

SURFACE-TO-AIR

Osa-1T upgrade boosts combat capability

The Belarus company Tetraedr has completed the development of its 9K33M3-1T OSA-1T upgrade for the 9K33M3 Osa-AKM (SA-8 'Gecko') mobile surface-to-air missile system, writes **Miroslav Gyürösi**.

This adds new guidance modes and includes the optional replacement of some displays and control consoles with more sophisticated hardware. Air conditioning can also be provided.

Almost 80 per cent of the existing computing, command-coding and functional test hardware is replaced by new solid-state-based equivalents. As a result, the time needed for technical maintenance is reduced to 25 per cent of the original, while the number of spare parts has fallen by more than half.

The upgrade does not require the vehicles to be shipped to Tetraedr's facilities; it can be carried out by the customer. All the new hardware meets the Russian GOST V 20.39.304-76 standard for mechanical stress.

The travelling-wave tube (TWT) high-frequency amplifiers previously used in the vehicle's radars give way to modern solid-state replacements. Thus the UV-75G amplifier in the SOTs surveillance radar is replaced by a new USVCs-1-0 solid-state amplifier, while the UV-67A amplifier in the SSTs guidance radar is replaced by a new USVCs-2-0 solid-state amplifier. The noise coefficient of both radars falls from 10 dB to ≤ 3 dB, while the amplification coefficient is unchanged at ≥ 20 dB. As a result, the target channel is five times more sensitive, increasing the performance against targets of lower radar cross-section.

In the unmodified vehicle, the reception channel of the SOTs surveillance radar is particularly vulnerable to hostile jamming. By using new correlated filtering schemes, Tetraedr has increased the suppression of jamming to 25 dB or more.

A new SRP-1T subsystem replaces the older SRP computing and cypher hardware. During the upgrade, the existing SP-2M1, OR-11, OR-12M1, OR-12M2, OR-13, OR-14, OR-15, OR-21, OR-22, SP-1M1 and OK82-2M1 sub-units are dismantled, and the SRP-1T is fitted in the location originally used by the OR-11. The replacement unit adds two guidance modes developed by Tetraedr – KDU (Kinematicsesko-Dinamicseskoye Upravleniye) and MTT (Modifitsirovannaya Trekhtotska). In English-language material released by the company, these are referred to as KDC (Kinematic Differential Control) and MTP (Modified Three-Point) guidance. Both extend the vehicle's air-defence coverage under different firing conditions, including the presence of intense radar jamming.

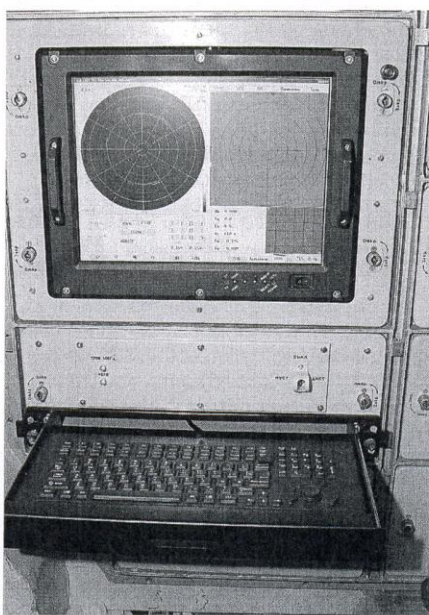
The SPR-1T generates and encrypts the commands needed to steer the missile in



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> (Above) The Osa-1T upgrade increases the system's performance and extends its service life.

> (Left) The vehicle commander's ARM-1T workstation has an LCD colour display and a pull-out keyboard.



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flight; selection between the KDU or MTT guidance methods can be automatic or manual. It provides the 'K1' and 'K2' signals needed to move the missile's control surfaces, and the 'K3' signal that activates the warhead's radio-frequency proximity fuze.

Another example of how a single modern unit replaces several older modules is the new OK51-6M-1T solid-state subsystem used to eliminate false radar signals. This replaces the earlier OO51-7M2, OK51-6M2 and OS51-8M2, which performed the same function.

The vehicle can be operated in several modes: BR (Boyevoy Rezhim = combat

mode), Trenazh (crew drill mode against simulated targets), FK (Funktsionalniy Kontrol = functional test) and RR (Remontniy Rezhim = repair mode). In FK mode, the entire sequence of engaging a target is exercised, but the firing of the missile is electronically simulated.

The vehicle commander now has an ARM-1T automated workstation. This automates the calculation of the engagement zone for the target being tracked, and displays the result and the target data in real time on a flat LCD colour display. Other ARM-1T functions include the control of automatic system tests and crew-training exercises. The screen is hinged in the horizontal plane and the keyboard is a pull-out device.

Training was originally carried out using a 9F632 trainer in a cabin aboard a ZIL-131 truck chassis. This stand-alone system has been eliminated – every fire unit now has a built-in OO04-12M-1T training subsystem. This is located in the SL-1M equipment rack, where it replaces the earlier OO04-12M sub-unit.

Two upgrade features are offered as options. The first involves replacing the existing 9Sh38 Karat day-only camera with an OES-1T (Optiko-Elektronnaya Stantsiya) combined day/night electro-optical package mounted in the same location. The OES-1T can detect and semi-automatically track >>

> This demonstration firing was made against a target flying at 790 km/h, more than 6 km from the vehicle.



