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SHARKS OF STRATEGIC DESIGNATION

by Igor Sutyagin

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The giant submarines, known in the West as Typhoon class SSBNs, are known in Russian as Heavy Underwater Missile Cruisers of Strategic Destination (TRPK SN—the Russian equivalent of this phrase) Project 941. *Projects* in the Soviet Union/Russia are close equivalent to U.S. SCB technical projects or *classes*. Some of them (especially recent ones) have names, and the Project 941 is Akula. [Editor's Note: *The huge Russian ballistic missile submarines which the West has named Typhoons are actually known as Akulas in Russia. The attack submarine class which we call Akula is their Project 971 and the correct name is Stchuka-B (pike or bars) multi-purpose (attack) submarine.*] These submarines are the largest such in the world and represent an unique design which, probably, will never be repeated in the future, and due to this reason they deserve description.

Akula subs are the key element of the Typhoon missile system which was designed in the Soviet Union as the technical counter-balance to the U.S. Trident system.

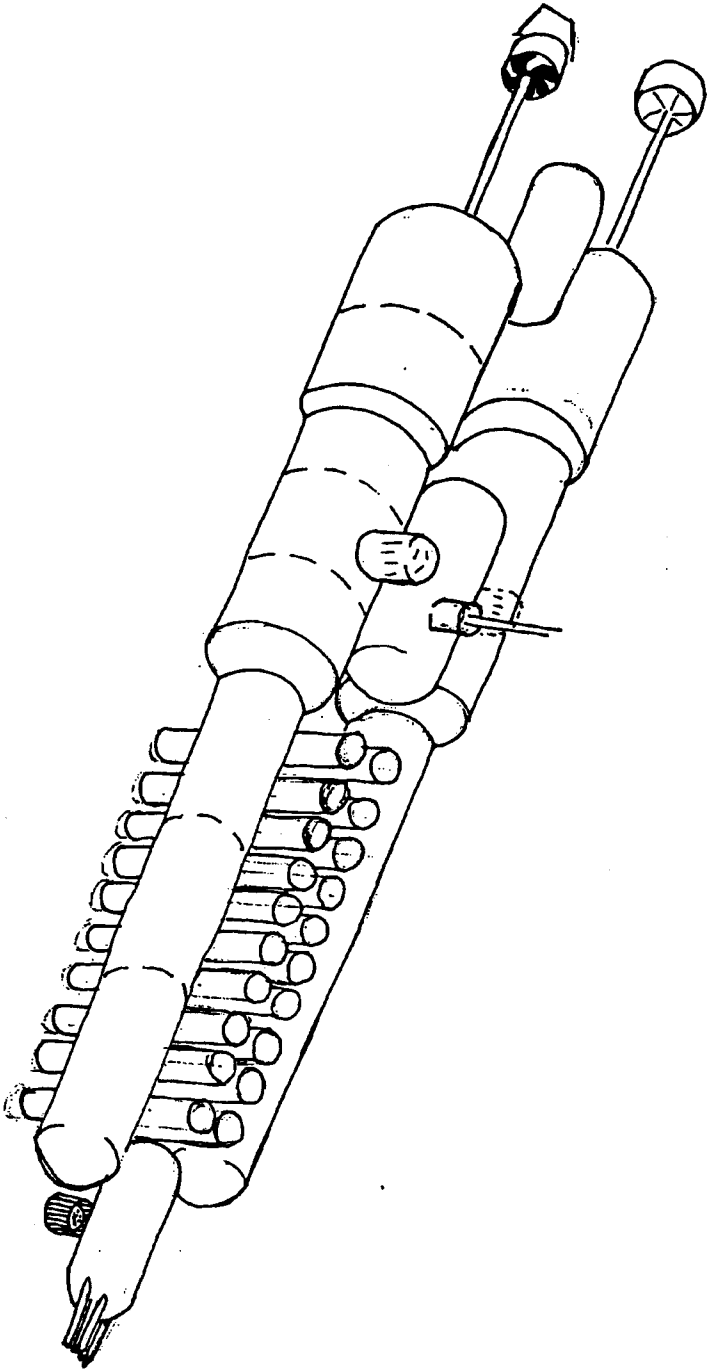
Akula subs, designed at the St. Petersburg Rubin Design Bureau, are the members of the third generation of Soviet/Russian nuclear propelled submarines. Academician Sergey Nikitich Kovalev was their Chief Designer. Their technical (design) project was confirmed in December 1972, and the construction of the first hull began at the Northern Machine Building Enterprise (Sevmash or SMP) in Severodvinsk in March 1977. The last and sixth ship of the class entered service with the Soviet Navy in September 1989, while the seventh hull was cut *for needles* at the yard. Akula subs have designations (so called tactical numbers which are permanent for the submarine's service life) TK-208, TK-202, TK-12, TK-13, TK-17 and TK-20. TK in their tactical

numbers stands for the Russian of *heavy cruise (submarine)*.

