ivan Fedorovich Aleksandrovsky, a St Petersburg photographer by profession but with considerable training in mathematics, physics and mechanics. Constructed between 1863 and 1866, the design displaced 355 tons, had a length and width of 33.2 and 4 m (109 and 13 ft) respectively, and a draft of almost 3.65 m (12 ft). Motive power appears to have been furnished by some sort of hydraulic mechanism that connected compressed air to two propellers operating in tandem. The vessel reportedly became lost in 1877 when the hull collapsed at too great a depth.

It was also in 1877 that one of the best known Russian submarine designers, S K Dzhevetsky, launched the first of what became a successive series of miniature submarines. Dzhevetsky's first design was a 4 m (13 ft)-long craft similar in appearance to the early submarines built by the American John P Holland. It was propelled by a single screw that received motive power from foot pedals, much like a bicycle. The hull was made of steel and was topped by a stubby conning tower that gave the sole occupant an occasional glimpse of the horizon. Since human muscle power obviously limited the craft's radius of action, steel eyebolts were located near the bow and stern for raising and lowering the tiny vessel from a 'mother ship'.

Dzhevetsky's design had two particularly interesting features; one was a small pump that, operated by the propulsion gear, exchanged the foul air inside the boat for fresh air from the outside. The other was the submarine's 'weapon system' – a set of externally-carried explosives that, through manipulation with a kind of leather glove on each side of the conning tower, was to be placed against the hull of a target vessel. Rubber suction cups were to ensure that the explosives would remain attached to the victim's hull.

Stepan Karlovich Dzhevetsky (1843–1938). (Central Naval Museum, Leningrad).

Dzhevetsky's idea of carrying the submarine's armament outside the hull eventually evolved into the famous 'Dzhevetsky gear' or 'drop collars' – an externally-mounted torpedo-carrying, aiming and release mechanism that was widely adopted in the Russian submarine fleet and elsewhere, notably on board pre-First World War French submarines. The advantage of the drop collar was its cheapness compared with the cost of internal torpedo tubes, and the ability of the submarine to carry a larger torpedo load-out than was possible with internal stowage only. Even boats with 'standard' internal tubes were frequently retrofitted with additional Dzhevetsky 'apparatus'. The system had its drawbacks however; aiming of the torpedo was difficult, and the release mechanism had a tendency to function at the wrong time and lose the expensive torpedos. Also, the collar and the weapon itself were vulnerable to damage on the surface, while the constant exposure to the natural elements lowered reliability.

Dzhevetsky's second design, a four-man operated boat, was completed on commission to the Russian government in 1879. Apart from larger displacement, several other innovations marked this 6 m (20-ft) craft. Fitted to the forward end of the conning tower was, some 25 years ahead of its general introduction, a primitive persicope constructed of a system of prisms and a magnifying glass, that allowed the helmsman to view the surface of the water while submerged. Armament consisted of two torpedoes attached to the exterior of the boat. The weapons could be released from the inside of the submarine whence they would float upward for attachment against the keel of the ship under attack. The torpedo's flotation and attachment mechanism was ingenious; placed on either side of the weapon were rubber girdles or cushions that would fill with compressed air from inside the submarine just prior to attack. Although there are no records to show how effective this system turned out to be in fact, Russia's Ministry for Coastal Defence was sufficiently impressed with the boat to order 50 similar vessels. Instead of two propellers, one fore and one aft, this series carried only one that, located aft, was capable of moving the craft in every direction; presumably some sort of reversible propeller was involved. Also introduced was what has been described as a system of 'travelling weights' that could be moved the length of the boat to ensure stability and course keeping.

The full complement of 50 'mini-submarines' was eventually completed; 34 were reportedly sent to the Black Sea for the defence of Sevastopol, while the balance of 16 stayed behind to protect the harbour of Kronshtadt. Still, the tiny vessels evidently never served in their intended role. Responsibility for Russia's coastal defence was transferred, in 1886, from the Navy to the Army and with it went control over the 'submarine forces'. The craft served out their careers as floating bridge pontoons and as light buoys.

Another result of this change of jurisdiction had more serious implications: official Russian interest in the submarine languished for nearly 20 years, until the outbreak of the Russo-Japanese war. Although Dzhevetsky could find little material support at home for his designs, abroad he was recognised as one of the world's foremost submarine designers. His plan, in 1896, for a 190-ton submarine was awarded with a prize of 5000 francs from the French Naval Ministry, and even though the design itself was not produced, the Dzhevetsky torpedo drop collar became a standard feature throughout the French submarine fleet.

Two other Russian submarine enterprises near the turn of the 19th century merit mention. The first involved the design, in 1896, of a one-man craft by the engineer Pukalov. Described in contemporary accounts as a 5.8 m (19 ft)-long craft that, powered by electric batteries, was reputedly capable of a top speed of ten knots, the Pukalov boat sounds remarkably similar to Dzhevetsky's harbour defence submarines. Building of the Pukalov design reportedly started at Kronshtadt, but it is uncertain if she was actually completed and, if so, what became of her.

The second, more ambitious project, enlisted the dubious submarine design talents of the Swedish inventor Thorsten Nordenfelt. Nordenfelt, who had already made his fame and

fortune with the invention of a reliable machine gun, had teamed up, in the early 1880s, with the English submarine pioneer George William Garrett. Although Garrett's own ideas about how to design and build a submarine were sound enough, the more ambitious but also less practical plans of his better-known and monied partner held sway. A faulty understanding by Nordenfelt of the principles of submariner operations caused a succession of his boats to suffer from severe longitudal instability. The Nordenfelt submarines, wrote one commentator, not many years after the Swede and his English partner had left the submarine business, 'are principally useful as examples of what to avoid'.

Before this conclusion had become the general consensus, however, Nordenfelt enjoyed considerable success in exploiting Europe's rivalries. The *Nordenfelt I* was bought by the Greek Navy in 1886, and the Turks, not to be outdone, promptly ordered two of Nordenfelt's next and larger design. None of the vessels had any operational value, but on paper at least, Turkey became the strongest submarine power in the Black Sea. Russia responded as might be expected, and bought the *Nordenfelt IV*, a 245-ton submarine propelled by steam. Steam was a common mode of submarine propulsion at the time, particularly on the French submarines, for movement on the surface and for recharging the electric batteries (then known as 'accumulators') for submerged navigation. Nordenfelt's steamplant went one step further however, and was intended to furnish motive power on as well as below the surface. The idea was for the live steam from the submarine's boiler to give up its heat, via a heat exchanger, to a reservoir filled with water. The superheated water thus stored would ostensibly be sufficient to give the submarine a submerged range of 20 nautical miles at five knots on latent heat alone. There were obvious problems with the system, not the least one being that, once the reserve of latent steam had been used up, further submerged operations had for all intents and purposes become impossible. The submarine would have to first return to port and fire up her boilers for several days to build up enough steam pressure for the next underwater sortie.

The representatives of the Tsar's navy apparently were not overly concerned with this drawback, for they went ahead and signed a contract without bothering to first see the craft perform underwater. The *Nordenfelt IV* departed England in November 1888 to set sail for Kronshtadt. After a short call in Amsterdam, she rounded the Danish coastline and promptly ran aground off Jutland. The Russians had seen enough; although it was not long before the submarine was refloated, the Imperial Navy refused to accept her.

Russia's first submarine built in the 20th century was a small craft, named *Peter Kochka*. Designed by an engineer by the name of Kuteinikov and Navy lieutenant E V Kolbasiev, the 20-ton, 6 m (20-ft) vessel was launched at Kronshtadt in 1902 to become the first Russian submarine assembled from prefabricated hull sections. Nine sections were joined together by bolts, and could be disassembled and reassembled at will. The three centre components contained the machinery for surface operations, and the three fore and three aft sections held the batteries while at the same time serving as ballast tanks. Two externally-carried torpedoes comprised *Peter Kochka*'s armament.

The small boat was plagued by serious stability problems. According to a contemporary account, written before the vessel's final trials, the craft, when inclined to 90 degrees (!) 'rights itself immediately'. The erratic performance of the torpedo drop collars further contributed to *Peter Kochka*'s failure as an effective weapon. Nevertheless, *'Little Peter's'* sectional construction can take credit for inaugurating a solution to the Russian Navy's long-standing problem of how to strengthen its distant fleets in the Far East and in the Black Sea. Sectional construction became a standard feature of Russia's smaller submarines for decades to come.

The Russo-Japanese War

The huge geographic distance that separated Russia's interests in the Far East from the centre of its naval strength in the Baltic Sea contributed heavily to the Imperial Navy's disastrous defeat at the hands of the Japanese in 1904–05. War between the two countries broke out on 6 February 1904. Two days later, a Japanese destroyer attack with torpedoes on Port Arthur put two Russian battleships and one cruiser out of action. After several months of mining and countermining, and with the Japanese infantry slowly infesting Port Arthur from the landside, the opposing fleets met in the Yellow Sea on 10 August 1904. After a running firefight in which the Russian squadron commander, Vice-Admiral Vitgeft, was killed by a shell splinter, the bulk of the Russian force hastened back to Vladivostok where it remained under the watchful eyes of the Japanese fleet.

Meanwhile drawn-out preparations had been completed on the other side of the Eurasian continent to dispatch Vice-Admiral Rozhdestvensky's 'Second Pacific Squadron' from the Baltic Sea. After an eventful journey of some 21 000 nautical miles that took over seven months, the Baltic reinforcements of nine battleships and a mixture of cruisers, armoured coastal defence ships and destroyers met Japanese Admiral Togo's numerically inferior but materially better prepared fleet in the Korean Straits, off Tsushima Island. Japan gained a decisive victory; the Russians lost eight battleships in addition to 22 smaller combatants, compared with Japanese casualties that amounted to two badly damaged cruisers and three sunken torpedo-boats. When the smoke had cleared, the Imperial Russian Fleet had been relegated from third to sixth place among the world's naval powers.

When the war erupted, neither side possessed any effective submarines. Japan had yet to acquire its first submarine of any kind, and the only Russian craft worthy of being called 'submarine' was the 113-ton *Delfin* (Dolphin) that had only recently completed her trials. *Delfin* was the brainchild of Ivan Grigorievich Bubnov, an engineer and one of the most famous names in the history of Russian submarine design (and elsewhere). Built at the Baltic Shipyard in St Petersburg, her characteristics were as follows:

Displacement	113/135 tons
Length	19.2 m (63 ft)
Beam	3.6 m (12 ft)
Draught	3.3 m (11 ft)
Time to dive	20 min
Surface speed	9 knots
Submerged speed	4.5 knots
Complement	20
Armament	2 Dzhevetsky torpedo drop collars

Delfin was immediately pressed into service as a training vessel for the crews that were to man the new submarines that were hurriedly ordered at home and abroad. Unfortunately, the instructors were hardly more familiar than their students with submarine operations. On the morning of 20 June 1904, with the craft being overloaded with ten to 20 additional trainees, a passing paddlewheel steamer caused a large wave to wash over the shallow craft into the open conning tower. One of the crew panicked and managed to become lodged under the hatch cover. *Delfin* rapidly filled with water; a short in the electrical circuitry caused an explosion of the built-up hydrogen gas and petrol fumes, and the boat foundered. Only six of the crew survived this second submarine disaster of the 20th century. Raised and refitted, *Delfin* later served in the Pacific Ocean and in the White Sea, where she ended her career in 1919.

As the first shots were exchanged, both the Japanese and Russians hastened to build up their respective submarine arms. The Japanese Navy enlisted the services of the Electric Boat

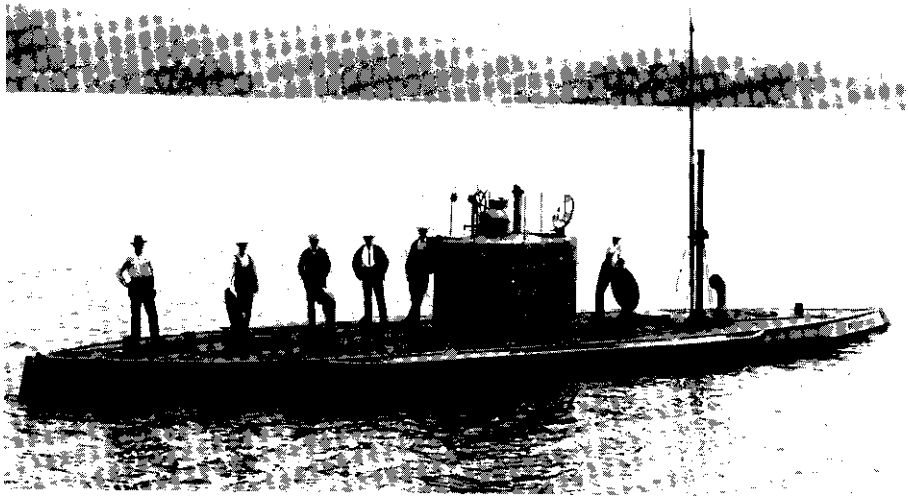
Company in the USA that had absorbed the Holland Torpedo Boat Company, and ordered five 103-ton submarines. All five arrived disassembled in Yokohama, but none became ready in time to see action against the Russians. Russian submarine acquisition plans were more ambitious. One stopgap measure was the ordering of a wooden submarine designed by a Lieutenant Botkin, and the alteration of the Dzhevetsky-designed *Keta* (Siberian salmon) of 1886. A more substantial step was taken in February 1904 with an order for four Bubnov-designed boats of 140 tons at the Baltic Yard. A certain Count Sheremetyev footed the bill of 400 000 rubles for a fifth vessel on the condition that she be named after one of his ancestors, a contemporary of Czar Peter the Great. A sixth unit was added to the commission later.

All six boats of what came to be known as the *Kasatka* (Swallow) class were launched between July and August 1904. Their names were *Feldmarshal Graf Sheremetyev, Kasatka, Skat, Nalim, Makrel* and *Okun*. Only the lead vessel, *Kasatka*, went through trials, the others being shipped, disassembled, to Vladivostok via rail. Upon their arrival in the Far East, it was soon discovered that none was ready for operational duty. Due to delays in the shipment of the German-manufactured petrol engines that the original design had called for, the craft had been refitted with small dynamos. Used for surface as well as submerged navigation, speed was reduced to four and one-half knots. The main problem though was poor stability. Moving the conning tower well forward of the hull took care of the difficulty of proper trimming, but this, in turn, displaced the centre of buoyancy. An engineer named N A Smirnov solved this difficulty through the rather unique idea of installing a false conning tower well aft. This rectified the buoyancy problem, but created a new problem: the hulls had been designed to withstand the pressure of water at 90 m (300 ft), but the additional conning towers had made the boats top-heavy. Making matters worse was the otherwise inventive idea of the commanding officer of *Feldmarshal Graf Sheremetyev* to use the false towers for carrying fresh water. As it turned out, the various alterations to the *Kasatka* class reduced diving depth by more than 50 per cent to only 36 m (120 ft).

While work progressed at the Baltic Yard, additional Russian orders were placed abroad. In the United States, contracts were let with both the Lake Torpedo-Boat Company and the Electric Boat Company for the construction of four and five submarines each. Included in the package deals were Simon Lake's *Protector* and John P Holland's experimental *Fulton*. In the case of the Lake contract, moreover, Simon Lake himself and a party of American engineers were engaged to supervise crew training for *Protector* and the construction of the Lake boats in St Petersburg.

The account of the shipment of the 130-ton *Protector* reads like a cloak-and-dagger story. Doubtful that the US government would give permission to export the submarine to a belligerent nation, and worried that Japanese spies might sabotage the craft, Lake arranged for his submarine to secretly meet with the chartered steamship *Fortuna*. Under the cover story of a trial run, *Protector* set out from Bridgeport, Connecticut on a Saturday, when government offices were closed. Once out of sight from land, the two ships met and the submarine was lifted onto the deck of the steamer with the help of a large wrecking barge. The trip across the ocean was uneventful until *Fortuna* and her deckload entered Russian waters. The suspicious captain of a Russian gunboat did not believe that the tarpaulin-covered *Protector* was destined for Russia and forced the steamer to pull into the nearest Russian port, from which she eventually arrived in Kronshtadt. Five days after her arrival at the Baltic Fleet's main naval base, Lake himself arrived to oversee crew training, just in time to hear the news of the *Delfin* disaster.

The Russians were evidently satisfied enough with the performance of *Protector* (which they renamed *Osyotr*) to increase their order with Lake with another five boats similar to *Protector*. At least four units in this second batch were delivered in 1905, but none could be made ready in time to see service in Russo-Japanese War. The four boats involved were named *Bytchok, Kefal, Paltus* and *Plotva*. After the war, in June 1906, one more Lake-built



The *Protector* before her departure to Russia (US Navy)

submarine entered Russian naval service. This was the former *Lake X* that had been built to participate in US government-sponsored submarine trials but had been completed too late to enter. *Lake X* was commissioned into the Imperial Russian Navy as *Sig*.

The Russians were much less happy with the delivered performance of the first four Lake submarines ordered. Lake had promised, and the contract had stipulated that the vessels would have enough endurance to negotiate passage from Kronshtadt to Port Said, Egypt (and hence to the Far East via the Suez Canal) without refueling. The advertised characteristics of the submarines (which came to be named *Alligator, Drakon, Kaiman* and *Krokodil*) were impressive enough. Displacement was 410 tons on the surface and 482 tons submerged. The designed surface speed was 15 knots, and cruising radius was to be as high as 3500 nautical miles. These were very ambitious statistics, considering that the typical 'modern' submarine at the time was only half this size, considerably slower, and not expected to range beyond 500 nautical miles. The armament of the *Alligator* class did justice to her size: four inches (101 mm) of armour surrounded the exposed portion of the hull which carried two 47 mm guns in addition to four internal torpedo tubes. No doubt, if the boats had lived up to expectations and had been finished in time, they could have presented a formidable threat to Japan's commanding naval position in 1905. Since anti-submarine measures against a submerged submarine had yet to be invented, it is difficult to see how the Japanese Navy would have ensured the blockade of the Lake submarines along with the surface elements of Russia's Far Eastern squadron. Once at sea, the boats' combat radius would have been more than enough to imperil Japan's line of communications to its besieging army at Port Arthur; even Japan's own coastal seagoing traffic would have been at risk. The Japanese Navy might also have found that the submarine's armament and small profile when awash added up to a respectable opposition for smaller warships. Finally, Lake's long-time interest in the submarine as a minelayer and mine-clearing vessel was reflected in the incorporation of diving airlocks whence the Russians might have covertly tried to neutralise the Japanese minefields while planting their own.

As things turned out, however, the *Alligator* class as first completed became, in the words of one commentator, 'perhaps the most unhappy episode in Russian submarine development

for this period'. The submarines proved to be, according to the same observer, complete failures in every respect. Tests and trials were conducted in 1909–1910 and revealed, according to one Russian eyewitness, that the submarines 'were unable to submerge and invariably stood on end, first by the bow, then by the stern'. Lake insisted that his customer accept the boats in spite of their flaws. When the Russians threatened to cancel the contract, he warned that they would be turned over to the Swedish Navy, which just might solve the submergence problem. The two sides went back to the negotiating table, and the Russians decided to keep the four Lake boats after all. They spent the next two years trying to iron out the various difficulties.

The Imperial Navy's efforts to make the *Alligator* class seaworthy gives the lie to the popular notion that the Russians are not mechanically inclined. Lake's team of American engineers had been baffled by the boats' instability problems, but after the Russian Navy had taken over, its technical personnel determined, before too long, that excessive weight was the root cause. The submarines had to somehow be lightened by about 12 tons but it was not evident how and where. The Russian Admiralty, perhaps even more so than their colleagues abroad, was not known for pragmatism, but this time, it took the unusual step of giving the commanding officers of the *Alligator* class *carte blanche* to spend up to one million rubles to get their craft operational, however they saw fit. This they did by virtue of the rather drastic decision of removing four of the submarine's engine cylinders and next by eliminating the useless 47 mm conning tower gun. A further modification was the installation of a ballast-compensation system that used engine-driven pumps to offset the loss of petrol during operations with an equal amount of water. Finally, torpedo armament was strengthened with the addition of two drop collars.

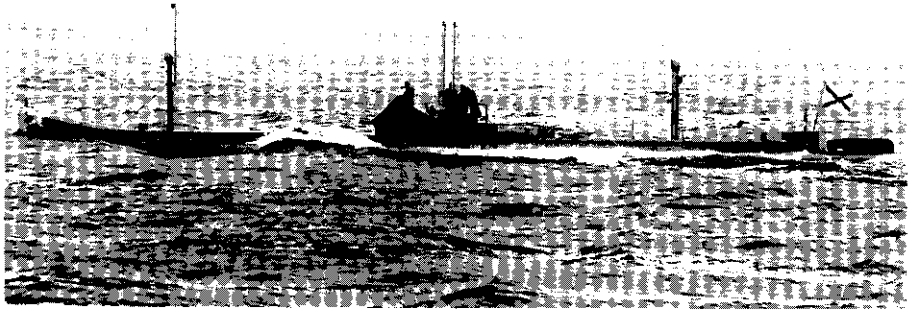
The *Alligator* class became operational in the spring of 1911; the weight reduction and addition of a ballast system had increased the speed of submersion to five minutes, and underwater handling was also improved substantially. An added gain was that the underwater design speed had been bettered from six to seven and one-half knots. It is true that when war came three years later, the four large Lake submarines proved to have only limited effectiveness. Nevertheless, the ability of the Russian submarine service to take the initiative and overcome the same problems that had confounded a much more experienced and ostensibly more technically skilled team of designers and engineers is testimony to a Russian ingenuity that Westerners are wont to ignore.

Mention has already been made of Russia's second American order for submarines with the Electric Boat Company. *Som* (ex-*Fulton*) was shipped overseas, in disassembled form, for reassembly at the Nevsky yard. The other five in the group were built from the keel up at Nevsky, and were christened *Sterlyad* (the lead boat), *Byeluga*, *Peskar*, *Shchuka* and *Losos*. *Shchuka*, together with *Som*, were originally sent by rail to Vladivostok (where they were still reported to be in early 1914), but eventually finished their careers in the Baltic. *Sterlyad*, *Byeluga* and *Peskar* were directly assigned to the Baltic Fleet where, in 1918, they were captured by the Germans at Reval (Tallinn). The fifth unit in the group, *Losos*, was joined by one additional Holland-type submarine, the *Sudak*, that had been built from the keel up at Nevsky in 1907; together they became the nucleus of the Black Sea submarine flotilla.

Besides the wartime orders for American submarines, a further three boats were contracted for, in April 1904, with the Germania-Werft at Kiel. The stage for this particular transaction had been set earlier when, aware of Russia's naval predicament, this Krupp-owned subsidiary had invited a Russian technical committee to inspect its experimental, all-electric *Forel*. The Russian team were impressed with the 16-ton boat's diving capabilities, and placed an order for three submarines with a displacement of 205 tons each. German Emperor Wilhelm II gave the tiny *Forel* to his imperial Russian cousin as part of the bargain. The craft was shipped to St Petersburg via rail in June 1904 and, after trials in the Baltic Sea, was sent to Vladivostok. There she proved to be all but useless. Twice she foundered – once

during the Russo-Japanese War itself, and again in 1910 while under tow by the destroyer *Plotva*.

Like the American orders, the three Germania-built *Karp* class submarines *Karp*, *Kambala* and *Karas* arrived much too late. The first boat was to have been delivered in August 1905, but it was not until two years afterward that Russian crews sailed all three into Libau for subsequent railroad transport to Sevastopol. The Russians accused the Germans of deliberately delaying delivery so as to gain experience for their own Navy's first U-boats. The Germans on the other hand claimed that Russian changes to the original design were largely to blame. Both arguments have some validity; certainly, the similarity between the *Karp* class submarines and the German *U-1* supports the Russian suspicion. One lesson the Germans undoubtedly learned from their Russian commission: instead of using the highly explosion-prone petrol engines that powered the *Karp* boats, the *U-1* was given the much safer Koerting heavy oil (paraffin) plant.



The *Karp* after her commissioning into the Imperial Russian Navy (Krupp Archives).

None of the three *Karp* class submarines had a particularly illustrious career. *Kambala* sank during manoeuvres in the Black Sea on 12 June 1909, when she crossed the path of the battleship *Rostislav* and was cut in half. Twenty out of a crew of 24 were lost, including the commander of the Black Sea submarine flotilla. *Karp* and *Karas* were already obsolete when the First World War broke out, and were scuttled off Sevastopol in 1919.

In April 1904, the Royal Navy's First Sea Lord, Admiral Lord Fisher, received news of the eighth (unsuccessful) Japanese attempt with torpedo boats to flush out Russia's Far Eastern Squadron at its Port Arthur roadstead. Indignantly, he wrote to a confidant: 'Why! Had he (Admiral Togo) possessed submarines it would have been one attack and one attack only! It would have been all over with the whole Russian Fleet, caught like rats in a trap!' And, Fisher thundered, if only the Russians had had submarines, 'Togo outside would never have dared to let his transports full of troops pursue the even tenor of their way to Cemulpo and elsewhere!'

As events turned out, Russia's submarine build-up in the Pacific was too little and too late. A total of perhaps 14 boats of different types managed to arrive in Vladivostok before the armistice was declared in October 1905, but only nine reportedly were ready for sea duty. Those that did venture out were used for the one purpose that most naval authorities at the time believed was the submarine's sole legitimate role: as a coastal reconnaissance auxiliary on behalf of the 'real' navy of battleships and battlecruisers – not as an offensive weapon. It is nevertheless interesting to note that considerable speculation existed on both sides during

the war that submarines would make their presence felt. Thus, one early report on the sinking of the Japanese battleship *Yashima* in May 1904 claimed that a submarine, not a mine, had been the culprit. But, noted the British journal *Engineer* dryly, 'had a submarine done it Russia would have let the world know the fact'.

Even had Russia's submarine flotilla in the Far East been employed more aggressively, it is extremely doubtful that the balance of power could have been changed to a telling degree, especially after Rozhdestvensky's defeat at Tsushima. Unit for unit, the odd assemblage of 'submarine-boats', many of them manned with only partially-trained crews and marginally sea-worthy, would have been hard pressed to inflict significant losses on the well-trained and materially well-prepared Japanese battlefleet. Few knowledgeable naval observers at the time, including even the staunchest advocates of the submarine, believed that a single or even a few torpedoes would suffice to sink a well-armoured surface warship. Moreover, the disappointing performance of the torpedo early in the Russo-Japanese War, compared with the devastating effectiveness of the mine, had led some commentators to question the usefulness of the submarine as a torpedo-firing weapon. Confounding the low reliability of the early Whitehead torpedo was the Russian custom of carrying the weapon exposed, slung inside its submarine hull-mounted drop collar. It is not difficult to imagine how the constant exposure to salt water and air must have rapidly degraded the reliability of both weapon and launch mechanism.

These can only be speculations; certain however is that the Russo-Japanese conflict had firmly committed the Imperial Russian Navy to the submarine. Indeed, the case can be made that it was precisely Russia's *defeat* in that war that helped set the stage for the creation of what became the numerically strongest submarine fleet in the world.

Organisation and equipment before the First World War

From the point of view of the Tsarist autocracy, the military defeat at the hands of the Japanese was not the only, possibly not even the most important loss. The decimation of the fleet undermined national and military morale and was seen by the middle class as another sign of a bankrupt political system. Unrest and strikes spread and became organised to the point that Russia's economy came to a virtual standstill. On 30 October 1905, Tsar Nikolai II was compelled to sign into force the October Manifesto granting Russia its first constitutional parliament, the Duma. Although the Duma never evolved into a Western-style parliament with effective control over the actions of government or Tsar, its existence nevertheless represented a limitation on autocratic power. The Duma became the centre of Russia's political life; its debates filled the newspapers, and its leadership learned to use their limited powers to good effect, particularly when it came to approving the budget and questioning the Tsar's ministers.

One result of Russia's short-lived 'democratisation' was the popularisation of the debate over the future of the post-Tsushima navy. The first reaction was to rebuild the fleet to its pre-war glory, centred about battleships and battlecruisers. Thus, the navy's first proposal called for the construction, by 1915, of a total of 118 warships, including 12 battleships and 15 cruisers, but only ten submarines. The newly-elected Duma refused to fund this programme, however, and demanded instead that the navy scale down its plans pending a thorough reorganisation of the fleet's administration as a whole, and a clearer definition of Russia's military and naval needs.

Complicating the navy's choices was that traditional notions of battleship design had suddenly been outmoded with the appearance, in 1906, of the Royal Navy's revolutionary *Dreadnought*. Not only had *Dreadnought* made all of her predecessors obsolete, she also was much more expensive. The recovering Russian economy could hardly afford construction of

enough of the big ships, and it was doubtful in any case whether Russian yards had the necessary skills.

The Duma's budgetary reluctance to sanction a large ship building programme was fuelled, in part, by the debate within the Navy itself between the 'Old School' and 'Young School' of naval strategy. The former represented 'traditional' navy thought that emphasised offensive operations with capital ships. The strategy and material condition of the fleet should, according to the Old School adherents, be consistent with the 'proper' purpose of naval power: to gain command of the sea in Russia's maritime approaches via a decisive battle with the opponent's high seas fleet. The Old School, in short, wanted to recreate a fleet in the image of the one that had gone down in the Far East, only larger. Submarines, according to this doctrinal philosophy, were for reconnaissance and counter-blockading purposes, but were rejected as a cheap alternative to the deciding gunpower of a high seas battlefleet.

Arranged in opposition were the Young School, whose image of the objective of war at sea was based largely on the doctrine popularised by French Admiral Aube in the 1880s. The latter had stressed the importance of coastal hit-and-run tactics and *guerre de course* against enemy commerce, rather than the search for a decisive clash between organised battlefleets. Instead of a concentrated force of large gunships, the Young School wanted to employ the offensive-defensive tactics of 'mosquito flotillas' of destroyers, torpedo boats and submarines to defend Russia against invasion and blockade.

The effective outcome of the dispute was a compromise fleet that failed to satisfy the material requirements of either strategy. Delay after delay set back the reconstruction of Russia's fleet; when war came, in 1914, Russia lacked both the flotilla forces needed for an effective coastal defence, and a battlefleet powerful enough to seek a decision on the high sea.

Meanwhile, the nearly 10-year interregnum between the Russo-Japanese War and the First World War was marked by a virtual explosion in submarine construction worldwide. By late 1913, France, the leading submarine navy, had increased its number of submarines from about 60 in 1905 to 90, Great Britain from 40 to 85, the United States from 15 to 44, and Russia's underwater fleet had grown to 48 boats. Newcomers to join the ranks of the submarine navies during this period included Italy with 20 units in 1913, Germany with a fleet of 30 in the same year, and Japan and Austro-Hungary with 15 each.

Qualitatively, too, the submarine had progressed rapidly. The typical submarine of 1905 displaced about 150 tons; its successor eight years later displaced some 800 tons. Surface speed improved from a maximum of less than ten knots to twice as much; underwater speeds also doubled. Cruising endurance went up from perhaps 500 nautical miles in 1905 to 1500 nautical miles or more in 1913–1914. Speed of diving from an awash condition was cut from at least 20 minutes to five minutes or less. Possibly less dramatic at their inception, but at least as important in the long run, was the creation by the principal submarine powers of specialised submarine support vessels, the introduction of wireless radio aboard submarines, the deck-mounting of medium-calibre guns and, most important, the first experiments at anti-submarine warfare with aircraft.

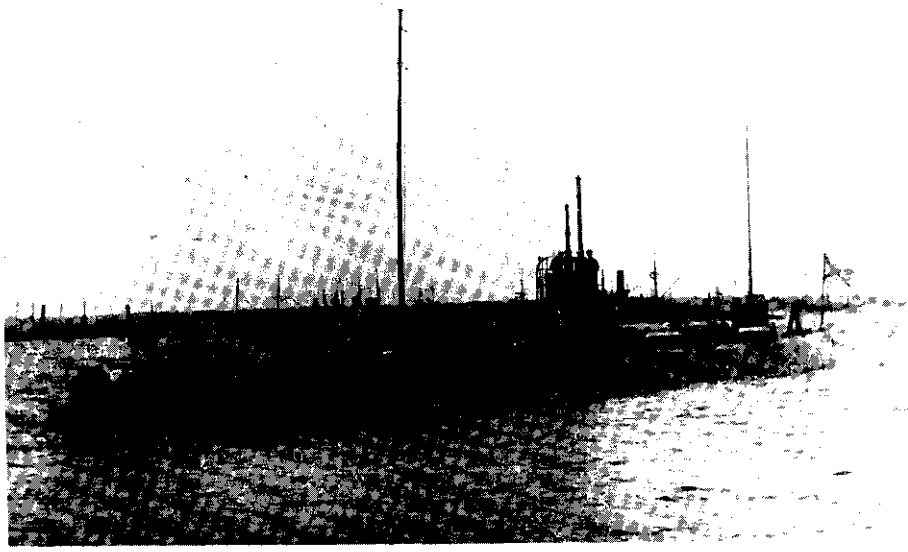
One major implication of technical advances such as these was that submarines were rapidly assuming the capability of long-range offensive operations on the high seas. Improvements in speed and endurance meant that the submarine would be able to accompany the battlefleet, that is to say, at least until the impending 'decisive' clash. Joint operations between submarines and the battlefleet became a regular feature of the manoeuvres held annually by the major naval powers. Some submarine enthusiasts went so far as to predict that their favourite weapon might soon replace the 'destroyer torpedo boat' as the battlefleet's armed scout.

Russia's submarine fleet during the interwar years fairly kept pace with tactical and

technical improvements elsewhere. A submarine training school was established at Libau (Liepaja) in the autumn of 1906. All student officers were given a thorough instruction not only in the principles and handling of a submarine, but were also expected to be intimately familiar with all aspects of engineering operations. Each candidate officer was taught skills that elsewhere were normally assigned to enlisted personnel, such as the operations of the vertical and horizontal rudders, watch standing in the engine room or at the electrical controls, etc. The reported Soviet Navy custom today for officers to carry out duties that are normally entrusted to noncommissioned personnel in Western navies has been cited as evidence of inadequate enlisted training. Perhaps; it might also reflect a tradition that has been carried over from procedures that were first inaugurated more than 70 years ago.

Casualty drills, too, were a standard aspect of Russian submarine training before the First World War. Granted that it is difficult to draw a scientifically valid conclusion about comparative safety records (for example, number of submarine casualties per number of submarine days at sea), it is noteworthy nonetheless that the Russian Navy experienced only four submarine sinkings prior to the First World War, compared with eight in the Royal Navy and 11 in the French fleet.

The last Russian submarine to suffer this fate before the First World War was the 147-ton *Minoga*. A contemporary account of the mishap in 1913 follows. It is interesting in part, for the graphic description of the perilous life aboard the early submarines, but more so for its picture of an efficient rescue and salvage operation:



The Bubnov-designed *Minoga* as she appeared in 1909. Note the rows of torpedo drop collars (Central Naval Museum, Leningrad).

> '*Minoga*, under the command of Lt Garsoyev, was manoeuvreing off Libau, when she was seen to take a sudden plunge. The appearance of the emergency buoy first gave the alarm at 3 in the afternoon, but it was not until 9 at night that the salvage vessels reached the spot. The weather conditions remained happily favourable, and divers having fixed the heavy lifting chains, the *Minoga* was successfully brought to the surface by midnight . . .
>
> When the after hatch was opened, 3 men staggered out, barely able to crawl. Fifteen of the crew and the captain were got out unconscious from the after part of the vessel. There remained only the coxswain, who was in the conning-tower amidships. It was necessary to raise the

submarine well out of the water to get at the conning-tower, and this took another 3 hours work, but the coxswain, when released after 12 hours confinement, was in the best condition of any of the crew. Thus the whole command of 20 men was saved and the submarine recovered after lying 9 hours at the bottom of the sea helpless.

The cause of the accident has been ascertained to have been a defective ventilator. Before exercising, these ventilators, which are indispensable to proper actions of the accumulators which provide the motive energy of submarines, are screwed home from the inside. A ventilator in the forward part of the vessel was either defective or had not been properly screwed home, and water leaked in through this forward ventilator until the delicate trim of the submarine was affected and she plunged head foremost to the bottom. Water continued to enter until the air within the vessel was so far compressed as to resist the entrance of any more at a pressure of 7 fathoms (42 feet) depth.

On this air the crew of 20 survived, the captain and 15 men in the body of the submarine suffering from the fumes of chlorine gas given off by the accumulators. The 3 men who crawled out unaided by the after hatch and the coxswain, . . . were apparently out of reach of the chlorine gas fumes . . . All have now recovered from the effects of their terrible experience.'

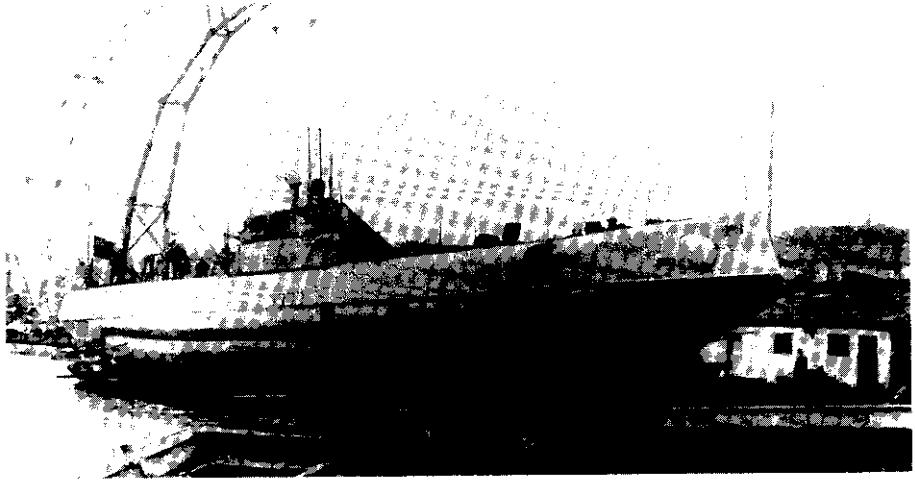
Steps toward better administrative and operational control over Russia's submarine forces progressed hand in hand with improved training and support. In 1907 supervision of all submarine matters was placed under the Department of the Chief Inspector of Torpedo Affairs with a subsection strictly concerned with submarines. Three years later the first submarine 'type command' was set up in the Baltic Fleet with the organisation of a Brigade of Submarines. The Brigade was made up of two Divisions, each with a nominal strength of five submarines. The 1st Division was supported by the tender *Khabarovsk*, and the 2nd by the tender *Yevropa*. Also, construction was taken in hand for the rescue ship *Volkhov*, an 800-ton vessel equipped with pumps, cranes, and hospital facilities for the injured.

Joint manoeuvres between Baltic Fleet submarines and battlefleet units became a routine annual event, starting in the autumn of 1909. Unfortunately, the persistent perception of the submarine as a weapon suitable primarily for coastal defence inhibited the development of realistic offensive tactics. Instead, pre-1914 war plans, instructions and exercises ordinarily called for the submarines to take up pre-assigned patrol positions and lie there in wait for the advancing 'enemy' fleet. A successful submarine attack could take place only when the 'enemy' ships followed the rules of manoeuvres and passed through the pre-positioned submarine barrier; little attention was given to the offensive closing of enemy vessels. A related consequence of this artificiality was an exaggerated expectation of the submarine's defensive potential and a failure to develop adequate anti-submarine warfare equipments and tactics.

The years before the First World War produced a plethora of ambitious fleet and submarine building programmes. A five-year construction programme developed by the newly-established Naval General Staff in 1907 proposed that the defence of the Baltic approaches be entrusted to 40 submarines and 90 torpedo boats, among others. Another 26 submarines were believed required for the defence of the Black Sea coast in addition to offensive operations against the Turkish Straits. Alternative programmes, some produced by the Navy Department and others from the hands of the Chief of the Naval General Staff, circulated at the same time, including one for the building of as many as 120 submarines. No firm action was taken, however; instead different factions within the Navy, the Council of State Defence, and the Duma spent their time in fruitless debate. The unavoidable outcome was that the Fleet was unprepared to do much more than help defend the Army's coastal flanks.

The most interesting submarine laid down during the interwar years was the world's first underwater vessel specifically designed for minelaying purposes. The vessel was the brainchild of Mikhail Petrovich Nalyetov, a railroad engineer. Nalyetov was in Port Arthur during the war with Japan, and had witnessed the destructive power of mines. While in Port

Arthur, he had begun construction of a submarine, but the unfinished boat was blown up to prevent its capture by the Japanese.



The *Krab*, popularly known as the 'box of surprises', about to undergo repairs at a Black Sea yard sometime during the First World War (US Naval Historical Center, courtesy of Boris V Drasphil)

In 1906, the Admiralty approved his plan for a 512-ton minelaying submarine. Construction of the *Krab* began at the Nikolayev Yard in 1908 but did not finish until 1915. To her crew the boat became known as the 'box of surprises'. During her wartime career, she was plagued by a series of mechanical mishaps; as far as can be determined, she carried out only four mine-laying missions in the Black Sea.

Another innovative design was Dzhevitsky's *Pochtovy* (Postal). Built in 1907–1908 by popular subscription, this 134-ton vessel was powered by a 'unified' engine, an early form of closed-cycle propulsion. A petrol engine was used both on the surface and for underwater running. Compressed air for engine use replaced conventional storage batteries for underwater navigation which had the unfortunate by-product of a long – and very noticeable – trail of exhaust gas bubbles on the surface. *Pochtovy* was stricken from the naval list in 1913.

A number of conventional submarines was completed before the war. The Bubnov-designed *Minoga* and *Akula* were laid down at the Baltic Yard in 1907, and accepted by the Navy in 1909 and 1911 respectively. The twin-screw *Akula* was Russia's first diesel-propelled submarine, and stood out for her ram bow, a characteristic of the later Bubnov designs. Her wartime career in the Baltic Sea showed many deficiencies. The absence of mufflers made her extremely noisy, and the Navy's insistence on space for reserve torpedoes had been accommodated at the expense of storage for reserve lubricating oil. Also completed in 1909, after four years of construction and alteration, were the 140-ton *Okun* and *Makrel*. Both joined *Akula* and *Minoga* to form the 1st Division of the Baltic Fleet Brigade of Submarines.

Until 1912, the submarine flotilla in the Black Sea had depended on the shipment of disassembled boats via rail. One major drawback of this practice was the tendency of the connecting flanges and nuts and bolts that held the different sections together to rust quickly. The corrosion on the *Karp* class, for example, was so severe that the boats' design depth of 30 m (100 ft) had to be cut back to a maximum of 18 m (60 ft). A solution came in 1912, when the Black Sea acquired its own centre for submarine construction with the

completion, at the Nikolayev Yard, of three 630-ton Holland designs: *Kashalot*, *Kit* and *Narval*. They were succeeded immediately by the *Morzh* (Walrus) class, also of three boats: *Morzh*, *Tyulen* and *Nerpa*. The latter were built according to a Bubnov design, but because of their near-identical size, armament, and speed characteristics, they have frequently been grouped together with the *Kashalot* class.

The Russian Navy's most capable group of submarines in the First World War, the *Leopard* class, was ordered under the naval programme of 1912. The recently-founded Nobel-Lessner Yard at Reval (Tallinn) received an order for 12 of these Bubnov-designed submarines, and a second order for an equal number went to the Baltic Yard. The latter facility shared its commission equally with Nikolayev.

The original design features of the *Leopard* class compared favourably with the best submarines then produced in the United States, France and Italy. Displacement was 650 tons on the surface and 784 tons submerged. Speeds were 18 knots on the surface and 9.5 knots below, while a long cruising radius classed the boats as long-range ocean patrol types. Armament was impressive also, and included four internal torpedo tubes, eight external drop collars, and one or two 6-pounder guns. Up to one half of the *Leopard* class submarines were laid down too late to be completed according to the original design specifications, however. The first 12 boats received their planned German-built 2640 hp engines for surface running, but the next ten were given 500 hp power plants taken from the *Kopje* class of Amur river gunboats. As a consequence, surface speed dropped to nine knots. The final two boats in the group of 24, received 840 hp engines. Both (*Forel* and *Yorsh*) were also retrofitted with external minelaying mechanisms in place of their original torpedo drop collars. The *Leopard* class altogether included these boats:

Group I		*Group II*		*Group III*	
Bars	(N&L)	*Leopard*	(N&L)	*Forel*	(B)
Gepard	(N&L)	*Pantera*	(N&L)	*Yorsh*	(B)
Ugor	(N&L)	*Tigr*	(N&L)		
Yaz	(B)	*Tur*	(N&L)		
Yedinorog	(N&L)	*Yaguar*	(N&L)		
Kuguar	(N&L)	*Volk*	(B)		
Vyepr	(B)	*Lyebed*	(N)		
Lvitsa	(N&L)	*Ryss*	(N&L)		
Zmeya	(B)	*Pelikan*	(N)		
Burevestnik	(N)	*Utka*	(N)		
Gagara	(N)				
Orlan	(N)				

B = Baltic Yard, St Petersburg; N&L = Nobel & Lessner Yard, Reval; N = Nikolayev Yard

An overall assessment of the state of Russia's submarine forces on the eve of the First World War can fairly be summarised as one of promise but with limited operational and material capabilities. Tactical training was adequate in terms of the prevailing notions of the main purpose and missions of submarines, ie scouting and defensive barrier operations aimed at harassing and slowing down an approaching enemy fleet. Officers and enlisted personnel as a whole appear to have been as qualified as most of their foreign counterparts in the materiel handling of submarines, but barring some notable exceptions, failed to adapt their operational routines to the aggressive tactics that the war soon showed were necessary for the submarine to fully make its presence felt.

When war broke out, the submarine support organisation was still being developed; once at war, a key limitation on the effectiveness of the Russian submarine fleet was low

operational readiness as the result of a dearth of repair and maintenance facilities. Complicating the ability of the Russian yards to keep enough submarines at sea was the lack of standardisation. Germany entered hostilities with 45 U-boats at sea or under construction belonging to three basic classes, most of them built after 1910. Russia started with about the same number of boats, but they belonged to at least nine different – and older – classes in addition to several one-off types. This mixture was the pay-off, in part, of the need during the war with Japan to press into service *any* submarine, no matter what kind. It also reflected the inability of the Russian Navy to decide what type of submarine with what characteristics was best suited to its naval needs. This dilemma was symptomatic, in turn, of the Navy's failure to agree on its principal roles and missions, and a force structure to match – whether the fleet should be organised around light forces for coastal defence, or be based on capital ships designed for offensive action on the high seas. Various submarine projects typified this quandary. For example, in the same year – 1909 – that the army engineer corps ordered three useless 33-ton Holland-type miniature submarines for the defence of Kronshtadt harbour, design went underway for a 1700-ton submarine minelayer and a 4500-ton armoured cruiser submarine. The latter was to have a combat radius of 18,500 nautical miles, a maximum surface speed of 25 knots and a submerged speed of 14 knots. The design's weapon system was to consist of no fewer than 36 torpedo tubes and five 5-in (127 mm) guns! An even more ambitious project was the proposal, in 1911, by the engineer Shuravlev for a 5000-ton minelaying submarine with a capability for 150 mines. None of these monstrous vessels ever progressed beyond the drawing board, but almost equally far-fetched design plans continued to distract from Russia's real naval needs right through the war itself.

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Much of the preceding chronology of Russian submarine developments before the First World War is based on contemporary English-language reports in the professional naval journals, including the US Naval Institute's *Proceedings* and the *Army and Navy Journal*. Specific key sources consulted include the following:

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communications. This omission was corrected, when, starting in September 1915, the larger submarines, together with the British boats, began a systematic, if somewhat low-key campaign against the German iron ore traffic with Sweden. On 28 September *Akula* sailed for Libau, *E.8* for the Gulf of Danzig, and *E.19* for the Dagerort-Falsterbo area. The patrols lasted from ten to 12 days. *Akula* returned empty-handed, but *E.8* and *E.19* shared in the sinkings of seven transports. By December, the Anglo-Russian submarine force had taken a toll of 14 German merchant ships, two cruisers and one torpedo boat. The enemy was also forced to beach two steamers, and three vessels were taken as war prizes. Although the numbers themselves were small in relation to Germany's total Baltic traffic, the portent of larger losses to come forced the Germans to transfer additional escorts from the North Sea. More important perhaps from the Russian point of view, the loss of and damage to some of their large warships prompted the Germans to withdraw the older battleships and armoured cruisers from Baltic operations.

At this point it is useful to consider the operational condition of the Brigade of Submarines of the Baltic Fleet, changes to its order of battle since August 1914, the pattern of operational submarine tactics, and the overall performance of the Baltic Fleet submarines so far.

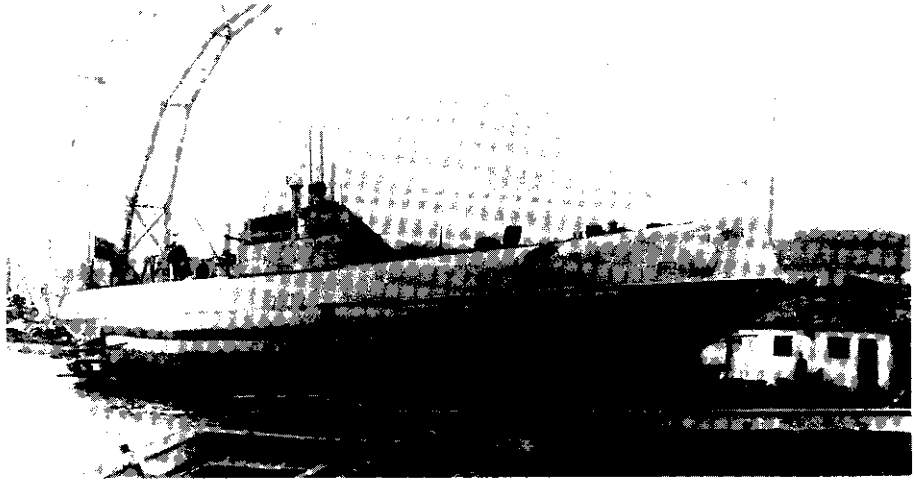
The Baltic Fleet commenced wartime operations with an active inventory of 11, perhaps 12 submarines. They included the 1st Division with *Akula, Minoga, Makrel,* and *Okun,* the 2nd Division with *Alligator, Drakon, Kaiman,* and *Krokodil,* and a training division composed of three Holland-designed *Sterlyad* class boats: *Sterlyad, Byeluga,* and *Peskar.* The ex-*Simon Lake X,* renamed *Sig,* may also have begun her wartime career with this command before being transferred to the Far East.

Altogether six Baltic Fleet submarines were lost during the war due to hostilities (see Table 1 at the end of this chapter). The first loss involved the somewhat mysterious disappearance of *Akula* in November 1915. Some accounts reported that she had been sunk in the course of a gun duel with the German warship *Kaiserin* in the Bay of Danzig. According to these same reports, *Akula* had been engaged in an artillery bombardment of the city of Danzig. The official Soviet version of events is that she sank from causes unknown, but presumably from mines. The submarine's assigned mission at the time was to lay mines in the vicinity of Pappensee even though damage sustained in an earlier encounter had limited her operational condition to surface navigation only. Her disappearance prompted the suspension of further submarine minelaying operations.

Added to the fleet during 1915 were *Bars, Vyepr, Volk,* and *Gepard* so that, by the end of the year, the naval command could muster eight large and 13 small submarines. In addition, the British contribution had been raised to five. Further reinforcements were pending as the Russians had embarked on a crash building programme. Plans were completed in 1915 to build as many as 114 submarines by 1920. One order for the construction of a Holland-designed group of boats, known as the 'G-1' class, went to the Nobel-Lessner Yard. Characteristics were the following:

Displacement	960/1200 tons
Length	76.2 m (250 ft)
Beam	7.3 m (24 ft)
Draught	3.3 m (11 ft)
Speed	16/9 knots
Propulsion	2200/700 hp
Endurance	unknown (fuel capacity 60 tons)
Armament	8 internal and 4 external 533 mm (21-in) TT; 2 × 100 mm and 1 × 57 mm AA gun
Complement	approx 50

Arthur, he had begun construction of a submarine, but the unfinished boat was blown up to prevent its capture by the Japanese.



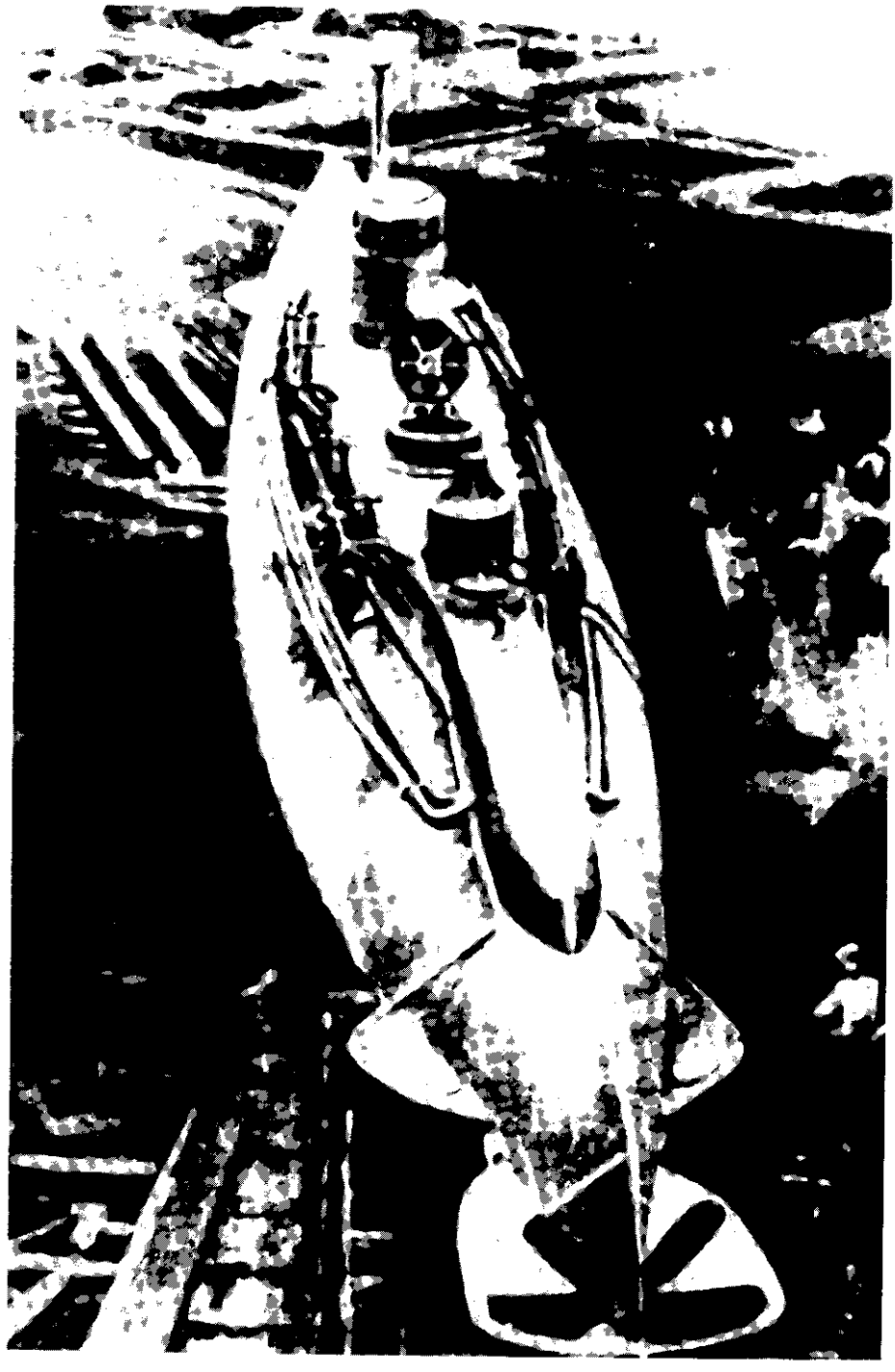
The *Krab*, popularly known as the 'box of surprises', about to undergo repairs at a Black Sea yard sometime during the First World War (US Naval Historical Center, courtesy of Boris V Drasphil)

In 1906, the Admiralty approved his plan for a 512-ton minelaying submarine. Construction of the *Krab* began at the Nikolayev Yard in 1908 but did not finish until 1915. To her crew the boat became known as the 'box of surprises'. During her wartime career, she was plagued by a series of mechanical mishaps; as far as can be determined, she carried out only four mine-laying missions in the Black Sea.

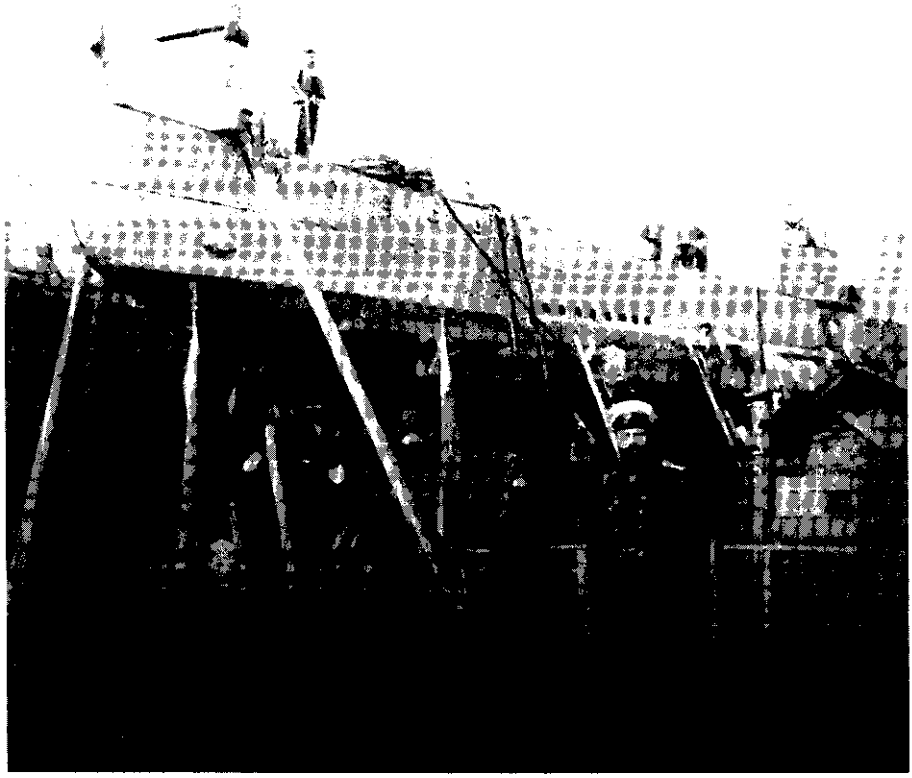
Another innovative design was Dzhevitsky's *Pochtovyi* (Postal). Built in 1907–1908 by popular subscription, this 134-ton vessel was powered by a 'unified' engine, an early form of closed-cycle propulsion. A petrol engine was used both on the surface and for underwater running. Compressed air for engine use replaced conventional storage batteries for underwater navigation which had the unfortunate by-product of a long – and very noticeable – trail of exhaust gas bubbles on the surface. *Pochtovyi* was stricken from the naval list in 1913.

A number of conventional submarines was completed before the war. The Bubnov-designed *Minoga* and *Akula* were laid down at the Baltic Yard in 1907, and accepted by the Navy in 1909 and 1911 respectively. The twin-screw *Akula* was Russia's first diesel-propelled submarine, and stood out for her ram bow, a characteristic of the later Bubnov designs. Her wartime career in the Baltic Sea showed many deficiencies. The absence of mufflers made her extremely noisy, and the Navy's insistence on space for reserve torpedoes had been accommodated at the expense of storage for reserve lubricating oil. Also completed in 1909, after four years of construction and alteration, were the 140-ton *Okun* and *Makrel*. Both joined *Akula* and *Minoga* to form the 1st Division of the Baltic Fleet Brigade of Submarines.

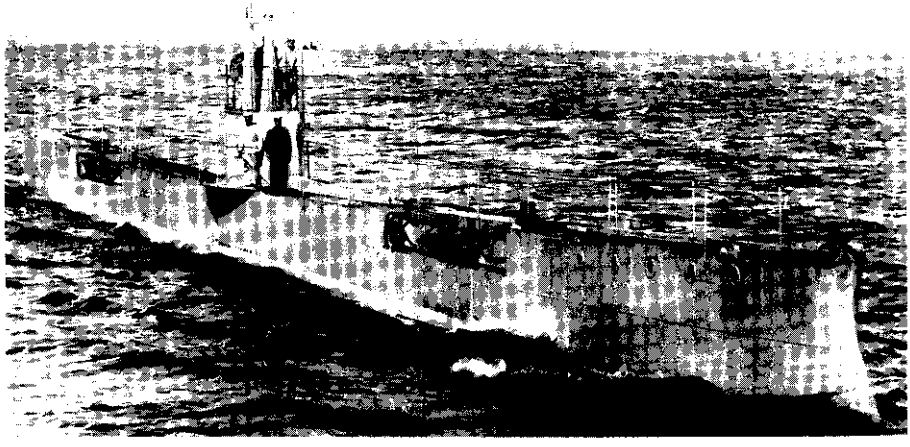
Until 1912, the submarine flotilla in the Black Sea had depended on the shipment of disassembled boats via rail. One major drawback of this practice was the tendency of the connecting flanges and nuts and bolts that held the different sections together to rust quickly. The corrosion on the *Karp* class, for example, was so severe that the boats' design depth of 30 m (100 ft) had to be cut back to a maximum of 18 m (60 ft). A solution came in 1912, when the Black Sea acquired its own centre for submarine construction with the



The Dzhevetskiy-designed *Pochtovy*. This was Russia's first attempt at a 'closed-cycle' submarine propulsion system (Central Naval Museum, Leningrad).



The *Akula* and her designer, I G Bubnov, at the Baltic Yard, St. Petersburg (US Naval Historical Center, courtesy of Boris V Drasphil)



Akula. Since she does not fly the Imperial Navy ensign, and her drop collars are empty, she appears to be on pre-commissioning trials. The submarine in the background is probably a Lake-designed Protector-type (US Naval Institute).

completion, at the Nikolayev Yard, of three 630-ton Holland designs: *Kashalot*, *Kit* and *Narval*. They were succeeded immediately by the *Morzh* (Walrus) class, also of three boats: *Morzh*, *Tyulen* and *Nerpa*. The latter were built according to a Bubnov design, but because of their near-identical size, armament, and speed characteristics, they have frequently been grouped together with the *Kashalot* class.

The Russian Navy's most capable group of submarines in the First World War, the *Leopard* class, was ordered under the naval programme of 1912. The recently-founded Nobel-Lessner Yard at Reval (Tallinn) received an order for 12 of these Bubnov-designed submarines, and a second order for an equal number went to the Baltic Yard. The latter facility shared its commission equally with Nikolayev.

The original design features of the *Leopard* class compared favourably with the best submarines then produced in the United States, France and Italy. Displacement was 650 tons on the surface and 784 tons submerged. Speeds were 18 knots on the surface and 9.5 knots below, while a long cruising radius classed the boats as long-range ocean patrol types. Armament was impressive also, and included four internal torpedo tubes, eight external drop collars, and one or two 6-pounder guns. Up to one half of the *Leopard* class submarines were laid down too late to be completed according to the original design specifications, however. The first 12 boats received their planned German-built 2640 hp engines for surface running, but the next ten were given 500 hp power plants taken from the *Kopje* class of Amur river gunboats. As a consequence, surface speed dropped to nine knots. The final two boats in the group of 24, received 840 hp engines. Both (*Forel* and *Yorsh*) were also retrofitted with external minelaying mechanisms in place of their original torpedo drop collars. The *Leopard* class altogether included these boats:

Group I		*Group II*		*Group III*	
Bars	(N&L)	*Leopard*	(N&L)	*Forel*	(B)
Gepard	(N&L)	*Pantera*	(N&L)	*Yorsh*	(B)
Ulgor	(N&L)	*Tigr*	(N&L)		
Yaz	(B)	*Tur*	(N&L)		
Yedinorog	(N&L)	*Yaguar*	(N&L)		
Kuguar	(N&L)	*Volk*	(B)		
Vyepr	(B)	*Lyebed*	(N)		
Lvitsa	(N&L)	*Ryss*	(N&L)		
Zmeya	(B)	*Pelikan*	(N)		
Burevestnik	(N)	*Utka*	(N)		
Gagara	(N)				
Orlan	(N)				

B = Baltic Yard, St Petersburg; N&L = Nobel & Lessner Yard, Reval; N = Nikolayev Yard

An overall assessment of the state of Russia's submarine forces on the eve of the First World War can fairly be summarised as one of promise but with limited operational and material capabilities. Tactical training was adequate in terms of the prevailing notions of the main purpose and missions of submarines, ie scouting and defensive barrier operations aimed at harassing and slowing down an approaching enemy fleet. Officers and enlisted personnel as a whole appear to have been as qualified as most of their foreign counterparts in the materiel handling of submarines, but barring some notable exceptions, failed to adapt their operational routines to the aggressive tactics that the war soon showed were necessary for the submarine to fully make its presence felt.

When war broke out, the submarine support organisation was still being developed; once at war, a key limitation on the effectiveness of the Russian submarine fleet was low

operational readiness as the result of a dearth of repair and maintenance facilities. Complicating the ability of the Russian yards to keep enough submarines at sea was the lack of standardisation. Germany entered hostilities with 45 U-boats at sea or under construction belonging to three basic classes, most of them built after 1910. Russia started with about the same number of boats, but they belonged to at least nine different – and older – classes in addition to several one-off types. This mixture was the pay-off, in part, of the need during the war with Japan to press into service *any* submarine, no matter what kind. It also reflected the inability of the Russian Navy to decide what type of submarine with what characteristics was best suited to its naval needs. This dilemma was symptomatic, in turn, of the Navy's failure to agree on its principal roles and missions, and a force structure to match – whether the fleet should be organised around light forces for coastal defence, or be based on capital ships designed for offensive action on the high seas. Various submarine projects typified this quandary. For example, in the same year – 1909 – that the army engineer corps ordered three useless 33-ton Holland-type miniature submarines for the defence of Kronshtadt harbour, design went underway for a 1700-ton submarine minelayer and a 4500-ton armoured cruiser submarine. The latter was to have a combat radius of 18,500 nautical miles, a maximum surface speed of 25 knots and a submerged speed of 14 knots. The design's weapon system was to consist of no fewer than 36 torpedo tubes and five 5-in (127 mm) guns! An even more ambitious project was the proposal, in 1911, by the engineer Shuravlev for a 5000-ton minelaying submarine with a capability for 150 mines. None of these monstrous vessels ever progressed beyond the drawing board, but almost equally far-fetched design plans continued to distract from Russia's real naval needs right through the war itself.

