

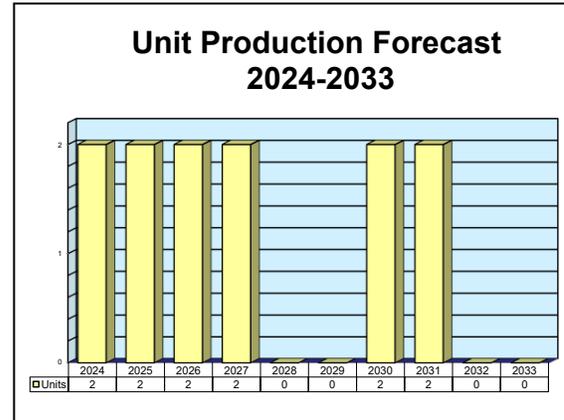
ARCHIVED REPORT

For data and forecasts on current programs please visit forecastinternational.com or call +1 203.426.0800

2S6 Tunguska Air Defense System

Outlook

- Minimal low-rate serial production ongoing
- 2S6 simply cannot compete with older, less expensive systems such as the ZSU-23-4 on the international market
- Even the Ukraine war, where the 2S6 should be of considerable value, has done little for its reputation
- Forecast reflects production for minimal Russian Army procurement and possible export



Orientation

Description. A tracked, self-propelled anti-aircraft artillery/surface-to-air missile system.

Sponsor. The Russian Army continues to sponsor this legacy program of the Soviet Union.

Licensees. None.

Status. Development through low-rate serial production.

Total Produced. Through 2023, we estimate the contractor produced 743 2S6 systems.

Application. A mobile air defense system, providing tactical support for maneuver forces.

Price Range. In 2024 U.S. dollars, the 2S6 carries an estimated unit price of \$15.113 million. The Russians routinely offer various discounts to any potential customers.

Contractors

Prime

Federal State Unitary Enterprise, Rosoboronexport, Rosoboronexport State Corp	http://www.roe.ru , 27/3 Stromynka St, Moscow, Russian Federation, Tel: + 7 495 534 6183, Fax: + 7 495 534 6153, Prime
Ulyanovsk Mechanical Plant	http://www.ump.mv.ru , Moskovskoye Shosse 94, Ulyanovsk, Russian Federation, Tel: + 7 8422 42 03 70, Fax: + 7 8422 32 61 63, Email: ump@mv.ru , Second Prime

Subcontractor

Chelyabinsk Emerson, (METRAN Industrial Group)	http://www2.emersonprocess.com , Komsomolsky Prospect 29, PO Box 11608, Chelyabinsk, Russian Federation, Tel: + 7 351 799 51 51, Fax: + 7 351 247 15 44, Email: info.ru@emerson.com (2S6 System Control Components)
Tulamashzavod JSC	http://www.tulamash.ru , 2 Mosin St, Tula, Russian Federation, Tel: + 7 4872 32 10 09, Fax: + 7 4872 50 51 89, Email: sekretar@tulamash.ru (2A38M 30mm Cannon)

2S6 Tunguska Air Defense System Archived DEC

Technical Data

Crew. Four: commander, gunner, loader, and driver.

Cannon Type. 2A38M.

Caliber. 30mm.

Muzzle Brake. None.

Breech Mechanism. Unknown.

Recoil System. Hydropneumatic.

Ammunition. The 2A38M ordnance fires the following standard Russian 30x291mm ammunition types:

- High Explosive Incendiary
- High Explosive-Tracer
- Armor Piercing-Tracer
- Armor Piercing Discarding Sabot-Tracer

Missile Type. 9M311 (SA-19 Grison).

Armor. Details remain unknown. The armor suite is reportedly of sufficient thickness and composition to provide protection from 7.62mm armor-piercing projectiles.

Dimensions. The GT-S transporter chassis serves as the basis of the 2S6. The following data reflect the latest production standard, the 2S6M. The height figure is with the 1RL144M radar assembly deployed; the height with the radar folded is in parentheses.

	<u>SI Units</u>	<u>U.S. Units</u>
Ordnance caliber	30mm	1.18 in
Length overall	7.93 m	26.02 ft
Width	3.24 m	10.63 ft
Height	4.02 (3.356) m	13.19 (11.01) ft
Combat weight	34.02 tonnes	37.5 tons
Fuel capacity (est)	850 liters	226.06 gal

Performance. The maximum ordnance range data reflect firing HE-I ammunition. The automotive performance data reflect use on a paved road.

