

ARCHIVED REPORT

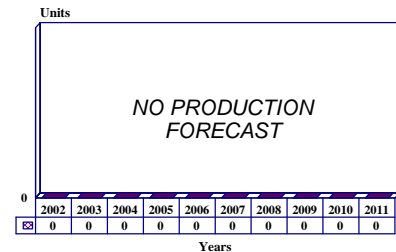
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Project 971 (Akula) - Archived 2/2003

Outlook

- All further investment in this class frozen
- Only seven of class left in service
- Two uncompleted hulls left in shipyard
- Unconfirmed reports that *Nerpa* and *Kuguar* may be leased to India

10 Year Unit Production Forecast
2002 - 2011



Orientation

Description. Nuclear-powered attack submarine equipped with cruise missiles and torpedoes.

Zavod Imeni Leninskogo Komsomol
Komsomol'sk-na-Amur Shipyard
Russia

Sponsor

Rosvoorouzhenie
18/1 Ovchinnikovskaya Emb.
113324 Moscow
Russia
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Fax: +7 795 233 0272 or +7 795 233 1813

Sevmashpredpriyatiye
Severodvinsk Shipyard 199
Severodvinsk
Russia

Licensee. No production licenses have been granted.

Contractors

Rubin Central Design Bureau for Marine Engineering
ul Marata 90
191126 St. Petersburg
Russia
Tel: +7 12 113 5132 or +7 12 314 0373
Fax: +7 12 164 2249 or +712 164 3749

Status. Production and service.

Total Produced. It is estimated that between 12 and 14 Project 971 class submarines of assorted sub-types had been built by mid-1998. So far seven of this class have been decommissioned.

Pennant List

<u>Name</u>	<u>Builder</u>	<u>Launch Date</u>	<u>Commission Date</u>
K-331 <i>Magadan</i>	Komsomolets	6/1990	9/1990
K-461 <i>Volk</i>	Severodvinsk	6/1991	12/1991
K-419 <i>Kuzbass</i> ^(a)	Komsomolets	5/1992	8/1992
K-328 <i>Leopard</i> ^(a)	Severodvinsk	6/1992	10/1992
K-295 <i>Samara</i> ^(a)	Komsomolets	9/1994	1998?
K-157 <i>Vepr</i> ^(a)	Severodvinsk	12/1994	12/1995
K-335 <i>Gepard</i> ^(b)	Komsomolets	9/1999	12/2000
K-152 <i>Nerpa</i> ^(b)	Komsomolets	5/1994	

<u>Name</u>	<u>Builder</u>	<u>Launch Date</u>	<u>Commission Date</u>
K-337 <i>Kuguar</i> ^(b)	Severodvinsk	2002	2005

(a) Project 971A (Improved Akula)

(b) Project 971U (Akula II)

Mission. The Project 971 Bars (Akula) class submarines were primarily designed for the launch of strategic nuclear and conventional cruise missile attacks against land targets. As a secondary role, the ships are equipped to conduct ASW and ASuW operations. Although designed primarily as a platform for the SS-N-21 SSM, they have become general-purpose submarines by virtue of their quiet operation and

relatively affordable cost. The Project 971s became the standard front-line Soviet/Russian submarine of the late 1980s and 1990s.

Price Range. No realistic cost estimate has been released for these ships. A common estimate on the unit cost for a submarine of this type is approximately US\$2 billion.

Technical Data

	<u>Metric</u>	<u>US</u>
Dimensions		
Length (overall):	110.3 m	361.6 ft
Beam (waterline):	13.6 m	44.6 ft
Beam (maximum):	15.4 m	50.5 ft
Draft:	9.68 m	31.7 ft
Displacement (surfaced):		8,140 tons
Displacement (submerged):		12,770 tons

Characteristics

Speed (surface):		10 kt
Speed (submerged):		33 kt
Speed (with reserve propeller sys.):		3-4 kt
Endurance:	100 days	
Safe diving depth:	420 m	1,390 ft
Never-exceed depth:	500 m	1,655 ft
Crush depth:	900 m	2,900 ft
Crew:	73	

	<u>Type</u>	<u>Quantity</u>
Armament		
Torpedo tubes:	53 cm internal	4
	53 cm external	6 (in Project 971A/971U only)
	65 cm	4
Torpedoes:	TEST-96 53 cm	(total of 40 weapons between the different types)
	SAET-96 65 cm	
Missiles		
Land attack:	RKB-500 Granat (SSN-21)	12
ASuW:	P-100 (SSN-22)	2
ASW:	100-RU (SSN-16 Stallion)	2
AAW:	Strela (SA-N-8)	18