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2 The First World War and Revolution

A detailed account of Russia's naval and submarine exploits during the First World War falls outside the scope of this volume. Instead, this chapter is limited to a broad outline of the Russian Navy's experience in the conflict while highlighting the main events involving the actions of its submarines. This chapter closes with a synopsis of the impact of the Bolshevik Revolution and subsequent Allied intervention and Civil War on the death of the Imperial Russian Navy and the birth of its successor, the Soviet Navy.

The description of naval action in the First World War is restricted to Russia's two main theatres of fleet operations: the Baltic Sea and the Black Sea. No Russian naval combatants in the Far East participated in hostilities; most of the Vladivostok-based submarines were transferred to the West during the course of the war. Fighting at sea did take place in Russia's Arctic regions especially as Allied shipments of war material increasingly attracted the attention of the German U-boats. Little is known, however, about the role that the two to three submarines stationed in the region had played.

Principal references consulted for this chapter include the declassified correspondence of US government officials stationed in wartime Russia, and *The Fleet in the First World War, Vol I: Operations of the Russian Fleet*, edited by Rear-Admiral Professor N. B. Pavlovich.

Operations of the Baltic Fleet, 1914–1915

The mobilisation and deployment of the Baltic Fleet began on 25 July 1914 in accordance with the 1912 'Plan of operation of the naval forces of the Baltic Sea'. The essence of this plan was defensive, positional warfare aimed at frustrating an expected German sea-based assault into the Gulf of Finland against St Petersburg. Central to this strategy was a combination of minefields and heavy-calibre coastal artillery with coverage of the line between Reval (Tallinn) and the Porkala-Udd peninsula jutting out from the Finnish south coast. Supplementing this so-called 'central position' was a flanking minefield along the line of Cape Takhona-Bengtokear, parallel to the Finnish shore. The fleet's active forces, from battleships to gunboats, were concentrated behind the mine artillery barrage, whence they were tasked to engage any German shipping attempting to break through. The fleet's subdivision of submarines based on Reval was the only naval force deployed ahead of the barrier. Its assigned mission was to lie in wait and harass the movements of the approaching enemy preparatory to its contact with the central position.

Beyond this strictly defensive and highly static scheme of operations, the 1912 plan left room, if the situation permitted, for offensive mining operations off Germany's Baltic ports and harbours, and along the principal sea routes leading to them. The long-term and most ambitious goal was for the Baltic Fleet to blockade the eastern end of the Kiel Canal with mines and supporting vessels after the British Navy had defeated the German High Seas Fleet.

Initial Russian naval operations in the Baltic Sea followed the prescribed course. The Gulf of Finland was closed with mines, and patrols by cruisers and lesser combatants kept a wary look-out for the anticipated German break-through attempt. When it became evident in the Autumn of 1914 that this was not the German intention, the area of Russian naval operations expanded to include offensive minelaying off the coast of East Prussia. Protecting

the minelaying forces were usually three submarines. Taking advantage of the relative passivity of the German Navy, the Russians also decided to extend the Baltic Fleet's main defensive perimeter westward to the Moon Sound that bars the entrance to the Gulf of Riga.

Easing the fleet's ability to meet its expanded responsibilities was the arrival of a number of reinforcements. Added during the first year of the war were four new battleships, a few destroyers and the three *Leopard* class submarines *Bars*, *Vyepr* and *Gepard*. Another important boost for the Baltic Fleet came in late October with the dispatch, via the Danish Straits, of the Royal Navy's submarines, *E.1* and *E.9*. The submarines, later joined by others, were placed under the commander of the Baltic Fleet, but were detailed to conduct independent operations against the capital ships of the German High Seas Fleet. One British writer's description of the operations of *E.1* and *E.9* in the spring of 1915 as 'an orgy of destruction on German shipping' may be slighted for a bit of chauvinistic colouring. It is true nevertheless that, in terms of enemy ship sinkings, the British Baltic submarine flotilla proved to be considerably more successful than its Russian counterpart. The German submarine commanders were instructed by Prince Heinrich of Prussia: 'I consider the destruction of a Russian submarine will be a great success but I regard the destruction of a British submarine as being at least as valuable as that of a Russian armoured cruiser'.

The balance at sea had remained virtually unchanged until action resumed in May 1915 when the annual five-month long ice-pack began to break up. The German Army meanwhile had slowly gained ground up the coast of Courland, so that by the end of April, the Baltic Fleet's main submarine base at Libau (Liepaja) was threatened from land as well as sea. The city fell on 8 May, thereby affording the German fleet a forward position for intensified operations against the Gulfs of Riga and Finland. At the end of June, German ground forces, supported by naval units, launched an offensive against Vindau (Ventspils), north of Libau, and the principal Baltic Fleet naval base west of Riga itself.

The seaborne portion of the assault was a failure. After a brief surface battle on 28 June, the German strike force, consisting of one older battleship, two cruisers and six minesweepers, was forced to cut short its bombardment of Vindau and return to Libau. The German Army was more successful; Vindau was captured by the German troops on 18 July, thus endangering the security of the Gulf of Riga directly.

The expected German attack into the Gulf of Riga proper came on the morning of 8 August. A large German force of seven pre-dreadnought battleships, six cruisers and 24 destoyers and torpedo boats entered the Irbe Strait, led by a flotilla of minesweepers. The mine-clearing flotilla succeeded in sweeping a channel through the first two fields, but the heavy German ships were unable to bring the inferior Russian forces to battle. When the Germans lost a minesweeper on a third line of mines, the break-through attempt was aborted. The Russians promptly re-mined the cleared passage.

On 14 August, a second German attempt to break into the Gulf of Riga began. Again, the accompanying minesweepers cleared a path for the heavy forces and, this time, the Russian covering forces were compelled to retreat north to prevent being cut off. The way cleared, the Germans entered the Gulf the next day to probe the coastline. After some desultory artillery exchanges with minor Russian forces and after losing two destroyers on mines, the German force withdrew a few days later. No further attempt to seize the Gulf of Riga and Riga itself by sea would be made until 1917, after the German Army had occupied the surrounding coastline. The Baltic Fleet, for its part, used the suspension of the German naval offensive to switch its forces to more active operations against the enemy sea lines of communications.

Since the start of the war, German shipping in the western part of the Baltic Sea had been able to function virtually unimpeded thanks, in part, to the overriding Russian concern with the security of the Gulf of Finland. A second, and related, reason was that Russian prewar plans simply had not considered aggressive operations against Germany's maritime

communications. This omission was corrected, when, starting in September 1915, the larger submarines, together with the British boats, began a systematic, if somewhat low-key campaign against the German iron ore traffic with Sweden. On 28 September *Akula* sailed for Libau, *E.8* for the Gulf of Danzig, and *E.19* for the Dagerort-Falsterbo area. The patrols lasted from ten to 12 days. *Akula* returned empty-handed, but *E.8* and *E.19* shared in the sinkings of seven transports. By December, the Anglo-Russian submarine force had taken a toll of 14 German merchant ships, two cruisers and one torpedo boat. The enemy was also forced to beach two steamers, and three vessels were taken as war prizes. Although the numbers themselves were small in relation to Germany's total Baltic traffic, the portent of larger losses to come forced the Germans to transfer additional escorts from the North Sea. More important perhaps from the Russian point of view, the loss of and damage to some of their large warships prompted the Germans to withdraw the older battleships and armoured cruisers from Baltic operations.

At this point it is useful to consider the operational condition of the Brigade of Submarines of the Baltic Fleet, changes to its order of battle since August 1914, the pattern of operational submarine tactics, and the overall performance of the Baltic Fleet submarines so far.

The Baltic Fleet commenced wartime operations with an active inventory of 11, perhaps 12 submarines. They included the 1st Division with *Akula, Minoga, Makrel,* and *Okun,* the 2nd Division with *Alligator, Drakon, Kaiman,* and *Krokodil,* and a training division composed of three Holland-designed *Sterlyad* class boats: *Sterlyad, Byeluga,* and *Peskar.* The ex-*Simon Lake X,* renamed *Sig,* may also have begun her wartime career with this command before being transferred to the Far East.

Altogether six Baltic Fleet submarines were lost during the war due to hostilities (see Table 1 at the end of this chapter). The first loss involved the somewhat mysterious disappearance of *Akula* in November 1915. Some accounts reported that she had been sunk in the course of a gun duel with the German warship *Kaiserin* in the Bay of Danzig. According to these same reports, *Akula* had been engaged in an artillery bombardment of the city of Danzig. The official Soviet version of events is that she sank from causes unknown, but presumably from mines. The submarine's assigned mission at the time was to lay mines in the vicinity of Pappensee even though damage sustained in an earlier encounter had limited her operational condition to surface navigation only. Her disappearance prompted the suspension of further submarine minelaying operations.

Added to the fleet during 1915 were *Bars, Vyepr, Volk,* and *Gepard* so that, by the end of the year, the naval command could muster eight large and 13 small submarines. In addition, the British contribution had been raised to five. Further reinforcements were pending as the Russians had embarked on a crash building programme. Plans were completed in 1915 to build as many as 114 submarines by 1920. One order for the construction of a Holland-designed group of boats, known as the 'G-1' class, went to the Nobel-Lessner Yard. Characteristics were the following:

Displacement	960/1200 tons
Length	76.2 m (250 ft)
Beam	7.3 m (24 ft)
Draught	3.3 m (11 ft)
Speed	16/9 knots
Propulsion	2200/700 hp
Endurance	unknown (fuel capacity 60 tons)
Armament	8 internal and 4 external 533 mm (21-in) TT; 2 × 100 mm and 1 × 57 mm AA gun
Complement	approx 50

In addition, specifications called for installation of four 550-hp diesel engines for surface cruising and for driving the generators while submerged. Diving speed was to be less than one minute from a complete surfaced condition, and minimum underwater endurance was to be 100 nautical miles at five knots.

In addition to the Holland types, the Baltic Works in Petrograd (formerly St Petersburg, renamed in Autumn 1914) was contracted to build a series of Bubnov-designed submarines, known as the 'B-1' class, that were virtually identical to the G-1 design. Neither group was completed, however, and no reliable figures are available on the numbers involved in either the B-1 or the G-1 order. One source cites a minimum of ten *G-1s*, while a report issued by the US Navy's Office of Intelligence (ONI), in January 1919, mentions that enough material remained at Revel (Tallinn) for the construction of 15 submarines.

The principal role of the Baltic Fleet submarines during the first year of the war was twofold: reconnaissance and early warning of enemy surface forces approaching the central mine-artillery barrier in the Gulf of Finland, and the screening of mine-laying vessels against enemy surface attack. The older and smaller submarines, if not tied up for frequent repairs, normally patrolled the flanks of the mine barrage, while the larger units would usually take up patrol stations ahead of the field. As had already been noted, offensive submarine operations against Germany's sea routes did not become a serious preoccupation until the Autumn of 1915, and it was only then that submarine commanders were authorised to destroy enemy shipping without examining cargo first, and detain neutral vessels if found to carry contraband. Even so, the campaign was never pressed with the kind of single-minded determination that marked the German or, for that matter, British efforts. Not enough submarines were assigned, and fear of complications with Sweden usually deterred the Russians from interfering with German shipping making passage inside that country's territorial waters.

During 1915, one attempt was made to employ Baltic Fleet submarines to lay mines. Three boats, *Akula*, *Vyepr* and *Bars*, were fitted with hull-mounted mine racks for manual delivery of the weapons into the water. There is no record if any of the trio attained any degree of success; as noted previously, *Akula* may have been lost on this particular mission. In any case, no further attempts were apparently made during the war to use submarines for this purpose in the Baltic.

Except on rare occasions, submarines operated independently, usually inside strictly circumscribed patrol quadrants. While awaiting the approach of a hostile ship, the submarine would be in an awash condition so as to present the smallest possible profile while still maintaining a clear view through 360 degrees of the horizon. If the detected vessel was a warship, the submarine would submerge and attack with torpedoes fired in salvoes of two to four. Gunfire was preferred against merchant vessels, but if a submerged attack was made, usually not more than a single torpedo was expended. The record of Russian submarine torpedo attacks was disappointing: out of a total of 50 torpedoes fired by submarines in 1915 not a single one found its target. Most of the 15 German freighters sunk by Baltic Fleet submarines during the year was the work of gunfire and demolition charges placed by boarding parties. Blamed besides 'the complexity of the situation' can be a combination of material, training and tactical inadequecies.

A broader reason for the limited impact of the campaign against enemy shipping was the submarines' low operational tempo, due, in good part, to the near-constant need for repair of the many obsolete boats. For example, when the first British submarines arrived in the Baltic, they reportedly found every one of the Russian submarines immobilised by engine trouble. The structures developed leaks, and the absorption of water destroyed the vessels' buoyancy. The petrol engines were not only a constant source of mechanical difficulties, but since their operation relied on the boats' limited oxygen supply, the crews were endangered by suffocation. The overall result of these and similar setbacks was that the large Baltic Fleet

submarines went on patrol for an average of a mere five or six days per month; the smaller boats spent even less time at sea. The German U-boats, by contrast, were able to deploy for up to four weeks at a time.

Operations of the Baltic Fleet, 1916–1917

No major naval actions took place in the Baltic theatre in 1916 until the end of the year while German military attention was concentrated on the Western Front, at Verdun, and on the two new theatres of hostilities that were created with the entry of Italy and Bulgaria into the war. Germany's first – and only – naval offensive in the Baltic during 1916 began in November; the outcome for the German side was a disaster. On the tenth day of November, the German naval command sent its 10th Mine Flotilla into the Gulf of Finland with the objective of destroying any Russian ship encountered and shelling the coastal ports. Eleven destroyers, protected by the light cruiser *Strassburg*, entered the Gulf; two destroyers promptly struck mines and were lost. A third destoyer picked up the crews and turned home. The others continued on their course and, after some ineffectual shelling of coastal targets, prepared to return to base. Five more combatants sunk in a minefield before the decimated flotilla arrived back in port.

Baltic Fleet activities during the year were limited also, and were mainly preoccupied with strengthening the defensive positions in the Gulfs of Riga, Bothnia and Finland. By the close of 1916, 25,000 Russian mines had been laid in these waters since the beginning of the war.

Ten, perhaps 11 new submarines joined the Baltic Fleet during the year: *Volk*, *Lvitsa*, *Pantera*, *Ryss* and *Tigr*, plus five or six 360-ton Holland types that were part of an order of 18 placed with the Electric Boat Company in the USA early in the war. Generally known as the 'H' class, the submarines received the Russian designation 'AG' for 'Amerikanski Golland'. *AG-11* through *AG-15* (plus possibly *AG-16*) arrived in their operational area via a circuitous route. Hull sections, machinery and other equipment were manufactured in the United States by the Bethlehem Steel Corporation with the Electric Boat Company acting as subcontractor. Because of America's neutrality laws, the subassemblies were sent by rail (along with an American workforce) to Montreal in Canada for final assembly at the Canadian Vickers yard. The latter was a wholly owned subsidiary of the giant British munitions concern, Vickers Ltd. The latter also held a 25-year patent on the Holland designs and was a part owner in the Electric Boat Company. After the submarines were completed at Canadian Vickers, they were again disassembled for railroad transport across the North American continent. Next, they were sent by ship to Vladivostok, whence they would again be placed on railroad cars to arrive at their destination for reassembly.

A second batch of six 'AGs' was sent to the Black Sea Fleet in a similar fashion, but only two had been reassembled before the Bolshevik Revolution. This event also prompted the US Government to embargo the balance of the order. They were purchased by the US Navy as *H-4* through *H-9*.

As noted, there is some uncertainty whether the first 'AG' shipment counted five or six, and if the latter is the case, what became of *AG-16*. A submarine with hull number *AG-16* was commissioned into the Finnish Navy in 1918. But it is not clear whether she was the 'missing' sixth unit in the group, or, in fact, a renumbering of the original *AG-13*.

The arrival of the new submarines occasioned minor changes in the administrative control of the Baltic Fleet submarine brigade. *Bars*, *Vyepr*, *Gepard*, *Yedinorog* and *Zemlya* were included into the 1st Division, *Lvitsa*, *Pantera* and *Yaguar* into the 2nd Division, and the older submarines henceforth reported to the new 5th and 6th Divisions. Submarines still under construction would be assigned to the 3rd and 4th Divisions.

Even as the submarines of the Baltic Fleet continued to produce negligible results against

enemy shipping, future building plans insisted on the grandiose in place of the practical. Construction began in late 1916 of two 2200-ton 'cruiser submarines', one at Reval, the other at Petrograd. The planned characteristics of the two craft – neither of which was ever finished – were the following:

Displacement	2200/3000 tons
Length	100 m (328 ft)
Beam	9.4 m (31 ft)
Draught	3.9 m (13 ft)
Speed	20/10 knots
Propulsion	4000/1600 hp
Armament	13 internal and 6 external TT (size unknown); 4 × 100 mm guns and 2 × 57 mm AA guns.

Submersion from an awash condition was to be accomplished in 15–20 seconds, and in one minute from a fully surfaced condition. Triple bottoms and watertight compartmentation were designed to limit the intake of water in case of a mine explosion. With a fuel capacity of 300 tons, cruising radius was estimated at 12,000 nautical miles. How and under what scenario these two vessels were expected to see action remains a mystery.

The fleet meanwhile went about its tasks with the materiel on hand. Since there were no firm indications, in the early part of 1916, that the enemy planned major operations against the Gulfs of Finland and Riga, the scope of submarine activities against the German sea routes could be expanded. The operational plan for the 1916 campaign instructed the Baltic Fleet, 'to attempt to destroy any weaker unit of the enemy fleet and *all* his merchant ships'.

After preliminary reconnoiterings with the objective of pinpointing the principal areas of concentration of enemy vessels, the first patrol aimed at the systematic interdiction of the enemy's commerce was launched on 25 May. *Bars* and *Gepard* were deployed in the region of the Swedish coast and Gotland Island, and the British *E.1*, *E.8* and *E.18* were sent off Libau to attack enemy troop shipping. The mission as a whole was a failure. Not a single German ship was sunk although *E.18* managed to blow the bow off a destroyer before she herself vanished the day after.

The next major submarine mission teamed *E.9*, *E.19*, *Vyepr* and *Volk* with a cruiser-destroyer detachment for the purpose of intercepting a German iron ore convoy heading south from Stockholm. Again, the results were nil. The submarines were tasked to protect the flanks of the surface force against the possible appearance of enemy reinforcements, but when the convoy was sighted the Russian destroyers charged ahead to engage their opponents while permitting the intended quarry to escape into Swedish territorial waters. On balance, the best that can be said for the Russian campaign against Germany's sea lines of communications is that it forced the opponent to take additional protective measures; it contributed all but nothing to Germany's supply problems.

The winter of 1916–1917 was a particularly severe one. Ice covered not only the Gulfs of Finland and Riga, but also extended along the eastern Baltic shore, well into the southern portion of this body of water. As a result, naval operations in the area did not commence until late May. By that time, the centre of attention had shifted to Russia's internal situation.

Widespread disorders broke out in Petrograd in February 1917; rioting strikers were joined by Army units sent in to quell the unrest. On 11 March, the Tsar ordered the Duma dissolved, but the representatives defied the command, and remained in informal session to elect a 'Provisional Committee' with the task of restoring order. On the same date another informal body of authority came into existence: the Petrograd Soviet of Workers' and Soldiers' Deputies. Two days later, Tsar Nikolai II abdicated in favour of his brother Grand Duke Mikhail. Mikhail refused to take over the reigns of power, and constitutional authority devolved to a Provisional government led by Aleksander F. Kerensky.

The Provisional government assured the Allies that Russia would stay true to its commitments and not sign a separate peace with the Central Powers. Changes were instituted in the military High Command, and Kerensky toured the troops in the field trying to instill a renewed faith in the righteousness of their cause. On 8 November and after another failed Russian offensive, Lenin and his Bolshevik Party seized power.

Little remains to be said about the course of Russian naval activities in the Baltic Sea. The 1917 campaign opened in June with the laying of additional minefields, but the outcome of events was being determined on land. On 1 September the German Army took Riga; by 6 October, Russian units were forced to evacuate the Gulf of Riga and surrender Moon (Mulm) Island that controlled passage into and out of the Gulf. On 28 November the Germans agreed to the Bolshevik proposal to negotiate an armistice, and on 15 December 1917 a ceasefire agreement came into force.

The final wartime Russian submarine acquisition was the 250-ton Italian-built *Sviatoi Georg*. Ordered in 1915 and constructed by the Fiat-owned concern of Ansaldo-San Giorgio in La Spezia, she arrived in Arklangelsk in September 1917. The submarine remained in the White Sea through the period of Allied intervention and later became the Soviet *Kommunist*.

Operations of the Black Sea Fleet, 1914–1915

War came to the Black Sea Fleet on 29 October 1914. A Turkish torpedo boat raid surprised the harbour of Odessa, while the German battlecruiser *Goeben*, nominally recommissioned into the Turkish Navy, shelled Sevastopol to damage or sink a number of Russian warships caught unawares of the outbreak of hostilities. Turkish naval forces next laid a minefield off Sevastopol and bombarded the town of Feodoisya.

Russian preparations for a naval campaign in the Black Sea proceeded from the primary objective of guaranteeing the security of the coastline by seizing and maintaining control of the Black Sea against the most likely opponent, Turkey, and its possible allies. The planned operational and material means to implement this purpose resembled those employed in the Baltic theatre. It had been decided that control of the Black Sea could best be gained by denying the Turkish Navy access through the Bosporus. The plan therefore was to block the northern exit of the Strait through the creation of a strong mine barrier backed by surface forces and submarines. If the enemy were to force his way through nevertheless, the Black Sea Fleet was to fall back and prevent him from penetrating into the northwestern part of the Black Sea and Sea of Azov.

The main problem with this strategy – aside from its overly defensive orientation – was that it underestimated the enemy's ability to clear the Bosporus minefields while overestimating the effectiveness of occasional mine plantings. As it turned out moreover, the second half of the blockading strategy would only be partially implemented. Maintaining a standing cruiser patrol near the centre of the enemy's military strength and away from Russia's main naval bases was found too risky a venture; the exit from the Bosporus would be guarded by submarines only instead.

The initial Russian response to the Turko-German surprise attack was to bar the entrances to the Black Sea's main ports with extensive minefields. This completed, four destroyers with the support of a potent force of battleships and cruisers set out on 4 November to mine the western end of the Bosporus. The next day, the same group of ships shelled Zonguldak on the Turkish coast, sinking three transports in the process. One Soviet historian has reported that 100 000 uniforms were destroyed along with one of the vessels.

The focus of military operations in the Black Sea theatre in late 1914 and 1915 was the Caucasian Front. Since the Turkish side relied heavily on seaborne supplies and reinforcements the interdiction of the same became a Russian objective of the greatest

importance. On 15 November virtually the entire Black Sea surface fleet, including five battleships, four cruisers and 13 destroyers, bombarded the main Turkish supply port of Trabzon on the Anatolian coast. Similar raids, although on a smaller scale, constituted the main business of the fleet through the first half of 1915. In fact, the first few months of the war fairly well set the pattern for the next three years of naval hostilities: defensive and offensive mining, interspersed by occasional clashes on the surface and the bombarding of coastal supply points.

Both sides received reinforcements by the middle of 1915. The Germans dispatched a number of small U-boats, and on the Russian side, the Black Sea Fleet was strengthened with two battleships in addition to nine submarines. Delivered from the Far East were the two *Kasatka* class boats *Skat* and *Nalim*, and two *Sterlyad* class submarines, *Shchuka* and *Som*. All four of this first generation of small boats proved to be all but useless for the – relatively – long-range deployments that the Black Sea command had in mind for them. Once an effort was made to tow them to the sea area off Zonguldak on the Turkish coast, but when this turned into a failure *Shchuka* and *Som* were loaded back onto flatcars and sent on to the Baltic Fleet. The others were henceforth kept near the Crimean coast.

Newly-commissioned in 1915 were the 630-ton *Kit*, *Narval*, *Tyulen* and *Morzh*, and the mine-layer *Krab*. The Soviet naval historian, N B Pavlovich has reported that ten *Leopard* class submarines entered the Black Sea Fleet as well during 1915. However, he makes no mention of any of the hull names involved; in fact, no *Leopard* class submarines are cited by name at all in his account of naval hostilities in the Black Sea. A further complication to Pavlovich's claim is that all other sources report the completion of only six *Leopard* class submarines at Nikolayev and that those six only saw service in the Black Sea.

The augmentation of the Black Sea submarine flotilla permitted the extension of offensive mining and anti-shipping operations into the Turkish Straits. No attempt to blockade the Bosporus with mines had been undertaken during the first few months of 1915 while the Russians awaited a more favourable balance of power in the area. The principal deterrent to more aggressive action in this regard was the presence of the German *Goeben*.

Submarine patrols near the Bosporus started in early March. The initial patrol schedule usually alternated *Nerpa* and *Tyulen*, but it was common later on for the two submarines to operate simultaneously, one to eastward, one to westward of the Bosporus.

The submarines were ordered to 'sink anything going in or coming out', but success did not come until the end of June; *Tyulen* sank a three-masted Turkish bark with gunfire, and *Morzh* destroyed a small steamer.

One reason for these mediocre returns was the prevailing method of patrol. The Black Sea Fleet submarines, in common with their counterparts with Baltic Fleet, usually operated in static, pre-assigned patrol positions or in extremely confined patrol *zones*. This meant that the probability of encountering an enemy vessel depended almost entirely on the movement of the opponent. Some writers have faulted the scarcity of enemy shipping, but that argument can equally well strengthen the case *against* the positional method of patrol. After all, it would only take for the first enemy vessel to chance an encounter with a submarine for it to raise the alarm and have all other shipping rerouted. Also, the fact that the Russian naval command was able to muster only two submarines to patrol the one body of water that prewar planning had agreed was critical to the control of the Black Sea as a whole is a fair indication of the fleet's operational condition.

One example of the poor mechanical state of the Black Sea submarine flotilla came in July 1915 on the occasion of the maiden voyage of the new battleship *Imperatritsa Maryia* from the Nikolayev Yard to Sevastopol. Fearing a German attack, every available submarine in the Black Sea was tasked to blockade the Bosporus for the duration of the big ship's passage. The flotilla included four submarines: *Nerpa*, *Tyulen*, *Morzh* and *Krab*. *Krab* was assigned the key role of mining the neck of the Bosporus; *Nerpa* was to take up a position east of the Strait,

and *Tyulen* was to keep station westward of the Bosporus. *Morzh*'s duty was twofold: first, she had to take *Krab* in tow because her engines were malfunctioning and after *Krab* had planted her mines, *Morzh* was to position herself directly astride the Bosporus. The mission itself was a success. *Krab* laid 58 to 64 mines. *Imperatritsa Mariya* was able to complete her voyage, unscathed and, as a bonus, one of *Krab*'s mines damaged the German cruiser *Breslau* seriously enough to require several months of repairs.

The enemy had meanwhile expanded its submarine operations also. Additional U-boats entered the Black Sea throughout the year, and matters became particularly grave for the Russians in October 1915, when Bulgaria's entry into the war gave the Germans direct access to the Black Sea. Fearing the escalated threat of submarine attack, the Russians became increasingly reluctant to operate their heavy surface units away from their home ports. As a corollary, smaller combatants, particularly destroyers, that could otherwise have been employed for offensive operations, now had to be progressively committed to the protection of merchant shipping.

Operations of the Black Sea Fleet, 1916–1917

The transport of troops, amphibious landings and fire support on behalf of the Russian Army's offensive against Turkish Anatolia were the principal responsibilities of the Black Sea Fleet in 1916. It was in addition forced to assume responsibility for the defence of Romania's coast after this country had joined the ranks of the Allied powers. Russian battleships, screened by the old submarines *Karp* and *Karas*, were sent to protect the harbour of Konstanza. Within two months however, the Russo-Romanian front collapsed, forcing Black Sea Fleet units to hurriedly evacuate the port city on 22 October.

The bulk of submarine activities during 1916 took place off the Turkish coast as part of the Russian naval blockade of the so-called Ugol'nyi region. In daytime, the boats – usually two – would patrol their assigned areas on the surface but dive for a submerged approach as soon as an enemy vessel was sighted. At night, the submarines remained on the surface to recharge their batteries.

One operational innovation at this time was the use of radio for two-way communcation between submarines and patrolling surface craft on the location of enemy shipping. A different form of co-operation was used to improve the accurate positioning of minefields. Having watched the comings and goings of enemy seagoing traffic, the observing submarine would float buoys along the most frequented routes, and position herself nearby at night to show screened lights to aid the work of the minelayers.

In the second half of 1916, an average of seven submarines was ready for sea duty. Hull names were: *Nerpa, Tyulen, Morzh, Kit, Krab, Kashalot* and *Narval*. Patrols lasted from five to 12 days as the seven submarines altogether logged 54 'long-range' cruises off the Turkish coast. The overall results were minor; the bulk of enemy shipping destroyed or captured were small sailing transports (although it must be added in fairness that the majority of Turkish coastal shipping happened to be of this type). At the same time, the most critical entry point for the enemy's supplies and reinforcements into the Black Sea, the Bosporus, continued to be guarded with inadequate forces, and was mined only intermittently.

An effort was begun in July and August 1916 to remedy this situation. *Krab* and a flotilla of torpedo boats, aided by buoys laid by *Nerpa*, planted 820 mines in the approaches to the Bosporus. In an ironic reversal of roles, the battleship *Imperatritsa Mariya* went along to *escort* the small craft. The minelaying campaign continued through December, but although the fields were a considerable nuisance to enemy shipping, the Strait was never blocked in its entirety. Coastal shipping continued to ply its waters, and the Russian minelaying expeditions could not outpace the opponent's clearing activities. Making matters worse for

the Russians was an easterly storm in late September which freed many of the mines to become a danger to Russia's own shipping.

The Black Sea Fleet's operational directives for 1917 remained unchanged. As before, the Navy's task was to maintain control of the sea, blockade the Bosporus to the extent possible, attack enemy shipping and support the land forces on the Caucasian and Romanian fronts. New additions to the fleet included the submarines *Burevestnik*, *Gagara* and *Utka*. Russia's numerical lead over the opposition was widened as the result, but material scarcities and spreading unrest among personnel seriously degraded effective strength. From 28 December 1916 to 27 October 1917, the Black Sea submarine fleet carried out altogether 29 offensive patrols, and managed to sink 91 enemy vessels.

Death of the Imperial Russian Submarine Fleet

Between November 1917 and 1920 the Imperial Russian Navy, including its submarine flotillas ceased to exist, literally and figuratively. The first few years of the Bolshevik regime were a period of utter military and political chaos. To begin with, the Treaty of Brest-Litovsk had carved part of Russia into a number of nominally independent but factually German-controlled republics. A feeble attempt by the Soviets' rag-tag military forces to overthrow the Ukranian Republic was quickly dismissed under the weight of a renewed German offensive with the result that, by mid-April 1918, German troops had become firmly established deep inside Russia. On 3 April the commander of the British submarine flotilla at Helsingfors, Finland was given the order to scuttle his seven craft to prevent their capture by the Germans. A notice in *The Times* of London reported that the Russians followed suit and blew up 'their four US submarines' along with several hundred mines and torpedo warheads. The units in question presumably were *AG-11*, *AG-12*, *AG-13* plus one unknown submarine. Scuttled one month earlier at Reval had been *Yedinorog*, but at least six other submarines (*Alligator*, *Drakon*, *Krokodil*, *Kaiman*, *Shchuka* and *Byeluga*) were seized by the Germans.

The initial fate of the Black Sea submarine flotilla after the cessation of hostilities is less clear. When German forces stood poised to occupy Sevastopol in April 1918, reports received by ONI warned that the 'six modern Russian submarines' (ie the *Leopard* class boats) would be transferred by the Germans to Constantinople. A later intelligence report confirmed that the entire Black Sea submarine fleet of up to 16 boats had passed into German control. It also conveyed the news that part of the German-claimed war booty at Nikolayev included two nearly-completed submarines plus 'the parts for six more, in packing cases'. The latter undoubtedly were hull numbers *AG-21* through *-26* shipped the year before by the Electric Boat Company. Yet, there is no evidence that any of the Black Sea Fleet submarines (or those with the Baltic Fleet for that matter) ever sailed under the German flag.

The ink on the paper of the Russo-German peace treaty had barely dried when Russia's former allies began landing troops at different strategic points around the Russian periphery. The reasons for the Allied intervention were manifold and varied from one partner to the other. The ostensible purpose was to keep large quantities of Western-supplied war material from falling into German hands and to prevent a German partition of the former Russian empire. This second motivation became readily translated into active support for whichever anti-Bolshevik faction appeared prepared to keep Russia in the war. An Allied favourite in this regard was the White Russian Army led by the former commander of the Black Sea Fleet, Admiral Kolchak. French and Greek forces were disembarked from British warships at Odessa. Japanese and US troops landed at Vladivostok, and additional American units arrived at Arkhangelsk. After a period of considerable military success, the uncoordinated anti-Bolshevik forces disintegrated under the blows of the newly-organised Red Army. The Civil War formally came to an end in 1921.

It is impossible to completely reconstruct the fate of the Russian Fleet during the years of Allied intervention and Civil War. Available Soviet and Western accounts of this episode are overwhelmingly preoccupied with events on land. The following brief account of the Russian underwater forces in the years immediately after the First World War does not overcome this limitation. Derived mainly from contemporary intelligence documents, it nevertheless fills part of the vacuum of information that links the histories of the Imperial Russian and modern Soviet submarine fleets.

A report received by ONI, on 31 March 1918, shortly before the German seizure of Hango, Finland, listed the following Baltic submarine order of battle:

Helsingfors (Helsinki)	:	1st, 2nd and 3rd Divisions of submarines and the British submarine flotilla.
Hango	:	three submarines plus a support vessel.
Reval (Tallinn)	:	two large and four small submarines.

None of the vessels was identified by name, but it is certain that included were *Alligator, Drakon, Kaiman* and *Krokodil* at Reval, and *AG-11, AG-12, AG-13* at Hango. The smaller submarines at Reval probably were *Shchuka* and *Byeluga*. Also, based on information in later intelligence reports, it can reasonably be ascertained that the 1st and 2nd Divisions included *Vyepr, Volk* and *Yaguar*, and *Tigr, Pantera* and *Ryss*, respectively.

A more comprehensive report on the status of the Baltic Fleet became available in early January, 1919. Commenting that, 'No submarine is believed to be seaworthy', ONI listed 25 hull names by class:

Yedinorog class	*Zmeya, Yaz* and *Forel*
Volk class	*Volk* and *Vyepr*
Tigr class	*Kuguar, Leopard, Pantera, Ryss, Tigr, Tur* and *Yaguar*
'Lake' class	*Krokodil, Alligator, Drakon, Kaiman* and *Minoga*
'Holland' class	*Sterlyad, Byeluga, Shchuka* and *Peskar*
'Bubnov' class	*Kasatka, Feldmarshal Graf Sheremetyev, Okun* and *Makrel*

ONI also estimated that one minelaying submarine remained under construction at Petrograd, and that enough material was probably ready at Reval (Tallinn) for another 15 submarines. As has already been remarked, the reference to the 15 unfinished boats may be connected with the Bubnov-designed 'B-1' group ordered during the war. Also involved may have been a number of otherwise unspecified 235-ton minelaying submarines. One ONI study of a much later date has speculated that the early generations of Soviet-built submarines may have been derived from these two groups.

Numerically, the Baltic Fleet submarine flotilla was still a potent force. In actuality, few, if any, vessels were capable of even the most ordinary peacetime exercises, let alone wartime duty. Those that were seaworthy at all were tied up for lack of fuel, crews and a virtually non-existent command structure. The fleet's large warships had their weapons removed for use in the Civil War, and many of the smaller vessels, including the submarines *Kasatka, Makrel, Okun, Feldmarshal Graf Sheremetyev* (renamed *Ugor* after the loss of the *Leopard* class submarine of the same name off Tallinn in February 1918), went inland to the Volga river via the canal system. A report received by ONI from Finland, in April 1919, had this to say about the condition of the Baltic Fleet:

> 'It may be considered that the active fleet is practically non-mobile . . . The morale of the navy is on par with its equipment and efficiency. Discipline has been done away with and as a fighting unit, the navy may be considered as having ceased to exist.'

Another message in the same month estimated that sufficient fuel was left for only four submarines, while a growing number of submarines was listed as 'under repair' – a

euphemism for *dis*-repair, inadequate spare parts, fuel, and trained officers and crew. Evaluated as 'put aside for an indefinite period' of repairs were, in March 1919, nine *Leopard* class submarines, practically the entire modern Baltic submarine flotilla. Submarine training had ceased and exercises had become a thing of the past.

The events that led to the disintegration of the submarine command in the Black Sea were different, but the results was much the same. After the Germans had departed, the majority of naval forces fell under the control of General Wrangel's White Army. The 'White' submarine flotilla, watched over by British and French warships, remained tied up in their Black Sea ports until the Bolshevik seizure of the Crimea in 1920. Three submarines, *Burevestnik*, *Tyulen* and *Utka*, escaped in November in company with the evacuating Anglo-French fleet, and were interned in Bizerta in French Tunisia. Most of those left behind were scuttled off Sevastopol; some were salvaged later on, and recommissioned into the Soviet Navy. The Imperial Black Sea Fleet, along with its counterpart to the north had ceased to exist.

Principal sources

A vast body of literature exists on the naval, including submarine aspect of the First World War. The bulk by far is concerned with events in the main, Atlantic and North Sea theatres, with scant attention paid to the 'backwaters' of the Baltic and Black Seas. There are a few German official and unofficial accounts, but they offer little insight into the progress of the naval war through Russian eyes. The critical source in this regard is Volume I of Professor N B Pavlovich's *The Fleet in the First World War*. The original Russian-language edition was published in 1964. An English translation, sold by an obscure publishing house in New Delhi, India, became available in 1979. It along with the 'Attaché Records' held at the National Archives in Washington, DC, have provided the principal source material for this chapter.

Table 1: Fate of the Imperial Russian Submarine Fleet

Submarine	Fate
AG-11	Scuttled off Hango, 1918
AG-12	As above
AG-13	As above
AG-14	War loss, July 1917, off Libau. Cause unknown, presumably mines.
AG-15	Scuttled off Hango, 1918
AG-16	Later in Finnish Navy
AG-21	Scuttled off Sevastopol, 1919. Raised and repaired in 1928, and renamed *Metallist*/*A-5*
AG-22	Interned in Bizerta, 1920
AG-23	Completed in 1920 as *Trotski*, later *Shakhtyor*, *A-4*
AG-24	Completed in 1920–21 as *Lunachharski*, later *Kommunist*, *A-1*
AG-25	Completed about 1922 as *Kamenyev*, later *Marksist*, *A-2*
AG-26	Completed about 1922 as *Politrabotnik*, later *A-3*
Akula (Shark)	War loss, Bay of Danzig, November 1915
Alligator	Captured by the Germans at Reval (Tallinn), 1918
Burs (Snow leopard)	War loss, Baltic Sea, May 1917
Burevestnik (Storm petrel)	Interned in Bizerta 1920
Byeluga (White sturgeon)	Captured by the Germans at Reval (Tallinn), 1918
Bytchok (Steer)	Fate unknown; probably destroyed or scrapped at Vladivostok in connection with Allied intervention 1919–21
Drakon (Dragon)	Captured by the Germans at Reval (Tallinn) 1918

Table 1 – Continued

Submarine	Fate
Feldmarshal Graf Sheremetyev	Fate unknown; reported at Reval (Tallinn) in January 1919
Forel (Trout)	Sunk by British destroyers in Gulf of Finland 1919
Gagara (Loon)	Scuttled off Sevastopol 1919
Gepard	War loss, Baltic Sea October 1917
Kaiman (Cayman)	Captured by the Germans at Reval (Tallinn), 1918
Karas (Crucian carp)	Stricken during First World War
Karp (Carp)	Scuttled off Sevastopol 1919
Kasatka (Swallow)	Fate unknown; reported on Volga river 1919
Kashalot (Sperm whale)	Scuttled off Sevastopol 1919
Kefal (Grey mullet)	Fate unknown; probably destroyed or scrapped at Vladivostok in connection with Allied intervention 1919–21
Kit (Whale)	Scuttled off Sevastopol 1919
Krokodil	Captured by the Germans at Reval (Tallinn) 1918
Krab	Scuttled off Sevastopol 1919
Kuguar (Cougar)	Renamed *Bednyak/B-1*
Lyebed (Swan)	Scuttled off Sevastopol 1919
Leopard	Renamed *Krasnoarmeyetz/B-4*
Losos (Salmon)	Scuttled off Sevastopol 1919
Lvitsa (Lioness)	War loss, Baltic Sea June 1917
Makrel (Mackerel)	Fate unknown; last report in March 1919 as part of the Astrakhan-Caspian River Flotilla
Minoga (Lamprey)	As above
Morzh (Walrus)	War loss May 1917
Nalim (Burbot)	Scuttled off Sevastopol 1919
Nerpa (Seal)	Renamed *Politruk*
Okun (Perch)	Fate unknown; last reported in March 1919 as part of the Astrakhan-Caspian River Flotilla
Pantera	Renamed *Kommissar/B-2*
Pelikan	Scuttled off Sevastopol 1919
Paltus (Halibut)	Fate unknown; probably destroyed or scrapped at Vladivostok in connection with Allied intervention 1919–21
Plotva (Roach)	As above
Peskar (Gudgeon)	Captured by the Germans at Reval (Tallinn), 1918
Ryss (Lynx)	Renamed *Bolshevik/B-7*
Shchuka (Pike)	Captured by the Germans at Reval (Tallinn) 1918
Skat (Skate)	Scuttled off Sevastopol 1919
Som (Catfish)	War loss; rammed and sunk by a steamship in the Baltic Sea, May 1916
Sterlyad (Sterlet)	Captured by the Germans at Reval (Tallinn) 1918
Sudak (Pike)	Scuttled off Sevastopol 1919
Sviatoi Georg	Renamed *Kommunist*
Tyulen (Seal)	Interned in Bizerta 1920
Tigr (Tiger)	Renamed *Kommunar/B-6*
Tur (Aurochs)	Renamed *Tovarishch/B-3*
Ugor (Conger eel)	Fate unknown; reported in March 1919 as 'under repair' in Baltic area
Utka (Duck)	Interned in Bizerta 1920
Volk (Wolf)	Renamed *Batrak/B-1*
Vyepr (Wild boar)	Fate unknown
Yaguar	Renamed *Krasnoflotyetz/B-10*
Yaz (Ide)	Fate unknown

Table 1 – Continued

Submarine	Fate
Yedinorog (Unicorn fish)	Scuttled at Reval (Tallinn) 1918
Yorsh (Ruff)	Renamed *Rabochy/B-9*
Zmeya (Snake)	Renamed *Proletary/B-11*

3 The interwar years

The growth of the Soviet submarine forces during the 20-year period that separated the final months of the Civil War from the German invasion in 1941 can conveniently be divided into three main phases. The first phase of *reconstruction and rehabilitation* began in 1921 with the decision of the Tenth Party Congress to rebuild the Workers' and Peasants' Red Navy (RKKF), and lasted until the completion of the First Five-Year plan in 1932. During this time, the heart of the Navy's submarine strength were the remnants of the Imperial Fleet, supplemented by a few newly-constructed craft designed during the war years.

The second phase was one of *modernisation and expansion*, and coincided with the Second Five Year Plan which ran from 1 January 1933 until 1 April 1937. At the end of this period, the Soviet economy had gathered enough strength to generate a naval budget large enough to underwrite construction of the most numerous submarine fleet in the world.

The third phase came to an end with the opening shots of the Second World War, and can perhaps best be labelled as the 'Big Navy' era in Soviet pre-war naval doctrine and construction. Doctrinal changes that had already germinated in the final years of the second phase came to full flower as the flotilla strategy of active coastal defence gave way to a much greater traditional emphasis on a fleet suitable for forward and offensive operations on the high seas. Procurement decisions reflected this tilt as the keels were laid for battleships, battlecruisers and cruisers, and plans came afoot to build the first aircraft carriers. On the submarine side, the construction of small and medium-size boats for coastal defence shifted to progressively larger and ocean-going vessels, culminating in the 'K' class cruiser-submarine of nearly 1500 tons.

Phase I: Reconstruction and rehabilitation

Little was left, in 1921, of the navy that had fought the First World War. Dockyards and port facilities were a shambles; ships that had not been scuttled by the White forces or the evacuating Allies were in desperate need of overhaul and repairs; fuel, ammunition and spare parts were lacking, and political agitation interfered with the efforts of crews to man and run their ships. On top of all this, the fleet had lost its forward bases in the Baltic Sea with the creation of the independent states of Finland, Lithuania, Latvia and Estonia. Gone as a result were Libau, Vindau, Riga, Reval and Helsingfors (Helsinki).

With the defeat of Turkey, no potential enemy of consequence faced the Soviet Union in the Black Sea. Quite the opposite was the case to the north. Poland remained implacably hostile after its short and initially successful invasion of the Ukraine in 1920; Finland was staunchly anti-Bolshevik, and although the German Navy had been decimated under the Treaty of Versailles, its post-war concentration in the Baltic Sea made it the most efficient naval force in the area.

The main threat from the sea however, was believed to lie with Great Britain. With memories still fresh of the Royal Navy's intervention, sharpened by a surprise British torpedo-boat raid against Kronshtadt harbour in June 1919, no Soviet politician or naval leader could close his eyes to the possibility of a renewed British attempt to overthrow the fledgling regime by military force. Given this assessment of the threat, it is no surprise that the Tenth Party Congress of 1921 readily adopted the recommendation to place priority on 'repair, outfit and provide regularly with fuel the most important units of the Baltic Fleet'. New construction was out of the question for the time being pending the restoration of the

country's shipbuilding infrastructure and, more important, the availability of funding. It was decided instead to salvage, rehabilitate and, when affordable, modernise the remaining ships of the Tsarist fleet.

The *material* strength of the Baltic submarine forces at this time stood at 20. In reality, only nine of these, all members of the *Leopard* class, could be considered effective. All nine were renamed to properly symbolise Russia's new revolutionary spirit. Now known as the 'Bolshevik' class, they included:

Tsarist name	**Soviet name**
Volk	*Batrak* (Farm labourer)
Pantera	*Kommissar*
Tur	*Tovarishch*
Leopard	*Krasnoarmeyetz* (Red Army trooper)
Zmeya	*Proletary*
Tigr	*Kommunar*
Ryss	*Bolshevik*
Yorsh	*Rabochy* (Worker)
Yaguar	*Krasnoflotyetz* (Red Navy sailor)
Kuguar	*Bednyak* (Poor peasant)

All would be later be re-numbered *B.1* through *B.9*, plus *B.25* (ex-*Kuguar*). Submarines still under construction at the former Imperial yards in Leningrad (formerly Petrograd/St Petersburg) were never completed. Among them were four minelayimg boats, known only as *Z.1* through *Z.4*.

The condition of the Black Sea submarines was even worse. After the Allied withdrawal, the Bolsheviks were left with a single submarine, *Nerpa*, renamed *Politruk*. By 1923, *Politruk* was joined by four of the American-built 'AG' group of submarines shipped during the war but left unassembled. Completed were *Trotski* (ex-*AG.23*), *Lunacharski* (ex-*AG.24*), *Kamenyev* (ex-*AG.25*) and *Politrabotnik* (ex-*AG.26*). The group as a whole later became known as the *Metallist* class following the renaming of the raised and repaired *AG.21* in 1928. More name changes would come with the shifting political fortunes of the Bolshevik 'old guard' under Stalin's rule.

The Soviet leadership was well aware that, come war, their meagre and ill-equipped fleet could do little but perhaps fight a holding action. The naval strategy that evolved in the 1920s was designed to precisely do that – to interfere with and delay an enemy seaborne attack long enough for the Red Army to be mobilised and be rushed to the threatened landing area. The strategy's material ingredients were coastal fortifications, old battleships used as floating batteries, destroyers and small attack craft, and of course, the submarines. Operationally and administratively, defensive plans were elaborated in accordance with the Leninist concept of the unity of military command. This meant that all naval forces were to co-ordinate their operations with the forces on land in line with a single plan of action. Conversely, coastal army units were to orchestrate their plans with those of fleet. The practical implication of this unified command principle was that the navy became effectively subordinated to the decisions of the army leadership.

Using the navy as a 'fortress fleet' to defend the immediate approaches to the Soviet Union's strategically most sensitive coastlines was probably the only strategy that the Soviet economy could realistically afford. The choice did not come without opposition and debate, however. Criticism of a passive coastal defence came from the Tsarist 'Old School' whose adherents, in many instances, still officered the Red Fleet. Others could be found in influential teaching positions at the Voroshilov Naval War College and the Frunze Naval Academy in Leningrad. Old School advocates conceded the unexpected accomplishments of the submarine in the past war, but remonstrated that the underwater craft had proved neither

decisive nor able to replace capital ships as the tools for seizing and maintaining command of the sea. Moreover, they pointed out, the 'inevitable' development of countermeasures would surely deny the submarine of much of its sting in the next war.

These arguments were very much in the mainstream of naval thought elsewhere. In Great Britain and United States too, the weight of post-war professional naval opinion acknowledged that the ability of the submarine to circumvent a blockade and avoid a 'decisive battle' had changed the traditional significance of command of the sea. But, naval officers pointed out, the submarine had not changed the need to protect one's *own* shipping; this, they insisted, only a surface fleet could do. Leningrad Professor Gervais faithfully echoed this view in 1922. Submarines, he said, 'are an effective weapon of sea warfare which constitute a grave threat to the maritime communications of any enemy with the outside world'. However, he reminded his audience, 'to cut the maritime communications of an enemy . . . is only half of the wartime task. Yet another task remains, one that is not less if not more important: to secure one's own communications with the outside world. In what manner can this task be accomplished by submarines?'

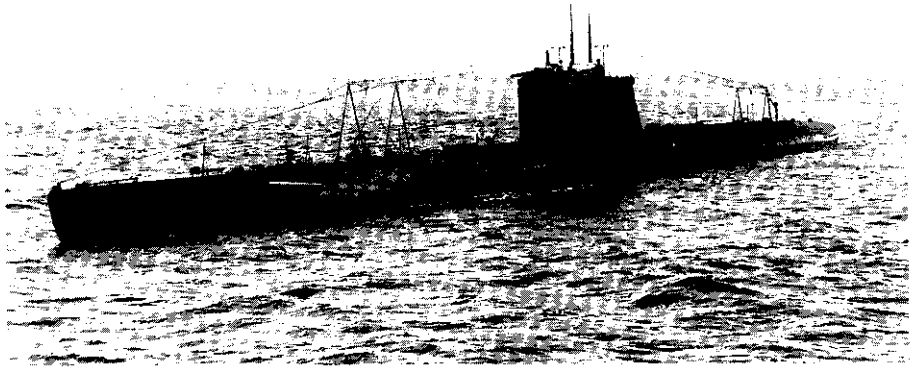
The difference between the 'capitalist' navies and the Soviet fleet of the 1920s was that the former could afford to build navies in the image of the command of the sea model. Aside from the debatable military value for the Soviet Union of a strategy and force structure that might be appropriate for an insular nation, such as Great Britain or Japan, the Old School's insistence that the new Soviet Navy be a capital fleet to contest and command the seas simply did not mirror fiscal realities. Speaking before a gathering of naval officers in 1925, Navy Commissar V. Zof said as much:

> 'You speak of aircraft carriers and of the construction of new types of ships . . . at the same time ignoring the economic situation of our country and corresponding conditions of our technical means, completely ignoring the fact that perhaps tomorrow or today we will be called on to fight. And with what shall we fight? We will fight with those ships and personnel that we have already.'

The Young School strategy, modified to take greater account of the submarine, and 'dressed up' in proper Bolshevik revolutionary terminology, provided the doctrinal underpinning for Soviet naval building programmes in the 1920s and early 1930s. By the mid-1920s essential repairs to the shipbuilding and repair industry had been completed, the worst fuel shortages overcome, and regular exercises had again become possible. To the surprise of some Western observers, a Baltic flotilla managed to steam as far as west of Kiel in the Summer of 1925. The economy had improved enough to permit a modest budget increase for new construction.

In November 1926, the construction of 12 (some reports claim 15) new submarines was approved. Six of the vessels became the Series I *Dekabrist* or 'D' class, built in equal numbers, from 1927 to 1931, at Leningrad's Ordzhonikidze Yard (the former Baltic Yard) and the Marti Yard in Nikolayev. The Baltic Fleet boats were commissioned as *Dekabrist*, *Narodovoletz* and *Krasnogvardeyetz*. The second batch of Black Sea Fleet hulls were named *Revolutsioner*, *Spartakovetz* and *Yakobinetz*. Although reported to have been good seaboats, the *Dekabrist* class never became effective war-fighting submarines. Design and combat capabilities were already ten years behind the state of the art elsewhere, and poor workmanship and material shortcomings caused a continuing need for repairs and modifications. *Krasnogvardeyetz* sank during an exercise in the Baltic Sea in June 1935, but was raised and repaired.

The obsolescence of the *Dekabrist* class submarines may be accounted for, in part, by unconfirmed reports that they were, in fact, the unfinished Bubnov-designed *B-1* series of the First World War. Other knowledgeable sources, however, have credited the Italian firm of Cantieri della Adriatico with inspiring the *Dekabrist* design. Adding to the confusion



The first *Soviet* submarine design, the *Dekabrist* class (Central Naval Museum, Leningrad).

about the background to this group of submarines is the report in *Jane's Fighting Ships* of the 1930s that a *fourth* unit, presumably built at the Ordzhonikidze Yard and reputedly named *Bezbozhnik* (Godless), sank in September 1927 while on trials in the Baltic Sea. To add to the puzzle, the Soviets shortly gave the same name to the British *L.55* which had sunk off Kronshtadt in June 1919, but was raised by the Soviets in 1928, and recommissioned into the Baltic Fleet in 1931.

Table 2: *Dekabrist* ('D') class submarines

Number built	6 (7?)
When built	1927–1931
Where built	Ordzhonikidze Yard (Leningrad), Marti Yard (Nikolayev)
Displacement	920/1318 tons
Length	86 m (282 ft)
Beam	6.5 m (21.25 ft)
Draught	3.9 m (12.75 ft)
Propulsion	2600 bhp/1260 shp
Speed	15/8 knots
Endurance	8000 nm at 9 knots/105 nm at 5 knots
Armament	8 × 533 mm (21-in) TT (6 bow, 2 stern), 1 × 102 mm gun, 1 × 45 mm AA gun, 2 machine guns, 14 torpedoes
Diving limit	900 m (300 ft)
Complement	53

Within a few months of the launchings of the *Dekabrist* class the keels were laid for a second series of six boats approved under the 1926 Naval Programme. Again, the order for this Series II was split equally between Ordzhonikidze, the lead yard, and the Marti facility. The lead boat was launched at Ordzhonikidze in February 1931, and commissioned in the Autumn of 1933 as *Leninetz*. Subsequent hulls were named *Marksist*, *Bolshevik*, *Garibaldietz*, *Chartist*, and *Karbonari*. *Marksist* and *Bolshevik* were later re-named *Stalinetz* and *Frunzovetz*, respectively, but the group as a whole ultimately sailed under numerical designations *L.1* through *L.6*.

Leninetz class submarine (Central Naval Museum, Leningrad).

Built mainly for minelaying duties, the *Leninetz* submarines were fitted with two stern-located mine shafts whence they were capable of depositing a mine complement of 14 to 20, depending on the type of mine used. Bearing a strong resemblance to the ex-British *L.55*, the class has been criticised for poor design and construction methods, inadequate ventilation, and a low battery capacity.

The Series II was followed by the Series XI and XIII built under the Second Five-Year Plan. Series XI consisted of six submarines, and Series XIII counted seven, all built, in prefabricated form, at the Ordzhonikidze Yard for shipment and reassembly at the Dalzavod Yard in Vladivostok.

The Series XIII and modified Series XIII-*bis* were the most capable units in the overall 24-unit 'L' class. They carried eight instead of six torpedo tubes, and installed engine power was nearly doubled from 2200 to 4100 bhp. Rated horsepower for submerged cruising was increased as well, from 1050 to 1450 shp. The result was an improvement in surface endurance from a normal 7400 to at least 10,000 nautical miles. The characteristics of the Series II *Leninetz* class submarines are listed in Table 3.

Table 3: Series II *Leninetz* ('L') class submarines

Number built	6
When built	1929–1933
Where built	Ordzhonikidze Yard (Leningrad), Marti Yard (Nikolayev)
Displacement	1040/1335 tons
Length	81.0 m (265.7 ft)
Beam	6.9 m (22.6 ft)
Draught	4.18 m (13.7 ft)
Propulsion	2200 bhp/1050 shp
Speed	13.8/8.5 knots
Endurance	7400 nm at 7.5 knots/154 nm at 2.5 knots
Armament	6 × 533 mm (21-in) bow TT, 1 × 102 mm gun, 1 × 45 mm gun, 12 torpedoes, 14–20 mines laid via twin stern mine shafts
Diving limit	75 m (246 ft)
Complement	50

Note: Series XI (1934–1938) included six boats, Series XIII (1935–1938) seven, and Series XIII-*bis* (1938–1943) five.

Phase II: Modernisation and expansion

The 13 Series XI and XIII *Leninetz* class boats completed under the Second Five-Year Plan underwent final assembly at the Dalzavod Yard in Vladivostok for deployment in the Far East. There, they joined the newly established (1932) Pacific Fleet to offset the ominous growth of the Imperial Japanese Navy. Shortly, additional submarines began to arrive, prompting a flurry of reports and rumours abroad of a vast Soviet 'mystery fleet'. The dire warnings that came especially from the German and Japanese press would find an echo, 20 years later, in American and British newspapers and journals.

The British *Journal of the Royal United Services Institute* set the tone, in 1935, when it cited a Japanese report of a Soviet plan to deploy 50 'very modern submarines' in Vladivostok. The German *Marine Rundschau* followed up a few months later when it alleged that the Soviets had at least 30 and probably more submarines available in the Far East. The Japanese, who had their own reasons for keeping the Soviet 'threat' in the news, confirmed, in April 1936, that 35 400- to 800-ton submarines 'of the latest design and equipment' had been stationed in Vladivostok. Next, the *Chicago Tribune* reported another Japanese claim that the number of submarines could be as high as 80. The newspaper went on to say that none were reported on the 'regular naval lists' and that 'no prying eyes are permitted to fathom their design'. The British *Sunday Times* 'explained' the reason for the rumoured Soviet build-up:

> '. . . Russia is determined to build a barrier of submarines all the way north and south along the Russian coast . . . this chain of submarine craft would never allow the Japanese fleet within striking distance of any important area.'

As rumours of imminent war in the Pacific escalated, so did foreign estimates of the Soviet 'mystery fleet'. In early 1938, the count rose to 'over 100' with 'more arriving each week by way of the Trans-Siberian Railway to be assembled.' The Italian *Revista Marittima* took note of the Japanese assertion that most of an estimated Soviet submarine strength of 200 was based at Vladivostok, but, the magazine cautioned, most other expert sources thought that the entire Soviet underwater fleet counted only 75 vessels. A French publication was even more skeptical, and accused the Japanese and Germans of deliberately inflating the 'mystery' threat. The actual number of effective submarines in the Soviet Navy, maintained the *Revue des Deux Mondes*, in late 1938 was only 50, including obsolete types. 'Russia's naval strength', the magazine editorialised, 'has been grossly exaggerated by both Japan and Germany so that these powers could further increase their naval armaments with the support of public opinion'.

The Soviets' own public pronouncements complicated the mystery. Instead of publishing 'hard' numbers, Soviet commentators typically boasted of their navy's growth in terms of *percentages*, without bothering to spell out whether the alleged increases were tons of displacement or numbers of ships. Even this difficulty could have been overcome, were it not for the fact that the Soviets also failed to provide any 'baseline' numbers. For example, Assistant Defence Commissar Marshal Mikhail Tukhachevsky told the Congress of Soviets in January 1935, that the Navy's submarine *tonnage* had grown by 435 per cent since 1931. The next year, the commander-in-chief of the Soviet Fleet, Nikolai Orlov, announced that the *number* of submarines had been increased by 715 per cent since 1933. In neither case, did the Soviets offer a basis for comparison by reporting the tonnage and numbers extant in 1931 or 1933.

Today, with the benefit of hindsight, the size and composition of the Pacific 'mystery fleet' has been fairly well determined. The numbers involved were neither as high as claimed by Japanese propagandists, nor certainly as miniscule as reported by the French. The most detailed estimate has been developed by the Swiss naval historian Jürg Meister, who has reported a numerical growth between 1932 and 1940 as follows:

Year end	Total number of submarines in the Soviet Navy	Number of submarines in the Pacific Fleet
1932	20	0
1933	38	8
1934	82	39
1935	106	45
1936	143	57
1937	151	67
1938	168	69
1939	181	74
1940	205	87

Source: Jürg Meister, *Soviet Warships of the Second World War*. London: Macdonald and Jane's 1977, pp 168–69.

No question, these are impressive numbers; from 1934 until 1940, an average of 43 per cent of the entire Soviet submarine fleet was stationed in the Pacific. Moreover, at the end of the second year of the build-up, 1934, Soviet submarine strength in Vladivostok already exceeded that of the Imperial Japanese Navy. The lead would continue to widen until the Second World War. Not obvious from the tabulation is the fact that the Vladivostok-based fleet was mainly composed of medium- and short-range submarines, designed for near-shore defence – not to attack Japan's sea routes. The bulk of the 'mystery fleet' were the medium-size (600 tons) *Shchuka* or 'Shch' boats and the 160 to 200-ton *Malodki* or 'M' coastal midgets. The *Shchuka* and *Malodki* would be the Soviet Union's most ubiquitous submarines of the Second World War.

The *Shchuka* and *Malodki* classes

Construction of the *Shchuka* class was first approved and initiated during the course of the First Five-Year Plan under the designation Series III. After that, the design evolved through six major modifications to become the most prolific Soviet submarine of the Second World War. Some of the later *Shchuka* series were still being completed and commissioned into the Navy after 1945.

As had been the case with the *Leninetz* group, successive *Shchuka* series underwent gradual improvements. The original Series III boats were powered by two 8-cylinder diesels with a combined horsepower of 1370; the final Series X-*bis* came equipped with two diesels with a combined rating of 1600 bhp. Also, a progressive increase in size allowed for more fuel to be carried and an increase in armament from ten to 12 torpedoes. More powerful engines and larger fuel tanks translated into higher speed and greater endurance. The Series III submarines were designed for a maximum speed of 13 knots and a combat radius of 3250 nautical miles at eight knots. At-sea endurance was 20 days. By comparison, the Series X-*bis* were nominally capable of a top speed of 15 knots, a combat radius of 5000 nautical miles, and a patrol endurance of 40 days. In short, the *Shchuka* evolved from a coastal patrol boat suitable for 'in-and-out' patrols, to a reasonably capable, medium-endurance ocean-going boat. It seems, in fact, that at least some of the *Shchuka* series may have been intended as ocean-going fleet types: the second group, the Series V, was first reported as *Lineya Lodki* types, meaning 'boats of the line'. The lead submarine in this series was commissioned with the abbreviated name *Lin* (*Shch.305*), prompting some Western sources to distinguish between the *Shchuka* and *Lin* classes for years afterwards.

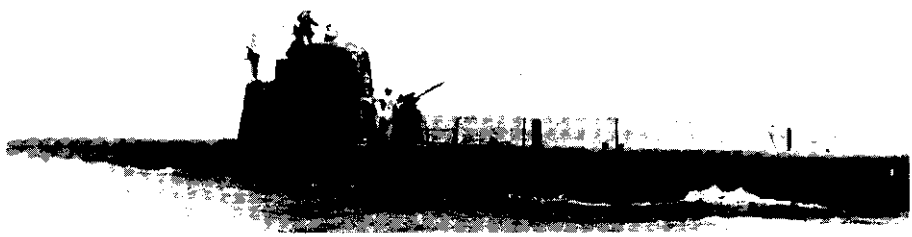
More than 80, possibly as many as 100 *Shchuka* class submarines were built between 1930 and 1948, involving at one time or another, at least six different yards. Sectional hulls destined for the Pacific Fleet were shipped by the Marti and Ordzhonikidze Yards for final assembly at the Dalzavod Yard. Initially at least, the Pacific Fleet submarines were numbered from 100 upwards. Black Sea Fleet units were built at the 61-Kommunar and Marti Yards in Nikolayev, and were numbered from 200 upwards. The Zhdanov, Marti and Ordzhonikidze Yards in Leningrad built the Baltic Fleet hulls with numbers in the 300 series. Interestingly, the *Shchuka* submarines were the first Soviet-built boats to inherit the names of prominent Imperial Russian submarines. Besides *Shchuka*, there were, among others, *Losos*, *Karp*, *Karas* and *Delfin*.

Table 4: Series III *Shchuka* ('Shch') class submarines

Number built	4
When built	1930–1934
Where built	Ordzhonikidze Yard (Leningrad)
Displacement	577/704 tons
Length	57 m (187 ft)
Beam	6.4 m (21.1 ft)
Draught	3.78 m (12.4 ft)
Propulsion	1370 bhp/800 shp
Speed	13/8 knots
Endurance	3250 nm at 8 knots/110 nm at 1.75 knots
Armament	6 × 533 mm (21-in) TT, 1 × 45 mm AA gun, 10 torpedoes
Diving limit	76 m (250 ft)
Complement	35

The second group of submarines that was largely responsible for the Vladivostok 'mystery fleet' was the *Malodki* class.*Malodki* is the abbreviation for *Maliye lodki* meaning 'small boats'. The description was appropriate, for the first Series VI of this sectionally-built group of vessels displaced a mere 160 tons on the surface, and was crewed by only three officers and 13 enlisted personnel. Armament consisted of two bow torpedo tubes that had to be loaded externally before the submarine left port.

The *Malodki* was the first submarine built at a Soviet inland yard. The Ural Machine Works (Krasnaya Sormova) in Sverdlovsk began construction of the first four submarines in



Series XII-bis *Malodki* (for *Maliye lodki* or 'small') submarine (Central Naval Museum, Leningrad).

1932, but the order was quickly increased to 30 under a supplemental five-year plan for the Pacific Fleet. When the boats were first assembled (depending on the series, they consisted of six or seven prefabricated sections), trials were held in the Caspian Sea. Next, they would be placed on specially designed railroad cars for shipment to Vladivostok.

