

SOVIET CRUISE MISSILE SUBMARINES OF THE COLD WAR

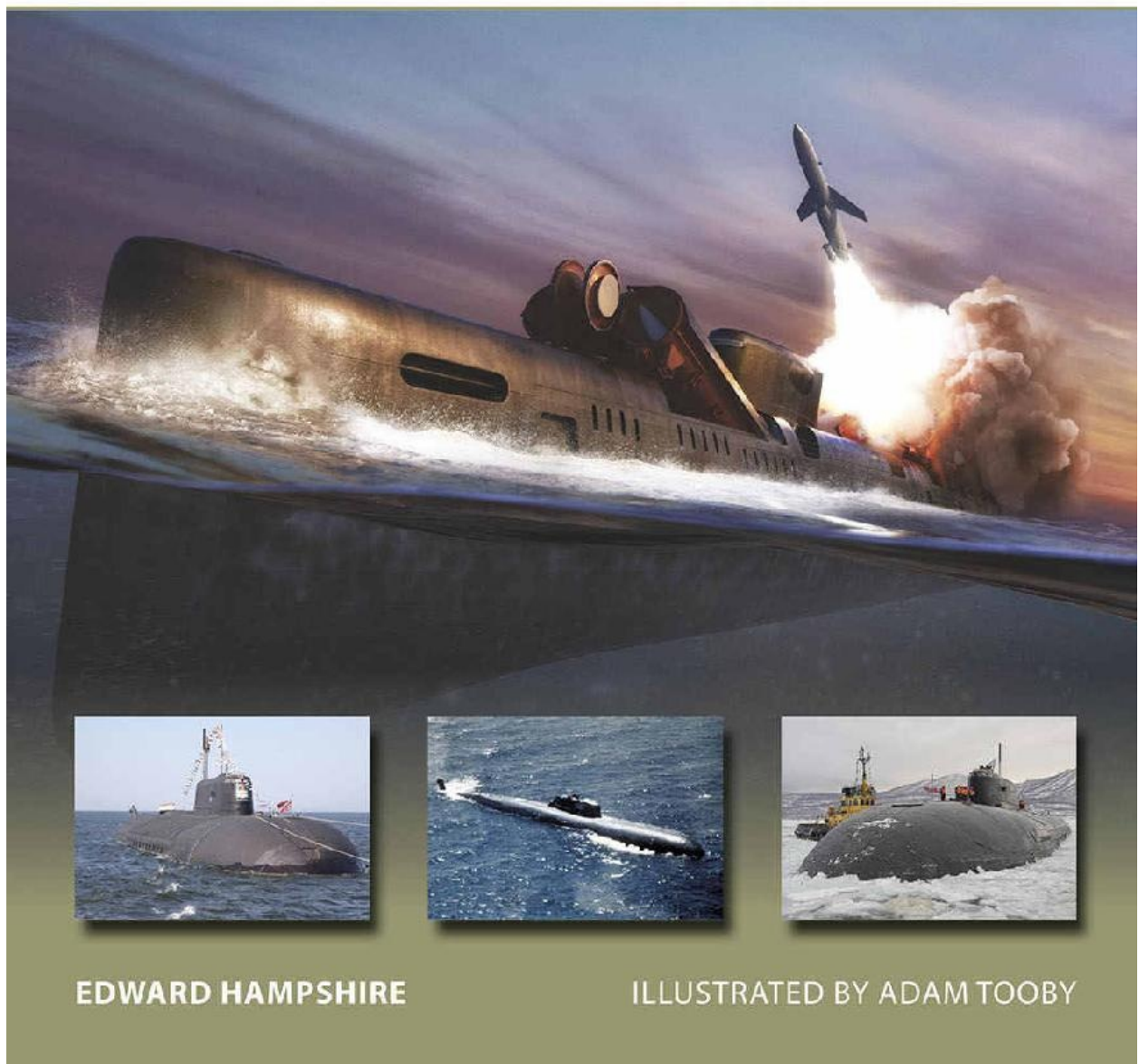


EDWARD HAMPSHIRE



ILLUSTRATED BY ADAM TOOBY

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NEW VANGUARD 260

SOVIET CRUISE MISSILE SUBMARINES OF THE COLD WAR



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CONTENTS

INTRODUCTION

Soviet naval strategy and cruise missile submarines

Approval, design and construction

Submarine design bureaus and shipyards

WEAPON SYSTEMS AND SENSORS

Cruise missile systems

Torpedoes

Other weapon systems

Sonar

Radar and electronic systems

EARLY CRUISE MISSILE CONVERSIONS

ECHO I AND ECHO II CLASSES (PROJECTS 659 AND 675)

JULIETT CLASS (PROJECT 651)

PAPA CLASS (PROJECT 661)

CHARLIE I AND CHARLIE II CLASSES (PROJECTS 670 AND 670M)

OSCAR I AND OSCAR II CLASSES (PROJECTS 949 AND 949A)

YANKEE CLASS CONVERSIONS AND YASEN CLASS (PROJECTS 667M, 667AT AND 885)

OPERATIONAL SERVICE

Accidents

Service summaries

BIBLIOGRAPHY

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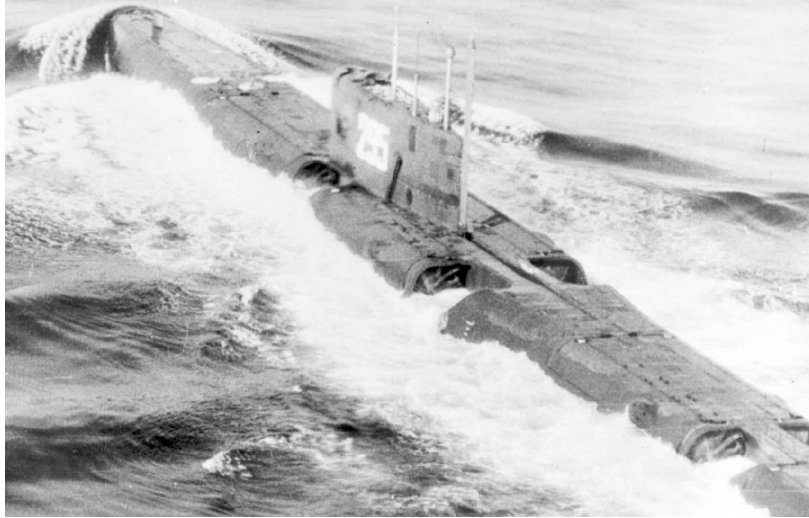
INTRODUCTION

Soviet naval strategy and cruise missile submarines

The Soviet Navy in the Cold War, for reasons of history, geography and strategic prioritization, developed a set of capabilities in two particular areas that were not seen to such a great extent in other major navies. First was the emphasis on the submarine as a weapon, a preference that had pre-dated the Russian Revolution. Throughout the Cold War, the Soviet Navy was primarily a submarine-armed service, and even after the 1970s, when a powerful ocean-going surface fleet was created, the numbers of submarines it fielded far outnumbered those of NATO in quantity and often in quality. For a state that felt vulnerable to powers that had easier access to the open oceans, the stealthy submarine held out the promise of a force multiplier and an ability to break out from naval blockades of the 'choke points' (such as the Greenland-Iceland-UK gap or the Danish Skagerrak) that might keep a Russian or Soviet navy locked within its local waters.

Second, the Soviet Navy relied upon long-range cruise missiles to a much greater extent than the West, initially as a strategic nuclear deterrent, and then from the late 1950s as potent weapons against NATO carrier groups. Lacking aircraft carriers until the late 1970s, the Soviet Navy developed a number of air- or sea-launched cruise missiles to strike the capital ships of their adversaries. Therefore, for the Soviets, their main strike capability for most of the Cold War resided in long-range guided missiles and not in the carrier strike aircraft that dominated NATO's concepts of operations.

This book is about the vessels that combined both of these Soviet naval specialisms in one hull: cruise missile-firing submarines. As will be seen, Soviet cruise missile development, which stemmed from captured German equipment, designs and engineers involved with V1 rockets, began immediately after World War II. Josef Stalin's lack of interest in aircraft carriers, and then Nikita Khrushchev's scepticism of the worth of a surface fleet, forced the Soviet Navy to find new ways to contribute to nuclear deterrence and to counter NATO aircraft carriers armed with nuclear weapon-carrying aircraft.



The Project 675 (Echo II class) cruise missile submarines were the largest single class of nuclear submarines built by the Soviets in the Cold War: 29 boats were completed between 1963 and 1968. (© Imperial War Museum HU 82594)

Initially the focus was on nuclear strike, and the first operational Soviet cruise missile-carrying submarines of the Project 644 (Whiskey Twin Cylinder), 665 (Whiskey Long Bin) and 659 (Echo I) classes were all designed to carry just strategic land attack cruise missiles. From 1956, work began to modify the P5 land attack missile into an anti-ship missile, the P6. The Project 675 (Echo II) and 651 (Juliett) classes were designed to have a dual role – both in land attack and anti-carrier operations, the latter in concert with land-based aircraft providing targeting information.

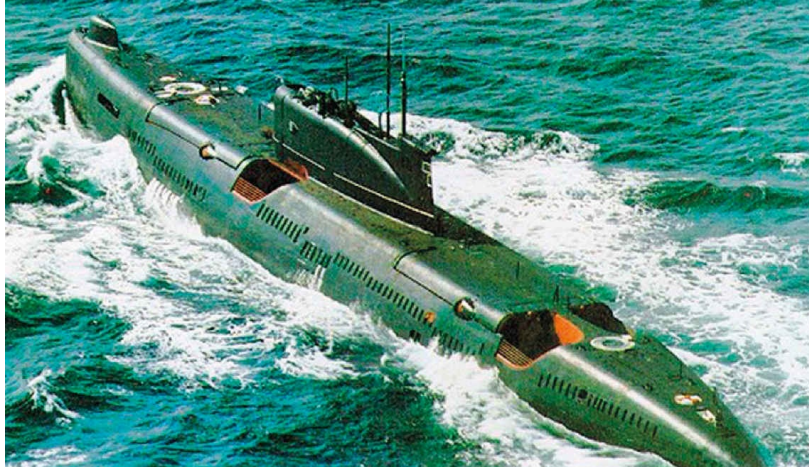


USS *Forrester* was the first US 'super-carrier'. Displacing over 70,000 tons, the Soviet leadership was

deeply concerned about such carriers launching attacks on its cities and other key targets with nuclear-armed bombers. (Photo by © Museum of Flight/CORBIS/Corbis via Getty Images)

In 1958, the development of a second generation of seaborne cruise missiles and the submarines to carry them was approved. This time greater speed and underwater launching were emphasized, in order to make the cruise missile-launching boats less vulnerable. The requirement eventually produced the single Project 661 (Papa) submarine, which combined extreme speed with the underwater-launched Ametist missile. The Project 670 and 670M vessels (Charlie I and II) used the Ametist (and its longer-range successor Malakhit) but emphasized stealth over speed. However, well before either of these classes had been developed, the decision by Khrushchev in December 1959 to create a separate armed service, the Strategic Rocket Forces, which would have sole responsibility for strategic nuclear strike, largely removed the strategic strike role from the navy, which now was only permitted to strike coastal targets. The anti-carrier role now became almost the sole purpose of the Soviet cruise missile submarine.

Through the early 1960s, the significance of the perceived threat from NATO carriers meant that large numbers of first generation cruise missile-firing submarines were built. However, the realization that the US Navy's main strategic nuclear capability was increasingly residing in submarine-launched ballistic missiles such as Polaris meant that the Soviet Navy's focus shifted more towards countering such vessels with anti-submarine surface forces and with nuclear powered hunter-killer submarines. Additionally, by the late 1960 and 1970s, the navy was gradually able to claw back a strategic nuclear strike role, which meant that considerable resources flowed into the production of ballistic missiles with ever greater ranges and into the design of the submarines that would carry them.



The Project 651 (Juliett class) cruise missile submarines were a conventionally powered version of the Project 675 class with a single salvo of four cruise missiles. (United States Navy: US federal government)

The golden age of cruise missile-carrying submarines was therefore over, but with the first generation nearing the end of their operational lives (despite many having been modernized to take the Bazal't and Vul'kan cruise missiles) and a perceived need still to strike ever more capable US carrier battle groups, a third generation of cruise missile submarines was built: the enormous Project 949 and 949A boats (Oscar I and II), carrying 24 long-range high-speed Granit cruise missiles.



K-162 was the only submarine built to the Project 661 (Papa) design. Extraordinarily fast, she retains to this day the record for the most rapid submarine under water. (USN: US federal government)

After the SALT (Strategic Arms Limitation) treaty of 1972, which equated ballistic missiles with strategic strike and then limited the number of ballistic missiles and the submarines that fired them, attention returned to the use of cruise missiles in the strategic role. In the 1980s, former ballistic missile-carrying submarines (Project 667M and 667AT) were converted to take two new strategic cruise missile systems, Meteorit and Granat. The former system was a long-range high-altitude cruise missile, but was ultimately unsuccessful and was cancelled, whilst the latter was similar to the US Tomahawk cruise missile in its range and role. The fourth generation of cruise missile submarine (Project 885) was still at the planning stage when the Soviet Union collapsed in December 1991. Armed with Oniks and Kalibr cruise missiles, the first of the class was only laid down in 1993. After many years of suspended construction, she was finally completed in 2011. Others of the class are being built and it has been recently announced that the surviving Project 949A (Oscar II) boats will also be modernized with Oniks and Kalibr. Underwater cruise missile carriers are now regaining a prominence in the Russian Navy they have not had since the last years of the Cold War.



The Project 670 (Charlie class) were quieter submarines that could launch their missiles from under water; their Achilles heel was the short range of the Ametist missiles they launched. (Department of Defense, US Federal Government)

Approval, design and construction

The construction of Soviet submarines, as with other major military projects, required approval from the Council of Ministers, the most senior governmental (not Communist Party) body in the Soviet Union. A decree from this body would then permit construction, but prior to this, considerable work was done to plan for the fitting of potential submarine building programmes into the forthcoming five-year plan. This would then allow for the marshalling of the required physical and human resources to carry out the work.

Operational and capability requirements would be prepared by the naval staff, and in concert with higher naval institutes within the naval staff, initial sketch designs would be developed. This would produce a tactical-technical requirement that would then be handed to a warship design bureau, either through competition or through a direct allocation. The warship design bureaus would then develop the detailed technical designs for the planned vessels, taking advice from the shipbuilding ministry. Sometimes the resulting detailed design would be quite different to the tactical-technical requirement set out by the naval staffs. In addition, both the naval staff and the design bureaus would have to coordinate with missile design bureaus, which would be developing the missiles that would arm these vessels.



The Projects 949 and 949A (Oscar I and II classes) cruise missile submarines were the culmination of 30 years of Soviet cruise missile submarine development: they displaced over 20,000 tons submerged and carried 24 underwater-launched Granit cruise missiles. (Department of Defense, US Federal Government)

Submarine design bureaus and shipyards

A number of separate design bureaus had responsibility for submarine design and development during the Cold War. These are listed below:

| Bureau | Submarines designed |
|-----------------------------|--|
| TsKB-16/Volna | Project 665 |
| TsKB-18/Rubin | Projects 644, 659, 675, 651, 949, 949A |
| SKB-112/Sudoprojekt/Lazurit | Projects 670, 670M |
| SKB-143/Malakhit | Projects P-627A, 653, 885 |

In 1966, their former numerical identifiers were replaced by names, and in 1974 Sudoproyekt had its name changed again and Volna was folded into Malakhit. With the end of the Cold War, Rubin and Malakhit continued to design submarines as well as branching out into civilian spheres such as oil rig design.