Electronics

Sonars		
Bow mounted low-freq:	MGK-503 Skat	1
Flank arrays:	Akula	2
Passive ranging:	Chanel-B	1
Towed array:	Skat-3	1

	<u>Type</u>	<u>Quantity</u>
Mine avoidance:	MG-519	1
Environmental monitor:	MG-553	1
Radar		
Search/Fire control:	Kremlin-2 (Rim Hat)	1
Electronics (continued)		
Electronic warfare		
ESM:	Kremlin-2 (Rim Hat)	1
COMINT:	Khrom-KM	1
SATCOM:	Pert Spring	1

Propulsion

Main machinery:	OK-650B nuclear powered steam turbine complex	
Reactor:	VM-5 Pressurized Water	2x95 MW
Steam turbine:	Pobov GT-3A	1x50,000 shp
Auxiliary diesel engines:	Generator motors	2x750 shp
Propulsion motors:	Electrical	2x276 kW
Reserve propeller system:	Electric motor powered	2x370 kW
Propeller:	7-bladed fixed-pitch	1

Design Features. The Project 971 Akula class is a lineal development of the Project 671RTM (Victor III) class attack submarines. The 971 retains the general conformation of the older design with a sleek, highly streamlined sail. This is faired smoothly into the outer hull casing in order to reduce water resistance and flow noise. This design feature also reduces the snap-rolling tendency experienced with most fast submarines. The sail is very long in proportion to its height and width, leading to speculation that it contains an air defense post similar to that installed on the Project 877 (Kilo) class submarines. It does not seem probable that the mast configuration would allow space for such an installation. In its place, the Project 971 boats carry shoulder-fired Strela missiles.

The submarine uses double hull construction with both inner and outer hulls being fabricated from high-tensile (HY-100 equivalent) steel. Reports that these submarines have titanium pressure hulls are incorrect. The pressure hull is externally framed, with a substantial proportion of its subsystems mounted between the two hulls where access for repair and/or routine maintenance is difficult. The outer hull is oval (acceptable since it is free-flooding and does not have to be pressure-resistant) with approximately a two-meter gap between the hulls. The number of free-flooding holes in the outer casing has been reduced over previous Russian designs, and some photographs suggest that snap closures may be provided to seal those free-flood holes that are included. The hull and sail are coated with anechoic tiles for sound insulation.

The submarine has a large, egg-shaped pod mounted on the upper vertical fin aft. Over the years, this has had many functions attributed to it, including a magneto-

hydrodynamic drive motor, a towed decoy dispenser, and a propulsor for a creep motor. As usual, the simplest explanation, a towed array dispenser, turned out to be correct; the large dimensions of the pod are due to the poor quality of Russian rubber, which imposed severe limitations on the angles through which the array could be bent.

The Project 971 class is powered by the OK-650B power complex. This includes two VM-5 pressurized water reactors driving two Pobov steam turbines with a total output of 43,000 shp. These provide an underwater speed of 36 knots. The turbines drive a single seven-bladed propeller with a three-axial skewed pitch to reduce noise generation. All the machinery is rafted to assist in silencing.

Operational Characteristics. The primary armament of the Akula class is its battery of 12 RKB-500 Granat (SSN-21 Sampson) cruise missiles. These were originally nuclear-tipped and were assigned to the sub-strategic and strategic roles. In recent years, the Russian Navy has endeavored to withdraw nonstrategic nuclear weapons from its fleet; it is not known whether the Project 971 force was affected by this. In most Russian Navy documentation, the Bars class is carried as part of the Strategic Rocket Forces, and its RKB-500 missiles may, therefore, still be nuclear-tipped. The RKB-500 has a maximum range of 3,000 kilometers and a speed of Mach 0.7.

The RKB-500 missiles are fired from four 53 cm torpedo tubes. An additional four tubes for 65 cm units are also included. Non-cruise missile armament is intended primarily for self-defense. These weapons include six 53 cm ASW torpedoes, two 100-RU Vodopod ASW missiles carrying either nuclear depth

charges or homing torpedoes, two P-100 Oniks hypersonic anti-ship missiles, and two 65 cm wake-homing anti-ship torpedoes.