The *Malodki's* small size and simplicity of construction meant that large numbers could be built quickly without interrupting ongoing work at the traditional yards. The drawbacks of a submarine this small quickly became obvious, however. Besides limited armament, economical endurance was restricted to 1600 nautical miles, and submerged running was limited to 55 nautical miles. These and other shortcomings were partially alleviated with successively larger *Malodki* series. The final Series XV was completely redesigned around a hull with a normal displacement of 400 tons. The number of torpedo tubes was doubled, and endurance at economical speed was improved to 4000 nautical miles. Other earlier deficiencies were overcome with the entry of the experienced shipyards in the building programme. The principal characteristics of the Series VI *Malodki* class are detailed in Table 5.

Table 5: Series VI *Malodki* ('M') class submarines

Number built	30
When built	1932–1935
Where built	Ural Machine Works (Sverdlovsk), Marti Yard (Nikolayev)
Displacement	160/202 tons
Length	37.8 m (124 ft)
Beam	3.1 m (10.2 ft)
Draught	2.58 m (8.5 ft)
Propulsion	685 bhp/240 shp
Speed	13.25/7.5 knots
Endurance	1600 nm at 8.25 knots/55 nm at 2.5 knots
Armament	2 × 533 m (21-in) bow TT, 1 × 45 mm AA gun, 2 torpedoes
Diving limit	50 m (165 ft)
Complement	16

The *Pravda* class

The building of small- and medium-size submarines designed and armed for operations in near-shore waters against a penetrating enemy fleet conformed with the doctrinal tenets of the Young School. Yet, even as the 'small fleet' strategy seemed to be firmly entrenched in Party and Navy doctrine, and the arguments for a high seas fleet apparently had lost all favour, design and construction decisions in the early 1930s signalled an important change of direction.

Stalin's special and curious passion for heavy cruisers, or as Professor John Erickson has phrased it, his 'big ship megalomania', has commonly been cited as the driving force behind the Soviet Union's 'big fleet' programme of the 1930s. This is partly true. All accounts of Stalin's involvement in the Soviet Union's armament programme of the 1930s and 1940s cite the dictator's very personal concern and indeed surprising knowledge of the technical characteristics of different weapon systems.

Why Stalin chose to shift gears and provide 'his' navy with a mix of capital ships that the majority of high-ranking officers – including Old School supporters – viewed as unbalanced and inappropriate for Russia's needs, remains an open question. The end of the battleship 'holiday' and the resumption of vigorous naval rearmament among the major powers has

frequently been cited. Yet, the end of the naval ratio system did not come until 1936, whereas work on the Soviet Navy's first cruisers was begun in 1935. The construction of battleships was ordered in 1937 and the first keels were laid the next year. Given a lead time of at least five years between the definition of operational and design requirements, and the first bending of metal, it stands to reason that Soviet battleship plans were drawn up in the early 1930s.

Viewed from the perspective of the Soviet 'threat analyst' of the early 1930s, Stalin's decision to build a fleet capable of sustained combat operations on the high seas may have made considerable sense, in fact. Capabilities and apparent intentions suggested that the Soviet Union's most acute seaward danger came from Japan. In 1931, Japanese troops entered Manchuria; their objective in the eyes of Soviet military planners appeared no less than to gain a springboard against Northern China and the Soviet Far East. Japan's ability to mount and sustain a campaign on the Asian continent hinged on domination of the adjacent sea areas by the Imperial battle fleet. While the Pacific Fleet's *Shchukas* and *Malodkis* might make the transportation of Japanese troops and supplies costly, they would have achieved few results against the true 'shield' of the Japanese supply line – the battlefleet! In order to wrest command of the sea from Japan, the Soviet Union would have to build a fleet to fight the Imperial Japanese Navy on *its* terms, i.e. with another battlefleet. Stalin's 'big fleet' was probably never intended for concentration in the constricted waters of the Baltic and Black Seas – had the programme been completed, its fruits would have found a 'home' in the *Pacific*.

Stalin's ambitions for a capital fleet were not limited to large surface combatants. Plans were developed, in the early 1930s, for a 'cruiser-submarine', a heavily-armed, large-displacement submarine vessel capable of operations more than 10,000 nautical miles away from its home base. Granted that the Soviet design was not quite as grandiose as some of the 'monster' submarine building plans then popular in Western movies, (the French Navy, for example, launched its 2880-ton *Surcouf* in 1929), it was impressive enough to raise some doubt about the doctrinal conviction, as opposed to expedient pragmatism that underpinned the avowed acceptance of the Young School strategy. One development in the early 1930s, for example, was the so-called 'Project KE-9' submarine which, in the second half of the decade would become the 'K' class cruiser-submarine of 1480 tons. Preceding these large vessels, however, came the *Pravda* group of three submarines that, by appearance at least, were clearly designed for long-range offensive cruises on the high seas.

As it turned out, the three Series IV *Pravda*, or 'P', class boats *Pravda* (Truth), *Zvezda* (Star) and *Iskra* (Spark) were complete failures. Despite their large size (955 tons on the surface and 1671 tons submerged), they carried only six torpedo tubes in addition to two 100 mm guns and one 45 mm anti-aircraft gun. Endurance was a mere 20 days (compared with 30 to 40 days for the much smaller *Shuchuka* series), and diving from a surfaced condition to periscope depth took a long 90 seconds. An additional problem was shallow draught of barely over ten feet, which meant that the least amount of swell exposed the propellers and seriously degraded mobility and speed. Despite repeated alterations, the *Pravda* class submarines never became capable fighting boats, and were used mainly as transports during the Second World War.

Table 6: Series IV *Pravda* ('P') class submarines

Number built	3
When built	1931–1936
Where built	Ordzhonikidze Yard (Leningrad)
Displacement	955/1671
Length	87.1 m (268 ft)

Beam	8.0 m (26.25 ft)
Draught	3.1 m (10.2 ft)
Propulsion	2700 bhp/1100 shp
Speed	15/7 knots
Endurance	5750 nm at 10 knots/105 nm at 4 knots
Armament	6 × 533 mm (21-in) bow TT, 2 × 100 mm guns, 1 × 45 mm AA guns, 12 torpedoes
Diving limit	60 m (200 ft)
Complement	54

One noteworthy aspect about the *Pravda* group was the powerplant: two 6-cylinder diesel engines, manufactured by M.A.N. of Germany, powered the boats on the surface. M.A.N. diesels would similarly propel the next series of Soviet submarines as well. German-supplied main machinery was merely the tip of the iceberg in a 'German connection' that would heavily influence Soviet submarine design and construction through the next two decades.

The German connection

On 16 April 1922, the Soviet Union and Germany signed the Treaty of Rapallo. In addition to extensive trade agreements, the pact gave the Soviet Union its first *de jure* international recognition, and cancelled all war claims between the two countries. Furthermore, since the Soviets were not a party to the Treaty of Versailles, they were not obligated to respect its provisions, including those that prohibited German rearmament.

Reports of secret joint Soviet-German endeavours in the naval field began circulating in the Western press shortly afterwards. One French commentator, reflecting his country's particular sensitivity to the slightest hint at German rearmament, warned of the 'imminent' prospect of Germany 'constructing many submarines in the Russian dockyards'. He claimed that more than 200 German-manufactured diesel engines had been shipped to Kronshtadt, 'all of which are certainly not reserved for Russian submarine use'.

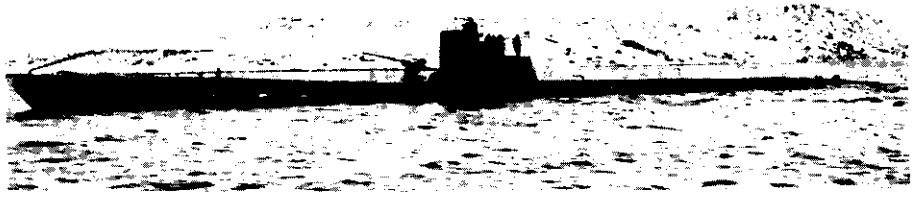
The report was not entirely baseless. It is known for a fact that at least three different classes of Soviet submarines received M.A.N. diesel engines. They were the *Pravda*, *Leninetz* and *Stalinetz* classes. It is probable moreover that the Soviet-made Kolomna 1-D 8-cylinder, 4-cycle diesel plant that powered the later *Stalinetz* and large 'K' class submarines were copies of the German equipment.

The full extent of Soviet-German naval co-operation – technical and operational – during the 1930s is still not fully known. There is no doubt that it was quite extensive. A report prepared by ONI after the Second World War, and based on captured German documents, concluded that, 'in some ways the Soviet-German naval co-operation in the years prior to 1941 was as great or greater than that afforded the Royal Navy by the Russians from 1941 until the end of the war'.

The *Stalinetz* class

One important form of Russo-German co-operation in the naval sphere took shape in 1933–34 with the design and construction of the Soviet Navy's next generation of long-range patrol submarines, the Series IX *Stalinetz*, or 'S', class. Unhappy with the *Pravdas*, the Soviets turned to the Ingenieurskantoor voor Scheepsbouw (I.v.S.) in The Hague, The

Netherlands. The I.v.S. was a German front organisation, set up and owned jointly by the Krupp-owned Germania Yard, the Deutsche Schiff und Maschinenbau AG, and the German Navy. Staffed by German engineers, the organisation was tasked to develop Germany's next generation U-boats. Short of capital, the I.v.S. readily sold its blueprints to foreign navies, including Japan, Spain, Finland, Turkey, The Netherlands, *and* the Soviet Union.



'S'-type submarine. The 'S' is commonly thought to stand for *Stalinetz*. Modern Soviet sources use the transliteration *srednaya* for 'medium.' (Central Naval Museum, Leningrad).

The design that interested the Soviets was the 862-ton Type A1, forerunner of the German Navy's most successful submarine of the Second World War, the Type VII. The Soviet Navy agreed to purchase a larger and more powerful version of the Type A1, and construction of the first three hulls of what became the *Stalinetz* class began, supervised by a German technical team, at the Ordzhonikidze Yard in December 1934.

The lead boat was launched less than eight months after keel-laying. Originally planned to carry the name *Nalim* (Burbot), she received the numerical designation *N.1* instead. On 20 October 1937, *N.1* and the two follow-on boats were redesignated *S.1* through *S.3*. Many more were to follow.

The *Stalinetz* class submarines turned out to be very successful. They displayed a good economical range of nearly 10 000 nautical miles at an average speed of 10.4 knots, were capable of diving twice as fast as the *Pravda* class, and had operational characteristics that were simple and easily understood.

As is the case with most series-built Soviet submarines of the 1930s, the final number completed remains in doubt. The original plan reportedly called for the construction of 49 units, but the war interrupted the building schedule. An added problem is the Soviet habit of periodically renumbering their submarines, frequently, but not always, to mark transfers between different fleet areas. In any case, different estimates have cited the completion of 42 to 53 *Stalinetz* class submarines by 1948. Building yards included Ordzhonikidze, Sudomekh and Zhdanov in Leningrad, Marti in Nikolayev, Dalzavod in Vladivostok (for final fitting out of boats built in Leningrad) and the Krasnaya Sormova Yard in Gorki. Hulls completed at this last inland yard were towed on pontoons to Leningrad, Molotovsk and Nikolayev for final fitting out.

Table 7: Series IX *Stalinetz* ('S') class submarines

Number built	42–53
When built	1934–1948
Where built	Ordzhinkikdze, Sudomekh, Zhdanov Yards (Leningrad), Marti Yard (Nikolayev), Dalzavod (Vladivostok), Yard 402 (Molotovsk)
Displacement	840/1070 tons
Length	78 m (255.8 ft)

Beam	6.4 m (21 ft)
Draught	4.4 m (14.5 ft)
Propulsion	4000 bhp/1100 sph
Speed	19.5/9 knots
Endurance	9800 nm at 10.4 knots/148 nm at 3 knots
Armament	6 × 533 mm (21-in) TT (4 bow, 2 stern), 1 × 100 mm gun, 1 × 45 mm AA gun, 12 torpedoes
Diving Limit	80 m (263 ft)
Complement	45

Note: Present name of Molotovsk is Severodvinsk

Phase III: The 'Big Navy'

The full flowering of Stalin's 'big navy' programme came with the Third Five-Year Plan that started on 1 April 1937. Young School adherents within the navy still opposed to the dictator's schemes were purged in the course of the next several months along with the greater part of the higher officer corps in the other services. Stalin now had a free hand to place 'fundamental emphasis . . . on constructing a surface fleet for the Baltic, Black and Barents Seas'. But the price would be a high one, and one to be paid in the coming war years. With most of the experienced and capable naval leadership eliminated, and with the survivors fearful to object, strategy would be made and force structure decisions taken without the benefit of considered professional advice.

Robert W Herrick's *Soviet Naval Strategy* cites a number of reasons for the 'big fleet' shift in Soviet naval doctrine and material preparations. Aside from Stalin's personal predilections, they can be summarised as follows: (1) Stalin's desire for greater international prestige, (2) an inflated estimate of the Soviet Union's industrial and modern ship building capacity, and (3) the perception of an increasingly threatening international environment spurred on by the military preparations of Japan, Germany and Italy.

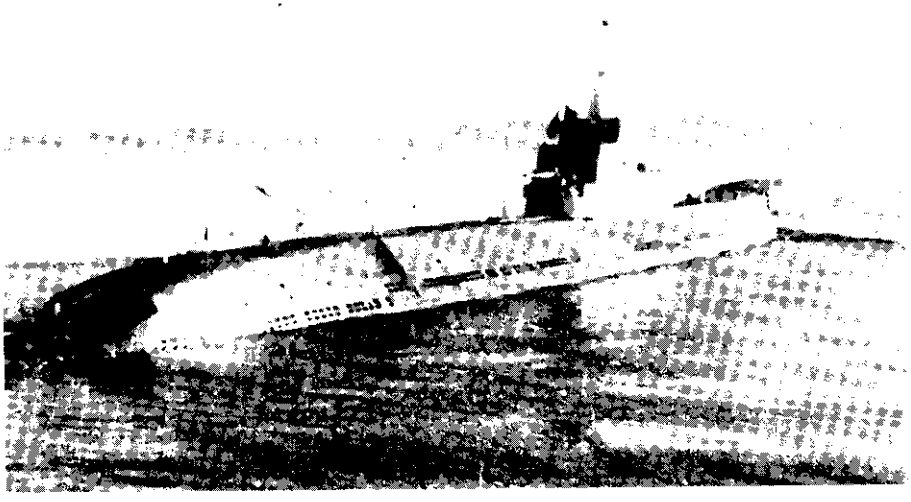
Once Stalin had decided that, in the words of *Pravda*, 'Only the biggest High Seas Fleet will meet Soviet demands', work began accordingly in a grandiose fashion. Four battleships of 59,000 tons each (more than 30 per cent heavier than the US Navy's USS *New Jersey*!) were laid down between 1938 and 1940. Also, construction was begun on two battlecruisers with displacements of 35 240 tons, in addition to seven *Chapayev* and *Kirov* class cruisers. None of these big ships, with the exception of two *Kirov* class cruisers built in Vladivostok, were completed before or during the Second World War. The partially-finished battleships and battlecruisers were either cannibalised by the Soviets or destroyed the German occupation forces. Five *Chapayev* class cruisers were completed after the Second World War.

Complementing the capital surface combatants were to have been several aircraft carriers. Construction of at least one large carrier was slated for the end of the Third Five-Year Plan, but the project was cancelled when (although not necessarily because) the United States refused to sell the Soviets its latest aircraft carrier blueprints.

The 'K' class

The final pre-war class of Soviet submarines, the Series XIV 'K' class, faithfully reflected the Navy's 'big fleet' ambition. The letter 'K' has been reported as standing for *Kreiserny*, ie 'cruiser' type. The size of the submarine did justice to the latter designation. Surface

displacement was 1498 tons (comparable to the largest German and US fleet submarines of the Second World War), and submerged displacement amounted to 2095 tons. Fuel capacity was 255 tons, sufficient for an endurance of 15,000 nautical miles at nine knots. Rated horsepower was 4200, which leads one to suspect Soviet claims of a sustained maximum speed of 20 knots for 2900 nautical miles.



'K' class 'cruiser' submarine. (Central Naval Museum, Leningrad).

During the 1920s and 1930s, all of the principal submarine navies were experimenting with submarine-based aircraft for reconnaissance purposes. The 'K' class was the Soviet Union's only known attempt to mate the stealth and firepower of the 'cruiser submarine' with the speed and range of the aircraft.

Sometime between 1931 and 1934, the young aircraft designer Ivan V Chetverikov received Navy approval to design a submarine-carried variant to the OSGA-101 amphibian aircraft. The latter had been built and flight-tested to become the 'eyes' of the freighter *Chelyuskin* which was about to (unsuccessfully) navigate the newly-opened Northern Sea Route. The OSGA-101 derivative was given the designation SPL (for *Samolyot podvodnoy lodki*) to identify it as a submarine-borne aircraft. Some Soviet sources refer to the aircraft as the Gidro-1, but that designation came into effect only after the plane had failed acceptance tests and became available for exhibition abroad.

Flight tests took place between late 1934 and early 1935. With an empty weight of only about 544 kg (1200 lb), the aircraft, with its wings folded, was intended for storage in a space measuring 7.5 × 2.1 × 2.3 m (24.6 × 7 × 7.6 ft). Soviet sources report that dismantling the SPL to hangar configuration took 3–4 minutes; preparation for flight by three crew members could reportedly be accomplished in 5 minutes. The aircraft established a number of flight records for its class, but it proved too light and too small for safe take-offs in the open sea. Since the solution – a larger and heavier aircraft – could not be accommodated by

the intended carrier, interest waned, and none of the 'K' class boats ever went to sea with its organic 'eyes'.

The armament of the 'K' class included ten torpedo tubes (including two external ones), two 45 mm anti-aircraft guns, and, as the war was to show, a most formidable battery of two 100 mm anti-ship guns. The weapons load-out itself included 24 torpedoes and 20 mines. The latter were stowed amidships on the lower deck, and were dropped into the water via two vertical chutes located below the control tower.

Table 8 details the principal features of the 'K' class. The data reflect the uncertainty about the actual number built.

Table 8: Series XIV 'K' class submarines

Number built	12–17
When built	1936–1947 (?)
Where built	Marti Yard, Ordzhonikidze Yard (Leningrad)
Displacement	1480/2095 tons
Length	97.1 m (319 ft)
Beam	7.4 m (24.3 ft)
Draught	4.5 m (14.8 ft)
Propulsion	4200 bhp/2400 shp
Speed	20/10 knots
Endurance	15,000 nm at 9 knots/160 nm at 2.9 knots
Armament	10 × 533 mm (21 in) TT (6 bow, 2 stern, 2 external stern), 2 × 100 mm guns, 2 × 45 mm AA guns, 24 torpedoes, 20 mines in internal chutes
Diving limit	80 m (263 ft)
Complement	60

The Second and Third Year Plans had produced the greatest *defensive* navy in the world, but also, as contemporary commentators were quick to point out, the 'strangest' navy in the world; measured by traditional standards, the Soviet fleet on the eve of war was completely unbalanced.

The decade before the German invasion had been used to built the world's largest submarine fleet by far, larger in fact than the two next strongest underwater fleets – Italy and the United States – combined. It was a force that had been built largely in the active defence image of the Young School activities of the 1920s. The word 'largely' is important, for the price paid for the 'big navy' tilt was a failure to 'flesh out' the Navy's coastal defence core with a balanced force of supporting ships and weapons, mainly minelaying and -sweeping vessels and an adequate stockpile of mines themselves.

Soviet naval doctrine shared with its Army counterpart an almost religious emphasis on the *offensive*. Defensive operations meant inactivity, and inactivity signified defeatism. Soviet Navy regulations in force in 1941 befitted the kind of high seas fleet that was Stalin's aspiration – not the coastal flotillas that were on hand in fact. The Navy's first objective, they stated, was to conduct 'offensive operations on the high seas, in the air, and off an opponent's coast and bases . . .' The Soviet Union's standard unified plan of action still called for the Navy to support the Army's flanks, but the invocation was much less emphatic than only a few years before. According to Achkasov and Pavlovich's chronology of *Soviet Naval Operations in the Great Patriotic War 1941–1945*, 'it was envisaged that the tasks assigned to each of the fleets in a particular maritime theatre could be fulfilled as a result of conducting

them both as *independent and as joint operations with ground forces*' (emphasis added). In practice, however, these same two authors point out, 'top priority was assigned to the traditional role of destroying enemy forces at sea'. By comparison, 'undue attention was paid to the development of naval warfare at the expense of preparations for joint operations with the army'. In defence of the Navy's 'unbalanced' preoccupation with an independent and offensive campaign, it should be repeated that it no more than mirrored Soviet military doctrine *as a whole*. Soviet military science in the late 1930s was predicated on the premise that, after a brief defensive struggle, its forces would assume an uninterrupted offensive. The Navy's doctrinal orientation no more than echoed this optimistic prognosis.

Would the Soviet fleet have made a better showing had it had the time to build the battleships, battlecruisers and aircraft carriers that Stalin had in mind? Probably not. The solution to the Soviet naval dilemma had (and has today) less to do with the kind of fleet on hand than the 'permanently operating factor' of unfriendly geography. It is questionable whether *any* navy, faced with the all but land-locked geography of the Baltic and Black Seas, could have turned in a much better performance than the Soviets'. As the Red Army reeled under the onslaught of the German Panzer divisions, the Soviet Navy and its submarine component were quickly forced to re-order priorities and assume the role of 'faithful assistant of the ground forces'.

Principal sources

Key references for the foregoing description of inter-war developments include contemporary Western and Soviet periodicals. With regard to the latter, the pre-Second World era is the most recent period in Soviet military history that has been opened, by the Soviets, to a relative abundance of 'hard' and primary data. Another important source, albeit one written in retrospect, turned out to be the *ONI Review*. This document especially offers insights into two aspects of Soviet inter-war submarine developments: one, the characteristics and capabilities of the different submarine classes that, at war's end, were still at the core of the 'threat', and two, the extent of German pre-war submarine technology transfer.

4 Submarine operations in the Second World War

This account of the operations of Soviet submarines in the Second World War (the 'Great Fatherland War' in Soviet history books) follows the same general format used in Chapter 2's narrative of the First World War. Each of the three principal theatres of naval hostilities involving the Soviet submarine fleet is reviewed separately in this order: Baltic Sea, Black Sea, and Arctic Sea. The Pacific Fleet did not become an active participant to the war until the Soviet Union declared war on Japan on 8 August 1945. No Pacific Fleet submarines saw action in the eight days before the Japanese surrender.

As in Chapter 2, the descriptive material in this chapter summarises the main course of naval events in each theatre and highlights the key actions involving Soviet submarines. An important difference from the account of the First World War is the greater difficulty of evaluating the Soviet naval performance in the Second World War. Soviet source material to this day suffers from incomplete data, unreliable information, and, in some cases, plain misrepresentation of fact. Soviet reports of alleged successes at sea can be quite detailed, but when it comes to setbacks, causes and circumstances are mentioned only sporadically. For this reason, the wartime career of many submarines remains in doubt, and heavy reliance must be placed on German wartime records and their principal interpreters, Jürgen Rohwer, Jürg Meister, and Friedrich Ruge. This writer personally experienced the Soviet Union's continued refusal – more than 40 years after events – to furnish comprehensive, 'hard' information on the negative side of its Navy's wartime performance. Repeated requests for a summary of submarine losses went unanswered.

It is common for belligerents to inflate their own claims of success while minimising defeats and the claims of the opponent. It is also common that, as the war and the passions it generated recede further and further into history, claims and disclaimers on both sides tend to become more moderate, frequently to the point of convergence. The prerequisite is that the former belligerents and their historical recorders have free and open access to their countries' wartime files and, most important, that they are permitted to 'exchange notes'.

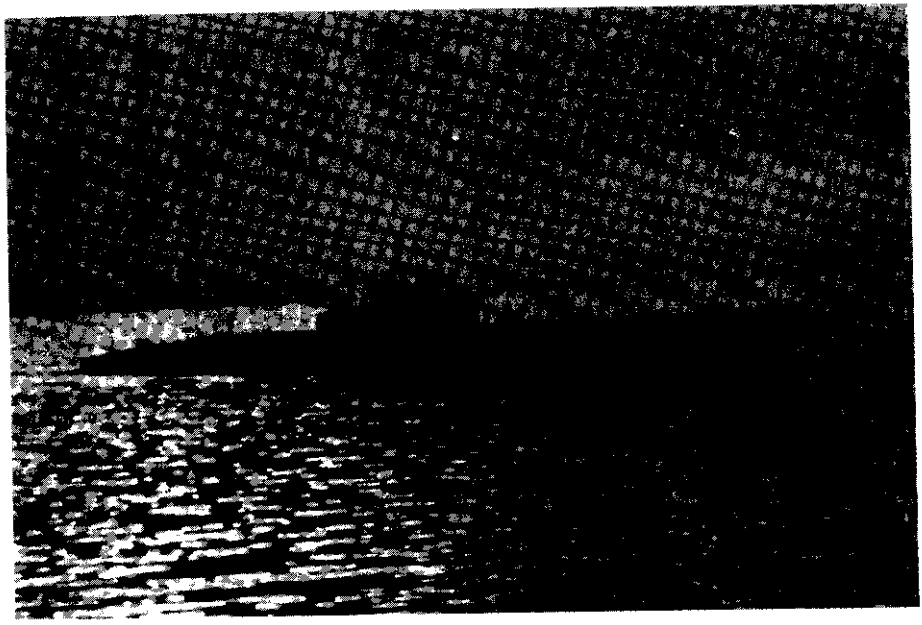
The Soviet historian of the Second World War at sea is at a disadvantage on both counts. For one, his access to the Soviet equivalent of, say, the British Admiralty files, remains extremely limited; the source material for Soviet historical publications is overwhelmingly based on 'finished' evaluations of what happened – not data-in-the-raw. In the second place (and in part because the Soviets attach much greater contemporary relevance to the 'lessons' of the Great Fatherland War than does the West), the Soviet military historian's opportunities to meet with his Western colleague are severely circumscribed by an inflated 'security' consciousness.

Despite these handicaps, there has been a modicum of convergence between Western (mainly German) and Soviet accounts of events nevertheless. For example, in stark contrast with the Stalinist 'chronologies' of the war years, modern Soviet military writers are quite prepared to admit that the first year of retreat had less to do with a clever and deliberate strategy of 'active defence' (and 'overwhelming' enemy superiority) than with their own country's mistakes at all levels of military planning – strategical, tactical, and intelligence. Soviet 'revisionist' history stems from eminently practical reasons – Soviet military art, especially under modern (meaning nuclear) conditions, could hardly expect to advance if writers no more than parrot its intrinsic infallibility. One result has been that, compared with

Soviet writings during the 1950s, contemporary claims of victories and defeats at sea much more closely match those of the Germans. By the same token, the Western literature has tended to perpetuate certain negative images of Soviet naval performance that, in some cases at least, may have little basis in fact. For example, German sources have commented on how 'inexperienced' Soviet submarine commanders would frequently come to the surface prematurely in order to inspect a presumed successful 'kill'. In many instances, these sources report, the submarine would find itself face to face with a 'victim' still very much alive. It is true enough that Soviet submarines were in the habit of prematurely broaching the surface of the water, not uncommonly because the second-in-command, the *politruk*, wished 'to see for himself', and finish off the enemy with gunfire instead of expensive torpedoes. It is also apparently true, however, that *material* problems, not necessarily lack of skill, were sometimes the culprit. The design of the *Shchuka* class was reportedly flawed in that it took some time for the torpedo tubes to fill with counter-balancing water once the torpedo was fired. With the boat out of balance, the lighter bow would tend to force the submarine to the surface.

Submarine Order of Battle, 21 June 1941

The Soviet order of battle for submarines on 21 June 1941 was as follows: Baltic ('Red Banner') Fleet under Vice Admiral V F Tributs – 65 submarines; Black Sea Fleet under Vice Admiral F S Oktyabrsky – 47 submarines; Northern Fleet under Rear Admiral A G Golovko – 15 submarines; and Pacific Fleet under Vice Admiral I S Yumashev – 91 submarines. Geographical distribution by submarine type has been calculated by Jürg Meister as shown in Table 9.



An unidentified Soviet submarine (S-class?) on a Baltic Sea patrol on the eve of the Second World War (US Naval Institute, courtesy TASS News Bureau).

Meister's estimate adds up to a total available inventory of 213 submarines, five more than Soviet historians have reported. The discrepancy may be due to Meister's inclusion of a few obsolete Tsarist vessels. Another possible reason may be the use of slightly different criteria for availability. At the outbreak of hostilities, according to Meister, nine Soviet submarines were running acceptance trials, while another 49 were conducting builder's trials or fitting out. Pinpointing the moment when a newly-built combatant is to be considered fully operational is a very inexact art (witness the much more contemporary dispute between the Soviets and Americans over precisely *when* a ballistic missile submarine is to be counted against the SALT ceilings). In any event, John Erickson's *The Road to Stalingrad* has reported that as soon as the Soviet Fleet went to 'Readiness State No 1' just before midnight 21 June 1941, a number of warships on trials were immediately accepted into the fleet and placed under operational commands.

Table 9: Soviet Submarine Fleet by Fleet area, 21 June 1941

Submarine class	Baltic Fleet	Black Sea Fleet	Northern Fleet	Pacific Fleet
Dekabrist	1	3	1	—
Leninetz	3	3	—	13
Pravda	3	—	—	—
'K'	4	—	2	—
Stalinetz	11	4	—	1
Shchuka	20	15	6	34
Malodki	21	14	6	37
Metallist	—	5	—	—
Bezbozhnik	1	—	—	—
Leopard	1	—	—	—
ex-Estonian	2	—	—	—
ex-Latvian	2	—	—	—
Totals	69	44	15	85

Operations of the Baltic Fleet

It is said that no two wars are fought alike. Strictly speaking, this is true, yet the initial opposing plans and pattern of hostilities in and around the Baltic Sea displayed some marked similarities with events in August 1914. On the strategic level, the Soviets again expected the Germans to combine their overland attack with a strong naval offensive into the Gulf of Finland. The Soviet Navy responded as its Imperial predecessor had done 27 years before. Disregarding its own fighting instructions to conduct an offensive battle at sea, the Baltic Fleet proceeded to implement a static defensive strategy by closing off the Gulf of Finland with minefields supported by coastal artillery batteries.

On the German side, naval priorities again faced westward, and did not envisage an aggressive naval campaign into the Gulf of Finland with Leningrad as its aim. Like their opponent's, German naval strategy in the Baltic Sea was mainly defensive and aimed at protecting the sea lines of communications to Sweden, Finland and along the army's coastal flank. Tactically, the Germans sought to contain the Baltic Fleet inside the Gulf of Finland by means of extensive minefields and land-based air power.

On the map at least, the Soviet Union's geo-strategic situation in 1941 was not unlike that of 1914. In 1939, the Baltic states that had become independent from Imperial Russia after the First World War were forced to accept Soviet naval, land and air bases on their territory.

These 'mutual assistance' pacts, and the subsequent complete Soviet occupation in summer 1940 of Estonia, Lithuania and Latvia had given the Soviet Navy control over Baltic Port and the islands of Hiiumaa (Dagoe) and Saaremaa (Oesel) in the Irben Straight, as well as Tallinn, Riga, Liepāja and Ventspils (formerly Libau and Vindau).

Finland had refused to give in to Soviet demand for a military presence but, after the ferocious 'Winter War' of 1939–1940, was compelled to grant Moscow a 30-year lease to the naval base at Hango at the westernmost end of the Gulf of Finland.

The strategic advantage that had come with the possession of these advance positions was more apparent than real, however. The Hango naval base was surrounded on the landward side by hostile Finnish territory so that supply and reinforcement were dependent on Soviet control of the Gulf of Finland. Instead of being fronted by a secure rear area as had been the case when Finland was a Russian province, Hanko (formerly Hango) would this time bear the brunt of a Finnish Army that had cast its lot with the Germans.

The security of the bases on the southern Baltic coast was not much better and had become worse with Germany's advance into the western portion of Poland in 1939. Soviet military planners expected – correctly – that the main threat would come from land, and had begun to develop a series of defensive positions. The pace of construction had been slow however, due in part to the Red Army's doctrinal expectation that defensive operations would quickly shift to the offensive on the enemy's territory. Exacerbating the resulting shortage of supplies and weaponry to fight a drawn-out siege were the uncertain command arrangements between the Army and Navy. Responsibility for the defence of naval bases had been entrusted to the ground forces which were to co-operate with naval artillery and naval infantry forces. Seemingly a sensible arrangement, this practical application of the 'unity of command' principle had only sporadically been translated into effective joint operational planning. Achkasov and Pavlovich tactfully put it as follows: 'unanimity in the organisation of forces operating jointly in the defence of a base was not achieved prior to the beginning of the war'. When the defending Army units were repeatedly forced back or cut off from the base they were supposed to protect, responsibility for base defence would repeatedly and suddenly fall into the lap of the unprepared Navy, forcing the latter to strip its ships of crews for duty on the frontline.

The Baltic Fleet went to 'Readiness State No. 2' on 19 June, meaning that ships were fuelled and crews put on alert. Other precautionary measures had been taken earlier in the wake of repeated German reconnaissance overflights and reports of German submarine movements off the fleet's forward bases. In mid-May, Vice Admiral Tributs, the Baltic Fleet commander, had decided to disperse some of his units, including submarines, from Liepāja to Daugavgriva (Ust-Dvinsk). Other ships were moved from Tallinn to Kronshtadt. Yet, despite an overwhelming number of strategic and tactical indicators of an impending attack, tactical surprise was complete. The result was that none of the Baltic Fleet's submarines was at sea when the German assault came on the break of day of 22 June.

German naval operations had preceded the main assault on land by a few days with the laying of mine fields in the Gulf of Finland. Additional barrages were shortly planted between Tallinn and Suursaari (Hogland) Island, off Liepāja, Ventspils, in the Irben Strait and elsewhere in the Gulf. Luftwaffe aircraft began to systematically attack the naval base at Liepāja, and magnetic mines were dropped in the fairway of Kronshtadt.

When it dawned upon Stalin that more than a 'provocation' was involved, the Soviets' first reaction was to emplace large defensive minefields across the Gulf of Finland. Three destroyers and one cruiser covered the operation on the night from 22 to 23 June; one destroyer sank on an enemy mine, while the two others suffered damage. On 26 June, the unexpectedly rapid advance of the German Army prompted Admiral Kuzentsov's order for the fleet's withdrawal. The panic-stricken local political commander in Liepāja ordered the destruction of all vessels, including five submarines, that could not be moved immediately.

The five underwater craft included the ex-Latvian *Ronis* and *Spīdola* that, through materially ready to go to sea, were evidently beyond the skills of their newly-installed Soviet crews.

The situation deteriorated rapidly. On 7 August German troops arrived on the coast of Kunda Bay in the Gulf of Finland, and, three weeks later, they stood on the outskirts of Tallinn. The order for naval units in Tallinn to evacuate had come the day before, and for the next several days, hundreds of large and small warships and transport vessels braved attacks from the air by day and the danger of the minefields at night to reach Kronshtadt. According to Soviet sources, 16 combatants of different types in addition to 87 per cent of the transport force were lost to mines and air attacks. German-source statistics are in approximate agreement.

The fate of the Baltic Fleet's outlying bases was the same elsewhere. The islands of Saaremaa and Muhu in the Irben Strait were lost on 21 October, and Hanko, about to be cut off from seaborne reinforcement and resupply with the oncoming ice, was evacuated in late November. At the close of 1941, both the northern and southern shores of the Gulf of Finland were in German-Finnish hands. Leningrad was under siege, and Stalin issued orders to begin preparation to scuttle all warships in Leningrad should the city fall. Meanwhile, the German-Finnish forces tightened the noose by seizing the islets of Suursari, Tyttersaari and Lavansaari deep inside the Gulf.

Few Soviet submarine operations of significance were carried out during the first six months of the war. Achkasov and Pavlovich merely report that, 'in connection with the withdrawal of the main forces of the Red Banner Baltic Fleet to eastern bases, the already adverse conditions for submarine operations against the enemy sea lanes continued to deteriorate'.

Before the war, the main task envisaged for the submarines had been the destruction of enemy shipping in the Baltic Sea. As already mentioned, not a single Baltic Fleet submarine was evidently on sea duty at the moment of the German attack. Three units of the 1st Submarine Brigade at Liepāja managed to take up stations between Liepāja and Klaipeda (Memel) sometime on 22 June. For reasons that are not obvious, the balance of the 15-strong brigade was evacuated to Ventspils and elsewhere. On the second day of hostilities, six submarines of the 2nd Brigade at Tallinn went to sea to assume defensive positions. By 27 June, a grand total of 20 boats operated in various locations along the Baltic coast for purposes of reconnaissance, minelaying and defensive 'holding'. All were recalled at the end of the month without having sunk a single enemy vessel. At the end of August, the Baltic Fleet had been forced to give up everyone of its advanced bases, so that all but two submarines had fallen back inside the confined waters of the Gulf of Finland.

The avowed aim of the Baltic submarine fleet to interdict the German-Finnish lines of communications became more and more difficult with each German advance up the Baltic coast and the growing threat of minefields deep inside the Gulf of Finland. By October-November, enemy mine barrages extended as far east as Hogland Island. An even greater danger than the minefields or the constant threat of air attack, however, was the spectre of losing Leningrad to the encircling German army. In an effort to put pressure on the German supply lines, the Baltic Fleet sortied 21 submarines in the second half of September. The results were meagre. The Soviet account lists five transport vessels, two tankers and one enemy submarine, while the German version of the episode credits Soviet achievements with only one steamer and one submarine.

Achkasov and Pavlovich's account of events concedes that, 'the enemy's extraordinary ability to employ positional anti-submarine warfare defences resulted in great losses'. They offer no detailed numbers, but German sources have it that 27 Soviet submarines (39 per cent of the starting line-up) were sunk or destroyed in port before the close of 1941. Soviet and German accounts dispute the amount of German shipping lost in exchange, but the most telling measure of the rather insignificant impact of the Soviet submarine weapon is that

German merchantmen in the Baltic Sea were permitted to sail without naval escorts. The Soviet submarine sink-loss ratio would improve somewhat in 1942, but the operational future of the Baltic Fleet's submarines was about to take a decided turn for the worse. Shortly, the German-Finnish forces would emplace the most successful anti-submarine barrier ever constructed in the history of naval warfare.

The Baltic Submarine Fleet contained

Although the annual freeze-over of the Gulf of Finland had brought all shipping to a standstill, hostilities in this strategic body of water continued through the winter of 1941–1942. German-Finnish forces occupied virtually the entire Gulf shoreline, but had yet to secure control of the Gulf itself. A key obstruction was the continued Soviet possession of several small islands deep inside the Gulf. Not only did the latter permit the Baltic Fleet to maintain a tenuous supply line to the encircled Soviet Army on the Oranienbaum beachhead opposite Kronshtadt, but also local artillery positions and forward-based torpedo boats continued to harass German-Finnish shipping. Both were sufficient reasons for the German-Finnish forces to attempt to dislodge the Soviet garrisons, but an even more important consideration motivated German and Finnish military planners. Namely, the idea had arisen to hermetically seal off the entire Gulf of Finland as far east as possible by means of a net barrier complemented by mine barrages. The Gulf islands were the linchpin to this strategy, prompting the Finns, later supported by German troops, to launch a series of furious infantry attacks across the ice.

Two of the islands, Suuarsaari and Suur-Tytersaari, were taken at the end of March, but the others, including Lavansaari, Peninsaari and Serikari, remained in Soviet hands. Despite partial success, the German-Finnish forces went ahead with establishing what has probably been the densest minefield in history. Some 13 000 mines of different types were planted across the eastern portion of the Gulf of Finland through the autumn of 1942. According to Soviet calculations, the interval between mines varied from about 18–137 m (60 to 450 ft), and the probability of a submarine encountering a mine from 30 to 60 per cent.

The opponent's failure to seize all of the Gulf islands, particularly Lavansaari at the centre of the mine barrier, had left the Soviets with a critical *point d'appui* in support of the continuing effort by the submarines of the Baltic Fleet to break out into the open sea. Lavansaari-based aircraft and artillery positions were able to provide much-needed assistance to minesweepers while, at the same time, presenting a constant threat to enemy anti-submarine warfare forces and mine-laying vessels.

The first Soviet submarine break-out attempt into the Baltic Sea came in June, and involved from seven to nine vessels. Unlike later practice, this first penetration called for the submarines to force the minefields independently, ie in groups of two and without the benefit of 'combat stability' provided by minesweepers and armed escorts. The first wave was relatively fortunate; apparently only one submarine (*M.95*) was lost on a mine. Clear of the barrier, the submarines operated in the western portion of the Gulf of Finland and in the Baltic Sea itself as far west as Swedish coastal waters. Soviet sources claim that this sortie produced the sinkings of 14 transports and damage to one. They offer no commentary that three of the destroyed vessels probably belonged to neutral Sweden. Reportedly, 47 torpedoes were expended in the course of 50 separate attacks.

The second wave of ten submarines began to deploy on 11 August, after the return on the same day, of the last submarine in the first echelon. The break-out was supported this time by energetic efforts, both in the air and on the surface, to suppress enemy anti-submarine warfare forces. The Soviets claim that the second-echelon submarines sustained 'relatively insignificant losses' on their patrols, and credit the 'tactical skill' of their commanders and

ineffectiveness of the opponent's anti-submarine measures. Again, there is a second opinion. Retired West German Vice Admiral Friedrich Ruge maintains that two submarines were lost on mines and that a third received serious enough damage to return to base. Also conflicting are alleged exchange ratios. Soviet literature credits the submarines in the second wave with the sinkings of 14 vessels, whereas Ruge limits the number to five. The latter also asserts that all five sinkings, in addition to two ships damaged, were caused by torpedoes. Achkasov and Pavlovich's version of events agrees that all sinkings were the result of torpedo attack, and adds that 46 torpedoes were expended in the process. If the Soviet claim is the correct one, then the consumption of 46 torpedoes to sink 14 ships is quite comparable to the relative effectiveness of German and Allied torpedo attacks during the Second World War.

The third and last wave of submarines to break out before the onset of the winter of 1942–1943 departed in groups of five, four, and seven between 15 September and 4 November. Before the last one returned in, the middle of November, about 15 transports plus several small combatants were destroyed in the course of 68 individual attacks.

Whichever figures are used, Soviet or German, the results of the Soviet Baltic submarine campaign in 1942 can hardly be called outstanding. The Soviets claim that the total of 35 submarines that participated in the three break-outs accounted for the destruction of 40 merchant vessels, several small warships, and possibly a number of freighters that ran onto submarine-laid mines. The German story, by contrast, holds to the destruction of only 26 ships with a gross tonnage of 52 500 and the damage of eight more (34 000 gross tonnage). The Soviet version of events acknowledges that success came 'at high cost', but fails to provide specific numbers. Ruge and Rohwer have estimated Soviet submarine losses in the Baltic Sea in 1942 at ten, plus at least seven damaged. Rohwer moreover points out how overall German and German-controlled shipping in the Baltic Sea for the year (excluding independent sailings) added up to 1738 vessels with a gross tonnage exceeding five million. It goes without saying that if these numbers are even anywhere close to correct, the Soviet submarine campaign had made little immediate impact, and that what little effect it did have came at a high price in submarines and experienced crews.

In fairness to the Soviet side, it must be emphasised that the Baltic Fleet submarines were forced to operate under the most difficult conditions. First of all, the annual icepack in the Gulf of Finland restricted submarine and other naval activities to about seven months out of the year. The forced five-month hiatus not only limited the opportunity to seek out the enemy, but it also gave the German-Finnish forces a long breathing spell to repair and strengthen their mine and other defences. One wonders also what the effect of long periods of inactivity may have had on crew proficiency.

A second handicap peculiar to naval operations in the Baltic theatre was the dominating influence of the area's constrictive maritime geography. Its impact on the productiveness of the Soviet submarine campaign worked in more than one way. Sea distances being relatively short, the length of time that a ship was exposed to the threat of submarine attack was comparatively brief. Quite often, German merchantmen and supply vessels travelled within sight of the coast, and therefore had the opportunity to quickly seek shelter in shallow and friendly (or neutral Swedish) waters. Moreover, the same ship that, when damaged in the middle of the Atlantic Ocean, might have to be abandoned, might well be kept afloat in the Baltic long enough to be brought into port for repairs, and sail another day. Another implication of the Baltic's confined geography was the constant threat of land-based air attack. This meant that German or Finnish ship or convoy under attack could often quickly call for assistance.

There was little the Baltic Fleet submarines could have done about these basic disadvantages. Many years later, Admiral of the Fleet of the Soviet Union Sergei G Gorshkov's *The Sea Power of the State* took the German U-boat campaign to task for its failure to combine operations with adequate air support. It is doubtful that the Admiral implied

criticism of his own service in this regard; it is true nevertheless that even though the Baltic Fleet on the eve of the war boasted a 600-plus aviation support unit, few aircraft, including the otherwise capable torpedo-bomber version of the Ilyushin DB-3F (Il-4) long-range bomber, were a match for the German Messerschmitt Bf 109 fighters. In any case, the bulk of Navy's attack aircraft was quickly diverted to the battle on land.

Still, modern Soviet commentators have not been loath to admit that material and tactical shortcomings contributed to the fleet's disappointing results. Submarine commanders repeated some of the same mistakes made by the Imperial Fleet 25 years before. Again, patrolling submarines relied mainly on the passive, so-called 'positional method' to wait for an enemy ship to happen within torpedo-launching range. Achkasov and Pavlovich blame an 'insufficiently critical approach to the results of operations by Russian submarines in 1914–1917 . . . which clearly demonstrated the inadvisability of this method'. Holding operations in narrowly-defined patrol zones, the same authors rightly conclude, sharply reduced the probability of detecting enemy ships while increasing the chances of hostile counter-detection.

The low probability of sinking a vessel with a single-torpedo salvo was another lesson the Soviets had to relearn. Firing distances were typically between 1830–2290 m (2000–2500 yds). This was well within the advertised range of contemporary torpedoes, but it did not account for such tactical factors as relative speeds, firing angle, and the size of the target. By the end of 1942, the Soviet submarine fleet had learned the same lesson that became common practice for submariners elsewhere: the necessity to attack with multiple torpedoes fired in spread salvoes or at rapid intervals.

Western sources have, with little exception, rated the material and human quality of the Soviet submarine force in the Second World War much below the standards of the German and Anglo-American navies. The purported stoicism and perseverance of Soviet submarine crews, and their ability to improvise under the worst of circumstances, have been praised highly, but the balance of opinion has been well summed up by Jürg Meister:

> '. . . Soviet submarines were technically inferior; commanding officers and crews were with very few exceptions inadequately trained, strategically badly employed and tactically unskilled.'

As has already been pointed out, Soviet sources themselves have not hesitated to complain about tactical mistakes, at least early in the war. Material shortcomings too have been criticised, although the technical quality of the submarines themselves has not been put into question. For example, the 'S' and 'K' classes have been lauded as 'most modern submarines' and 'not qualitatively inferior to those of foreign fleets'. Soviet authors similarly claim that their country's models 1933 and 1938 torpedoes were on a *par* with the majority of foreign torpedoes, and they disclaim having experienced the problems with proper depth-keeping and premature detonation that plagued German and American torpedoes early in the war.

A few Soviet submarines at the start of the war were equipped with an acoustic detection system, known as Drakon-129. By all accounts, the equipment proved of little value in the detection of enemy vessels or the safe navigation of enemy minefields. Attempts to use the Drakon device for submarine-to-submarine communications appear to have been unsuccessful.

All Soviet submarines were equipped with short-wave radio sets, but there are conflicting reports about the extent of their use. Several non-Soviet accounts claim that Soviet submariners used their radios quite freely with the result that their opponents usually knew how many were at sea. A report by ONI in 1948, on the other hand, concluded that Soviet doctrine during the war prohibited submarines on patrol outside home waters from ever using their radios except in an extreme emergency. The report's opinion that, there 'is no reason to believe that there has been a change in such high standards of communication security', implies that Soviet submariners generally abided by this rule.

A major material shortfall in the Soviet submarine force of the Second World War as reported by the Soviets themselves were insufficient numbers of modern support forces, especially minesweepers and reconnaissance aircraft. Regarding the first category, the entire modern Soviet minesweeping fleet on the eve of the war stood at 39 (the *Tral* class built between 1935 and 1940). A corollary effect of the lowly place of mine warfare forces in Stalin's 'Big Navy' plans was that planners had failed to stay abreast of evolving mine technologies. As a result, the German use of influence mines was completely unanticipated and found the Soviets without countermeasures.

As has already been noted, the *paper* strength of the Baltic Fleet's air arm was considerable. However, between a majority of obsolete planes, the lack of a night-flying and all-weather capability, and the competing demands of the war on land, its *effective* strength was minimal. Throughout 1941, the Baltic Fleet could call on only 242 aerial reconnaissance sorties for all of its operations.

Combat activities in the Baltic Sea during 1943 and the first nine months of 1944 were marked by the effective neutralisation of the Soviet submarine force. The renewed German-Finnish anti-submarine campaign began with the laying of over 10 000 mines and explosive floats in both the western and eastern ends of the Gulf of Finland. Meanwhile, the earlier Finnish idea to close the Gulf once and for all was put into effect, between March and May, with the installation of the 'Walross' double submarine net between Porkala on the Finnish coast and Nargoen west of Tallinn. Measuring about 48 km (30 miles) across and some 55 m (180 ft) in depth, this new obstruction accomplished what tens of thousands of mines had not: not a single Soviet submarine managed to penetrate the barrier until after the capitulation of Finland in September 1944. Several attempts were made between May and September, but in each case the daring submarine was either forced to turn back or destroyed by mines and enemy patrols. A Soviet account appropriately concluded: 'Further attempts to force the Gulf of Finland made no sense in the face of such a tight anti-submarine barrier'. And, it added, 'it would be necessary to eliminate the anti-submarine barrier with force or to create a by-pass route . . . by seizing the south and north coasts of the Gulf of Finland'.

The opportunity to by-pass the 'Walross' barrier came with Finland's acceptance of a cease-fire on 4 September 1944. Soviet forces occupied the island of Surrsari, bringing to an end German control of the minefields, and on 23 September the last German forces were evacuated from Tallinn spelling the end of the 'Walross' net. After an absence of 22 months, Baltic Fleet submarines reappeared in the Baltic Sea in October, too late to interfere with the massive German withdrawal from Tallinn. Curiously, none of the 18 submarines that patrolled in the Baltic until the end of the year made an attempt to attack the 'pocket battleship' *Lützow* or the heavy cruiser *Prinz Eugen*.

The Soviet version of the last three months of 1944 reports 23 submarine sorties against enemy sea routes and 11 reconnaissance missions. Also claimed are the sinkings of 13 transports for an expenditure of 132 torpedoes – an abominably low hit rate, especially considering that three of the victims were sunk by gunfire. The Soviets admit that their accomplishments 'could have been significantly greater', and attribute this poor performance to a variety of factors, including the deterioration of crew efficiency after a nearly two-year break in operations, and inexperience with night torpedo attacks. Also blamed are the 'deleterious consequences' of the minelaying operations conducted by the Royal Air Force. Commented Achkasov and Pavlovich: 'The brilliant successes of the Soviet armed forces made it possible to draw a fairly reliable conclusion as to the real purpose behind these British mine plants'.

According to official Soviet statistics, the Baltic Fleet on 1 January 1945 was 24 submarines strong. Yet, between that date and the German surrender on 8 May, the same source reports that only 27 submarine patrols were staged. It is not clear if this patrol rate reflects the work of a few submarines or a fairly even division of labour. One indication that

the former may have been the case is that a detailed chronology of this period identifies only six Baltic Fleet submarines. Soviet historians also fail to mention the participation during the final months of the war of the (largely Estonian-crewed) ex-Estonian *Lembit*. In any case, the productivity of this flotilla remained as low as it had been before – this in spite of the fact that the Soviets had complete mastery of the air and an abundance of lightly protected German sea traffic engaged in carrying off an estimated 2.2 million refugees.

The submarines did claim their victims, including several liners with thousands of refugees aboard. German and Soviet sources are in agreement that altogether 13 transports were sunk by submarines through the beginning of May. Again, the hit rate was a low one: 152 torpedoes were launched in 52 attacks.

The Soviets credit the Baltic Fleet submarines with the destruction, throughout the war, of 74 enemy merchant vessels with a gross tonnage of 113 180. German figures are much lower. The Soviets have not announced how many of their submarines were lost in the process, confirming merely 'the difficulty of using (submarines) in a theatre such as the Baltic'. One non-Soviet estimate had established the number of Baltic Fleet submarines destroyed or scuttled at 45 – hardly a favourable trade-off.

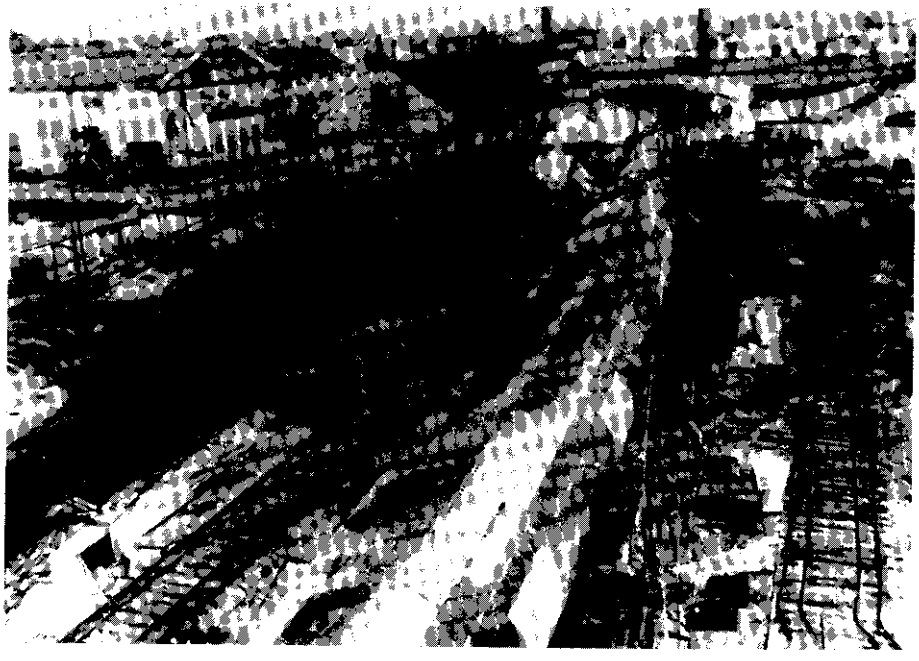
Operations of the Black Sea Fleet

When the Black Sea Fleet received Admiral Kuznetsov's signal on the midnight of 21 June to go to 'Readiness State No 1', the majority of its warships was concentrated at Sevastopol, having recently completed a series of manoeuvres. Within a few hours of the order, German aircraft, guided by the lights of Sevastopol's lighthouses, began to drop magnetic mines.

As in the north, the German High Command had given little thought to ways and means of seizing control of the Black Sea as part of its overall strategy against southern Russia. The adverse naval balance gave the Germans little incentive, of course, to seriously contemplate the prospect of a major naval offensive. Besides 47 submarines, the Black Sea Fleet had at its disposal 22 large combatants, numerous torpedo boats, and a naval air arm with 626 aircraft. The German effort at sea had to rely principally on the small and mostly obsolete naval forces of allied Romania.

As was the case in the Baltic Sea, so naval events in the Black Sea were determined almost exclusively by the ebb and flow of combat on land. They were two very important differences nevertheless. In the first place, the Axis never quite succeeded in extending their control over the southern USSR shoreline to the same degree as they were able to in the Baltic theatre. Even though their forces eventually occupied about two-thirds of the Soviet Union's Black Sea coast, including its principal ports and harbours, the Black Sea Fleet was always left with enough manoeuvring room to pose a constant threat to the German positions on land and at sea. Secondly, the distant geography of the Black Sea made it difficult for the Germans to replace shipping losses. This meant that even moderate losses could have an immediate and serious impact on the supply situation on land.

The initial German advance, supported by the Romanians, portended the same disaster that had befallen the Soviets and their fleet in the Baltic area. Nikolayev with its huge shipyards fell on 17 August. The Soviets managed to evacuate some of the partially-completed warships, but many had to be scuttled or fell under German control. Among the latter were the battleship *Sovietskaya Ukraina* (75 per cent complete), two *Chapayev* class cruisers, and a battlecruiser (20 per cent complete). Odessa was lost after a drawn-out siege in the middle of October, and Rostov on the Sea of Azov was captured by the Germans on 22 November. A Soviet counter-push dislodged the Germans from this second city within a week, however, and it would not be until the middle of the next year that Rostov would fall into German control again.



S-class submarines (*S.36* and *S.37*) captured by the Germans at the Nikolaev Yard in August 1941 (US Naval Historical Center).

The siege and eventual capture of Odessa was the first instance to show the attacker's weakness at sea. Surrounded from all sides on land, the order to evacuate the city was given on 30 September. For the next 16 days, convoys and individual sailings managed to transport 86 000 Soviet troops with much of their equipment, for their next stand, at Sevastopol. Enemy interference was minimal, and limited to sporadic aerial mining of Sevastopol harbour.

Both sides recognised that possession of Sevastopol was critical to the other's sea lines of communications. Continued Soviet control of the Black Sea Fleet's main base meant that the German supply line from Romania to the Crimean Peninsula would be constantly at risk from the air and at sea. German control of the waters around the Crimea, or at least the denial of such control to the Soviets, would be even more important as the Germans prepared their main advance into the Caucasus and to the eastern shore of the Black Sea.

Sevastopol's defenders had turned the city into a gigantic fortress. When the enemy launched its first attack on 30 October 1941, the garrison mustered 52 000 men, 170 guns, and about 150 aircraft. Supported by the big guns of the ships of the Black Sea Fleet, and resupplied and reinforced by sea, the city held out for 150 days. Making matters worse for the investing Germans, who could ill-afford a lengthy siege, were repeated Soviet flanking attacks from the sea.

The final offensive against Sevastopol began on 7 June 1942, and required nine infantry divisions supported by over 2000 batteries of guns and the entire strength of the VIII German Air Corps. As each of the city's main fortifications was systematically battered to rubble, and constant air- and long-range artillery bombardment forced the Soviet Navy to pull out its large warships, Black Sea Fleet submarines and motor torpedo boats bore the brunt of resupply and evacuation of the wounded. Sevastopol fell on 5 July, and with it went into capture nearly 100 000 defenders whose evacuation had been forbidden by Stalin. Two

months later, the Germans reached the limit of their advance along the Black Sea with the crossing of the Kerch Strait and the capture of the Black Sea Fleet's last main port, Novorossiysk. Henceforth, the over-extended German war effort in southern USSR essentially concentrated on safeguarding Army Group A's supply line to the northern slopes of the Caucasus.

The condition of the Germans deteriorated inexorably after the surrender of Von Paulus' 6th Army at Stalingrad on 2 February 1943. Within a few months, the Soviets had pushed their opponents across the Donets river and, after another major offensive in July, the Crimea itself was being threatened. On 10 September the Soviets staged a large-scale amphibious assault against Novorossiysk, two days after Hitler had permitted his forces there and on the Kuban River brigehead to evacuate. The German retreat back to the Crimea was completed in good order; losses in lives and equipment were small, although the Soviets have claimed differently.

The Black Sea Fleet suffered a major setback in its attempt to cut off the withdrawing enemy. Two destroyers and one destroyer leader were caught by German dive bombers at early daylight on 6 October. All three (40 per cent of the remaining destroyer force of the Black Sea Fleet) were sunk under repeated attacks. Shocked, Stalin gave immediate orders that the surface fleet would henceforth limit its operations to direct support of the ground forces and only insofar it would have the protection of airpower. The withdrawal of the fleet from offensive seagoing operations was probably instrumental in the successful German blockade and ultimate destruction of the Soviet beachhead at Eltigen, south of Kerch.

As 1943 drew to a close, continued German control of the Crimea became increasingly irrelevant to Germany's overall strategic condition in the south of the USSR. By November, the main German defensive line had fallen back across the Dnieper river, south to Odessa, with the result that the Crimea had become cut off from the rest of the front. Minor units of the Black Sea Fleet had already begun to use some of the small harbours and roadsteads west of the peninsula, thereby endangering the last escape route for the occupying Germans. Fortunately for the Germans, the Soviets made no concerted effort to cut Sevastopol's supply line westward, but focused their attention instead on Odessa. Still no large surface combatants were employed; submarines and torpedo boats were active, but the principal means of attack were the bombers of the Soviet Air Force and the naval air arm.

Nikolayev was retaken by the Soviets on 28 March 1944, and Odessa was evacuated by the Germans in the first half of April. Again, the Germans were able to complete their seagoing retreat to Romanian ports without substantial interference from the Black Sea Fleet. Nearly 25 000 soldiers and refugees, along with 54 000 tons of materiel were moved during a ten-day period without suffering – according to German reports – a single loss. One Soviet claim that over 30 assorted vessels were sunk has been rejected by Ruge as 'pure invention'.

The last important chapter in the Black Sea campaign lasted from 8 April until 13 May, and entailed the Soviet offensive to recapture Sevastopol. The attack was carried out on land and from the air, while an average of eight submarines joined with torpedo boats in an attempt to cut German communications across the sea. Again, the presence of the Black Sea Fleet's large warships would have been helpful, for despite constant harassment, especially from the air, the Germans succeeded for two months in bringing in essential supplies and removing their wounded. The Soviets inflicted the heaviest losses during the final days of the siege, after Hitler had finally given permission to evacuate Sevastopol, and German shipping of all types attempted to remove the garrison. Between 5 and 12 May, eight transport vessels and about twice as many auxiliaries were sunk, mostly due to air attack.

Submarine actions

The main responsibilities of the submarines of the Black Sea Fleet on the outbreak of war were twofold: one, interrupt the enemy's sea routes along the Romanian and Bulgarian coasts, and two, protect the Soviet Union's own sea lines of communications, particularly the tanker lanes along the shores of the Caucasus. The commitment of part of the Black Sea Fleet's two brigades of submarines to this second task away from the centre of fighting probably reflected Soviet uncertainty about Turkey's attitude.

Between sporadic mine laying and torpedo attacks, little was accomplished at first against enemy shipping. This was partly due to the low density of traffic, but also because of a shrinking patrol rate. During the first three months of warfare, about 13 submarines accumulated some 113 patrol days, so that an average of little over one submarine was at sea on any given day. From mid-October 1941 until the beginning of July of 1942, only nine submarines spent a total of 85 days on patrol, for an average daily presence of less than one-third of a submarine. These low numbers are all the more surprising in light of the Black Sea Fleet's starting line-up of 44 submarines. Two reasons can be advanced for this apparently low rate of availability. The first is that, although numerically considerable, the Black Sea Fleet submarine flotilla operated a number of boats that were clearly obsolete and that, as reported in the previous chapter, demanded constant repair and maintenance. Included among those were three *Dekabrist* class, three *Leninetz* class and five *Metallist* class submarines. The second possible explanation is that the enforced evacuation of the fleet from its main bases compelled the submarines to spend more and more time in transit to and from their new and improvised harbours further eastward, thus leaving less time on station. This new circumstance practically excluded the small *Malodki* class submarines from offensive operations, and placed a much heavier strain of the medium-entrance 'Shch' type boats as well. Paradoxically, the effective reduction of the Black Sea Fleet's operating strength had one beneficial result: in order to still cover the areas of interest, the submarines were forced to switch from positional patrol tactics to cruising operations over wider areas.

Submarine operations in 1942 were keyed to the developing situation on the Crimean Peninsula and in southern Russia. As the Germans pushed toward the Caucasus and prepared their siege of Sevastopol, their dependence on seaborne supplies grew. Italian and Romanian tankers had begun to pass through the Turkish Straits, causing the Soviets to regularly deploy two or three submarines at the entrance to the Bosporus. Evidently, neutral Turkish shipping was brought under attack as often as the enemy's.

With the tightening German investment of Sevastopol in the spring of 1942, Soviet reinforcement and resupply by sea became increasingly difficult. At first, the Soviets turned to the use of fast warships to transport troops and materiel, but this solution could only be temporary in the face of the enemy's superiority in the air. Starting in the early May, submarines of all types were thrown into the battle to replenish the garrison and evacuate the wounded. Additional cargo space was created by the removal of reserve torpedoes, ammunition and other essentials. According to Soviet authors, 3700 tons of supplies and about 1200 personnel were moved in this fashion during May and June. The Germans report that four submarines (*Shch. 208, 212, 214* and *S.32*) were lost during the operation.

After the fall of Sevastopol, the submarines returned to their favourite patrol areas off the Bosporus and the coastal convoy routes along Romania and Bulgaria. No Soviet statistics are given for 1942, probably a reliable indication of the insignificant results that were achieved. German sources admit the loss of 11 vessels, including six Turkish, in exchange for the sinkings of ten submarines.

Soviet historians divide the Great Patriotic War into two periods; the first is the period of 'active defence' that ended with the German defeat at Stalingrad in December 1942, and the second includes the great offensive campaigns that culminated in the fall of Berlin in May

1945. With the decline of Germany's military fortunes during this second period, the security of the Black Sea coastal lines of communications became increasingly important. Especially critical to the Germans was the Kerch Strait that connects the Crimea with the eastern shore of the Black Sea. Cut off on land, German troops on the Kuban bridgehead had become vitally dependent on supplies by ship across the Strait. Small wonder Soviet submarines concentrated their efforts on blocking this passage.

Unfortunately, the Soviets have failed to give a thorough account of the results of what became, in Achkasov and Pavlovich's own words, 'one of the most important (tasks) for the Black Sea Fleet'. Three or more submarines commonly patrolled the southern entrance to the Kerch Strait, but Achkasov and Pavlovich concede that despite the 'growing effectiveness' of Black Sea Fleet submarine operations generally, the blockade itself was ineffective. The final Soviet balance sheet could show the sinkings of perhaps three steamers, a few tugboats and lighters, and a handful of small patrol craft.

It is not clear at all why the Soviets were unable to achieve more substantial results. At one point, the alleged German habit of sending convoys in small groups is blamed, yet elsewhere, Achkasov and Pavlovich report convoys with as many as 300 vessels. In any case, studies of the convoying system in the Atlantic theatre have consistently shown that the effectiveness of the U-boats was directly related to the number of individual targets, whether sailing in single convoys or independently, and not the size of the convoy.

Soviet success on the opposite shore of the Black Sea was not much better. Possibly seven, including three neutral Turkish, vessels were sunk off the Bosporus and the Romanian coast. The best available estimate for total Black Sea Fleet submarine losses in 1943 is seven.