The following shipyards built the submarines set out in this book. All were specialist submarine builders, and are referred to in the text by the cities in which they were based. Various yards undertook refits and modernizations.

| Shipyard | Submarines built |
|--|---|
| Shipyard No. 402, Severodvinsk | Projects 611P, 675, 661, 949/949A, 885 |
| Krasnoye Sormovo shipyard, Gor'kiy | Projects P-613, 644, 665, 651, 670/670M |
| Baltic shipyard, Leningrad | Projects 665, 651 |
| Shipyard No. 199, Komsomol'sk-na-Amure | Projects 659, 675 |

Until the end of the Cold War, Soviet submarine design numbers and code names (and most individual submarine numbers) were unknown in the West. Most analysts and observers knew Soviet submarine classes through code names allocated by NATO. The main submarine classes described in this book are listed below alongside their NATO code names:



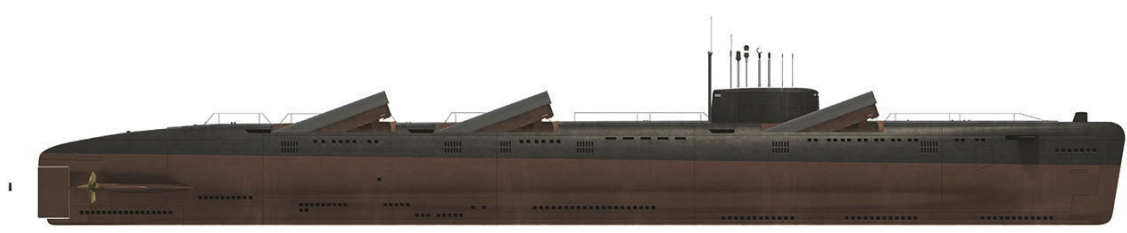
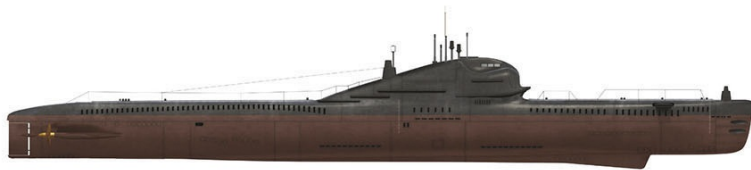
The headquarters of the Sevmashtorg corporation today, the Russian successor to the Soviet submarine-building shipyard number 402 at Severodvinsk on the coast of the White Sea. (Yakovlev Sergey/ [Shutterstock.com](https://www.shutterstock.com))

| Project number | Soviet code name | NATO code name |
|-----------------------|-------------------------|-------------------------|
| P-613 | - | Whiskey Single Cylinder |
| 644 | - | Whiskey Twin Cylinder |
| 665 | - | Whiskey Long Bin |
| 659 | - | Echo I |
| 675 | - | Echo II |
| 651 | - | Juliett |
| 661 | Anchar | Papa |
| 670 | Skat | Charlie I |
| 670M | Skat-M | Charlie II |
| 949 | Granit | Oscar I |
| 949A | Antey | Oscar II |
| 667M | Andromeda | Yankee Sidecar |
| 667AT | Grusha | Yankee Notch |
| 885 | Yasen | - |

A

PROJECT 665 (WHISKEY LONG BIN) AND PROJECT 659 (ECHO I)

After the test submarine for the P5 cruise missile, and the conversion of four Project 613 boats to fire two P5 missiles (Project 644), a much more ambitious conversion was designed by the Volna design bureau (Project 665: NATO Whiskey Long Bin). To allow for four P5s to be launched, the conning tower was considerably widened and two pairs of launchers were placed either side, fixed in their firing elevation *en echelon*. This ingenious solution allowed for the carrying of four large cruise missiles on a relatively small submarine, but it did result in a cumbersome and seemingly top-weighted design. Six boats were converted to Project 665. The first class designed from the outset to launch the P5 was the Project 659 (Echo I) class, based upon the Project 627A (November class) but with a traditional hull form to provide additional stability on the surface when launching missiles. As can be seen here, the class had six P5 missiles whose launchers were elevated into position after surfacing. As these boats were designed for the strategic land-strike role, they did not have the aircraft down-link aerial or missile communication antennae of the later tactical-strike submarines.



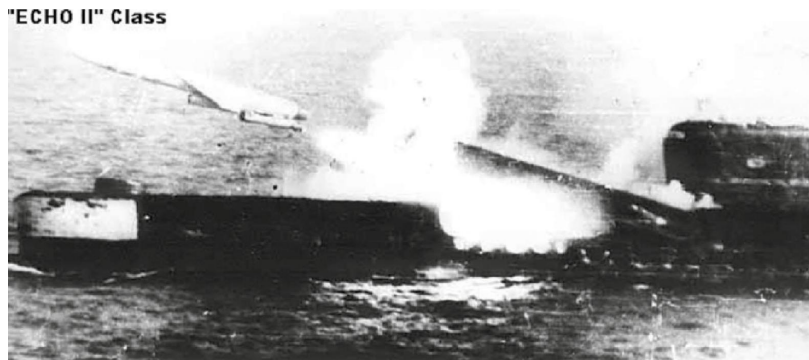
WEAPON SYSTEMS AND SENSORS

Cruise missile systems

The first Soviet cruise missiles designed to be launched from submarines were meant for the 'strategic' attack role, *i.e.* to attack major enemy land targets such as manufacturing centres, military bases, transport hubs and political and military command centres with nuclear weapons. There were two main missile options available for such long-range strikes. The first was the cruise missile, which used jet engine technology to fly a nuclear warhead at a standard aircraft-flying altitude to its target. Such missiles were descended from the German V1 'flying bombs' of World War II, and had the advantage of being based on existing technologies and hence relatively cheap to develop. Their disadvantages were that they could be intercepted by enemy air defence aircraft that could match their speed, and later by air defence missile systems. The second option, descended from the German V2, was the ballistic missile, which used rocket engines to reach a very high altitude in the upper atmosphere where the missile could fly much further using much less fuel, and then descend to its target largely powered by the inertia of its descent. This was a much more complex and expensive technological proposition that in effect meant the design of something close to a space rocket, but it was less vulnerable to interception and used less fuel (and therefore did not have to be as large as an equivalent-range cruise missile).

The Soviet leadership decided to develop both types of delivery system, and by the early 1950s the Soviet missile design bureaus were designing cruise missiles for both ship and submarine launch. Four bureaus produced cruise missiles that got as far as designing the submarines to carry them. The Chelomey bureau, working from adapted V1 designs and the British Nene jet engine, developed what later became the P5 cruise missile with a 500km range. Vladimir Chelomey suffered as a result of the purges and faction-fighting in the last year of Stalin's rule and was removed from his bureau, but was lucky enough to find an academic role where he perfected his design, not least by using folding wings to allow for direct launch of the P5 from its container. He returned to favour and to his old bureau after Stalin's death and gained the support of Nikita Khrushchev, the new General Secretary. It helped that Khrushchev's son worked as an engineer in Chelomey's bureau.

Whilst Chelomey was in the wilderness, the Il'yushin bureau had developed the P20 large and very long-range cruise missile, the Lavochkin bureau the P40 300km-range missile and the Beriev bureau the P10 600km-range missile. With the second, design work began on a carrying submarine, the Project 624, but missile and submarine were both cancelled in 1955 following Chelomey's re-emergence and the demonstrable superiority of the P5 in range and launching procedures. The Il'yushin bureau's P20 design for a very long-range cruise missile (with a range equivalent to a ballistic missile) required considerable size to hold the necessary fuel but looked like a more promising option for the strategic role: its great speed and relatively high altitude made it difficult to intercept, and its range would not place its launching submarine in great danger. The Beriev P10 missile also looked promising. Trials submarines were designed for both the P20 and the P10 (Projects P-627A and 611P respectively), as were their follow-on production successors (Projects 653 and 646). However, although the P10 trials proved successful, it was twice the size of the P5 and in late 1957 it was decided to cancel the larger missile.



A rare photograph of a cruise missile submarine firing, in this case, a Project 675 (Echo II) firing a P6 missile. (US Federal Government)

Following Chelomey's return, the P5 missile began trials on the Project P-613 test submarine. They proved successful and conventional submarines were converted to carry the P5, and design work began on specially built nuclear-powered and conventional submarines to carry the missile. Chelomey developed a modified version of the P5, the P5D, which had a lower cruising altitude and a slightly longer range in response to the appearance of US supersonic air defence jets. The P5D was fitted to the first new-build P5 launching submarines. In 1956, after the Soviet political and naval leadership became increasingly worried about the threat from NATO aircraft carriers flying bombers armed with nuclear

weapons, Chelomey began development of an anti-ship version of the P5, the P6. Successfully striking a small moving target with a conventional warhead was a much more complex task than a land attack nuclear weapon that only needed an accuracy radius of a couple of kilometres. Chelomey's answer was an ingenious but complex multiple-platform weapon system consisting of four interlinked and communicating elements: a shore-based command centre, long-range land-based targeting aircraft, the launching submarine and the missile itself. This process is described in more detail in the commentary to plate D. Project 675 and 651 submarines were constructed armed with this new system, designated P6.



This photograph is of the former B-24 (ex-K-24) moored at Peenemünde in Germany. It shows to good effect the 'Argument' missile communications antenna, which would be swivelled into position having previously been hidden within the conning tower. The submarine's U-461 pendant is a fictitious one created by the museum of which the vessel is a part. (Dirk Vorderstrasse/ [CC-BY-SA-2.0](#))

The Soviet leadership was conscious of the vulnerability of the submarine whilst on the surface: loading, firing, tracking and course correcting the cruise missile took up to 30 minutes in total. This led to a Council of Ministers order in 1958 to develop a cruise missile that could be launched underwater. This resulted in the P70/Ametist short-range cruise-missile system. It could be launched in up to 30 metres of water but only had a range of 70km, largely due to its reliance on solid-fuel for propulsion (the only option then open for undersea missile launching). It was also an early 'fire-and-forget' missile that allowed the submarine to escape quickly: the missile guided itself to the target by radar and using algorithms to assess which target was most likely to be the carrier. The very short range of the P70, and the increasing numbers of anti-

submarine aircraft being used by NATO forces, resulted in the development of a more advanced underwater launching missile, the P120 Malakhit. It had increased range of 120km, combined radar and infra-red guidance and had an ability to load in target data prior to launch as in the P6. Despite these improvements, the launch position was still worryingly close to the enemy carrier group, and the P6 remained the backbone of the submarine cruise missile capability.



This image shows the Tu95RTs (Bear D) targeting aircraft with its distinctive radar-dome and high-frequency datalink antenna. Its role was to guide Soviet cruise missiles onto their targets. (USN: US federal government)

NATO counter-measures against the P6 soon forced the Soviets to adapt. By the early 1960s, development work began on a modified system that moved away from targeting aircraft for initial data towards data provided by space satellites. A number of Project 675 submarines were modernized and armed with the first cruise missile system to be guided in this way, the P500 Bazal't. This is described in more detail in the commentary to plate B.



An F14 Tomcat air defence aircraft flying away from the USS *America*. Attached to the aircraft's underbelly are two Phoenix long range high-altitude anti-cruise missile missiles. It was the introduction of new defensive weaponry such as this that spurred the Soviets into developing the third generation of cruise missiles and the submarines to fire them. (Photo by © CORBIS/Corbis via Getty Images)

The next step was the P700 Granit cruise missile, which had a similar range and capability as Bazal't but could be launched from under the water. These were fitted to the huge Project 949/949A (Oscar I and II) submarines, which, it was planned, would replace the previous generations of submarines and their missiles (P6 Ametist and Malakhit). Two further missile systems effectively marked the end point of this line of cruise missile development. The P1000 Vul'kan was a further development of the Bazal't, also surface-launched, and was fitted to four Project 675 boats. The P750 Meteorit-M had characteristics that were not too different from the long-before cancelled P20: greatly extended range, a very high cruise altitude and a strategic land-attack role. It was tested on a converted ballistic missile submarine but appears not to have been successful and was cancelled in 1990.

The final generation of Soviet naval cruise missiles was in development and testing as the Cold War ended. The Granat cruise missile was developed primarily for reasons of diplomatic-strategic balancing with NATO, in response to the US development of the Tomahawk strategic/tactical cruise missile. Granat adopted many of the characteristics of its US equivalent: relatively slow speed but very low-flying, coupled with guidance from a pre-programmed electronic 'map' of terrain. Oniks was an equivalent of NATO's Harpoon – a medium-range cruise missile that was fast, low-flying and had 'fire-and-forget' guidance. The Kalibr missile system was a further development of the Granat: supersonic and in both land-attack and anti-ship variants.

Towards the end of the Cold War, the Soviet military satellite system that enabled the cruise missile capability quickly collapsed as little money existed to maintain the regular launches of new reconnaissance and communications satellites. It was not until after 2005, as money from Russian oil and gas returns fed into a revived satellite programme, that a new satellite network could be built and this most recent generation of cruise missiles completed, tested and made operational. The successful use of land-attack Kalibr cruise missiles during the Syrian civil war shows that these systems are now, after much investment, operable and effective.



This image shows the considerable beam of the Project 949/949A (Oscar I and II) submarines. (USN: US federal government)

| System/ designation/ code name | NATO code number/ name | Role/engine type | Range/speed/ altitude | Length/ warhead size/launch weight | Fitted on (Project numbers) |
|--------------------------------------|---------------------------|---|--|--|--------------------------------|
| P5/4K34/- | SS-N-3B Shaddock | Land attack/ turbo-jet | 500km 1,250kmh 400-800m | 11.85m c. 900kg 5,100kg | P-613/ 644/665 |
| P20/-/- | - | Land attack/ ramjet | 3,000km 3,200kmh 24,000-30,000m | 21m c. 2,700kg c. 27,000kg | P-627A/653 |
| P5D/4K95D/- | SS-N-3B Shaddock | Land attack/ turbo-jet | c. 600km 1,250kmh 250m | 11.85m c. 900kg 5,100kg | 659 |
| P6/4K48/- | SS-N-3A Shaddock | Anti-ship/ turbo-jet | 380km 1,250kmh 100-7,000m | 10.2m 930kg 5,300kg | 675/651 |
| P70/4K66/ Ametist | SS-N-7 | Anti-ship/ solid fuel | 80km 1,160kmh 60m | 7.0m 1,000kg 3,700kg | 661/670 |
| P120/4K85/ Malakhit | SS-N-9 Siren | Anti-ship/ solid fuel | 120km 1,100kmh c. 60m | 8.8m 1,000kg c. 3,200kg | 670M |
| P500/4K80/ Bazal't | SS-N-12 Sandbox | Anti-ship/ turbo-jet | 550km c. 3,000kmh 50-5,000m | 12.4m c. 500kg c. 6,000kg | 675MU/MK |
| P1000/-/ Vul'kan | - | Anti-ship/ turbo-jet | c. 1,000km c. 3,000kmh 400-7,500m | 12.4m | 675MKV |
| P700/3M45/ Granit | SS-N-19 Shipwreck | Anti-ship/ turbo-jet + booster | 550km c. 3,000kmh - | 10m 750kg 6,980kg | 949/949A |
| P750/3M25/ Meteorit-M | SS-N-24 Scorpion | Land-attack/ turbo-jet | 5,000km 3,000kmh 22,000-24,000m | 21m | 667M |
| RK-55/3M10/ Granat | SS-N-21 Sampson | Anti-ship + land- attack/ turbo-jet + booster | 2,500km 850kmh 10-150m | 8.1m 410kg 1,700kg | 667AT |
| P800/3M55/ Oniks | SS-N-26 | Anti-ship/ solid fuel ramjet | 120-300km 2,500-3,000kmh 5,000-15,000m | 8.9m 250kg 3,000kg | 885 |
| P10/3M54K/ Kalibr | SS-N-27A Sizzler | Anti-ship/ turbo-jet + booster | 250km 850-3,000kmh 10-20m | 8.22m 450kg 2,500kg | 885 |
| P10/3M14K/ Kalibr | SS-N-30A | Land-attack/ turbo-jet + booster | 250km 850-3,000kmh | 8.22m 450kg | 885 |

Torpedoes

Although cruise missiles were the main armament of the submarines described here, all were also fitted with torpedoes, either to defend the boat against submarine or surface attack, or as a secondary form of attacking enemy surface ships. Most of the submarines here had forward-facing 533mm tubes and rear-

facing 400mm tubes for defensive firing. The Project 949/949A (Oscar I and II) class submarines also had 650mm tubes for large offensive anti-ship torpedoes capable of carrying nuclear warheads. Most of the torpedoes listed below were acoustic homing torpedoes, though the 53-65 also had thermal homing. The Shkval torpedo, due to its closed cycle propulsion system and its use of cavitation to speed its travel, could reach the unheard-of speed of over 200 knots.

| Designation | Calibre | Speed/Range | Target/guidance/warhead | In service |
|-------------|---------|---|--|------------|
| 65-76 | 650mm | 50 knots/50,000m | Anti-ship/acoustic homing/ nuclear or conventional | 1976 |
| 53-61 | 533mm | 55 knots/19,000m or 35 knots/22,000m | Anti-submarine/acoustic homing/conventional | 1962 |
| 53-65 | 533mm | 65 knots/12,000m or 40 knots/24,000m | Anti-ship/wake homing/ conventional | 1965 |
| SAET-60 | 533mm | 42 knots/13,000m | Anti-ship/acoustic homing/ conventional | 1961 |
| SET-65 | 533mm | 40 knots/15,000m | Anti-submarine/passive acoustic homing/conventional | 1965 |
| SET-53M | 533mm | 29 knots/14,000m | Anti-submarine/acoustic homing/conventional | 1964 |
| TEST-71 | 533mm | 40 knots/20,000m | Dual-purpose/wire guidance/ conventional | 1971 |
| V111/Shkval | 533mm | 50-200 knots/7,000m | Anti-submarine super- cavitating rocket torpedo/ internal or acoustic homing/ nuclear or conventional | 1977 |
| MGT 1 | 400mm | 28 knots/6,000m | Anti-ship evasion/acoustic homing/conventional | 1961 |
| SET-40 | 400mm | 29 knots/7,500m | Anti-submarine evasion/ acoustic homing/conventional | 1962 |

Other weapon systems

Some submarines were equipped from the late 1970s with hand-held air defence missile systems (Strela series – NATO SA-N-5/SA-N-8 Grail/Gremlin) to provide some protection whilst on the surface. In addition, Soviet submarines from the 1970s carried the 81-R (NATO SS-N-15) torpedo tube-launched anti-submarine missile system.



An export version of a submarine-launched Kalibr missile at an arms show: the Kalibr is the supersonic development of the Soviet Union's first Tomahawk-style cruise missile, the Granat.

(<http://vitalykuzmin.net> *Wikimedia Commons* **CC-BY-SA-4.0**)

Sonar

The main sonar systems are listed below. In addition to active search sonar, submarines would also have a range of other hydro-acoustic equipment, including passive sonar detectors (such as MG-10), sonar intercepts (such as MG-13), navigation sonars, sea bottom detection and ice detection sounders. From Kerch' onwards, sonar systems combined a number of active and passive arrays into a single system or 'kompleks'.