The sensor array is virtually identical to that of the Project 671RTM (Victor III) submarines. It consists of an integrated sonar complex designated MGK-503 Skat. The primary hull sensor is a cylindrical bow sonar, capable of both active and passive operation. The reduced diameter is essential since the bow torpedo tubes occupy much space in the submarine's nose section. The sonar has less than a thousand elements (presumably the accurate figure is 956) and operates between 0.5 and 5 kHz in the passive mode and at 3.5 kHz in the active mode. A linear passive array receiving at 3.5 kHz is wrapped around the small cylinder. This has 27 staves (20 double and seven single) and acts as both receiver for the cylinder array and as an intercept receiver for NATO submarine sonars.

The flank arrays are named Akula in Russian service and are improved versions of the version installed on the Project 671RTM. They extend for one-third of the length of the submarine in a continuous array, rather than the three separate arrays preferred by Western designers. Akula is derived from the British Type 2007 flank array. The intercept sonar is a version of the Anglo-French Type 2019 PARIS with five receiver stations situated on the sail (as opposed to three in Type 2019). The final sonar system is the Skat-3 towed

array. This is a thick-line short array, 80 meters long and 8 centimeters in diameter. It has 50 hydrophones operating between 20 and 200 Hz. It is streamed on a 756 meter long cable, and the onboard processing system has full DEMON capability.

Although the sonar array is complex, it is primarily defensive in orientation, being mainly intended to detect and evade enemy submarines so that the Akula can launch its missiles safely. Offensive ASW and ASuW capabilities are primarily aimed at protecting the platform rather than hunting enemy targets.

The Project 971 class submarines are equipped with the Kremlin-2 (Rim Hat) fire control complex. This consists of a four-port radar warning array, above which is a four-tiered, eight-port, direction-finding ESM system. This is topped by a MRK-50 Tobol radar/ESM/datalink complex. The MRK-50 consists of two back-to-back antennas which act as search/navigational radars; a very precise ESM system, and a datalink for missile control. The MRK-50 complex nods to give limited 3-D coverage.

The approximate target location is determined using the ESM array and is used to point the appropriate Kremlin-2 ESM antenna. This gets a fine cut on the emitter and trains the radar to give a single pulse for range. Once the missile (either P-100 Oniks or 100-RU Vodopod) is fired, the datalink receives target picture data and transmits course correction information.



PROJECT 971A CLASS SUBMARINE

Source: Russian Northern Fleet



PROJECT 971 CLASS SUBMARINE

Source: Russian Northern Fleet

Variants/Upgrades

Important note on nomenclature: *The release by the Russian Navy of the class names and Project Numbers for their ships was a major breakthrough in that it revealed the relationship between many designs and identified the various classes properly. However, this also caused serious confusion in the West since the familiar NATO code names were shown to be inaccurate and often misleading. In some cases quite different systems had been identified as being identical and allocated the same code name, while identical systems on different platforms were given different code names. Many nonexistent systems were given NATO code names, while highly significant equipment was missed completely. The Project 971 class is a good example of the confusion; its proper class name is Bars, and its NATO code name, Akula, is the Russian class name for a very different submarine, the Project 941 class SSBN, known in the West as Typhoon. This has led to many erroneous scare stories about Russian SSBNs being “transferred” to India or China. For this reason the use of NATO code names is being systematically discontinued in this book and replaced by correct national designations where known.*

Project 971. This is the original design, evolved from the Project 671 RTMK series submarines but with more emphasis on hydrodynamics and quieting. Although the Russian Project numbers and ship names are conflicting, it is generally estimated that the first seven ships of this class constitute the Project 971 series, with the *Tigr*, *Drakon*, and *Gepard* being of Project 971A series and the most recent hulls of the longer Project 971U series.

Project 971A. Version of the basic Project 971 equipped with additional 53 cm tubes mounted externally to the pressure hull. These were originally intended for the RKB-500 missiles, leaving the torpedo room clear for torpedoes and anti-ship missiles. They are now used for the MG-74/GPD-3 programmable acoustic decoy system, with two such decoys being held in each tube.

Project 971U. The latest production version of the Akula design, 3.7 meters longer than the original Project 971. The Project 971U has an active noise cancellation system and an extensive array of thermal wake sensing equipment. The Project 971U has been claimed to be faster, quieter, better armed, more agile, and deeper-diving than the US Navy's SSN-688I Improved Los Angeles class. Its command system and sensors are, however, substantially inferior to those in the US design.

Akula. NATO code name for the original Project 971 class.

Improved Akula. NATO code name for the Project 971A class.