The Soviet failure to report their wartime submarine losses is part of the reason for the uncertain strength of the Black Sea Fleet submarine fleet in 1943–1944. Ruge has reported that an average of 30 boats was available through 1943, six of which were routinely on station. Meister has listed the official Soviet figures at the beginning of 1943 and 1944 of 22 and 29 submarines, respectively. Seven *Malodki* class boats were reportedly transferred in the second half of 1943, the implication being, of course, that the Soviets suffered no submarine losses at all in the Black Sea during 1943. Confusing matters further is a Soviet statement that 18 to 19 of their submarines in the Black Sea were serviceable in the first half of 1943, and that another two or three became available later in the year. Based on a starting inventory of 22, this implies a serviceability rate during the first six months of 1943 of 90 per cent or better! This is an unusually high figure for *any* navy; in the Soviet case, it is simply extraordinary! Indeed, the Soviets themselves have provided figures that cast this claim in serious doubt, to say the least. According to Achkasov and Pavlovich, 'limited repair facilities' caused the submarines of the Black Sea Fleet to begin operations in 1944 with a serviceable strength of 40 per cent. This number reportedly dropped to 32.2 per cent by March. It is highly implausible that operational readiness could have fallen by 50 per cent or more in one year's time. The same authors also report that 13 submarines were on duty at the end of April, which is close enough to 40 per cent of 29 to seemingly substantiate the Soviet implied claim of zero submarine losses during 1943. Yet, it does not. For, starting in the early spring of 1944, the Black Sea Fleet had begun to receive large reinforcements from the other theatres. Four *Malodki* class submarines were shipped overland from the Arctic Fleet, ten came from the Pacific, and one more was delivered after trials in the Caspian Sea. These additions more than made up for the seven sinkings in 1943 claimed by the Germans, and could furthermore readily account for the ability of the Black Sea Fleet to deploy 13 submarines in spite of a serviceability rate of 40 per cent or less.

The 1944 offensive by the Black Sea Fleet against the retreating Germans relied mainly on aircraft. A Soviet history of this campaign year offers little explanation for the relative inactivity of the submarines other than citing the aforementioned low availability rate. Those submarines that did go to sea were most active in the course of the German

evacuation of the Crimea. Seven to eight cruised almost continuously between Sevastopol and Romanian ports, and were reportedly responsible for destroying 13 vessels.

The campaign in the Black Sea ended on the Soviet side of the ledger with 217 Axis vessels with a gross registered tonnage of 317 522 sunk. Thirty-three of the enemy's losses in shipping that the Soviets have claimed was the work of submarines, ie approximately 72 ships with a total displacement of some 105 000 gross registered tons. Again, the Soviets have not announced their submarine losses. Meister has calculated that they amounted to 28.

Northern Fleet operations

The Northern Fleet was preparing to celebrate the eighth anniversary of its establishment, when its commander-in-chief, Rear Admiral G G Golovko, received the order on 19 June 1941 to prepare his submarines for sea. The brigade consisted of three divisions and an order of battle as follows:

1st Division: *K.1*, *K.2*, and *D.3*
2nd Division: *Shch.401*, *402*, *403*, *404*, *421*, and *422*
3rd Division: six *Malodki* types

In addition, the Northern Fleet had available five modern and three older destroyers, three torpedo boats and 20 torpedo craft, 12 mine warfare vessels, and a variety of auxiliaries, including a few icebreakers. Its naval air arm counted 116 aircraft.

Although small compared with the other fleet areas, the Northern Fleet had one very important advantage: an open exit to the Arctic Sea afforded it wide manoeuvring room and ensured an – albeit tenuous – line of communications with the rest of the world, including its Anglo-American allies. Two routes connected the Fleet with the open ocean. The first and most important one led around Norway's North Cape to the Atlantic Ocean. Next, the Northern Sea Route skirted the Siberian landmass and the permanent icepack of the North Pole to provide passage to the Pacific Ocean. Both routes were risky, however. The westward passage rounded German-occupied Norway, whereas the Arctic passage could be safely negotiated only about two months out of the year.

A third route used by the Northern Fleet to receive reinforcements was the Stalin Canal. Built in the 1930s, it connected the White Sea with Leningrad via a series of lakes and interconnecting canals. The canals were large enough to accommodate ships up to 3000 tons.

The German-Finnish offensive in the northernmost tip of Europe was aimed at forestalling a possible Soviet threat against German-occupied Norway. Key enemy objectives were the Northern Fleet's principal naval bases and airfields, and the severance of the Murmansk railway. As elsewhere in their Russian offensive, the Germans failed to exploit the full advantages of seapower. Instead of assaulting the bases at Murmansk and Polyarny directly from the sea, they placed their hopes on a conventional attack across land. The advance went according to plan for a few weeks, but by the close of 1941, the frontline ground to a halt on the Litsa river, about halfway between Petsamo and Murmansk. Here, the two sides would face one another until the German retreat in 1944. Throughout, Murmansk and Polyarny remained fully operational. Both sides' efforts at sea settled down to breaking the other's line of communications. For the Germans, the principal naval target were the Allied convoys to Arkhangelsk and Murmansk. The Soviets concentrated their submarine efforts on the enemy's coastal supply trade.

Opening moves

While operations on land slowed down to static warfare, both sides proceeded to reinforce their respective naval contingents. In early July 1941, the Germans sent a few U-boats along with the 6th Destroyer Flotilla to begin operations off the Kola coast. The next month, the Soviets used the Stalin Canal to transfer three 'K' types (*K.21, 22, 23*). In September additional units arrived via the same route, including the *Stalinetz* class boats with hull numbers *S.101* and *102*, plus at least one further 'K' type (*K.3*). Complementing the underwater order of battle at the end of August were two partially finished *Leninetz* types and, reminiscent of the period 1914–1917, two British submarines.

Nine of the 15 submarines in the Arctic Fleet were at sea on 22 June. Two had been ordered to take up defensive positions off the Kola Fjord, three guarded Rybachy (Fisher) Peninsula with its artillery defences overlooking Motovsky Bay, and four were deployed between the Varanger Fjord and the Norwegian port city of Hammerfest. *Shch-402* has been reported as the first Arctic Fleet submarine to attack German shipping. According to the Soviet account, a vessel was sunk at anchor at Honningsvag, at the entrance to the Porsangen Fjord. The German version of events acknowledges that an attack was made, but insists that *Shch-402*'s torpedoes exploded harmlessly on the rocks near the ship.

After the first few patrols, the Arctic Fleet reorganised its submarine patrol schedule to better accommodate the different ranges and endurance of each class of boats. The smaller *Malodki* types would henceforth cruise among the skerries in the Varanger and Tana Fjords; the medium-size *Shchuka* class boats were assigned to the area west of the Tana Fjord as far as North Cape, and the large 'K' types deployed as far west as Vest Fjord between the Lofoten and the Norwegian mainland. Besides attacking shipping, the vessels, particularly the 'K' class, were frequently detailed to lay mine barrages.

Soviet historians have modified (meaning reduced) claimed enemy shipping losses in the Arctic during 1941 on several occasions. Achkasov and Pavlovich do not cite specific numbers of vessels or tonnages sunk. Instead, they merely confirm that 40 enemy transports plus several small warships fell prey to submarines during the 'first period of the war'. Elsewhere in their book, they compare the opponent's overall wartime submarine-inflicted losses of 184 475 gross registered tons with his alleged loss of 120 000 tons during 1943 and 1944 alone. Based on these numbers, the Northern Fleet's submarines would have reduced the amount of German shipping space during 1941 and 1942 by less than 65 000 gross registered tons.

The amount of submarine-inflicted destruction in the Arctic region during 1941 was evidently less than satisfactory. Achkasov and Pavlovich have commented on 'negligible results' and the 'poor success of submarine operations in the early months of the war'. Many of their reasons are identical to the ones given for the problems of the Baltic and Black Sea Fleets: inadequate support from reconnaissance aircraft, the false economy of trying to inflict a 'kill' with a single torpedo, and the overly-static positional patrol method.

The most versatile submarine type in the Northern Fleet was the 'K' class. The boat's 100 mm gun battery usually outclassed the opponent's escorts, and there have been several occasions in which a 'K' out-duelled a surface opponent. Its principal weapon against German convoy traffic, however, was a large load-out of mines. A standard tactic was to strew mines in the path of the advancing enemy ships.

Important defensive operations were carried out on behalf of the Allied convoys. One tactic was the use of a so-called 'suspended screen', whereby four or five submarines would interpose themselves between the enemy-held Norwegian coastline and the convoy route. Once the convoy had passed through the danger area, the submarines would switch back to offensive operations against German coastal traffic. The Soviets claim to have sunk 45 transports with a total gross registered tonnage of 45 000 during 1942. The opposite side

has admitted to about one-half of these numbers. German records also disclaim the Soviet report that a torpedo attack by *K.21*, on 5 July 1942, damaged the battleship *Tirpitz*, forcing the latter to cancel a planned attack against Allied convoy PQ-17.

German and Soviet records are in agreement that the Northern Fleet lost nine submarines during the course of 1942. Newly-commissioned into the fleet during the same year were *L.20* and *22*, and two or three *Malodki* types. A further five *Malodkis* (*M.105* through *108*) may have arrived in late 1942, but probably did not become fully operational until the spring of the next year.

Substantial reinforcements arrived in 1943. They included eight *Stalinetz* types, two *Malodkis*, and *L.15*. The latter, in company with *S-51* and *S-54* through *56*, arrived after an eventful journey across two oceans that began in September the year before. Sailing in groups of two and four, the original complement of six boats set out from their Pacific Fleet bases into the direction of the Panama Canal. After a stop-over in Dutch Harbor, Alaska, *L-15* and *L.16* were nearing their next port of call, San Francisco, when *L.16* was struck by one or more torpedoes and sank. Although the evidence is still not foolproof, most non-Soviet sources are agreed that the responsible party was probably the Japanese *I-25*. Soviet sources have speculated that the culprit may have been an American submarine.

Operations in 1943–44

Submarine action in the Arctic waters during 1943 and 1944 followed the pattern set in 1942. Six submarines were typically on station off the Norwegian fjords, waiting to intercept the small German supply convoys and independent sailings. Co-operation with aircraft for reconnaissance purposes increased as the naval air arm began to receive more aircraft. The daily patrol routine was very much affected by the changing seasons. During the Arctic summer, perpetual daylight forced the submarines to interrupt their standing patrols and move further out to sea to recharge the batteries. Unfortunately, the submerged trip back to station exhausted much of the newly-stored energy.

As time went by, the submarines of the Arctic Fleet became more proficient, but so did the opponent's countermeasures. Additional minefields were planted in the Kola Bay and Kara Sea, and as the Germans tightened their escort screens, Soviet submarines were forced to open up the range for torpedo attack. Responding to the heightened effectiveness of German anti-submarine measures, the Arctic Fleet resorted increasingly to the use of aircraft to both attack enemy shipping directly and to strike against the bases of the opponent's escorting forces. At the end of 1943, submarines still accounted for most of the enemy shipping tonnage sunk, aircraft being in second place, but one year later the positions had reversed when aircraft reportedly destroyed about three times as many vessels as did the submarines.

The Northern Fleet entered its final year of active hostilities with an official inventory of 23 submarines. During 1944, it was strengthened with the arrival of three ex-British 'U' type boats, redesignated by the Soviets as the 'V' class. The three vessels (*V-2* through *V-4*) were part of what been originally a four-unit transfer arrangement pending Soviet receipt of its share of the surrendered Italian fleet. *V-1* was lost at sea while *en route* to her new Northern bases; *V-2* through *V-4* were returned to the British in 1949.

At least 11 Northern Fleet submarines were at sea in January 1944 to participate in a co-ordinated air-surface-submarine offensive against enemy shipping in the area off North Cape. One freighter of some 5000 tons was reportedly sunk. A second combined operation was staged in the second half of February, again with negligible results. It was on this occasion that *S.56* became the first Soviet submarine to make a submerged attack on the basis of acoustic information only.

Submarines were teamed up with aircraft or torpedo boats on several more occasions, but results were disappointing. The bulk of enemy losses was attributable to the increasingly potent Air Force and Naval Air Arm. Some Soviet writers have blamed insufficient numbers of submarines. But if this is so, the question is begged why more submarimes were not transferred away from the Pacific Fleet. Throughout the war, the size of the Pacific submarine force matched (and sometimes exceeded) the combined forces in the three-war-fighting theatres. Certainly, the likelihood of a Japanese attack after the defeat at Midway in June 1942 was practically zero.

Drawing up a final balance sheet on the performance of the Soviet submarine fleet during the Second World War is a risky undertaking at best. As reported in the opening pages of this chapter, the main problem is the Soviet refusal to fully disclose their war records. It is not obvious what gain can be had by treating the 'after-action' reports on events more than 40 years ago as state secrets. Indeed, it may have precisely the opposite effect, and help perpetuate the generally low esteem that is held in the West of Soviet wartime performance.

Soviet historians record that their submarine fleet sank a grand total of 402 437 gross registered tonnage. German records confirm one-half or less than this number. Reportedly, altogether 109 Soviet submarines were lost due to enemy action or scuttling. Based on the Soviet-supplied estimate of enemy sinkings, this translates into an exchange rate of one submarine lost for every 3700 enemy tons destroyed.

Soviet sources are even less precise about the *number* of vessels that made up the 402 437 tons reputedly sank. The displacement of the average German coastal vessel was about 2500 tons. If this criterion is used, it turns out that the sinkings of about 160 vessels would have been achieved at the cost of more than 100 submarines.

Meister has calculated that a total of 272 Soviet submarines saw service at one time or another during the war years. This suggests that two out of every five operating boats were destroyed. By comparison, the Germans lost two of every three submarines placed into service, and the United States two of every 11. Table 10 compares the performance of the German and American submarine fleets with the (inferred) accomplishments of the Soviets.

Table 10: Soviet submarine performance in the Second World War compared with the United States and Germany

Country period	Number of submarines in service			Merchant ships sunk by submarines		Merchant ships sunk per submarine lost	
	Initial	*Total*	*Lost*	*Number*	*Tonnage*	*Number*	*Tonnage*
Germany 1939–6/42	57	410	78	1602	7 860 000	20.5	100 800
Germany 7/42–1945	331	1080	707	1226	6 827 000	1.7	9700
Germany 1939–1945	57	1162	785	2808	14 687 000	3.6	18 700
USA 1942–1945	111	288	52	1178	4 860 000	23.0	93 500
USSR 1941–1945	218	272	109	160	402 437	1.5	3692

Source for German and US data is George R Lindsey, 'Tactical Anti-Submarine Warfare: The Past and Future'. *Adelphi Paper* No 122, spring 1972.

The most obvious contrast that shows up in Table 10 is the relatively poor record of the Soviets in terms of merchant tonnage sunk versus submarines lost. The German statistics become comparable for the period after July 1942, ie after the U-boats had lost the Battle of the Atlantic.

One difficulty with comparisons such as the one above is that much depends on one's

measures of effectiveness. For example, the Soviets turn in a somewhat better performance if they are measured based on the percentage of enemy 'throughput' destroyed. Throughput in this case means the amount of convoyed tonnage that arrives at its destination unscathed. In the case of the Western Allies, the overall loss in convoyed throughput for the duration of the war was 0.7 per cent. No comparable overall figures are available for the volume of Axis shipping tonnage that travelled in convoy. But a few isolated figures may be suggestive of Soviet performance based on the throughput criterion. For example, German war records report that 1 300 000 tons of escorted shipping moved in the Black Sea during 1943. The same records also show the loss of 28 000 tons; the Soviet claim is 35 000 tons. This implies that Soviet submarines were responsible for eliminating 2.2 to 2.5 per cent of the enemy's throughput. A similar calculation for the Northern theatre in the same year is much more sensitive to a wide variation in losses claimed and admitted. The submarine-inflicted loss rate to German convoy traffic based on German records was 0.4 per cent; the Soviet claim results in a loss of 2.4 per cent. Yet, even the lower number is comparable with the performance of the U-boats.

Perhaps the truest measure for judging the Soviet submarine fleet is a qualitative one. Two considerations merit attention: first, the unusually difficult circumstances in which it had to carry out its duties, and secondly, 'mission asymmetry'. With regard to the first, one need only compare the Soviet and Anglo-American histories of the Second World War in order to quickly realise that the Soviets fought a *land* war, and the Western Allies an *oceanic* war. The heroic moments in the British and American chronologies turn on events at sea: Dunkirk, Pearl Harbor, Midway, the Battle of the Atlantic, the Normandy invasion. For the Soviets, the war was decided at Leningrad, Moscow, Stalingrad, and Kursk. By the same token, the fortunes and misfortunes of the Soviet Navy and its submarines were shaped by success or failure on land. For the Anglo-Americans, the *sea* was the medium for choosing the point of attack on land; the Soviet Union's constricted maritime geography ensured that the relationship was quite the reverse. The Soviet fleet in the Second World War was more than an assistant of the Army – it was a dependent!

As to the matter of mission asymmetry, it is important to remember that the German and American submarine fleets enjoyed the 'luxury' of being able to concentrate their efforts almost exclusively against their opponents' sea lines of communications. The Soviet submarines had to divide their responsibilities among a variety of offensive and defensive tasks: disrupt enemy seagoing traffic, protect friendly and Allied convoys, provide amphibious transportation for troops, guard ports and harbours, etc. The Soviets, in other words, had fewer opportunities to raise the scoreboard. It may be argued that the Soviets used their submarines for the wrong purposes; giving up the submarine's offensive capability in order to evacuate a few troops is certainly a questionable choice between cost and effectiveness. Yet, because of past mistakes, primarily Stalin's fancy with an 'offensive' battlefleet in place of a balanced combination of an *offensive* submarine force, supported by a modern and *defensive* fleet of gun-, mine warfare- and anti-submarine-heavy craft and vessels had served to preclude such a choice.

In conclusion, it is simply impossible to arrive at an objective assessment of the productivity of the Soviet submarine fleet in their Great Patriotic War. It is true enough that it had little or no effect on the outcome of the conflict. All the same, western naval planners should tread carefully when they attempt to draw lessons from events and circumstances more than four decades ago when they evaluate the potential wartime capability of the modern-day Soviet fleet.

Principal sources

The principal non-Soviet source on the naval dimension of the Great Patriotic War are the post-action reports of German naval units available in microfilm at the US Naval Archives in Washington, DC. Excellent secondary non-Soviet sources are Jürg Meister's *Soviet Warships of the Second World War*, J Rohwer and G Hümmelchen's two-volume *Chronology of the War at Sea*, and Friedrich Ruge's *The Soviets as Naval Opponents 1941–1945*. The best current semi-official Soviet account is *Soviet Naval Operations in the Great Patriotic War 1941–1945* by V I Achkasov and N B Pavlovich.

5 Postwar reconstruction 1945–1960

Western fears and Soviet realities

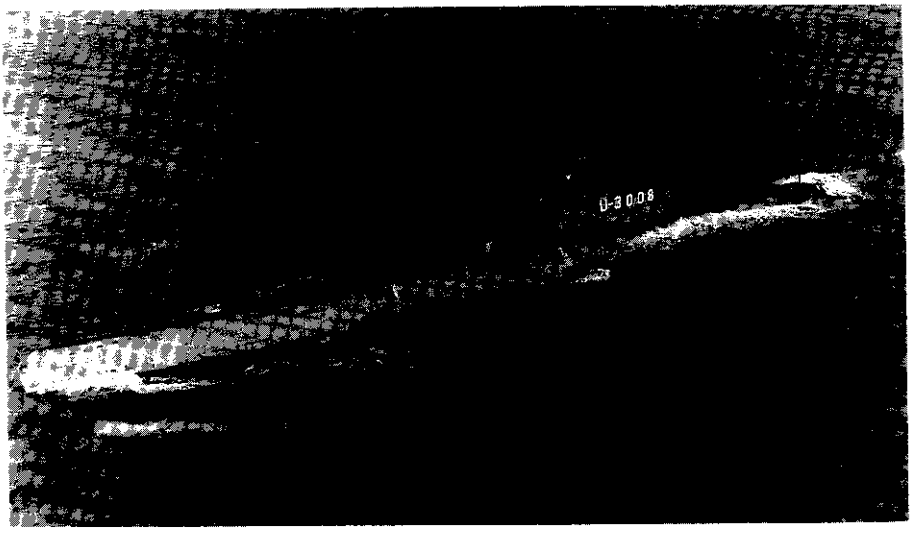
Winston Churchill called the Allied victory over the German submarine fleet in the Second World War a 'close-run thing'. Only a few months after the U-boats had raised the black flag of surrender, suspicion waxed among Western naval planners that the next battle against the submarine would be even more trying. The US Chief of Naval Operations, Admiral Chester W Nimitz, wrote in a secret report in January 1946 that it was 'evident that our present anti-submarine forces will be unable to cope with the submarine of the future with the same degree of effectiveness as attained in the past war'. Developing new countermeasures, he declared a few months later, was as important as finding ways for the fleet to survive the newest weapon of war, the atomic bomb.

Nimitz did not cite the Soviet Union by name, but it was obvious that this was the only potential opponent he had in mind. After the Second World War, the Soviet submarine fleet was the only conceivable threat to what was otherwise an overwhelming Anglo-American command of the world's oceans. The numerical strength of the Soviet underwater navy was the immediate concern; more ominous for the future, however, was the prospect of the Soviets taking advantage of German wartime submarine developments. Much of this technology was considerably more advanced than that produced by the Allies and had in many cases outpaced prevailing anti-submarine warfare capabilities and tactics.

The Soviet Union, along with its principal wartime allies, the United States and Great Britain, had become the recipient of a wide range of German technological know-how in submarine design, propulsion plants, and weapon systems. Complete ex-German Navy submarines were allocated to the Soviet Union in 1946 under the auspices of a tripartite (US-British-Soviet) naval commission established after the Potsdam Conference in the summer of the year before. In addition, the Soviets embarked upon their version of 'Operation Paperclip', and removed thousands of German technicians and scientists, along with tons of technical documentation and hardware in various stages of completion, from their occupation zone. It is not known precisely how many German submarine design and construction personnel ended up in the Soviet Union; a commonly-mentioned figure is 4000.

Next to acquiring an unknown number of partially assembled submarines, the Soviets dismantled for shipment home entire construction and assembly facilities. Among the latter were the Schichau and Danzig yards in Danzig and several smaller plants in the area of Stettin. Most of the equipment taken at Schichau found a new home at the Nikolayev Yard on the Black Sea.

The German submarine development in Soviet hands that most worried US and Britain naval authorities was the Type XXI submarine. A total of 118 of these 1819-ton (submerged displacement) vessels were built between June 1944 and April 1945, but only two had departed on operational patrols before the war ended. This short-lived operational career was fortunate for the Allies, for the teams of US and British scientists and operating personnel that inspected the craft after the war quickly discovered that, had it been deployed in quantity, victory in the Battle of the Atlantic would most certainly have been delayed. The Type XXI revolutionised submarine warfare as much as the first nuclear-powered submarine, the USS *Nautilus* (SSN 571) would ten years later. Designed to navigate and fight primarily in a submerged condition, she was streamlined, incorporated a snorkel system, and



The most advanced submarine at the close of the Second World War was the German Type XXI. Depicted (after extensive conversion) is one of two Type XXIs received by the US Navy. The Soviet Union's share was four (US Navy).

possessed a battery capacity that allowed a sustained underwater speed of 12 to 16 knots.

The Type XXI's predecessors could keep up a submerged speed of four to five knots for only 45 minutes. Two 83 kilowatt 'creeping' motors were installed for silent running at speeds up to six knots.

It was this combination of capabilities that compelled the leadership of the US Navy in the late 1940s to take a dim view of the outcome of a future anti-submarine campaign. Had the Type XXI been introduced earlier in the war, concluded one report in 1946, 'our barrier patrols, search plans, escort of convoy plans, and hunter-killer tactics (would have been) rendered ineffective'.

US intelligence experts had no doubts that the Soviets were both capable of and intent upon rapidly absorbing and exploiting the Type XXI for their own purposes. It was estimated, moreover, that once the Soviet Union had mastered the submarine's sophisticated design features, it would promptly embark upon a massive programme of series construction. Only four months after V-J Day, the Office of Naval Intelligence (ONI) warned: 'In view of the performance of German submarines, the strides made by German industry in their mass production, and the availability of German talent, a radical change in Russian submarine design philosophy may be reasonably expected in the next few years'.

The Potsdam tripartite naval commission had presented the Soviet Union with four complete Type XXI submarines (*U-2529*, *U-3035*, *U-3041*, and *U-3515*). Additionally, an unknown number of partially completed hulls, plus some sectional subassemblies, were recovered by the Soviets at the Schichau Yard in Danzig. ONI estimated in the summer of 1948 that the Soviet submarine fleet included four operational Type XXIs, while an equal number was believed being completed. This combined total of eight was close to ONI's projection two years earlier, but the intelligence organisation's evaluation of the scale of the Soviet Union's Type XXI construction effort was a far cry from its prediction, in 1946, that no fewer than 300 units would be completed by 1950. Yet, even as ONI revealed its moderated estimate of the Soviet Type XXI threat, Navy Secretary John L Sullivan told a Navy League audience that Soviet production of the Type XXI was running at 20 to 30 units

per year, and would increase to 200 before the close of 1951. This force, the Secretary warned, would join 350 'conventional' boats for a combined submarine fleet 'vastly superior to any operated by the German Navy during World War II'. The *New York Times* military correspondent, Hanson W Balwin, reported Sullivan's prediction in March 1948, but commented that it seemed 'excessive'.

Predictions of Soviet progress in large-scale production of the Type XXI turned out to be far in excess of extant technological and manufacturing capabilities. Ultimately, only the four units received under the tripartite agreement served with the fleet. Even so, it is questionable whether they ever joined the operational brigades. It is quite likely that they were used for basically the same experimental purposes as the American two-unit allotment. The US experience with the Type XXI became the basis for the US Navy's *Tang* class of submarines. The Soviets most likely used their tests and trials to refine the designs of the 'Whiskey' and 'Zulu' classes.

The difficulty of reliable intelligence was part of the reason why estimates of Soviet submarine (and other military) capabilities during the first decade after the Second World War were commonly biased by what was thought the Soviets *might* do rather than *could* do. Space-based surveillance systems to keep track of shipyard construction did not come into existence until the early 1960s. With the 'Iron Curtain' hermetically closed to foreigners, Western intelligence analysts in the late 1940s and early 1950s were heavily dependent on titbits of information brought in by repatriated Germans. Their reports were frequently unreliable and contradictory. Few were skilled or, for that matter, objective observers. Their participation in military or semi-military projects had usually been very specialised, so that they rarely could elaborate on the status of a programme as a whole. One result was that reports of Soviet experimentation or even of an expressed interest in a given technology area, tended to be interpreted as indicative of an established military programme and intention.

Intentions aside, the Soviet shipyard industry in the late 1940s was simply not in the position to support a novel design and construction programme such as the Type XXI on the scale predicted. Sullivan's forecast of an annual production of 200 units was admittedly far below Germany's actual output of about 350 U-boats a year in 1943 and 1944. But the German feat included *all* types of submarines, with most being much smaller, less capital and labour-intensive, and less sophisticated than the Type XXI. Furthermore, Germany had been building U-boats at peak capacity under wartime conditions, and at the expense of other armament programmes. Most important, German submarine production had reached the peak of the 'learning curve'; it had mastered, through wartime experience and a superior military-technological base, the technological and production intricacies of managing a high-volume, yet high-quality submarine building programme. During the war, Germany commissioned over 1100 new ocean-going submarines; the Soviet Union less than 60.

At the end of the war, the great naval building yards at Leningrad and Nikolayev were a shambles. Rudolf Lusar wrote in the January 1954 issue of the US Naval Institute's *Proceedings* that the yards were back in complete working order before the end of 1945. In reality, they did not recover until about five years later.

Estimates of the number of submarines built during the immediate post-war years vary considerably. Siegfried Breyer's *Die Seerüstung der Sowjetunion* which was published in 1964, reported that about 50 were completed at the end of 1950. One set of ONI data, based on post-war completion dates, suggests that the number was much closer to 90.

Meister has calculated that the Soviet submarine inventory at the end of the Second World War numbered 173. Table 11 shows ONI's estimate of the Soviet submarine order of battle in early 1950. When allowance is made for the 18 German and Italian 'war prizes', it turns out that Soviet yards would have delivered a near-five year grand total of 95 submarines. This converts to an annual production of almost 22 submarines.

Table 11: Soviet submarine Order of Battle, 1 February 1950

Number	'Ocean Patrol' Types
4	ex-German Type XXI
2	ex-German Type IXC
5	ex-German Type VIIC
3	'N' types
8	'B' (*Leninetz* Series III?)
10	'K' class
34	*Stalinetz* class
16	*Leninetz* Series II class
8	*Leninetz* Series I class (O)
2	*Pravda* class (O)
	'Medium Range' Types
62	*Shchuka* class
2	ex-Italian types
16	*Shchuka* class (O)
	'Coastal' Types
2	ex-German Type XXIII
104	*Malodki* class
6	*Malodki* class (O)
3	ex-German Type II (O)
1	ex-Estonian *Lembit*

Note: (O) = obsolescent and considered available only for training and limited operations.

Source: ONI, *Submarine Tabulation*, February 1, 1950. De-classified.

More important than numbers *per se* is the obvious fact that Soviet submarine forces on the eve of the Korean War were little different in numbers or quality than those on the eve of the Second World War. Every one of the boats that left the building ways between 1945 and 1950 were pre-war designs. With the exception of some of the ex-German types, none were fitted with the one piece of equipment that the Germans had found to be essential to survive Allied anti-submarine warfare capabilities: the *Schnorchel* (snorkel).

Having said this, it is only fair to add that (a) there is no certainty what Stalin's plans for a war against the West were in fact, and (b) Admiral Kuznetsov's own declared goal, in 1948, of a 1200-strong submarine fleet gave reasonable grounds for the West's worst fears.

The Soviet 'anti-SLOC threat'

It took until the late 1960s for most students of Soviet naval affairs to conclude that the Soviet submarine fleet of the early 1950s was neither capable of nor probably intent upon a tonnage war U-boat style. The view was different during the formative years of the North Atlantic Treaty Organisation. Even though the Western Alliance increasingly depended on the USA's 'Great Deterrent', planners feared that an initial and short atomic exchange would evolve into a drawn-out conventional conflict on the pattern of the last world war. Again, a submarine-strong enemy would seek to stop the arrival of American reinforcements and resupplies. The UK *Statement of Defence* of 1954 called it 'broken-backed' warfare.

Not untypical of contemporary perceptions of the Soviet submarine danger was a

strategic intelligence estimate, issued by ONI in 1950. It proposed that a Soviet onslaught against the Western sea routes would encompass virtually every available submarine, including the diminutive *Malodki* and even those that ONI's own assessments had declared 'obsolescent'.

The Soviet campaign, said ONI, would take its course in two phases: phase one would have the submarines mine US and Allied ports and harbours. This accomplished, the opponent would switch to phase two and follow in the footsteps of Hitler's U-boats.

The study predicted that different classes of submarines would probably be deployed to match their range and endurance characteristics. Thus, the six ex-German Types IX and XXI would team up with the 'K' and *Stalinetz* units to patrol west of Central America and south of the Equator. The ex-German Type VIIs were expected to join the *Leninetz* and *Pravda* boats to obstruct traffic between Norfolk, Virginia and the Cape Verde Islands. The *Shchuka* class would attack shipping north of a line extending between Cape Farewell, Greenland and Gibraltar. Finally, all submarines classified 'coastal', including the *Malodkis*, would range as far south as the British Isles and Northern France.

It is precisely this kind of scenario that has given the term 'worst case' analysis a derogatory connotation. Its premises and conclusions were excessively dominated by 'mechanistic' calculations of the most basic of enemy material capabilities – range and endurance. The ONI analysts calculated that 170 submarines were *capable* of operations on the high seas, but that only (!) 80 per cent would be readily available for such duty. The agency took its clue apparently from the German experience in its estimate that normally one-third of the available force would be on station.

The result of these different 'baseline' and inferred numbers would have been a 'steady state' forward presence of about 45 submarines. This number is close to the size of the U-boat fleet on Atlantic patrol between late 1942 and the middle of 1943. But, Germany's daily operational availability at the time was only 25–26 per cent – *not* 80! Moreover, the Germans never committed more than 40 per cent of their operational submarine fleet to the Atlantic Ocean. The Soviets, on the other hand, were presumed to dedicate their *entire* underwater fleet to an oceanic anti-shipping campaign!

Fresh memories of the Second World War combined with an exaggerated fear of Western vulnerabilities and Soviet military designs to fuel this offensive image of the Soviet underwater threat. Conclusions today have the benefit of hindsight. In fairness to those actually responsible for the defence of the West at the time, one should be mindful that the day-to-day spectre of a four million-strong Red Army, ready to lend a helping hand to Western Europe's 'proletariat', hardly left room for a different judgment.

The reality of the Soviet naval position in the early 1950s was that few submarines possessed the range and endurance to fight a wide-ranging tonnage war. By illustration, the one-way distance from Murmansk to an imaginary patrol line connecting the American east coast and the Cape Verdes is about 4000 nautical miles. The maximum economical endurance of the Series XIII *Leninetz* that ONI postulated would operate there was 10 000 nautical miles; her cruising speed on the surface was in the neighbourhood of seven knots. This means that a Northern Fleet *Leninetz* type would have had to spend nearly 50 days in transit and consume some 80 per cent of its nominal patrol endurance. Without even considering the Soviet lack of experience with commerce destruction outside coastal waters, it should be patently obvious that their submarine fleet of 1950 was far short of the threat capability it was credited with.

In terms of capabilities and most likely wartime roles and missions, the Soviet Navy of 1950, including its submersible component, had changed little in ten years. Indeed, a strong argument could be made that the victory over Germany served to strengthen the Soviet Union's landward orientation and, as a corollary, the Navy's subsidiary role. This is not to say that the military high command did not appreciate the fact that the next likely opponent

would be a maritime coalition that would pose a far greater seaward threat than the Axis. However, from the Soviet perspective, the key to victory in a potential war with the United States remained the clash of arms on land. Accordingly, the principal perceived danger of the Anglo-American navies was their ability to influence the 'correlation of forces' on land by means of large-scale amphibious assaults. To prevent this from happening, the Navy was charged with active defence of the coast, at the same time that the Army would complete its offensive drive to the Atlantic.

The Navy's operational-strategic concept was the same, by and large, that had dominated plans in the 1920s and 1930s. Potential enemy landing areas would be safeguarded using the idea of a layered 'zone defence'. The outermost zone would be defended by dispersed flotillas of submarines. Admiral Kuznetsov announced, in 1948, that his Navy had set a goal of 1200 submarines. The next defensive belt would consist of minefields, while the third and final seaward 'backstop' would be the task of major and minor surface forces. With regard to the latter, work resumed on the incompleted *Chapayev* class cruisers, and plans were put in motion to build 24 *Sverdlov* class cruisers and two 40,000-ton *Stalingrad* class battlecruisers.

Neither the battlecruisers, nor the full complement of *Sverdlovs* or the armada of 1200 submarines were ever realised. The death of Stalin, in 1953, also sounded the deathknell of the dictator's vision of a traditional 'big navy'. His successor, Nikita Khrushchev, had little interest in naval matters, and what little he did have lay an entirely different direction. Khrushchev takes credit for pushing the Soviet Navy, 'kicking and screaming', into the 'revolution in military affairs'. Yet, Khrushchev was no more than the instrument in a systemic change in threats, weapons and technologies. The transition of the submarine fleet of the Second World War to the nuclear-powered and rocket-carrying force of the 1960s and beyond was *evolutionary*, however. Bridging the generation of the *Shchukas* and *Stalinetz* of the 1930s, and the 'November's, 'Echo's, and 'Hotel's of the 1960s, were the Soviet Union's first post-war generation of conventional submarines: the 'Whiskey', 'Zulu', and 'Quebec' groups.

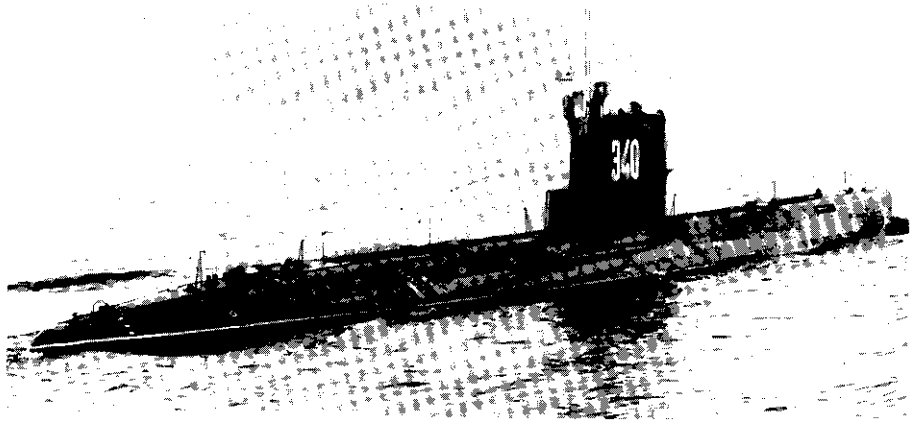
'Whiskey', 'Zulu', and 'Quebec'

The lead unit of the class that become known by the NATO designation 'Whiskey' was completed in 1951 at the Krasnaya Sormova Yard in Gorki. Production of altogether 236 vessels terminated in 1957 after the participation of three more yards – the Baltic Yard in Leningrad, the Marti Yard in Nikolayev, and the Amur Yard in Komsomolsk. About 50 'Whiskeys' were still reported operational in 1986.

When the submarine was first observed, the initial inclination among Western analysts was to suspect a Type XXI lineage. The balance of opinion today is that, although the boat probably incorporated some of the features of the German submarine, Soviet design characteristics predominated. The Soviets themselves have claimed that the design of the 'Whiskey' dates from 1944, and was based on the *Stalinetz* class.

A comparison of the external characteristics of the 'Whiskey' and Type XXI makes a common origin doubtful. The Type XXI was highly streamlined, whereas the appearance of the Soviet vessel is quite conventional, exhibiting, particularly in the early variants, many protuberances inimical to good underwater speed. The 'Whiskey' has a fairly high freeboard appropriate for good seakeeping on the surface; the Type XXI's main deck was only four feet above the waterline. The layouts of the torpedo tubes are quite dissimilar as well: the German submarine carried all six tubes in the bow, whereas the 'Whiskey' has four tubes forward and two aft. Another important difference is that the first series of 'Whiskeys' were not equipped with snorkels. The first snorkel-fitted 'Whiskey' was not photographed until 1955.

The conjecture that the Soviet Union was building a submarine fleet to fight an Atlantic tonnage war, added to the supposition that the 'Whiskey' marked the successful Soviet adoption of the Type XXI design, contributed to an overestimate of the new submarine's capabilities. First (1952–1956) evaluations credited the vessel with a patrol range of 16 500 nautical miles. This was later downgraded to 10 000, and ultimately to 8500 nautical miles. Based on these new figures, ONI concluded, in 1960, that fewer submarines than previously estimated were expected to threaten the Allied SLOCs in the Western Atlantic. But, it



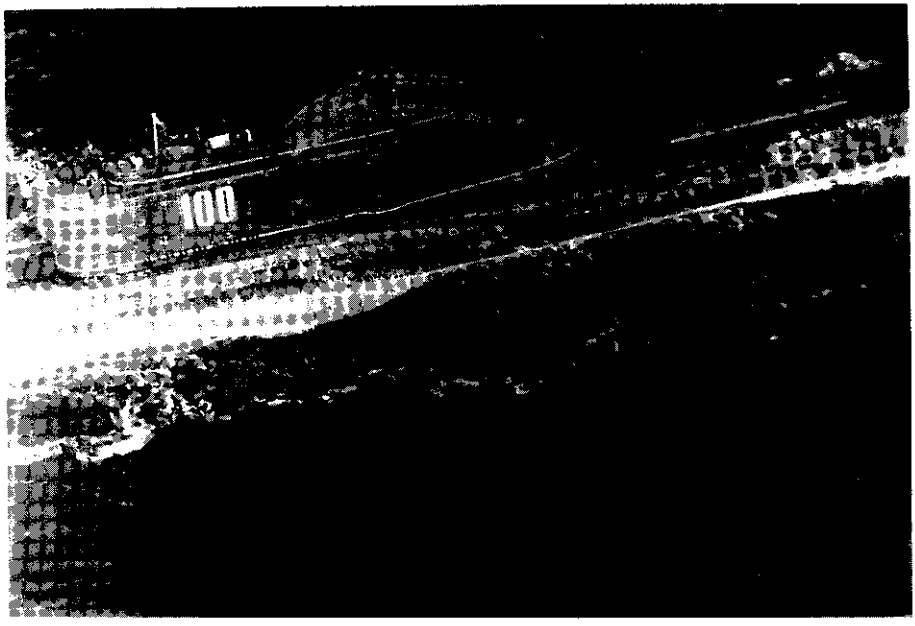
Series V 'Whiskey' class submarine (US Navy).

hastened to add, this did not mean that the threat of a tonnage war had become less – the battle would be concentrated in the Eastern Atlantic instead.

As had the Soviet Union's pre-war submarines, the 'Whiskeys' went through repeated series modifications. The series I displayed a stepped extension forward of the sail which was topped by a twin 25 mm anti-aircraft gun. The II variant had a second extension that housed an open 57 mm or 76 mm gun. Intended to engage surface targets, the gun supports the assessment that the design of the 'Whiskey' did not fully embrace the underwater fighting philosophy of the Type XXI. The 'Whiskey III' kept the same fin shape but without the gun armament. The 25 mm gun reappeared on the next evolution in the class, the 'Whiskey IV', which also received a direction finder attached to a new diesel exhaust stack. The stack was, in fact, the first positive evidence that the Soviets had succeeded in the installation of a permanent snorkel system. The final Series V had the extension forward of the fin eliminated along with the flak battery.

Modifications and improvements continued after production halted in 1957. The addition of sonar equipment was discovered in 1957–58. The Tamir hydrophone array was installed inside a bulbous expansion of the bow. Slightly abaft of the bow, just off the centreline on the weatherdeck, came a small dome containing an attack sonar, known under the NATO reporting name as Top Hat. The three or four bright metal plates that are arranged on either side and forward of the sail are believed to act as a passive warning device against approaching torpedoes. Also observed for the first time in 1957 was the addition of radar intercept and direction finding device, designated Stop Light.

The 'Whiskey' was a successful design. Evidence includes the numbers built, its service longevity, and its adaptability to changing mission requirements and, as a result, important physical modifications. The series were still in full production, when significant numbers were recalled for various conversions intended to improve the navy's ability to defend against the stand-off threat of US carrier-borne nuclear air attack. One programme included



'Whiskey Canvas Bag' with 'Boat Sail' air search radar deployed (US Navy).

the conversion of five boats to early warning picket duty. Modifications included the addition of the 'Boat Sail' air search radar and 'Snoop Plate' surface search radar. The converted boats were dubbed 'Whiskey Canvas Bag' for the tarpaulins that first hid their radar antennas from preying eyes.

A second – and in the long run more important – conversion was spotted by Western intelligence in 1957. The presence of cylindrical objects on the decks of several 'Whiskey' types became compelling evidence that long-rumored Soviet attempts to combine the submarine with the missile had borne fruit. The background and characteristics of the Soviet Navy's first-generation missile-launching submarines are discussed in the concluding portion of this chapter. Table 12 lists the characteristics of the fifth and final variant in the 'Whiskey' series.

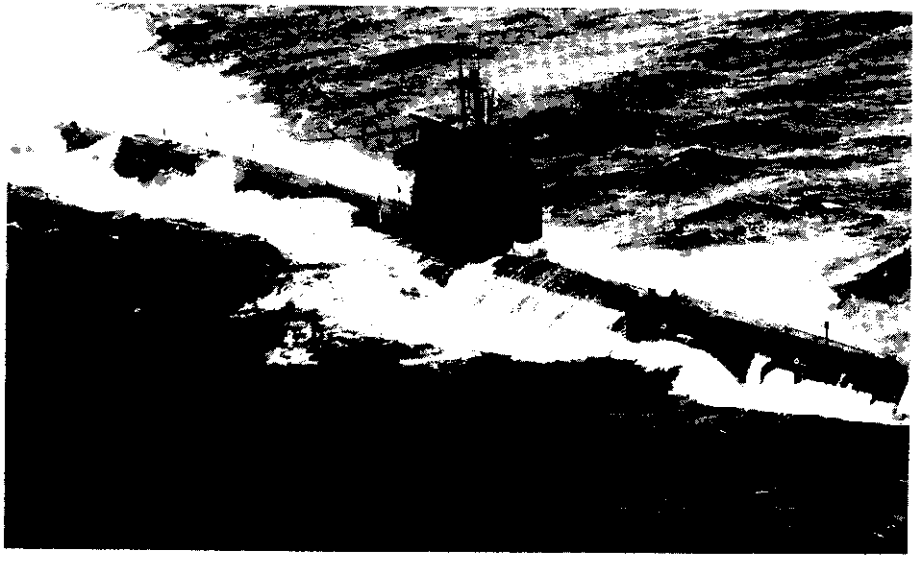
Table 12: 'Whiskey' class submarines

Number built	236
When built	1951–1957
Where built	Krasnaya Sormova Yard, Gorki, Baltic Yard, Leningrad, Marti Yard, Nikolayev, Amur Yard, Komsomolsk.
Displacement	1055/1355 tons
Length	75.9 m (249 ft)
Beam	6.4 m (21 ft)
Draught	4.3 m (14.2 ft)
Propulsion	4000/2700 hp
Speed	18.5/13.5 knots
Endurance	6500 nm at 5 knots (snorkel)/300 nm at 2.5 knots
Armament	6 × 533 mm (21-in) TT (4 bow, 2 stern) 12 torpedoes or 24 mines
Diving limit	200 m (656 ft)
Complement	50–60

One year after the completion of the first 'Whiskey' class boat, the lead unit of a second class of post-war submarines left the ways at the Sudomekh Yard. The advanced hull form of the 2500-ton (submerged displacement) of what came to be known as the 'Z' or 'Zulu' class was clearly derived from the German Type XXI. The boat was much more streamlined than earlier submarines and it was marked by the numerous floodholes that had been a prominent feature of the Type XXI. In contrast with the German vessel, however, the early 'Zulu' variants still came equipped with medium calibre surface gunnery.

The 'Zulu's propulsion system has been a source of controversy over the years. Some sources have reported that the original design called for a Walter closed-cycle drive, but that technical problems (similar perhaps to those allegedly experienced with the 'Quebec' class) forced the Soviets to settle on a conventional diesel-electric powerplant. The declassified pages of the *ONI Review* offer no hint on this issue. The 'Zulu's' installed horsepower and attendant endurance has also been a question mark. A few publications continue to claim a propulsive power on the surface of 10,000 hp, and initial intelligence assessments credited the submarine with an endurance of 26 000 nautical miles at an average speed of ten knots. Actual performance figures are considerably less ambitious. Intelligence estimates since the early 1960 have rated the 'Zulu's powerplant at 6000 hp, and have calculated a cruising range of 9500 nautical miles at an average surface speed of eight knots.

Series production of the 'Zulu' came to an end in 1957 with the completion of the 26th unit. Eighteen were delivered by the Sudomekh Yard, while Severodvinsk was responsible for the balance. This second yard also built six variants – the 'Zulu V' – that carried the Soviet Navy's first ballistic missiles. Two units, renamed *Lira* and *Vega*, were converted for oceanographic research.



'Zulu IV' class submarine (US Navy)

Table 13: Series IV 'Zulu' class submarines

Number built	20
When built	1952–1957
Where built	Sudomekh Yard, Leningrad, Yard 402, Severodvinsk
Displacement	2100/2500 tons
Length	90 m (295 ft)
Beam	7.9 m (26 ft)
Draught	6 m (19.7 ft)
Propulsion	6000/5300 hp
Speed	18.5/16 knots
Endurance	9500 nm at 8 knots/250 nm at 3.2 knots
Armament	10 × 533 mm (21-in) TT (6 bow, 4 stern), 22 torpedoes or 44 mines
Diving limit	230 m (750 ft)
Complement	75

The third interim group of post-war submarines was designated the 'Quebec' class. Although much smaller than the 'Whiskeys' and 'Zulus', the initial inclination in the West was to credit it with performance capabilities disproportionate to its size. The 'Quebecs' were briefly thought to be the crowning achievement of a ten-year Soviet effort to perfect the Walter closed-cycle propulsion system. Named after its German inventor, the system used a hydrogen-peroxide solution to power the propelling turbines. Its principal advantage was that a submarine so driven would be independent of an external air supply (as is the modern nuclear-powered submarine). Wartime experiments had also shown the plant capable of delivering a 'burst speed' up to 24 knots. Although various design problems had kept the German experiments from progressing to the operational stage, the principle had shown enough promise for Germany's erstwhile enemies, especially Great Britain and the Soviet Union, to temporarily pursue its realisation with a considerable investment in talent and money.

The Walter plant was one closed-cycle system that intrigued submarine designers of the 1940s. Another system – also a German development – was the so-called *Kreislauf* (meaning 'closed cycle') diesel. The *Kreislauf* did not produce the concentrated energy output of the Walter, but it had the advantage of not depending on scarce hydrogen-peroxide. The engine operated in the usual fashion on the surface; when submerged, it released only part of the exhaust while the rest, cooled and purified, was re-introduced along with pure oxygen.

Intelligence reports in the 1950s suggested that Soviet closed-cycle work favoured the *Kreislauf* diesel over the Walter system. Reasons, according to these reports, were relative simplicity, cost, and ease of installation. One experimental submarine may have been powered by the engine in 1955.

Evidently, the Soviet attempt to mate the 'Quebec' with a *Kreislauf* powerplant met with failure. Repeated engineering and human casualties earned the submarine the nickname 'Cigarette Lighter'. The group of 30 was fitted with a conventional triple diesel plant.

Some sources still cite the early estimate of a cruising range of 7000 nautical miles; the actual number is much more modest. In 1958, ONI reduced the endurance of the 'Quebec' to 4500 nautical miles; next to 3800 nautical miles, and finally, in 1960, to 2750 nautical miles. If this final calculation is correct, the 'Quebec' cannot be treated other than as a very short-range 'interceptor' submarine, intended for little or no more than the coastal defence function of the *Malodkis* of the 1930s.

Table 14: 'Quebec' class submarines

Number built	30
When built	1954–1957
Where built	Sudomekh Yard, Leningrad
Displacement	420/510 tons
Length	56.4 m (185 ft)
Beam	5.5 m (18 ft)
Draught	4.1 m (13.5 ft)
Propulsion	1650/1900 hp
Speed	16/8 knots
Endurance	2750 nm at 10 knots/144 nm at 4 knots
Armament	4 × 533 mm (21-in) bow TT, 8 torpedoes or 12 mines
Diving limit	137 m (450 ft)
Complement	40

Countering the American Carrier Fleet: Early missile developments

On 1 October 1955, the US Navy accepted the USS *Forrestal* (CV 59), the first of repeated generations of 'super carriers'. The *Forrestal's* deckload of A3D Skywarrior jet bombers represented the US Navy's contribution to America's declaratory strategy of 'massive retaliation' against Soviet aggression at 'times and places of its choosing'.

The nuclear-capable aircraft carrier changed the Soviet Union's naval defensive priorities; the importance of defeating an amphibious assault force gave way to the even greater importance of 'neutralising' the carrier threat and limitation of atomic damage to the homeland.

A principal Soviet counter-weapon to this day is the submarine-launched anti-ship missile. But it is not true that this weapon was developed as the discrete response to a specific (anti-carrier) requirement – the promise of the anti-ship missile happened to (partially) fill the need for some way to stymie the new American 'offensive'. The fact of the matter is that the Soviets began work on a ship- and submarine-carried missile capability almost ten years before the commissioning of the *Forrestal*. The initial intent and result was an *anti-land* cruise missile, but throughout the development process, an important side effort was focused on ways and means of using missiles against ships.

Early submarine missile developments

The fact that the 'Whiskey', 'Zulu', and 'Quebec' programmes all terminated in the same year, 1957, prompted intense speculation among Western intelligence specialists whether the Soviet Union was about to launch its first nuclear-powered submarine, possibly armed with missiles. ONI took stock of the slow-down in Soviet naval construction generally, and concluded, in 1958, that the Soviet Navy would probably 'soon adapt missiles and nuclear propulsion to all classes of warships and return to full-scale construction geared to the nuclear age'. Herbert Scoville, the assistant director for scientific intelligence for the Central Intelligence Agency (CIA) seconded this appraisal. In secret testimony before the Armed Services Committee of the US Senate, he opined that the curtailment in Soviet production of conventional submarines probably foreshadowed the introduction of new missile-carrying nuclear types.

Reports of Soviet experimentation with missiles launched from the decks of submarines

had filtered through the 'Iron Curtain' since about 1948. It has been established that early Soviet tests did approximately coincide, in fact, with similar efforts carried out in the United States. On 12 February 1947, the converted *Gato* class submarine USS *Cusk* (SS 348) became the first Western submarine to successfully launch a missile, the LTV N-2 Loon. The Loon was a copy of the German wartime FZG 76 (Fi 103), better known as the V1 'buzz bomb'.

The Americans had produced their version of the FZG 76 since 1944; the Soviets had to wait until the surrender of Germany. It is not certain whether Moscow acquired any intact samples (although it seems plausible in light of the tens of thousands produced), but there is no doubt that it secured the necessary technical documentation along with the German personnel to set up production lines. By 1950, ONI reported, 'several hundreds' of V1s had been assembled at Khimki, 12 miles northwest of Moscow.

In a detailed 1950 assessment of future Soviet submarine capabilities, especially with reference to the potential exploitation of German wartime developments, ONI predicted an early adaptation of the V1. ONI's reasoning was based on three grounds: first, a series of alleged eye-witness and hear-say accounts by German repatriates of test-firings; secondly, the knowledge that the Soviets had acquired the technical know-how to manufacture the missile; and thirdly, the logical inference that combining the V1 with a submarine was not only 'good engineering practice', but also made strategic sense for a power that was short of a long-range bomber force.

News of Soviet test firings of V1-like missiles from submarine deck installations similar to the one on the *Cusk* first arrived in the summer of 1948. Firing ranges were reportedly located in the Northern Fleet area, off Arkhangelsk, and in the Black Sea, off the Kerch Peninsula. These reports, plus other evidence, caused ONI to conclude, in 1950, that, 'it is logical to assume that at least several of the large Soviet undersea fleet are equipped for test-firing V1s from submarines and for training personnel'. Even more ominous, the same report warned that, 'if the Soviets so desired, several V1s could be launched against our coastal cities this year'.

The ONI document did not spell out the probable weight of such a hypothetical attack, but a 'worst case' estimate can be derived from the organisation's own assessment of the theoretical missile-carrying capability of the Soviet submarine fleet.

Based on the submarines' size, ONI postulated that the large 'Ks' might carry five weapons, the *Leninetz* and *Stalinetz* boats plus a few ex-German types two each, and the *Shchukas* one a piece 'without any serious effects on stability and performance'. The collective 'load-out' of the Soviet submarine fleet in 1950 would have added up to slightly over 200 V1s. The number is impressive only on the surface. In the first place, it is predicated on a 100 per cent availability of every submarine that was *materially* qualified to carry the weapon. Secondly, the assumption that the entire fleet could readily be converted to carrying missiles and missile launch installations 'without any serious effects on stability and performance' is a highly tenuous one at best (later reports of seakeeping problems with the missile-converted 'Whiskeys' argue to the contrary). And thirdly, it takes a leap of imagination to expect that some 150 pre-snorkel submarines would manage to arrive within firing range of the continental United States without being detected and brought under attack.

The Soviet Union exploded its first nuclear bomb in 1949. ONI thought that a nuclear-tipped V1 would not be 'remotely possible' until 1951 – an optimistic prognosis, given the size and weight of the first generations of US and Soviet nuclear weapons. The implication is that the hypothetical Soviet V1 barrage would have involved conventional high explosives not much different to the 850 kg (1870 lb) warheads used by the Germans. Although the Sovietised V1 could have had a somewhat better accuracy than the 7.4 circular error probable (CEP) of the 'buzz bomb', it would have lost some precision due to inaccuracies in submarine navigation.

The most realistic criterion for estimating the level of destruction that might have been inflicted by a Soviet salvo of 200 V1s is the German experience in the Second World War: according to Peter G Cooksley's *Flying Bombs – The Story of Hitler's V-Weapons in World War II*, almost 7000 V1s flew to within sight of the British coast in 1944 and 1945. Those that survived the air defences killed 5500 people, injured another 18 000, and destroyed some 23 000 homes. It is true that the cities and industrial centres along America's eastern seaboard would have been without the massed air defences that whittled down the number of incoming V1s in 1944–45, and that the effect on civilian morale might have been far out of proportion to the damage actually inflicted. Nevertheless, an attack on the scale described by ONI could hardly have been more than a symbolic gesture, and a very expensive one at that.

More worrisome than the scenario described above was the possibility that the Soviet Union would successfully combine the submarine with Germany's other 'revenge weapon', the V2, technically known as the A4. German scientists and technicians under the supervision of a Soviet Special Commission first resumed work on the A4 at the wartime underground plant at Nordhausen in Harz. In late 1946, the most prominent German specialists were moved to the Soviet Union to help establish an indigenous experimental facility and production line. The best-known developmental research and development (R&D) establishment thus established was NII-88 (for *Nauchni Isledovatelski Institut-88*), headed by one of the premier Soviet missile designers, Sergei P Korolev. Between October and November 1947, the NII-88 was involved in the launching of some V2s at a new testing range at Kapustin Yar, about 120 km (75 miles) east of Stalingrad. Between 1948 and 1949, Korolev's design bureau prepared the designs of what was to become the Soviet Union's first generation of long-range ballistic missiles and space boosters. Until NATO's introduction of its own coding scheme, the projects were commonly known by the Soviet prefix 'R' (for *Raketa*). For example the SS-1 'Scunner' was known during the 1950s as the R-1.

Early Western estimates of a future Soviet submarine-launched ballistic missile threat focused on the so-called 'amphibious V2'. Also known as the *Lafferentz Projekt*, this involved a German plan late in the war for a submarine to tow up to three encapsulated V2s to within striking range of the American east coast. The statically buoyant capsules or barges would be submerged as long as the submarine maintained cruising speed, but would float to the surface when the towing vessel lay dead in the water. By flooding the trim tanks, the barges would be up-ended into vertical launch positions for fueling and check-out. The entire launch preparation was to have taken 30 minutes or less. The project did not progress further than towing tests with the barges in the Baltic Sea. After the war, the Soviets evidently obtained at least one version of the barge system along with a partially completed firing tube. During the early 1950s, the American press published a number of dramatic reports (including one by the former chief of the German V-weapons programme, Walter Dornberger), hinting that the Soviets had perfected a nuclear-tipped version of the 'amphibious V2'. There may have been some rudimentary experiments, but there is no evidence that the Soviets ever launched a missile in this fashion, let alone deployed an operationally efficacious weapon.

Soviet parallelism

Most Western intelligence predictions in the early and mid-1950s held that Soviet submarine missile progress would follow the same technological path that had been set by the United States. Like the United States, the Soviet Union was expected to build an initial strategic delivery capability around a 'conventional' V1. The next generation of missiles was expected to resemble the US Navy's own submarine-launched Regulus II. The latter's design

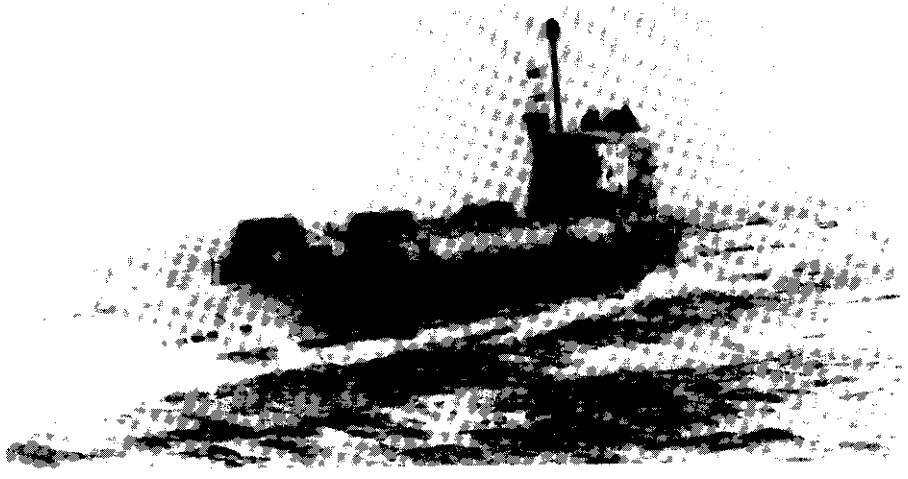
began in 1952. Like the Regulus II, the Soviet Navy's second-generation 'winged missiles' had projected characteristics that included supersonic speed, folding wings, a nuclear warhead, and a range of 450 nautical miles (this would have been about 120 nautical miles less than the Regulus II at Mach 2). Its guidance system would have been a carbon copy of the Regulus II's subsonic predecessor, the Regulus I, namely line-of-sight radio control that required the deployment of a relay of buoys or co-operating submarines between the launching vessel and the target area.

ONI also expected, as early as 1950, that in parallel with anticipated US developments, the Soviets would make a sharp transition from advanced cruise missiles to a first-generation of submarine-launched ballistic missiles. This judgment appears to have been based less on direct evidence of Soviet strategic and technological plans than on the premise that such an evolution was 'natural'.

Predications of Soviet *technological* parallelism were matched by the expectation that the Soviet Union intended to employ its submarine-carried missiles against more or less the same strategic, ie land targets as was planned for the US fleet. None of the declassified issues of the *ONI Review* of the 1950s hint at any suspicion that the Soviets might take missiles to sea for *anti-ship* purposes. It is true enough that the more difficult task of mastering the technology for guiding a missile to a point target at sea had a lower military priority for the Soviets than the creation of a strategic capability. Yet, a significant Soviet anti-ship missile programme was in existence throughout the 1950s, possibly even earlier. One declassified CIA document, dated 1954, contained the unevaluated account by a German repatriate that a missile 'resembling a torpedo' was fired from a submarine against the hulk of a gunboat in 1947! By the mid-1950s, the Soviets were heavily engaged in the S-2 coastal defence missile (known in the West as SSC-2b 'Samlet'), and by the late 1950s, flight tests of the P-15 (SS-N-2 'Styx') probably begun.

The 'Whiskey' and 'Zulu' missile conversions

In 1956, reports of unusually-configured 'Whiskey' class submarines arrived in the West. The next year, American naval intelligence acknowledged the 'possible existence of (unidentified) Soviet submarines with external or deck-fitted missile launching systems'. The



'Whiskey Twin-Cylinder' submarine underway (US Navy).

number and cylindrical shape of the launchers led to the designations 'Whiskey Single-Cylinder' and 'Whiskey Twin-Cylinder'. The bulky and awkward-looking 'add-ons' most likely caused stability problems (one Single or Twin-Cylinder may have sunk as result in the Northern Fleet area). The problem was solved by taking the next six 'Whiskeys', cutting their hulls in half and inserting a new centre section about 8 m long. First spotted in 1960, the resulting 'Whiskey Long Bins' contained two pairs of missile launchers each. None of the 'Whiskey' missile conversion have been reported operational since the early 1980s.

The missile system that has commonly been associated with the 'Whiskey' conversions is the SS-N-3 'Shaddock'. This system has been deployed in three different versions: the 'a' submarine-carried anti-ship variant, the 'b' surface ship-carried anti-ship variant, and the 'c' submarine-carried anti-*land* version. The SS-N-3a and SS-N-3c reportedly had the Soviet designations P-6 and P-7. Their earliest reported initial operational capability (IOC) has been traced to the early 1960s.

The time lag of about five years between the introduction of the 'Cylinder' conversions and the SS-N-3 raises a question about the boats' initial armament. There are two possibilities: one, the submarines spent several years with empty missile tubes, or two, they carried an 'interim' missile system. There is scant evidence to support both hypotheses. As to the first one, ONI reported on several occasions, during the late 1950s, that none of the 'Whiskey' missile boats seemed to have achieved operational status. It also appears that they rarely, if ever ventured outside coastal waters.

'Whiskey Long Bin' cruise missile submarine. Note 'Top Hat' attack sonar on top of the bow of the submarine (US Navy).

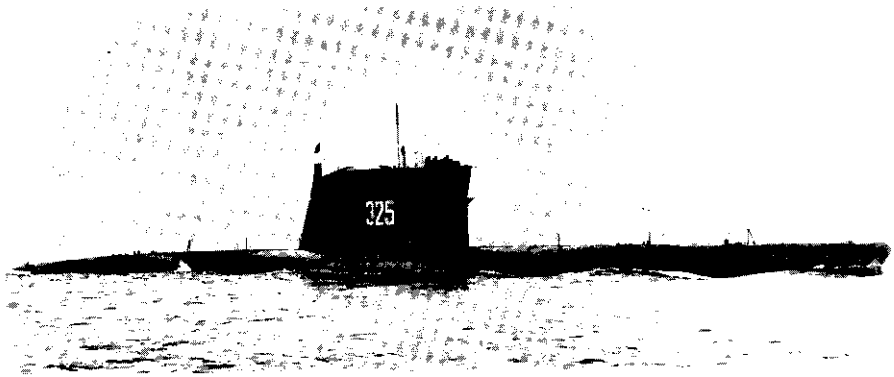
The questionable early operational career of the submarines can also be marshalled, however, in support of the second hypothesis, namely that the introduction of the SS-N-3 was preceded by a different missile that shortly proved to be a failure. Collaboration for this theory has come from a one-time participant in the Northern Fleet's missile R&D programme. In a report, entitled *The Introduction of Missile Systems Into the Soviet Navy (1945–1962)*, this emigré (who writes under the pen name Mikhail Turetsky) claims that three submarines 'of an obsolete design' were armed with P-5 missiles. The P-5s were stowed inside one or two containers that had been welded onto the decks.

The P-5, Turetsky reports, had been developed by the design bureau headed by V N Chelomei (also the designer of the P-6/7) for use against shore targets 350 nautical miles away. The unguided weapon carried about 900 kg (2000 lb) of high explosives, and was supposed to fly at an altitude of 45 m (150 ft). The entire system, according to Turetsky, proved to be a failure. Flight behaviour was erratic, and targeting accuracies were far below the requirement. Finally, the 'quick fix' of externally-mounted cylinders proved to be a serious danger for the parent submarine's manoeuvrability. The system failed its acceptance test after one submarine disappeared at sea.