The Shkval torpedo has an incredible underwater speed of 200 knots. This is enabled by her rocket motor and by the use of oxygen bubbles released from the nose-cone to create an air pocket at the front of the missile, thus reducing its drag in the water. (One half 3544 *Wikimedia Commons* Public Domain)

| Name/designation | Fitted on |
|---------------------------|-------------------------------|
| Tamir 5P | 644, 665 |
| Arktika or -M/MG100-MG200 | 659, 675, 651 |
| Kerch'/MGK100 | 675K, 675MK, 675MKV, 670 |
| Rubin/MGK300 | 661 |
| Rubicon/MGK400 | 670M +670 modernized, 667M/AT |
| Skat-KS or M/MGK500 | 949 +670M modernized |
| Skat-3/MGK540 | 949A |
| Amfora/MGK600 | 885 |

Radar and electronic systems

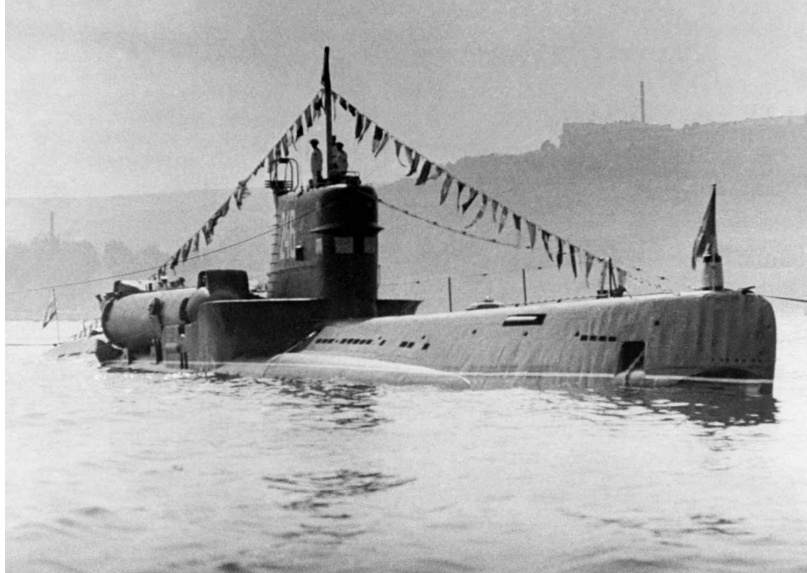
| Type | System | Fitted on (project numbers) |
|---|------------------|-----------------------------|
| Radar | Prizma | 659 |
| | Al'batros | 675, 651, 667M/AT |
| | Kaskad | 670/M |
| | Radian | 949A |
| | Pristavkoy-Korma | 667M/AT |
| | Topol | 670/M, 949/A, 667M/AT, 651 |
| Navigation systems | Pluton | 659 |
| | Sila | 675, 651 |
| | Sigma | 661, 670/M |
| | Medveditsa | 949 |
| | Simfoniya | 949A |
| Astro-navigation systems | Lira | 675, 651 |
| | Parus | 949/A |
| | Shlyuz | 667M/AT |
| Land-attack guidance system | Sever | 644, 665, 659, 675, 651 |
| Missile communications | Argument | 675, 651 |
| | Argon | 675K, 675MK, 675MKV, 651K |
| Targeting aircraft down-link | Uspekh | 675, 651 |
| Targeting satellite down-link | Kasatka | 675K, 675MK, 675MKV, 651K |
| Satellite communications system | Molniya | 675, 661, 651, 670/M, 949/A |
| 'Pop-up' communications array | Paragon | 670/M |
| | Zalom | 949/A |
| | Paravan | 667M |
| Towed communications array | Lastochka | 949/A, 667M |
| Electronic support measures (radar intercept) | Nakat-M | 659, 675, 651 |
| | Zaliv-P | 670/M, 667M/AT |
| | MRP-23 | 949/A |
| Combat direction systems | Brest | 670/M |
| | Omnibus | 949/A, 667AT |
| | Almaz | 667M |

EARLY CRUISE MISSILE CONVERSIONS

Design development

As ship-launched cruise missile designs began to reach the testing phase, submarines were needed to undertake these tests. The first design developed was the abortive Project 624 submarine launching the P40 missile designed by the Lavochkin bureau. The missile was cancelled in 1955 and so was the submarine. At about the same time, work began on two trial submarine conversions: B-64, a Project 611 (Zulu) submarine, was converted to a test-bed for the P10 cruise missile (Project 611P), whilst S-146 was converted to test the P5. Both were completed in 1957. The former had a hangar installed aft of the conning tower; the missile and its launcher would then be rolled out from the hangar, elevated and the P10 fired forward. Four test firings were undertaken in late 1957 but the system was later cancelled due to the success of the P5. S-146 of Project 613 (Whiskey) was converted to fire a single P5 missile (Project P-613, NATO designation Whiskey Single Cylinder). Instead of a hangar for the missile, the P5 had its tubular launcher well aft; the launcher was elevated and the missile fired over the conning tower. Tests were started at around the same time as those for the P10, but then continued through the next year until the P5 became fully operational in 1959.

After the two test submarines came conversions of further Project 613 (Whiskey) boats as operational cruise missile carriers. The first conversion was designated Project 644 (NATO Whiskey Twin Cylinder) with two P5 tubular launchers placed side-by-side just aft of the conning tower. They elevated facing the stern, firing behind, thus requiring the submarines to manoeuvre into a position facing away from their target to launch. Six boats were converted to this design. A second design was developed that enabled four P5s to be launched and allowed for forward firing.



This photograph shows K-246, one of the first operational cruise missile-carrying submarines in the Soviet fleet. (AFP/Getty Images)



The six Project 644 submarines (Whiskey Twin Cylinder) were converted from the ubiquitous Project 613 (Whiskey) diesel-electric submarines, of which a total of 215 were completed between 1952 and 1957. (USN: US federal government)

| | Project 644 | Project 665 |
|--|---|---|
| Length/Beam/Draught (m) | 76.0/6.6/4.6 | 76.0/6.7/5.3 |
| Displacement (tonnes, surfaced/ underwater) | 1,160/1,430 | 1,490/1,660 |
| Maximum diving depth (m) | 170 | 170 |
| Endurance (days) | 30 | 30 |
| Armament | 2xP5 4x533mm torpedo tubes (10 torpedoes) | 4xP5D 4x533mm torpedo tubes (10 torpedoes) |
| Sonar | Tamir-5P, MG-10 | Tamir-5P, MG-10 |
| Radar | Flag | Flag |
| Radio/electronic systems | Sever | Sever-N-665 |
| Propulsion | 2x37D diesel/2 xPG-101 electric, 4,000hp/2,700hp | 2x37D diesel/2xPG-101 electric 4,000hp/2,700hp |
| Design bureau | TsKB-18 | TsKB-16 |

These conversions had enabled the P5 missile to get to sea as quickly as possible in the strategic land-attack role, and although some design work was done on Project 646, a new-build development of the Project 641 (Foxtrot) diesel electric submarine with either four P5s or two P10s, attention and resources rapidly moved towards nuclear-powered cruise missile-launching submarines, and the Project 646 designs were cancelled.

Construction programme

The initial cruise missile test submarines, followed by the two production conversions, are listed below. Project 611P was undertaken at Severodvinsk, Projects P-613 and 644 at Gor'kiy, and Project 665 at both Gor'kiy and Leningrad.

| Project number | NATO code name | Vessels converted | Cruise missiles | Dates converted |
|-----------------------|-------------------------|--|------------------------|------------------------|
| 611P | - | B-64 | 1xP10 | 1956–57 |
| P-613 | Whiskey Single Cylinder | S-146 | 1xP5 | 1957 |
| 644 | Whiskey Twin Cylinder | S-44, S-46, S-69, S-80, S-158, S-162 | 2xP5 | 1959–60 |
| 665 | Whiskey Long Bin | S-61, S-64, S-142, S-152, S-155, S-164 | 4xP5 | 1961–63 |

A number of conventional submarines were converted into later test beds for the succeeding generations of cruise missiles. These are listed below.

| Project number | Vessels converted | Cruise missiles | Dates converted |
|-----------------------|--------------------------|------------------------|------------------------|
| 644D | S-162 | 2xP5D | 1965–67 |
| 644-7 | S-158 | 1xP7 | 1962–64 |
| 613AD | S-72 | 2xAmetist | 1965–66 |
| 06333 | SS-128 | Granat | 1980? |

ECHO I AND ECHO II CLASSES (PROJECTS 659 AND 675)

Design development

Whilst the first submarines to be fitted with cruise missiles had been conversions of existing boats, in 1956 approval was given for the development of specially designed cruise missile-firing submarines. By 1957, cruise missile types were available, the P5 and the much larger and longer-ranged P20 being developed by the Il'yushin design bureau.

The first P20-carrying boat was to be a development of the Project 627A (November class) nuclear-powered hunter-killer submarine: the experimental Project P-627A. The design work for this began in 1956. Aft of the boat's sail was a huge 25 metre-long hangar for a single P20 missile, but otherwise the vessel shared many characteristics with the class from which it had been developed. The P20 would be launched while the submarine was on the surface, the hangar would lift up and the missile would be elevated on a launcher to 16 degrees and then launched. The whole process would take six-and-a-half minutes before the vessel could dive and escape.

Construction of the experimental prototype Project P-627A boat began at Severodvinsk in March 1957. Design work for the series-production P20-carrying vessel began a few months later and was designated Project 653. Carrying two P20 missiles, it would be much larger and its hull shape more bulbous, with a large and wide conning tower. It had one P20 stowed either side of the centre of the conning tower, and then towed on rails to a launching position further aft. Design work was completed in 1959 and work began on the first vessel for completion in 1962. Initially three were to be built, but this was later increased to 18.

| | Project P-627A | Project 653 |
|-----------------------------------|---|---|
| Length/Beam/Draught (m) | 110.2/9.2/6.3 | 97.5/12.2/7.8 |
| Normal displacement (tonnes) | 3,950 | 5,250 |
| Maximum depth (m) | 285m | 300m |
| Maximum speed (knots, underwater) | 23–25.5 | 22–24 |
| Endurance (days) | 50–60 | 80 |
| Complement | 90 | 101 |
| Armament | 1xP20 4 x533mm, 2x400mm torpedo tubes (4+6 torpedoes) | 2xP20 4x533mm, 4x400mm torpedo tubes (4+12 torpedoes) |
| Propulsion | VM-A reactor | VM-1M reactor |
| Design bureau | SKB-143 | SKB-143 |
| Chief designer | G. T. Svetlov | M. G. Rusanov |

However, with the Project P-627A vessel partly constructed and the assembly of materials under way for the Project 653s, development of the P20 missile system was cancelled in February 1960 and with it the Project P-627A and 653 boats. The single Project P-627A, which would have been completed by September 1960, was considered for conversion into a hunter-killer torpedo-firing boat – designated Project PT-627A – but this was abandoned and it was eventually decided to take the materials from the uncompleted boat and use them to build a final Project 627A hunter-killer. This boat became the K-50 and was completed in July 1964.



A rare photograph of a Project 659 (Echo I) submarine, taken after the boat had been converted into a torpedo-firing attack submarine. They were built in, and also spent their whole careers based in, the Soviet

Far East. (US Federal Government)



A Project 675 (Echo II) submarine on the surface, showing the class's narrow hull-form and traditional conventional submarine lines. (US Federal Government)

In parallel with the abortive P20-launching submarines classes, authorization had been given to the production of specially designed submarines for the smaller P5 cruise missile. Designated Project 659 (Echo I class), it was approved on 26 August 1956, and was derived from the Project 627A (November class) design. However, in order to provide stability when on the surface and preparing to launch, a more conventional hull shape was used. The double-hulled design included six paired launchers for the P5 missile counter-sunk into the top of the outer hull. These would be launched on the surface and would rise to an angle of 14 degrees to fire. The boat had to maintain a speed of no more than 8 knots on the surface, and launch was possible up to sea state 4 or 5.

As has been seen, both the P20 and P5 cruise missiles were designed for the strategic nuclear land-attack role, but permission was given in 1956 to redesign the P5 cruise missile to attack aircraft carriers. As carriers were relatively small and moving targets, much more accurate targeting would be required. The solution developed by the Chelomey design bureau has been set out earlier in this book, but it did require the redesign of the Project 659 (Echo I) submarine, increasing the number of missiles to eight and including space for antennae to communicate with targeting aircraft and the missiles when in flight. This new process is described in detail in the commentary to plate D. The new design, designated Project 675 (Echo II class), would therefore be a dual-purpose vessel, capable of launching both P5 and the new P6 missiles.

| | Project 659 | Project 675 | Project 675MK |
|--|--|--|--|
| Length/Beam/Draught (m) | 111.2/9.2/7.6 | 115.4/9.3/7.9m | 115.4/9.3/7.9 |
| Displacement (tonnes, surfaced/underwater) | 3,731/4,920 | 4,450/5,760 | 5,090/6,390 |
| Maximum depth (m) | 300 | 300 | 300 |
| Maximum speed (knots, surfaced/underwater) | 15/29 | 14/23 | 14/23 |
| Endurance (days) | 90 | 90 | 90 |
| Complement | - | 104 | 109 |
| Armament | 6xP5D 4x553mm, 4x400mm torpedo tubes (20 torpedoes) | 8xP5D/P6 4x553mm, 2x400mm torpedo tubes (20 torpedoes) | 8xP500 Bazal't 4x553mm, 2x400mm torpedo tubes (20 torpedoes) Strela-3M |
| Sonar | Arktika-M MG200 MG15, MG13 | Arktika-M MG200, MG10, MG23, MG29 | Kerch' MGK100 |
| Radar | Prizma | Al'batros RLK50 | Al'batros RLK101 |
| Radio/electronic systems | Sever Nakat-M | Argument Uspekh Sever-D-675 Sila-N-675 Nakat-M | Argon-K Uspekh-Y Kasatka-K Sever-D-675K Sila-N-675 Molniya Nakat-M |
| Propulsion | 2xVM-A reactors 35,000hp 2xDG400 diesel generators 2xPG-116 creep motors | 2xVM-A reactors 39,000hp 2xDG400 diesel generators 2xPG-116 creep motors | 2xVM-A reactors 39,000hp 2xDG400 diesel generators 2xPG-116 creep motors |
| Design bureau | TsKB-18 | TsKB-18 | - |
| Chief designer | P. P. Pustyntsev/ N. A. Klimov | P. P. Pustyntsev | - |

B

ECHO II LAUNCHING A BAZAL'T CRUISE MISSILE

This plate shows a Project 675 submarine launching a single P6 missile. Plate D and its commentary sets out the process for finding, launching missiles and hitting an enemy warship using a Tu95 (Bear) aircraft for targeting. However, using an aircraft for targeting had a number of disadvantages: its very presence would alert the enemy to an impending attack and it would itself be vulnerable to attack before it had sent its data to the submarine, whilst the missile system was also limited by the range of these shore-based surveillance aircraft. In addition, NATO forces began to use counter-measures, including frequent changes of course and a reduction in the use of high-frequency radio, which was one of the main ways in which the Tu95s first detected enemy forces.

The answer to these problems was the development of a worldwide network of surveillance space satellites: they would be almost invulnerable to NATO attack and through multiple orbits of the Earth could provide coverage of the whole planet. It was code-named *Legenda* by the Soviets and was fully operational, after many years of trials, in 1979. A network was created of active radar satellites (US-A, NATO code name RORSAT) and passive radar-intercept satellites (US-P, NATO code name EORSAT) to spot enemy ships. The active radar satellite was powered by a small nuclear reactor, operated in pairs, and had a 45-day operational life. The satellite network would be controlled from a central ground-based headquarters, which would now not only co-ordinate attacks but also cue in the short windows in time during which the targeting data would be transmitted from the satellite to the waiting submarine. This meant that much depended upon the correct co-ordination of the cueing process between submarine and satellite, and gave submarine commanders even less tactical autonomy – much of their time would be spent waiting for orders to receive data, and then orders to fire. Also, the satellites were only able to detect ships the size of aircraft carriers, and in bad weather and heavy seas had trouble detecting even US super-carriers.

The *Legenda* satellite system was used to guide a new generation of cruise missiles. Shown here is a P500 Bazal't missile being launched. It was much faster than the preceding P6, but achieved this speed partly by accepting a smaller warhead. The satellite down-link system, *Kasatka*, included a retractable radar-dome in the conning tower, and the missile communication system was upgraded to the *Argon* system in place of the earlier *Argument* system.