The length of Project 941 ships is 172 meters, their beam 22.8 meters and draft while in port 13 meters. (At sea these giant subs do not drain all main ballast tanks while surfaced and their draft is inevitably deeper.) The height of the ship from the keel to the roof of the sail (which hardly can be called so due to its dimensions) is 26 meters. Displacement of these submarines is 23, 500 metric tons surfaced, reserve buoyancy is 38 percent and the submerged displacement is 33,800 MT (metric tons). In fact submarines of the twin hull design, and Akula is designed along this principle, while submerged are to be described by the volume of the outer casing (*light hull* in Russian terms) because they *move* the water the light hull contains between the strong hull and the outer casing. This is especially correct in the case of Akulas due to their design with free flooding holes being closed by hatches while underway submerged for decreased underwater noise. The total underwater displacement of Akulas closely approaches 50,000 MT.

Project 941 submarines have five separate titanium strong hulls and a steel outer casing (see diagram). Two of these strong hulls are the main ones, and three separate compartments are situated between and slightly over them in the centerline fore, middle and aft of the submarine. The main strong hulls are connected to each other through separate compartments by strong passing tunnels. Twenty missile tubes, as well as main ballast tanks and auxiliary machinery and equipment are located between strong hulls of the submarine.

The length of the Akula's main strong hulls is about 149 meters. Each of the two consists of eight compartments separated by bulkheads which withstand overpressure of 10 kgf(kilograms force) per square centimeter [*Editor's Note: roughly 100 meters of depth*]. The diameter of compartments changes along the hull, with three fore compartments (76 meters of the hull's length) having a diameter of 7.2 meters, the following three compartments (in the region of the submarine's sail, their length is 31 meters) about 10 meters, reactor and turbine compartments (30 meters altogether), slightly more than 10 meters. The stern compartment has a length of 13 meters and a diameter of about 8.5 meters.



The central post and attack center of the Project 941 subs is located in the separate compartment (its length is 30 meters, diameter, 6 meters) inside the massive hump under the submarine's sail. The conning tower, as is traditional for the Soviet/Russian design practice, is mounted atop the central post compartment. The torpedo compartment is situated centerline in the fore end of the ship between and slightly over the two main strong hulls and has the length of 22 meters and diameter of about 8 meters.

The Typhoon submarines are equipped with two crew escape modules (VSK—*vsplyvayustchie spatelnyye kamery*, or surfacing escape chambers) flanking the sail between the strong hulls and outer casing. The two VSKs allow the whole crew to escape in case of the submarine sinking to depths one and a half time deeper than the submarine's *design depth* (i.e., its crush depth).

The forward horizontal planes of Akulas are mounted on the hull and are made retractable. This along with the design of the stern planes (*beaver tail*) and the enhanced structure of the sail and the vertical rudder permits the submarines of this project to surface through ice as thick as 3 meters.

The Project 941 subs are powered by two pressurized water reactors (supposedly of the VM-5 type) with OK-650 core. Reactors can operate independently as well as in concert. The first loop of each reactor, each of 190 MW (thermal), includes a pair of heat exchangers (steam generators) with one circulation pump each. One reactor feeds a single main turbine with an output of 70,000 shaft horsepower (shp). The total power of the pair of turbines (140,000 shp) which drive two 6-blade skewed shrouded propellers gives Akula the top speed of 36 knots (submerged).

The steam of each reactor is also used to feed a pair of TMV-32 autonomous turbo alternators (four per ship) of 3,200 kW electric power each. Two 800 kW DG-750 diesel generators (one in each main strong hull) serve as emergency power supply. Project 941 subs are equipped with two 190 kW emergency electrical motors each driving one small size propeller. To improve maneuverability while in restricted areas (in narrows, base, etc.) Akulas are equipped with a pair of auxiliary thrusters, one forward and one stern.

The quieting technique used on the submarines of this project includes two-stage rafting on rubber cord pneumatic shock

absorbers. All quieting measures acting together permits the project 941 subs an underwater noise level (at 4 knots) as low as 65 dB (at the distance of 50 meters against the level of 20 micro Pa) for discrete tones in the range of 5 to 200 Hz and 45 dB/Hz for the 1 kHz wide band.

The main armament of the Akula TRPK SNs is the D-19 Typhoon missile complex (i.e., weapons system) with 20 launching tubes for R-39 SLBMs. (R-39 refers to the missile and associated equipment and interfaces. The missile itself is designated, item 3M65.) The launch weight of these 16 meter long three stage solid fuel MIRVed ballistic missiles is 90 MT with parts, which separate in the process of launch; net launch weight of the R-39 missile is 84 MT.

The missile usually carries 10 independently targeted warheads of 100 kT range yield and delivers the throw weight of 2.55 MT at a range of 9,300 kilometers, 1,000 kilometers more than R-29RM (RSM-54, SS-N-23) SLBM and thus 1,000 kilometers more than it is usually assumed in Western sources. The inertial guidance system of the R-39 missile allows a CEP of 500 meters at the maximal range. Interestingly, the guidance system of these SLBMs does not rely on astro-correction usual for other modern Soviet/Russian SLBMs.

The design of the Project 941 submarines and its missile complex facilitates *salvo* launch of SLBMs which in fact supposes very short—only 15 seconds—interval between separate launches.

