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Defense Threat Information Group

THE KLUB MISSILE FAMILY

Special Report

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The Klub missile family

The Yekaterinburg-based Novator Design Bureau has developed a new cruise missile system designated Klub (NATO**:** SS-N-27 & SS-N-30) and is sometimes referred to as the Club, Biryuza and Alpha / Alfa. The Klub ASCM (anti-sub/ship cruise missile) has been designed to destroy submarine and surface vessels of all known types and also engage static/slow-moving targets, whose co-ordinates are known in advance, even if these targets are protected by active defences and electronic countermeasures. There are presently, two 'known' modifications of the system; Klub-S (for submarines) and Klub-N (for surface vessels). The latter can be installed in vertical launch cells or in angled missile boxes, depending upon operational requirements. Both systems are based on common hardware, the only difference being the design of the missile launchers and the missile transport-launching containers. Both modifications come in the supersonic 3M54E or the subsonic 3M54E1 AShM (anti-ship missile) variant and the 3M14E LACM (Land Attack Cruise Missile) variant. Klub-S can also be armed with the 91RE1 anti-submarine missile and Klub-N with the 91RE2 anti-submarine missile.

The Klub missile family. From the left 91RE2, 91RE1, 3M54E, 3M54E1

3M54E1 / 3M54E1 (SS-N-27 Sizzler)

The 3M54E three-stage anti-ship missile consists of a booster, a subsonic cruise low-flying sustainer stage and a low-flying supersonic terminal stage. For surface vessels of smaller displacement or with shortened torpedo launchers, the system uses the 3M54E1 anti-ship missile, which has a booster and a subsonic cruise sustainer stage, but carries a heavier warhead than the 3M54E missile. After launch from either a vertical or angled deck-mounted launcher or from a submarine torpedo tube, the 3M54E and 3M54E1 follow similar trajectories. At an altitude of up to 150 metres, the solid-propellant booster is jettisoned, the under-fuselage air intake is extended, and the air-breathing sustainer engine is started. At the same time the wings and tail surfaces are extended, and the weapon descends to its cruising altitude of 10 to 15 metres above sea level. At a distance of up to 30 to 40 km from the target, the missile climbs to higher altitude and activates its ARGS-54 active homing radar seeker.

The pointed nose of the supersonic rocket, which forms the payload of the deadly 3M54E AShM, protrudes from the front of the complete missile

Developed by the Radar-MMS company of St. Petersburg, the ARGS-54 seeker has a maximum operational range of 60 km. As the missile continues towards the target at subsonic speed, the seeker scans from +45º to -45º in azimuth, and from and +10º to -20º in elevation. The ARGS-54 is 70 cm long, 42 cm in diameter, and weighs 40 kg without the radome. It can operate in precipitation conditions of up to 4mm/sec and in heavy sea conditions of up to sea state 6. After the target is detected and the seeker has locked on, the 3M54E1 flies on at high subsonic speed to destroy the target. The 3M54E, on the other hand, reaches its target in a different manner. At 20 km from the target, the 3M54E's supersonic solid rocket-powered third-stage terminal 'dart' separates from the missile, descends to 3 to 5 metres above sea level and accelerates to a supersonic speed of Mach 2.9 in a zigzagging terminal run to hit its target. On the one hand helps in penetration of the enemy ship's air defenses, but on the other hand, due the high velocity the missile to become aerodynamically heated, giving it a relatively high infrared signature.

The 3M51E on display in 1996, by Novator NPO, in front of a Su-27IB Flanker.
The scoop for the turbojet is visible to the rear of the missile.

A universal FCS is used to plan the flight mission, upload this to the missile, and conduct pre-launch preparations. Both versions use a common shore-based system for planned inspection and maintenance of the missiles. Since the different types of missile are compatible with a common shipboard system, the user can load the vessel with whatever mix of weapons is best suited to the planned mission. An un-named official with the Novotar Design Bureau, when describing the 3M54E variant, said "The Alfa combines aspects of the U.S. Harpoon and French Exocet besides the U.S. Tomahawk. This configuration offers speed, better fuel economy and a greater accuracy rate than the current Western missiles. Once launched from ship, submarine or aircraft, the 1.5 ton missile cruises at subsonic speed 4.5 meters above the sea to evade radar."