Construction programme

| Project 659 | | | | |
|-------------|----------------------|-----------|----------|--------------|
| Name | Builder | Laid down | Launched | Commissioned |
| K-45 | Komsomol'sk-na-Amure | 22/12/58 | 12/5/60 | 28/6/61 |
| K-59 | Komsomol'sk-na-Amure | 30/9/59 | 25/9/60 | 16/12/61 |
| K-66 | Komsomol'sk-na-Amure | 26/3/60 | 30/7/61 | 30/6/62 |
| K-122 | Komsomol'sk-na-Amure | 21/1/61 | 17/9/61 | 30/9/62 |
| K-151 | Komsomol'sk-na-Amure | 21/4/62 | 30/9/62 | 28/7/63 |

| Project 675 | | | | |
|--------------------|----------------------|------------------|-----------------|---------------------|
| Name | Builder | Laid down | Launched | Commissioned |
| K-166 | Severodvinsk | 30/5/61 | 6/9/62 | 31/10/63 |
| K-104 | Severodvinsk | 11/1/62 | 16/6/63 | 15/12/63 |
| K-170 | Severodvinsk | 16/5/62 | 4/8/63 | 26/12/63 |
| K-172 | Severodvinsk | 8/8/62 | 25/12/63 | 30/7/64 |
| K-47 | Severodvinsk | 7/8/62 | 10/2/64 | 31/8/64 |
| K-1 | Severodvinsk | 11/1/63 | 30/4/64 | 30/9/64 |
| K-28 | Severodvinsk | 26/4/63 | 30/6/64 | 16/12/64 |
| K-22 | Severodvinsk | 14/10/63 | 29/11/64 | 7/8/65 |
| K-74 | Severodvinsk | 23/7/63 | 30/9/64 | 30/7/65 |
| K-35 | Severodvinsk | 6/1/64 | 27/1/65 | 30/6/65 |
| K-90 | Severodvinsk | 29/2/64 | 17/4/65 | 25/9/65 |
| K-116 | Severodvinsk | 8/6/64 | 19/6/65 | 29/10/65 |
| K-125 | Severodvinsk | 1/9/64 | 11/9/65 | 18/12/65 |
| K-128 | Severodvinsk | 29/10/64 | 30/12/65 | 25/8/66 |
| K-131 | Severodvinsk | 31/12/64 | 6/6/66 | 30/9/66 |
| K-135 | Severodvinsk | 27/2/65 | 27/7/66 | 25/11/66 |
| K-175 | Komsomol'sk-na-Amure | 17/3/62 | 30/9/62 | 30/12/63 |
| K-184 | Komsomol'sk-na-Amure | 2/2/63 | 25/8/63 | 31/3/64 |
| K-189 | Komsomol'sk-na-Amure | 6/4/63 | 9/5/64 | 24/7/65 |
| K-57 | Komsomol'sk-na-Amure | 19/10/63 | 26/9/64 | 31/10/65 |
| K-31 | Komsomol'sk-na-Amure | 11/1/64 | 8/9/64 | 30/9/65 |
| K-48 | Komsomol'sk-na-Amure | 11/4/64 | 16/6/65 | 31/12/65 |
| K-56 | Komsomol'sk-na-Amure | 30/5/65 | 10/8/65 | 26/8/66 |
| K-10 | Komsomol'sk-na-Amure | 24/10/64 | 29/9/65 | 15/10/66 |
| K-204 | Komsomol'sk-na-Amure | 20/3/65 | 20/5/66 | 27/12/66 |
| K-108 | Komsomol'sk-na-Amure | 24/7/65 | 26/8/66 | 31/3/67 |
| K-7 | Komsomol'sk-na-Amure | 6/11/65 | 25/9/66 | 30/9/67 |
| K-23 | Komsomol'sk-na-Amure | 23/2/66 | 18/6/67 | 30/12/67 |
| K-134 | Komsomol'sk-na-Amure | 18/6/66 | 23/9/68 | 30/12/68 |

In-service modifications

The five Project 659 (Echo I) boats, having only a strategic land-strike capability, were deployed in that role until 1965 in the Pacific, when they were withdrawn. The five boats were then converted in the late 1960s to torpedo

nuclear submarines, with their missile launchers removed and the spaces plated over.

The Project 675 (Echo II) vessels remained the backbone of the Soviet cruise missile submarine fleet until the mid-1980s. Capable as the later Project 670 and 670M (Charlie I and II) boats were, their missiles were much shorter-range and they had been built in much fewer numbers. As a result, 15 Project 675 boats were extensively modernized over their service careers: the faster P500 Bazal't cruise missile was fitted from the mid-1970s and was followed by the longer-range P1000 Vul'kan in the early 1980s. The prototype modernization was that of K-28 (Project 675MU), with the production run involving nine further boats (Project 675MK). One boat, K-48, was updated with all of the necessary equipment to support Bazal't, but did not have the missile launchers themselves fitted (Project 675K). The modernized boats had the Kasatka satellite down-link installed and other systems updated. The modernization of K-10 to take Vul'kan at Vladivostok was apparently abandoned due to a lack of funds. Finally, between 1978 and December 1984, K-86 (ex-K-170) was modified at Severodvinsk to carry underwater swimmers. Her cruise missile launchers were removed and a bulbous section protruding from the keel was installed, presumably to house and release the underwater swimmers or midget submarines. The names and dates of these modernizations are listed in the service notes section near the end of the book.

C

K-22 SURFACES AFTER COLLIDING WITH USS *VOGE*

On 28 August 1976, in the eastern Mediterranean, the Project 675 submarine K-22 collided with the frigate USS *Voge* during US Navy exercises. The K-22 was semi-submerged, with only her conning tower above water, when she collided with the stern of the *Voge* broadside on. The *Voge* suffered flooding to her steering compartment and one of her propellers was damaged. K-22's conning tower was damaged, as were many of her antennae and one of her forward cruise missile launchers. Her command compartment just below the conning tower suffered from flooding and following the collision she proceeded for some metres with only her damaged conning tower visible. The K-22 eventually surfaced to inspect her damage and was later attended to by a nearby Soviet warship. It is unclear why this collision occurred, but it seems likely that the K-22 was attempting to surface close to the frigate but had misjudged distances and collided with the US warship. No one was killed or seriously injured, but the incident did emphasize the risks inherent in the close-in manoeuvres and marking that could occur in the Cold War at sea.



JULIETT CLASS (PROJECT 651)

Design development

Project 651 (code-named Juliett by NATO) was developed in parallel with Project 675 (Echo II) as a one-salvo diesel-powered version of the latter. It therefore had four P6 launchers in two pairs, and a similar conning tower to Project 675, with the same opening and rotating missile guidance antennae. One major problem with diesel-electric submarines in the anti-carrier role was their relatively slow speed underwater. This made it more difficult to manoeuvre underwater before positioning and to escape from enemy surface vessels and submarines. In order to counteract this, the Project 651 design included two significant innovations. First, special low-magnetic steel was used to reduce the chance of detection, but corrosion problems meant that only the first five boats were constructed in this way, with the others reverting to ordinary steel. Second, the boats had innovative silver-zinc batteries that had much greater capacity than conventional lead-acid batteries. This meant that a maximum speed of 18 knots could be achieved underwater, at least 3 knots faster than equivalent diesel-electric submarines with conventional batteries. Unfortunately this innovation did not stretch beyond the first three boats, as the supply of silver from China dried up due to the deterioration in relations between the two Communist states from 1960. As a result, later boats had to make do with ordinary lead-acid batteries that not only reduced speed, but also significantly reduced the boats' range.

In 1960, and possibly because of the failure of the two innovations mentioned above, design work began on a nuclear-powered version of the Project 651. Designated Project 683, this boat would have had the single salvo armament of four P5 or P6 missiles of their predecessors, but with two small nuclear reactors. It was proposed that this submarine could be built at those yards with shorter slips that had in the past produced diesel-electric boats, such as Leningrad and Gor'kiy. It soon became obvious that the clear priority from the Soviet leadership was the development of underwater-launched cruise missiles, and the decision was made to cease work on the Project 683 and concentrate resources on the Project 670 (Charlie I class) boats.



A Project 651 (Juliett) submarine. The large notches abreast the conning tower and aft are to allow the exhausts from the P6 cruise missiles to escape on launch. Also visible is the starboard retractable diving plane just aft of the bow. (USN: US federal government)

| | Project 651 | Project 683 |
|--|--|---|
| Length/Beam/Draught (m) | 85.9/9.7/6.92 | [not known] |
| Displacement (tonnes, surfaced/ underwater) | 3,174/3,750 | [not known] |
| Maximum depth (m) | 300 | [not known] |
| Maximum speed (knots, surface/ underwater) | 16/14.5 | [not known] |
| Endurance (days) | 90 | [not known] |
| Complement | 78 | [not known] |
| Armament | 4xP5D/P6 6x533mm, 4x400mm torpedo tubes (6+12 torpedoes) | 4xP5D/P6 6x533mm, 4x400mm torpedo tubes |
| Sonar | Arktika-2M, MG-10, MG-13, MG-15 | Arktika-2M , MG-10, MG-25 |
| Radar | Al'batros RLK-50 | Al'batros RLK-50 |
| Radio/electronic systems | Argument Uspekh-U Sever-D-51 Nakat-M | Argument Uspekh-U Sever-A-683U Nakat-M |
| Propulsion | 2x1D43 diesels (8,000hp) 2xMG-141 electric (12,000hp) 1x1DL42 charging diesel (1,000hp) 2xPG140 creep motors (400hp) | 2xMPU-153 reactors (28,000hp) |
| Design bureau | TsKB-18 | TsKB-18 |
| Chief designer | A. Kassatsier | [not known] |

Construction programme

| Name | Builder | Laid down | Launched | Commissioned |
|-------|-----------|-----------|----------|--------------|
| K-156 | Leningrad | 16/11/60 | 31/7/62 | 10/12/63 |
| K-70 | Gor'kiy | 25/8/62 | 6/2/64 | 22/1/65 |
| K-81 | Gor'kiy | 20/11/63 | 7/8/64 | 27/12/65 |
| K-63 | Gor'kiy | 25/4/62 | 26/7/63 | 12/6/66 |
| K-58 | Gor'kiy | 15/7/63 | 12/2/66 | 23/9/66 |
| K-73 | Gor'kiy | 1/8/64 | 31/5/66 | 27/1/67 |
| K-304 | Gor'kiy | 6/8/66 | 24/11/67 | 21/8/68 |
| K-318 | Gor'kiy | 29/3/67 | 29/3/68 | 21/10/68 |
| K-120 | Gor'kiy | 25/3/67 | 11/7/68 | 8/1/69 |
| K-68 | Gor'kiy | 25/1/62 | 30/4/63 | 28/12/65 |
| K-85 | Leningrad | 25/10/61 | 31/1/64 | 22/1/65 |
| K-24 | Gor'kiy | 15/10/61 | 15/12/62 | 19/11/65 |
| K-77 | Gor'kiy | 31/1/63 | 11/3/65 | 19/11/65 |
| K-67 | Gor'kiy | 31/1/65 | 29/10/66 | 13/10/67 |
| K-78 | Gor'kiy | 25/7/65 | 30/3/67 | 1/11/67 |
| K-203 | Gor'kiy | 23/12/65 | 30/6/67 | 26/12/67 |

In-service modifications

One vessel, K-81, was modified at Severodvinsk to take the Kasatka-B satellite datalink system (Project 651K), but the space required to add this new system made the rest of the submarine too cramped. No further vessels were updated in this way. Seven vessels in the class were completed with additional emergency 533mm torpedo storage. Four (or in some accounts six) additional torpedoes could be stowed in a mobilization situation on special dual-purpose shelves that doubled up as crew bunks in peacetime. Informally designated Project 651T, K-67, K-78, K-203, K-304, K-318 and K-120 were all equipped to this standard.

One vessel, B-68 (ex-K-68), was modernized at Gor'kiy to include a small nuclear power-plant (VAU-6) to provide the additional speed and endurance (Project 651E). Trials took place from 1986 to 1991 and appear to have been successful. The collapse of the Soviet Union and the increasing age of Project 651 (Juliett) vessels meant that no further boats were so modernized.



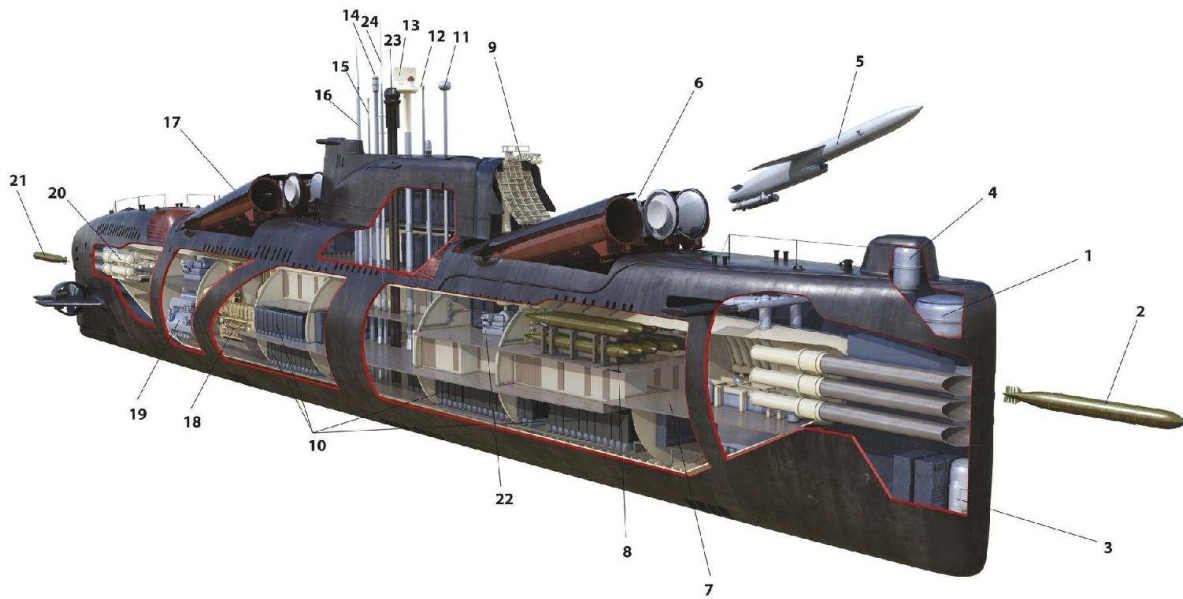
This view of a Project 651 (Juliett) boat at sea emphasizes the size and length of the conning tower and the short, wide shape of the hull in comparison to the Project 675 (Echo II) nuclear equivalents. (USN: US federal government)

D PROJECT 651 (JULIETT) CLASS

The cutaway shows a Project 651 (Juliett) submarine preparing to launch P6 cruise missiles. As can be seen, both pairs of launchers have been raised into the launching position and the missile communications array has been revealed from the submarine's conning tower.

The first part of the process of finding, selecting, launching and hitting a target involves a Tu95 (Bear) targeting aircraft. The Tu95 would find an enemy carrier group using its radar, transmitting the position co-ordinates to the submarine, which would receive the data from its high-frequency communications mast. The submarine would then calculate where the carrier group was likely to have moved in the intervening time, surface, load the extrapolated data into the missiles and then launch a salvo of missiles. In this case, it is launching its full armament of four P6 missiles, considered the minimum in the early 1960s of giving a good chance that one would find its target. To provide an even greater chance of success, such submarines and their targeting aircraft would undertake attacks co-ordinated from an ashore command centre, placing the targeting aircraft and launching submarines in the best positions to launch simultaneous attacks, perhaps even co-ordinated with air-launched cruise missiles on bombers or surface-launched cruise missiles on cruisers.

As the enemy carrier group would have moved yet again during the launch process and whilst in flight, the submarine will then stay on the surface to help guide the missile to its target. The missile communications array on the forward portion of the conning tower, which reveals itself by turning 180 degrees once the submarine has surfaced, allows the submarine's targeting officer to see a radar image transmitted from the missile. The officer then selects an updated target for the missile and then through the datalink sends the modified orders back to the missile. Once the missile flies over the horizon away from the launching submarine, it is on its own, tracking the selected target by radar and then homing in on it in the final stages of flight. Up to this point, the submarine is vulnerable: on the surface, communicating with the missile and liable to be attacked by the carrier group's aircraft. The time from surfacing to diving in such an operation would take 15 minutes for a four-missile salvo.



KEY

- | | | | | | | | |
|---|----------------------------------|-------------|--|--------------------------|-------------------------------|--------------------------------------|------------------------------|
| 1 | MG-10 hydrophone | compartment | 13 | Uspekh system, antenna 1 | 19 | Electric motor/generator compartment | |
| 2 | 533mm torpedo | 8 | Torpedo reloads | 14 | Uspekh system, antenna 2 | 20 | Rear torpedo compartment |
| 3 | Arktika-M sonar | 9 | Argument cruise missile guidance antenna | 15 | PZNA-10 periscope | 21 | 400mm torpedo |
| 4 | MG-25 sonar | 10 | Batteries | 16 | Topol antenna | 22 | Central command post |
| 5 | P6 cruise missile | 11 | Lira astronavigation periscope | 17 | Rear cruise missile launchers | 23 | Diesel exhaust |
| 6 | Forward cruise missile launchers | 12 | PZNG-8 periscope | 18 | Diesel engine compartment | 24 | Ramka radio direction finder |
| 7 | Forward torpedo | | | | | | |

PAPA CLASS (PROJECT 661)

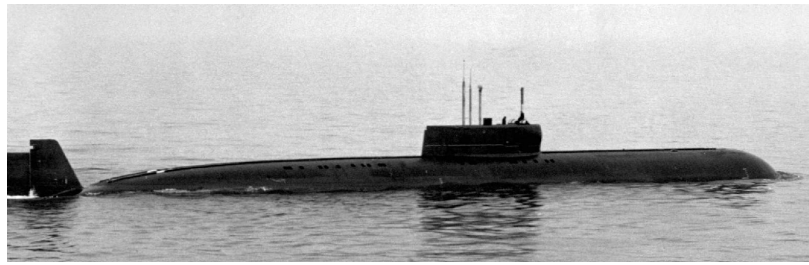
Design development

The Soviet naval leadership was well aware of the vulnerabilities of those submarines carrying P6 cruise missiles. The vessels had to surface in order to launch their missiles, which made them intensely vulnerable to enemy aircraft and surface ships. In addition, their relatively low underwater speed and diving depth meant that they would have problems both keeping up with their warship targets and escaping from enemy vessels after conducting attacks. As a result, a Council of Ministers decree of 28 August 1958 ordered the development of a new generation of nuclear-powered submarines that had considerably greater underwater speed and diving depth, and a new generation of cruise missiles that could be launched from below the water. These were ambitious targets and were made more so by the decision to combine all of these innovations into a single submarine design, which became the Project 661. That the Soviet naval design bureaus succeeded in achieving all of this is testament to their skill and ingenuity against the odds, as well as the enormous resources that were directed towards the project.