	<u>SI Units</u>	<u>U.S. Units</u>
Maximum speed	65 kmph	40.4 mph
Maximum range	510 km	316.7 stat mi
Step	1.1 m	3.61 ft
Trench	2.1 m	6.89 ft
Slope	25%	25%
Gradient	36%	36%
Fording	0.8 m	2.62 ft
Elevation	+80 deg	+80 deg
Depression	-6 deg	-6 deg
Traverse	360 deg	360 deg
Effective ordnance range	4.0 km	4,374.4 yd
Missile range	8.0 km	8,748.8 yd
Rate of fire (ordnance)	5,000 rounds/min	5,000 rounds/min

Engine. V-46-4 liquid-cooled V-12 diesel engine. This powerplant generates 522 kilowatts (699.7 hp), with a power-to-weight ratio of 15.34 kilowatts per tonne (18.65 hp/ton).

The vehicle also mounts a 50-kilowatt (67.02-hp) auxiliary power unit, providing 27-volt DC and 220-volt/400-hertz AC power.

Gearbox. Unidentified manual, constant mesh-type gearbox. The driver employs a hydraulically assisted steering system.

Suspension and Running Gear. Hydropneumatic suspension system, with six roadwheels and three return

rollers on each side. The drive sprocket mounts to the rear. The driver can lower the suspension system 20 to 25 centimeters (7.87 to 9.84 in).

Fire Control. While normally deployed as an element of the 2K22M air defense system, the 2S6 is also capable of fully autonomous operation; the fire control system features both radar and electro-optic tracking and aiming components.

The 1RL144M (HOT SHOT) radar suite consists of two main components:

2S6 Tunguska Air Defense System Archived DEC

- An E-band surveillance radar (with an effective range of 18 km/19,686 yd) on the rear of the 2A40M turret
- A J-band target tracking radar (effective range, 13 km/14,218 yd) on the front of the turret

The surveillance radar can fold to the rear, reducing the traveling height of the vehicle. All turret/armament operations are hydraulically controlled.

The radars provide data to the 1A26M computer, which the gunner controls via the PUIM console. The gunner's

station also features the turret roof-mounted 1A29M stabilized optical sight, which can relay data to the fire control computer. The gunner controls the ordnance and SA-19 missiles through two engagement consoles, with manual backup controls.

The commander operates the search radar and 1RL138M identification friend or foe (IFF) system through the OK1M console. The commander's station also features a target warning/weapon status system.



2S6 Tunguska M Air Defense System

Source: Rosoboronexport

Program Review

Background. Prompted by the perception that the ZSU-23-4 self-propelled anti-aircraft artillery system lacked effectiveness against NATO attack helicopters, the Soviet Army began development of the 2S6 around 1975.

The Mysterious SPAAG

Reportedly entering field service with the Soviet Army in 1985, the 2S6 has existed largely under a cloak of secrecy. Indeed, NATO did not discover the existence of the 2S6 until 1986, referring to the system as the

SPAAG M-1986, ZSU-X, and ZSU-30-2. Prior to 1990, even the type of ordnance employed by the new system remained unknown to Western observers.

Russian troops refer to the 2S6 by the nickname Tunguska. Although it is capable of autonomous operation, the 2S6 normally operates as part of the larger 2K22M air defense system.

Description. Despite the collapse of the Soviet Union and India's employment of this weapon system since 1992, detailed data concerning the 2S6 remain scarce.

2S6 Tunguska Air Defense System Archived DEC

ZSU-Style Layout

The hull features an all-welded steel alloy armor suite, reportedly capable of defeating 7.62mm armor-piercing projectiles. The vehicle exhibits the conventional three-compartment interior layout of the earlier ZSU-23-4. The driver's station occupies the left-front of the hull; the auxiliary power unit mounts in the right-front of the hull. The powerplant and gearbox mount in the rear of the hull. The driver's station features an infrared night driving device and a single-piece hatch cover.

The 2S6 fire control suite consists of the following components:

<u>Designation</u>	<u>Function</u>
1RL144M HOT SHOT	Search (E-band) and target tracking (J-band) radar suite
1A29M	Electro-optical sight
1A26M	Fire control computer
1RL138	IFF receiver
R-173	Vehicular radio
PUIM	1A26M computer control console
OK1M	Radar/IFF control console
PK	30mm 2A38M ordnance control console
PP	9M311 missile control console; also controls NBC protective suite
PN	Sight/weapons control console
SI1M	1RL144M radar control console
SI23M	1RL144M radar control console
SU5M	1RL144M radar control console

The water-cooled 30mm 2A38M cannon each mount a muzzle velocity-measuring device. The cannon fire electrically in an alternating manner. Individual rates of fire are adjustable between 1,950 and 2,500 rounds per minute, yielding a combined maximum rate of fire of 5,000 rounds per minute for each twin 2A38M mount.