The supersonic 3M51E, with wings extended. The missile also goes by the designation, ASM-MS.

Both the 3M54E1 and 3M54E are small weapons which are difficult to detect on radar, especially should even basic radar signature reduction techniques be applied to them. The use of a bandpass radome and minimal absorbent coatings could push the weapon's head on radar cross section down to that of a large grapefruit.

The subsonic 3M54E1's two stage motor gives it a long reach of 300 km

The first-stage booster of the 3M54E1 missile

The official adds, "At around 40 miles to its approach to the target, the forward section of the missile separates and ignites a solid booster, which rockets the missile to a supersonic speed of Mach 2.9. The purpose of this is to defeat current anti-missile systems with the Alfa missile's sheer speed. By the time the missile is within enemy radar range, it is already doing Mach 2.9. Within seconds it will be upon its target, even before existing anti-missile systems can fire their engines. Its ability to attack land targets is enhanced by a new homing and guidance system that put it in the Tomahawk league." The Klub presents new challenges to Western defenses like Phalanx CIWS and Aegis currently found aboard many Western-built naval vessels. The Klub-S ASCM is planned to be incorporated into Russia's next generation Amur Class submarine, reportedly of which the first vessel is being built for the Indian Navy. However, that is yet to be confirmed from reliable sources.

Russian Designation	3M54E / P-900 Alfa / Klub-S	3M54E1 / P-900 Alfa / Klub-S
NATO / DoD Designation	SS-N-27 Sizzler	
Type	Submarine-launched Anti-Ship missile	
Guidance	Inertial plus Active Radar Homing	
Warhead	200 kg semi-armor piercing	400 kg semi-armor piercing
Propulsion	Solid-rocket booster and turbojet sustainer, rocket boosted penetrator	Solid-rocket booster and turbojet sustainer
Range	220 km	300 km
Speed	Cruise Mach 0.8, terminal up to Mach 2.9	Mach 0.6-0.8
Length	8.22 m	6.20 m
Body Diameter	533 mm	
Wingspan	3,100 mm	
Launch Weight	2,300 kg	1,780 kg
Flight Path	Low-flying, sea-skimming	

Russian Designation	3M54TE / P-900 Alfa / Klub-N	3M54TE1 / P-900 Alfa / Klub-N
NATO / DoD Designation	SS-N-27 Sizzler	
Type	Ship-based vertical launched Anti-Ship missile	
Guidance	Inertial plus Active Radar Homing	
Warhead	200 kg semi-armor piercing	400 kg semi-armor piercing
Propulsion	Solid-rocket booster and turbojet sustainer, rocket boosted penetrator	Solid-rocket booster and turbojet sustainer
Range	220 km	275 km
Speed	Cruise Mach 0.8, terminal up to Mach 2.9	Mach 0.6-0.8
Length	8.92 m	8.92 m
Body Diameter	645 mm	
Wingspan	3,100 mm	
Launch Weight	3,655 kg	3,210 kg
Flight Path	Low-flying, sea-skimming	

91RE1 / 91RE2 (SS-N-27 Sizzler)