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>> aerial targets, and measure their angular co-ordinates and range. It consists of a TOV-1T charge-coupled device (CCD) TV camera usable at low light levels and in the presence of atmospheric haze; a TPVT-1T thermal sight; and an LD-1T laser rangefinder.

According to Tetraedr, the TPVT-1T thermal sight has a 1.5°x1.5° field of view and can detect a tactical fighter at a range of 20–25 km or a cruise missile at 8–10 km. The LD-1T laser rangefinder works in the

1.06 µm band, and can measure the range of a tactical fighter flying up to 13–15 km distant.

The second optional upgrade replaces the vehicle's two original R-123M radios with two new 30–76 MHz R-173M Abzats-M radios. Able to operate in analogue and digital modes, the new radios are designed to cope with high levels of vibration and humidity.

The Osa-1T upgrade increases the maximum speed of engageable approaching tar-

gets from 1,800 km/h to 2,500 km/h, and that of receding targets from 1,080 km/h to 1,260 km/h. The maximum engagement altitude is raised from 5,000 m to 7,000 m.

The maximum range against a tactical fighter rises from 10.3 km to 12 km (20 km if the improved 9M33M3-1 missile is used), and against a helicopter from 6.6 km to 10 km (15 km with the improved missile).

Single-shot kill probability (SSKP) against a tactical fighter rises from 0.5–0.7 of the unmodified system to 0.6–0.8, and for a helicopter from 0.4–0.7 to 0.6–0.8. Against a manoeuvring target, the SSKP of the original system is only 0.2–0.5. After the upgrade, this is boosted to 0.4–0.7.

The 9K33M3-1T Osa-1T upgrade faces competition from modernisation proposals offered by Poland and Russia. Large-scale promotion of the system started in October 2005, with a live-fire presentation at the 174th training range of the Belarus Air Force and Air Defence Forces in Domanovo.

Two successful KDU-mode missile firings were watched by more than 100 invited guests from 10 countries, including representatives of six potential customers – Algeria, Azerbaijan, Ecuador, Eritrea, Iran and Ukraine. The first firing achieved a missile miss distance of 1.7 m in elevation and -0.3 m in azimuth; the second scored -0.1 m in elevation and 3.6 m in azimuth.

Tetraedr is now working on a further upgrade that will create real-time datalinks between all the components of an Osa-1T missile battery.

Greece links Tor-M1 with air-defence system

The Antey Tor-M1 (SA-15 'Gauntlet') self-propelled surface-to-air missile (SAM) system has been successfully linked with Greece's air-defence system, said a report in the Greek newspaper *Ta Nea*.

The procurement of the Tor-M1 between 1998 and 1999 was the subject of a Greek parliamentary board of inquiry, which looked at the problem of linking this Russian-built SAM system with Greece's NATO-standard air-defence system. In 2003, the Greek parliamentary opposition claimed that the Tor-M1 systems were non-operational.

To meet concerns that Russian engineers could gain access to NATO communication protocols, the integration task was tackled by the Greek-owned electronics company SSA, the newspaper reported.

The resulting link-up was successfully demonstrated in two trials conducted in northern Greece under simulated combat conditions. These tests were conducted in December 2005.

Russia offers Buk-M1-1 to Malaysia

Russia's Rosoboronexport arms export agency is striving to market the 9K37M1-2 Buk-M1-2 (SA-17 'Grizzly') self-propelled land-based surface-to-air missile (SAM) system to the Malaysian army, writes **David C Isby**. According to Moscow press reports, the Buk-M1-2 is being promoted to meet an existing requirement under the forthcoming Ninth Malaysia Plan for a medium-range SAM.

Malaysia is reported to be in the process of evaluating the Buk-M1-2, including studying how the Russian missile system would be integrated with the country's predominantly Western-origin defence electronics and equipment. The evaluation will also include an assessment of how the system would be maintained, including the supply of spare parts.

This is understood to be the third time Malaysia has evaluated the Buk-M1-2 system, which was demonstrated recently at the 2005 Langkawi International Military and Aviation (LIMA) arms show in Malaysia. The system faces substantial competition from both western and Chinese counterparts. Press reports in the past have said that Malaysia had agreed to purchase the Chinese KS-1A low-to-high-altitude SAM system to meet its medium-range

SAM requirement. While these have not been confirmed, it appears that the KS-1A remains a strong competitor to the Russian system.

The Tikhomirov Instrument Engineering Research Institute developed the Buk-M1-2 system, while the Dolgoprudny research and development centre developed its missiles. Each system consists of a command post, a target acquisition radar vehicle and up to six self-propelled missile launchers.

● Almaz-Antey stated at the 2005 LIMA exhibition that Russia has shipped to Vietnam the second of two battalions of S-300PMU1 SAM systems ordered in August 2003. The first battalion was delivered in August 2005. Negotiations were under way between Rosoboronexport and Vietnam for the supply of a further batch of systems. Almaz-Antey also confirmed work was under way on the first S-300PMU2 Favorit SAM systems for China. The sale is believed to be for a total of eight battalions.

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