

## PROGRAM DOSSIER

# S-300 Surface-To-Air Missile System

**Definition:** The S-300, S-350, S-400 and S-500 are Russian designations for two related but separate surface-to-air missile (SAM) systems. Development of the S-300P and S-300V began as a single system designed to meet the joint requirements of the Soviet Air Defense Forces (Voyska-PVO), Red Army Air Defense Corps (PVO-SV) and Soviet Navy, but diverging requirements ultimately led to two design bureaus building two systems with less than 50% commonality: the S-300P for the V-PVO and Navy and the S-300V for the PVO-SV.

S-300P series was produced by Almaz and its variants carry the NATO designations SA-10 and SA-20. The vast majority of S-300 family systems in service today are part of the S-300P series. The S-300V series was produced by Antey and its variants bear the NATO designations SA-12 and SA-23. These two companies officially united into Almaz-Antey in 2002 and their joint name is associated with later variants of the S-300P, the S-400 (SA-21), S-350 and S-500. China has created a version of the system called the HQ-9, an export version called the FD-2000 and a naval version called the HHQ-9.

Modern Russian long-range SAM units are typically organized around a battery-level unit, often described as a “complex” in Russian, each consisting of a single engagement radar and multiple vehicles that carry the missiles during movement, erect them to vertical when going into operation and launch them during the engagement - and are thus referred to as transporter-erector-launcher (TELs).

**Variants:** The Almaz S-300PT (sources disagree if the ‘P’ stands for PVO or podvizhnyi [“mobile”] and T for Transportiruyemiy) - NATO codename SA-10A - was the original S-300P variant of the system, designed to replace the medium-range S-25 (SA-1) and S-75 (SA-2). Development began in 1969 and the system entered Russian service in 1980. Even the initial S-300PT represented a huge advance in technology beyond its predecessors. It was the first system to use microchip-based processors in all of its components. Its missiles were faster and more agile, its TELs carried more of them and could launch in any direction, and they were guided by a far more advanced radar. Russian S-300PT systems are likely now all out of service, replaced or upgraded to follow-on standards.

The S-300PS (S for samokhodnyye or “self-propelled”) / SA-10B is the first fully mobile member of the S-300P family, which entered service in 1983. The system essentially takes the S-300PT’s components and mounts them on tractors, permitting a set-up and breakdown time for the battery of five minutes each. This ability to “shoot and scoot” gives the system greater survivability against suppression of enemy air defense (SEAD) aircraft. The HQ-2 is a Chinese copy of the system.

Development on the family continued in the late 1980s with attention turning to improved performance against cruise missiles. Around 1990 (one U.S. Army source says 1984), the S-300PM (‘M’ for modifikatsionniy or ‘modified’) / SA-10C variant was introduced. A version for export, known as the S-300PMU (‘U’ possibly for usovershstvovannaya meaning “improved” or uproschenny meaning “simplified”), was cleared for export in 1989.



First shown at the MAKS Airshow in 1992 and cleared for export in 1993, the S-300PMU-1 / SA-20A Gargoyle (originally, SA-10D) introduced a vastly improved, fully mobile search radar, updated engagement radar and TELs and a new missile with far greater range. It could engage aerodynamic targets at altitudes down to 10 meters and intercept ballistic missiles with ranges up to 1,000 km, traveling at speeds up to 2,800 m/s at distances up to 40 km from the battery.

The S-300PMU-2 “Favorit” / SA-20B (originally SA-10E) is a “deep modernization” of the system developed from 1995 to 1997, primarily for the export market. It was first displayed at the 1997 MAKS airshow and first exported to China in 2004.

The S-400 Triumph (originally, S-300PMU-3) / SA-21 Growler is referred to as another “deep modernization” of the system with improved performance against stealthy aircraft, UAVs, precision-guided munitions (PGMs) and large-scale raids as well as the ability to engage stand-off EW, ELINT and AWACS aircraft. It achieves these capabilities by incorporating longer-range radars and missiles, and adding smaller missiles for defense against PGM saturation attacks.

The most recent member of the S-300P series, the S-350E Vityaz, recedes slightly in alphanumeric designation. Development of the system began in 2007 as a follow-on to South Korea’s KM-SAM system that was originally being developed by Russia. Initial firing trials with the 9M96 missile occurred in 2011 and are said to have revealed shortcomings in the seeker, necessitating a redesign that was introduced in 2012. The system was first exhibited at MAKS 2013 and firing trials for the complete system commenced that year. Series production commenced in 2015. Service entry is now expected in 2016.

The S-500 Triumphator continues the S-400’s line of development. The system is said to be capable of engaging targets including ballistic missiles with a range of 3,500 km (or perhaps even ICBMs), hypersonic cruise missiles and perhaps objects in low earth orbit. The system

**Continued, p. 9**

**PROGRAM DOSSIER**

## S-300 Surface-To-Air Missile System, *Continued*

appears intended to complement, rather than replace, the S-400 and may incorporate technology from the S-300V series (described below). Russia currently claims the system will enter service in 2017.