Four 9M311 series missiles, sealed in their container/launch tubes and protected by armor plate, mount on each side of the turret. The 9M311 (SA-19) missile is 2.562 meters (8.41 ft) in length. The complete missile weighs 42 kilograms (92.4 lb); the HE pre-fragmented warhead weighs 9 kilograms (19.8 lb). This surface-to-air missile system features a range envelope from 2,500 to 8,000 meters (2,734 to 8,749 yd), with a maximum velocity of 900 meters per second (2,952.7 ft/sec). The 9M311 (SA-19) system employs automatic command-to-line-of-sight guidance. The warhead features a combined laser proximity/impact fuze.

Other onboard equipment includes a combination overpressure/filtration nuclear, biological, and chemical (NBC) protective suite; an automatic fire detection and suppression system; and night vision devices.

The 2K22M Air Defense System

The 2S6 normally deploys as a component of the 2K22M system, which operates as an autonomous air

Guns and Missiles

The 2A40M turret mounts four 30mm 2A38M cannon and eight (six in the original model) 9M311 (SA-19 Grison) surface-to-air missiles. The weapons stations mount in vertically pivoting external sponsons on either side of the turret – two 2A38M cannon and four 9M311 missiles occupy each sponson. The 2S6 carries 1,904 rounds of 30mm ammunition.

In the turret, the commander sits to the right, the radar operator sits to the left, and the gunner sits to the rear.

defense battery. The 2K22M air defense battery consists of the following elements:

- Six 2S6/2S6M fire units
- Six 2F77M missile/ammunition transporter/loader vehicles
- One 1P10-1M repair and maintenance truck
- One 2F55-1M repair and maintenance truck
- One 2B110-1 maintenance truck
- One MTO-ATG-M1 maintenance shop

While the 2S6 can operate autonomously, the support capabilities of the 2K22M battery significantly enhance the capabilities of the 2S6 in the field.

Advantages vs. Disadvantages

The 2S6 represents a significant enhancement of Russian tactical air defense capabilities over the older ZSU-23-4 system. The 1RL144M HOT SHOT two-radar configuration corrects a major flaw of the single GUN DISH radar on the ZSU-23-4, which could not perform simultaneous search-and-target tracking functions. This simultaneous function capability greatly reduces the system's vulnerability to multiple attacks by hostile aircraft.

The mix of 30mm ordnance and surface-to-air missiles offers the best of both worlds, resulting in a tactically

2S6 Tunguska Air Defense System Archived DEC

flexible system. Yet, despite aggressive marketing by the Russian Federation since 1992, the 2S6 has thus far attracted export sales from only five customers (Algeria, India, Morocco, Myanmar, and Peru). This failure to attract export sales suggests that potential customers are

finding faults – real or perceived – in the 2S6 during their evaluations, as well as pointing to the wide availability of less expensive surplus ZSU-23-4 systems.

Funding

The Ministry of Defense of the Russian Federation funds this legacy program of the Soviet Union.

Worldwide Distribution/Inventories

Export Potential. Since the Russian Federation began offering the Tunguska for export in 1992, the 2S6 has generated a good deal of interest on the international market. In 1992, India purchased 54 2S6 systems to replace the ZSU-23-4. However, this air defense system has thus far scored only five additional export sales.

Countries. Algeria, India, Morocco, Myanmar, Peru, Russian Federation.

Forecast Rationale

The 2S6 Tunguska program has been limping along at a minimal production rate, accomplishing little beyond keeping the production line open and the workforce employed.

have done little if anything to help the Tunguska's reputation.

Further, the wide availability of less expensive ZSU-23-4 systems simply renders the 2S6 unnecessary to potential customers.

Fatal Flaws?

As the unit price of the 2S6 is competitive on the international market, the relative lack of export sales leads one to question the effectiveness of this system. This failure to attract significant export sales despite aggressive marketing suggests that potential customers continue to find significant faults – real or perceived – in the 2S6 during their evaluations.

Only a Temporary Reprieve?

We expect only a minimal level of 2S6 production for Russian Army procurement, as well as possible export orders. However, without significant new orders, the remaining production may offer the 2S6 program only a temporary reprieve from oblivion. Notwithstanding the boasts of President Vladimir Putin, the Russian Federation simply cannot afford major 2S6 procurement to replace the 3,279 ZSU-23-4s in Russian Army service.

Even combat operations in Ukraine, where a weapons system such as the 2S6 should be of considerable value,

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Ulyanovsk Mechanical Plant												
2S6												
	743	2	2	2	2	0	0	2	2	0	0	12
Total	743	2	2	2	2	0	0	2	2	0	0	12