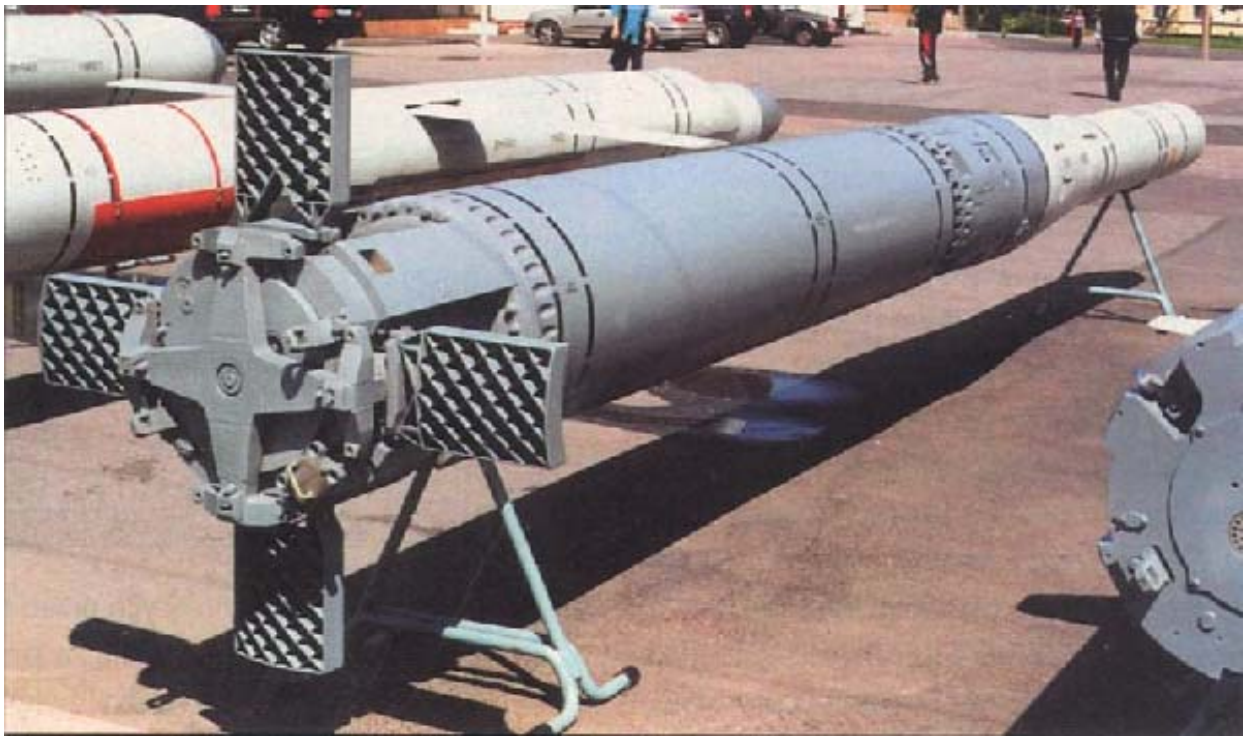
The 91RE1 (Klub-S) and 91RE2 (Klub-N) anti-submarine torpedoes, use a separating underwater missile with a hydro-acoustic seeker and have been designed to destroy submarines. They differ only in their booster configuration. In the Klub-S, the missiles are launched from the submarine's torpedo tubes, while the Klub-N uses ship-mounted launchers and so can fire in any direction.

The submarine-launched 91RE2 anti-submarine missile.

Both variants use a rocket-booster to reach the designated target area. This considerably extends the target-engagement range in comparison to a conventional torpedo. In the case of the 91RE2 variant, it allows surface vessels to create a far larger defensive perimeter against submarine threats. The 91RE2 weights 1200 kg and has a maximum range of 40 km. The 91RE1 variant allows the launch submarine to engage the target submarine much earlier than a conventional tube-launched torpedo. The 91RE1, is designed to be launched from a 533mm torpedo tube at depths of up to 150 meters while the launch submarine is traveling at up to 15 knots. The missile weighs a total of 2050 kg. At the maximum launch depth, target engagement can be at a range of up to 50 km.

The ship-launched 91RE1 anti-submarine missile.

The 91RE1 and 91RE2 anti-submarine missile have a largely ballistic flight profile. The maximum velocity indicated in the table below relates to the ballistic phase, and not the speed at which the weapon emerges from the torpedo tubes or re-enters the water! The missile continues to accelerate during its burn, until the motor cuts out and it coasts to the top of its trajectory. The APR-3 torpedo payload is released and a parachute is deployed to reduce velocity and prevent break up on splash down, upon which the torpedo engages the target submarine.