The solution to the Whiskey/P-5 debacle was twofold: first, the P-5 was improved to become the P-6/7 (SS-N-3a/c); secondly, instead of retrofitting the existing fleet of submarines with cumbersome external launchers, a specialised 'missile shooter' was designed and built from the keel up. In fact, *two* different versions resulted: the diesel-powered 'Juliett' class, and the nuclear-propelled 'Echo I'.

The Soviet Union of the late 1950s was in a hurry to offset the West's bomber-based strategic nuclear preponderance. Khrushchev repeatedly bragged that his country's lead in 'atomic missiles' had reduced the B-47s and B-52s of the Strategic Air Command (SAC) to obsolescence. Inside the Soviet military establishment, the Navy was in a race with the Army to develop and deploy a working strategic ballistic missile capability. The early outcome appears to have been a setback comparable to the P-5 problem.

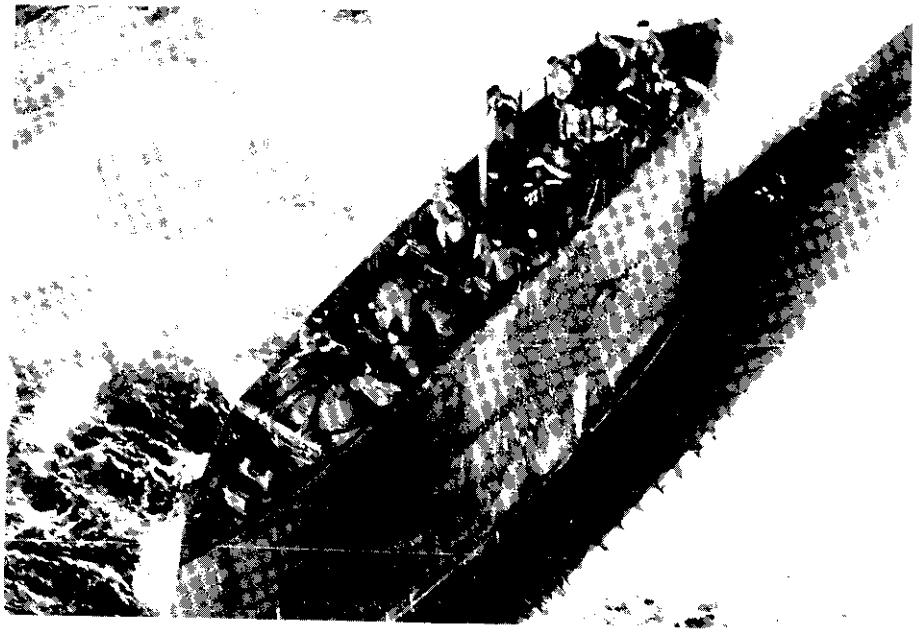
Close on the heels of the report of the 'Whiskey' missile conversions came news of an 'unusually configured' 'Zulu' class submarine. First observation reports arrived in the West in 1956. Three more units, some of which appeared to be returning from patrols in the northeast Atlantic Ocean, were listed in 1959. By February 1959, ONI had ruled out the possibility that the 'Zulu' modifications were connected with new radar or sonar equipment.



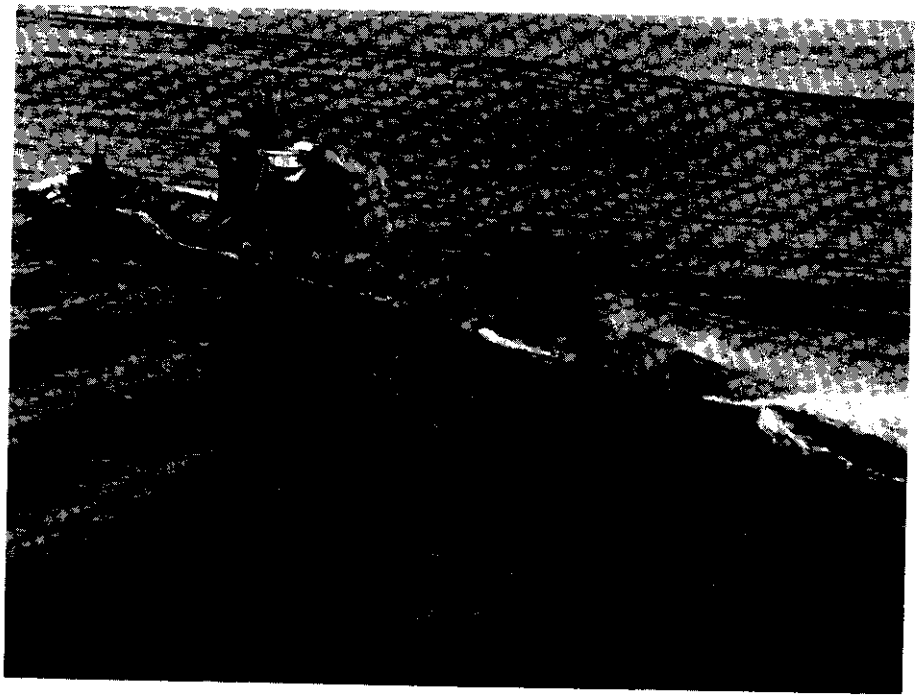
'Zulu V' class ballistic missile submarine (US Navy).

It deduced that if the boats' two vertical tubes were, in fact, missile launchers, a 'ballistic missile type' was most likely. Positive confirmation of the 'Zulu's ballistic missile capability came in a dramatic way. After a drawn-out pursuit by USS *Grenadier* (SS 525) in the northern Atlantic Ocean off Iceland, a missile-converted 'Zulu' was forced to the surface in May 1959. The cameras aboard a co-operating ASW aircraft left no doubt that, housed inside the fin of the 'Zulu V', were two ballistic missile cannisters.

The discovery of the 'Zulu V' approximately coincided with reliable sightings of a second group of probable ballistic missile types. First observations of what became known as the 'Golf' class were made in the Northern and Pacific Fleet areas in mid-1958. Two additional units were reported under construction in 1959. Table 15 lists the characteristics of the 'Golf' group as first built.



'Zulu V' with SLBM tubes exposed. (US Navy).



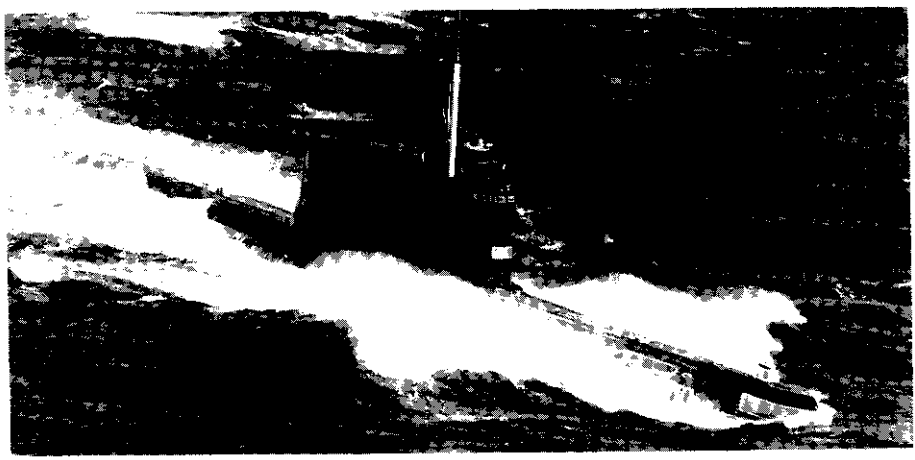
The 'Golf I' was the Soviet Navy's first ballistic missile submarine built from the keel up. It is possible that this class first went to sea with an SLBM with the Soviet designation R-11FM (US Navy).

Table 15: 'Golf' class submarines

Number built	23
When built	1957–1961
Where built	Yard 402, Severodvinsk, Amur Yard, Komsomolsk
Displacement	2350/2850 tons
Length	98.5 m (323 ft)
Beam	8.5 m (28 ft)
Draught	6.4 m (21 ft)
Propulsion	6000/5300 hp
Speed	17/14 knots
Endurance	9000 nm at 8 knots/250 nm at 3 knots (est)
Armament	3 × SS-N-4 Sark SLBM; 10 × 533 mm (21-in) TT (6 bow, 4 stern), 26 torpedoes or 44 mines
Diving depth	230 m (750 ft)
Complement	85

Preliminary estimates of the missile weapon housed inside the 'Zulu Vs' and 'Golfs' identified a 'modified R-10', believed to be a second-generation V2 adapted for air ejection from the submarine launch tube. General characteristics were tabulated as follows:

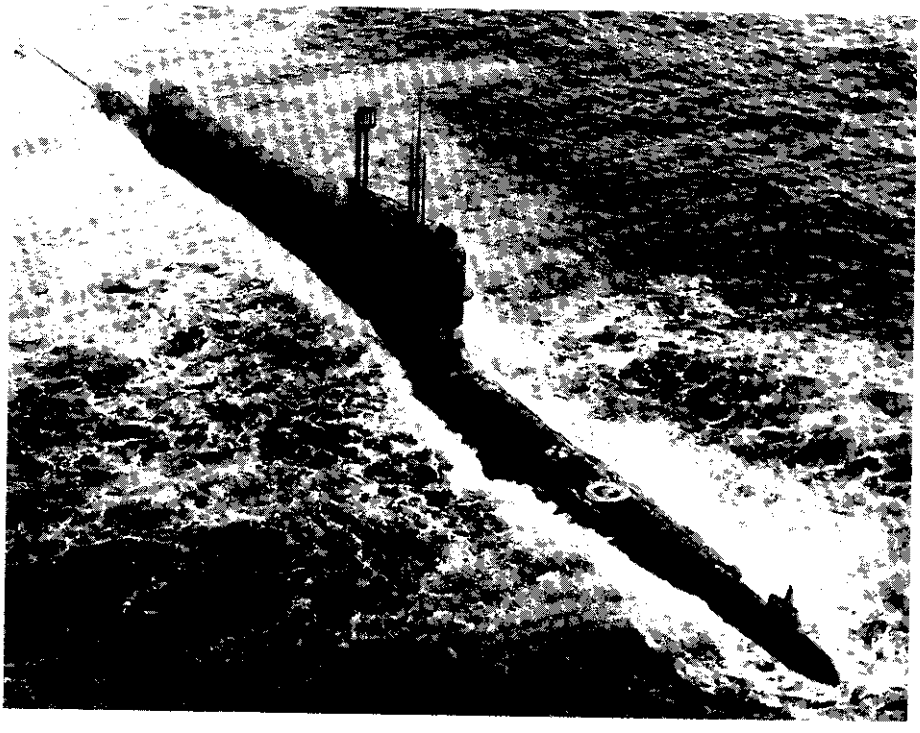
Length	12.8 m (42 ft)
Diameter	1.6 m (5.4 ft)
Tailfin diameter	2.9 m (9.5 ft) retractable to 2 m (6.8 ft)
Range	350 nm
Thrust	31,890 kg (70,300 lb) st
Accuracy	1–2 nm
Specific impulse	240 sec
Combustion pressure	21.1 kg/cm² (300 lb/sq in)
Propellant	storage hypergolic liquid
Guidance	inertial
Launch weight	13,608 kg (30,000 lb)
Warhead	907 kg (2000 lb) nuclear



The Soviet Navy's first submerged-launchable SLBM, the SS-N-5, went to sea on board the 'Golf II' shown here (US Navy)

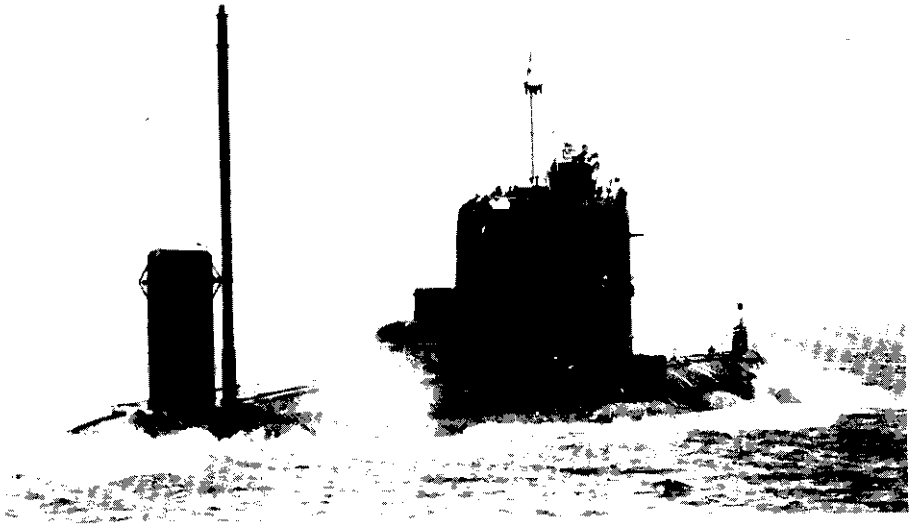
As is suggested in Table 15, the missile commonly associated with the 'Zulu Vs' and 'Golfs' is the SS-N-4 'Sark'. But, just as it is questionable that the 'Whiskeys' first went to sea with the SS-N-3, so it is doubtful that the 'Sark' was the Soviet Navy's first-deployed ballistic missile. Curiously perhaps, ONI's estimate of the characteristics of the 'modified R-10' closely match those generally associated with the SS-N-4. The original 'Zulu V' and 'Golf' missiles most likely were modified versions of the R-10 (itself a derivative of the V2), but the weight of (albeit circumstantial) evidence proposes that the submarines' initial load-out was a 'navalised' version of the Army's SS-1b 'Scud A' (with the Soviet designation R-11).

The Navy's adaptation of the R-11 went into limited production with the designation R-11FM. The letter 'F' probably stood for *forsirovanny*, meaning 'boosted'; the 'M' was most likely the prefix for *morskaya* or 'naval', or possibly for 'modified'). According to Turetsky, the R-11FM was based on a proven Army design, adapted for stowage aboard diesel submarines of the 'Project 611 design'. Turetsky continues that the '611' submarines were 'reconstructed' at the Severodvinsk Yard to carry two missiles each. His description leaves little doubt about that the '611' submarines belonged to the 'Zulu' class.



The 'Golf III' (lengthened by 10 m) became a test-bed for the intercontinental-range SS-N-8, deployed since the early 1970s, on the 'Delta' class SSBN (US Navy)

The R-11FM evidently shared the same fate as its P-5 aerodynamic contemporary. Although the missile was accepted by the Navy in 1959, it never became fully operational due to guidance problems and frequent leakages of the liquid fuel. It may have been partly because of the R-11FM's low mechanical reliability that – according to Turetsky's story – it never went to sea with other than a conventional high explosive warhead. Another interesting sidelight is that the projectile was launched (on the surface) *not* by way of an air- or gas ejection system, but after it had been raised to the top of the submarine's conning



One of four 'Golf' class submarines converted to command and control purposes (U.S. Navy).

tower with the help of a mechanically or hydraulically-operated platform. Circumstantial evidence that the Soviets were experiencing difficulties in getting the 'Zulu Vs' and 'Golfs' operational is that, during 1960–1961, both types ceased operations in outside waters, and virtually no test firings took place at sea. The Soviets used the hiatus to perfect the 'real' SS-N-4, otherwise known as the R-13.

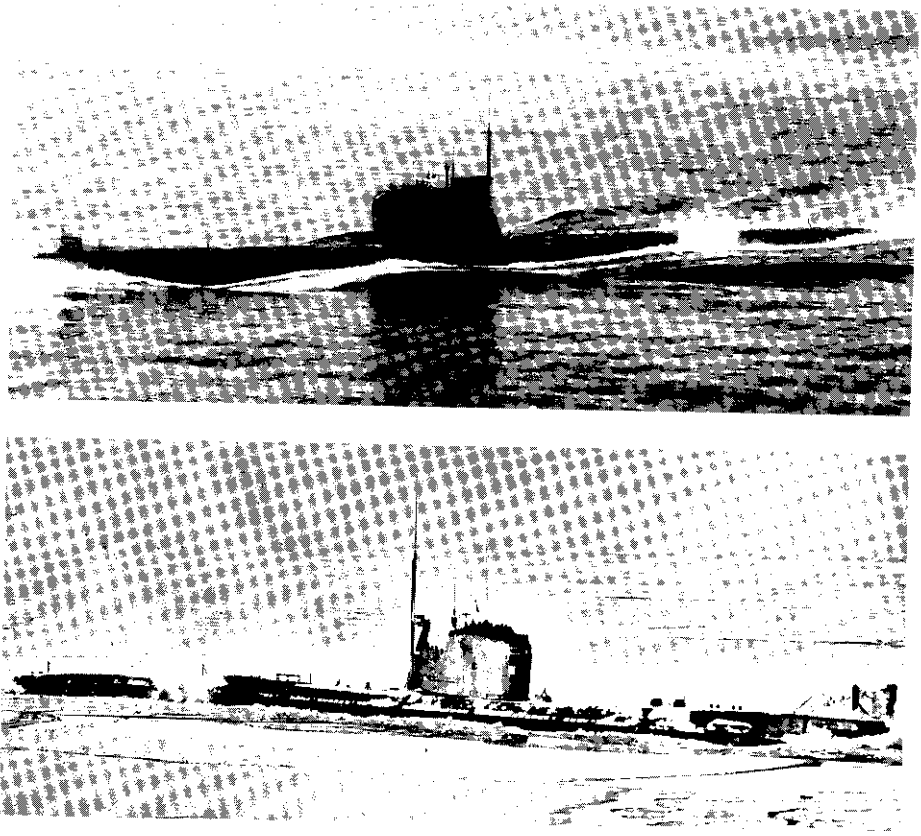
Principal sources

An invaluable source for this chapter was the *ONI Review*. The declassified 1945–1962 issues are available for at the Operational Archives at the Naval Yard in Washington, DC. Also available are scattered topical documents, including some fascinating estimates of Soviet submarine production capabilities. Another important source dealing with early Soviet submarine missile activities proved to be a collection of 'information documents' prepared by the Central Intelligence Agency during the early 1950s. Finally, mention must be made of Turetsky's *The Introduction of Missile Systems Into the Soviet Navy (1945–1962)*. This 147-page document was published in 1983 under the sponsorship of Delphic Associates of Fall Church, VA. Delphic Associates has produced a series of papers on the Soviet technology base based on the accounts of Soviet emigrés. A comparison of Turetsky's description of Soviet naval missile developments with other sources affirmed its reliability.

6 Transition to nuclear power, 1960–1970

'Foxtrot' and 'Romeo'

The general expectation among naval intelligence analysts in the mid- to late 1950s was that the Soviet Union's introduction of submarine-based ballistic missiles would coincide with the appearance of its first nuclear-propelled submarines. The consensus appears to have been moreover that the Soviets would imitate the United States and make a complete transition from diesel to atomic propulsion. Repeatedly, slow-downs or the termination in the production of current conventional types were seen as portents of the long-awaited arrival of the first Soviet nuclear-driven boat. In 1957, production of the 'Zulu' class came to a halt, prompting ONI to speculate that the next series of submarines might be built with advanced propulsion and weapon systems. Nuclear submarines, ONI commented, are a 'natural weapon for a navy whose primary offensive arm is the submarine branch, and whose



The 'workhorse' of the Soviet submarine fleet since the late 1950s, the 'Foxtrot' is routinely spotted, by Western navies, at both southern and northern latitudes. The top photograph was taken off the coast of Spain in 1972. (US Navy).

principal offensive objectives are the interdiction of the vital enemy transoceanic lines of communications and the destruction of vital overseas enemy shore installations'.

The intelligence community was correct on at least one count: in 1957 the Soviets laid the keel for their first nuclear-powered submarine. But before this became known in the West, calculations that the Soviet move would be an 'either-or' choice were upset by the appearance of an entirely new type of conventional boat, the 'Foxtrot' class.

First sighted by Western intelligence sources in January 1958 while under construction at the Sudomekh Yard in Leningrad, the 'Foxtrot's' conventional propulsion system and torpedo armament caught Western naval circles off guard and, for a short while at least, cast doubt on the assumed Soviet aspiration to build a nuclear-powered missile fleet on the pattern of the American Polaris force. One ONI report proposed that a large fleet of traditional torpedo-firing submarines for attacking the West's sea lines of communications, *not* a missile capability, might remain the Soviet Navy's highest building priority after all.

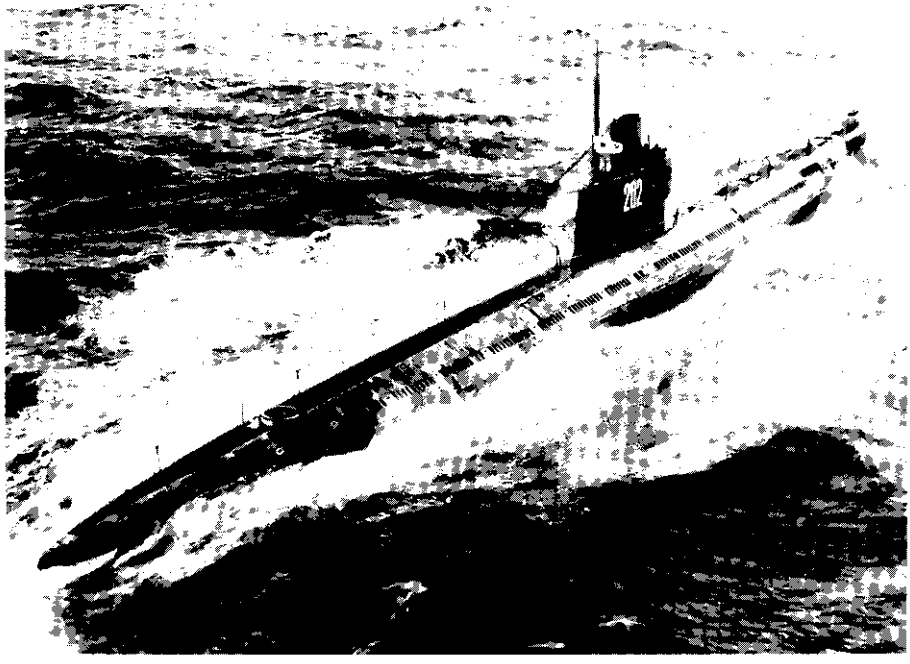
To this day, the 'Foxtrot' has been the 'workhorse' of the Soviet underwater fleet. Sixty-two units were completed Sudomekh between 1958 and 1971 for the Soviet Navy itself. Another 15 units have been built since for transfer to foreign fleets. Operationally, the 'Foxtrot' is the direct successor to the open-ocean patrol mission of the 'Zulu'. Technically, however, it represented a marked improvement over the 'Zulu' design, especially in the area of acoustic sensors. Indeed, the discovery that the 'Foxtrot' came equipped with a sonar array (dubbed 'Herkules') contributed to the short-lived speculation that the submarine might be the Soviet Union's first dedicated ASW 'hunter-killer', or SSK. This hypotheses has been by and large rejected with the discovery that it lacks effective silencing measures.

The 'Foxtrot' turned out to be, in fact, a traditional ocean patrol type, intended to operate on a patrol line or barrier astride the expected line of advance of enemy surface forces. Its range, endurance and armament were adequate for the requirements of an oceanic tonnage war, but the weight of the evidence nevertheless suggests that coastal defence, albeit a greater distances, was the 'Foxtrot's' principal intended mission.

Designed for mass production, pairs of 'Foxtrots' were assembled at the Sudomekh Yard in four distinct phases: phase one, which averaged four and one-half months, involved the initial construction and partial assembly of basic hull sections; phase two, which took approximately a similar amount of time, included assembly of the basic hull sections into larger subassemblies incorporating machinery, piping, insulation, and compartment furnishings; phase three – final assembly – came after movement of the subassemblies into a large two-door shed, and took another four and one-half months; and phase four was taken up by final fitting out quayside, requiring from 17 to 30 weeks to complete. Table 16 summarises the principal characteristics of the 'Foxtrot' class.

Table 16: 'Foxtrot' class submarines

Number built	62 (Soviet Navy production only)
When built	1958–1971 (Soviet Navy production only)
Where built	Sudomekh Yard, Leningrad, and Severodvinsk
Displacement	2100/2500 tons
Length	91.5 m (300 ft)
Beam	7.9 m (26 ft)
Draught	6.1 m (20.1 ft)
Propulsion	6000/6000 hp
Speed	16/16 knots
Endurance	12,000 nm at 5 knots/250 nm at 3.2 knots
Armament	10 × 533 mm (21-in) TT (6 bow, 4 stern), 22 torpedoes or 44 mines
Diving limit	280 m (920 ft)
Complement	75



'Romeo' class submarine (US Navy).

Before the Soviet Navy's long-awaited nuclear types made their appearance, one more conventional design made its debut. This was the 'Romeo' class, first sighted in August 1960, when two units completed passage through the Turkish Straits for assignments with the Northern Fleet. Because of certain external similarities, the 'Romeo' was for a while thought to be a hunter-killer conversion of the 'Whiskey' class. The similarities that count are few. The Romeo's surface displacement is 30 per cent greater than the 'Whiskey's'. The operating and collapse depths of the 'Whiskey' have been estimated at 200 and 300 m (656 and 948 ft), respectively; those for the 'Romeo' at 280 and 430 m (920 and 1400 ft). The Romeo is armed with ten torpedo tubes, compared with six for the 'Whiskey'. The newer submarine was fitted with a much more extensive sonar suite than had been the 'Whiskey', but its capabilities were still ten years behind those of the American hunter-killers. They were identical to the devices observed on the 'Foxtrot', and included a *Feniks* bow-wrapped passive array, the deck-mounted 'Herkules' sonar dome, and the 'Top Hat' (or 'Fez') underwater communications system.

Table 17: 'Romeo' class submarines

Number built	20
When built	1958–1961
Where built	Krasnaya Sormova Yard, Gorki
Displacement	1400/1800 tons
Length	76.2 m (250 ft)
Beam	7 m (23 ft)
Draught	5.5 m (18.2 ft)
Propulsion	4000/4000 hp

Speed	15.5/12.5 knots
Endurance	16,000 nm at 10 knots/300 nm at 2.5 knots
Armament	8 × 533 mm (21-in) TT (6 bow, 2 stern), 18 torpedoes or 36 mines
Diving limit	280 m (920 ft)
Complement	55

Production of the 'Romeo' lasted for only three years (1958–1961). Indications are that the series was first intended to be at least twice as large as the 20 units finally built. The question has been raised, from time to time, why the Soviet Union chose to introduce two new classes of conventional attack submarines ('Foxtrot' and 'Romeo') at the same time that it embarked upon the production of nuclear boats. The more intriguing part of this question is why there were *two* conventional types that, on most counts at least, were remarkably similar in performance. The handiest answer (and admittedly not a very satisfying one) is a Soviet tradition of repeatedly fielding the products of different design bureaus that are virtually identical in assessed capabilities and mission requirements. Examples outside the field of submarines are the high-speed, high-altitude interceptor aircraft built by the MiG and Yak teams, and the Yangel and Chelomei SS-17 and SS-19 intercontinental ballistic missiles (ICBMs). A much more recent (and more comparable) example is the recently-deployed (mid-1980s) triple-generation of *Akula*-'Mike-Sierra' class nuclear submarines. Other than being built by different shipyards and displaying slightly different displacements, these most recent additions to the Soviet Navy's attack submarine fleet appear to be about equally capable. One suspects that the Soviet military-industrial complex has its own inter-bureau competitive momentum.

First-generation nuclears: The HEN Group

The Soviet Navy's first nuclear-powered submarine, the *Leninsky Komsomol*, was commissioned on 8 April 1958, nearly four years after the United States had commissioned the USS *Nautilus* (SSN 571). During the five years following the commissioning of *Nautilus*, the Americans added seven more nuclear submarines; collectively, they represented five distinct classes, powered by six different nuclear powerplants. By comparison, five years after the introduction of the *Leninsky Komsomol*, the Soviet Navy operated two dozen nuclear-driven boats that belonged to a mere three distinct types. All used the same pressurised water plant, dubbed HEN (for 'Hotel-Echo-November'). The HEN reactor was most likely a straight derivative of the plant that powered the nuclear icebreaker *Lenin*. The long-time chief of the US Navy's nuclear reactor programme, Admiral Hyman G Rickover, visited the *Lenin* in the summer of 1959. He was not very impressed with what he saw, and later derided the ship's engineering plant as a 'sloppy job'. The ship suffered an apparent reactor melt-down sometime during the 1960s.

It has been said that preoccupation with conventional closed-cycle technology may have been one reason for the Soviet Union's four year lag behind the United States in adopting nuclear propulsion. A comparison of early 'milestones' in the US and Soviet nuclear programmes says otherwise, that the arrival of the *Leninsky Komsomol* four years behind *Nautilus* was quite consistent with the Soviet Union's 'late' nuclear start as a whole. Moreover, the Soviet Union's rate of nuclear development has been remarkably similar to that in the United States. The following key dates illustrate the point: the United States tested its first nuclear weapon in 1945; the Soviets exploded theirs in 1949. The US Navy became serious about nuclear propulsion for submarines in late 1945, and set upon the preliminary design of *Nautilus* in 1947; the Soviets trace their work on submarine nuclear propulsion back to 1947, and probably started initial design of *Leninsky Komsomol* in 1953.

The keel for *Nautilus* was laid on 1952; work on *Leninsky Komsomol* presumably began between 1955 and 1956. A final point of interest that has been reported by Arnold Kramish in his *Atomic Energy in the Soviet Union*, is that the Soviet Union's first materials and shielding testing reactors went into operation at about the same time as their American counterparts, in early 1952. Both reactors were important to the US (and one supposes Soviet as well) development of a submarine reactor.

From the mid-1950s onward, ONI acknowledged 'indirect information' that the Soviets were capable of building a nuclear submarine, but it evidently failed to verify that such work was underway at the Severodvinsk Yard. In November 1959, Khrushchev told President Eisenhower that his country had nuclear submarines twice as fast as those of the United States. Yet, it would be another three years before ONI would definitely confirm the existence of a Soviet nuclear submarine.

First photographic observations of probable nuclear-powered Soviet submarines were made in the Northern Fleet operating area in the spring of 1961. Tell-tale evidence included the absence of a snorkel exhaust. ONI tentatively identified the two vessels as 'probable SSN, possibly missile-equipped', but expressed doubts that their apparent size could accommodate missiles, fire control equipment, torpedoes and sonar, as well as a nuclear plant.

More sighting reports later in 1961 forced the conclusion that the Soviet Navy's nuclear propulsion programme might be much more ambitious in scope than had thus far been anticipated. The occasion was the discovery of a third probable nuclear submarine in the Northern Fleet area. After a detailed comparison of the three boats seen so far, it was found

This 'Hotel II' class SSBN was spotted in trouble 600 miles northeast of New Foundland in February 1972. She was taken in tow by a Soviet salvage vessel (US Navy).

that the Soviets had deployed not one, but at least two classes of atomic submarines – the 'Hotel' type ballistic missile boat, and the 'November' class attack submarine. At least five 'Hotels' and three 'Novembers' (including the *Leninsky Komsomol*) were believed operational with the Northern Fleet in late 1961. Before another year went by, the third member in the HEN group – the 'Echo I' nuclear cruise missile submarine (SSGN) – was spotted in the Pacific Fleet area.

The HEN group was a tangible result of a major review of naval needs that took place in the Soviet Union in the mid-1950s. The 1956–1958 slow-down in Soviet naval construction that had struck Western intelligence agencies was part of an overall reorientation in the Soviet armed forces from dependence on a Second World War-style mass army, to acceptance of the 'decisiveness' (offensively and defensively) of nuclear weapons. For the Navy this meant that nuclear strike and defence *against* nuclear strike (ie, damage limitation) became the primary tasks. The material implication entailed the cancellation or cut-back in production of conventional building plans (especially major surface combatants) in favour of 'high-tech' nuclear and missile combatants. Khrushchev selected Admiral Sergei G Gorshkov to preside over the transition to a new missile-armed and atomic-powered fleet.

The Soviet Union's principal seaward threat from the mid-1950s to the early 1960s was the American nuclear-capable aircraft carrier. For this reason, the most important mission of the HEN group would have been to defend the sea approaches, sink the US carrier task forces, and thus limit nuclear damage to the Soviet homeland. Based on the HEN group's different weapon capabilities, the likely 'division of labour' would have been the following: close to home, the torpedo-carrying 'Novembers' would maintain relatively static patrol line on the outer perimeter of a multi-tiered defensive zone. Back-up defensive tiers would be built around anti-ship missile-armed land-based aircraft, destroyers and a 'mosquito fleet' of *Osa* and *Komar* fast attack craft.

The 'Hotel' and 'Echo' classes were strategic submarines, armed with four SS-N-4 'Sarks' and six SS-N-3c 'Shaddocks', respectively. Western strategic thinking overwhelmingly associates strategic missiles with countervalue attacks against population targets, or 'counterforce' strikes against the opponent's intercontinental missiles. By contrast, the main strategic targets for the 'Hotels' and 'Echos' appear to have been dictated by the considerations of damage limitation, ie coastal targets, including the home ports and bases of the American carriers.

The 'Echo' and 'Hotel' classes represented different means toward the same end. The technical difficulties that were experienced with the P-5 and R-11FM were probably the reason why the Soviet Union deployed the apparent redundant capabilities of the SS-N-4 and the SS-N-3c – the one would have served as a 'hedge' against failure of the other. As the SS-N-4 evolved to the SS-N-5 and SS-N-6, the 'Echo's SS-N-3cs were replaced by the anti-ship targetable SS-N-3a.

The successful modification of the SS-N-3 from an anti-land to an anti-ship-capable weapon may have contributed to the devaluation of the Navy's aspirations to escape the role of assistant to the Army, and assume instead a main strategic task. Furthermore, the disappointments of the R-11FM and P-5 would have made it difficult for the Navy hierarchy to explain why the Soviet Union should depend on the vigilance of a sea-based deterrent and striking force.

In 1959, the Soviet Union created the Strategic Rocket Forces (SRF). Institutionally dominated by Army generals, the SRF was (and is) chartered with administrative responsibility for all land-based missiles with a range of over 1000 kilometres (about 625 miles). Doctrinally, the SRF has since occupied the position of main and decisive branch among the different branches of the Soviet military establishment. As a corollary, the 'deep strike' role of the Navy's ballistic missiles was limited to that of an SRF back-up at best. From

about 1960 onward their principal targets during the first phase of a nuclear exchange were naval and maritime in character. Tables 18 through 20 portray the main characteristics of the HEN group of submarines.

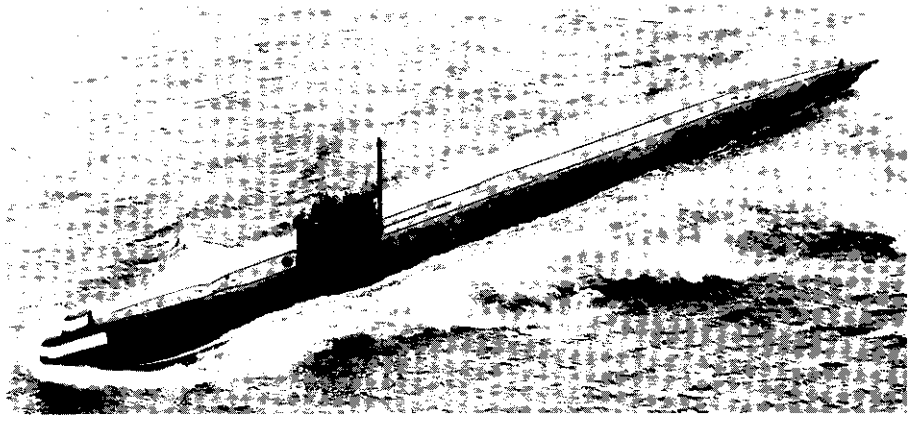
Table 18: 'Hotel' class submarines

Number built	9
When built	1958–1962
Where built	Severodvinsk and Komsomolsk
Displacement	5000/6000 tons
Length	115 m (377.3 ft)
Beam	9 m (29.5 ft)
Draught	7.2 m (23.6 ft)
Propulsion	22,000 hp
Speed	20/25 knots
Endurance	NA
Armament	3 × SS-N-4 Sark SLBMs; 6 × 533 mm (21-in) bow and 4 × 356 mm (14-in) stern TT; 20 torpedoes
Diving limit	305 m (1000 ft)
Complement	90

*Eight 'Hotels' were converted during 1963–1967 to carry the new, submerged-launched SS-N-5 'Serb' SLBMs, and were redesignated 'Hotel II'. A single 'Hotel II' was modified again, probably about 1970, to become the test platform for the SS-N-8, and became known as the 'Hotel III'.

Table 19: 'Echo I' class submarines*

Number built	5
When built	1960–1962
Where built	Severodvinsk
Displacement	4500/5500 tons
Length	114 m (375 ft)
Beam	9.1 m (30 ft)
Draught	8.4 m (27.5 ft)
Propulsion	22,000 hp



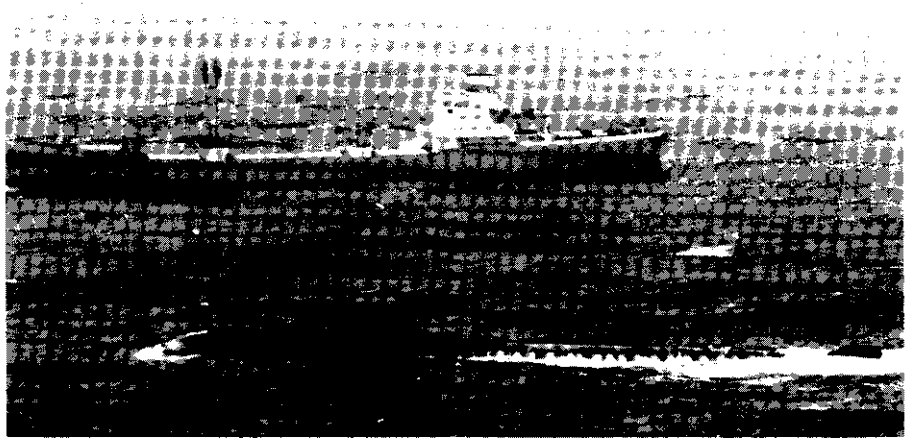
'Echo I' class SSGN (US Navy)

Speed	20/26 knots
Endurance	NA
Armament	6 × SS-N-3c Shaddock; 6 × 533 mm (21-in) bow and 4 × 356 mm (14-in) stern TT; 22 torpedoes or 36 mines
Diving limit	305 m (1000 ft)
Complement	90

*All five 'Echo Is' were converted to torpedo attack submarines between 1968 and 1974.

Table 20: 'November' class submarines

Number built	15
When built	1956–1964
Where built	Severodvinsk
Displacement	4600/5300 tons
Length	111 m (364 ft)
Beam	9 m (29.5 ft)
Draught	7.7 m (25.3 ft)
Propulsion	22,000 hp
Speed	20/25–28 knots
Endurance	25,000 nm
Armament	10 × 533 mm (21-in) TT (6 bow, 4 stern); 32 torpedoes or 64 mines
Diving limit	305 m (1000 ft)
Complement	35



A 'November' class submarine off the coast of Spain. The crew was transferred to the Soviet merchant vessel standing by before the submarine sank on 12 April, 1970 (US Navy).

The 'Juliett' class

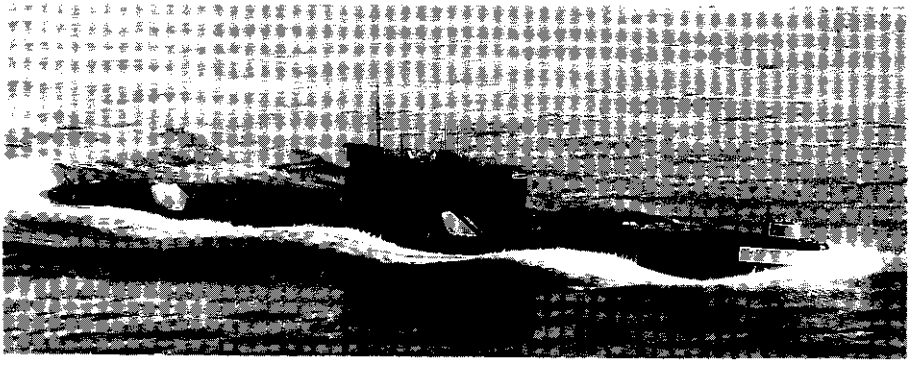
Each of the HEN group of submarines had its conventional counterpart; the 'Hotel' was matched by the 'Golf', the 'November' by the 'Foxtrot' and 'Romeo', and the 'Echo I' by the 'Juliett'. Fourteen diesel-powered cruise missile submarines with the designation 'Juliett' left the building ways at the Gorki yard between 1962 and 1969. The first few deliveries at least

began operations with the land strike version of the SS-N-3. All eventually were rearmed with the anti-ship SS-N-3a. All but one were still reported with the operational fleet in 1986.

Table 21: 'Juliett class' submarines

Number built	16
When built	1962–1969
Where built	Krasnaya Sormova Yard, Gorki
Displacement	2800/3500 tons
Length	87 m (285 ft)
Draught	7 m (23 ft)
Beam	10 m (33 ft)
Propulsion	6000/6000 hp
Speed	15/15 knots
Endurance	9000 nm at 7 knots/300 nm at 2.8 knots
Armament	4 × SS-N-3c 'Shaddock'* 6 × 533 mm (21-in) bow and 4 × 356 mm (14-in) stern TT; 18–22 torpedoes or 36 mines
Diving limit	396 m (1300 ft)
Complement	80

*SS-N-3c later replaced by SS-N-3a



'Juliett' class submarine off the coast of Spain (US Navy).

Countering the Polaris threat

In 1960, the USS *George Washington* (SSBN 598) departed on what would become the standard 60-day underwater patrol cycle of the US Navy's SSBN fleet. Two years later, a total of nine American SSBNs, each with 16 1200-nautical miles range Polaris A-1 submarine-launched ballistic missiles (SLBMs), were operational. On 22 October 1962, at the height of the Cuban missile crisis, another 18 boats were in various stages of completion. The Polaris A-2 with a range of 1500 nautical miles had been tested in May 1962, and the 2,500 nm A-3 was in advanced deployment. The Soviet Union could take credit for launching and deploying the world's first SLBMs, but the capabilities of the 'Zulu Vs', 'Golfs' and 'Hotels' were at least one generation behind those of the new USN SSBNs.

Initial Soviet reactions in open sources were guarded, even doubtful of Polaris'

operational longevity. Commenting on the recent successful test-firing of a Polaris from the test ship *Observation Island*, one Soviet writer claimed, in 1959, that the US Navy nevertheless had second thoughts about the weapon. As evidence of alleged difficulties with the solid rocket propellant, he cited the decision to arm some Polaris submarines with torpedoes, the recent approval by the US Congress to build a second nuclear aircraft carrier, and statements by high-level US Navy officers that, despite Polaris, the aircraft carrier remained the centrepiece of US naval striking power.

The success of the Polaris programme prompted some Soviet writers to take a different tack. In his famous book *Voennaya Strategiya* (*Military Strategy*), Marshal of the Soviet Union V D Sokolovsky played down the SSBN's vaunted vulnerability:

> 'Much has been said in the foreign press about nuclear submarines armed with Polaris missiles. The assertion has been made that these are the most invulnerable means for the use of missiles. Actually, these weapons are also vulnerable. Homing missiles launched by submarines and surface ships are an effective weapon against missile-carrying submarines.'

Sokolovsky's naval colleagues were much less sanguine about the ease of SSBN countermeasures. Retired Admiral Alafuzov took Sokolovsky and his co-authors to task for their 'brash', 'unconvincing' and 'unproven' conclusion that the SSBN was vulnerable to homing missiles. Had Sokolovsky *et al*, asked Alafuzov, perhaps not considered the fact that nuclear submarines only operated submerged?

In truth, Sokolovsky's claim on behalf of 'homing missiles' may have been not nearly as preposterous as his critics made it out to be. Starting in the late 1960s, the Soviet Union deployed a series of missile-like ASW weapons, including the SS-N-14, -15, and -16. They are carried on board submarines and surface vessels, and considered a potential threat to Western SSBNs. It is quite probable that the SS-N-14 at least was already in advanced development when Sokolovsky first made his claim in 1962. In support of the hypothesis that the Marshal may actually have had the SS-N-14 in mind is the fact that, despite Alafuzov's criticism, he repeated his claim vertabim in the third (1968) edition of *Voennaya Strategiya*.

Western analysts today disagree over the nature of the (initial) Soviet anti-SSBN solution. Other than doing nothing, the Soviets had basically two options. The option that fit the Soviet doctrinal prediliction for active defence and damage limitation, and indeed the one that most analysts believe was taken (or attempted, at least), was the development of a strategic ASW capability. As evidence is cited the introduction, in the late 1960s, of a variety of improved ASW combatants, sensors, and weapons. From the mid-1960s onward Soviet naval warfare priorities reputedly shifted from anti-carrier to anti-SSBN.

Soviet open-source naval writings of the period support the contention that active anti-SSBN defence became a main task. Admiral Gorshkov wrote in *The Sea Power of the State* that,

> 'The intensive development of submarines, in particular the appearance of missile submarines with atomic power, the *fight against which assumed the character of a state task*, raised the question of a further and sharper rise in the effectiveness of antisubmarine weapons.' (emphasis added)

Soviet statements of military policy or doctrine are frequently quite ambiguous on the distinction between actual *capabilities* and *ambitions* or intentions. Thus, one cannot tell from Gorshkov's statement whether defence against the SSBN was a Navy capability or an aspired capability. More on the practical reality of the anti-SSBN option is said elsewhere in this book.

Even had the Soviet Union chosen to pursue a policy of strategic ASW, its leadership must have realised that it would be many years before the necessary ships and weapons would go to sea. One possible interim measure would have been the second option, namely the creation of a 'countervailing deterrent' of the Soviet Union's own SSBNs.

Again writing in *The Sea Power of the State*, Gorshkov has implied that this was part of the thinking that went into the building of the modern Soviet SSBN fleet. Referring to the Polaris boats, he remonstrated that, 'Naturally, in the face of such a formidable danger we were compelled to take all necessary steps to defend our country, . . . (and) our country began to explore the possibilities of arming ships with qualitatively-new missile weapons'.

The 'true' answer to the question of how the Soviet Union intended to confront the SSBN threat is not known. But it probably involved a *mix* of both the defence and deterrence options. One of the problems with dissecting Soviet naval decisions of the mid-1960s is that certain types of behaviour that seemed to match one option were probably symptomatic of a variety of unrelated considerations. The choices that were made by the Soviet Navy during the mid-1960s were a composite of strategic, military-technological, and political considerations. The need to 'do something' about Polaris was one. But so was the still-expanding threat of carrier-borne aircraft (the 3000-mile range A-5 Vigilante Mach 2 bomber was formally re-assigned to a reconnaissance role in 1964, but it retained its nuclear delivery capacity). The debacle at Cuba was another factor, and so was Moscow's search for ways and means to proselytise the Third World with more than fraternal promises. Contrary to early opinions, defence against the Polaris fleet was probably one of the least pressing reasons why the Soviet Navy was ordered to sea.

The Soviet Navy 'Goes to Sea'

Most observers of Soviet naval affairs have traced the Soviet naval build-up and forward deployment of the 1960s to one or two events: one, the realisation, in the wake of the Cuban missile crisis, of the continued relevance of ocean-going, traditional naval power, and two, the requirement to offset the threat of the Polaris fleet. Practical first steps included the geographical expansion of the Navy's traditionally coastal-bound exercise areas, the systematic use of long-range aviation to monitor US fleet movements in the northern Pacific and eastern Atlantic Oceans, and, in 1964, the establishment of a permanent *eskadra* in the Mediterranean Sea.

The intellectual history of the serious Western study of the Soviet Navy is barely two decades old. Its dean is Robert W Herrick, a former US Navy intelligence officer attached to the American embassy in Moscow. Herrick's *Soviet Naval Strategy: Fifty Years of Theory and Practice* upset official US Navy wisdom with the argument that Soviet naval capabilities and purposes were essentially *defensive* in character.

The Soviet Navy became a subject worthy of study because its behaviour had become *salient*. Its salience derived from the fact that, after one-half century of what had been little more than coastal deployments, it suddenly sent its forces onto the high seas to apparently contest the West's monopoly.

The Soviet Navy's forward deployment *was* a salient event – but only so with regard to its surface component. In reality, the 'invisible' side of the Soviet Navy, the submarines, had operated far beyond home waters, including the North American continental shelf, since the late 1940s. It is not clear whether their purpose may have been more than reconnaissance, but the frequency and location of their reported appearances are intriguing enough to warrant mention.

Reports of possible, probable, and positive contacts with unidentified submarines off the North American coast showed up first in 1948. One 'positive' encounter, based on sonar and visual sightings occurred near the US naval base at Norfolk, Virginia in October 1948.

A different area of interest for Soviet submarines was Eniwetok Island in the south Pacific. Eniwetok was the site for America's second post-war series of nuclear tests. A report of an unidentified submarine off the atoll appears in the diary of then-Secretary of Defense

Forrestal. Bernard J O'Keefe's *Nuclear Hostages* has given an eye-witness account of how the sightings triggered fears that the Soviets might 'come ashore from a submarine and literally steal the bomb'.

Reports of Soviet submarine patrols in North and South American waters continued throughout the 1950s. Two unidentified submarines were spotted during the sea trials of the USS *Forrestal* (CV 59) off Norfolk in 1955. In 1958, sightings were registered as far away as the Marshal and Palau islands in the South Pacific.

The Mediterranean Sea, too, became a theatre for Soviet submarines long before the establishment of the surface *eskadra*. The centre for Soviet submarine activities during the 1950s was the Albanian island of Saseno in the Adriatic Sea. Construction of submarine pens began in the late 1940s after the Soviet-Yugoslavian split and the Soviet loss of access to the Yugoslavian naval base at Pola. Contemporary press reports drew a vastly exaggerated picture of this 'Soviet Gibraltar'. According to the accounts of Albanian exiles, thousands of slave labourers worked day and night to build underground berths for up to 90 submarines. Albania evicted the Soviets in June 1961; the Soviet naval presence at Saseno typically amounted to four 'Whiskey' class submarines, although enough berthing space may have been built for 12.

Second-generation nuclears: 'Victor', 'Yankee', and 'Charlie'

The *mix* of Soviet concerns with naval security (as opposed to a single overriding focus on the SSBN threat) materialised in the distinct characteristics of the successors to the 'November', 'Hotel', and 'Echo I' classes: the 'Victor', 'Yankee', and 'Charlie' types.

Sixteen 'Victor I' class torpedo attack submarines were built in Leningrad between 1965 and 1974. They are double-hulled vessels, as are most Soviet submarines (the 'Alfa' group appears to be an exception). The boat's principal advantages over the 'November' include a higher maximum speed (30 versus 25 knots) and a reduced self-noise. The 'Victor I's' radiated noise (ie, the sound produced by the main and auxiliary machinery, pumps, and propeller) has been favourably compared with the performance of the first-generation American *Skipjack* class.

'Victor I' class SSN being shadowed by US Navy P-3 Orion ASW aircraft of VP 48 while transiting through the Malacca Straits in April 1974. Unlike USN or Royal Navy submarines, Soviet SSNs are frequently caught transiting on the surface (US Navy).

The 'Victor I's possible 'quiet' hunter-killer role has been questioned in light of its apparent 30 knots speed potential. No question, moving at this speed would neutralise much, probably all, of the submarine's silent ability. Still, the argument overlooks two considerations – one operational, the other technical. In the first place, a speed of 30 knots would be the exception; the 'Victor I's typical patrol speed lies between five and 15 knots, depending on whether it passively listens for a suspected enemy datum, or searches for a first contact. For navigation at 'hovering' speed, two small two-bladed propellers can be used in place of the central main propeller.

High speeds may be the preferred tactic depending on the type of patrol operation. The Soviets recognise at least four basic search and track routines. Milan Vego, who is one of the West's premier analysts of Soviet submarine tactics, has listed them as follows:

- Forward positioning astride the probable path of intended movement (PIM) of enemy submarines to and from their bases;
- moving barrier patrols across narrow choke points with the aim of intercepting passing enemy submarines;
- combined surface ship-submarine barrier patrols across broad ocean areas, in which case the submarine is expected to 'hand-off' the initial decision to the surface combatants (or ASW aircraft) for prosecution;
- single but preferably co-ordinated dual submarine patrols in the open ocean at 'key points' along the enemy's lines of communications.

The 'III' version of the 'Victor' class is conspicuous for the streamlined pod on the tail fin. It is generally thought to contain a towed sonar array, but a few analysts hold that it might house an advanced form of auxiliary propulsion (US Navy).

The 'Victor' class has been built in three distinct series. The 'Victor II' and III are 4.6/13.7 m (15 and 45 ft) longer, respectively, than the 'Victor I'. Besides the standard torpedo armament, all three versions are believed armed with the SS-N-15, the approximate equivalent of the US Navy's SUBROC nuclear depth charge-carrying rocket. The IIs and IIIs have in addition been credited with a second ASW stand-off ASW weapon, designated SS-N-16. This has been evaluated as a torpedo-carrying missile (roughly the submarine equivalent of the SS-N-14) that, according to some sources, is launched from two specially designed tubes in the bow of the submarine.

The twenty-second hull in the 'Victor III' group was launched in 1984. Substantially quieter than the I and II, the 'Victor III' is currently (1988) the Soviet Navy's top of the line operational hunter-killer.

Table 22: 'Victor' class submarines

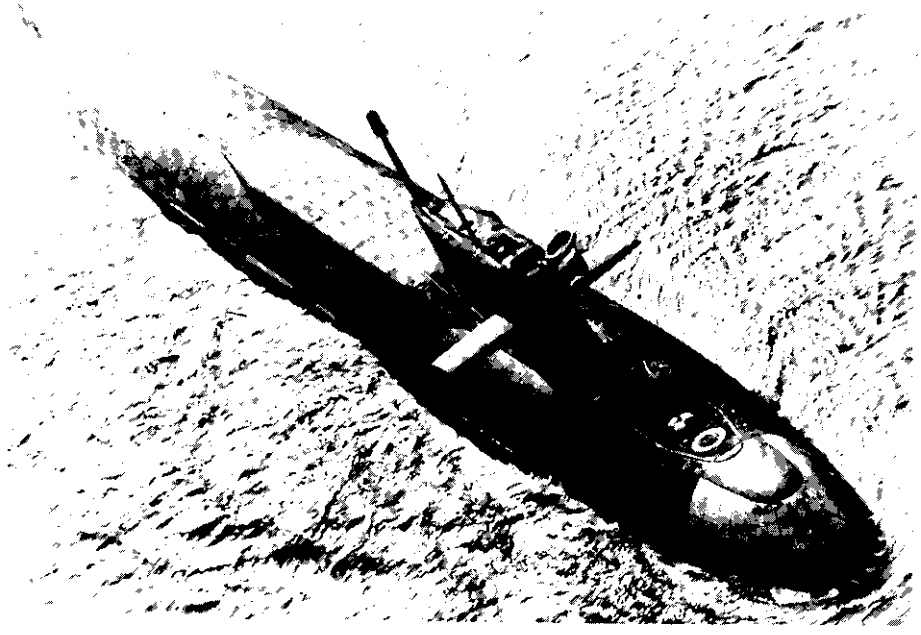
	'Victor I'	'Victor II'	'Victor III'
Number built	16	7	22 (spring 1988)
When built	1965–74	1972–78	1978–present
Where built	United Admiralty Yard, Leningrad	United Admiralty Yard, Leningrad	United Admiralty Yard, Leningrad and Komsomolsk
Displacement	4300/5100 tons	4500/5700 tons	4800/6000 tons
Length	95 m (312 ft)	100 m (328 ft)	106 m (348 ft)
Beam	10 m (33 ft)	10 m (33 ft)	10 m (33 ft)
Draught	7 m (23.1 ft)	7 m (23.1 ft)	7 m (23.1 ft)
Propulsion	30,000 hp	30,000 hp	30,000 hp
Speed	16/29 knots	16/29 knots	16/29 knots
Endurance	NA	NA	NA
Armament	6 × 533 mm (21-in) bow TT; SS-N-15; 32 torpedoes or 64 mines	6 × 533 mm (21-in) bow TT; SS-N-15, SS-N-16; 32 torpedoes or 64 mines	6 × 533 mm (21-in) bow TT; SS-N-15, SS-N-16; 32 torpedoes or 64 mines
Diving limit	396 m (1300 ft)	396 m (1300 ft)	396 m (1300 ft)
Complement	90	90	90-plus

About one year after the keel was laid for the first 'Victor I', work began on the Soviet Navy's first truly modern SSBN, the 'Yankee' class. The designation may have contributed to the boat's frequent comparison with the early US Navy SSBNs. Coincidentally, the 'Yankee' carried the same number of (16) SLBMs as its US counterpart. The US choice of 16 tubes, by the way, appears to have been mostly arbitrary.

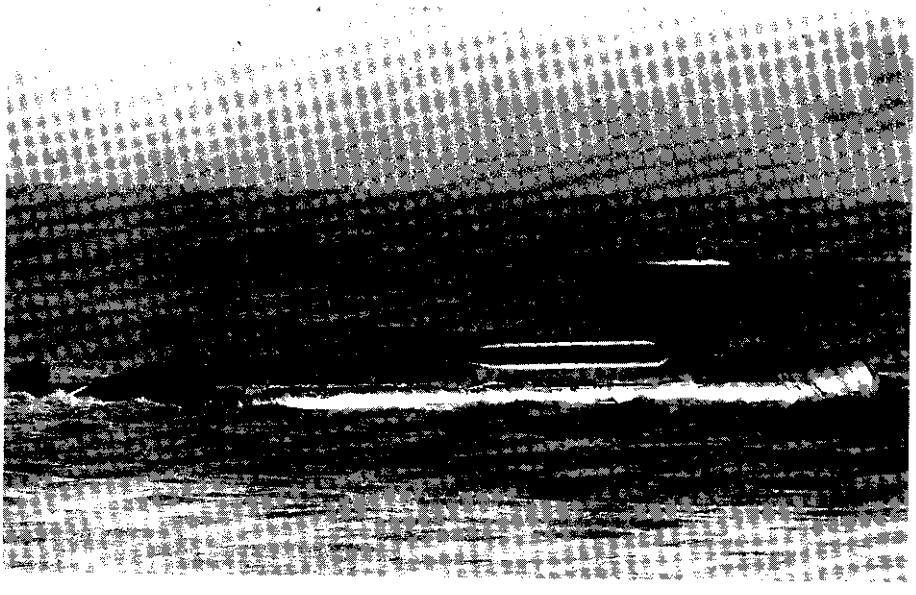
The differences between the 'Yankees' and the *Ethan Allen* class are more important than their similarities. To begin with, the Soviet boats displace about 50 per cent more tonnage than the American ones. Their nuclear propulsion system delivers at least twice as much horsepower (30 000 versus 15 000), but contrary to early estimates, this has not resulted in a significant speed advantage. Most of the 'Yankee's extra power output is probably consumed by its large size and a high drag factor. The latter is the result of the continuing Soviet practice of lining the outer hulls of their submarines with numerous free-flood holes. Another disadvantage is an excessive flow noise which is prone to detection and also masks the 'Yankee's' own listening ability. Indeed, the 'Yankee' is characterised by a high self-noise level generally, and is reportedly one of the easiest Soviet submarines to detect.

Another important difference between the 'Yankees' and the USN's SSBNs concerns their respective SLBM armaments. One of the keys to the success of the Polaris programme was a break-through in solid-propellant technology for large boosters; all American SLBMs since the Polaris A-1 have used solid propellant motors. Until the early 1980s (and the deployment of the SS-N-20), Soviet SLBMs were boosted by liquid fuel engines (one exception is the experimental SS-N-17 aboard a single 'Yankee II'). Liquid propellant systems have certain advantages; they can be throttled, stopped and restarted more easily than solid propellant motors. But the benefits are outweighed by certain important disadvantages. Liquid engines are larger and more complex than solid propellant motors. Liquid fuel is more volatile and is therefore more dangerous to transport; inspection of tanks and fuel lines must be done on a regular basis.

Unlike the first generations of Soviet SLBMs that could be fuelled only shortly before launch, the 'Yankee's' SS-N-6s went to sea with a storable liquid fuel. Even this had to be



'Yankee I' SSBN nearly dead in the water (US Navy).



'Yankee I' SSBN underway (US Navy).

periodically replaced as a safeguard against tank corrosion and evaporation. The comparative weight and bulkiness of liquid-fuel missiles help explain why the SS-N-6, though roughly comparable with the Polaris A-1 in terms of range, is some 35 per cent heavier and 50 per cent taller.

The first 'Yankee' patrol within SS-N-6 range of the US eastern seaboard occurred in 1968. Three years later, a Pacific station was established. As production reached ten a year, Western defence and intelligence officials fully expected that the Soviet Union would emulate the US Navy SSBN patrol pattern, and keep one-half of its burgeoning fleet within striking range of the North American continent. There is 'little doubt', Defense Secretary Melvin R Laird told the US Congress in 1972, 'that out-of-area operations by these submarines will increase over the next several years'.

The prediction has not been fulfilled. Although 33 'Yankees' were built, their number on out-of-area duty has apparently never exceeded five – three in the 'Yankee Box' off the US east coast, and two in the Pacific Ocean. Chapter Seven examines the apparent (and inferred) reasons for this 'anomaly'.

The operational 'Yankee' SSBN fleet in the Spring of 1988 stood at 17. This includes the single 'Yankee' II that has been modified to carry 12 SS-N-17s. Sixteen 'Yankees' had been taken out of service as ballistic missile boats since 1978 in compliance with the SALT I limits on modern SSBNs and SLBMs. They are being modified for torpedo or cruise missile attack purposes. One 'Yankee' sank near Bermuda in 1986 after an explosion and fire in the missile compartment. Table 23 compares the 'Yankee' class characteristics.

Table 23: 'Yankee' class submarines

Number built	34
When built	1966–1974
Where built	Severodvinsk and Komsomolsk
Displacement	8000/9600 tons
Length	130 m (426 ft)
Beam	12 m (39.3 ft)
Draught	9 m (29.8 ft)
Propulsion	30,000 hp*
Speed	20/ 30 knots
Endurance	NA
Armament	16 × SS-N-6 'Sawfly'; 6 × 533 mm (21-in) bow TT
Diving limit	396 m (1300 ft)
Complement	120

*Some sources report that the 'Yankee' is powered by two nuclear reactors with an aggregate output of 50 000 hp.

The fact that the erstwhile high priority of anti-carrier warfare had not entirely been overtaken by the anti-SSBN demand became clear with the deployment, in 1968, of the third member in the trio of second-generation Soviet nuclears: the 'Charlie' class.

The outstanding characteristic of the 'Charlie' is its SS-N-7 'Siren' armament. Launched from a submerged condition at a maximum range of about 25 nautical miles, and flying at a cruise altitude of some 90 m (300 ft), the missile barely affords a ship two minutes to react and defend itself. The threat posed by the 'Charlie'/SS-N-7 system had forced a wholesale revision in standard carrier battlegroup defensive tactics. The fact that a submerged submarine could henceforth attack a surface warship at stand-off ranges erased the traditional separation between anti-submarine warfare and anti-air warfare. Ships now needed to be capable of *simultaneous* warfare. The concluding portion of this chapter takes a closer look at the strengths and liabilities of the 'Charlie' class in an anti-carrier scenario.

The 'Charlie' class has been built in two series. Twelve 'Charlie Is' were completed at the Gorki yard between 1967 and 1973, and another six 'Charlie IIs' were delivered by the same

Aerial photograph of a 'Charlie I' class SSGN (US Navy).

facility through 1981. A total of 15 or 16 vessels remained operational in 1988 after one reportedly sank off the Kamchatka Peninsula in June 1983, and a second was transferred to India, in 1988, under a 'lease' arrangement.

There are conflicting reports that some 'Charlie' units have been rearmed with the longer-range SS-N-9 missile. The SS-N-9 is of about the same vintage as the SS-N-7, and was first seen on the *Nanuchka* class missile corvettes. It has also been identified as the armament of the one-off 'Papa' SSGN.

Several features of the SS-N-9 argue against a 'Charlie' refit. One is size. The SS-N-9 is considerably larger in both length and diameter than the SS-N-7 (9.1 m/30 ft versus 7.6 m/25 ft, and 2 m/6.7 ft versus 1.4 m /4.7 ft, respectively. Yet, the 'Charlie' shows no visible modifications. A second anomaly concerns the *range* of the SS-N-9. Official US Navy sources report a range of 60 nautical miles; other authorities have claimed as much as 150 nautical miles. Either range would seem to be far outside the 'Charlie's' own acoustic fire control range. If so, the need for third-party targeting assistance would largely negate the 'Charlie's' stealth advantage. Finally, it is not at all clear that the SS-N-9 turned out to be a success. Circumstantial evidence is that the *Nanuchkas* sold to the Indian Navy were armed with the SS-N-2c due to technical reliability problems with the SS-N-9. Table 24 compares the 'Charlie' I and II classes.

Submarine anti-carrier capabilities

As is related in the next chapter, the extent to which the Soviet Navy has managed to implement its anti-SSBN ambition through an efficient set of tactics and hardware is quite

doubtful. This is not the case with the avowed priority of defeating the US Navy aircraft carrier. The Soviets believe that they have developed an anti-carrier warfare (ACW) concept that, if carried out as practised repeatedly in major fleet exercises, will inflict 'unacceptable losses' on the opponent. Submarines play a critical part in this concept of operations. The concluding section of this chapter is an overview of this part with special emphasis on the estimated contribution of the cruise missile-firing submarine. The information reflects intelligence assessments of Soviet ACW capabilities and tactics current in the late 1960s to early 1970s.

Table 24: 'Charlie' class submarines

	'Charlie I'	'Charlie II'
Number built	12	6
When built	1967–1973	1972–1981
Where built	Krasnaya Sormova Yard, Gorki	Krasnaya Sormova Yard, Gorki
Displacement	4000/5000 tons	4500/5500 tons
Length	95 m (311 ft)	103 m (338 ft)
Beam	9.9 m (32.7 ft)	9.9 m (32.7 ft)
Draught	8 m (26.4 ft)	8.3 m (27.3 ft)
Propulsion	30,000 hp	30,000 hp
Speed	17/26 knots	17/26 knots
Endurance	NA	NA
Armament	8 × SS-N-7; 6 × 533 mm (21-in) bow TT; 18 torpedoes or 36 mines	8 × SS-N-7 (SS-N-9?); SS-N-15; 6 × 533 mm (21-in) bow TT; 18 torpedoes or 36 mines
Diving limit	386 m (1300 ft)	396 m (1300 ft)
Complement	90	90

The SSG and SSGN anti-carrier threat

Anti-ship cruise missile submarines in operation with the Soviet fleet around 1970 included the 'Echo II' and 'Charlie' SSGN, and the 'Juliett' SSG. The 'Echo I' series was in the process of conversion to torpedo attack boats. The 'Echo II' carried eight SS-N-3a Shaddocks, the 'Charlie' eight SS-N-7s, and the 'Juliett' four Shaddocks. An improved version of the SS-N-3c, the SS-N-12 Sandbox, was in advanced development and would later be retrofitted to the 'Echo II' and possibly the 'Juliett' as well. Table 25 compares the performance characteristics of the SS-N-3a and SS-N-7. Complementary flight profiles are shown in Figure 1.

