> S-125-2TM PECHORA-2TM ADMS

# TETRAEDR ENTERPRISE: 10 YEARS OF PROGRESS

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The TETRAEDR Unitary Enterprise (UE) is a scientific and industrial enterprise specializing in development and manufacture of advanced radio-electronic weapon systems, hardware and software used in radar and radio electronic control assets, as well as in upgrade of air defense missile systems.

The TETRAEDR Enterprise was founded on April 26, 2001, and now it employs over 350 employees.

Initially TETRAEDR's main direction was development of the cost-effectiveness program for upgrading the Soviet S-125 Neva/Pechora air defense missile system (ADMS) named **PECHORA-2T ADMS**. The upgrading program was mainly associated with introduction of two surface-to-air missile (SAM) guidance methods of the in-house design into the operation algorithms of the Soviet ADMS: the first one was the **kinematic differential control (KDC) guidance method** based on the terminal optimal aircraft control theory; the second one was the **modified three point (MTP) guidance method** based on the local optimal aircraft control theory.

Implementation of the upgrading program resulted in improving target kill probability with a single missile, extending target destruction zone boundaries, increasing manifold jamming immunity, providing two target channel capacity. The S-125-2T PECHORA-2T ADMS enabled destruction of modern small-size targets and aerial targets flying at a speed of 900 m/s compared to 700 m/s as with the baseline S-125 ADMS. An important advantage of the upgrading program was the fact that the upgrade was carried out directly in the customers' territory.

Since 2006, the TETRAEDR UE has been offering foreign customers the project of upgrading the S-125 PECHORA ADMS to the level of the **S-125-2TM PECHORA-2TM**.

Employment in the S-125-2TM ADMS of the KDC and MTP methods of missile guidance, new principles of radar signal processing, the modern electro-optical system and a number of other developments have resulted in creation of the upgraded ADMS that meets the up-to-date requirements in terms of combat effectiveness, jamming immunity, survivability, operation reliability and ergonomics.

At present the S-125-2TM PECHORA-2TM upgrade project is being implemented concurrently for several customers.

By the end of 2010 the total nuber of live firings conducted by the S-125-2T/2TM ADMS has reached 97.

In 2002, a project of upgrading the OSA-AKM ADMS to the **OSA-1T ADMS** version was initiated by using the developments which were incorporated during upgrade of the S-125 PECHORA ADMS. This enabled a substantial enhancement of the main combat characteristics and made them comparable with those of the modern ADMS like TOR-M1, Crotale-NG or ADATS. The target destruction range of the OSA-1T ADMS increased from 10 up to 12.2 km and the target destruction altitude – from 5 up to 7 km. The upgraded ADMS got an ability to destruct aerial targets flying at a speed of 700 m/s.

Further development of the upgrade project of the OSA-1T ADMS resulted in initiating a new project in 2008 – the **T38 STILET ADMS**. The T38 STILET ADMS features enhanced combat and performance characteristics as compared with the OSA-1T ADMS and enables employment of both the

9M33M2(3) SAM produced earlier and the new T382 SAM being developed by the TETRAEDR UE.

Equipment and eight SAMs of the new ADMS are accommodated on a single wheeled chassis MZKT-69222T carrying a powerful diesel engine, navigation systems, topographic precise positioning assets, survival facilities, communication means and power supply means.

The target destruction range of the T38 STILET ADMS employing the new T382 SAM has increased twofold as compared with the OSA-AKM ADMS – from 10 up to 20 km and the maximum target destruction altitude has increased from 7 up to 10 km. The new ADMS enables destruction of higher-speed targets flying at a speed of up to 900 m/s compared to 700 m/s as with the OSA-1T ADMS. The target kill probability is 0.9. The operational lifetime of the new T382 SAM is 25 years.

By the end of 2010 the total number of live firings conducted by the OSA-1T ADMS has reached 64.

The OSA-1T ADMS is in service with several customers.

Since 2009 the project of upgrading to the level of the OSA-1T ADMS has been closed out due to initiation of the T38 STILET ADMS project.

In October 2010 the first five live firings of the T38 STILET ADMS using the 9M33M3 missiles were conducted at training fire range #174 of the Air Force and Air Defense of the Ministry of Defense of the Republic of Belarus. All five targets including two fast-moving IVTs-M1 ones were destroyed.

At present the T38 STILET ADMS project is being implemented concurrently for several customers.

The R&D works carried out at our own initiative have resulted in creation of the **A3 Multipurpose Missile and Gun System** (antiair, antiarmor, antiterrorism). The A3 System was exhibited for the first time at the EUROSATORY-2008 Defense Exhibition (Paris, France).

Apart from solving air defense tasks the A3 Multipurpose Missile and Gun System can be employed to fight enemy's personnel and ground armored targets (main battle tanks, infantry fighting vehicles, armored personal carriers), as well as to solve antiterrorist tasks.

The A3 System is fitted with passive optical means for surveillance, tracking of targets and targeting of weapon assets which ensures complete concealment of its combat employment. The A3 System can be operated at any time under any weather conditions and in different climatic zones.

The A3 System comprises combat and technical assets. The combat assets include a command post and combat modules (up to 6 units); the technical means include a transportation-and-loading vehicle and maintenance vehicle.

The A3 System is constructed using the open architecture princple, i.e. it can integrate different types of antiaircraft missile, artillery and antitank weapons. The controllable rotating platforms, standard data communication channels and multifunctional automated workstations with a special program system constitute the basis of the A3 System. The rotating platforms made on the basis of direct drive motors can accommodate different types of weapons with their targeting systems which integrate into the common system by using special-purpose computers. The module design of the A3 System enables its mounting on different platforms. The A3 System can be integrated with other mobile or stationary air defense systems which safeguard the state's borders and protect seacoast.

In 2002-2005, the TETRAEDR UE developed the **IVTs-M1** and **IVTs-M2** fast-moving aerial target simulators for live firing from short-range and close-in ADMS. By the order of the Minister of Defense of the Republic of Belarus, the IVTs-M1 and IVTs-M2 target simulators were adopted for service with the Air Force and Air Defense in 2002 and 2005, respectively.

Since 2009, the TETRAEDR UE has been upgrading the P-18 radar to the level of the P-18T/TRS-2D and P-19 to the level of the P-19T/TRS-2DL. The TRS-2D radar meets all requirements to the up-to-date and advanced radars and can integrate into any air defense system, including air traffic control systems. All procedures of signal processing, target detection and information retrieval are performed totally automatically (without involvement of men-operators).

The TETRAEDR UE products have been presented more than once at many international exhibitions of arms and military & defense industry: MSPO (Kielce, Republic of Poland), IDEX (Abu Dhabi, UAE), MILEX (Minsk, Republic of Belarus), EUROSATORY (Paris, France).

The TETRAEDR UE has been awarded with medals and diplomas for achievements in the field of upgrade of armament and military equipment, diplomas for unique developments in the field of creation of up-to-date armament and military equipment.

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