A range of different design options were developed, though none fulfilled every one of the design targets. In July 1959, the State Committee for Shipbuilding approved the fastest variant, a relatively small design armed with Ametist. The technical design specification was completed in December 1960 and over 400 different organizations and state enterprises were involved in the design and construction of the boat. To provide the necessary speed, two VM-5 pressurized water reactors were selected, driving two turbines that produced a total of 80,000 horsepower, a then unprecedented amount for a submarine. The boat, named K-162, was laid down on 28 December 1963 but not completed until 13 December 1969, the long period of time reflecting the complexity and difficulties faced in producing her, many of which stemmed from the decision to build both her inner and outer hull out of titanium. This metal was both strong and light but was also expensive and difficult to use in manufacturing.

Ten Ametist cruise missiles were housed in inclined containers side-by-side in front of the conning tower. A missile could be launched from a depth of up to 30 metres and from an opened and pre-flooded container. All ten missiles could be launched in two salvos, with a gap of three minutes between each five-missile launch. K-162 also included the powerful new Rubin sonar, which automatically

transferred data to missile and torpedo systems for targeting purposes.



K-162, the sole Project 661 (Papa) submarine, took an unprecedented six years to build. She then spent a number of years conducting trials. (USN: US federal government)

| | Project 661 | Project 664 |
|--|---|--|
| Length/Beam/Draught (m) | 106.9/11.5/8.2 | 140.9/16.0/9.9 |
| Displacement (tonnes, surfaced/ underwater) | 5,197/5,000 | -/10,150 |
| Maximum depth (m) | 400 | 300 |
| Maximum speed (knots, surfaced/ underwater) | 25/44 | -/18 |
| Endurance (days) | 70 | 80 |
| Complement | 82 | 79 |
| Armament | 10xP70 Ametist 4x533mm torpedo tubes (12 torpedoes) | 6x533mm torpedo tubes (18 torpedoes) Transporting: 20 cruise missiles + 280 torpedoes |
| Sonar | Rubin MGK-300 | Kerch' MGK300 |
| Radar/electronic systems | Al'batros RLK-101 MTR-10 | Sigma-664 Zaliv-P |
| Propulsion | 2xVM5R reactors 80,000hp | 2xreactors 30,000hp |
| Design bureau | TsKB-16 | TsKB-16 |
| Chief designer | N. N. Isanin/ N. F. Shulzhenko | N. A. Kiselev |

Trials lasted nearly two years until September 1971, and included a series of underwater speed tests at which K-162 managed a record-breaking 42 knots at 100m depth with 92 per cent of available power, and then an amazing 44.7 knots at a deep water test site, by some margin the fastest-ever speed for a submarine – a record that is still held today. Soviet designers and engineers had created an incredible submarine that had achieved almost all of the Council of Ministers' initial requirements and exceeded them in some areas, but this was at a great cost in resources and manpower, so much so that K-162 was known as the 'Golden

'Fish' in service. In addition, the submarine was extremely noisy at speed, and the stresses and strains of high-speed operation meant that her components failed early, further increasing the cost of her upkeep. Combined with the short range of her missile system, these factors meant that a planned follow-up class of ten submarines was not ordered, and K-162 remained one of a kind.



This image of K-162 emphasizes her potential for speed on the surface as well as submerged. Her maximum surface speed was an impressive 25 knots. (PH2 D. Beech, USN: US federal government)

Demonstrating the extent to which the Soviet naval leadership envisaged their submarines operating for sustained periods away from their bases, in the early 1960s much work went into a 10,000-ton cruise missile supply submarine (Project 664). Derived from an earlier and smaller project (Project 648), it would have transported up to 20 P6 and Ametist missiles as well as 280 torpedoes, and would have rearmed cruise missile submarines at sea. The submarine could also act as a minelayer and transfer stores to submarines. Construction began at Severodvinsk in 1964, but when doubts emerged about the viability of combining these three roles, work was suspended and never restarted.

Construction programme

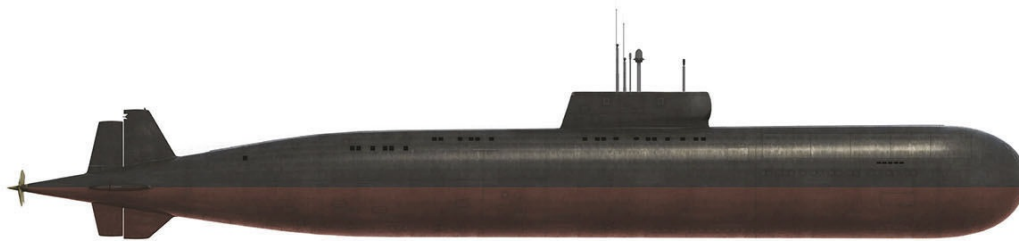
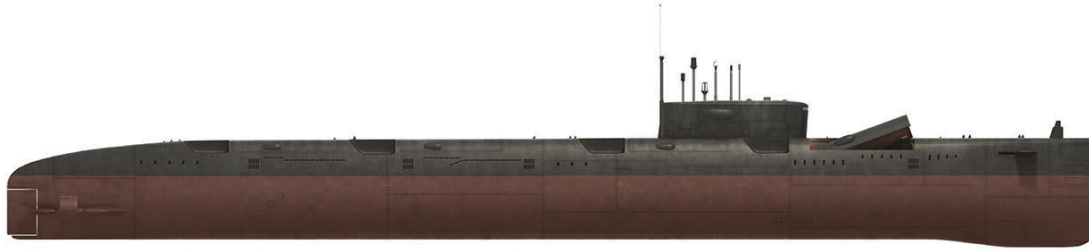
| Name | Shipyard | Laid down | Launched | Completed |
|-------|--------------|-----------|----------|-----------|
| K-162 | Severodvinsk | 28/12/63 | 21/12/68 | 13/12/69 |

E

PROJECT 675 (ECHO II) AND PROJECT 661 (PAPA)

The Project 675 (Echo II) class were a lengthened version of the Project 659 (Echo I) class, expanded in order to take a double salvo of P6 missiles. They also had the necessary electronic communication systems to enable anti-ship operations, using surveillance aircraft to provide over-the-horizon targeting coordinates. The long antenna at the rear of the conning tower is a high-frequency radio antenna. The two poles furthest forward on the conning tower are the periscope and attack periscope respectively. Behind them are the Al'batros radar, the Uspekh datalink, a radar direction finder and the Nakat-M intercept.

The single Project 661 submarine was revolutionary in a number of respects, not least in its very high speed. In order to help achieve the planned high speeds, the submarine had to be far lighter than existing vessels. It was eventually decided to use a light, strong but extremely expensive titanium alloy. The requirement for enormous quantities of high-quality titanium alloy resulted in problems during construction. Titanium could only be welded effectively in an argon-rich environment, so welders had to wear airtight suits to prevent contamination, whilst other materials were at risk of corrosion if fitted close and unprotected against titanium. Over 20 per cent of the titanium hull had to be replaced because of poor quality alloy sheets in the later stages of building.



In-service modifications

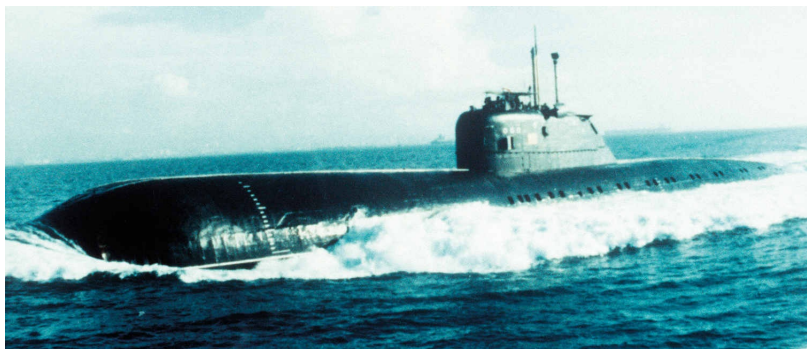
Consideration was given to the modernization of K-162, first in order to take the P120 Malakhit cruise missile and later the P700 Granit cruise missile. Neither of these proposals came to fruition and K-162 completed her service largely unmodified.

CHARLIE I AND CHARLIE II CLASSES (PROJECTS 670 AND 670M)

Design development

As has been seen in 1958, the Soviet Council of Ministers had put in train the development of a highly ambitious submarine that combined great speed with underwater missile launching. This became the Project 661 (Papa) described above. However, construction still needed to continue on other smaller cruise missile submarines in order to provide the numbers to counter the carrier threat. It has also been seen that development work was being undertaken on Project 683 as a small nuclear-powered P5/P6-launching submarine that could be built at the traditional diesel-electric yards such as Gor'kiy. Other options included cruise missile-firing versions of the Project 705 (Alfa) fast semi-automated hunter-killer submarines (Projects 705A and 705D).

In the event, none of these was chosen to be developed further. The clear emphasis on underwater launching meant that an Ametist-equipped submarine design was chosen, later designated Project 670 (Charlie I). This design had originally started life as a small hunter-killer nuclear submarine, but with the addition of the Ametist missile system it had the qualities necessary to be approved. It therefore meant that Gor'kiy, which had been building the Project 651 (Juliett) vessels and would have built the aborted Project 683, now had a follow-on class to construct.



The Project 670 (Charlie I) class submarines had a pronounced 'hump' in the bows. This was in order to accommodate the forward torpedo compartments above two large bow sonar arrays, which formed part of the Kerch' sonar complex. (USN: US federal government)

Although the Project 670 (Charlie I) design was not taking risks with respect to speed and construction material, risks were being taken in other areas, partly as a result of the small size of the boat. This included having only one rather than two reactors and the decision not to use a double hull in all parts of submarine, making the design more vulnerable to serious flooding in the event of an accident.

| | Project 670 | Project 670M |
|--|--|--|
| Length/Beam/Draught (m) | 95.5/9.9/7.5 | 104.5/10.0/6.9 |
| Displacement (tonnes, surfaced/underwater) | 3,574/4,980 | 4,300/5,500 |
| Maximum depth (m) | 300 | 300 |
| Maximum speed (knots, surface/underwater) | 12/26 | 12/24 |
| Endurance (days) | 60 | 70 |
| Complement | 102 | 90 |
| Armament | 8xP70 Ametist 4x533mm, 2x400mm torpedo tubes (8+4 torpedoes) | 8xP120 Malakhit 4x533mm, 2x400mm torpedo tubes (8+4 torpedoes) |
| Sonar | Kerch'-670 MGK300 | Rubicon MGK-400 |
| Radar | Kaskad MRK-50 | Kaskad MRK-50 |
| Radio/electronic systems | Paragon Brest Sigma-670 Molniya Zaliv-P MRP-21A | Paragon Brest Sigma-670 Molniya Zaliv-P MRP-21A |
| Propulsion | 1xVM-4-1 reactor (18,000hp) 1xDG-500 diesel generator 2xTMVV-2 turbo-generators | 1xVM-4-1 reactor (18,000hp) 1xDG-500 diesel generator 2xTMVV-2 turbo-generators |
| Design bureau | SKB-112 | SKB-112 |
| Chief designer | V. P. Vorob'ev | V. P. Vorob'ev |

The Ametist system did have one significant drawback from the Soviet perspective: its short range. This meant approaching perilously close to an enemy carrier battle group in order to launch missiles. Very soon, development was under way on a longer range, underwater-launched cruise missile: the P120 Malakhit missile system. With a new missile system, a new cruise missile submarine class would have to be developed in order to fire it. One option was

yet another modification of the Project 705 (Alfa) design: this was Project 686, of which little is known beyond the fact that it had 16 Malakhit missiles in counter-sunk angled launchers either side of the ship's conning tower. In the event, a modified version of the Project 670 type was chosen for production, Project 670M (Charlie II). It was somewhat larger to accommodate the new missile and improved sonar, but otherwise it was a similar design. The new design was 2 knots slower than its predecessor as the propulsive power was not increased to compensate for the increased tonnage.



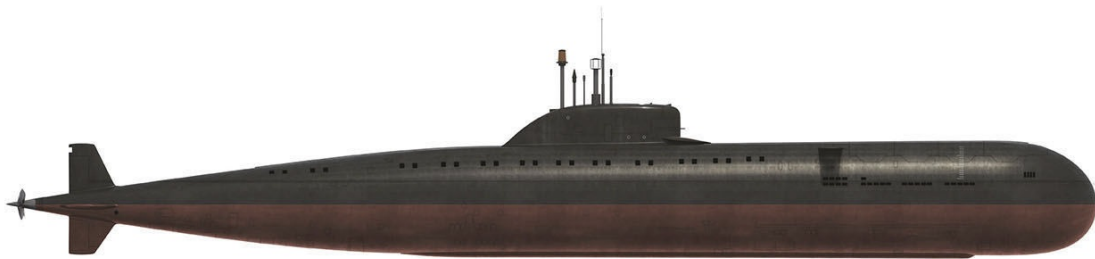
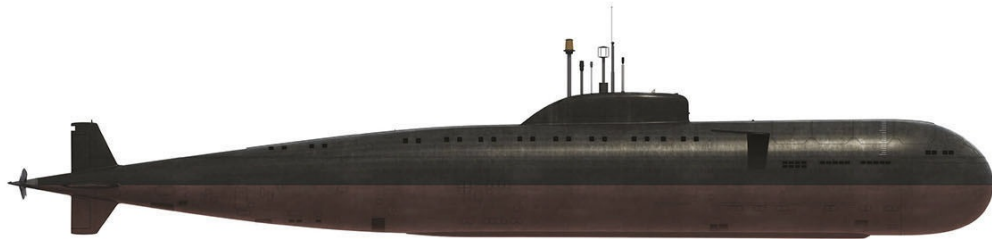
The Project 670 and 670M (Charlie I and II) boats were criticized by some western analysts as one of the least successful Soviet nuclear submarine designs. This fails to recognize the considerable noise reduction work undertaken on these boats, and the technological achievement of underwater cruise missile launch.

(©Imperial War Museum CT 426)

F

PROJECT 670 (CHARLIE I) AND PROJECT 670M (CHARLIE II) The Project 670 (Charlie I) class was armed with the Ametist missile system, but unlike the single Project 661 (Papa), quiet running had been placed as a priority over speed. As a result, considerable attention was made to making the vessel as quiet as possible: the hull-shape was much more hydrodynamic than previous vessels, sound damping was used around bulkheads and decks in order to reduce vibration, and a rubberized coating was applied to the outer hull of the submarine to reduce the boat's sonar signature. To lessen the submarine's magnetic signature, reduced-magnetic steel was used in places and the boat also had its own on-board demagnetizing device. The prominent bulged bow resulted from the need to position two separate arrays for the large Kerch' sonar system in the bow and then place the forward torpedo tubes above.

Following on from the 11 Project 670 (Charlie I) boats were six of the Project 670M (Charlie II) class, enlarged to take the longer-range Malakhit missile system. This newer class was completed in slow time, with only six entering service between 1973 and 1980. Submarine-building priorities in the 1970s clearly lay with ballistic missile submarines and hunter-killers. The relatively small size of the Project 670 and 670M class was partly as a result of the requirement to ensure that the boats could be transported along the Soviet Union's substantial canal network that linked the Baltic, Black and White seas and major rivers such as the Volga. This need for small size also resulted in a number of design features that were unusual for Soviet submarines, including a single nuclear reactor and no double hull in the centre section of the boat.