Table 25: SS-N-3a and SS-N-7 performance characteristics

Characteristics	SS-N-3a	SS-N-7
Max range, nm	220	30
Min range, nm	12	4–5
Probable operational range, nm	150	25
Cruise speed, Mach No	1.2	0.9
Terminal speed, Mach No	1.2	0.9

Cruise altitude	3960 m (13,000 ft)	90 m (300 ft)
Terminal profile	low-angle dive	low-angle dive
Guidance	track command with mid-course updating and active radar terminal homing	pre-set auto-pilot with active terminal homing and possible infrared back-up
Propulsion	turbojet and rocket-assisted take-off	turbojet and rocket-assisted take-off
Warhead	500–1000 kg (1100–2200 lb) HE or nuclear	500 kg (1100 lb) HE or nuclear

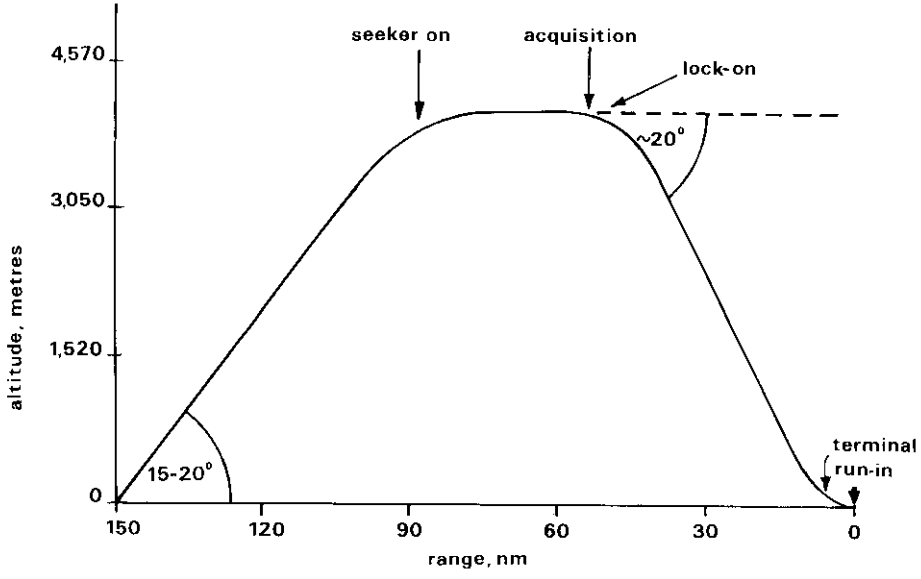


Figure 1a: SSN-N-3a flight profile at 150 nm from target

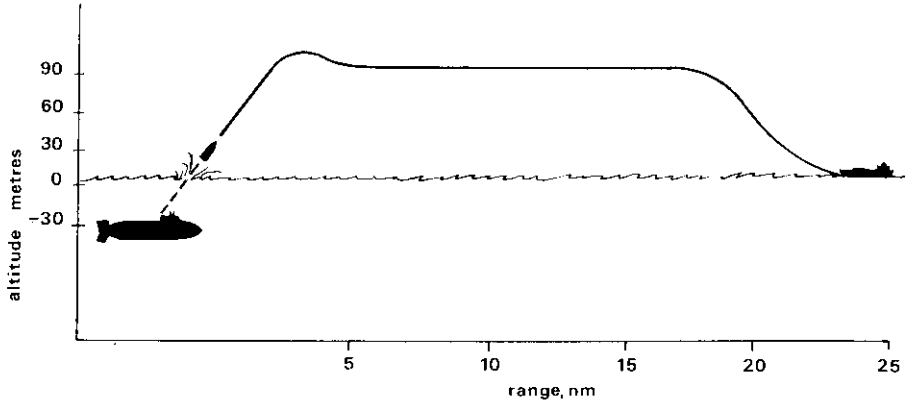
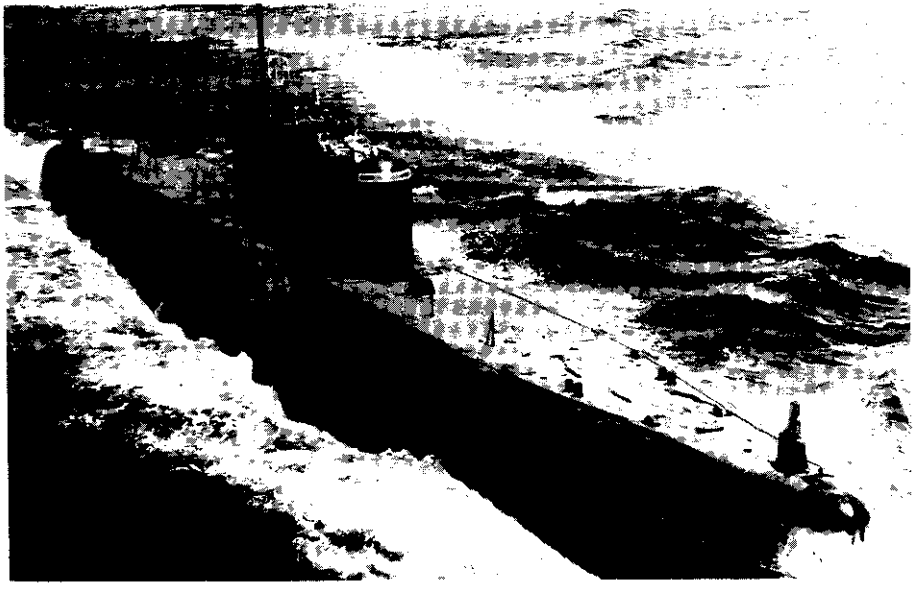


Figure 1b: SS-N-7 flight profile

Table 25 and Figure 1 offer a good clue to the respective strengths and limitations of the 'Echo II'/'Juliett' and 'Charlie' weapon systems. The most important, perhaps single benefit of the SS-N-3a is its great stand-off distance. When it was first deployed in the early 1960s, the outer air defensive perimeter of a carrier battlegroup was typically situated at about 100 nautical miles from the 'vital centre'. Accordingly, an 'Echo II' or 'Juliett' would have stood a reasonable chance of staging an attack undetected. Today, however, an aircraft carrier sends out its combat air patrol (CAP) aircraft at least twice as far. Radar early warning aircraft extend the battlegroup's 'eyes' another 200 nautical miles or so. The longer-range SS-N-12 and SS-N-19 may have been the Soviet response to this development.

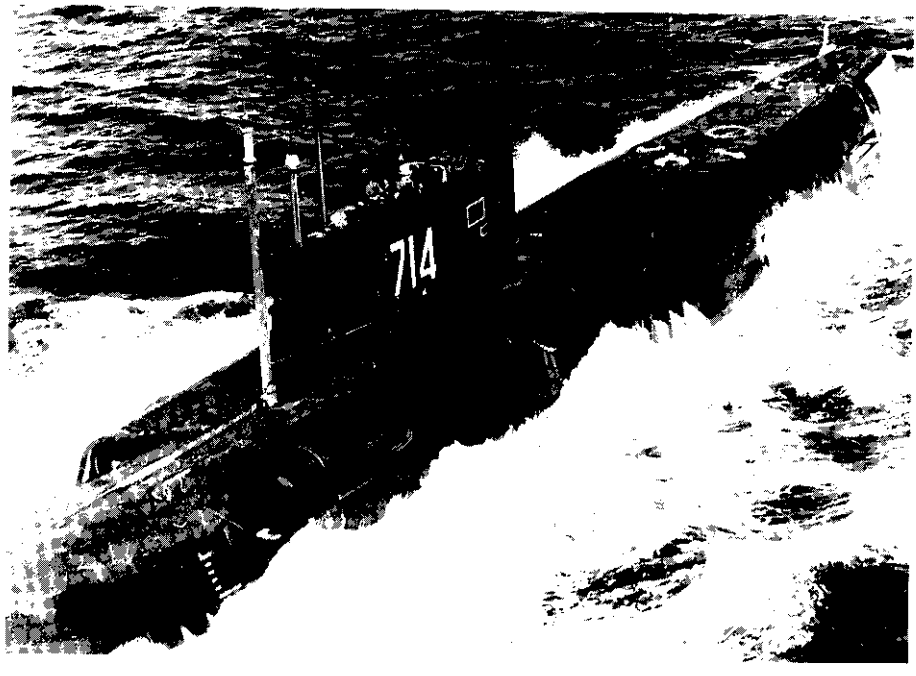


'Juliett' class SSG showing hull indentations that act as blast deflectors for the SS-N-3a (US Navy).

The SS-N-3a is marked by some distinct limitations. One is that is relatively bulky and therefore presents a radar cross section (RCS) comparable in strength to that of a jet fighter. A more important drawback is that the missile must be launched on the surface and requires a number of rather cumbersome and time-consuming preparations.

After an 'Echo II' or 'Juliett' has broached the surface of the water, it must elevate pairs of launch tubes at angles of 15–20 degrees. At the same time, the submarine must deploy the 'Front Door'/'Front Piece' guidance radar to provide tracking out to a distance of about 100 nautical miles. Throughout the tracking process, the launching platform must remain exposed on the surface. It can be estimated that, between launch preparations and 100 nautical miles of tracking, the submarine will spend about 30 minutes on the surface before the missile reaches the target area.

The SS-N-3a is apparently launched in pairs. Because of the limited ability of the 'Front Door'/'Front Piece' radar to track simultaneous targets, a second salvo cannot be fired until the SS-N-3a's own active radar acquires the target about 50 nautical miles away. If the flight trajectory is about 150 nautical miles, this means that the interval between salvoes is approximately 15 minutes. It also means that a single 'Echo II' or 'Juliett' is not likely to saturate modern shipboard defences.



SS-N-3a launcher arrangement on 'Echo II' SSGN (US Navy).

Another important liability inherent in the SS-N-3a system is that targeting an opponent beyond the radar horizon requires a co-operating platform for target co-ordinate updating and missile midcourse corrections. Three aircraft have been identified for this role: the Tu-95 'Bear D' turbo-propelled long-range reconnaissance aircraft, and the Ka-25 'Hormone B' and Ka-27 'Helix B' helicopters. The 'Bear D' and 'Hormone B' carry different variants of the 'Big Bulge' radar which operates in the I/J-band of the spectrum, and both have been associated with a video datalink signal with the designation A346Z.

Using the 'Bear D' or 'Hormone B' to extend the striking range of the SS-N-3a is an interesting *technical* solution; its *operational* efficacy is doubtful. The wartime life expectancy of both slow-flying aircraft within radar detection range of a carrier battlegroup is not very promising. Moreover, since the platform must be within radar range of both the 'Echo II' or 'Juliett' *and* the intended victim, the latter has an equal chance of intercepting the tell-tale A346Z video signal.

Co-ordinating the activity of a submarine and an aircraft is not a very difficult problem in an exercise setting. It is an altogether different matter to try and ensure their simultaneous arrival against a target of opportunity in time of war! Fleets carry out firing exercises after long and careful preparations and under ideal weather conditions. Neither side will have this luxury when real hostilities break out – the 'Bear D' that comes to the aid of an 'Echo II' may find the detection range of its 'Big Bulge' radar cut into half or less by a North Atlantic rain squall.

The 'Echo II' and 'Juliett's' SS-N-3a was a formidable weapon when first introduced in the early 1960s, before shipboard missile air defences had barely developed beyond the prototype stage, and when electronic countermeasures were virtually non-existent. Launched *en masse*, it still presents a dangerous saturation problem; in a one-on-one situation, the SS-N-3a has become outclassed by modern shipboard defences.

The 'Charlie'/SS-N-7 weapon system

First deployed in the late 1960s, the submerged-launch capability, low flight altitude and short time of flight of the SS-N-7 overcame many of the vulnerabilities of the SS-N-3a just described. Indeed, Western analysts were wont to cite the SS-N-7 as material evidence that the Soviets had recognised the weaknesses of long-range anti-ship missiles, that short-range 'low-fliers' were the wave of the future. In reality, the Soviet Navy has continued to deploy a *mix* of over-the-horizon 'high-fliers' and short-range sea skimmers.

It is tempting to see the SS-N-7 as the deliberate counter-response to the American reaction to the SS-N-3a. The US Navy countered the threat of long-range missile attack with the medium- and long-range Standard Missile 1 (SM-1), by expanding the aircraft carrier's anti-air and anti-submarine defensive perimeter with the E-2C Hawkeye and S-3A Viking aircraft, respectively, and by stationing its most capable ASW escort, the DD 963 class, on the outer flanks of the task force.

The characteristics of the 'Charlie'/SS-N-7 weapon system threatened to nullify those steps. Between the missile's short flight time and low incoming altitude, the SM's ability to make a timely intercept was put in doubt. The restationing of the DD 963s away from the 'vital centre' had opened gaps in acoustic coverage, and given a 'quiet' 'Charlie' the chance to slip through. The carrier was still protected by an inner screen of close-in cruisers and destroyers, but its main task was protection against a torpedo attack and *not* a missile fired from 5 nautical miles away!

The most difficult problem for a 'Charlie' class submarine working alone is an accurate fire control solution. Because the SS-N-7's maximum estimated range roughly coincides with that of the first acoustic convergence zone (CZ) (at temperate latitudes, that is), it is possible for the submarine to get a fairly reliable fix of the target's range (of course, CZ sound transmission works both ways, so that the target has an equal chance of counter-detection). In practice, however, CZ sound transmission channels are a highly variable phenomenon whose existence depends on such factors as seasonal variations, water temperature and water depth. Moreover, a CZ detection would still leave the submarine without bearing information.

Considering these limitations, it is likely that in most tactical circumstances, the 'Charlie' needs visual or electromagnetic confirmation of the target's position, or alternatively the support of a co-operating platform. The latter could conceivably be an acoustic triangulation with the help of a second submarine.

Anti-carrier doctrine and tactics

Predictions of *how* the Soviet submarine fleet might employ its ACW capabilities depend on three sources: (1) Soviet declaratory doctrine and military art as portrayed in Soviet writings, (2) the characteristics of Soviet fleet exercises, and (3) estimated capabilities. A standard analytical tool for examining the interplay of all three is the engagement scenario.

Typical Soviet ACW scenarios of the early 1970s were twofold: the first one was predicated on a bolt-from-the-blue attack against the US Sixth Fleet in the Mediterranean Sea; the second one postulated an encounter between an advancing carrier task force and Soviet 'barrier' forces in the area of the Greenland-Iceland-United Kingdom (GIUK) Gap. In both scenarios the brunt of the Soviet attack would be borne by missile-armed submarines and Soviet Naval Aviation (SNA) bombers. Missile-armed surface combatants were usually assumed to be held in reserve, while torpedo attack submarines were presumed to enter the fray mainly to 'mop up' against ships already disabled by the opening missile strikes.

Soviet declaratory doctrine and observed exercises (most notably the 'Okean 70'

manoeuvre) suggested a strategy based on mass, surprise, simultaneity of attack, and repeated follow-up strikes, all aimed at winning, in Gorshkov's words, the 'battle of the first salvo'.

In the GIUK scenario, the enemy disposition of submarine forces was generally envisaged as follows: (1) one or two submarines (probably a 'Charlie' and/or 'Victor' class) in trail of the advancing battlegroup; and (2) 'Echo IIs' and 'Julietts', intermixed with torpedo attack submarines deployed in mobile patrol zones as part of a general barrier formation astride the opponent's PIM.

The assault itself was expected to evolve along approximately these lines.

1. Tu-95 'Bear' and/or Tu-16 'Badger' reconnaissance aircraft, operating in pairs, provide final targeting data to the barrier-deployed 'Echo IIs' and 'Julietts', and the approaching SNA strike regiments;
2. SNA strike bombers, involving as many as three regiments of about 20 missile aircraft each plus escorting radar jamming aircraft, make their final run-in on different bearings from the task force;
3. Stand-off jamming aircraft attempt to distract the defender's CAP aircraft away from the 'real' attack corridors;
4. As the defending force is preoccupied with the nearing bomber force, the trailing 'Charlie' fires off an SS-N-7 salvo;
5. As the first wave of each SNA regiment approaches its launch point, the leading aircraft radios a final fire control solution to the following aircraft;
6. The first waves launch their missiles simultaneously or near-simultaneously with the first 'Echo II' and 'Juliett' salvos;
7. After the missile raid is completed, missile and torpedo attack submarines close to deliver the *coup de grace* against the survivors.

A much simplified depiction of this scenario is shown in Figure 2.

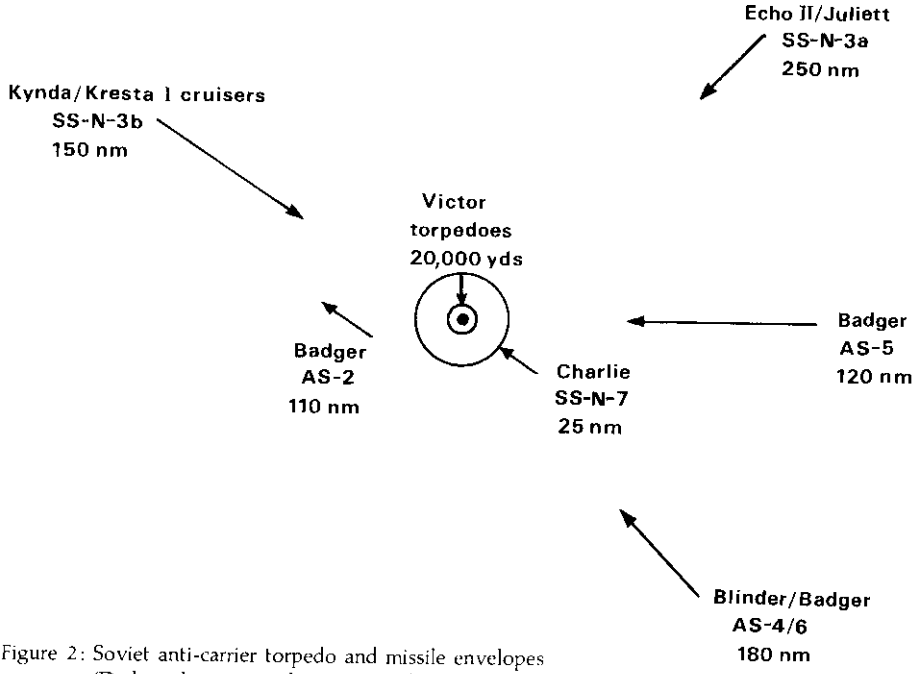


Figure 2: Soviet anti-carrier torpedo and missile envelopes
(Darkened centre circle is 10 nm diameter battle-group)

Principal sources

The *ONI Review* offered valuable data and commentary on the first-generation Soviet nuclear submarines, the HEN group. Important open-source documents included the annual posture statements by the US Secretaries of Defense and Navy, and the Joint Chiefs of Staff. Equally valuable were the transcripts of US Congressional hearings.

Important secondary accounts of Soviet naval developments became available in the late 1960s. The classic in this regard remains Herrick's *Soviet Naval Strategy: Fifty Years of Theory and Practice*. Also mentioned must be Siegfried Breyer's *Die Seerüstung der Sowjetunion* of 1964. The description of Soviet ACW tactics is indebted, in part, to information contained in the declassified *CV Concept Study*. This US Navy document was prepared in the early 1970s to examine the feasibility of employing the attack aircraft carrier for anti-submarine warfare purposes.

7 The Soviet submarine fleet in the 1970s

The evolution of the Soviet submarine fleet in the decade of the 1970s was highlighted by two, arguably three events. First came the signature, on 26 May 1972, of the SALT I treaty, officially known as the Protocol to and the Interim Agreement Between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with Respect to the Limitation of Strategic Arms. Second was the publication by Admiral of the Fleet of the Soviet Union Sergei G Gorshkov of the series *Navies in War and Peace* and the book *The Sea Power of the State*. Both prompted an intense debate in the West over Soviet naval purposes. The question of Soviet naval purposes, or more precisely a *shift* in purposes, was the third major development.

SALT I and the 'Yankee' threat

Permanent out-of-area 'Yankee' patrols off the North American coast were inaugurated between 1968 and 1971. In 1969, the US Navy issued instructions to its Atlantic Fleet that all submarine contacts within 1400 nautical miles of the Atlantic seaboard be identified immediately. Soviet missile submarines found in the area posed, according to the instructions, a threat of 'pre-emptive attack'.

Contemporary threat assessments maintained that the most likely targets of a pre-emptive 'Yankee' attack were the bomber bases of the Strategic Air Command (SAC). The 'Yankees', warned a 'Blue Ribbon Defense Panel' in 1970, were intended for a first strike with no effective warning, and were capable of 'destroying our national command centers and much of our B-52 bomber force'. Warning time would be five minutes or less if, as was feared by some defence planners, the Soviets developed the capability to launch their SLBMs on so-called 'depressed trajectories'.

Four 'Yankee' SSBNs were fitting out or operational in 1967. Four years later, the US Defense Department reported that the operational total had risen to 'at least 17', while another 15 or more were in various stages of assembly or fitting out. The apparent momentum of Soviet construction efforts caught the West by surprise. By contrast, the United States did not plan to build new SSBNs until the late 1970s.

In early 1971, the annual production rate of the 'Yankee' was estimated at seven to eight units. The next year, the Defense Department raised its estimate to nine to ten units, and held out a yearly potential of 12. At an annual building rate of nine to ten, the 'Yankee' fleet was projected to exceed the 41-strong US SSBN force by one in late 1973. Defense Secretary Laird warned, in 1972, that the Soviets could have 70 'Yankees' at sea before the United States completed its own forty-second SSBN.

The 'Yankee' momentum prompted the Joint Chief of Staff (JCS) to insist that the SLBM issue be included the Strategic Arms Limitations Talks (SALT), then in progress. Admiral Elmo R Zumwalt, Jr, then the Chief of Naval Operations, explained later in his book *On Watch* that the Soviet Union's largest submarine yard could turn out more SSBNs than the combined US facilities. A freeze on strategic weapons that excluded SSBNs, he argued, would not only give the Soviets a *quantitative* edge, but would also allow them to concentrate their resources on *qualitative* improvements of their SSBNs.

The SALT I Interim Agreement did put a cap (of sorts) on the Soviet SSBN momentum. Ironically, however, the 62 'modern' SSBNs allowed the Soviet Union were precisely the number that Laird had warned would constitute an unacceptable danger to SAC.

The two superpowers agreed that the Soviet Union could build up to a maximum of 62 modern SSBNs with no more than 950 modern SLBM launchers. The US ceiling was put at 41 SSBNs with a maximum of 710 modern launchers. Zumwalt later called the numbers 'appalling'. It is worthwhile reviewing their rationale.

The American opening proposal was for the Soviet Union to complete the 'Yankees' then under construction. In this way, the two sides would have a numerical parity of 41 modern SSBNs each. The Soviets rejected the offer out of hand. Their argument was that the 'true' measure of parity was not numerical equivalance, but *on-station* equivalence. Since it, the Soviet Union, did not have the benefit of forward bases such as Rota in Spain, Holy Loch in Scotland, and Guam in the Pacific, its SSBNs were forced to spend more time in transit. It followed, claimed the Soviet negotiators, that their side should have a numerically superior fleet.

The Soviet argument was simple, disingenous and, most important, effective. Perhaps not altogether coincidentally, the Americans had already calculated that the numerical equivalent of the Soviets' 'geographic disadvantage' was a 20-unit advantage in modern SSBNs. Thrown into the bargain (but excluded from the Soviet 62/950 ceiling) were the Soviet Navy's older ballistic missile submarines, mainly the 'Golfs' and 'Hotels', and older SS-N-4s.

The Soviet 'on-station equivalence' claim was disingenous on two counts. The SALT pact was signed in the spring of 1972, and already then there were ample indications that the Soviet SSBN fleet had no intention of copying the American example and keeping one half of its numbers out-of-area. In January 1972, the operational 'Yankee' inventory numbered 25, yet out-of-area deployments remained at a steady three. In the second place, the Soviets knew (and the Americans *should* have known) that the 'Yankee's' 'geographic disadvantage' was about to be offset by virtue of a new, long-range SLBM, shortly known as the SS-N-8. Zumwalt testified to that effect during the US Senate's ratification hearings on SALT I:

> '. . . the Soviets have tested a 3000 nautical mile missile for their submarines. This would, of course, be one of the reasons why the ratio in their favor should be negated, the justification for it would no longer exist in the long haul if they are operational at sea submarines . . . The justification for a superior number on their part . . . has been that they lack forward bases, you need enough additional submarines so that you can keep the same number on station; but as they get the 3000 mile missile their submarines will be on station just about the time they go to sea.

Zumwalt's 3000-nautical miles estimate of the SS-N-8 would later be raised to over 5000.

Building programmes: Tradition and innovation

The 'Yankee' building momentum was sustained at the price of 'general purpose' construction. As can be seen from Table 26, the Soviet Navy added only about 25 nuclear-powered non-strategic submarines to the fleet between 1971 and 1980. This translates into an average annual delivery of 2.5 boats. By comparison, the SSBN fleet was boosted with the addition of 24 'Yankees' and 32 'Deltas' for an average yearly completion rate of 5.6 SSBNs.

The completion of more than twice as many SSBNs as SSN/SSGNs invites a couple of broad observations. One is that although a ten-year annual average of 5.6 SSBN completions is much less than the nine to ten annual 'Yankee' building rate on the eve of SALT, it is quite another matter to claim that the SALT pact had served to halt the Soviet SSBN building 'momentum'. One may wonder to what extent the Soviet Union's own

building calendar rather than SALT I was responsible for the fluctuations in the 1971–1980 deliveries.

A second observation is that the comparison of SSBN and non-SSBN deliveries is hardly suggestive that anti-SSBN had a high priority in Soviet submarine construction. The only submarine built in the 1970s that could plausibly be considered an SSBN hunter-killer was the 'Victor' class. Yet, only about 16 were built. The obverse of this observation is that the Soviets may have placed greater stock in a large SSBN fleet to *deter* the Western SSBN threat than they did in a fleet of hunter-killers designed for active *defence*.

Table 26 compares the Soviet submarine orders of battle in 1971 and 1980. Also shown is a 1971 intelligence projection of Soviet submarine strength in 1980. The latter is based on the *Defense Intelligence Projections for Plans* that is produced annually by the Defense Intelligence Agency (DIA). It is commonly known as the DIPP.

The DIPP projection is included for the insight it gives into contemporary expectations about Soviet submarine building plans. The estimate repeated ONI's misjudgment in the 1950s about the speed with which the Soviet fleet would transition to nuclear power. Only some 25 per cent of the projected general purpose submarine force was expected to be still diesel-powered; the actual fraction turned out to be about twice as large.

Table 26: Comparison of the Soviet Navy's 1971 and 1980 projected and actual orders of battle of general purpose submarines

Class	Number in 1971	Projected number in 1980	Actual number in 1980
'Echo I' SSGN	2	0	0
'Echo II' SSGN	28	28	29
'Charlie' SSGN	6–7	24–34	15
'Papa' SSGN	1	10–15	1
'Juliett' SSG	16	16	16
'Whiskey' SSG	12	0	7
'Echo I' SSN	3	5	5
'November' SSN	14	14	13*
'Victor' SSN	9–10	27–37	26
'Alfa' SSN	1	10–15	2
'Foxtrot' SSK	45	40	60
'Zulu' SSK	25	0	10
'Bravo' SSK	5	5–10	4
'Romeo' SSK	14	0	10
'Whiskey' SSK	105	0	45
'Quebec' SSK	8	0	4
'Tango' SSK	0	0	10
Totals	294–296	179–214	257

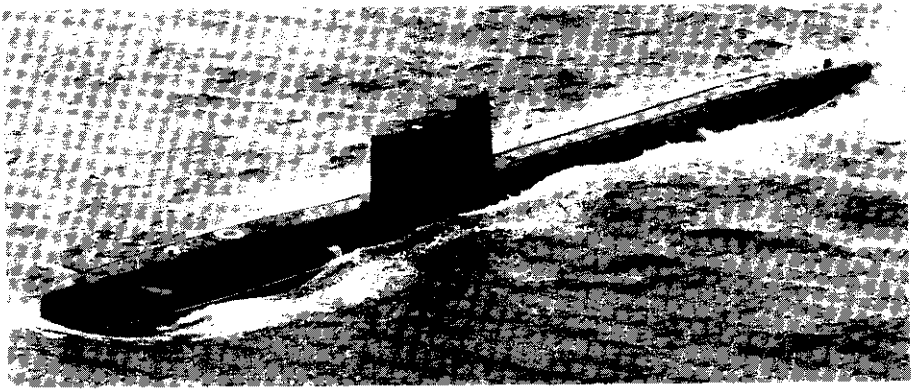
*One 'November' unit sank in the eastern Atlantic in 1970. See Appendix I.

Related to this overestimate of the Soviet nuclear building plans was DIA's *under*estimate of the operational longevity of the older diesel boats, especially the 'Whiskey' class. The Soviet Navy has repeatedly demonstrated that it does not abide by the (ideal) Western practice of retiring its submarines after 20 years of service.

Table 26 also reveals that the 'Foxtrot' was seen as the Soviet Navy's last conventional patrol design. Coincidentally, DIA published its estimate at the same time the keel was laid for a new series of diesel submarines, the 'Tango' class.

The 'Tango' class

Built at the Krasnaya Sormova Yard since 1971, about 18 'Tango' class submarines were still operational in 1986. With a surface displacement of 3000 tons, they are the world's largest conventional torpedo attack submarines by far. Although the design has been depicted as a lineal descendant from the 'Foxtrot' class, the similarities other than identical lengths and general appearance are non-existent. The 'Tango' hull from is broadly cylindrical and is marked by a prominent upward slope forward of the fin. The extra internal volume may house two additional launching tubes for the SS-N-15 or SS-N-16.



'Tango' class conventional attack submarine (US Navy).

The 'Tango's propulsion system is somewhat of an enigma. When the boat first made its appearance, there was some speculation that a Walter-type closed-cycle plant might be involved. The idea has since been discredited, but some disagreement still exists whether the conventional diesel-electric plant is connected to two or three propeller shafts. When navigating on batteries, the 'Tango' is reported to be much quieter than the 'Foxtrot' or 'Romeo', and in fact, more so than most Soviet nuclear-powered submarines. This feature, in addition to other silencing measures such as the application of anechoic hull coating, mark it as a good candidate for quiet line patrols in near-shore waters and choke points. The vessel is reputedly capable of maintaining 15 knots for up to six hours on batteries. Table 27 is a compilation of the 'Tango's main characteristics.

Table 27: 'Tango' class submarines

Number built	20
When built	1971–1984(?)
Where built	Krasnaya Sormova Yard, Gorki
Displacement	3000/3700 tons
Length	91 m (300 ft)
Beam	9 m (29.7 ft)
Draught	7 m (23.1 ft)
Propulsion	6000/6000 hp
Speed	20/16
Endurance	NA
Armament	SS-N-15/SS-N-16; 10 × 533 mm (21-in) TT (6 bow, 4 stern)
Diving limit	396 m (1300 ft)
Complement	60-plus

'Mystery' submarine No 1: The 'Papa' class

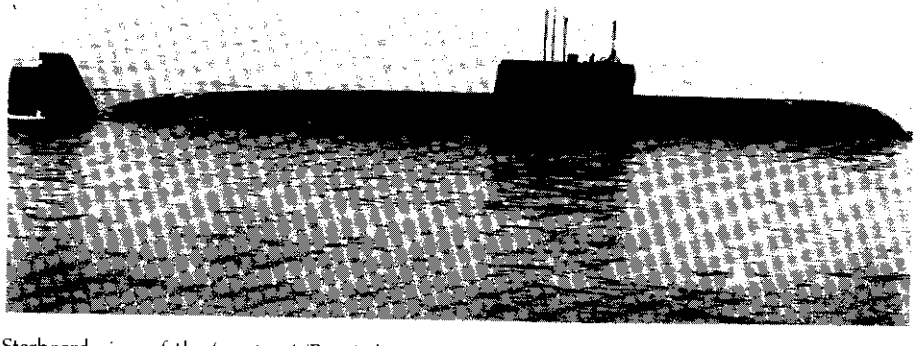
Because of cost, navies rarely enjoy the luxury that air forces and armies have of starting series production after a run-off between competing prototypes. Navies generally must 'live with' the design and performance characteristics that are decided on paper and in computer simulations. There are exceptions, however. Sometimes, the promise of a new technology outweighs cost and risk, and a prototype ship or submarine is built. Most of the early American nuclear submarines were prototypes – the *Nautilus* itself, the USS *Seawolf* (SSN 575) with its sodium-cooled reactor plant, the dual-reactor USS *Triton* (SSRN 586), and the USS *Tullibee* (SSN 597) whose experimental tear-drop hull shape set the standard for all next American (and foreign) submarine designs.

The Royal Navy, too, has a record of one-off or 'limited edition' submarines. High expectations with the Walter closed-cycle plant prompted the Admiralty to fund construction of two experimental boats (*Explorer 49* and *Excalibur 41*) during the mid-1950s.

The Soviet Navy has built experimental submarines on several occasions (an example is the 'Project 95' aluminium alloy derivative of the *Malodki* class built shortly before the Second World War). In stark contrast, however, to the experimental progression of the American nuclear submarine fleet, the Soviets chose to series-produce their first-generation nuclear boats around the first nuclear reactor that proved functional. As a matter of fact, the keels for the first 'November' types were laid before the *Lenin* testbed had completed trials.

With no recent Soviet precedent of experimental nuclear construction, it was understandable for the DIPP to predict that the first 'Papa' seen was the lead unit of a follow-on series to the 'Charlie' type. Moreover, from the Western point of view, the 'Charlie' was a 'successful' counter to the aircraft carrier that made sense to improve upon with a ten in place of an eight-tube missile load.

Not so plausible was the annual 'Papa' production forecast of a little more than one unit per year coincident with a near-tripling of the output of 'Charlies' at the *same* yard, Krasnaya Sormova. To begin with, the Soviets would have no good reason to continue, let alone boost production of the 'Charlie' if the supposed 'Papa' successor had proven successful enough to warrant her own series production. Secondly, even though the Krasnaya Sormova yard had demonstrated an impressive capacity in the past to produce conventional submarines, it was another matter to expect it to complete more than four much larger, nuclear submarines per year.



Starboard view of the 'mystery' 'Papa' class SSGN (US Navy).

Published characteristics of the 'Papa' class vary wildly – from physical size and powerplant to whether or not the hull is built of a titanium alloy. There are two possible reasons why the Soviet Union stopped building the submarine at one unit. Most analysts today seem to agree that the 'Papa' may have been a test-bed for the giant 'Oscar' class SSGN. It is not clear why. Other than the fact that both types were armed with submerged-launchable variants of surface ship-launched anti-ship missiles (the SS-N-9 for the 'Papa', and the SS-N-19 for the 'Oscar'), they share no similarities whatsoever. In any case, the SS-N-9 and SS-N-19 are quite different as regards their physical size and performance.

The other explanation for the 'Papa' is that it was a mistake, no more and no less. The 'mistake' may have been the attempt to take the SS-N-9, make it submerged-launchable, and put it on a submarine. Table 28 lists the characteristics of the 'Papa' class that are most commonly cited.

Table 28: 'Papa' class submarines

Number built	1
When built	1970
Where built	Krasnaya Sormova Yard, Gorki
Displacement	6000/7000
Length	109 m (357 ft)
Beam	11–12 m (36–40 ft)
Draught	7.5–9.6 m (24.8–31.4 ft)
Propulsion	40,000–75,000 hp
Speed	25/35-plus
Endurance	NA
Armament	10 × SS-N-9; 4–6 × 533 mm (21-in) bow TT
Diving limit	760 m (2500 ft) (assuming titanium hull)
Complement	90

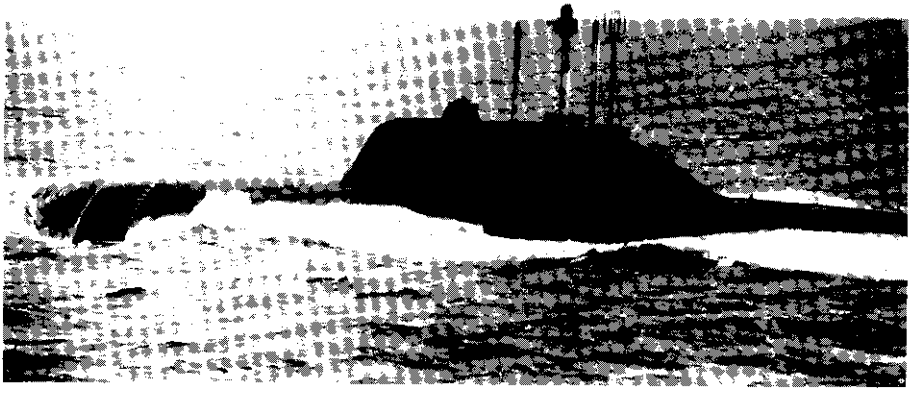
'Mystery' submarine No 2: The 'Alfa' class

A second 'mystery' nuclear attack submarine that the DIA erroneously predicted would be produced on a scale identical to the 'Papa' was the much-headlined 'Alfa'. A single 'Alfa' was reported in existence in 1970–71 (some reports claim that she may have been completed in 1967). Six follow-on units were built between the mid-1970s and 1984. The extraordinarily long delay between hull No 1 and Nos 2 to 7 is only one of the factors that has mystified Western analysts.

When the 'Alfa' was first reported in the early 1970s, its estimated characteristics seemed ordinary enough: a surface displacement of 2700 tons, a submerged displacement of 3300 tons, and an average submerged speed of about 30 knots, delivered by a single-shaft nuclear reactor rated at 24,000 hp. By the mid-1970s, and with no follow-units in evidence, it had become generally accepted that the 'Alfa' was an experimental platform whose production would be limited to one. Rumours circulated that it might have been fitted with an experimental reactor design that had suffered a melt-down.

The 'Alfa' returned to the news in the early 1980s after, contrary to expectations, the Soviets had resumed production and had apparently placed the first few units on operational fleet status. Reports of unheard-of performance capabilities quickly escalated. An underwater speed of 45-plus knots was reportedly clocked, leading some analysts to conclude that the 'Alfa' could 'outrun' Western torpedoes. The hull of the 'Alfa' was found to be constructed of titanium or a titanium alloy (a material that the US Navy had rejected for

submarine construction because of cost and difficult fabrication). It was calculated that this gave the 'Alfa' the ability to withstand pressure at a depth of more than 610 m (2000 ft) which, if true, put it outside the operating envelope of most Western-built torpedoes. The boat's titanium construction also meant that one of the principal means used by NATO ASW aircraft for submarine localisation – the magnetic anomaly detector or MAD – had been rendered powerless. The only apparent mitigating factor was that, navigating at 'hot rod' speed, the 'Alfa' would sound like a freight train and be acoustically 'blind'.



'Mystery' submarine No. 2: 'Alfa' class SSN (US Navy).

Six 'Alfa IIs' were produced at the Sudomekh Yard between the late 1970s and early 1980s. The entire group is attached to the Northern Fleet area, but it is not clear to what extent their duties are operational as opposed to experimental. There have been no reports that the Soviet Navy's large 'surge' exercises in recent years have included the 'Alfa'.

It appears, on balance, that the 'Alfa' was primarily designed with experimental purposes in mind, and is operated to develop practical experience with a variety of new-in-principle submarine technologies, such as titanium construction, a high degree of shipboard automation, and perhaps new reactor types (some sources report that the propulsion system is a liquid metal-cooled reactor while others have speculated on a new form of chemical propulsion). Proven concepts will presumably be incorporated into the next generation of production submarines. It is coincidental perhaps but notable nevertheless that the 'Alfa' has been built at the Leningrad Sudomekh Yard. This facility has a long record of innovative submarine designs. In the 1930s, it experimented with a diesel engine intended to operate in both surface and submerged conditions. During the same period, it was involved in the 'Project 95' aluminium hull *Malodki*. After the war, it was Sudomekh that attempted to mate the 'Quebec' class with closed-cycle propulsion.The initial Western excitement over the 'Alfa's' speed and diving performance has given way to a much more moderate assessment of the *operational* threat it presents; Western ASW planners of the late 1980s are much more concerned with the 'quiet revolution' in Soviet submarine design inaugurated by the *Akula* class. Given the technological thrust of the modern US and British nuclear submarine fleets, ie the priority placed on (relatively) slow and quiet operations, the 'Alfa's dependence on speed appears an 'anachronism'. It was not, however, when design requirements would have been first laid down, presumably sometime in the late 1950s. The Western submarine design emphasis on quietness came in the early 1960s, partly the product of advances in passive

sonar and, at the operational level, the emerging interest in 'static' ASW barrier deployments as opposed to 'active' hunt-and-kill patrols. When first designed, the 'Alfa' was the Soviet Union's 'countervailing' response to the high-speed attack submarines planned in the West. Western submarine design changed direction, thereby (inadvertently) neutralising what would have been the 'Alfa's' speed and depth-keeping advantage (an interesting analogy is the MiG-25 'Foxbat', built to counter the USAF B-70 bomber, but 'checkmated' by the bomber's cancellation). Perhaps the most important aspect of the 'Alfa' is that it sought to combine a series of hull and engine technologies – 30 years ago! – far in advance of those then planned in the West. Table 29 is a compilation of the wide range in open-source estimates of the 'Alfa's' characteristics.

Table 29: 'Alfa' class submarines

Number built	6 (plus 1)
When built	1967–1984
Where built	Sudomekh Yard, Leningrad
Displacement	2800/3700 tons
Length	80–82 m (262–269 ft)
Beam	9.6–10 m (31.4–32.8 ft)
Draught	7–7.6 m (23.1–24.9 ft)
Propulsion	24,000–45,000 hp
Speed	16–18/40–45
Endurance	NA
Armament	SS-N-15/SS-N-16; 6 × 533 mm (21-in) bow TT
Diving limit	610–915 m (2000–3000 ft)
Complement	40–60

The 'Delta' class SSBN

Production of the 'Yankee' class SSBN came to end in 1974. Work at the Severodvinsk and Komsomolsk yards had shifted meanwhile to her successor (itself basically an enlarged version of the 'Yankee'), known shortly as the 'Delta' class. Associated with the new vessel was a battery of 12 SS-N-8s. At this time, Western intelligence had upgraded the SS-N-8's range capability to 4200 nautical miles.

The first series of flight tests of the SS-N-8 were held in the Barents Sea around 1970, and were limited to single re-entry vehicles (RVs). A few years afterward, another series of tests with what appeared to be a MIRVed version of the SS-N-8 was observed. With the benefit of hindsight, it now seems fairly certain that a new missile, the SS-N-18 was involved instead. According to the US Defense Department's *Soviet Military Power*, both the Mod 1 and 2 versions of the SS-N-8 are armed with single warheads. The SS-N-18, by contrast, is credited with three different single or multiple warhead options. It is worth mentioning in this connection that US efforts at monitoring Soviet missile testing during 1974 were hampered by unusual Soviet attempts at camouflaging their SLBM programme. Telemetry signals were encrypted, Western monitoring equipment was jammed, and even the 'Delta' construction ways at Severodvinsk were physically shielded from the prying cameras on surveillance satellites.

Forty-one Delta SSBNs had been built by the spring of 1987. This makes it the second most numerous Soviet nuclear submarine programme so far. The most recent version, the 'Delta IV', remains in construction, thus holding out the possibility that the 'Deltas' may eventually outnumber the 43-unit strong 'Victor' class. The characteristics of the 'Delta' I through IV series are shown in Table 30. The progressive enlargement of the submarine to

fit newer and bulkier SLBMs (and indeed the 'Delta's own lineal descendancy from the 'Yankee') exemplifies the strong *evolutionary* theme in Soviet weapon design. A different perspective on the 'Yankee-Delta' 'family' is the widening qualitative gap between successive platforms and their weapons. The 'Delta IV's' SS-N-23 far outperforms the 'Yankee's' SS-N-6, yet with the exception of a moderate improvement in quietness, the Delta IV's hull and machinery (H & M) do not represent a significant advancement over the 'Yankee'. The different 'Delta' SLBM weapons systems are presented in Table 31.

'Delta III' SSBN (US Navy).

Table 30: 'Delta' class submarines

	Delta I	**Delta II**	**Delta III**	**Delta IV**
Number built	18	4	14	5 (spring 1988)
When built	1972–77	1973–76	1976–84	1986–present
Where built		Severodvinsk and Komsomolsk		
Displacement	9000/11,750	10,500/12,750	10,000/13,250	11,200/14,500 tons
Length	140 m (460 ft)	155 m (508 ft)	155 m (508 ft)	160 m (528 ft)
Beam	12 m (39.6 ft)	12 m (39.6 ft)	12 m (39.6 ft)	12 m (39.6 ft)
Draught	10 m (33 ft)	10 m (33 ft)	10.3 m (33.7 ft)	NA
Propulsion		60,000 hp		
Speed		20/25 knots		
Endurance		NA		
Armament	12 × SS-N-8 6 × 533 mm (21-in) bow TT	16 × SS-N-8 6 × 533 mm (21-in) bow TT	16 × SS-N-18 6 × 533 mm (21-in) bow TT	16 × SS-N-23 6 × 533 mm (21-in) bow TT
Diving limit	396 m (1300 ft)	396 m (1300 ft)	396 m (1300 ft)	396 m (1300 ft)
Complement	120	120	120	120

Table 31: 'Delta' class-carried SLBMs

	SS-N-8		**SS-N-18**			**SS-N-23**
	Mod 1	*Mod 2*	*Mod 1*	*Mod 2*	*Mod 3*	*Mod 1**
Year of IOC	1973	1977	1977	1978	1978	1986
Range, nm	4200	4900	3500	4300	3500	5000
No of RVs	1	1	3(MIRV)	1	7(MIRV)	10(MIRV)
Yield per RV, KT	1000	800	200–500	450–1000	200–500	100?
Est CEP, m(ft)	1510 (4950)	910 (3000)	1400 (4600)	910 (3000)	910 (3000)	< 910 (< 3000)

*SS-N-23 Mod 2 version may complete flight testing in 1988.

The SS-NX-13 enigma

Western SLBMs have been designed exclusively to attack land targets. Soviet open-source literature, on the other hand, has frequently mentioned the *anti-naval* potential of long-range ballistic missiles, including *submarine-based* strategic missiles. One possible candidate for such a role that caused considerable excitement during the first half of the 1970s was the KY-9 (the prefix KY stands for the Kapustin Yar testing facility), later known as the SS-NX-13.

At-sea testing of the SS-NX-13 was carried out from the late 1960s until November 1973 aboard a specially reconfigured 'Golf' class SSB. Then-retired CNO Admiral Elmo R Zumwalt told a US Congressional subcommittee, in 1975, that after the United States had signed the SALT I pact, Kissinger was forced into a 'secret agreement' in order to plug a loophole resulting from 'sloppy negotiating' that would have permitted the installation of 210 SS-NX-13s on the 'Golf' class submarines. This number obviously raises questions, since the 22 'Golfs' operational in 1972–73 clearly would not have been capable of carrying almost ten SS NX-13s each. By all accounts, the SS-NX-13 had the same external dimensions as the 'Yankee's' SS-N-6. Furthermore, a US Navy training document of 1973 identified only the 'Hotel IV' and a modified version of the 'Yankee' (dubbed 'Yankee II') as the SS-NX-13's likely launch platforms. According to this same estimate, the 'Yankee II' would hold ten of the missiles.

The estimated characteristics of the SS-NX-13 are displayed below. They are based, in part, on declassified telemetry data. Most sources, including official ones, have described the weapon as a ballistic anti-ship missile with a terminal guidance system. Some reports claim that it may have been intended for anti-submarine purposes as well.

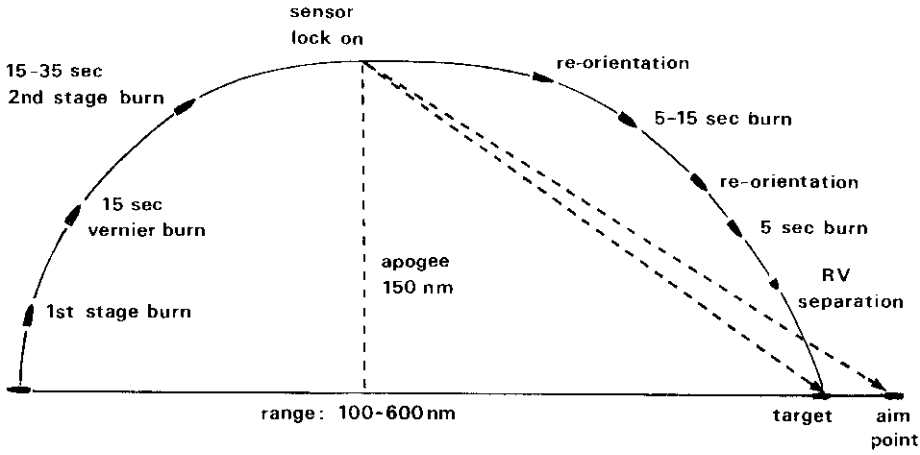


Figure 3: Estimated flight profile of SS-NX-13

Fired in an anti-ship mode, the SS-NX-13 would have been an extremely dangerous opponent. Its extreme range and flight altitude would have put it outside the intercept envelope of shipboard defensive missiles. On its final approach and even though within the range envelope of the defender, the SS-NX-13's down-the-stack dive angle (ie at near-90 degrees) would have exceeded the manoeuvring capability of most, if not all, ship-to-air missiles.

Employed as an anti-submarine weapon, the SS-NX-13 would presumably have been armed with a nuclear depth charge (a warhead yield up to one megaton [MT] has been cited).

A large-yield underwater nuclear explosion could kill a submarine in two different ways. First, overpressure could crush the hull. This method is at the heart of the open ocean 'barrage' scenario. Its practicality is quite limited by the very large number of detonations needed to cover the entire operating area of the opponent's submarines. The *MX Missile Basing Study*, produced by the US Office of Technology Assessment in 1981, calculated that 1130 nuclear detonations, each with a kill radius of about 3.5 nautical miles, were needed to destroy four SSBNs. The size of the barrage would multiply tenfold with a false alarm rate of 83 to 88 per cent (which is typical of actual ASW experience).

The second potential kill-mechanism of an underwater nuclear explosion is known as the Van Dorn effect. It, too, offers little practical promise, at least against the American operating routine in deep water. The Van Dorn phenomenon involves the propagation of an explosion-induced deep water wave into the shallower waters on the continental shelf. As the wave is funnelled onto the continental shelf it assumes extreme proportions; a submarine caught in its path is likely to be up-ended and, if not destroyed, severely damaged. But, there are two drawbacks to this tactic. In the first place, and as already mentioned, the US SSBN fleet is normally 'caught' on the continental shelf only during transit to and from port. In the second place, the wave action needs to be generated in sufficiently deep water, and takes therefore several hours to arrive. SSBNs near deep water would have time to escape; those who do not would still have ample time to launch their missiles.

The biggest problem, however, that an SS-NX-13-like system must overcome is *targeting*. The SS-NX-13's active homer permitted some self-correcting guidance (against surface targets, that is), but finding its victim would ultimately have depended on the reliability and promptness of third-party target co-ordinates. The state of Soviet 'real-time' ocean surveillance capabilities in the early 1970s could have caused the cessation of the SS-NX-13 programme. At that time, Soviet overhead tracking and trailing of Western naval movements still depended primarily on the 'Badger' and 'Bear' aircraft. The first ocean reconnaissance satellites had been put into orbit, but it would be almost another decade before their intelligence could be down-linked in 'real-time' fashion to ocean-going platforms. At the time instead, satellites had to store their information and wait until their orbits brought them within line-of-sight of Moscow headquarters for a 'dump'.

Two other reasons have been advanced for the cessation of the SS-NX-13 programme, in late 1973. Michael MccGwire has proposed that the missile embodied an early Soviet attempt at an 'exotic' breakthrough of the anti-SSBN problem, that the goal of a dual-capable anti-ship and anti-submarine weapon proved overly ambitious. Others have suggested that the Soviets had foregone deployment in order not to compromise their allowable ceiling on 'conventional' land attack SLBMs. The Kissinger 'secret protocol' suggests that the second is the more likely reason.

The Soviet SSBN operating enigma: bastions or break-out?

The SS-NX-13 played a minor role in what became a major Western reassessment of Soviet naval strategic priorities. The outcome of this reassessment has been codified today as the cornerstone of the West's agreed estimate of the Soviet Navy's wartime plans to deploy and employ its SSBN fleet, the so-called 'bastion' strategy. The concluding section of this chapter traces the 'intellectual maturation' of this bastion strategy from what was little more than one of several hypothetical constructs in the early 1970s to its wholesale adoption by the US Navy, a decade later, as the underpinning of its Maritime Strategy. Throughout this account, it is important to remember that the relevant Soviet military literature has never even alluded to the operational and doctrinal practices that Western analysts claim are central to the bastion concept.

Bastion origins

The intellectual origin of the bastion idea goes back to a series of conferences held at the Dalhousie University in Halifax, Nova Scotia during the first half of the 1970s. The transcripts of these meetings, attended by the *creme de la creme* of the American Soviet Navy analytical community, have been published under the co-editorship of Michael MccGwire, the conference chairman. The three published titles are *Soviet Naval Developments: Capability and Context*, *Soviet Naval Policy: Objectives and Constraints*, and *Soviet Naval Influence: Domestic and Foreign Dimensions*.

The backdrop to the first gathering, in 1973, was the recent publication of Admiral Gorshkov's *Navies in War and Peace*. At issue was the authoritativeness of the series: did they represent a formal, Politburo-approved statement of Soviet naval policies and priorities, or were they an exercise in navalist advocacy? And in either case, what exactly was being announced or advocated?

The chief protagonists on the question were MccGwire and James M McConnell, a senior analyst with the Center for Naval Analyses (CNA), a semi-official 'think tank' in the suburbs of Washington, DC. McConnell took the lead in claiming that *Navies in War and Peace* were an authorative announcement of current Soviet naval strategic priorities as approved by the country's top political and military leadership. The most important doctrinal innovation that could be gleaned from the series, he claimed, was the decision, formalised at the 24th Congress of the Communist Party in 1971, to turn the Soviet SSBNs into a strategic 'fleet in being'. This meant, he explained, that the SSBNs, especially the new 'Delta' class, would be withheld from the initial strategic exchange, so that their threat of follow-up strikes could be used to influence the course of hostilities and the shape of final peace negotiations.

Doctrinal witholding, McConnell went on, would be matched with a new policy of *geographical* witholding. Whereas the US Navy SSBN witholding option had always depended on the security afforded by oceanic dispersion, the Soviets had chosen to escond their SSBNs 'in local waters, protected in a wartime environment over a protracted period by the main ASW and other forces of the Russian fleet'. The building of the intercontinental-range SS-N-8, he said, was the direct result of this decision.

Bradford Dismukes, another CNA analyst, seconded his colleague's opinion that the Soviets would use their general purpose naval forces for 'pro-SSBN' protection. He adduced these reasons: (1) Russia's historical preoccupation with defensive missions, (2) its fear of Western ASW capabilities, (3) the heightened importance of a secure deterrent in an era of 'mutual assured destruction', and (4) Soviet recognition that current technical realities held out little hope for the erstwhile priority of *anti-SSBN*. This last point has interesting connotations in that it suggests that the fleet's re-assignment from an anti- to a pro-SSBN role was partly brought about by the navy's institutional need to justify its existence.

The strongest exception to McConnell's 'witholding' and 'pro-SSBN' theses came from MccGwire. Strategic ASW against the US SSBN fleet remained the Soviet Navy's foremost priority, he claimed. The Soviets were committed to anti-SSBN, he explained, for two reasons: one, damage limitation and two, to prevent the USA from using *their* witheld SSBNs to deter a victorious Soviet army from occupying Western Europe.

Shortly, MccGwire seemed to have second thoughts on the solidity of Moscow's anti-SSBN commitment. In 1974, the CNA published a trio of expert interpretations of the Gorshkov series under the title *Admiral Gorshkov on 'Navies in War and Peace'*. Having reiterated his conviction that destruction of the US Navy's SSBNs was still the Soviet Navy's main purpose, MccGwire went on to acknowledge a 'faint possibility' that Gorshkov might favour dropping the anti-SSBN task. But, he quickly added, the reasons would have less to do with doctrine than with operational practicalities, such as disappointing progress with strategic ASW capabilities, and the need to release more ships for naval peacetime purposes.

Also, he speculated, the Soviets might have concluded that the most cost-effective way of neutralising the US SSBNs was through the countervailing *deterrence* of their own SSBNs. Obviously, this last consideration would constitute a doctrinal shift of the greatest importance.

McCGwire also agreed with McConnell that the Soviet SSBN fleet, with the exception of the few 'Yankees' normally on patrol off the American coast, would probably be witheld from the initial strategic shoot-out. But he disagreed that such witholding would be doctrinally-motivated. The key to Soviet witholding, McCGwire maintained, was the SSBNs' vulnerability to Western ASW. This meant, he concluded, that the 'Yankees' with their relatively short-range SS-N-6s would probably attempt to break out only after Western ASW capabilities had been disrupted in the initial hostilities. Due to their much longer-range SS-N-8s, the 'Deltas' would have no need, of course, to break out.

McCGwire and McConnell's conflicting views on the relative importance of anti- versus pro-SSBN in Soviet naval strategy coloured their respective evaluations of the SS-NX-13 enigma. McCGwire saw the weapon as part of a Soviet campaign to find an effective counter to the Western SSBN. McConnell, on the other hand, thought that SS-NX-13-armed 'Yankees' might 'ride shotgun' in support of a break-out by the 'conventional 'Yankees'. In other words, whereas McCGwire stressed the SS-NX-13's ASW potential, McConnell's estimate focused on its role as an *anti-ship* weapon against Western surface ASW forces.

The McCGwire-McConnell controversy came to a head following Gorshkov's publication of *The Sea Power of the State* in 1976. McCGwire charged that his opponent's portrayal of the Gorshkov writings as an authoritative announcement of a 'new doctrine of conserving forces based on a "fleet-in-being" of SSBN' was based on a 'selective reading of (Gorshkov's) historical analysis'. A Soviet SSBN witholding decision, he objected, would not be dictated by doctrinal prescription but instead by *operational* requirements at the time. The most likely 'operational requirement', McCGwire proposed, would be to deter the United States (whose socio-economic system, like the Soviet Union's, would have been devastated in the initial strategic exchange) from taking over a (relatively) undamaged Western Europe. Evidently, McCGwire foresaw a post-exchange situation in which the United States and the Soviet Union both would use their witheld SSBN fleets to deter the other from a 'great migration' to Europe.

In a 1976 study sponsored by the Congressional Research Service under the title *Soviet Oceans Development*, McCGwire summed up his case against McConnell:

> 'The evidence in the Gorshkov series will not support the conclusion that Gorshkov is advancing a doctrinal rationalization for the political decision to withold a substantial portion of the Soviet SLBM in order to carry out 'deterrence' in war, conduct intra-war bargaining and influence the peace talks at the end of the war . . . Gorshkov shows no particular interest in the concept of a 'fleet in being' and its potential influence either on the outcome of war, or on the subsequent peace negotiations. If he had wanted to present this case, his naval historians could have produced a clutch of examples to bolster his argument.
>
> The SSBN force, together with the SRF (Strategic Rocket Forces), comprise the main striking power of the Soviet Union. Because of the system's characteristics it is likely that at least a proportion of SLBM will not be used in the initial exchange. SSBN are part of the Soviet Union's general war-fighting capability, and decisions on their use will depend on evolving operational requirements, the course and nature of the war, and the opportunities to influence its outcome. It is not clear why the Soviets should consider it necessary at this particular juncture to produce a convoluted doctrinal rationalization for a process that is inherent in the weapon system. But if they think it necessary, one would then expect the message to be clearly articulated and readily discernable by its readership.'

McConnell countered his critic with a series of excerpts from *The Sea Power of the State* which, he asserted, strengthened his claim of a Soviet SSBN witholding doctrine. True, he said, the

potential to withold was inherent in the high survivability of the SSBN, but the *capability* to withold was not the same as the *intent* to withold. The clear message of the Gorshkov series was, according to McConnell, that a political decision had been made to keep a large portion of the SSBN fleet in reserve for the purpose of intra-war deterrence and to influence the peace talks at the end of hostilities. Before this decision was made, McConnell argued, the Soviet SSBN fleet would probably have participated in the initial and short-lasting exchange; the need for pro-SSBN protection by the Navy's general purpose forces had then been minimal. Now however, the SSBNs would have to survive through a possibly protracted period of hostilities; it followed that the provision of 'combat stability' by the navy as a whole had become extremely important. It was also in this connection, McConnell concluded, that the recent rehabilitation in the Soviet naval lexicon of the 'command of the sea' concept should be appreciated.

The Bastions in the 1980s

It seems a bit ironic that it was apparently McCGwire who coined the term SSBN 'bastions'. Because of its association with active defence, the word was preferred over SSBN 'sanctuary' or 'haven'.

From the late 1970s onward, McCGwire (and most other Western Soviet Navy analysts) became converted to the McConnell thesis (although by no means to his reasoning and evidence). In a lengthy article, written in the magazine *International Defense Review* in 1980, McCGwire announced a 'fundamental shift' in the theoretical basis of Soviet naval policy. No longer was Soviet military science and war planning based on the fundamental premise of a short general nuclear war. The new Soviet planning assumption instead was a protracted conventional war not unlike the Second World War. Coincidentally, he claimed, the Soviets had also arrived at the conclusion (as had McCGwire himself) that the long-sought break-through in anti-SSBN ASW lay still far in the future.

These two new factors – a new doctrine and a technological setback – McCGwire theorised, had prompted the 'basic decision' to refocus Soviet naval planning on SSBN protection in 'defended ocean bastions in the Greenland and Barents Sea and in the Sea of Okhotsk'. New operational requirements, war-fighting plans, and warship design and construction specifications had cascaded in a logical fashion. Thus, the 'one-shot' Soviet surface fleet that had been sufficient for the short-war doctrine of the 1960s was no longer so today. Preparations for drawn-out conventional hostilities (which would include a 'stout' defence of the bastioned SSBNs) demanded a new generation of larger warships with the capability to fight and survive to fight another day. The *Kirov* battlecruisers, the *Sovremenny* and *Udaloy* destroyers, and the large *Berezina* replenishment ship, claimed McCGwire, were some of the material results of this new requirement.

McCGwire's 1980 argument has been further elaborated in his new (1987) book *Military Objectives in Soviet Foreign Policy*. In it, he grants that McConnell's intuition of 15 years before had been right after all – only his 'explanation and evidence were wrong'. Soviet SSBN witholding *did* rest on a doctrinal decision, but not the one McConnell had claimed. In McCGwire's judgment, the key reason for witholding and protecting its SSBNs is the Soviet Union's requirement for an insurance force against the risk that some sort of American technological break-through might 'outflank' the land-based Strategic Rocket Forces (SRF).

In his book, McCGwire speculates whether the Soviet bastion strategy is about to fall into disuse. Based on what he terms 'fragmentary evidence', he suggests that the Soviets may have decided that building an expensive fleet for the sole purpose of near-home defence of the SSBNs may not be cost-effective after all. Besides the fact that a lot of naval capability would be tied up, the Soviet Union may not be confident after all that their 'insurance force'

would stand up against a Western ASW campaign. MccGwire thinks that the Soviets may already have seized upon another option, namely to transfer the SSBNs' witheld insurance responsibility to a *land-mobile* missile force of SS-24s and SS-25s. This done, the Navy's 'pro-SSBN' general purpose forces would become available for other wartime tasks. MccGwire offers no hints as to the wartime assignments of the 'debastioned' SSBN fleet.

The Bastions: Policy versus evidence and inference

The bastion 'model' of Soviet SSBN capabilities and purposes is a coherent explanation of a number of aspects of Soviet naval activities that have puzzled Western intelligence and other interested observers ever since the Soviet Navy's forward deployment in the mid-1960s. It is also a construct that is beset by factual uncertainties and a good deal of inferential logic. It is important to be aware of those factual and inferential uncertainties for at least one very good reason: the presumption that the Soviet Union has committed its SSBNs, along with the bulk of naval general purpose forces, to wartime deployment in near-home waters, is critical to US and allied hopes with the efficacy of the evolving 'Maritime Strategy' (MS).

The most authoritative outline of the MS so far (1987) appeared in a special 'white paper' by the US Naval Institute in January 1986. Central to the strategy is the concept of an early 'forward offensive' against the *Schwerpunkte* of Soviet naval strength, primarily the Northern Fleet. A key purpose of the offensive would be to hold at risk and, if necessary, sink the Soviet SSBN fleet and the supporting 'pro-SSBN' flotillas. This purpose is expected to serve these goals:

- the destruction of the Soviet Navy, the US Navy's only competitor of consequence on the world's oceans;
- force the Soviet Union to divert military forces that otherwise face the allies on the main Central Front;
- prevent the Soviets from dispatching their attack submarine fleet against the allied sea lines of communication; and
- change the correlation of strategic nuclear forces to the allied advantage, thereby making prolongation of the war increasingly risky for the Soviet Union.

Many critics have taken the MS to task for its aggressive emphasis on strategic ASW against the Soviet SSBNs, and have argued that this could well turn a war that started out conventionally into a nuclear holocaust. This is certainly a legitimate consideration, but it seems that an even more basic question is whether the Soviets will, in fact, hold to an SSBN bastion strategy in wartime.