Akula II. NATO code name for the Project 971U class.

Bars Class. The Russian name for this class.

Schuka-B. Original Soviet class name for the Project 971 (Schuka-A being Project 671RTMK Victor III). Changed to Bars when the role of the submarine was recast.

Project 955. This is a new ballistic-missile submarine class. Initially it was believed that an SSBN version of the Project 971 class was being developed. This may

have been because of confusion resulting from the presence of vertical launch tubes behind the sail in the Severodvinsk design. The Russians have confirmed that Project 955 is a new SSBN design derived from the Project 667BDRM (Delta IV). It will carry 12 Topol-M or RSM-54s ballistic missiles. The boat is believed to have six 533 mm tubes, and is expected to incorporate some design details from the Severodvinsk class. Externally, the sail has been said to bear a strong resemblance to that of the Akulas.

This 17,000-ton ship will be powered by two nuclear heated turbines driving one shaft, giving a maximum speed of 26 knots submerged. Construction began in November 1996, but the submarine was only two or three percent complete by the end of 1998. At that time, the originally planned missile for these submarines, a naval derivative of Topol-M, failed spectacularly in trials and was canceled and replaced by an upgraded version of the RSM-54. This required a major redesign of the submarine, and completion is now not expected before 2010.

Borey Class. Class name for Project 955.

Project 885. A further development of the Project 971 class, intended for general-purpose hunter-killer duties. Changes in the design compared to the Akula include a new forward section where the existing torpedo tube arrangement has been changed to the standard battery of four 65 cm and two 53 cm tubes. Apparently, all these tubes are internal, and four (rather than three) sets of reloads are carried. The original design was for these tubes to be splayed out from the centerline to provide space for a full-size, two-element spherical sonar system similar to that installed on the new US Seawolf class. However, later drawings showed this arrangement being replaced by a conventional cylindrical sonar with the torpedo tubes above it.

The Severodvinsk is also armed with a battery of eight vertical launch tubes for surface-to-surface missiles,

installed behind the sail. The missiles are expected to be the Novator Alfa anti-ship and land attack missiles. Additionally, the sub has 86-R anti-submarine missiles fired from torpedo tubes. In total the submarine will carry about 40 weapons. The propeller system at the rear has been replaced by a pumpjet.

Construction of the first of these submarines began in late 1993, but the process has been very slow, due to lack of available funding. By mid-1996 only the stern third of the first-of-class had been completed and the scheduled launch date had receded into the uncertain future. Work appears to have stopped completely in 1998, and has not restarted. Although a second submarine of this class had been planned, no funding for this submarine was ever allocated and work was never started on her.

Project 093. In early 1995, the Chinese apparently laid down a nuclear-powered submarine using Russian technical aid and assistance. The design antecedents of this Project 093 class submarine are unclear; it has been described as a derivative of the Project 671RTMK design, and as a license-built Project 971 using components from incomplete 971s in Russian yards. There have been some reports that the Project 093 program may be struggling. This program is now covered in a separate report entitled "Chinese Nuclear Submarines."

Advanced Technology Vessel. This is an Indian program to produce a nuclear-powered attack submarine capable of firing cruise missiles at land targets. The program is acknowledged to be based on Russian technology assistance, but sources vary as to the Russian design used as a basis. Some point to the Project 670M (Charlie II) as a foundation, others to Project 971. This program is now covered in a separate report entitled "Indian SSN."

Program Review

Background. The Project 971 class submarines were one of three new-generation Russian submarines designed in the mid-to-late 1970s as replacements for those evolved during the 1950s and early 1960s. The Project 945 (Sierra) class was intended as a hunter-killer submarine to replace the existing Project 671 (Victor) and Project 705K (Alpha) classes. The Project 945 featured pressurized water reactors (thus avoiding the maintenance problems that had afflicted the Project 705K boats) but had a titanium alloy pressure hull to permit deep dives. Project 945 was intended to

establish a clear margin of superiority over the US Los Angeles class.

The second was Project 943 (Mike) class. This was a very fast, deep-diving submarine for which no clear tactical-technical requirement (TTZ) has yet been established. It may have been intended as either a specialized anti-ship platform to replace the Project 670 (Charlie) class or as an ASW design to exploit Deep Channel sonar characteristics. The only member of the class was lost at sea on its first operational deployment.