Construction programme

| Project 670 | | | | |
|-------------|---------|-----------|----------|--------------|
| Name | Builder | Laid down | Launched | Commissioned |
| K-87 | Gor'kiy | 6/2/65 | 20/3/68 | 28/12/68 |
| K-25 | Gor'kiy | 2/12/65 | 31/7/68 | 30/12/68 |
| K-325 | Gor'kiy | 6/9/69 | 4/6/71 | 5/11/71 |
| K-429 | Gor'kiy | 26/1/71 | 22/4/72 | 15/9/72 |
| K-43 | Gor'kiy | 9/5/64 | 2/8/66 | 5/11/67 |
| K-121 | Gor'kiy | 25/11/66 | 29/4/69 | 31/10/69 |
| K-313 | Gor'kiy | 14/7/66 | 16/7/69 | 16/12/69 |
| K-308 | Gor'kiy | 29/12/67 | 19/2/70 | 20/9/70 |
| K-320 | Gor'kiy | 30/4/68 | 27/3/71 | 15/9/71 |
| K-302 | Gor'kiy | 17/1/69 | 11/7/70 | 1/12/70 |
| K-201 | Gor'kiy | 16/11/71 | 9/72 | 26/12/72 |

| Project 670M | | | | |
|---------------------|----------------|------------------|-----------------|---------------------|
| Name | Builder | Laid down | Launched | Commissioned |
| K-458 | Gor'kiy | 12/2/74 | 30/6/75 | 29/12/75 |
| K-452 | Gor'kiy | 30/12/72 | 6/73 | 30/12/73 |
| K-479 | Gor'kiy | 20/12/75 | 6/5/77 | 30/9/77 |
| K-503 | Gor'kiy | 7/2/77 | 22/9/78 | 31/12/78 |
| K-508 | Gor'kiy | 10/12/77 | 3/10/79 | 30/12/79 |
| K-209 | Gor'kiy | 20/12/79 | 16/9/80 | 30/12/80 |

In-service modifications

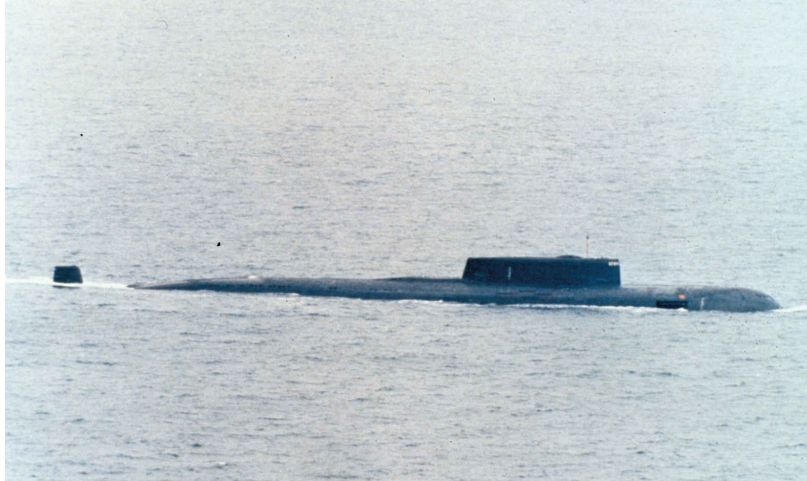
Unlike the preceding Project 675 (Echo II) class, the Project 670 and 670M (Charlie I and II) were not given major modernizations to take new missiles. However, between 25 June 1986 and 10 July 1992, K-452 was modified to act as a trials vessel for the Oniks cruise missile system (Project 06704). Four Project 670 submarines were modernized with Rubicon sonar systems. See the service summaries section near the end of this book for more details.

OSCAR I AND OSCAR II CLASSES (PROJECTS 949 AND 949A)

Design development

The first generation of cruise missiles protected their launching submarines through their long range; the second generation protected them through underwater launch. However, with the improvement of NATO air defence and anti-submarine capabilities in the 1960s, it was clear that in order to make the cruise missile threat still credible, long range had to be combined with underwater launch. A tactical-technical requirement for a 'heavy submarine rocket cruiser' was produced in 1969 and in parallel with the development of a third generation of cruise missile (which became 'Granit'), there began the development of a cruise missile submarine to launch it (also code-named 'Granit' and given the designation Project 949 – known by NATO as Oscar I). Given the increasing strength of NATO defences, it was estimated that a combined salvo of 20-24 missiles would be needed to overwhelm a carrier battle group.

The resulting design, which became the second largest submarine type ever produced, therefore had launchers for 24 Granit cruise missiles, as well as 533mm and 630mm torpedo tubes and the advanced Rubicon sonar system. In order to keep in contact with carrier groups, this huge new vessel needed an underwater speed of 30 knots, so the new submarine had two large OK-650 reactors, driving two generators that produced 100,000 horsepower turning two screws.



The Project 949 and 949A (Oscar I and II) classes represented the apogee of Soviet cruise missile submarine design, combining long-range missiles in large numbers with underwater launch. (©Imperial War Museum CT 2043)

After the first two vessels, the design was modified and enlarged (Project 949A, code name Antey, NATO Oscar II). An additional watertight compartment was included to bring the total to ten, improving internal arrangements and providing system space for equipment supporting the improved MGK 540 sonar.



This photograph emphasizes the considerable breadth of Project 949 and 949A submarines. Either side of the conning tower and along much of the length of the hull are hatches, each concealing two launchers for Granit cruise missiles. (US Federal Government)

| | Project 949 | Project 949A |
|--|--|--|
| Length/Beam/Draught (m) | 144/18.2/9.2 | 155/18.2/9.2 |
| Displacement (tonnes, surfaced/ underwater) | 12,500/22,500 | 14,700/24,000 |
| Maximum depth (m) | 600 | 660 |
| Maximum speed (knots, surfaced/underwater) | 15/32 | 15/32 |
| Endurance (days) | 120 | 120 |
| Complement | 94 | 107 |
| Armament | 24 P700 Granit 2x650mm, 4x533mm torpedo tubes (8+16 torpedoes) | 24 P700 Granit 2x650mm, 4x533mm torpedo tubes (8+16 torpedoes) |
| Sonar | Skat-KS MGK500 | Skat-3 MGK540 |
| Radar | Bukhta-Chibis | Radian (MRKP-58) |
| Radio-electronic systems | Omnibus Medveditsa-949M Zalom Lastochka Tsunami-BM Molniya-M Parus MRP-23 | Omnibus Simfoniya Zalom Lastochka Tsunami-BM Molniya-M Parus MRP-23 |
| Propulsion | 2xOK-650M.01 (100,000hp) | 2xOK-650M.02 (100,000hp) |
| Design bureau | Rubin | Rubin |
| Chief designer | P. P. Pustyntsev/ I. L. Baranov | I. L. Baranov |

The size and expense of the Project 949 and 949A (Oscar I and II) submarines made them controversial within the Soviet Navy, with some naval officers questioning the operational concept that underlay them and the fact that they cost nearly half the amount of a Soviet aircraft carrier. These vessels were certainly capable, but their main armament (and *raison d'être*) depended upon a world-wide satellite network that by the mid-1990s had deteriorated to such an extent that it was of little use for targeting purposes.

Construction programme

Up to 20 boats seem to have been planned, but in the event the programme was cut short by the end of the Cold War and the collapse of the Soviet Union.

Sixteen had been approved by the end of 1991, but construction of the last three was halted in the 1990s. K-160 would have been laid down in 1994, but building was cancelled before this could occur.

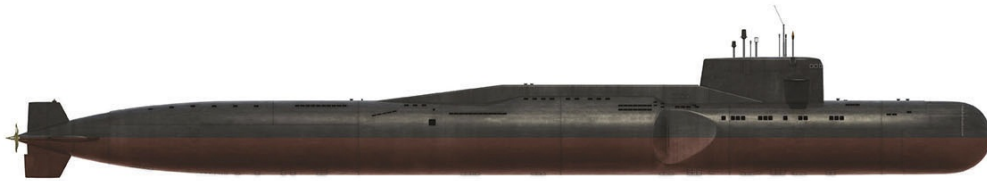
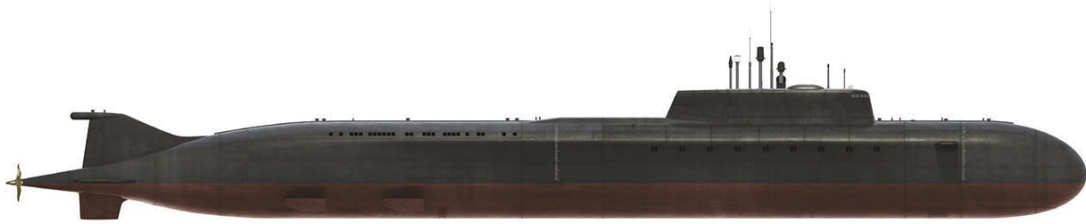
| Projects 949 and 949A | | | | |
|------------------------------|----------------|------------------|-----------------|---------------------|
| Name | Builder | Laid down | Launched | Commissioned |
| K-525 | Severodvinsk | 25/7/75 | 3/5/80 | 30/12/80 |
| K-206 | Severodvinsk | 22/4/79 | 10/12/82 | 30/11/83 |
| K-148 | Severodvinsk | 22/7/82 | 3/3/85 | 30/9/86 |
| K-173 | Severodvinsk | 4/8/83 | 27/3/86 | 31/12/86 |
| K-132 | Severodvinsk | 8/5/85 | 27/12/87 | 30/12/88 |
| K-119 | Severodvinsk | 25/2/86 | 16/12/88 | 29/12/89 |
| K-410 | Severodvinsk | 9/12/86 | 20/1/90 | 22/12/90 |
| K-442 | Severodvinsk | 21/5/87 | 18/6/90 | 28/12/90 |
| K-456/ <i>Kasatka</i> | Severodvinsk | 9/2/88 | 28/6/91 | 18/8/92 |
| K-266/ <i>Severodvinsk</i> | Severodvinsk | 19/1/89 | 22/5/92 | 30/12/92 |
| K-186/ <i>Omsk</i> | Severodvinsk | 13/7/89 | 10/5/93 | 10/12/93 |
| K-141/ <i>Kursk</i> | Severodvinsk | 22/3/90 | 16/5/94 | 30/12/94 |
| K-150/ <i>Tomsk</i> | Severodvinsk | 27/8/91 | 20/7/96 | 30/12/96 |
| K-139/ <i>Belgorod</i> | Severodvinsk | 24/7/92 | - | - |
| K-135/ <i>Volgograd</i> | Severodvinsk | 2/9/93 | - | - |
| K-160/ <i>Barnaul</i> | Severodvinsk | - | - | - |

G

PROJECT 949A (OSCAR II) AND PROJECT 667AT (YANKEE NOTCH)

The Project 949 (Oscar) class and its follow-up, the Project 949A (Oscar II), the latter being illustrated here, are enormous submarines, with only the huge Project 941 (Typhoon) ballistic missile submarine class being larger. Constructed at Severodvinsk, these vessels combined long-range submarine-launched cruise missiles in sufficient numbers to hopefully overwhelm the defences of the US carrier group. The hull shape required to accommodate the 24 missiles deemed necessary to saturate enemy counter-measures resulted in a wide submarine with paired launchers placed either side of the centreline. These launchers were set at their fixed launching elevation and were placed between the outer and inner hulls, stretching from near to the bow to past the conning tower. The boat's distinctive shape resulted in it being nicknamed the 'loaf' in the Soviet Navy.

The Strategic Arms Limitation Treaty of 1972 placed limits on the number of submarines carrying ballistic missiles. As a result, a number of the Project 667 (Yankee) strategic submarines were taken out of service and many were converted to other uses. Three of these submarines were successfully converted to launch the Granat cruise missile. Launched from torpedo tubes, the decision was made to place such tubes in the midships section of the submarine where the vertical ballistic missile silos had once been. To enable safe firing, these new tubes were gently angled outwards, thus producing the unusual 'notch' in the hull either side of the conning tower. Six conversions were planned, but the three being undertaken at Vladivostok were cancelled. Technical difficulties were encountered, and two conversions were abandoned whilst under way. A third boat was sent to the breakers just before work had been planned to begin.



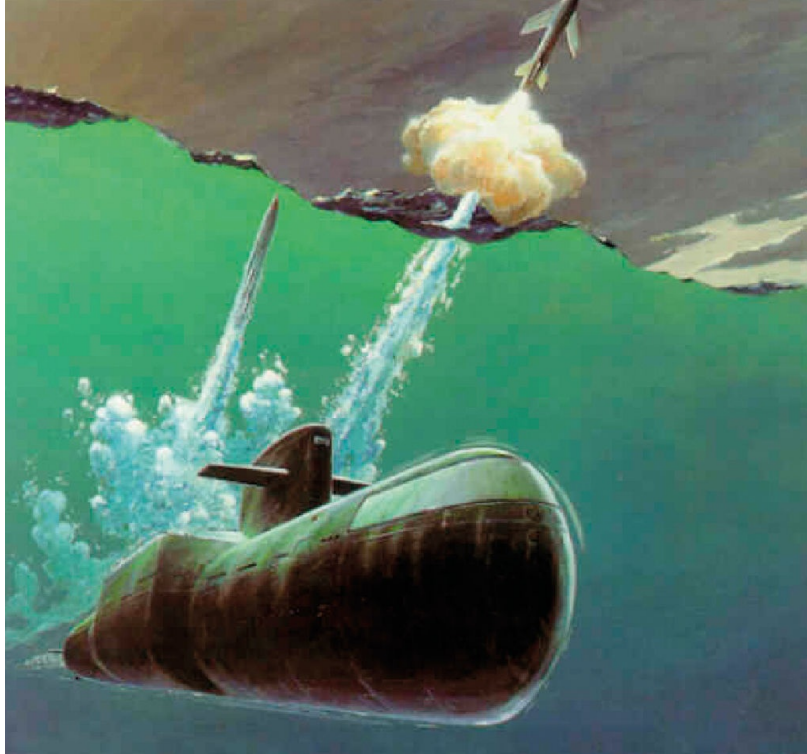
In-service modifications

By the late 2000s, the increase in the Russian defence budget meant that planned refits were again taking place and operational availability gradually rose. In parallel, the Russian satellite industry was being rebuilt, which suggests an increase in availability of targeting information. One of the three suspended boats, the *Belgorod*, had her construction recommenced in 2012, but to a modified design as a mini-submarine mother ship. In 2015, it was announced that Project 949A (Oscar II) boats would be modernized with the cruise missile systems fitted on the Project 885 boats (Severodvinsk class): Kalibr and Oniks. If this does occur, it would mean significant expenditure on hulls which are between 20 and 30 years old, but it would also mark a return to operational relevance for vessels which, only ten years before, seemed like relics of a long-gone Cold War era.

YANKEE CLASS CONVERSIONS AND YASEN CLASS (PROJECTS 667M, 667AT AND 885)

Design development

In 1976 development had begun on the Meteorit-M cruise missile system with a huge range of up to 3,000km and a speed of Mach 2.8. After it was found that it would be too complex to convert a Project 949A (Oscar II) vessel, K-420 of the Project 667 (Yankee) class was chosen to act as the trials ship for this system. Her ballistic missile tubes were removed and replaced by 12 paired 45-degree angled launching tubes aft of the conning tower. When completed, K-420 began a number of years of trials. The first launch of the missile occurred on 26 December 1983 and a total of 21 test launches were carried out in 1984. There were problems with the missile, however, and the increasing costs of resolving them made continued development of the system uneconomic. Meteorit-M was cancelled in late 1989 and K-420 returned to the Northern Fleet as a torpedo-only armed submarine.



This illustration produced by the US Department of Defense shows K-420 launching a Meteorit cruise missile. It erroneously has her launching a ballistic missile, although this capability had been removed.
(Brian W. McMullin, Defense Intelligence Agency, US Federal Government)

| | Project 667M | Project 667AT | Project 885 |
|---|---|---|--|
| Length/Beam/Draught (m) | 152.0/14.7/8.7 | 141.7/12.8/7.8 | 133/11.5/8.4 |
| Displacement (tonnes, surfaced/underwater) | 10,500/13,600 | 8,880/9,684 | 9,500/11,800 |
| Maximum depth (m) | 400 | 400 | - |
| Maximum speed (knots, surface/underwater) | 16.5/27 | 16.5/27 | 17/18 |
| Endurance (days) | 70 | 70 | - |
| Complement | 112 | 121 | 90 |
| Armament | 12x Meteorit-M 4x 533mm, 2x400mm torpedo tubes (12+4 torpedoes) | 8x Granat (32 missiles) 6x 533mm torpedo tubes (12 torpedoes) | 8x triple-tubed vertical launch containers for Oniks and Kalibr (24 missiles) 8x533mm torpedo tubes (c. 30 torpedoes) |
| Sonar | Rubicon MGK400 | Rubicon MGK400 | Amfora MGK600 |
| Radar | Al'batros RLK-101 Pristavkoy Korma | Al'batros RLK-101 Pristavkoy Korma | Surface search set |
| Radio/electronic systems | Almaz Tobol Shlyuz Paravan Lastochka Molniya-LM-1 Zaliv-P | Omnibus-AT Tobol-AT Shlyuz Paravan Lastochka Molniya-LM-1 Zaliv-P | Various including Nakat ESM |
| Propulsion | 2x VM-2-4 reactors (40,000hp) | 2x VM2-4 reactors (40,000hp) | 2x GT3A reactors (43,000hp) |

In 1976 the Soviet leadership decided to respond to the US development of the Tomahawk cruise missile by developing their own similar missile system, Granat: relatively slow-running, but long-range and low-flying and able to be launched from submarines. Project 667 (Yankee) ballistic missile submarines, which had been withdrawn from the strategic deterrent role following the SALT treaty, were chosen for modification following successful trials aboard a converted Project 671 (Victor) hunter-killer submarine. Their vertical-launch ballistic missile systems were removed and replaced by horizontal torpedo-style

launchers amidships, facing forwards but angled away from the hull. There were four tubes on each side of the hull with a total of 32 missiles carried.



Former ballistic missile submarines were converted into launchers for the Granat cruise missile. Launched from torpedo tubes amidships placed at a slight angle, this created a 'notch' in the side of the hull, thus the NATO code name of 'Yankee Notch'. (USN: US federal government)

Conversion programmes

The tables below set out the conversions for these vessels. Six boats had originally been allocated for conversion to Project 667AT (Yankee Notch), but the yard at Vladivostok had considerable technical problems in completing the work to the desired standard. It had initially been planned that K-236 would be the lead boat for the project, but more than 12 years later she was still in dry dock. The sixth earmarked boat, K-408, was decommissioned in July 1988 before she was due to enter the conversion process at Vladivostok. The two remaining conversions, K-236 and K-399, were cancelled in March 1990 as financing for the Far Eastern end of the project was terminated.