The preceding overview of the origins and development of the bastion concept showed that, whereas most analysts agreed that this was indeed an accurate description of Soviet SSBN strategy, they arrived at no single agreed explanation of why the Soviets chose this direction. Thus, McConnell's explanation relies on his interpretation of what he calls the 'language-within-a-language' of Soviet open-source military writings. MccGwire's explanation has varied over the years; initially, he cited the SSBNs' alleged vulnerability to Western ASW, while most recently he has alluded to a doctrinal decision made 20 years ago. Still others, most notably Kenneth McGruther in his *The Evolving Soviet Navy*, have hypothesised a Soviet Navy institutional rationale, namely the need of the professional Soviet naval officer to 'find a mission' to justify the building of large surface combatants after 'anti-SSBN' had proved a 'non-starter'. There is a hint here that the bastion proponents have spent more time marshalling evidence and formulating explanations to support conclusions already made instead of the other way around. The other side of the same coin is that evidence that cannot be easily accommodated by the bastion concept has been explained away, or if cited at all, has been labeled an 'anomaly'. Those anomalies warrant citation:

– the occasional 'Delta' patrols in the southern portion of the Atlantic Ocean. A possibly associated phenomenon is the extensive Soviet hydrographic exploration of the South Atlantic in recent years. A similar Soviet programme preceded the 'Yankee' patrols off the US East Coast;
– the very large size and nuclear propulsion of a Soviet SSBN fleet that will presumably limit its wartime patrols to near-home waters. If this is the Soviet strategy, would not a reasonable alternative have been to build many small and diesel-powered submarines? And if it were, why was this option foregone?
– is there perhaps a relationship between the low out-of-area patrol tempo of the Soviet SSBN fleet and the inefficiency of the Soviet submarine overhaul establishment mentioned in the JCS Posture Statements of the late 1970s?
– the fraction of the Soviet fleet as a whole normally on 'forward deployment' closely matches that of its SSBN portion, ie about 10–15 per cent. In other words, the low out-of-area patrol tempo of the Soviet SSBNs is a salient phenomenon only when compared with that of *US* SSBN fleet; it is entirely consistent with the normal operating pattern of the *Soviet* fleet;
– open-source evidence indicates that the Soviet Union's strategic nuclear forces are maintained at a lower level of readiness than those of the United States. Also, the open-source Soviet doctrinal literature suggests that Soviet strategic planners expect to use a period of 'crisis indicators' to ready their forces. Is it perhaps in this context that the Soviet Navy's periodic 'surge' exercises ought to be explained?
– when Soviet naval writers talk about the importance of a 'balanced fleet' for submarine combat stability, do they mean that the SSBNs must receive protection in *in situ* bastion waters, or while 'breaking out' onto the high seas?
– in 1985, the US Navy's CNO, Admiral James Watkins, told the US Congress that the Soviet SSBN fleet had introduced a dual crewing system similar to the US 'blue-gold' system. How does this fit a fleet, 85 per cent of whose units and crews is normally waiting in port or manoeuvring in coastal waters?
– a key reason, according to many analysts, why the Soviets chose to bastion their SSBNs was the boats' acoustic disadvantage against Western ASW capabilities. What are the implications, if any, of the recent (and apparently surprising) Soviet progress in submarine quieting? More on this is said in the concluding chapter.

Principal sources

Other than official US Government documentation, primarily the annual posture statements of the Departments of Defense and the Navy, the Joint Chiefs of Staff, and the transcripts of Congressional hearings, little primary source material on this period in Soviet submarine developments is available. Exceptions include a scattering of declassified documents originally marked 'confidential'. Key secondary sources that were consulted, especially in connection with the chapter's discussion of the 'bastion strategy', include the three volumes of essays on Soviet naval developments that have been published under the co-editorship of Michael MccGwire. They are: *Soviet Naval Developments: Capability and Context*, *Soviet Naval Policy: Objectives and Constraints*, and *Soviet Naval Influence: Domestic and Foreign Dimensions*. Another important series of documents is Robert W Herrick's multi-volume study of Soviet naval mission assignments, especially Parts I (*Soviet SSBN Roles in Strategic Strike*) and II (*A Protracted Witholding Role for Soviet SSBNs?*). These reports were produced, in the late 1970s, under contract to the US Navy.

8 The 'Quiet' revolution and the future

The overall size of the Soviet submarine fleet has declined by less than ten per cent over the past two decades. End strength in 1967 was about 380 units of all types; in 1986 the number was about 360. What has changed is the *composition* of this force. Two decades ago, the strategic portion (SSB and SSBN) of the fleet counted some 40 units. At the same time, altogether 50 boats (10 SSBNs plus 40 SSN/SSGNs) were equipped with nuclear reactors. In 1986, more than 20 per cent of the overall submarine inventory included SSBNs and SSBs; nearly 60 per cent of the total fleet was nuclear-powered.

Another change over the past 20 years that may not be as obvious is that the 1986 force is comparatively older than its 1967 forerunner. None of the submarines in the 1967 inventory had yet reached its normal 20-year life expectancy; the oldest vessels at that time were the 'Whiskeys' and 'Zulus' built in the early 1950s. In 1986, by contrast, nearly one-half of the reported *operational* inventory consisted of hulls 25 years or older. What is more, Soviet submarines built through the early 1970s are generally regarded to be up to ten years behind their Western chronological contemporaries in technological age. This means that, in an encounter with a Soviet submarine, there is a 50 per cent chance that a modern US (or British) submarine will have a 30-plus year edge in technological modernity.

At the close of the decade of the 1970s, especially the non-strategic half of the Soviet submarine fleet was threatened with 'block obsolescence'. One reason was that, beginning in the mid-1960s, Soviet yards had steadily cut back on the high annual production quotas that had marked the 1950s. As has already been reported in the preceding chapter, the yearly completion rate of non-strategic types during the 1970s was less than six units; the number was far from enough to carry out a one-for-one replacement of older types. Different mission requirements and different performance expectations could be one reason for the construction slow-down. As with all navies, however, *cost* was probably the most influential factor. As also shown in the previous chapter, Soviet submarine construction in the 1970s was weighted heavily in favour of ballistic missile types; short of an unlimited budget, the navy may have had to forego one-plus new general purpose boats for each SSBN it ordered. The navy's ambitious surface programme may have been another competitor for funding.

There is one other possible, albeit quite speculative reason for the general purpose construction slow-down of the 1970s. As is remarked upon in greater detail elsewhere in this chapter, there has been considerable commentary in the West of late about the advanced characteristics of the most recent series of Soviet attack submarines. US Navy sources have reported that their one-time ten-year lead in submarine quieting has narrowed to three years or even less. The design of the new 'Akula', 'Sierra' and 'Mike' classes presumably started in the very early 1970s. It was also at this time that the Soviets had the services of the Walker/Whitworth 'spy family' and reputedly learned how vulnerable to detection their submarines were in fact. It is widely suspected that the superior acoustic characteristics of the *Akula*, etc are a direct result, hence the nickname 'Walker' class for the *Akula*.

Is it possible that the Soviet Union had enough confidence in the *Akula et al* design that it risked a ten-year submarine building 'holiday?' In other words, assuming that the Soviets had indeed come to appreciate the necessity of building submarines far quieter than had been practiced so far, and also assuming that, between Walker, *et al*, 'technology transfer' from abroad, and indigenous ingenuity, they had acquired the necessary design knowledge, two

courses of action would have been open. One was to continue building and gradually improving second-generation nuclear boats such as the 'Charlies' and 'Victors' in large enough numbers to replace obsolescent types. The drawback would have been a costly programme that the Soviets already knew would do little to offset the Western acoustic and counter-acoustic advantage. The second choice (and the one that could be speculated was made) was to 'freeze' the production of inferior designs, and risk a ten-year 'window of vulnerability' in anticipation of a superior design for the 1980s.

Naturally, this is no more than a hypothesis. Still, this kind of development would not be unique in the history of Soviet weapons acquisition. An important precedent is Khrushchev's attempt, in the late 1950s, to 'leap-frog' the US advantage in strategic weapons delivery capability. Soviet production of long-range bombers was slowed down in anticipation of a breakthrough in ICBMs. Again, in the early 1960s, the Soviet Union accepted the temporary risk of a strategic missile gap. It stopped fielding the cumbersome first-generation SS-6/7/8, and waited for the much more flexible SS-11 to become available, in the second half of the 1960s, to create a numerical counter to the US Minuteman ICBM force.

SSBN developments – the 'Typhoon' class

In November 1974, Soviet Communist Party Chairman Leonid Brezhnev hosted US President Gerald Ford on the occasion of the signing of the 'Vladivostok Accords', better known as SALTII). Brezhnev informed his guest that if the United States went ahead with the Trident SSBN, his country would counter with the 'Taifun'.

At first, analysts were inclined to interpret the Taifun as a new missile, the literal counterpart to the Trident I SLBM. By 1978, it had become clear that involved was either a new class of SSBNs or a combination of a new SSBN *and* a new SLBM type. In one of three exceptions from the NATO reporting name scheme (the others being *Akula* and *Beluga*), the platform itself became known as the 'Typhoon' class. The associated SLBM system has been identified by the Soviets as the RSM-52; the NATO designation is SS-N-20.

The lead hull of the 'Typhoon' class was launched in September 1980, and became operational one year later. Production at the Severodvinsk yard has proceeded at about one a year, so that five units had been launched by January 1987. US Defense Department and Navy officials predict that the entire series will number seven or eight. So far, the Soviet Navy has introduced a new generation of SSBNs about every ten years (the 'Hotel' class in the late 1950s, the 'Yankee/Delta' group in the late 1960s-to-early 1970s, and the 'Typhoon' in the late 1970s). Based on this performance, the next generation of Soviet SSBNs should make its appearance by 1990.

The outstanding difference between the 'Typhoon' and the 'Delta' class is *size*; the 'Typhoon's length of 170 m (186 yards) has popularly been compared with the size of an American football field. The official US Navy's estimate of the vessel's submerged displacement has settled at 25 000 tons, but or other sources have reported 20 to 40 per cent more. Even at a 'mere' 25 000 tons, the 'Typhoon' almost matches the displacement of the *Kirov* class battlecruiser. It also exceeds that of the *Ohio* class SSBN by almost one third.

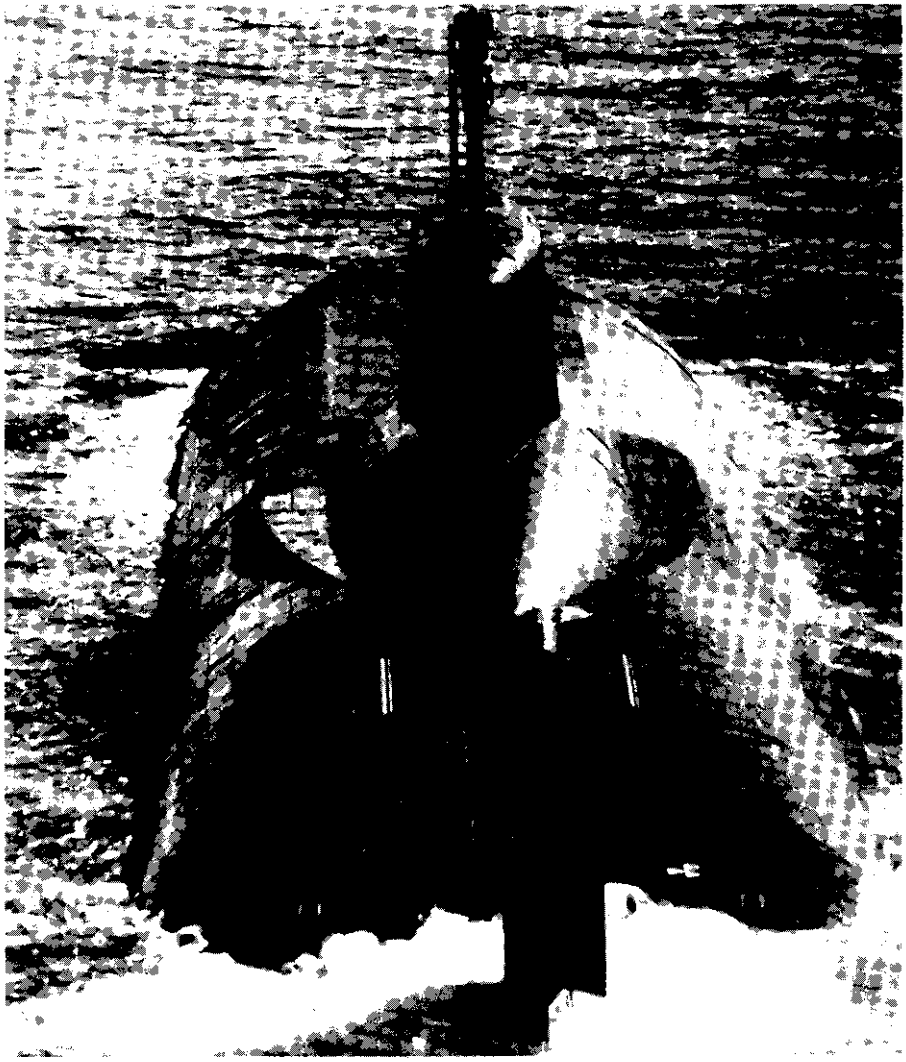
The 'Typhoon' carries 20 SS-N-20s. This is the Soviet Navy's first series-produced solid-fuelled SLBM with a 'bus'* that is estimated to contain eight MIRVs. Each warhead has an assessed yield of 100 kilotons (KT) that can be targeted with an estimated accuracy of 0.2–0.3 CEP (circular error probable). Range has been estimated at about 5000 nautical miles.

*Also known as post-boost vehicle, or PBV, 'bus' is the projectile of a missile with multiple re-entry vehicles, guidance system, propellant, and a thrust device for changing the ballistic path so that the RVs can be ejected sequentially against separate targets.

Other than these basic statistics, much about the 'Typhoon' is shrouded in speculation. Size and the possible purposes for the submarine's large internal volume is one question mark. Rear Admiral Sumner Shapiro, then the US Navy's Director of Naval Intelligence, conceded to a US Congressional subcommittee, in 1981, that his analysts had yet to grasp the reasons for the 'Typhoon's' dimensions:

> 'We never dreamed that the thing would be that big. It is a monster . . . it probably can carry extra people, extra equipment. It's monstrous. It can probably stay out for long periods . . . Maybe it will stay out longer.'

Some members of the subcommittee questioned the relationship Shapiro sought to draw between the 'Typhoon's' size and the ability of the SS-N-20 to target the continental United States from inside Soviet home ports. Between the many 'deleteds', the chief of US naval



'Typhoon' class SSBN (US Dept. of Defense).

intelligence acknowledged that the SS-N-20 could be carried on a much smaller submarine. The large 'Typhoon' was necessary, he said, to accommodate simultaneously the range and multiple warhead capability of the SS-N-20, and, at the same time, overcome the excessive noise level induced by the 'Delta's' notorious 'hump'.

A variety of other reasons has been advanced for the 'Typhoon's' size. Most have focused on a double-hull construction with a separation between inner and outer hulls of up to 1.8 m (6 ft). The double-hull design of the 'Typhoon' is not a novel feature *per se*; it has been a standard Soviet practive even though Western submarine builders switched to essentially single-pressure hull construction many years ago. Until the 'Typhoon', the popular impression was that the Soviet double-hulls were symptomatic of backward manufacturing standards. Namely, for a single-hull to withstand high underwater pressure it must have a uniformly circular shape built to extremely close tolerances; the presence of an outer hull allows for a greater margin of error.

It is now thought that the double-hulled Soviet SSBN fleet may reflect an eminently practical design objective, after all: the space between hulls could cushion the blow of, say, an exploding torpedo warhead. It would also give the submarine an extra margin of buoyancy in the event the outer hull became punctured by natural obstacles, say, ice. It should not be thought, however, that a Soviet double-hulled submarine that has taken a torpedo hit through the outer hull without damage to the inner hull cannot be vitally injured. Located between the shells is auxiliary equipment such as pumps, piping and wiring conduits. So are sonar hydrophones and the propeller shaft. Direct or shock damage could result in a 'mission kill'.

In line with Admiral Shapiro's speculation that the 'Typhoon' may have been designed to carry extra crew and equipment, some analysts have proposed the possible presence of a missile air defence system. Submarine self-defence capabilities against air attack went out of vogue when the diesel-propelled submersible was replaced by the true, nuclear-powered underwater craft. But the aircraft – the submarine's most dangerous opponent during the Second World War – adapted also; surface search radars were replaced by *sub-surface* search sonobuoys and magnetic anomaly detectors (MAD). This development has prompted a renewed interest in some sort of last-ditch self-defence capability for a submarine that knows it has been localised by an overhead ASW aircraft. In the late 1960s, the British introduced a submarine-carried variant of the Blowpipe infra-red homing surface-to-air missile, and called it SLAM (for Submarine-Launched Airflight Missile). In the United States, too, studies were carried out on a system variously known as SIAM (for Self-Initiated Anti-Aircraft Missile) and SUBADS (for Submarine Air Defense System).

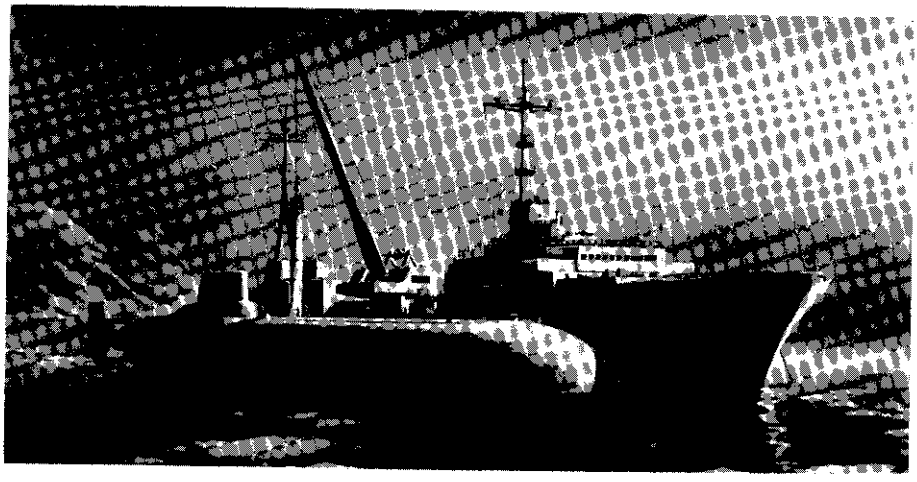
Western ASW capabilities rely heavily on long-range maritime patrol aircraft (MPA), most notably the ubiquitous P-3 Orion. It stands to reason that the Soviet Navy regards the MPA's wide-area search *and* localisation/attack capability a potent threat. A study, in the late 1970s, by Robert W Herrick of the Soviet perception of various US ASW capabilities found that the P-3 has come to be seen as a key anti-submarine threat, especially when operated in conjunction with the Sound Surveillance System (SOSUS) of ocean bottom hydrophone arrays.

Turetsky's earlier-cited account of Soviet Navy missile developments through the early 1960s makes mention of a conceptual design for a submarine-launched anti-air missile with a range of about six nautical miles. A technical presentation of the system was evidently prepared, in 1961, for Khrushchev.

Throughout the 1960s and 1970s, neither open Western sources nor since-declassified intelligence documents even hinted at the possible existence (current *or* projected) of a Soviet submarine surface-to-air missile (SAM). In early 1982, however, several Western defence journals reported the occasional sightings of a 'Tango' class submarine that appeared to have been retrofitted with a SAM system, mounted on the fin. Later reports have hinted

that the Soviet Union's newest diesel-driven submarine, the 'Kilo' class, may carry a similar armament.

No official confirmation or denial of a Soviet submarine SAM system had come forth at the time of this writing. Obviously, this can be no more than second-guessing, but it seems that this kind of capability would make considerable sense for the Soviets: (a) the physical/technical capability clearly exists, (b) the Soviets ought to have plenty of motivation do *something* about the West's airborne ASW threat, and (c) the size of the 'Typhoon' class affords ample opportunity to translate capability and motivation into practical hardware.



Artist's impression of submarine tender re-loading 'Typhoon' with SLBM rounds (US Dept. of Defense).

Most comparisons of the US-Soviet strategic military balance focus on numbers of missile launchers. The SALT counting regimen has reinforced this tradition. In the process, there has been a tendency to gloss over the fact that neither the Soviet Union nor the United States is barred from stockpiling launchers with multiple missile rounds. The Soviet Union has always placed an extremely strong emphasis on the importance of strategic reserve forces, to be thrown into the fray when both sides are exhausted in the initial clash. The Soviet Union conducted SRF exercises that involved the reloading of extra ICBM rounds. Moreover, the reported Soviet production of ICBMs and SLBMs seems to be far greater than necessary for a one-for-one replacement of older models. Table 32 compares the numbers of Soviet ICBM and SLBM launchers in 1977 and 1986, respectively. It shows that apparently 988 missiles (SS-7/-8/-9/-11 and SS-N-5/-6) were withdrawn from service. They were replaced by the SS-17/-18/-19/-25, in addition to the new SS-N-18/-20/-23. During the same time period, 74 new launchers were added, thus creating a basic one missile-per-launcher production requirement of 1062 ICBMs and SLBMs. But, according to the 1987 edition of *Soviet Military Power*, actual Soviet production between 1977 and 1986 totalled 3000, ie an 'excess' of nearly 2000 weapons.

Part of the apparent discrepancy can be accounted for by preproduction and operational flight-test programmes. The Soviet missile research and development cycle typically includes the launchings of some 25 developmental and pre-production prototypes. 'Spare' missiles are also set aside for training purposes. A most liberal allowance for these various purposes is 1000 missiles. This still leaves a ten-year 'overproduction' of almost another 1000 weapons. If this calculation is correct, the unescapable conclusion is that at least one-

third of the Soviet Union's strategic missile production in recent years has been allocated to a reserve stockpile. If so, it is a mistake to assume that all of the SRF and Navy's launchers are equal beneficiaries of this reserve. Some launchers built in the 1960s are not equipped for reloads; besides, it makes little sense to maintain a production line for systems in the process of retirement. The implication is that Soviet land- *and* sea-based strategic missile launchers built since the mid-1970s can likely call on at least one, probably two reloads. One obvious candidate is the 'Typhoon' class. The estimated characteristics of the 'Typhoon' class submarine are shown in Table 33 below.

Table 32: Soviet ICBM and SLBM launcher deployments in 1977 and 1986

Launcher type	Number 1977	1986
SS-7	80	0
SS-8	9	0
SS-9	208	0
SS-11	850	440
SS-13	60	60
SS-17	50	150
SS-18	100	308
SS-19	0	360
SS-25	0	100
SS-N-5	76	39
SS-N-6	516	272
SS-N-8	286	292
SS-N-17	12	12
SS-N-18	64	224
SS-N-20	0	80
SS-N-23	0	48
Totals	2311	2385

Sources: William T Lee and Richard F Staar. *Soviet Military Policy Since World War II*. Stanford, California: Stanford University Press, 1986, pp 82–85, and Department of Defense. *Soviet Military Power 1987*, 6th edition. Washington, DC: US Government Printing Office, 1987, p 25.

Table 33: 'Typhoon' class submarines

Number built (late 1986)	5
When built	1977–present
Where built	Severodvinsk
Displacement	20,000/25,000
Length	170 m (557 ft)
Beam	24.7 m (81 ft)
Draught	11.5 m (38 ft)
Propulsion	80,000–120,000 hp
Speed	24/29
Endurance	NA
Armament	20 × SS-N-20; 6 × 533 mm (21-in) plus 2 × 650 mm (25.6-in) TT
Diving limit	NA
Complement	150

The 'Delta IV' SSBN

The existence of the 'Typhoon' became public knowledge in the latter part of 1980. The reasonable assumption was that the submarine's size and armament was a logical progression toward a cost-effective balance of great striking power and small crews, comparable to the rationale for the 18 000-ton US Navy *Ohio* class SSBN. The Soviet Union failed to live up to expectations. In early 1984, Western intelligence announced the observation of a fourth major modification of the 'Delta' class SSBN, the 'Delta IV'. In early 1988 five units had been completed with another one or two under construction. A series of 'pie charts' in the 1987 edition of *Soviet Military Power* hint that the US Defense Department's expectation is that construction will stop with the sixth or seventh unit.

Two reasons have been given for what appears to be a competitive building programme with the 'Typhoon' group. The first is that the 'Delta IV' is the somewhat accidental result of the 'Delta' programme momentum, that it was built to 'use up' materials still on hand. The second is that the 'Delta IV' is perhaps part of a deliberate Soviet strategy at building a 'Hi-Lo' mix of SSBNs, the 'Delta IV' being the 'poor man's' version of the 'Typhoon'. A similar speculation has been advanced in connection with the simultaneous *Kirov* and *Slava* cruiser programme.

The problem with the first explanation is that it intimates a much greater lack of co-ordination between the Soviet Navy and the ministries of defence and shipbuilding than most analysts have commonly claimed exists. If this were the case, then it becomes difficult to explain why the Soviet Union armed the 'Delta IV' with the entirely new SS-N-23 whose development presumably began at the same time that the *first* 'Deltas' became operational.

The idea of a Hi-Lo SSBN mix is the more plausible one of the two. The 'Typhoon' must be an extremely expensive platform. It has the advantage of great endurance and firepower, but individual wartime survivability is likely to be offset by the small numbers the Soviet Union can afford.

There is a third hypothesis that is impossible to prove, however, until much more is known about the physical characteristics and performance of the 'Typhoon' and 'Delta IV' weapon systems: it is conceivable that the 'Typhoon'/SS-N-20 and 'Delta IV'/SS-N-23 combinations have been designed to distinct mission requirements. At this time, the only known outstanding difference between the SS-N-20 and SS-N-23 is that the first relies on solid fuel propulsion whereas the second is a return to the Soviet Union's traditional dependence on a liquid fuel engine. Both missile flight test programmes appear to have been failure-prone. One unusual aspect of the SS-N-23's flight test series has been the incidence of short-duration trajectories well inside the weapon's assessed 5,000 nm flight envelope.

The 'Delta' 'analogous response' of 1984

In January 1984, the Pentagon announced that the Soviet Union had bolstered its routine 'Yankee' patrols off the North American coast with several 'Deltas'. This was reported to be the first time that this SSBN type had deployed outside 'bastion' waters. The background to what became known as the 'Deltas' 'analogous response' was the following.

On 16 March 1982, Soviet President Leonid Brezhnev warned that NATO plans to install Pershing IIs and ground-launched cruise missiles (GLCMs) on European soil would be met by 'retaliatory steps that would put the other side, including the United States, in an analogous position'. Brezhnev's successor, Yuri Andropov, reaffirmed that the 'Euromissiles' would invite unspecified measures against the territory of the United States itself. Many Western analysts thought that the Soviet counter-move would be to forward-deploy SS-20 intermediate range ballistic missiles (IRBMs) in Eastern Europe, possibly even Cuba.

In November 1983, the *Bundestag* approved the deployment of Pershing IIs and GLCMs on West German territory. Andropov promptly announced that, 'corresponding Soviet means will be deployed in ocean areas and seas . . . equal to the threat created for us and our allies . . .' In January 1984, two 'Delta' class SSBNs were spotted moving south through the Greenland-Iceland-United Kingdom (GIUK) Gap. An 'Echo II' type was observed in the waters off Bermuda.

The Soviet Union made no attempt to hide the 'Deltas' dispatch. Defence Minister Dimitry Ustinov told a press gathering that, 'We have increased the number of our submarines with nuclear missiles aboard off the coast of the USA in terms of their characteristics – yield, accuracy, the ability to reach targets on the territory of the United States and the flight time to target'.

The official American reaction to the event was to downplay it as an ineffective Soviet attempt at strategic 'gunboat diplomacy'. President Reagan assured reporters that one or two more Soviet SSBNs off the US coast was nothing new, and certainly would not keep him from getting a good night's sleep in the White House. US Navy spokesmen claimed that the Soviet move was actually to the US advantage. Deploying their 'Deltas' out of their normal more distant operating areas, said Lehman, 'increases our ability to deal with them'.

James McConnell is probably the only one who has examined the analogus response episode for more than its symbolic significance. His views are contained in a 1985 CNA report, entitled *The Soviet Sea-Based 'Analogous Response' and Its Role in Soviet Doctrine for Theater Nuclear War.*

McConnell believes that 'Deltas' forward deployment signalled an important Soviet *doctrinal* shift. Specifically, the threat of a Euromissile strike against targets on Soviet territory allegedly caused Moscow to 'recouple' its theatre-only and intercontinental nuclear options, and thus place US soil at risk analogous to that posed by the Pershing IIs and GLCMs against *Soviet* soil. The analogous character of the Soviet response, claims McConnell, had two dimensions, one geo-political and the other operational-tactical. On the first level, the Soviet counter had to match the Euromissile threat in the sense that it, too, had to be based away from the home territory. For the Soviets this meant sea-basing. From the operational-tactical perspective, the Soviet analogous response force needed to duplicate the weight of a potential Euromissile assault in terms of numbers of weapons, weapon yields and accuracies. This meant, according to McConnell, that a Soviet analogous response attack would be discriminate and aimed at strictly military targets located in the United States. Such an attack would be carried out by a dedicated SSBN task force, separate and geographically detached from the main body of bastioned SSBN reserves.

This reasoning raises several provocative questions. In the first instance, it is not clear why the Soviet Union should find it necessary to forward-deploy the 'analogous response' 'Deltas' when, by all accounts, the boats are capable of striking US targets from inside home waters. McConnell proposes that by doing so the Soviets hope to minimise the likelihood of an all-out US campaign against their 'general war SSBN reserves'. But in its new Maritime Strategy the United States has already declared the intention to attack the SSBN 'bastions' even if hostilities are limited to conventional weapons.

Then there is the question of proportionality. Euromissile deployment plans called for a total of 572 Pershing IIs and GLCMs. Both missiles carry a single warhead; the Pershing II's W-85 has a dial-a-yield capability between five and 50 KT, and the GLCM's W-84 is rated at 200 KT. The assessed accuracy of the GLCM is about 15 m (50 ft), compared with a CEP of about 38 m (125 ft) for the Pershing II.

McConnell's interpretation demands that the analogous response SSBNs possess identical capabilities. At the *numerical* level this means that in order to match 572 Euromissiles, the Soviets would have to forward-deploy some 27 'Delta' I, II and IIIs with an aggregate load-out of 340 single SS-N-8 warheads plus 240 triple SS-N-18 warheads (assuming an average

of three RVs per SS-N-18). In other words, nearly one-half of the Soviet SSBN fleet would need to be reassigned from bastioned reserve status to out-of-area analogous response duties.

The problem for the Soviets is even worse at the *qualitative* level. The yield of the SS-N-8 and SS-N-18 warheads is estimated from 500 to 800 KT, ie at least two-and-half times as much as the largest Euromissile yield. Next, estimated accuracies lie between 910 m and 1520 m (3000 and 5000 ft), which is at least 24 times worse than that claimed for the Pershing II. Clearly, even should the Soviet Union wish to match the Euromissiles round-for-round and target-for-target, it lacks the capability by virtue of a 'Delta' analogous response force.

Forward deployment of the attack submarine fleet

The 'Deltas' forward deployment made news headlines for less than a week. One year later Western intelligence experts had their attention focussed on another pattern-breaking activity of the Soviet submarine fleet. In June and July 1985, the Soviet Navy held a large-scale exercise in the Norwegian Sea and North Atlantic. Called 'Summerex-85' in the West, the manoeuvre involved over 100 surface ships and about six dozen submarines.

The unusual aspect of the exercise was the arrival off the US east coast of several nuclear submarines. The presence of a 'pack' of Soviet submarines was first reported by the *Royal Gazette*, a Bermuda newspaper. It noted that an augmented squadron of 15 US Navy P-3s was attempting to track from eight to ten boats, some which were described by the newspaper's sources as SSBNs. The US Navy subsequently confirmed, in Secretary Lehman's words, that 'for the first time we saw new (Soviet) submarines operating aggressively in *our* waters against *our* vulnerabilities'. (emphasis in the original). As to the identity of the submarines, the US Navy would only confirm the presence of several 'Victor IIIs'.

Soviet out-of-area deployments declined noticeably during 1986. Taking note of this, Lehman in his final posture statement credited the Maritime Strategy for having compelled the Soviets to pull back. The Soviets evidently did not agree. On 7 April 1987, the US Navy confirmed the presence of 'about half a dozen' (later reduced to five) Soviet nuclear attack submarines in the waters between Connecticut and Virginia. Again, the 'Victor III' was identified. It is possible that at least one 'Charlie II' was present as well. The force left the eastern Atlantic in the second week of April.

The appearance of the 'Victor III' class off the US eastern seaboard was not a novel phenomenon *per se*. Dramatic confirmation of its presence came in October 1983, when a unit was forced to come to the surface off the coast of South Carolina after its propeller had become entangled in the towed sonar array cable of the frigate USS *McCloy* (FF 1038). What *was* new was the co-ordinated arrival of *multiple* units.

Three possible scenarios could lie behind the 'Victors' forward deployment. First, it has been proposed by a number of analysts that Soviet war planning has shifted to a conventional emphasis and that, as a corollary, the Soviet Navy has become serious about the necessity of an Atlantic anti-shipping campaign. Accordingly, the 'Victors' may be practising a potential Soviet version of the German *Paukenschlag* campaign of 1942. Between mid-January and the end of April of 1942, German U-boats that never exceeded 12 in number sank at least 198 ships with a total gross tonnage of 1,150,675 in US coastal waters. This was more than 50 per cent of the Allied tonnage lost in the Atlantic due to *all* caused throughout 1941. The Soviet naval high command may have concluded that – as was the case in 1942 – the Americans will be relatively unprepared to protect their trans-Atlantic resupply bridge in home waters.

A second possibility is that the Soviets have decided that the best defence against the

announced forward thrust of the Maritime Strategy is to go on the *offence*. Thus, instead of waiting for the US Navy carrier battlegroups after they have safely crossed three-fourths of the Atlantic, Soviet attack submarines may attempt to take their toll just outside the great US Navy bases such as Norfolk, Virginia.

The third possible targets for the 'Victor III' exercise scenario are the US Navy SSBNs. For the first 20 years of their patrols, the SSBNs operated out of four widely scattered locations: Holy Loch, Scotland; Rota in Spain; Apra Harbour, Guam; and Charleston, North Carolina. By the early 1990s, there will be only two homeports: Kings Bay, Georgia on the east coast and Bangor, Washington on the west coast. The reduction in home basing facilities will be matched by smaller number of SSBNs. Although much depends on the future of strategic arms agreements, the currently planned *Ohio* class force goal made public is 20, ie 50 percent of the size of the original Polaris/Poseidon fleet.

Between a smaller number of targets and only two 'launch corridors', early tracking and trailing of the US Navy's SSBNs may become a feasible proposition for the Soviet attack submarine fleet. Recent Soviet strides in submarine quieting strengthens the plausibility of this particular scenario.

The 'Quiet Revolution'

The balance of Western versus Soviet submarine capabilities has always been a trade-off between Soviet *quantity* and Western *quality*. A key reason why the United States made the decision, now more than 30 years ago, to build an all-nuclear underwater fleet was the expectation that quality, though bought at great expense, would more than offset the Soviet Union's 4:1 numerical superiority. The American technological lead has been particularly strong in the area of submarine quieting and acoustic detection capabilities. Compared with modern US or British nuclear attack boats, early Soviet atomic submarines sounded like a 'rumbling train'. In fact, in order to make ASW exercises realistic, Western nuclear submarines, playing the role of the 'enemy', were fitted with noise augmentation devices.

Why the Soviet Union's submarines were noisier than their Western-built chronological counterparts was another question. One answer has been that the Soviets deliberately chose to sacrifice stealth for speed. The problem with this hypothesis has been that Soviet operational submarine strategy presumably looked to slow-moving defensive patrols within the framework of a predeployed and relatively static series of defensive barriers.

Soviet technological backwardness has been the second answer. According to this theory, the Soviets simply had not managed to develop the engineering and machining techniques to produce moving parts (eg, turbines and propellers) at the necessary close margins of tolerance. It is in the context of this hypothesis that the US Senate penalised the Japanese Toshiba Corporation, in 1987, for selling the Soviet Union equipment allowing it to mill quieter submarine propellers.

In 1982–83, reports accumulated in the public press that newer types of Soviet submarines were much quieter than the long-acclaimed US DoD ten-year lead in the area of acoustics had predicted they would be. Within the next couple to three years, different authorities on the subject claimed that the Soviets had (a) caught up to no more than a four-year-lag and would match the radiated noise level of American submarines before the year 2000, (b) already built new classes of submarines that were the acoustic equals to their potential US opponents, and (c) surprised the West with one or two new types that had acoustical superiority. Thus, Admiral Wesley McDonald, recently retired as Supreme Allied Commander, Atlantic (SACLANT), wrote in the 1987 edition of the US Navy League's *Almanac of Seapower* that the 'Typhoon' was the 'quietest submarine yet to be built *anywhere*' (emphasis added).

The American tendency to blame the Soviet advance in acoustical performance on espionage and technological theft is reminiscent of the stories, in the early 1950s, that the Soviet Union had, somehow, stolen the secret of the atomic bomb. No doubt, the Soviets have taken advantage of the illegal transfer of technology, yet most people familiar with the field of submarine acoustics and counter-acoustics concede that the Soviets would have caught up regardless.

The fact is that acoustic 'observables' and acoustic means of detection have been close to reaching a technological *plateau*. The US Navy has advertised that the self-noise of its newest planned submarine, the SSN-21 *Seawolf* class, will be essentially indistinguishable from the ambient noise created by the ocean; in other words, the SSN-21 will be the quietest submarine that is physically possible to build. In the field of acoustic detection, progress in detection *per se* has been slow for the past 20 years; advancements have come primarily in computerised acoustic signal processing. It is for this reason that the US Navy research and development community, notably the Defense Advanced Research Projects Agency (DARPA) and the Office of Naval Research (ONR) have focused their ASW funding on *non-acoustic* methods.

The Walker family espionage affair and other illicit transfer of Western technical know-how have undoubtedly helped the Soviets to better define and speed up their submarine silencing efforts. But it is also true that it was merely a matter of time before Western ASW forces would encounter the quiet *Akula* or its like in any case. After all, told the Commander-in-Chief of the US Navy's Atlantic Command, Admiral Lee Baggett, Jr, a US Senate committee in 1986, all the Soviets had to do was 'check out the book that pointed out . . . to them . . . that you can do preventive maintenance and you can decrease your source level significantly'.

Quieting trends

Little information exists in the public domain to allow more than the most general observations about the past and present of Soviet submarine noise characteristics. Most of it has become available in the course of US Navy testimony on behalf of the SSN-21 *Seawolf* programme. Tom Stefanick in his recent book, *Strategic Antisubmarine Warfare and Naval Strategy*, has used this data to develop the only non-classified model of comparative US and Soviet quieting trends. The figure reproduces Stefanick's estimate of the trend in total acoustic output for a variety of US and Soviet nuclear-powered submarines. The reader is referred to Stefanick's text for the model's estimating assumptions.

Figure 4 allows these general observations:

- until the introduction of the 'Victor III' class, Soviet submarines lagged 10–15 years behind US submarines in comparative levels of radiated (broadband) noise;
- the 'Victor III', with a noise level comparable with that of the SSN 637 *Sturgeon* class, reduced the gap to about seven years;
- the new *Akula* and possibly also the 'Sierra' match or nearly match the (broadband) acoustic performance of the SSN 688 *Los Angeles* class;
- a projection of the current trend suggests that the *Akula* follow-on class is likely to be as quiet as the planned US SSN-21 *Seawolf* class.

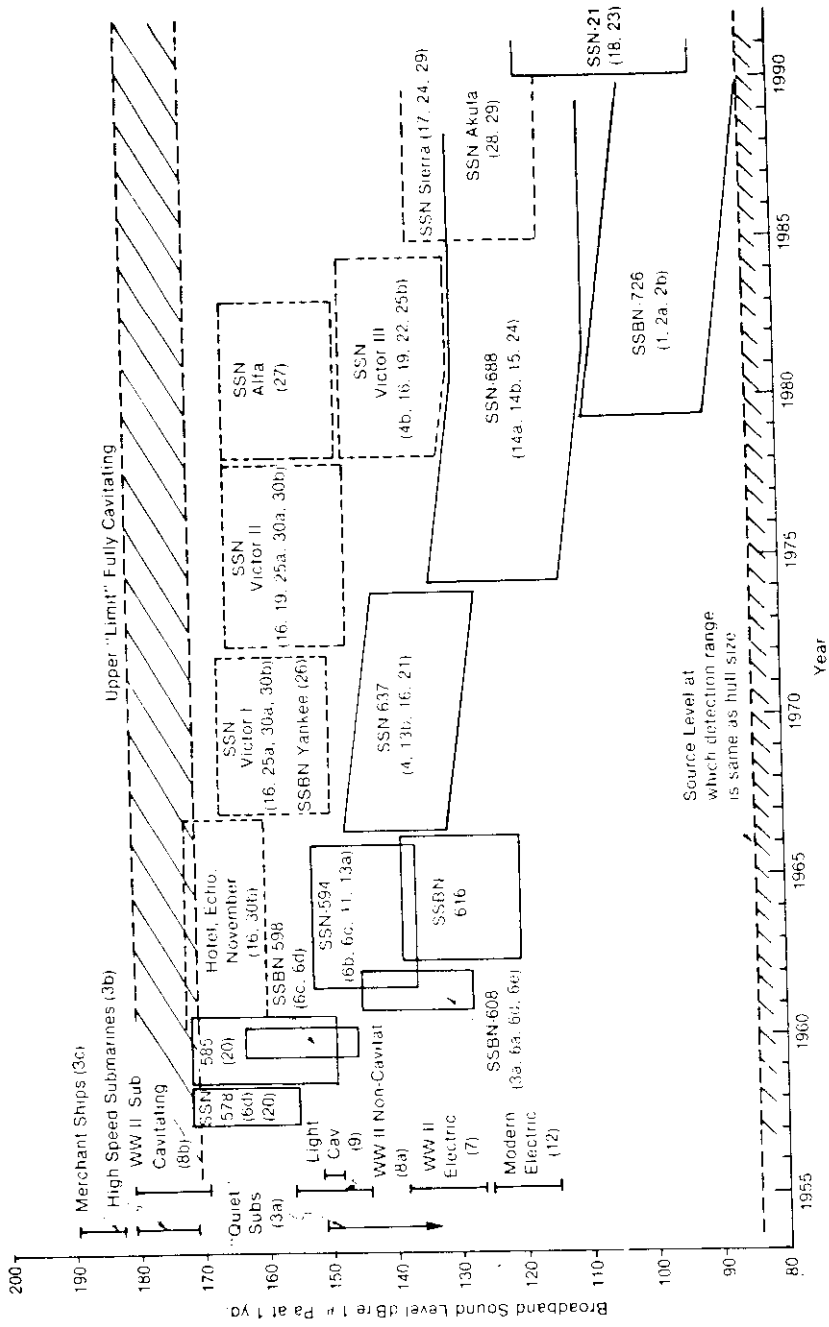


Figure 4: Trends in comparative broadband acoustic sound levels of US and Soviet submarines

Source: Tom Stefanick. *Strategic Antisubmarine Warfare and Naval Strategy*. Lexington, MA: D.C. Heath and Co, 1987, p 274.

Implications for Soviet Submarine Roles

The different roles a navy is charged with are perhaps equally a function of the prevailing estimate of the threat and doctrinal-strategic priorities, as they are of technological opportunity. In fact, a study of Soviet writings on the relationship between military science and new weapons suggests the view that, more often than not, technological progress acts as the 'independent variable', and doctrinal innovation as the 'dependent variable'. This view is entirely consistent, of course, with the Marxist materialist interpretation of social developments.

The question whether the recent Soviet progress in submarine silencing has been 'driven' primarily by military requirements or by technological *momentum* is probably less important than how this new capability may be integrated into the Soviet Navy's wartime role responsibilities.

It may be recalled from the discussion in an earlier chapter that Western intelligence analysts in the late 1950s were somewhat puzzled over the apparent Soviet failure to develop an ASW 'hunter-killer' submarine. A reasonable answer is that, until the early 1960s, the Soviet Navy had no requirement. For nearly the first two decades after the Second World War, the overriding seaward threat to the Soviet homeland was on the surface of the oceans, namely the Western carrier fleets. A moving carrier battlegroup produces very high noise levels; even if the Soviet Union had had the technological wherewithal to build quieter submarines, it had no obvious requirement to make the necessary investment.

The US and NATO situation was quite the opposite. It has been said that, were it not for the hundreds of Soviet submarines, the post-war US Navy would have lost its *raison d'etre*. The recognition, in the late 1940s, that the sole significant and long-term Soviet naval danger was the submarine spurred 'Project Hartwell'. Named after its chairman, this 1950 convention of the country's foremost ASW specialists effectively pointed the way for ASW technology (including SOSUS, passive acoustic detection systems, nuclear underwater weapons, and continued development of the nuclear submarine) for the next 20 years or so.

In the mid-1960s, naval threat priorities for both sides had begun to shift. For the first time in 20 years, the Soviet Union faced a naval opponent whose primary offensive power rested with submarines; the Polaris submarine had replaced the aircraft carrier as the US Navy's principal strategic strike platform, and the US Navy was about to deploy its first series-built counter (the SSN 667 *Sturgeon* class) to the Soviet Navy's first-generation SSBNs.

On the American side of the equation, the two decades-long preoccupation with finding ways to defeat the submarine threat was reoriented to developing a balanced defence against the burgeoning Soviet surface fleet. The US Navy had to overcome the Soviet lead in anti-ship missiles; the Soviet Navy had to catch up in ASW capabilities.

It must be remembered that the Soviet surface and subsurface combatants that, according to most analysts in the early 1970s, were forward-deployed in the mid-1960s for 'anti-SSBN' purposes, were designed during the mid-1950s, *before* ASW had become an important Soviet warfare area. The Soviets went to sea with the material that happened to be available. They probably did not expect an immediate operational pay-off; it is much more likely that they used the experience to discover shortfalls and identify technological and design requirements for the *next* generation of ASW combatants. By the early 1970s, this knowledge would probably have been assimilated sufficiently to draw up the designs for the *Akula*, 'Mike' and 'Sierra' classes.

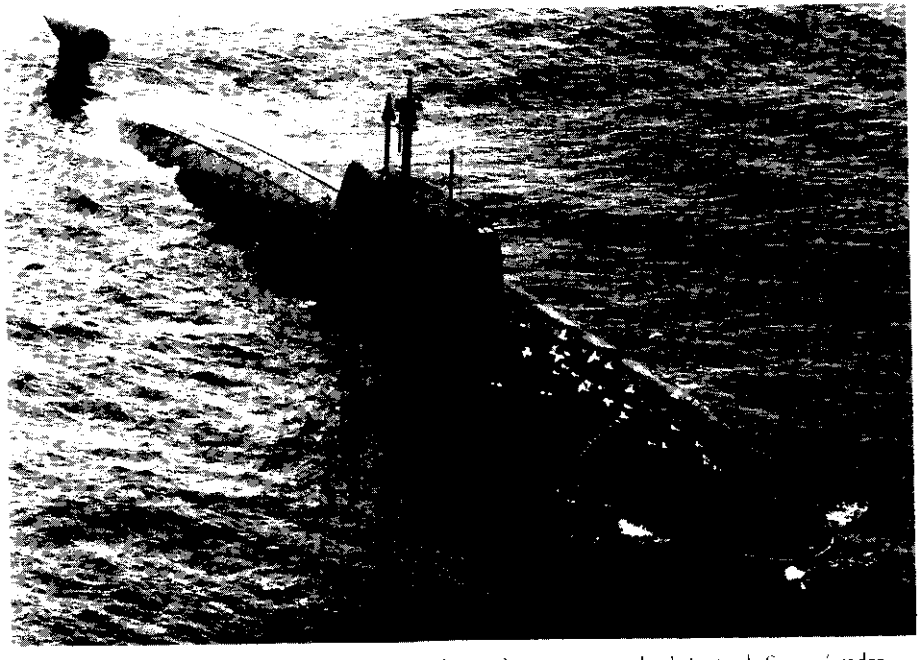
Defence against the West's SSBNs has been a high Soviet priority since the early 1960s. Until recent years, Soviet ambitions in this area have been ahead of actual capabilities. When Western analysts recognised this discrepancy, the general feeling was that the Soviets would attempt to skip the 'normal' evolution of ASW capabilities and focus their research on some

sort of 'esoteric' break-through. The Soviet Union's basic research organisation probably pursues many of the same non-traditional ASW avenues as does the West's. Meanwhile, the Soviet Navy appears to have gone ahead and put into practice basic submarine building principles they found worked for the West.

The *Akula*, 'Sierra' and 'Mike' classes

The types that embody the 'quiet revolution' of the Soviet submarine fleet are the *Akula*, 'Mike', and 'Sierra' classes. They are part of what one former director of US naval intelligence, Rear Admiral John Butts, called an 'unprecedented number and variety of (Soviet) nuclear attack submarines'. Strictly speaking, Admiral Butts was wrong on both counts. Since the early 1930s, the Soviet Union had launched a new 'family' of a half-dozen or so submarines about every ten years. After the Second World War, from the late 1950s until 1960, eight different classes were introduced: 'Hotel', 'Echo I' and 'Echo II', 'November', 'Juliett', 'Foxtrot', 'Romeo', and 'Golf'. Between the second half of the 1960s until 1971, the West was presented with the 'Yankee' and 'Delta', the 'Victor', 'Charlie', 'Papa' and 'Alfa', and the 'Tango'. Moreover, the newest submarines are evidently being produced at a much slower rate than were their predecessors of 20 and 30 years ago. The expectation is that, after a 'shake-out', only a few types will enter into series-production.

Little solid information has so far become available on the SAM 'Sierra-*Akula*-Mike' group of submarines, in part, because production rates for all three have been - by Soviet standards – uncommonly slow. All three types have been identified as possible successors to the 'Victor III', and all three have been picked as possible launch platforms for the SS-N-21, the Soviet Navy's land-attack version of the US Tomahawk cruise missile.



'Sierra' class SSN. Masts (from r. to l.) search (binocular) periscope; back-to-back S 'loop' radar with EW radar warning aerials mounted below; top of separate HF radio mast, forward of the radar mast; SATCOM aerial. (RNOAF)

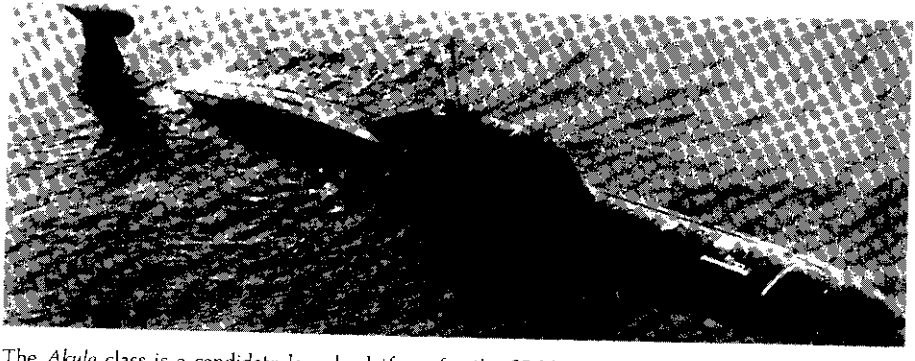
The lead 'Sierra' unit was completed at the Krasnaya Sormova Yard in Gorki in 1984. It is a double-hulled vessel with an external appearance that is generally reminiscent of the 'Victor III'. The 'Sierra' is larger than the 'Victor III', but there is no agreement on how much larger. The US Navy's 1985 edition of *Understanding Soviet Naval Developments* cited a surface displacement of 5500 tons (the same as the 'Papa' class), but other, more recent sources have claimed as much as 6500 tons. Official US Navy sources have reported a length of 110 m, or about five per cent more than the 'Victor III'. This suggests that the 'Sierra' is slightly 'beamier' than the 'Victor III'. Basic armament appears to be identical the 'Victor III's', including eight 533 mm torpedo tubes with the capability to launch the SS-N-15 and SS-N-16. Like the 'Victor III', the 'Sierra', if put into series-production is expected to carry the torpedo tube-launched SS-N-21.

Table 34: 'Sierra' class submarines

Number built	2 (spring 1987)
When built	1983–present
Where built	Krasnaya Sormova Yard, Gorki
Displacement	6500/8000
Length	119 m (360 ft)
Beam	10–12.5 m (33–41 ft)
Draught	9.0 m (29.5 ft)
Propulsion	NA
Speed	NA/33
Armament	SS-N-15/16; SS-NX-21; 6 × 533 mm (21-in)
Diving limit	396 m (1300 ft)
Complement	90-plus

The *Akula* class, too, has been described as a potential successor to the 'Victor III'. First launched at the Komsomolsk Yard in mid-1984, its overall silhouette resembles the 'Victor III's' even more than does the 'Sierra's'. A notable feature on all three types is a large streamlined pod on top of the vertical tail fin. The official judgment is that it probably contains a towed sonar array. Others have speculated that a new type of auxiliary propulsion system, based on magnetohydrodynamics (MHD), is involved.

Like the 'Sierra', the *Akula* has so far been produced at a rate of less than one unit per year; three units were reported at sea in 1988. Between similar weapons capabilities and



The *Akula* class is a candidate launch platform for the SS-NX-21 Tomahawk-like cruise missile (US Dept of Defense).

approximately the same size, the two types could be competitive designs, only one of which may eventually survive for series-production. Table 35 tabulates the limited information so far available on the *Akula*.

Table 35: 'Akula' class submarines

Number built	3 (spring 1988)
When built	1983–present
Where built	Komsomolsk
Displacement	8000/10000
Length	110 m (360 ft)
Beam	approx 11.3 m (37 ft)
Draught	approx 7.6 m (25 ft)
Propulsion	40,000 hp
Speed	NA/32-plus
Armament	SS-N-15/16; SS-N-21; 8 × 533 mm (21-in)
Diving limit	396 m (1300 ft)
Complement	90-plus

The 'Mike' class is evidently a one-off model and, like the 'Papa', apparently intended for testbed purposes. The propulsion system reportedly is based on two liquid metal cooled nuclear reactors, capable of producing 50 000–60 000 shaft horse power and a submerged speed of more than 36 knots. Unlike the 'Sierra' and *Akula*, it does not display the prominent tailfin pod. If the latter does indeed contain a towed array, then its absence on the 'Mike' suggests a role other than 'hunt and kill' ASW. Other negative evidence is the submarine's high speed potential. One possibility is that 'Mike' is a testbed for a dedicated carrier of the SS-N-24 land attack cruise missile.

Table 36: 'Mike' class submarines

Number built	1
When built	1983- 1984
Where built	Severodvinsk (Sudomekh, Leningrad?)
Displacement	7800/9700
Length	110 m (360 ft)
Beam	approx 12 m (40 ft)
Draught	approx 9 m (30 ft)
Propulsion	50–60,000 hp
Speed	NA/ 36
Armament	SS-N-15/16; SS-N-24(?); 6 × 533 mm (21-in)
Diving limit	610–915 m (2000–3000 ft)
Complement	90-plus

The SS-NX-21 and SS-NX-24

The SAM group, in addition to the 'Victor III', has been pinpointed as the likely launching platforms for a new generation of Soviet strategic cruise missiles, designated SS-NX-21.

The first public hints that the Soviet Union was developing a Tomahawk-like land attack cruise missile came during US Congressional hearings in the spring of 1982. The next year, the US Defense Department's *Soviet Military Power* used the designation SS-NX-21 to

describe a submerged-launched 1600 nautical miles-range missile, intended 'primarily (for) nuclear strike'. The weapon's external similarity with the US Navy's Tomahawk earned it the nickname 'Tomahawkski'.

The SS-NX-21 apparently surprised the intelligence community. As the United States developed its own Tomahawk programme, Defense Department officials repeatedly declared that the Soviet Union had neither a military requirement nor the technological wherewithal to follow suit. Defense Secretary Donald Rumsfeld's 1976 posture statement declared that, 'there is no evidence as yet that the Soviets possess the technology to pursue over the near-term a strategic cruise missile development'. (Author's note: 'near-term' usually meant within the next five years).

In 1979, Defense Secretary Harold Brown reported that the Soviet Union had 'some new ones under development', but he apparently had evolutionary improvements of *existing* systems in mind. Indeed, the American lead in key cruise missile technologies, notably light-weight propulsion systems and microcircuitry) seemed so overwhelming that some commentators felt that the United States could safely slow down its programme so as to stabilise the arms race.

Since the mid-1960s, after the withdrawal of the SS-N-3C from service, the Soviet Navy has focused its cruise missile efforts on anti-ship weapons. Intelligence projections in the mid-1970s foresaw a progressively more capable family of submarine-launched anti-ship missiles, but could discover no compelling reason why the Soviets might wish to resurrect its long-range land-attack programme. General George Brown, then the chairman of the JCS, cited, in 1978, 'asymmetries in geography and population distribution' as the reasons the Soviets did not seem interested. Since most American population centres were within 500 nautical miles of the 100 fathoms depth curve, Brown explained, the Soviets had no need for a long-range cruise missile. The situation was different for the United States, he said; only six of the major Soviet cities with only some 2.2 million people were located at a similar distance from the sea. The JCS chairman's suggestion that both US and Soviet submarine-launched cruise missiles would be targeted against cities is revealing of contemporary perceptions of Soviet targeting doctrine.

Close upon the heels of the SS-NX-21 revelation came the report of a second and much larger submarine-launched strategic cruise missile, the SS-NX-24. This is believed to be a supersonic weapon, capable of delivering a nuclear warhead over a distance of at least 2700 nautical miles. If the sketch of the weapon made public by the US Defense Department is reasonably accurate, length is in the neighbourhood of 12.5 m (41 ft) and wingspan about 6 m (20 ft). This would mean that the SS-NX-24 is nearly 40 per cent taller than the SS-N-6 SLBM. The SS-NX-24 has been flight-tested from a modified 'Yankee' type. But since fitting the much larger SS-NX-24 will require extensive (and expensive!) alterations, the Soviets might choose the deploy it on the older units of the roomier 'Delta' class instead. Assuming that the Soviet Union will continue to informally abide by the SALT ceiling on allowable SSBNs and SLBM launchers, and also assuming that the 'Typhoon' and 'Delta IV' will be built at one unit per year each, the 'Delta Is' should become available for SS-NX-24 conversion by the mid-1990s. Also not to be ruled out as an SS-N-24 carrier is a 'Mike' or 'Oscar' development.

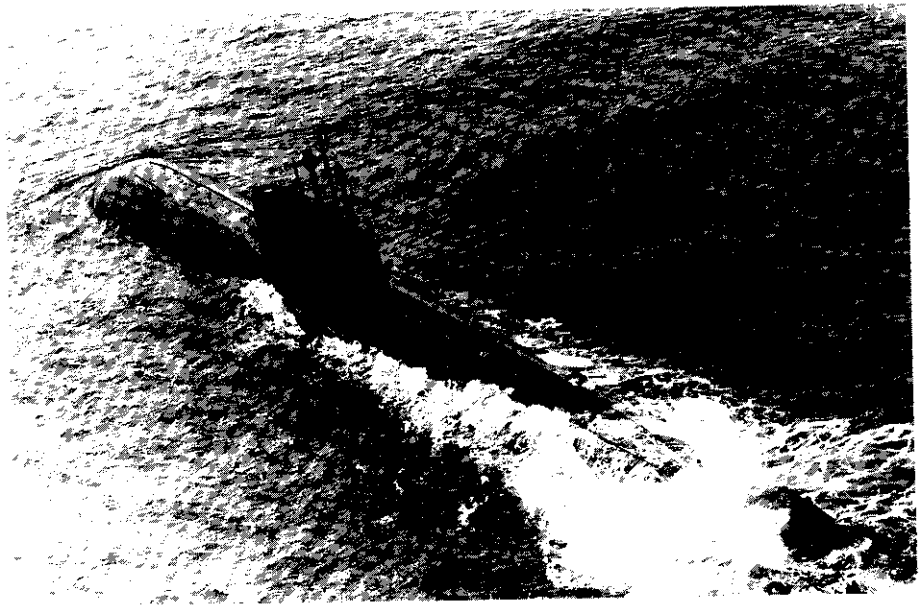
There are indications that the SS-NX-21 and SS-NX-24 programmes are behind schedule. The 1984 edition of *Soviet Military Power* predicted that the SS-NX-21 would probably become operational in 1984, and that the larger missile could attain its IOC before the end of 1986. The next year's version of the same publication repeated this forecast, but the 1986 issue limited the projected deployment date of the SS-NX-21 to 'soon'. The SS-NX-24, the publication announced, 'could' become operational in 1987. *Soviet Military Power*'s most recent (1988) edition has reset the IOC of the SS-NX-24 to 'the next few years'. SS-NX-21 was flight-tested from an *Akula* unit in early 1988.

There are two possible reasons for the apparent four-to-five year's delay in the fruition of the SS-NX-21/-24 projects: one, the intelligence community could have over-estimated the ability of the Soviets to, first successfully complete a novel missile R&D programme and secondly, integrate a major new weapons system with a suitable launch platform. Support for this hypothesis comes from the unusually low-key production of the SS-NX-21's candidate launch platforms, the SAM group. Also, a Soviet Defence Ministry spokesman admitted, in a press conference in August 1986, that his country's moratorium on nuclear testing had 'damaged' certain unnamed weapons programmes. No hint was made at the specific project or projects that had presumably been affected, but the complaint did leave room for the possibility that *political* rather than technical considerations have impeded the operational introduction of the SS-NX-21 and SS-NX-24. Support for this hypothesis, albeit circumstantial, comes from repeated Soviet warnings, in *1984*, that the installation of the Tomahawk on American attack submarines invited an immediate Soviet step in kind. In October 1984, shortly after the US Navy had announced that its first *Los Angeles* class submarines had gone to sea with the Tomahawk, the Soviet Defence Ministry announced that, in order to maintain the 'existing equilibrium', long-range cruise missiles were being installed on bombers and submarines.

The 'Oscar' class 'battle submarine'

Western interpreters of Soviet naval developments in the early 1970s were inclined to view the 'Charlie' class SSGN with the horizon-range SS-N-7 as the 'wave of the future' of Soviet submarine anti-ship missile capabilities. It appeared that the Soviets had rejected the earlier reliance on long-range missiles that required targeting and mid-course guidance assistance from a co-operating platform.

The Soviet Union upset this calculation when it introduced, in 1979, the 'Oscar' type submarine. Not only was the 'Oscar' armed with a new type of long-range, over-the-



The 'Mike' class is another potential launch platform for the SS-NX-21 (US Dept of Defense).

horizon (OTH) cruise missile, but it also carried three times as large a load-out (24 versus eight) as the 'Echo IIs' and 'Charlies'. Built around the 24 SS-N-19s was a vessel with a surface displacement of 12,000 tons; the only larger submarines in existence are the US *Ohio* and the Soviet 'Typhoon' SSBNs.

Because of its size and heavy armaments, the 'Oscar's' likely wartime use is sometimes compared with that of the floating batteries or casemate battleships before the First World War. According to this theory, it is unlikely that, because of its size (and therefore restricted mobility) and expense, the Soviets will use the 'Oscar' for 'free-play' operations on the high seas. The expectation instead is that the huge submarine will be held back as part of a pre-positioned anti-carrier barrier.

The basic reported characteristics of the SS-N-19 suggest that this is an evolutionary development of the SS-N-3 and SS-N-12. A maximum range of 300 nautical miles has been quoted, but the likely effective range is closer to 250 nautical miles. The missile's speed of about Mach 2.5 is comparable to the SS-N-12's, but the testimony by US Navy officials before the US Congress has suggested a greater cruise altitude and more extreme dive angle. It is probable that the SS-N-19 can achieve a flight altitude of about 24 000 m (80 000 ft), which would place it at the limit of the SM-2's engagement envelope. Guidance is evidently the function of an active radar seeker, possibly backed up by an anti-radiation homer.

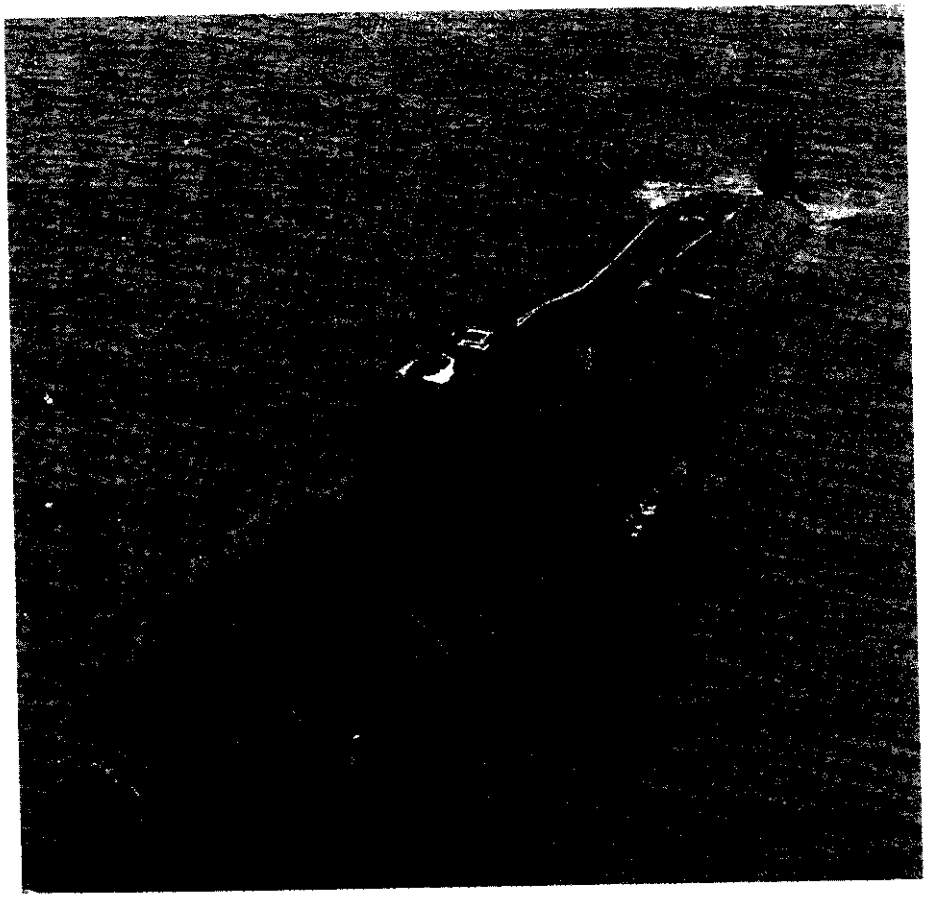
The 'Oscar's' intended concept of operations is puzzling, especially with regard to targeting. It is physically impossible for a submarine to detect, locate and identify a target 250 or more nautical miles away with sufficient precision to develop a missile fire control solution. This means that the 'Oscar', like the 'Echo II' and 'Juliett', probably depends on a data relay platform. For 'real-time' targeting it might take advantage of satellite data, assuming of course, that the submarine, the satellite, and the intended victim ship all happen to be within line-of-sight (LOS) communications of one another. If the 'Oscar' is pre-deployed for an 'ambush' attack, it could receive regular updates on the target's co-ordinates via land-based extremely-low frequency (ELF) radio.