The Project 971 class was the third member of the group and was a direct derivative of the Project 671RTMK class. The design changes included a major increase in hull size to allow more weapons stowage and, more important, to raft the power train, dramatically reducing noise emissions. The shape of the outer hull was changed from circular to oval, providing a wide safety gap between the hulls.

The TTZ for Project 971 was issued by the Strategic Rocket Forces, and it appears to have been aimed at developing a cruise-missile launching submarine from the outset. The chosen weapon for the submarine was the RKB-500 Granat missile. This is an almost exact copy of the US UGM-109A Tomahawk cruise missile; the timing of the TTZ suggests that the blueprints of the US weapon were compromised at a very early stage in its development. The adoption of a back-engineered US design meant that the weapons would be fired from 53 cm torpedo tubes, whereas a Russian-designed weapon would have utilized 65 cm tubes. For this reason, Project 971 was unique among modern Russian submarines in having a primary armament of 53 cm torpedo tubes.

The first of the Project 971 class submarines, the *K-284* (later renamed the RFK *Puma*), was laid down in 1982, launched in 1983, and entered service in 1984. This rapid construction time suggests that the ship was actually built with preassembled modules and that the first steel was probably cut some years earlier. The close relationship to the Project 671 design meant that first-of-class trials were relatively brief compared with those for the Project 943 and Project 945 classes, and the *K-284* undertook her first deterrent patrol off the coast of the US in 1985. The apparent purpose of the deployment was to provide an equivalent risk counter to US Tomahawk missiles stationed in Europe.

Apparently, only a single brigade of Project 971 boats was planned. However, the Project 945 dedicated hunter-killer design turned out to be very expensive and time-consuming to build. The Project 943 class also ran into serious problems involving the new liquid-metal cooled reactor, and plans to build additional ships of the type were abandoned. In contrast, the Project 971 turned out to be an economical and technical success. Accordingly, an improved version, Project 971A, was designed in 1991. This included six additional 53 cm torpedo tubes mounted between the pressure hull and the outer casing.

In 1994, there were a number of reports suggesting that negotiations were in progress for the sale of the Project 971 design to other countries. Suggested clients at that time included India, China, Brazil, and Pakistan. Later, in early 1995, some confirmation for these

reports was received when the Chinese apparently laid down a nuclear-powered submarine using Russian technical aid and assistance. The design antecedents of this Project 093 class submarine are unclear; it has been described as a derivative of the Project 671RTMK design, and as a license-built Project 971 using components from incomplete 971s in Russian yards.

In April 1996, two Akulas were reported to be incomplete at Komsomol'sk, with the *Nerpa* having already had the reactor installed. However, the work on it had already been halted in September 1995. In July 1997, the *K-267 Drakon* had still not been commissioned. Acceptance trials had already been completed two years earlier, but the Russian Navy's final payment for the submarine had been returned due to insufficient funds. The shipyard therefore withheld delivery of the submarine and was reportedly seeking a buyer. Later, completion funds were provided by the city of Samara, and the submarine was renamed in its honor.

By late 1998, the Russian naval construction programs had fallen back into chaos due to the chronic lack of funds. At the Severodvinsk shipyard, work was halted for a week to avoid unrest resulting from an inability to pay the workers' salaries. At that time, only one Project 971U was reported to be under construction at the site, suggesting that efforts to complete other hulls had been discontinued. It is highly unlikely that any more Akulas will be built beyond that one; even completion of the unfinished boat is increasingly uncertain.

In September 1998, a 19-year-old conscript went on a shooting spree that killed eight of his shipmates. The incident ended only when Russian special forces stormed his submarine, a Severomorsk-based Project 971, possibly the *K-461 Volk* or the *Puma*. Evidence for the growing breakdown of discipline in the Russian fleet was reinforced by an incident in September 1999 in which 59 cartridges for the air purification system on the *K-317 Pantera* were stolen and the palladium powder within them sold on the black market. This was the latest in a series of thefts from unidentified submarines that included instrumentation and reactor control equipment.

In June 2000, the Russian Navy released a fleet plant that suggested that 12 strategic nuclear submarines, 20 general-purpose nuclear submarines, 35 diesel submarines, and around 70 surface vessels would be enough to ensure the country's security in the 21st century. The general-purpose nuclear submarine fleet already consists of the Project 945 class boat, RFK *Pskov*, recommissioned in 1998 after a two-year hiatus, nine Project 971 class boats in commission (plus three

more incomplete), and 10 Project 949A (Oscar II) class boats (excluding the *Kursk*, lost at sea in August 2000). This existing inventory appears to make further construction most improbable.