The Project 885 combined cruise missile and attack submarine began design work in the early 1980s. The first of the class, *Severodvinsk*, was completed in 2011. (Oleg Kuleshov *Wikimedia Commons* [CC-BY-SA-4.0](#))

| Project 667M | | | |
|--------------|--------------|---------|-----------|
| Name | Shipyard | Started | Completed |
| K-420 | Severodvinsk | 25/9/79 | 15/10/82 |

| Project 667AT | | | |
|---------------|--------------|-----------|------------------|
| Name | Shipyard | Started | Completed |
| K-423 | Severodvinsk | 16/10/78 | 27/12/87 |
| K-253 | Severodvinsk | 17/5/84 | 20/12/88 |
| K-395 | Severodvinsk | 24/6/88 | 30/12/91 |
| K-236 | Vladivostok | 1978? | (abandoned 3/90) |
| K-399 | Vladivostok | not known | (abandoned 3/90) |

Project 885

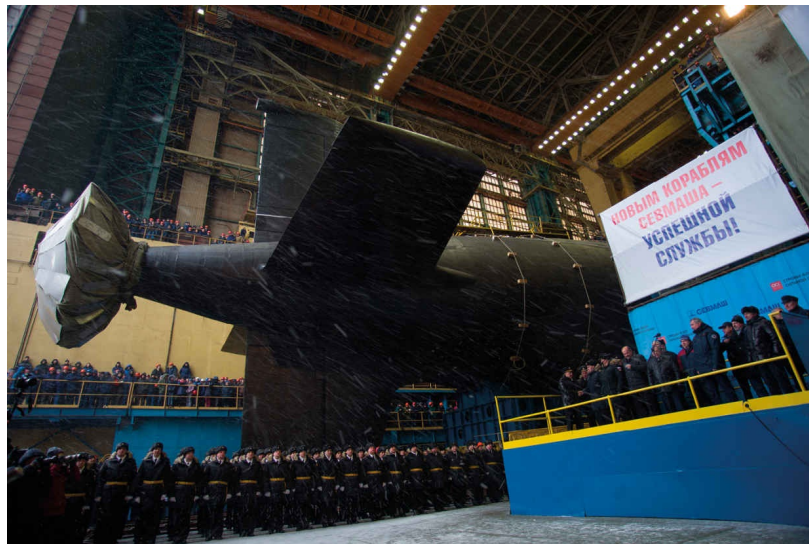
Design work on the next generation of cruise missile submarines began in the early 1980s. In 1983 it was decided to combine the designs for hunter-killer submarines with those for cruise missile submarines: with the development of missiles such as Oniks that could be fired from torpedo tubes, there appeared to be little need for two separate types. The design that emerged combined launch silos at a 10-degree angle for a mix of the new generation of Oniks and Kalibr cruise missiles, with torpedo tubes able to launch torpedoes, anti-submarine missiles and cruise missiles. The size of the new bow sonar was such that the forward torpedo tubes were angled by 10 degrees. US assessments of the stealth of the new design placed the submarine close to that of the US Seawolf and

Virginia classes, demonstrating a continued emphasis on quiet running that had begun with the Project 670 boats 30 years before.

No boats had been laid down when the Soviet Union collapsed, but materials had been delivered to Severodvinsk shipyard, and eventually the first of the class was laid down at the end of 1993. The difficulties of the post-Soviet economy and the priority accorded to the next generation of ballistic missile-firing submarines meant that construction was suspended or slowed to a minimal rate a number of times. It was only with the increased flow of funds into the navy in the mid-2000s that completion appeared imminent; the opportunity was then taken to modify and improve the design. The first of the class, *Severodvinsk*, was finally completed in 2011 and she then embarked on nearly three years of trials. Five sister ships are now under construction or on order, with a total of 12 vessels envisaged.

OPERATIONAL SERVICE

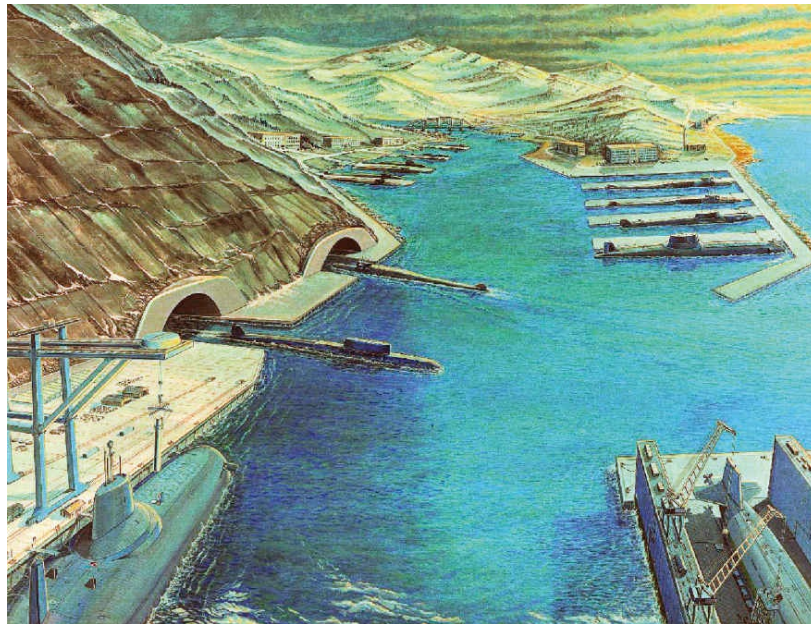
Cruise missile submarines were generally based in the Northern and Pacific fleets. The waters of the Baltic were too constrained for effective submarine cruise missile operation and in any case, no NATO carriers would have risked entering the Baltic in a war or near-war situation. NATO carrier groups did of course operate in the Mediterranean, but the constricted nature of the Bosphorus meant that transits from the Black Sea would be detected by NATO. As a result, although cruise missile submarines operated in the Mediterranean for most of the Cold War, these were usually Northern Fleet boats on extended deployment, sometimes using the Soviet Navy's anchorage off Alexandria.



The second Project 885 boat, *Kazan*, at her launch and naming ceremony. This photograph emphasizes the size of the submarine. (Kuleshov Oleg / [Shutterstock.com](https://www.shutterstock.com))

The first cruise missile submarines, the Project 644 and 665 (Whiskey Twin Cylinder and Whiskey Long Bin) and the Project 659 (Echo I) operated as strategic deterrent vessels, maintaining patrols off the coast of NATO states, targeting sites of strategic significance. As they operated cruise missiles with a 500km range, their patrols would have to be relatively close to the US or European coastline. Their missile warheads initially had a 200-kiloton yield (ten times as powerful as the Nagasaki bomb) and were later increased to 650 kilotons. The Project 659 boats were the Pacific Fleet's first nuclear-powered submarines, and it is known that during the early 1960s they were

allocated targets in Hawaii, the Panama Canal and Japan, as well as a range of sites on the western coast of the United States, including the Boeing aircraft works in Seattle and a number of industrial, administrative and military sites. By late 1964, the relatively short range of their cruise missiles meant that the Project 659 boats were withdrawn from the deterrent role and refitted as torpedo submarines. The Project 644 and 665 boats remained in service until the early 1980s, but given their short range they are likely to have been deployed to provide local deterrent roles targeting sites in Europe.



An imaginative rendering of an unnamed Soviet naval base, published in the United States pamphlet *Soviet Military Power*. In the centre, a Project 949 submarine is seen emerging from an under-mountain dock.
(Brian W. McMullin, Defense Intelligence Agency, US Federal Government)

By the late 1960s, the first generation of cruise missile submarines, operating under their new tactical strike role as ‘carrier-killers’, were all in service. The Project 675 boats were evenly split between the Pacific and Northern fleets, whilst three-quarters of the Project 651 boats were with the Northern Fleet. The primacy of the Northern Fleet in Soviet thinking is demonstrated by the first boats of the new second generation classes also being commissioned into that fleet. The disposition of Soviet cruise missile submarines in late 1970 is set out in the table below.

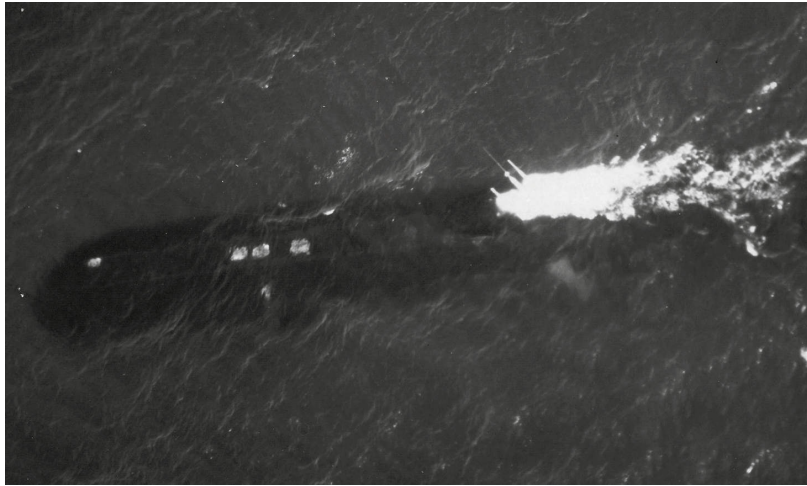


Zaozersk submarine base on the Barents Sea, near the Norwegian border. The submarine in the centre is a Project 949A (Oscar II) boat. (Lelique/ Russian Wikipedia / [CC-BY-SA-3.0](#))

| | Northern | Pacific |
|-------------------------|----------|---------|
| Project 675 (Echo II) | 15 | 14 |
| Project 651 (Juliett) | 12 | 4 |
| Project 670 (Charlie I) | 2 | |
| Project 661 (Papa) | 1 | |

Many of the Project 675 boats operated over great distances on multiple deployments during their careers. For example, K-131 undertook a total of 12 long-range deployments over her 20-year service life. These were mostly in the Atlantic and Caribbean, but did include a deployment to the Mediterranean and to Egypt specifically between March and December 1969. The focus on the Mediterranean by Soviet naval forces had resulted from much-increased tensions in the region during the 1960s. US deployment of a Polaris submarine near the Bosphorus highlighted Soviet vulnerability in this area, whilst the conflicts between Israel and neighbouring Arab states, which drew in the superpowers to either side, led to confrontations and tension at sea, culminating in the Soviet-US stand-off in the eastern Mediterranean at the end of the 1973 Arab-Israeli Yom Kippur War. Project 675 submarines were regularly deployed to the Mediterranean, as were the new generation of Project 670 submarines. With their short-range ‘fire and forget’ missile launched from beneath the surface, these new boats were well matched to this environment, and missile tests were undertaken by K-202 in May 1972 in the Mediterranean to show off this new capability to NATO navies.

Meanwhile, the unique Project 661 boat, after two years of trials (which included a number of deep water exercises throughout the Atlantic, from Greenland to Brazil), was finally able to show her mettle to a US carrier group in 1974. The USS *Saratoga* and her group were successfully tailed by K-162 for many weeks, using her great speed to prevent the American ships from shaking her off. Over a two-and-a-half month operation, the K-162 only surfaced once, and was able to outpace the carrier on a number of occasions.



A Project 670M (Charlie II) submarine at periscope depth in the clear seas of the Mediterranean. (USN: US federal government)

During the 1970s and early 1980s, many of the cruise missile boats were redeployed to different fleets. As Project 670M boats were commissioned, the slightly older Project 670 boats were transferred to the Pacific as part of the build-up of Soviet capabilities in this region (probably in response to US naval activity off Vietnam and the growth of the Japanese Navy). These transfers might take the 'northern route' under the Arctic ice (such as K-429 did in April 1977), or they might take the 'southern route' via the Indian Ocean (stopping off at new bases provided by friendly governments in Somalia and Aden), like K-201 between January and May 1974.

The Project 651 boats were also transferred to other commands, but this seems to reflect their relative lack of capability: with only four missiles, limited in range and endurance by their diesel-electric propulsion and too small to fit the Kasatka satellite down-link, a number of boats were transferred via the extensive Soviet canal network to the Baltic and Black Sea fleets. It appears probable that once deployed to these seas, they were used simply as torpedo firers or as mobile complements to Soviet shore-based cruise missile batteries. Two of the class

were even decommissioned for a number of years and placed under preservation from 1978 to 1983 (B-156 and B-203). The table below sets out the disposition of Soviet cruise missile submarines in late 1985, just as the first Project 949 boats were entering service, but before the economic difficulties encountered in the 12th five-year plan began to affect deployability. Note that some of these boats would have been in refit or repair at the time.

| | Northern | Pacific | Baltic | Black Sea |
|-------------------------------|-----------------|----------------|---------------|------------------|
| Project 675 (Echo II) | 8 | 3 | - | - |
| Project 675MK/K/MKV (Echo II) | 4 | 7 | - | - |
| Project 651 (Juliett) | 7 | 4 | 3 | 2 |
| Project 670 (Charlie I) | 2 | 9 | | |
| Project 670M (Charlie II) | 6 | - | - | - |
| Project 949 (Oscar) | 2 | - | - | - |
| Project 667M/AT (Yankee) | 1 | - | - | - |

By the collapse of the Soviet Union in December 1991, most of the older Project 675 and 651 boats were being withdrawn from service or placed in reserve. Most had had their names changed earlier in their careers: see the service summaries section near the end of this book for details. Many were in poor condition: for example, K-23 was in such a poor state that in January 1991 her diving depth was restricted to 100m. B-67 was in an even worse state, being judged in 1989 to be only nominally operational due to the lack of maintenance and spares. Many other submarines must have been in a similar condition. A number of boats in the last four years of the USSR either began refits or were placed in reserve pending refit, never to emerge, their work being abandoned (K-94, K-70, K-121, K-479, K-525).



A Project 949A (Oscar II) boat of the Russian Far East Fleet sails past Koryaksky volcano on the Kamchatka peninsula. (Photo by: Sovfoto/UIG via Getty Images)

During the 1990s, as the Russian economy rapidly contracted and funding for the armed forces plummeted, all but the Project 949A boats were decommissioned and gradually scrapped. The fate of four Project 651 (Juliett) submarines (B-81, B-124, B-478, B-203), moored in reserve or decommissioned at Liepaja in Latvia, also illustrates the problems facing naval leaders as the USSR fell apart. In early 1991, Latvia declared independence from the Soviet Union and these four boats were now stranded in a breakaway state that the USSR initially did not recognize. The navy nominally recommissioned B-124 to emphasize her continued ownership by the Soviet state, but as with the other three she was in no fit state to be moved. By 1993, B-124 had semi-submerged at anchor, her crew having long since been withdrawn to Russia, and the other boats were only in a little better condition. Eventually it was agreed to sell the boats for scrap after negotiations between Russia and Latvia. B-124 was salvaged for scrapping, whilst B-81 was purchased as a floating museum in the United States (sinking at her moorings some 15 years later). Another 651 boat, B-24, was also sold as a museum ship and is still open to the public today in Peenemunde, Germany.

Western concerns about Russian management of the reactor cores of the decommissioned vessels resulted in much overseas investment in ensuring safe disposal or storage of radioactive material. The fate of B-313 provides an example of the state of some decommissioned submarines: she sank at her moorings in May 1997, but three attempts had to be made to raise her in October 1997, the first being thwarted after a storm struck and the raised vessel crashed back to the sea bed. Concerns about the legacy of decommissioned nuclear submarines remain: in April 2016, the former *Krasnoyarsk* caught fire whilst being broken up at Vilyuchinsk in the Russian Far East.

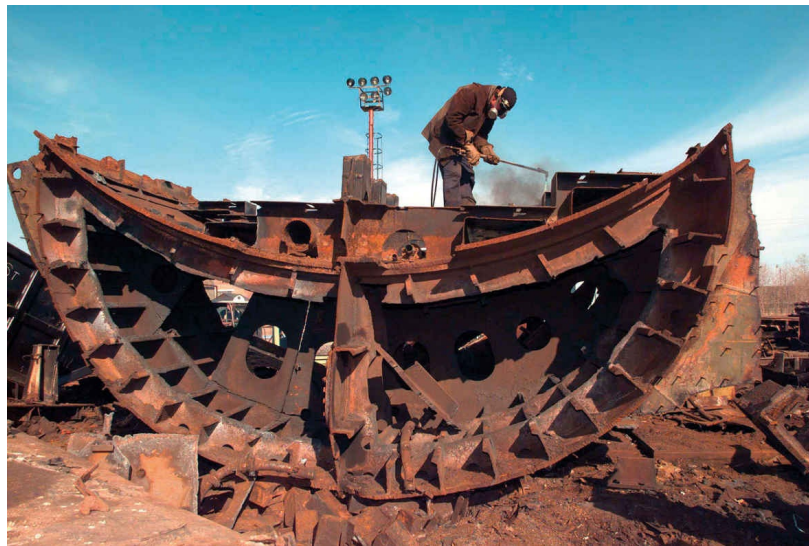


The winter weather conditions in the bases of the Northern and Far East fleets are extreme and can hamper warship operations. This image shows *Tomsk* of the Far East Fleet at Vilyuchinsk. (Sergey Konovalov/ Ministry of Defence of the Russian Federation/Mil.ru)

The *Kursk* tragedy, which is described below, was a reflection of how far the Russian Navy had fallen by the end of the 1990s. Of the remaining Project 949A boats following the loss of the *Kursk*, only five were operational in 2000. *Krasnoyarsk*, *Irkutsk* and *Chelyabinsk* had all been in reserve for many years awaiting refits that were repeatedly postponed, whilst *Vilyuchinsk* was still in repair after her starboard propeller had failed in December 1996. From the mid-2000s, Russian naval capability recovered as more funds were made available to defence, and the surviving Project 949A boats began to receive refits and modernizations. The much-delayed first boat of the Project 885 class, *Severodvinsk*, was completed in 2011 and undertook at least three years of trials, marking a recovery in the fortunes of the Russian naval service over the last decade.