The S-300V (sources suggest three abbreviations - 'V' for VPO-SV, Vysokopodvishnyi meaning "high mobility" or Voyskovoy meaning "tactical"), also known as 9K81, began development in 1969, just like the S-300P, but under the aegis of NPO Antey (also known as the Scientific Research Institute of Electrical Mechanics, or NIEMI). Firing trials of the initial S-300V1 occurred in 1980 and 1981 and the system entered service in 1983, but the preliminary system was only capable of intercepting 300-km-range missiles. The full system became operational in 1988 under the designation S-300V (removing the "-1").

Media reports mention that another variant - the S-300V3 - may have been fielded with Russian armed forces beginning in 1999. The variant may have been procured in small numbers and featured missiles with ranges up to 300 km. The feature and timing raises the possibility of some inclusion of S-300VM technology.

The S-300VM and its export version, the Antey-2500, are thought to have completed development in 1999 and were offered for export as early as 2003. Still intended to defeat both aerodynamic and ballistic

and the commander of Russian Land Forces Air Defense Troops, Lt. Gen. Alexander Leonov, stated that the system entered service at the end of 2014. A second batch, consisting of three batteries, was delivered in March 2015. At that time, Russian media stated the military's contract with Almaz-Antey stipulated the delivery of nine brigades by 2020.

**Exports To China:** China ordered two battalions of the S-300PMU in 1991. The \$220 million deal covered eight batteries, 32 5P85T TELs and between 256 and 384 5V55U missiles. The equipment arrived in 1993. In 1994, Beijing ordered two battalions of the S-300PMU-1. The \$400 million deal covered eight batteries, 32 5P85SE TELs and 196 48N6E missiles. The equipment arrived in the late 1990s. This deal is thought to be part of the 12 S-300PMU-1 battalions China is believed to have acquired between 1994 and 2001.

In 2002, the People's Liberation Army Navy ordered the S-300F Rif for its Type 051C destroyers. The \$200 million deal covered six revolvers with eight 5V55RM missiles for each of the two ships in the order. In 2003 or 2004, Beijing followed up with an order for four to eight S-300PMU-2 battalions consisting of 16 batteries, 64 5P85SE TELs and 256 48N6E2 missiles, for a total of \$980 million.

The Pentagon believes China has produced at least 64 HQ-9 TELs, formed into eight to 16 batteries.

On April 13, 2015, the head of Rosoboronexport confirmed China had contracted with Russia to procure the S-400 system. It is believed the contract was signed in September 2014 and covered delivery of four battalions.

**Exports To Iran:** In 2007, Tehran signed an \$800 million contract with Moscow to purchase eight S-300PMU-1 battalions with 40 TELs. However, in 2010, the United Nations Security Council passed Resolution 1929, which levied sanctions on Iran and prohibited the sale of advanced weapons to the country. In compliance, Russian President Dmitry Medvedev canceled the deal and Tehran subsequently sued Russia in a Swiss court, asking for \$4 billion in fines. Russia has since offered substitute systems including, reportedly, the Tor-M1E and Antey-2500.

In April 2015, following the announcement of a preliminary agreement between Iran and six nations on the nuclear issue, Russian President Vladimir Putin signed a decree removing the ban. In June, Vladimir Kozhin, assistant to the president on military-technical cooperation, said delivery to Iran would proceed and that Moscow and Tehran were negotiating the contract. However, since the S-300 has now been out of production in Russia for several years, Iran would be supplied with S-300s from Russian stocks that would be upgraded before delivery.

**Continued, p. 10**



An S-350 TEL: Vitaly Kuzmin

target, the new version boasted improved range and better performance against stealthy targets. The S-300VM can simultaneously engage up to 24 aircraft.

Slightly more is known about the S-300V4 than the preceding domestic systems due to appreciable Russian media coverage. In 2010, the Russian defense ministry awarded Antey a contract to develop the S-300V4 and produce 30 battalions of the missiles. Development took place between 2012 and 2014, leading to firing trials in November 2014. The first brigade of the system was delivered in December 2014

## PROGRAM DOSSIER

# S-300 Surface-To-Air Missile System, *Continued*

### Other Exports

- Algeria purchased eight S-300PMU-2 BNs in 2006.
- Azerbaijan is believed to field the S-300PMU-2.
- Belarus received at least four batteries of a modernized S-300PS in 2006.
- Bulgaria is believed to have received two BNs of the S-300PT.
- Cyprus ordered the S-300PMU-1 in 1997 and received two battalions, which it deployed on Crete. Around December 2007, the systems were turned over to Greece in exchange for Tor-M1s.
- In March 2015, Russian media reported Egypt had signed a \$1 billion deal with Moscow to procure the Antey-2500 system. Delivery is expected in 2016.
- Eight battalions of the S-300PMU were delivered to Kazakhstan in 2000.
- Serbia and Montenegro have been reported as possessing at least some elements of the S-300PM system.
- Slovakia has one battalion of S-300PMUs and may have upgraded its radar to double their ranges.