The Project 971A submarine RFK *Gepard* was launched in September 1999, and construction continued in fits and starts until the ship was finally completed in December 2000. She then ran machinery trials – again, much interrupted by lack of funding – until August 2001, followed by an initial series of acceptance trials in the White Sea before returning to her home base. These trials were greeted with a certain level of hysteria in some circles, apparently because the RFK *Gepard*'s sound reduction was so much greater than anyone had expected.

Early in 2002, reports from Moscow suggested that all additional funding for the Project 971 class program had been frozen. This left two submarines, the *Nerpa* and *Kuguar*, under construction. *Nerpa* was fairly close

to completion (82 percent complete), but *Kuguar* was much further out and was considered unlikely to be completed within three years, even if sustained funding could be made available. In addition, it was revealed that the number of Project 971 boats in service had fallen to seven (including the recently commissioned *Gepard*), since many of the older boats had run out of reactor core life and been decommissioned to save the expense of refueling.

Coincidentally with this news came reports that the Indian Navy had signed a lease with the Russian Navy for the two remaining, incomplete Project 971 boats as part of the Indian nuclear submarine program. These reports were subsequently denied by the Indian Ministry of Defense. In parallel with these reports were suggestions that the two incomplete Project 971 class submarines may be sold or leased to China. At this time, the situation concerning these possible transfers remains unclear.

Funding

The development of the Akula design was funded by the Soviet government for the Strategic Rocket Forces and the Soviet Navy. Following the demise of the Soviet Union, the current work is being funded by the Rubin Design Bureau as a private venture.

Recent Contracts

No contractual information is available.

Worldwide Distribution

Russia. 7 in service with two “under construction.”

Forecast Rationale

The continued decline of the Russian Navy in the face of a never-ending series of financial famines is illustrated by the current state of the Project 971 class. Although designated as being the backbone of the Russian general-purpose nuclear submarine force, the 971s are fading from service as their reactor core lives expire and funding is unavailable for their refueling. Most of the earliest group of the 971 class have been decommissioned, and the first of the improved Project 971A class has also been withdrawn. The balance of the fleet is operating on a severely limited basis in order to conserve their reactor core lives.

The decision to freeze further investment in these submarines is apparently intended to free up what cash reserves are available for investment in the follow-on

Project 885 class attack submarines (the lead boat of which has now been under construction for 10 years and reportedly less than 10 percent complete). This does not bode well for the 971 class and suggests that the numbers in service will continue to fall. The financial crisis also explains the reports that the two remaining incomplete Project 971 boats will be sold or leased; the funding from such a deal would be invaluable in the present environment.

The real significance of these reports is the common factor that both the Chinese and Indian nuclear submarine programs draw heavily on the Project 971 for their design expertise. The Chinese design, Project 093, is believed to be a derivative of the earlier 971 and may even use components assembled for later members

of the 971 family but never used. Other accounts suggest that India may also be using Project 971U as a base, and that would give the Indian program a very different structure from that currently accepted.

Due to the uncertain relationship between the Chinese and Indian nuclear submarine programs and the Project 971 class, we have now created new reports for both of the non-Russian projects. Any further relationship between 971 and those designs will be discussed there.

One minor point that had caused some dispute was sorted out by photographs of the RFK *Gepard* following her trials in the White Sea. These showed her to differ significantly from the older submarine *Vepr*. *Gepard* is longer, and has additional retractable sensor arrays and a more compact and redesigned housing for the towed array sonar. These differences identify

Gepard as a Project 971U class submarine and confirm that the *Vepr* was a Project 971A, not the first 971U as sometimes alleged.

A dispassionate analysis suggests that the *Gepard* – and, by implication, her sisters from the same sub-class – are generally on a par with the early Los Angeles class SSNs now being withdrawn from US service. On one hand, the Project 971 boats are reputedly a little bit faster than their American rivals, can probably dive a little deeper, and certainly have a more flexible armament. On the other hand, the US submarines are still significantly quieter, and have much better sensors and battle management facilities. The Project 971 has a technical performance that is no better (and no worse) than one might expect of a well-designed boat that dates from the early 1980s. That makes her a good submarine and one well suited to be the basis of the future Chinese and Indian fleets.

Ten-Year Outlook

As no new production is projected, and only modernization and upgrade activity of the onboard systems will continue throughout the forecast period, the forecast chart has been omitted. Any Indian and Chinese production will be listed in the reports devoted to those submarines.

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