The 'Oscar's' submerged-launch capability makes it less vulnerable to detection and attack than the 'Echo II' and 'Juliett'. But this added measure of security may last only as long as the first SS-N-19 salvo. Even at 250 nautical miles from the centre of a carrier battlegroup, the 'Oscar' will be within the radar and acoustic coverage of carrier-based aircraft such as the E-2C Hawkeye and S-3A/B Viking. As soon as the first SS-N-19 breaks the surface of the water, the 'Oscar' is placed at the same risk that is often cited in connection with an SLBM launch, namely it has given away its position. An SSBN stands a fair chance of launching without hostile ASW forces being in the area; this is not so for the 'Oscar'. Considering the SS-N-19's unusual combination of strengths and weaknesses, it cannot be ruled out that the missile has a secondary (perhaps even primary) *land-attack* role.

Table 37: 'Oscar' class submarines

Number built	4
When built	1979–present
Where built	Severodvinsk
Displacement	12,000/15,400 (hulls 1 and 2)
Length	143 m/470 ft (hulls 1 and 2)
Beam	17.6 m (57.8 ft)
Draught	11 m (36.3 ft)
Propulsion	60,000 hp
Speed	NA/ 30
Endurance	NA

Armament	24 × SS-N-19; SS-N-15/16; 6 × 533 mm (21-in) plus 2 × 560 mm (25.6-in) TT
Diving limit	NA
Complement	130



The 'Oscar II', which was first photographed in 1988, is longer than the 'Oscar Is'. The added space may be due to a redesign of the engineering spaces or to modification of the SS-N-19's command centre and launch tubes. (333 Squadron, Royal Norwegian Air Force)

'Oscar II'

Most Soviet nuclear-propelled submarines have been deployed in at least two different 'editions', eg 'Echo' I and II, 'Charlie' I and II, and 'Victor' I to III. In each case, the 'mod' hulls have incorporated larger displacements in order to accommodate a more voluminous weapons load-out and/or engineering plant. The 'Oscar' class appears to have lived up to this pattern as well. Following the completion of the first two units, in 1981 and 1982, respectively, official US Navy sources reported a submerged displacement of 15 400 tons. In 1985, hull number three was launched; fitting out and sea trials were presumably concluded in late 1986. The Pentagon's annual *Soviet Military Power* shortly reported a new 'Oscar' displacement figure – 17 600 tons. The report's 1988 edition also made reference, for the

first time, to 'Oscar I', thereby clearly indicating the existence of a II version. Other sources have recorded somewht different displacement estimates, but all point to a significant growth in size between the lead and follow-on hulls. The conclusion is that 'Oscar I' probably involves units one and two, whereas successors will be known as 'Oscar II'.

The estimated 14 percent increase in 'Oscar II's' displacement must be the result of a longer hull. Given 'Oscar's' extreme 'beaminess', it is plausible that the added displacement has permitted no more than a 5–10 percent growth in hull length. This means that 'Oscar II' should be 23.5 to 47.0 feet longer than 'Oscar I'.

The reason for the added space is another matter. One possibility is a redesign of the engineering spaces; another could involve modification of the boat's SS-N-19's command centre and launch tubes for retro-fitting with the SS-N-24. The SS-N-24 is evidently considerably larger than the SS-N-19; however, the Soviet submarine fleet has a long history of speeding up new weapon deployments with the help of drastic 'interim' conversions.

Return of the midgets

As attention in the West was riveted on the 'Typhoon' and 'Oscar' behemoths, rumours and reports from places as far apart as Scandinavia and Japan pointed to the existence of a Soviet submarine capability on quite the opposite end of the scale: the two- or three-man 'midget' or miniature submarine.

Reports of the existence of Soviet midgets have been closely associated with the repeated sightings of mystery submarines in the fjords and shoals of the Scandinavian countries. Between the early 1960s and the beginning of the 1980s, the navies of Norway, Sweden and Finland had all had occasion to (unsuccessfully) hunt down unidentified submarine intruders. Success of a sort came to the Swedish Navy on the evening of 27 October 1981, when a 'Whiskey' type submarine (pennant number *137*) was found lodged inside the shallow waters of the Gasefjaerden. The unfortunate Soviet captain claimed a navigational error. After 10 days of tedious negotiations Swedish tugboats pulled the submarine into open waters, but not until after Swedish personnel had used radiation scanners to determine that the vessel almost certainly carried nuclear weapons. The Swedish government later presented Moscow with a bill for $212 000 for the cost of the salvage operation.

Less than one year after the 'Whiskey-on-the-rocks', the Swedish armed forces spent from 1 October to 1 November 1982 in staging the country's largest ASW operation since the Second World War. The 'Horsfjaerden incident' (so named for the location of the events in the Stockholm archipelago) involved dozens of ships and helicopters; mines and depth charges were used to try and flush out up to six 'alien' submarines. None were caught.

A special commission convened by the Swedish government issued its report on the operation in 1983. It concluded that the 'co-ordinated operation' of three pairs of conventional and 'mini' submarine teams had been involved. Based on photographs of trackmarks on the bottom of the area, two different miniature types were identified. One appeared to be a caterpillar-tracked vehicle for movement on the seafloor itself, while the second was evidently a twin-propeller buoyant vessel with a reinforced keel.

The Commission left no doubt about its conviction that the intruders belonged to the Warsaw Pact. It was much less certain about the Soviet Union's reasons. A variety of possibilities was considered – from training exercises to 'gunboat diplomacy', and from intelligence gathering to a survey of possible wartime hiding places for the Baltic Fleet's 'Golf' SSBs. The Commission's 'main impression (was) that this submarine activity represents the preparatory phases of military operational planning'. As to the particular type of operational planning at issue, it took special note of the existence of Soviet special purpose troops, the so-called *Spetsnaz*.

Soviet midget submarine developments and the *Spetsnaz* connection

The developmental history of Soviet midget submarines and the associated technologies of underwater habitats, deep-submergence vehicles, and remotely-operated vehicles (ROVs) is sketchy. Most submarine fleets before the Second World War, notably Great Britain, Italy and Japan, carried out experiments with a variety of one- or two-men midgets. Given that it owned the world's most ambitious submarine building programme by far in the 1930s, it would be surprising if the Soviet Navy had been the exception. During the War itself, Great Britain, Italy and Japan, in addition to Germany, employed their midgets with varying degrees of success. There is no record of Soviet wartime activities of this kind.

At the end of the war, the Soviets became the heirs to the midget technology of the Axis powers. Perhaps the most valuable find came with the occupation of the Schichau-Elbing shipyard in February 1945. This had been the lead yard for Germany's most successful *Seehund* (Seal) midget. The Soviets found 18 *Seehund* in different stages of assembly. Shortly after the war, in 1948, ONI reported that four had definitely been spotted in Leningrad, but that there might be as many as seven. In 1950, ONI calculated that, between captured and newly-constructed units, the Soviet Navy probably owned from 50 to 70 midget submarines. Most were thought to be German designs such as the *Seehund*, *Molch* (Salamander), and *Biber* (Beaver). The balance was believed to be made up of ex-Italian and ex-Japanese types that had been captured in the Black Sea and on Sakhalin, respectively. Construction of the German derivatives – based primarily on the Schichau work – was evidently carried out by the Nikolayev yard. ONI reported that the Sudomekh yard was engaged in experimental work with two unidentified ex-German midgets.

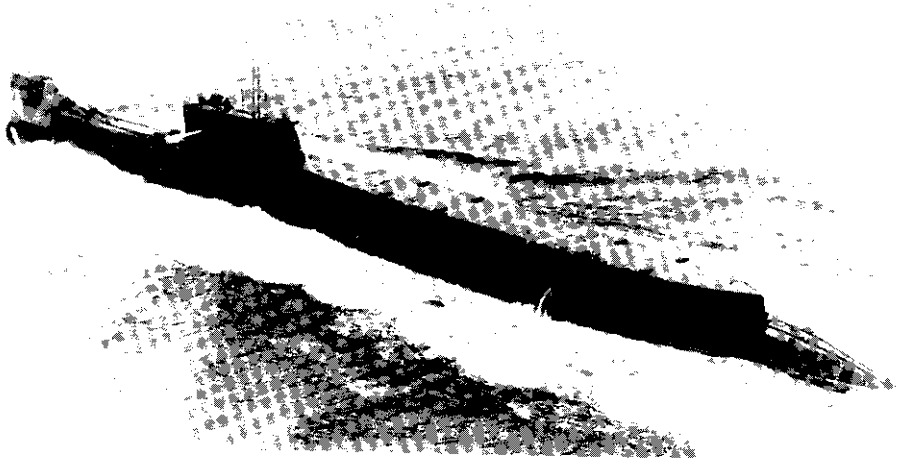
The midget submarine as a weapon of war disappeared from the news for almost 30 years. Ironically perhaps, during the same time period, but especially in the 1960s and 1970s, many of the technical difficulties that had tended to make the midget more dangerous to its crew than to the enemy were being 'pushed' to resolution as the result of the commercial interest in the exploitation of ocean resources.

The international search for ocean minerals and more efficient fishing methods has spawned a host of survival, communication, propulsion, and automation technologies aimed at creating a workable human underwater habitat. The Soviet Union is no exception. Different ministries have been involved in a variety of manned and unmanned submersible projects for such purposes as acoustic fishery research, fish behaviour studies, and ocean bottom profiling. One development by the Soviet Academy of Sciences, reported a 1976 study by the US Congressional Research Service, was a three-man vehicle, known as *Argus*. An unmanned version has been identified as *Zbug*. *Argus* is apparently a 'bottom crawler' and may therefore be related to the tracked visitor to the Horsfjaerden area. It has been speculated that both may be derivatives, in turn, of the German wartime *Seeteufel* (Sea Devil). The latter was a two-men vehicle 13.7 m (45 ft) long and with a displacement of 35 tons. During experiments in 1944 it managed to operate at a depth of 20 m (70 ft).

It has been suggested that the Soviet version of the *Seeteufel* may be 50 per cent longer than the original. If so, it probably cannot hold more than five people, including a two-man operating crew. This means that a boarded *Spetsnaz* raiding party with equipment would have limited capabilities. It seems likely that such scarce accommodations would be reserved for highly specialised operations such as the precision placement (or deactivation) of minefields, communications and acoustic surveillance equipment.

The special purpose nature of the midget-*Spetsnaz* team is also hinted by the limited availability of Soviet 'mother submarines'. Cited most often for this purpose has been the 'India' class. Built into the deck of this submarine are two wells, each of which can hold a single deep submergence rescue vehicle (DSRV). There is no obvious physical difficulty with the 'India' being used for *Spetsnaz* missions, but the limiting factor is that only two vessels are

in existence. Both are attached to the two Soviet fleet areas where a DSRV capability is most necessary – the Northern and Pacific fleets. One can imagine that the local submarine force commanders will be very reluctant to 'loan out' this scarce asset for a risky *Spetsnaz* mission. A more conventional option would be for the midget to be towed to its zone of operations by a standard submarine. This is how the Royal Navy managed to get four 'X-craft' midget submarines across the Norwegian Sea to attack the German battleship *Tirpitz* in 1943. 'Operation Source' was a success in the sense that the *Tirpitz* was put out of action for six months, but the price was a high one: between mechanical casualties, broken tow ropes and other mishaps none of the six 'X-craft' that originally left Britain returned home. Nine of the overall crew complement of 24 died, and another six survived as prisoners of war.



'India' class 'mother submarine' for deep submergence rescue purposes. (Above) The unusual construction on the bow is attached when the vessel operates in ice-infested waters. (Below) The wells in the casing of the 'India' are occupied by two DSRVs. It is thought that the same space might be filled by Spetsnaz-controlled midget submarines (US Navy).

Conventional submarines – alive and well in the Soviet Union

The demise of the Soviet conventional submarine has been predicted for almost three decades. On the contrary, the introduction of each new generation of Soviet nuclear boats has been complemented with a novel diesel-powered design. The arrival of the HEN group

in the late 1950s was accompanied by the 'Foxtrot', that of the 'Charlie'/'Victor'/'Yankee' by the 'Tango', and most recently, the SAM group and 'Typhoon'/'Oscar' have received their conventional counterpart in the form of the 'Kilo' type.

Supporters of the US Navy's all-nuclear submarine fleet have been inclined to treat the Soviet Union's parallel nuclear and conventional building programmes as somewhat of an oddity. In reality, it is the exclusively nuclear US underwater fleet that is the exception. Five of the world's navies have so far built and operated nuclear submarines: the United States, the Soviet Union, the United Kingdom, France, and the People's Republic of China (PRC). Only the United States has chosen to rely exclusively on nuclear power. In the process, American submarine designers and building yards have surrendered the country's one-time lead in conventional submarine technology. At the same time, the United States has become the only modern maritime builder that is incapable of exporting state-of-the-art diesel submarines.

Perhaps because the United States has not built a non-nuclear submarine in 30 years, the popular image is that the diesel boat has not changed much since the Second World War – cramped quarters, limited range and endurance, and the need to expose a snorkel apparatus every few hours or so. This is not an accurate picture. A modern conventional submarine with a displacement of, say, 1500 tons, can be as quiet as the newest US nuclear attack boats; low battery discharge rates permit it to manoeuvre at operational underwater speeds for eight hours or more, and new types of closed-cycle engines (eg, the Stirling and Brayton cycle plants) are about to offer an effective underwater endurance of up to 70 days.

Conventional submarines make sense for the Soviet Navy from a military-strategic as well as economic perspective. Western preoccupation with the offensive dimension of Soviet submarine power – the 'Typhoons', 'Oscars' and *Akulas* – has tended to overshadow the fact that, in terms of relative numbers, the Soviet Navy is still mostly a coastal defence force; the greater portion of the Soviet surface and subsurface naval threat is made up of 'green' and 'brown' water gun-, missile- and torpedo patrol craft, and 'short-legged' diesel submarines.

A nuclear submarine costs about twice as much as a modern 1500-ton conventional boat. The extra cost is commonly defended as an advantageous trade-off between *quantity* and *quality*. But that advantage depends on the particular scenario. All other things being equal, a modern nuclear submarine will have the upper hand in one-on-one encounter with a diesel submarine in the open ocean. The predicted 10:1 'kill ratio' that US submariners talked about in the 1960s should be understood in this context.

But chances are that the opponent of a Soviet diesel attack submarine will not be an USN or Royal Navy nuclear boat, but a NATO resupply ship instead. The success of a Soviet tonnage war will hinge on the number of vessels and cargoes sunk. This is much more of a function of the number of submarines poised to attack than of the *quality* of the individual submarine.

It is too early to say at the time of this writing if the 'Kilo' will be the straightforward successor to the 'Foxtrot' class, in part because average production at the Komsomolsk yard has so far been barely more than two per year. Eleven out of a total of 20 built so far (spring 1988) have been transferred to foreign navies (see Appendix II).

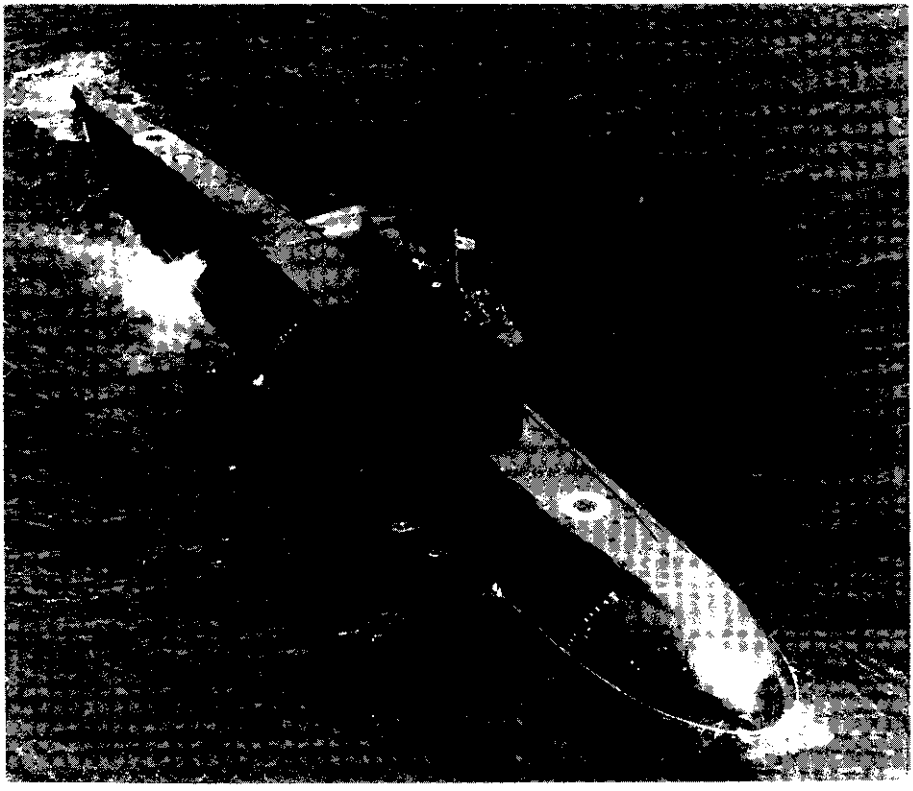
The 'Kilo' is a large submarine by conventional standards. Surface displacement is estimated at 2500 tons, compared with 3200 tons in submerged condition. It is a 'beamy' boat with a length-to-beam ratio of about 7:3, which makes it the stubbiest submarine in the Soviet fleet other than the 'Bravo' class.

The 'Kilo's general appearance is that of a 'true' submarine, reminiscent of the cigar-shaped form introduced by the US Navy's *Albacore* (AGSS 569) in the early 1950s and since adopted in the design of the Dutch *Walrus* and the UK Type 2400 classes. The resemblance between the 'Kilo' and the Dutch built-for-export *Moray* class is especially striking. Unlike

the Type 2400 and the *Moray*, the 'Kilo' retains a series of free-flood holes, indicating that it has a double-hulled construction.

Table 38: 'Kilo' class submarines

Number built	20 (spring 1988)
When built	1979–present
Where built	Komsomolsk
Displacement	2500/3200
Length	73 m (240 ft)
beam	9 m (29.5 ft)
Draught	7 m (23 ft)
Propulsion	
Speed	12/16
Endurance	70 days
Armament	6 × 533 mm (21-in) TT; SAM ?
Diving limit	300 m (1000 ft)
Complement	about 50



'Kilo' class submarine (US Navy).

Figure 5 Annual completion rate 1950–1985.

The future

The Soviet submarine fleet of the mid-1980s appears to be going through a critical period of transition. Its newest units, such as the 'Sierra', *Akula*, 'Mike', 'Kilo', and 'Typhoon', present Western ASW forces with their greatest qualitative challenge since the Second World War. At the same time, annual production of submarines has declined to the lowest level in 40 years. As Figure 5 shows, the annual completion rate has gone down from a peak of 80-plus units in 1955 to about one-half dozen in 1985. It also points out the tendency for each peak production milestone during the past 35 years to be succeeded by a distinct dip, followed, in turn, by another production surge. Yet, the general trend has been for each new production surge to be smaller than its predecessor.

This trend will probably persist, so that production of the current third-generation nuclear submarines and of the 'Kilo' class should peak in about 1990 with a maximum total output of between eight and ten units. Production by type is likely to look like this:

'Typhoon'	1
'Delta IV'	1
'Oscar'	1
'Sierra'-*Akula*	3–4
'Kilo'	2–3

One result of declining production is the spectre of massive block obsolescence. The overall size of the Soviet submarine fleet has stayed remarkably steady at about 360 units over the past 20 years. This has been possible largely by delaying the retirement of units that had reached their nominal 20–30 year life expectancy. But the decision can no longer be postponed. In 1985, more than 50 per cent of the Soviet submarine fleet was at least 21 years old; almost 20 per cent was more than 30 years old. These numbers include the generally newer SSBNs, which means that the *general purpose* force is even comparatively older.

Just as the decline in production levels has been a long-term tendency, so the 'aging' of the Soviet submarine fleet has been a steady and consistent phenomenon. The table below compares the age distribution of the fleet at ten-year intervals from 1955 until 1985. In 1955 more than one-half of the fleet was less than ten years old, in fact considerably so. Over 50 per cent included the newly-produced 'Whiskeys', 'Zulus' and 'Quebecs'; the balance was accounted for by post-war built 'K', 'S', and *Shch* types. The 1965 fleet is still a 'young' force. Built in the preceding ten years was the numerous 'Foxtrot' class, the final 90-odd units of the 'Whiskey', and the first-generation nuclear-powered HEN group.

Age	Fleet strength by year			
	1955	*1965*	*1975*	*1985*
10 years	283 (57 %)	243 (47 %)	120 (36 %)	65 (16 %)
11–20 years	154 (31 %)	250 (48 %)	135 (40 %)	125 (32 %)
21–30 years	58 (12 %)	24 (5 %)	78 (24 %)	129 (33 %)
31–40 years	– (–)	– (–)	– (–)	77 (24 %)

Age distribution of the Soviet submarine fleet, 1955–1985

Note: Data are estimates based on multi-sources

The gradual obsoleteness of a good part of the fleet becomes noticeable in 1975. During the preceding decade, the production of general purpose boats took a backseat to the 'Yankee' and 'Delta' SSBN programmes. This is also the period when the Soviet Navy

became serious about creating a 'balanced' fleet; competition from the burgeoning *surface* programme most likely made an additional inroad on funding for submarine construction.

By 1985, less than one-half of the fleet still met the standard 20-year useful life criterion for a submarine. Vivid evidence of worsening materiel difficulties has been the growing frequency of various accidents and engineering casualties at sea (see Appendix I). From 1976 until 1985, series-production was limited to fewer than 20 'Victor' II/IIIs, six 'Charlie IIs', and about ten 'Tango' types. At the same time, 14 'Delta IIIs' were completed.

Mindful of earlier Soviet ambitions at creating a 'big navy' (notably in the late 1930s and early 1950s), some analysts have proposed that, this time too, the build-up of large surface combatants may be a temporary phenomenon that will fade and be overtaken by a new emphasis on submarines. This is improbable, at least in the forseeable future. Economic constraints may slow down the building of *Kirovs*, *Tbilisis* and their successors, but it is unlikely that the Soviet Navy will return to the submarine-dominated fleet of the 1950s and 1960s. Aside from such bureaucratic reasons as sunk costs and institutional self-interest, important military-strategic and economic considerations argue against such a development. On the economic side, the submarine simply is no longer the 'poor man's' alternative to a major surface combatant. A modern, fully-equipped nuclear submarine costs as much (be it in dollars or rubles) as a 6000–8000-ton surface warship. Next, the Soviet Union's military-strategic situation in the mid-1980s has outgrown the possibilities of the submarine alone. The Soviet Union until the mid-1960s was a *regional* superpower. Its military dilemma was relatively simple: how to minimise the weight of US nuclear retaliation while the Soviet Army went about destroying the NATO armies on the European continent. The division of labour between the Soviet Army and Navy was also relatively simple: while the Army pursued its offensive against the NATO defenders, the Navy would try and hold a *defensive* line against the US Navy's strike carriers and trans-Atlantic reinforcements. The submarine was the most efficient weapon for this kind of strategic defence. Since the Anglo-American fleets of the mid-1950s to mid-1960s could call on over 1000 warships, it was important that numbers be met by numbers.

The Soviet Union in the mid-1980s is a *global* superpower. Interests and security problems are no longer limited to the western appendage of the Eurasian continent. From the point of view of the Soviet military planner, the most dangerous development in the past 20 years has been the Sino-Soviet 'split' and the possibility of a two-front war. Faced with a potential enemy to the east, the Soviet Union had to find ways to better its ability to shift military power from the centre of Russia proper to the Orient. Reinforcement of the garrisons on the border of China was one step; another was to open up new lines of communications, including the construction of the Baikal-Amur Mainline (BAM) railway and the creation of a stronger naval presence in the Pacific and Indian Oceans.

Soviet Navy roles and missions in a war against China would be a mix of *defensive* convoying of Siberian resupplies and reinforcements, and *offensive* fleet-against-shore operations. The latter would include the mining of Chinese coastal waters, amphibious landings in support of the main axis of advance, and shore bombardment and air strike. Both the defensive and offensive tasks are beyond the capabilities of submarines alone.

The Soviet surface fleet will be a fact of life for at least the next 30 years. Meanwhile, the Soviet Navy is faced with hard choices between the *quantity* and *quality* of its submarine service. The new types that have been introduced since the early 1980s suggest that it has decided upon a considerably smaller submarine fleet with capabilities near or equal to those of its potential Western opponents. Based on current and foreseeable production rates, it is likely that the Soviet submarine fleet of the mid-1990s will number about 200 non-strategic types that are 20 years old or less. In the early 21st century, the number will probably be about 25 per cent smaller.

Military doctrinal innovation and the quality of military hardware co-exist in a mutually-

reinforcing relationship. Chances are that the Soviet shift from *quantity* to *quality* submarine production is as much a function of a change in military-strategic priorities as it is *vice versa*. Specifically, a smaller but higher-quality submarine force is likely to reinforce Soviet strategic reasons for moving away from the traditional reliance on a defensive zonal or barrier defence to offensive and mobile forward operations. A passive zonal defence was a plausible strategy as long as the Soviet Navy owned enough submarines to guard all possible enemy approaches to the Soviet homeland. Moreover, since the submarines would be pre-deployed and be lying in wait, there was no need to match the Western submarines in 'acoustic speed'.

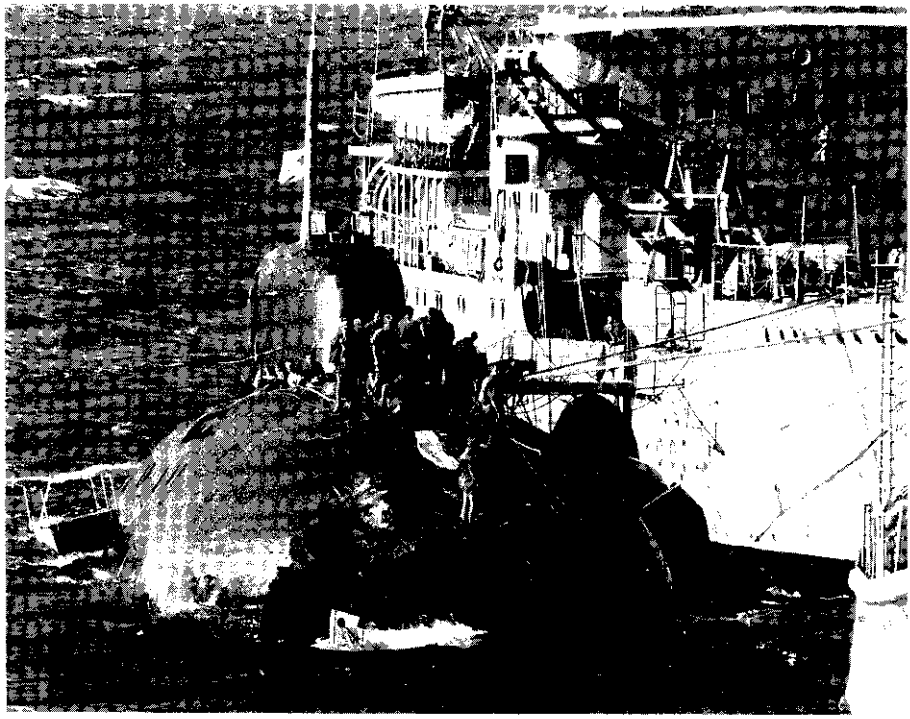
Fewer, yet quieter submarines both offer the *opportunity* and *compel* the Soviet Navy to push its defensive perimeter forward. The essence of high-quality forces is *manoeuvrability* – both cost and capability militate against using the quiet and high-speed submarine for a 'Maginot Line' type of defence. Military forces must use their mobility to seek out the opponent! The arrival of the 'Victor III' class off the principal exit ports of the US Navy may be a warning that the Soviet Navy intends to carry out the seaward defence of the Soviet homeland off American shores.

Principal sources

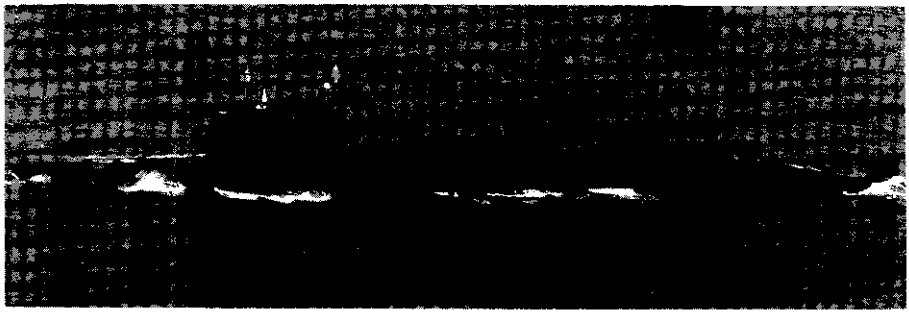
Principal source materials for this chapter included the transcripts of US Navy budgetary testimony before the US Congress. An important secondary source was professional naval journals, especially the US Naval Institute's *Proceedings*, *Jane's Defence Weekly*, and *Navy International*. An indispensable account of recent Soviet progress in submarine quieting is Tom Stefanick's *Strategic Antisubmarine Warfare and Naval Strategy*.

Appendix 1: Soviet submarine accidents

According to former US Navy Secretary John Lehman, Jr, the Soviet submarine fleet suffered over 200 accidents between 1975 and 1985 alone. The most recently reported (and most dramatic) episode unfolded during the first week of October 1986. On the third day of the month a fire broke out inside the SS-N-6 missile compartment of a 'Yankee' class SSBN about 600 nautical miles east of Bermuda. The fire evidently caused enough heat to cause the explosion of the liquid fuel tanks of the number 13 missile. The explosion blew a hole



Two recent Soviet submarine casualties. The photo above shows the damage sustained by a 'Victor I' as the result of a collision with a Soviet merchantman in the Strait of Gibraltar on September 21, 1984. The one below shows the damage to a 'Yankee' SSBN after an explosion and fire in the missile compartment. The photo was taken on August 5, 1986, one day before the submarine sank in 18,000 feet of water (US Navy/US Dept. of Defense).



through the outer casing of the hull, killing three crewmen and injuring others. The Soviet news agency TASS reported that the fire was brought under control on Sunday, 5 October. With the reactor shut down, a Soviet merchantman attempted to take the 'Yankee' in tow. The effort failed; on 6 October the submarine was either abandoned or scuttled, and sank to a depth of over 5500 m (18,000 ft).

Various reasons have been offered for the apparently high accident proneness of the Soviet submarine fleet, including (1) sub-standard design, construction, and engineering methods, (2) poor maintenance practices, and (3) insufficiently trained crews. Indications are that all three have played a role.

Stark evidence of primitive construction methods came to light with the raising of the forward section of a 'Golf II' SSB by the CIA-operated *Glomar Explorer* in 1974. Hull thickness varied widely, and welds were uneven and dangerously pitted. Most surprising was the use of four-by-two wooden beams for internal structural support.

Another instance of 'make-shift' construction were the 'Whiskey' missile conversions. It is known that the addition of the 'Single' and 'Twin-Cylinder' launchers caused serious stability problems. One boat, presumably a 'Whiskey Twin-Cylinder', reportedly sank as a result and was never recovered.

Basic design flaws and inadequate quality control and safety provisions in main and auxiliary equipments have been another cause for mishaps. In the 1950s, a series of explosive accidents with the 'Quebec's' experimental closed-cycle engine earned it the nickname 'Cigarette Lighter'. In more recent years, there have been a number of confirmed and suspected instances of fires and radiation leakage involving the first-generation HEN nuclear reactors. The prototype HEN reactor on the icebreaker *Leningrad* experienced a melt-down sometime in the 1960s. It has also been speculated that the original 'Alfa' may have been broken up after suffering a catastrophic reactor accident.

Accidents have also been traced to the weapons area. In 1972, radiation leakage inside the storage area for nuclear-tipped torpedoes reputedly caused a number of fatalities among the crew of an unidentified nuclear submarine. The extent of the radiation was evidently such that the boat had to be taken in tow to Severomorsk.

Propellant leakage, sometimes resulting in crew poisonings, was a problem with the first-generation liquid-fuel SLBMs, such as the SS-N-4. The SS-N-4 used non-storable liquid fuel which meant that the tank would be filled on board the submarine just before the actual launch. Turetsky has reported that it was not uncommon for the vibration of the submarine's machinery to cause leaks in pipes and seals. A leak at the rate of one drop per minute, claimed Turetsky, was enough to debilitate the crew in adjoining compartments in eight hours.

The comparatively small amount of time that Soviet submarine crews spend away from port and the resultant loss of practical at-sea experience have been cited as another cause for a high frequency of materiel casualties. Admiral James Watkins, then the Chief of Naval Operations, told a US Congressional committee, a few years ago, how 'Soviet crews decry the fact they don't get enough at-sea training time. They bitch about it in the documents and we see the results'.

The ability of a submarine crew to operate, maintain and, if necessary, carry out repairs at sea depends, in part, on how 'user-friendly' the equipment is. No matter how simple, if machinery is ill-designed and constructed, even the much more highly-trained Western submarine personnel would be 'stretched thin'.

Design and construction flaws also have an adverse effect on the ability of shipyard personnel to carry out necessary maintenance and overhauls. The questionable performance of the Soviet Union's submarine overhaul infrastructure was commented upon in a report by the US Joint Chiefs of Staff (JCS) in 1973. According to the *United States Military Posture for FY 1979*, it took the Soviets an average of 30–36 months to overhaul a nuclear submarine – twice as long as the United States.

Part of the reason for this backlog may be an institutional impediment. Soviet industry, including the shipbuilding component, is *output*-oriented. Industrial performance (and rewards for the Soviet captains of industry) is measured by production – not by the efficiency of maintenance and repair chores that might interfere with pre-set quotas.

The Soviet Navy depends on the Ministry of Shipbuilding Industry for major submarine repairs and overhauls. In theory, this organisation is an equal to the Ministry of Defence which has ultimate control over naval matters. In practice, however, the first and foremost pre-occupation of the Ministry of Shipbuilding Indistry is *new construction*, be it naval or civilian, *not* 'non-productive' repairs. A 1970 US Congressional report explained the reluctance of the Ministry of Shipbuilding Industry as follows:

> '. . . repair work is a less efficient process (than is new-construction) in the shipyard. In (the US) system, we plan on an input cost basis. The total input cost is less to repair a nuclear submarine than to replace it. In the Soviet system, the shipbuilding industry is not on a cost basis, and they maximize output not minimize input. I suggest that the Soviet Ministry of Shipbuilding does not want to be in the ship repair business, especially the most difficult of all ship repairs, nuclear submarine work. . . . In our own system, shipbuilding and ship repair are very compatible. The funds to build ships and those to overhaul them are almost non-competitive in our budget process . . . Ship overhaul funding gets low visibility in the annual budget and is usually less volatile than the shipbuilding budget. As a result, submarine overhaul is desirable work for even our private yards. They can rely on a steady backlog of work and do not have to deal with large changes in the work force to fit the ups and downs of the shipbuilding budget.'

Table 39 is a partial listing of major Soviet submarine accidents in the past 20 years. Two things need to be kept in mind. In the first place, there is no 'scientific' evidence *per se* that the Soviet submarine fleet has experienced a proportionately larger number of accidents than has the United States'. For one, the US Navy provides no detailed data on the frequency and scope of *its* submarine 'incidents'. For another, the Soviet Union operates more than three times as many submarines as the United States. All things being equal, the Soviet fleet should *statistically* expect a higher incidence of accidents. Needed to confirm or disprove this (statistical) hypothesis is something similar to the safety criterion used in the airline industry, ie the number of aeroplane accidents per thousands of miles flown.

In the second place, the reader is cautioned that much of the data shown in Table 39 is based on second- and third-hand reports by Soviet emigrés; their credulity as expert witnesses is doubtful in some cases. For example, much of the evidence of so-called 'nuclear' accidents is circumstantial.

Table 39: Soviet submarine accidents 1966–1986

Date	Class/type	Nature	Location	Casualties/damage
'Around 1966'	unidentified submarine	radiation leakage in reactor area	Polyarny	unknown number of crew members hospitalised for radiation sickness
Between 1966 and 1968	'November' class SSN (*Leninski Komsomolsk*)	internal fire	near North Pole	unknown number of crew members received burns
11 April 1968	'Golf II' class SSB	internal explosion followed by fire. Sank with all hands in 5120 m (16,800 ft) of water	750 nm NW of Hawaii	bow section recovered by *Glomar Explorer* in July 1974
1968	unidentified submarine believed nuclear	cause unknown; sank with all hands; salvaged	Kolsky Zaliv estuary off Severomorsk	90-man crew perished after consuming food supply
12 April 1970	'November' class SSN	propulsion failure and internal fire	NW of Spain	boat sank after crew abandoned vessel
April–May 1970	unidentified nuclear submarine	internal fire	near Faeroe Islands	scuttled by crew to prevent fire from reaching reactor compartment. Accident took place during 'Okean 70' exercise
January 1971	'Foxtrot' class SSK	apparent surface collision with Soviet merchant ship	Mediterranean Sea	6 m (20 ft) of bow section missing
February 1972	'Hotel II' class SSBN	lost all power after serious propulsion malfunction	600 nm NE of Newfoundland	several deaths possible; taken in tow
December 1972	unidentified nuclear submarine	radiation leakage in nuclear-tipped torpedo storage area	off North American coast	submarine towed to Severomorsk; radiation sickness and deaths reported among crew
October 1976	unidentified nuclear submarine, possible SSBN	fire in missile launch compartment	Atlantic Ocean	unknown; returned under own power

1977	unidentified nuclear submarine	internal fire, possibly due to outdated reactor	Indian Ocean	unknown number of deaths; submarine towed to Vladivostok
1977	unidentified nuclear submarine	radiation leakage	Atlantic Ocean	12 officers evacuated to Soviet Union via Canada
28 August 1977	'Echo' class SSGN	surface collision with USS *Voge* (FF 1047)	Mediterranean Sea	hull damaage
19 August 1978	'Echo II' class SSGN	engineering casualty in nuclear power plant	140 nm NW of Scotland	casualties unknown; taken in tow
21 August 1980	'Echo' class nuclear submarine	internal fire	290 nm E of Okinawa	at least nine dead, three injured; submarine taken in tow by Soviet tug
September 1981	unidentified nuclear submarine	'series of strong and sudden physical shocks' made boat 'no longer navigable'	Baltic Sea	unknown number of crew members hospitalised for radiation exposure; boat towed to Kaliningrad
June 1983	'Charlie I' class SSGN	unknown	off Kamchatka Peninsula	casualties, if any, unknown; reportedly salvaged
September 1983	unidentified nuclear submarine	unknown	Northern Pacific Ocean	unknown
31 October 1983	'Victor III' class SSN	propeller entangled in towed array cable of USS *McCloy* (FF 1038)	off South Carolina, US coast	taken in tow to Cuba by 'Purga' class Soviet tug
21 March 1984	'Victor I' class SSN	collision with USS *Kitty Hawk* (CV 63)	Sea of Japan	damage unknown; submarine dead in the water after collision
20 September 1984	'Golf II' class SSB	fire, possibly due to electrical overload	Sea of Japan about 50 nm NW of Okino-shiwa Island	casualties, if any, unknown; submarine headed for Vladivostok under own power after 52 hr of fire-fighting efforts
21 September 1984	'Victor I' class SSN	collision with Soviet merchant vessel	Strait of Gibraltar	damage to forward hull section; emergency repairs in Hammamet, Tunisia
13 January 1986	'Echo II' class SSGN	unknown	280 nm NW of Okinawa in China Sea	damage or casualties unknown; taken in tow by Soviet salvage vessel
3 October 1986	'Yankee' class SSBN	internal explosion in No 13 missile tube	east of Bermuda	three reported dead, others injured. Sunk on 6 October 763 nm SE of New York

Appendix II: Soviet transfers of submarines abroad 1945–1988

The Soviet Union became a major exporter of submarines abroad in the early 1950s. Until the early 1970s, it followed the example of the United States and limited overseas 'gifts' and sales to older cast-offs of its own fleet. The pattern was broken with the re-opening of the 'Foxtrot' production line for export purposes. The decision to build the new 'Kilo' class also appears to have been partially motivated by the expectation of foreign sales. An even more important precedent-breaking move was the first international transfer of a nuclear-powered submarine. In early 1988, India received from the Soviet Union, under a 'lease' agreement, a 'Charlie I' class submarine. It is widely expected that the 'permanent' transfer of one or more 'Victor' types will follow the training of Indian crews.

Table 40: Foreign transfers of Soviet submarines, 1945–1986

Recipient country	Submarine type	Number	Year
Albania	'Whiskey'	2	1960
	'Whiskey'	2	1961*
Algeria	'Kilo'	1	1988
Bulgaria	Series XV 'M'	3	early 1950s
	'Whiskey'	2	1958
	'Romeo'	2	1972–73
	'Romeo'	1	1985
Cuba	'Whiskey'	1	1979
	'Foxtrot'	1	1979
	'Foxtrot'	1	1980
	'Foxtrot'	1	1984
Egypt	Series XV 'M'	1	1957
	'Whiskey'	4	1957
	'Whiskey'	3	1958
	'Whiskey'	1	1962
	'Romeo'	5	1966
	'Romeo'	1	1969
India	'Foxtrot'	1	1968
	'Foxtrot'	1	1969
	'Foxtrot'	2	1970
	'Foxtrot'	2	1973
	'Foxtrot'	1	1974
	'Foxtrot'	1	1975
	'Kilo'	1	1986
	'Kilo'	3	1987–88
	'Charlie I'	1	1988
Indonesia	'Whiskey'	8	1960–62**
	'Whiskey'	4	1962
Libya	'Foxtrot'	1	1976
	'Foxtrot'	1	1977
	'Foxtrot'	1	1978

	'Foxtrot'	1	1981
	'Foxtrot'	1	1982
	'Foxtrot'	1	1983
North Korea	'Whiskey'	2	1967
	'Whiskey'	2	1971–72***
People's Republic of China	Series XV 'M'	1	1953***
	Series VI 'M'	2	1954
	Series IXbis 'S'	2	1954
	Shchuka	4	1954–55
	Series XV 'M'	2	1955
Poland	Series XV 'M'	4	1954
	Series XV 'M'	2	1955
	'Whiskey'	1	1962
	'Whiskey'	1	1964
	'Kilo'	1	1986
	'Kilo'	1	1987–88
Romania	'M' type	4	1957
	'Kilo'	1	1987–88
Syria	'Romeo'	2	1986

*seized at Soviet withdrawal from Sazan Island.
**in 1959 2 'Whiskeys' were transferred via Poland.
***in 1986, 16 'Romeos' had been delivered by the PRC or built locally since 1973.
****The PRC has built its own version of the 'Whiskey' and 'Romeo' classes since 1956, and has exported a number, in turn, to several Third World countries. Most sources claim that Chinese construction of these two types began after the Soviet Union had delivered several fully assembled copies of each. David Muller claims, based on declassified ONI reports that no actual transfer of Soviet Navy 'Whiskeys' or 'Romeos' took place. See his *China As a Maritime Power*. Westview Press, Boulder, Colorado, 1983, p. 29.

Appendix III: Basing infrastructure

Fleet Area Base Infrastructure

Within the Soviet Navy's four principal fleet areas, the submarine contingents are dispersed among dozens of individual operating bases. Some, especially those harbouring the SSBNs, are very large and fully equipped to service hull, machinery and weapons. Many others are little more than out-of-the-way anchorages. Figures 6 to 9 display the known locations of individual submarine operating bases in the four fleet areas; where known SSB and SSBN bases are marked as such. As a point of interest, Figure 6 shows the Northern Fleet submarine bases infrastructure on the Kola Peninsula. It indicates a degree of concentration (hence potential vulnerability) much greater than a listing of site names alone might suggest.

Out-of-Area Deployments and Base Infrastructure

Since the mid- to late-1960s, routine Soviet out-of-area submarine patrols have been concentrated in six ocean areas: (1) SSBN, SSGN and SSN patrols in the North Atlantic and North Pacific off the North American coast; (2) once-a-year Caribbean cruises by torpedo and/or cruise missile attack submarines; (3) torpedo attack submarines temporarily attached to the 'West Africa Patrol' in the South Atlantic Ocean; (4) a varying mix of diesel and nuclear-powered boats armed with torpedoes and anti-ship missiles in the Indian Ocean; and (5) a similar but larger contingent associated with the *5th eskadra* in the eastern and central portions of the Mediterranean Sea.

Apart from the 'analogous response' episode of 1984, the maximum number of Soviet SSBNs on patrol in North Atlantic and Pacific waters outside Soviet 'home waters' has never exceeded a simultaneous total of five – one-half in the Gulf of Alaska or north of the Hawaiian Islands, and the other one-half in the 'Yankee Box' off the US east coast. The 'Yankee' out-of-area patrols ceased in 1987, prompting speculation within the Western intelligence community that this move was (a) part of an overall Soviet Navy 'economising' programme, and/or (b) connected with a re-shuffling of *theatre* nuclear targeting responsibilities in the wake of the Intermediate Nuclear Forces (INF) agreement and the concomitant requirement for the Soviets to compensate for the elimination of the land-based SS-20.

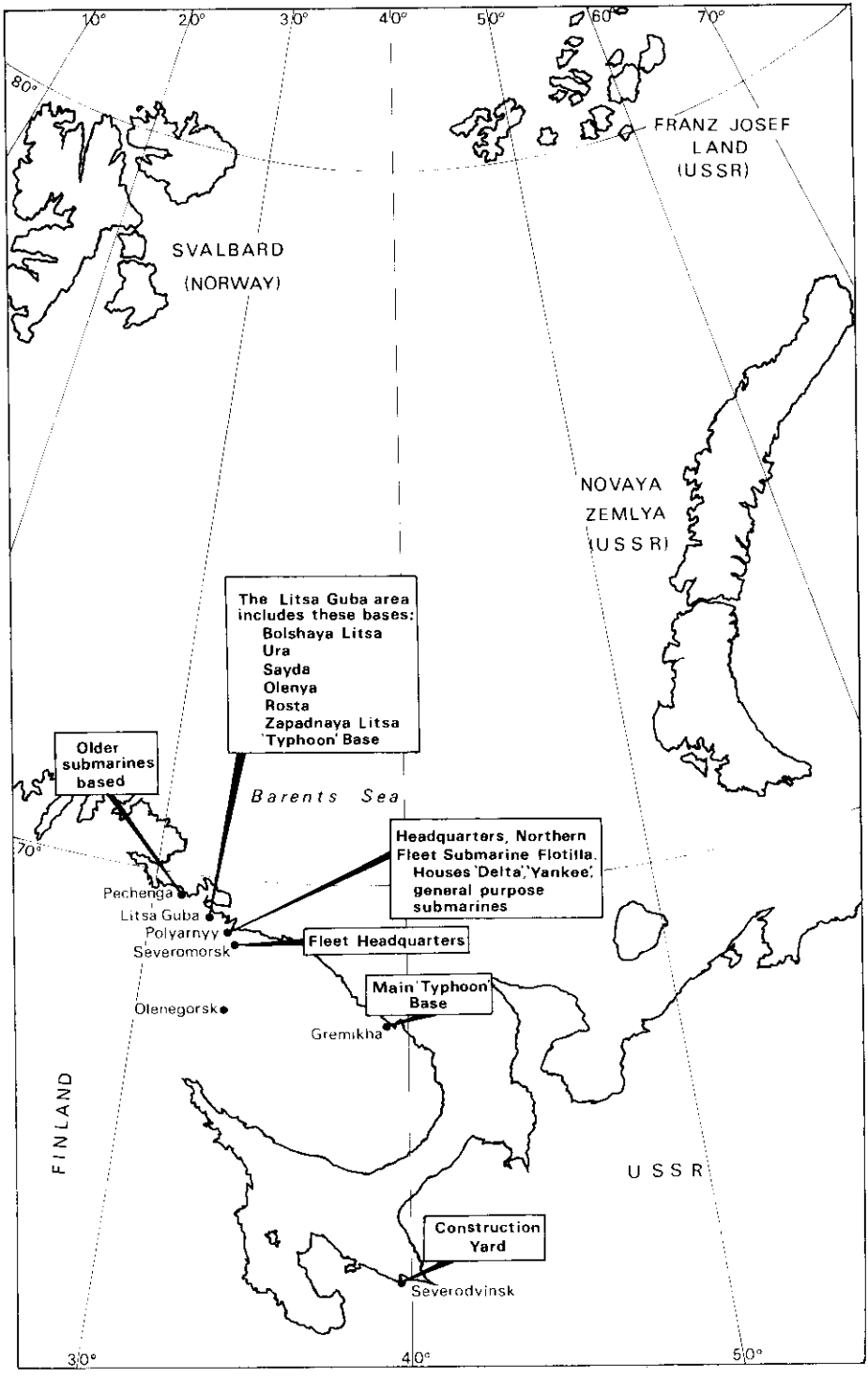
After a one-year hiatus, the Atlantic 'Yankee' patrol was re-established in mid-1988. It seems likely that the patrol's one-year suspension had less to do with an economy drive or a Soviet reassessment of post-INF needs for theatre nuclear coverage, than with a very practical decision to 'recall' the 'Yankees' after the disaster of October 1986.

The 'Yankees' have carried out their patrols without the benefit of a 'chain' of intermediate 'way stations', analogous to the overseas infrastructure (eg, Holy Loch, Scotland, and Apra Harbor, Guam) that has supported the US SSBN fleet. There is (marginal) evidence that the Soviet Union may have tested the US determination to deny it 'Yankee' 'on-station equivalence'.

Caribbean Operations and Basing

In July 1969, shortly after the arrival of the first 'Yankee' of the US east coast, a seven-ship Soviet flotilla, including two 'Foxtrot' and one 'November' types submarines, accompanied by a tender, arrived in Caribbean waters. The two diesel submarines called on Havana, but it is not clear if the 'November' entered a Cuban port. In April 1970, a second Soviet flotilla visited Cuba, calling on the port of Cienfuegos on the island's southern coast. The group included two 'Foxtrots', one 'Echo II', and a tender. Its arrival had been preceded by the

Figure 6 Northern Fleet submarine basing infrastructure.


10°
20°
30°
40°
50°
60°
70°
80°
FRANZ JOSEF LAND (USSR)
SVALBARD (NORWAY)
NOVAYA ZEMLYA (USSR)
The Litsa Guba area includes these bases:
Bolshaya Litsa
Ura
Sayda
Olenya
Rosta
Zapadnaya Litsa
'Typhoon' Base
Older submarines based
Barents Sea
Headquarters, Northern Fleet Submarine Flotilla. Houses 'Delta', 'Yankee', general purpose submarines
Pechenga
Litsa Guba
Polyarnyy
Severomorsk
Fleet Headquarters
Main 'Typhoon' Base
Olenegorsk
Gremikha
FINLAND
USSR
Construction Yard
Severodvinsk
70°
30°
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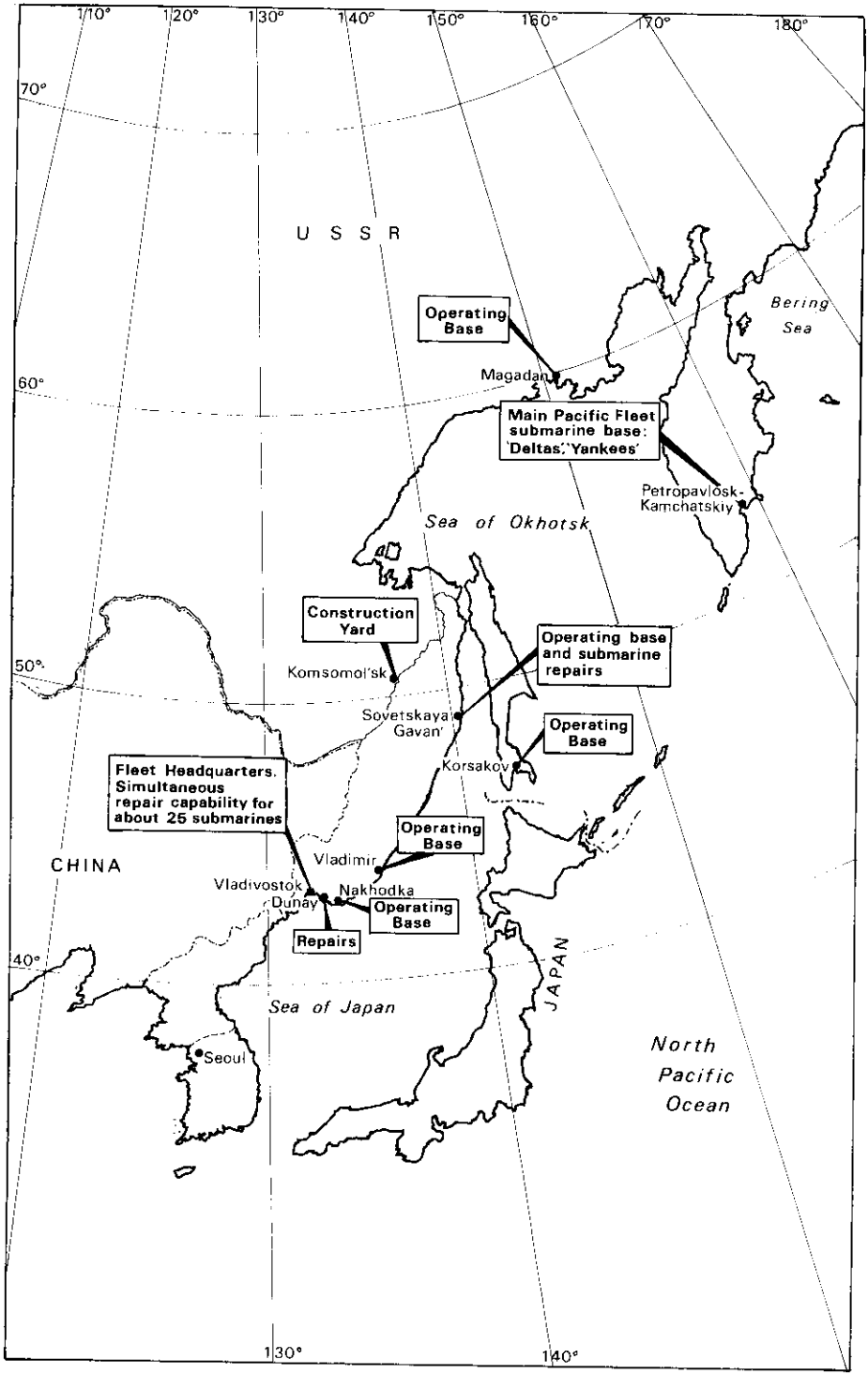
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U S S R
Bering Sea
Operating Base
Magadan
Main Pacific Fleet submarine base: 'Deltas', 'Yankees'
Petropavlosk-Kamchatskiy
Sea of Okhotsk
Construction Yard
Komsomol'sk
Operating base and submarine repairs
Sovetskaya Gavan'
Operating Base
Korsakov
Fleet Headquarters. Simultaneous repair capability for about 25 submarines
Operating Base
Vladimir
CHINA
Vladivostok
Dunay
Nakhodka
Operating Base
Repairs
JAPAN
Sea of Japan
Seoul
North Pacific Ocean
130°
140°

highly publicised visit, in November 1969, by Soviet Defence Minister, Marshal Andrei Grechko, and the Deputy Chief of the Soviet Naval Staff. U-2 reconnaissance flights had meanwhile confirmed the erection, at Cienfuegos, of installations apparently designed to serve nuclear weapons. Indications were that the two superpowers were about to 're-visit' the Cuban Missile Crisis of 1962.

The impending showdown was resolved in the winter of 1970–71. On October 6, 1970, the Soviet ambassador in Washington, DC, Anatoly Dobrynin, presented President Nixon's national security advisor, Henry Kissinger, with a formal note, reaffirming the Kennedy–Khrushchev understanding of 1962 that no Soviet offensive nuclear missiles would be introduced into Cuba. According to Kissinger's account of events, Dobrynin gave oral assurances that his country's ballistic missile submarines would never visit Cuba 'in an operational capacity'.

Despite assurances, there have been at least two occasions when Soviet strategic submarines have called on Cuban ports. On 29 April 1972, a 'Golf' class SSB, accompanied by a tender, entered Bahia de Nipe. Exactly two years later another 'Golf' put in at Havana. With those two exceptions, the Soviets have apparently kept their commitment – literally, that is. In practice, Cuba has become an important *Stützpunkt* for Soviet 'strategic' submarine operations. Cuban access supports Soviet 'pro'- and 'anti-SSBN' missions in at least three ways. First, beginning in 1983, the Soviets have used Cuban airbase facilities to routinely stage long-range ASW reconnaissance flights by Tu-95 'Bear Fs'. Those flights can serve two purposes: one, general surveillance of US Navy underwater ASW forces tasked to counter the 'Yankees' and 'own force' anti-SSBN 'Victor IIIs', and two, general surveillance of US SSBN movements in support of 'Victor III' tracking-and-trailing tasks. The third 'strategic' contribution of the Cuban facilities was demonstrated in October 1986, when *Cuban*-based Soviet ships were dispatched to try and save the explosion-stricken 'Yankee'.

From 1969 though 1986, Soviet Navy general purpose forces visited the Caribbean operating area on 27 different occasions. Typical deployments have included at least one 'Foxtrot' type (sometimes two) plus, on more than a sporadic occasion, a single 'Echo II'. The submarines have always been part of a combined surface-subsurface task force, usually consisting of two surface combatants and an oiler. Shoreside support for the flotillas has been provided by a steadily expanding Soviet-owned logistics infrastructure at Cienfuegos. Besides shorebased facilities (including unconfirmed press reports of concrete submarine 'pens'), submarines can also call on the services of a semi-permanently based tender and other auxiliary craft.

West African Presence

The Soviet Navy has maintained a 'West Africa Patrol' in South Atlantic waters since 1970. 'Steady state' forces are usually limited to surface vessels, including one or two surface war vessels, an amphibious unit, a mine warfare ships, and several oceanographic research and other auxiliary vessels. Submarines apparently 'chop in' periodically while in transfer between the Northern and Pacific Fleet areas. While in the area, submarines can call on repair and maintenance services from Soviet auxiliary repair ships based at Luanda, Angola and Conakry, Guinea.

Indian Ocean Operations and Infrastructure

The Soviet Navy became a 'permanent' aspect of the naval scene in the Indian Ocean in 1968. The *eskadra* has typically averaged some 20 ships, mostly drawn, on a semi-annual basis, from the Pacific Fleet. The 'average' submarine component has been two 'Foxtrot' class submarines, also usually detached from the Pacific Fleet. The largest congregation of Soviet

Figure 7 Pacific Fleet submarine basing infrastructure.

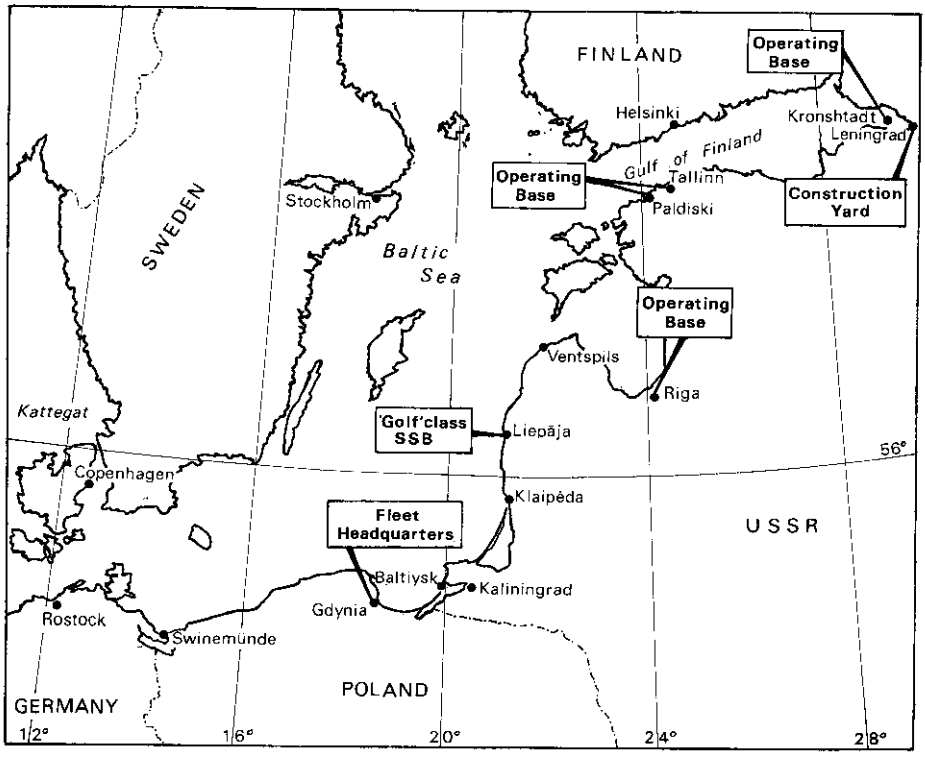

Figure 8 Baltic Fleet submarine basing infrastructure.

submarines in the area was reported in July 1980 (following the arrival of two US Navy carrier battlegroups in response to the Iranian 'hostage crisis'). Counted were two 'Foxtrots', two 'Echo IIs' and two 'Victor' class attack boats. Together, the force accumulated 554 shipdays. In 1983, Soviet submarine shipdays had tailed off to 81.

Soviet submarines operating in the Indian Ocean have included virtually every type, excluding so far as known, the SLBM classes. When the Soviet fleet made its first appearance *en masse* in the region in the late 1960s, Western analysts tended to interpret the event as a counter to US SSBN patrols. The interpretation is highly suspect; there is no evidence that the Polaris-Poseidon boats ever patrolled the Indian Ocean (if for no other reason that few Soviet targets would have been within reach of Indian Ocean Polaris/Poseidon stations). The much longer-range Trident 1C4 of 20 years later *can* cover Soviet targets from the Indian Ocean, however, the superlative acoustic quietness of the *Ohio* class obviates the need for expanding its patrol area outside the Atlantic and Pacific Oceans.

The size and composition of the Soviet Indian Ocean *eskadra*, including the submarine component, suggest four motivations: (1) a routine show-of-the-flag peacetime presence, (2) a 'baseline' fleet-in-being that can be augmented quickly to become a 'countervailing deterrent' to American crisis reinforcements in the region, (3) peacetime intelligence gathering needs, and (4) material deployability of whatever Pacific Fleet units happen to be on hand.

Soviet Indian Ocean submarine deployments are supported by two, possibly three, out-of-area 'bases'. The most important facility, since 1981, is the former US military base at Cam Ranh Bay in Vietnam. According to the US Congressional testimony by the director of US naval intelligence in March 1988, Cam Ranh Bay harbour, on the average, two to three

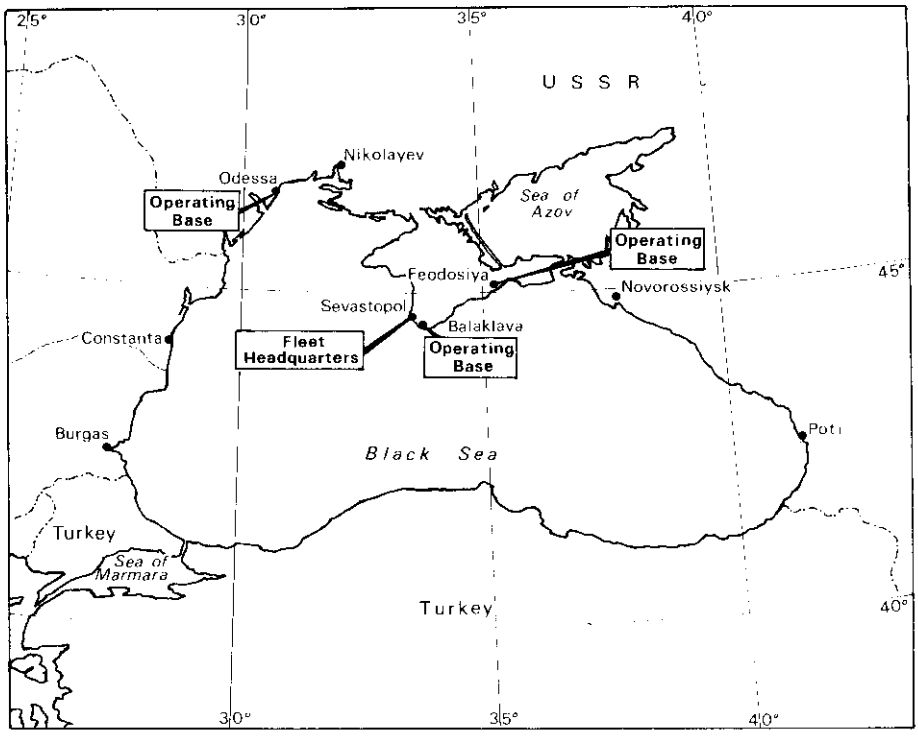

Figure 9 Black Sea Fleet submarine basing infrastructure.

torpedo or cruise missile attack submarines. Repair facilities have been available, since 1984, by virtue of a submarine tender.

On the opposite side of the Indian Ocean basin, Soviet submarine units can call on shoreside support at the Ethiopian island of Dehalak at the southern tip of the Red Sea (facilities include a floating drydock), and the port of Aden. The latter berths an auxiliary tender, and has become the 'homeport' for at least one 'Foxtrot' class unit.

5th Eskadra Operations and Base Infrastructure

Since the early 1980s, the overall size of the Soviet Navy presence in the Mediterranean Sea has fluctuated from 30 to 40 vessels, The Northern (and occasionally Baltic) Fleet has typically contributed six-to-eight submarines. One or two usually involve anti-ship missile types, including the 'Charlie', 'Echo II' and 'Juliett' classes. Torpedo attack types have included the 'November', 'Victor', and 'Tango'. Transit routes to and from the Northern and Baltic Fleet areas lie west of Ireland (for the nuclear types) and via the North Sea (for diesel classes). North Sea transits are commonly on the surface.

Since the Soviet withdrawal from Egypt between 1972 and 1976, *5th eskadra* submarine repair and maintenance facilities in the Mediterranean Sea have been restricted to Tivat, Yugoslavia and Tartus, Syria. The Tivat shipworks have been available on a commercial basis since 1974, but repairs are limited to no more than two combatants at a time, and they are not to exceed six months. The Tartus harbour facility houses some auxiliaries, including a submarine repair ship; however, the small and ill-equipped Syrian port has proven to be a poor substitute for the spacious facilities at Alexandria and Mersa Matruh 15 years ago.

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