The first two Typhoon submarines are now undergoing major overhaul at Severodvinsk. This includes installation of improved R-39UTTKh SLBMs carrying eight warheads instead of 10 as on the previous modification of the missile. (Russian UTTKh stands for "improved technical-tactical characteristics" which means they have advanced capabilities. Other submarines of the class are scheduled for the same sort of overhaul, but it is not clear, due to financial constraints, whether the plan will be successfully put into life, or if even the first two submarines will be successfully modernized. They are some rumors that, due to lack of funds, the first two Typhoon submarines will never reenter service with the Russian Navy and could be scrapped. (With regard to the latter possibility, rumors mainly mention the first hull of the Project 941 class, TK-208, which began the overhaul as early as 1992.)

In addition to the D-19 missile complex, Akulas are armed with four torpedo tubes, two each of 21 and 26 inches, located in two

rows one above another in the torpedo compartment. Combat load is the mix of 20 conventional and rocket powered torpedoes. For handling torpedoes and loading torpedo tubes, submarines of the class are equipped with hydraulically actuated automated rapid loading. In the process of loading of torpedoes aboard the ship while in base, a crane lowers a torpedo on the special tray, which, when not in use, is covered by the longitudinal rectangular hatch easily visible on the pictures of Akula centerline on the bow of the submarine. From this position hydraulic gears of the rapid loader pull the torpedo in the strong hull, move it all around the torpedo compartment to a designated rack and then, when necessary, load it into a designated tube. The operations of the rapid loader are controlled either remotely from the Murena integrated control panel in the torpedo compartment or from local control panels at specific locations.

There are two additional non-reloadable 21 inch tubes on Project 941 subs. These are located externally to the strong hull of the torpedo compartment flanking the lower row of the torpedo tubes and are used to launch VIPS self-propelled acoustic decoys/evasion devices. For self defense against low to medium altitude air threats Akulas are armed with short range IR homing 9M313 Igla-1 SAMs (SA-N-10); eight of which are located in the upper section of the sail behind the bridge.

Underwater surveillance is carried out aboard the Akula TRPK SN by the Skat (skate) sonar suit (sonar integration system) which includes four different sonars. MGK-503 low frequency sonar is the heart of the system. It has the spherical antenna of about a 3 meter diameter with 960 hydrophones situated on its surface wrapped in a 27-stave cylindrical array (with 20 double and 7 single hydrophone staves). The MGK-503's arrays are located below the torpedo compartment. The spherical array operates both in active and passive modes at the frequency range of 0.5-5 kHz which the cylindrical array is used mainly for passive detection of active *pings* of adversary submarines. For this use the cylindrical array is tuned to 3.5 kHz. Information concerning the detection range of MGK-503 sonar in direct path is not available, while it is known the sonar detects targets in the first and second convergence zones.

The MG-519 high-frequency underwater obstacle avoidance and under ice navigation sonar is mounted at the fore section of the submarine's sail on the middle of the sail height. Another sonar

intended to cover the stern arc of acoustic shadow is installed in the stern portion of the sail. The Skat sonar suit also includes the Piton (python) towed array. Its hydrophone section is 80 meters long and has a diameter of 8 centimeters, and it consists of 50 hydrophones operating at 20-200 Hz. Range of this array is 15 nm direct path and the first and second convergence zones. The hydrophone section is towed on a cable 3.75 centimeters in diameter x 750 meters long.

As far as it is known the Skat complex is built around digital computers and a common data bus and can track simultaneously 10 to 12 targets.

Project 941 submarines are equipped with the Tobol navigational radar and Samum (simoom) radio sextant which share the telescopic mast with the Kremniy-2 IFF interrogator/responder. The Medveditsa-941 inertial navigational system of the Akulas can be corrected by star observations as well as with assistance of acoustic beacons deployed all around the area of combat patrol. In addition to that, Akulas use the Simfoniya (symphonia) satellite navigational system which works with Uragan (GLONASS) satellites.

The Tsunami space communication system is the main means of communications for the Project 941 submarines while they receive also ELF and VLF transmission from Zevs and Gerkules (hercules) communication centers. In this case Akulas use Lastochka (swallow) communication buoys, a pair of which is located in the light hull abaft the sail. Tu-142RT Orel aircraft basically similar to the U.S./TACAMO planes are also used to retransmit signals to submerged submarines.

The giant subs are manned by a crew of 170 men, including 50 officers, 80 NCOs and 40 enlisted men. The fact deserves mentioning that originally there were no enlisted billets assigned for Project 941 subs. Crews were supposed to be all professional, (i.e., consist of only commissioned officers and warrant officers). But due to lack of funding for accommodations of necessary personnel ashore, enlisted men were let aboard on some billets intended for NCOs.

The living conditions aboard TRPK SN are superb: all crew members are accommodated in 2 or 4 man staterooms. There are also facilities aboard Akulas which are traditionally considered superfluous for submarines: these are recreational areas (in addition to usual wardrooms), a sauna with a small swimming pool and even a greenhouse. ■