- Syria is suspected to have contracted with Moscow for an unknown number of S-300 units after Syrian President Bashar Al-Assad showed interest in the S-300PMU-2 during a state visit in December 2006. Evidence of delivery has yet to emerge.

- In September 2009, Venezuela signed a \$2.2 billion contract, using loan money, to purchase an Antey-2500 system from Moscow. Dates of delivery have not been revealed.

- Between 2003 and 2005, Vietnam acquired two battalions of S-300PMU-1s at a cost of \$200 million. These were delivered in 2005 and 2006.

—Prepared by Dan Katz, lead defense analyst



All Program data is excerpted from the Aviation Week Intelligence Network ([awin.aviationweek.com](http://awin.aviationweek.com)). To learn how to receive full access to updated online profiles of major international defense programs, call +1 646.291.6353 or email [anne.mcmahon@aviationweek.com](mailto:anne.mcmahon@aviationweek.com)

# AVIATION WEEK *Laureate Awards*

March 3, 2016 • The National Building Museum • Washington, DC

Honoring extraordinary achievements and significant, broad-reaching progress in aviation, aerospace, and defense.

Get the **recognition** you and your team **deserve** and submit your nominations by **October, 9!**

[www.aviationweek.com/laureates](http://www.aviationweek.com/laureates)

Powered by Penton<sup>®</sup>

## Industry Data

Specifications: S-300 Surface-To-Air Missile System						
Russian Designation	NATO Designation	Missile	Min. Range	Missile Range	Min. TGT alt. (a/c)	Max TGT alt.
S-300PT	SA-10A Grumble	5V55K	7 km	47 km	25 m	25 km
S-300PS	SA-10B Grumble	5V55R	7 km	75 km	25 m	25 km
S-300PM/PMU	SA-10C Grumble	5V55RUD (V55R)	5 km	90 km	25 m	27 km
S-300PMU-1	SA-20A Gargoyle	48N6E	5 km	150 km	10 m	27 km
S-300PMU-2 Favorite	SA-20B Gargoyle	48N6E2	3 km	200 km	10 m	27 km
S-400 Triumph (orig. S-300PMU-3)	SA-21 Growler	40N6	3 km	380 km	UNK	UNK
		48N6E3	3 km	250 km	10 m	30 km
		48N6E2	3 km	200 km	10 m	27 km
		9M96E2	1 km	120 km	5 m	30 km
S-350E Vityaz	None	9M96E2	1 km	120 km	5 m	30 km
		9M96E	1 km	60 km	5 m	20 km
		9M100		10 km		
S-500 Triumphator	None	40N6M 77NG6-N 77N6-N1		600 km		
S-300V	SA-12A	9M83	6 km	75 km	25 m	25 km
	SA-12A Giant	9M82	13 km	100 km	1,000 m	30 km
S-300VM (Antey 2500)	SA-23	9M83ME	6 km	120-130 km	25 m	30 km
		9M82ME	13 km	200km		30 km
		9M82M2E	13 km	250 km		
S-300V4		UNK		150 km		
		UNK		400 km		37 km
HQ-9 / FD-2000			7 km	125 km	25 m	27 km
		FT-2000	12 km	100 km	3 km	20 km

Source: Aviation Week Intelligence Network

## Industry Data

Specifications: S-300 Surface-To-Air Missile System						
Russian Designation	Launch Rate	Max Speed	Missile Weight	Missile Length	Missile Max Diam	Warhead Wt.
S-300PT	1 / 3 s	2,000 m/s	1,665 kg	7.25 m	514 mm	133 kg
S-300PS	1 / 3s	2,000 m/s	1,665 kg	7.25 m	508 mm	133 kg
S-300PM/PMU	1 / 3s	2,100 m/s	2,300 kg in canister	7 m	513 mm	133 kg
S-300PMU-1	1 / 3s	2,100 m/s	1,799 kg	7.50 m	519 mm	145 kg
S-300PMU-2 Favorite	1 / 3s	2,100 m/s	1,799 kg	7.50 m	519 mm	180 kg
S-400 Triumph (orig. S-300PMU-3)	UNK	UNK	1,893 kg	UNK	UNK	UNK
	1 / 3s	2,000 m/s	1,835 kg	7.50 m	515 mm	180 kg
	1 / 3s	2,000 m/s	1,799 kg	7.50 m	515 mm	180 kg
	1 / 3s	1,800 m/s	420 kg	5.65 m	240 mm	24 kg
S-350E Vityaz	1/ 2s	1,800 m/s	420 kg	5.65 m	240 mm	24 kg
	1/ 2s		333 kg	4.75 m	240 mm	24 kg
				2.5 m	125 mm	
S-300V	1 / 1.5s	1,700 m/s	3,500 kg	7.9 m	915 mm	150 kg
	1 / 1.5s	2,400 m/s	5,800 kg	9.9m	1,215 mm	150 kg
S-300VM (Antey 2500)	1 / 1.5s		3,073 kg	8.6m		150 kg
	1 / 1.5s		6,158 kg			150 kg
HQ-9 / FD-2000			1,300 kg	6.8 m	466 mm	

Source: Aviation Week Intelligence Network