Accidents

During the 1970s and 1980s, Soviet submarines suffered from a high number of accidents at sea and in harbour. Worryingly, a large proportion related to faults or problems with the boats' nuclear reactors. There are a number of reasons why this might have occurred, including the use of conscripts, problems of training and expertise, a greater willingness to take risks in design and deployment, and from the early 1980s, funding difficulties. The table below sets out some of the major engineering-related accidents suffered by cruise missile submarines.



Following the collapse of the Soviet Union, an enormous task faced Russia in safely dismantling much of her huge fleet of nuclear submarines. (Todd P. Cichonowicz, USN: US federal government)

| Date | Name/class/fleet | Details |
|----------|--------------------|---|
| 8/7/78 | K-1/675/Northern | Discharged reactor coolant into sea due to salinity problems; both generators then failed. Towed back to port |
| 2/7/79 | K-116/675/Pacific | Port reactor depressurized whilst surfacing, reactor compartment flooded to control radiation. Submarine not repaired |
| 30/11/80 | K-222/661/Northern | Rods installed improperly during refuelling. Repaired 1980-81 |
| 24/6/83 | K-429/670/Pacific | Sank during exercises. 16 killed. Raised 9/8/84. Sank at moorings 13/9/85; raised again and used as training hulk |
| 18/6/84 | K-131/675/Northern | Fire at sea; 13 killed. Repairs abandoned. Survived as hulk |
| 10/8/85 | K-431/675/Pacific | Reactor explosion whilst refuelling. Beached to prevent sinking. 10 killed, 46 suffered radiation sickness |
| 29/9/85 | K-175/675/Pacific | Both reactors depressurized during maintenance in Aden |
| 11/86 | K-175/675/Pacific | Reactor leak off Vietnam. Repairs begun but abandoned 10/89. |
| 16/6/89 | K-192/675/Northern | Reactor leak at sea. Boat unrepairable |

Following the collapse of the Soviet Union, fewer accidents during the 1990s reflected more the dramatic reduction in deployments and the rapid removal from service of older submarines than necessarily any improvement in training and safety. The *Kursk* tragedy probably reflects the dangers of an increased operational tempo following many years of decay in equipment and personnel effectiveness. The *Kursk* (Project 949A, Oscar II) had been completed in 1994 and was one of the five commissioned boats of this class in the Northern Fleet. During exercises in the Barents Sea on 12 August 2000, there was an explosion in the forward torpedo compartment, causing a severe fire, and the submarine began to take on water and sink. In a second explosion, as stored torpedoes detonated on hitting the sea bottom, her inner and outer hulls across a number of compartments were breached. Most of the crew died as a result of these two explosions, but delayed rescue efforts meant that a number who survived for a few hours in aft compartments did not make it out either. The submarine was raised the next year, and following an investigation was scrapped in 2002 and 2003. Despite general improvements in safety over the next 15 years, fires in submarines during refit remain worryingly common: *Tomsk* caught fire in September 2013 and *Orel* 18 months later in April 2015. This contrast between recent operational improvements and continued safety issues exemplifies the overall history of Soviet cruise missile submarines: a combination of impressive innovation and world-beating submarines on the one hand, with significant risks and tragic accidents on the other.



The *Kursk*, pictured here, sank with the loss of all hands on 12 August 2000, resulting from an explosion forward due to either a faulty hydrogen peroxide-powered torpedo or to the mishandling of such a weapon

by the crew. (Photo by Antoine GYORI/Sygma via Getty Images)

Service summaries

The Project 659 (Echo I) vessels were no longer cruise missile boats by the late 1960s, so their services details are not set out here, although two were decommissioned as a result of accidents and the remaining three had been decommissioned by 1993. The Project 644 and 665 boats had all been decommissioned by 1990. Most of the submarines listed here were only scrapped many years after being decommissioned.



K-43 of the Soviet Far Eastern Fleet was leased to India from January 1988 to January 1991 and renamed *Chakra*. This was the only time the Soviet Navy permitted a nuclear submarine to be operated by a foreign power. (Photo by © CORBIS/Corbis via Getty Images)

Project 675

| Name | Renamed | Fleet | Fleet transfer | Modernized (Project no. and dates) | Decommissioned |
|-------|---|----------|----------------|---------------------------------------|----------------|
| K-166 | K-71 15/1/78 | Northern | - | | 30/5/89 |
| K-104 | - | Northern | - | 675MK 10/11/77-9/3/82 | 10/90 |
| K-170 | K-86 15/1/78 KS-86 8/4/85 | Northern | - | 675N 1978-12/84 | 24/6/91 |
| K-172 | K-192 15/1/78 | Northern | - | - | 19/4/90 |
| K-47 | B-47 25/1/94 | Northern | - | - | 25/7/94 |
| K-1 | B-1 3/6/92 | Northern | - | 675MKV 2/81-12/85 | 3/7/92 |
| K-28 | K-428 25/7/77 | Northern | - | 675MU 21/10/68-6/1/75 | 19/4/90 |
| K-22 | <i>Krasnogvardeets</i> 3/11/67 B-22 7/7/94 | Northern | - | 675MKV 12/85-12/90 | 15/7/94 |
| K-74 | - | Northern | - | - | 8/92 |
| K-35 | B-35 3/6/92 | Northern | - | 675MKV 12/84-12/87 | 20/6/93 |
| K-90 | K-111 25/7/77 | Northern | - | - | 14/3/89 |
| K-116 | - | Northern | Pacific 7/4/66 | - | 10/9/85 |
| K-125 | - | Northern | - | - | 24/6/91 |
| K-128 | K-62 15/1/78 | Northern | - | 675MK 21/12/78-9/3/82 | 19/4/90 |
| K-131 | B-131 3/6/92 | Northern | - | - | 8/84 |
| K-135 | K-235 25/7/77 | Northern | - | - | 14/3/89 |
| K-175 | - | Pacific | - | 675MK 25/2/74-2/3/78 | 10/89 |
| K-184 | - | Pacific | - | 675MK 22/10/75-21/6/78 | 19/4/90 |
| K-189 | K-144 9/3/82 | Pacific | - | 675MK 12/76-16/7/82 | 24/6/91 |
| K-57 | K-557 25/7/77 | Pacific | - | 675MK 27/6/77-26/1/78 | 3/7/92 |
| K-31 | K-431 25/7/77 | Pacific | - | - | 16/9/87 |
| K-48 | - | Pacific | - | 675K 25/3/83-21/2/85 | 19/4/90 |
| K-56 | B-56 28/4/92 | Pacific | - | 675MK 9/8/79-12/11/86 | 3/7/92 |
| K-10 | - | Pacific | - | - | 5/91 |
| K-204 | K-94 25/7/77 B-94 28/4/92 | Pacific | - | 675MK 28/10/72-21/12/77 | 3/7/92 |
| K-108 | - | Pacific | - | - | 19/4/90 |
| K-7 | K-127 25/7/77 | Pacific | - | - | 19/4/90 |
| K-23 | - | Pacific | - | 675MK 2/3/79-20/12/84 | 8/92 |
| K-134 | B-134 28/4/92 | Pacific | - | 675MKV 24/11/82-25/9/88 | 5/7/94 |



Following the collapse of the Soviet Union, the new Russian Navy decided to give names to most of its nuclear submarines. The Project 949 and 949A classes were given names of Russian cities. This image shows *Omsk*, named after the city in western Siberia. (Alex Omen / [CC-BY-SA-3.0](#))

| Project 651 | | | | | |
|--------------------|-------------------------------|--------------|-----------------------|---|-----------------------|
| Name | Renamed | Fleet | Fleet transfer | Modernized (Project no. and dates) | Decommissioned |
| K-156 | B-156 25/7/77 | Northern | | - | 19/4/90 |
| K-70 | B-260 25/7/77 | Northern | Pacific 15/3/65 | - | 30/6/89 |
| K-81 | B-81 25/7/77 | Northern | Baltic 23/4/81 | 651K 24/6/6721/12/70 | 19/4/90 |
| K-63 | B-63 25/7/77 | Northern | Pacific 8/10/66 | - | 14/8/89 |
| K-58 | B-58 25/7/77 | Northern | | - | 19/4/90 |
| K-73 | B-73 25/7/77 | Northern | Pacific 14/10/67 | - | 19/4/90 |
| K-304 | B-304 25/7/77 | Northern | | - | 19/4/90 |
| K-318 | B-318 25/7/77 | Northern | Black Sea 3/12/82 | - | 19/4/90 |
| K-120 | B-120 25/7/77 | Pacific | - | - | 19/4/90 |
| K-68 | B-68 25/7/77 BS-68 19/4/90 | Northern | - | 651E 25/9/79-30/1/85 | 3/7/92 |
| K-85 | B-124 25/7/77 | Northern | Baltic 24/2/81 | - | 30/6/93 |
| K-24 | B-24 25/7/77 | Northern | Baltic 1/10/81 | - | 30/6/93 |
| K-77 | B-77 25/7/77 | Northern | Baltic 6/9/91 | - | 30/6/93 |
| K-67 | B-67 25/7/77 | Northern | Black Sea 25/9/81 | - | 5/7/94 |
| K-78 | B-478 25/7/77 | Northern | Baltic 8/12/89 | - | 24/6/91 |
| K-203 | B-203 25/7/77 | Northern | Baltic 31/1/90 | - | 30/6/93 |

| Project 661 | | | |
|--------------------|----------------|--------------|-----------------------|
| Name | Renamed | Fleet | Decommissioned |
| K-162 | K-222 1978 | Northern | 1988 |

| Project 670 | | | | | |
|--------------------|--------------------------------|--------------|-----------------------|------------------------------------|-----------------------|
| Name | Renamed | Fleet | Fleet transfer | Modernized (type and dates) | Decommissioned |
| K-87 | K-212 15/1/78 | Northern | Pacific 13/11/78 | - | 19/4/90 |
| K-25 | - | Northern | Pacific 15/11/84 | - | 24/6/91 |
| K-325 | - | Northern | Pacific 13/11/78 | - | 24/6/91 |
| K-429 | UTS-130 5/3/87 | Northern | Pacific 30/4/77 | - | 1983 |
| K-43 | B-43 28/4/92 | Northern | Pacific 17/12/80 | - | 30/7/92 |
| K-121 | K-143 25/7/92 B-121 28/4/92 | Northern | Pacific 6/10/83 | - | 30/6/92 |
| K-313 | B-313 28/4/92 | Northern | Pacific 25/9/86 | Rubicon 11/12/81-18/5/85 | 3/7/92 |
| K-308 | B-308 28/4/92 | Northern | Pacific 31/10/85 | Rubicon 20/9/82-10/5/84 | 30/7/92 |
| K-320 | B-320 28/4/92 | Northern | Pacific 25/9/79 | Rubicon 4/82-12/87 | 5/7/94 |
| K-302 | - | Northern | Pacific 28/9/88 | Rubicon 20/4/85-4/3/88 | 30/6/92 |
| K-201 | - | Northern | Pacific 27/5/74 | - | 1998 |

| Project 670M | | | | |
|---------------------|--|--------------|---|-----------------------|
| Name | Renamed | Fleet | Modernized (Project no. and dates) | Decommissioned |
| K-458 | - | Northern | - | 24/6/91 |
| K-452 | B-452 3/6/92 <i>Novgorod Velikiy</i> 22/12/97 | Northern | 06704 25/6/86-10/7/92 | 30/5/98 |
| K-479 | B-479 3/6/92 | Northern | - | 5/7/92 |
| K-503 | B-503 3/6/92 | Northern | - | 30/6/93 |
| K-508 | B-508 3/6/92 | Northern | - | 4/8/95 |
| K-209 | B-209 3/6/92 | Northern | - | 4/8/95 |

| Projects 949/949A | | | |
|--------------------------|--|--------------|-----------------------|
| Name | Renamed | Fleet | Decommissioned |
| K-525 | <i>Arkhangel'sk</i> 6/4/93 | Northern | 31/7/96 |
| K-206 | <i>Minskiy Komsomolets</i> 14/4/87, <i>Murmansk</i> 6/4/93 | Northern | 16/4/96 |
| K-148 | <i>Krasnodar</i> 3/6/92 | Northern | 1999 |
| K-173 | <i>Krasnoyarsk</i> 13/4/93 | Pacific | 1998 |
| K-132 | <i>Irkutsk</i> 13/4/93 | Pacific | - |
| K-119 | <i>Voronezh</i> 6/4/93 | Northern | - |
| K-410 | <i>Smolensk</i> 6/4/93 | Northern | - |
| K-442 | <i>Chelyabinsk</i> 13/4/93 | Pacific | - |
| K-456 | <i>Kasatka</i> 15/2/92, <i>Vilyuchinsk</i> 20/6/96, <i>Tver</i> 2011 | Pacific | - |
| K-266 | <i>Severodvinsk</i> 12/91, <i>Orel</i> 6/4/93 | Northern | - |
| K-186 | <i>Omsk</i> 13/4/93 | Northern | - |
| K-141 | <i>Kursk</i> 13/4/93 | Northern | 2000 |
| K-150 | <i>Tomsk</i> 13/4/93 | Pacific | - |

Projects 667M/AT

| Name | Fleet | Decommissioned |
|-------|----------|----------------|
| K-420 | Northern | 5/7/94 |
| K-395 | Northern | 1999 |
| K-253 | Northern | 30/6/93 |
| K-423 | Northern | 5/7/94 |



A memorial to the *Kursk* and its crew in the city of Murmansk. (Christopher Michel/ [CC-BY-SA-2.0](#))

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- www.bellona.org**
- See also various Jane's publications, including *Jane's Fighting Ships*, *Jane's Naval Weapon Systems*, *Jane's Underwater Warfare Systems* (various editions)

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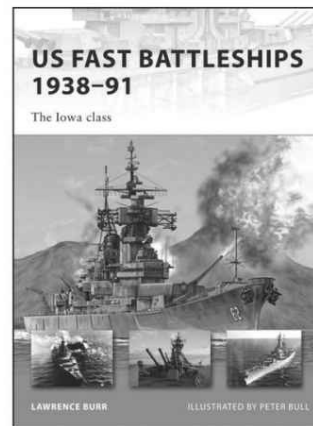
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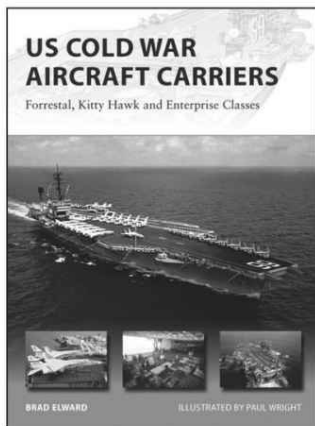
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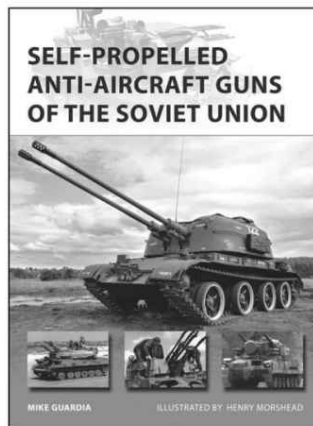
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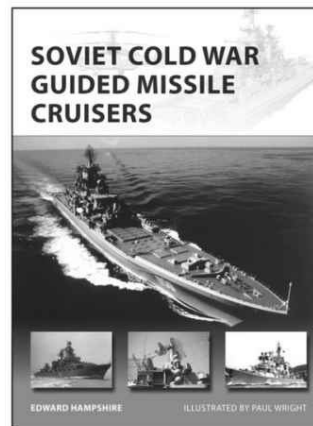
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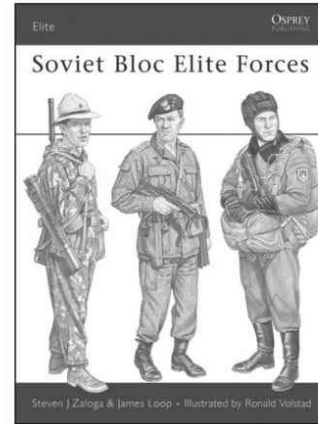
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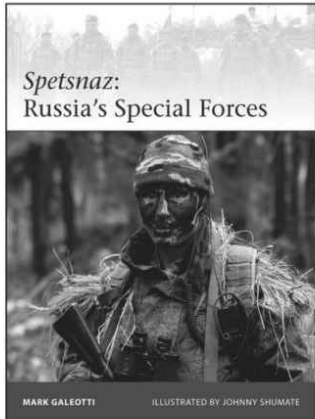
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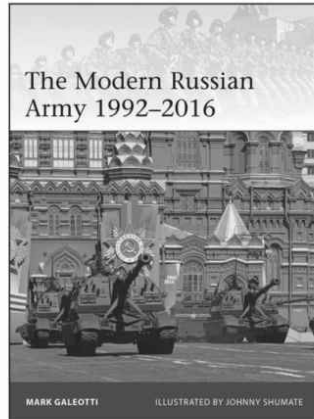
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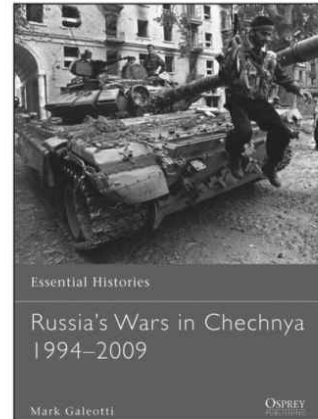
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