The first-stage booster of the 91RE1 missile

Russian Designation	91RE1 Biryuza	91RE2 Biryuza
NATO / DoD Designation	SS-N-27 Sizzler	
Type	Anti-submarine missile	
Guidance	Inertial	
Warhead	APR-3ME torpedo / 76 kg semi-armor piercing	MPT-1ME torpedo / 76 kg semi-armor piercing
Propulsion	solid-fuel booster, solid-state rocket	solid-fuel booster, solid-state rocket
Range	50 km	40 km
Speed	Mach 2.5	Mach 2.0
Length	7.65 m	8.90 m
Body Diameter	533 mm	645 mm
Wingspan	n.k.	
Launch Weight	2,050 kg	2,900 kg
Flight Path	Ballistic	

APR-3ME rocket torpedo

The APR-3ME rocket torpedo, the payload of the 91RE1 missile

Russian Designation	APR-3ME
NATO / DoD Designation	n.k.
Type	Anti-submarine torpedo
Guidance	Hydroacoustic
Warhead	76 kg semi-armor piercing
Propulsion	Two-mode solid-propellant mixture water jet with adjustable trust
Speed	130 km/h
Running depth	Up to 800 m
Length	3.20 m
Body Diameter	350 mm
Launch Weight	475 kg

3M14E (SS-N-30)

The 3M14E LACM has been designed to destroy ground-based targets and consists of a booster stage and a subsonic low-flying sustainer stage. The onboard control system includes a barometric altimeter used to maintain altitude in terrain-following mode (making the weapon stealthier than designs which rely on radar altimeters), plus a receiver for the GLONAS Satellite navigation system. The missile has a low flight altitude, 20 meters above sea and 50-150 meters over land. At the terminal stage of the flight the guidance is effected by the 'Korrelatsionaya' system. This guidance system employs a Scene Matching Area Correlator package, which guides the missile to a set of coordinates within a preprogrammed image surrounding the target – it is similar technology to the DSMAC in the BGM-109 Tomahawk. European sources claim this guidance package can hit completely hidden targets providing their location is well known relative to visually prominent features surrounding the aimpoint.

With the exception of the supersonic terminal stage, the 3M14E LACM flies largely in subsonic mode.

The missile exists in two versions - the 3M14E for submarine-launch and the 3M14TE for surface ships. Designed to be fired from standard 533mm torpedo tubes, the missile is almost identical in shape to that of the Klub-S / Klub-N 3M54E1 anti-ship missile. Pre-launch preparation and handling are done using the same hardware as is used for the other missiles of the Klub-S / Klub-N system.

The only difference between the two land-attack variants is that the 3M14E can be launched from a depth of 30-40m below the sea surface, while the 3M14TE surface ship version is compatible with vertical or slant launch from the TPS (transportno-puskovoy stakan) transport-launching container. The modified 3M14EE missile fitted with an enlarged conventional unitary fragmentation warhead or bomblets (a mix of incendiary, AP, HE, which can be varied to meet requirements).

The 3M14E's two stage motor gives it a long reach of 275 km.

The 3M14E and 3M14TE are intended for use against stationary ground targets such as administrative and economic centres, weapon and petrochemical storage areas, command posts, seaports, and airports. Once the mission data needed by the mid-course navigation system has been prepared, it is loaded into the missile's onboard computer prior to launch.

Both versions are launched under the power of a tandem solid-propellant rocket booster fitted with four small lattice stabilisers. Once the missile has reached flying speed, it is powered by a small turbojet engine.

For most of the flight to the target area, the missile flies autonomously, following the pre-programmed route and turning points. Once over land, it uses a terrain-following flight path that will make it a difficult target for enemy air defences. This low-level flight mode poses a higher load on the wings and missile structure than flight over the sea surface, so the land-attack missile has slightly redesigned wings of shorter span and deeper chord, plus a stronger structure.

A close up shot of the 3M-14E's missile fins which it uses to maintain attitude control during flight.

Russian Designation	3M14E / P-900 Kalibr	3M14EE/TE / P-900 Kalibr
NATO / DoD Designation	SS-N-30	
Type	Land-attack cruise-missile	
Guidance	Inertial / GLONASS plus image Correlation	
Warhead	400kg HE	FRAG-HE or submunitions
Propulsion	Solid-rocket booster and turbojet sustainer	
Range	275 km	
Speed	Mach 0.6-0.8	
Length	6.20 m	8.20 m
Body Diameter	533 mm	645 mm
Wingspan	3,080 mm	n.k.
Launch Weight	1,770 kg	1,951 kg
Flight Path	Low-flying, terrain hugging	