

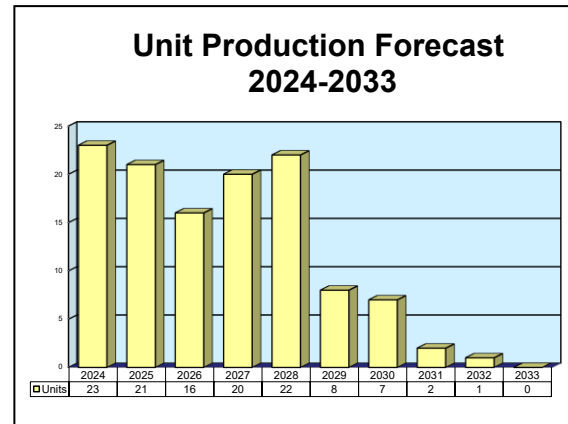
ARCHIVED REPORT

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Bars

Outlook

- Bars flies exclusively on the Russian Su-30MKI / Su-30SM fighter jet and its derivatives
- Indian upgrade requirement calls for an AESA radar; may be filled by a variant of the Irbis-E instead of Bars
- Prospects may be limited for long term production



Orientation

Description. The Bars is an airborne, multimode, pulse-Doppler passive electronically scanned array fire control radar.

Status. In service and production; ongoing logistics support and upgrades.

Application. The Bars equips Sukhoi Su-30MKA, Su-30MKM, and Su-30MKI aircraft. The Russian domestic version of this aircraft is designated Su-30SM.

Price Range. The Bars is typically sold as part of larger packages and contracts. Its estimated price tag is \$2.5 million per unit, but it could vary depending on options, quantity purchased, maintenance provisions, and other factors.

Contractors

Prime

V. Tikhomirov NIIP

<http://www.niip.ru>, 3, Gagarina St, Zhukovsky, Russian Federation,
Tel: + 7 095 556 2348, Fax: + 7 095 556 8887, Email: niip@niip.ru, Prime

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

Bars Archived FEB**Technical Data**

	<u>Metric</u>	<u>U.S.</u>
Radar Type	Phased Array (PESA)	
Amplifier Type	Traveling Wave Tube	
Frequency	I- / J-band	X-band
Max Transmitter Power	1 kW - 5 kW (customer specified)	
Max Targets	25	
Max Target Engagement		
Air	8	
Ground/Surface	4	
Targets with Measurement of Parameters	4	
Max Resolution	10 m - 20 m	32.8 ft - 65.6 ft
Scan Sweep		
Azimuth	+/-70°	
Elevation	+/-45°	
Electronic Scanning	≤+/-45°	
Max Range (Air-to-Air)		
Head-On	≤140 km	≤75.6 nm
Trailing	≤60 km	≤32.4 nm
PPS in Free Space (RCS 3 m ²)	≤110 km - ≤150 km*	≤59.4 nm - ≤81.0 nm*
ZPS in Free Space (RCS 3 m ²)	≤60 km	≤32.4 nm
Max Range (Air-to-Ground/Air-to-Surface)		
Aircraft Carrier	≤250 km	≤135.0 nm
Destroyer	80 km - 120 km*	43.2 nm - 64.8 nm*
Rail Bridge	80 km - 120 km*	43.2 nm - 64.8 nm*
Tank Group	40 km - 50 km*	21.6 nm - 27.0 nm*
RCS 10,000 m ² (Sea Mode)	120 km - 250 km*	64.8 nm - 135.0 nm*
EPR 2,000 m ² (Low Resolution)	80 km - 180 km*	43.2 nm - 97.2 nm*
RCS 200 m ² (Medium Resolution)	50 km - 100 km*	27.0 nm - 54.0 nm*
RCS 10 m ² (High Resolution)	30 km - 50 km*	16.2 nm - 27.0 nm*

* Upper range indicates performance after retrofit upgrade.

Air-to-Air Modes	IFF Data Integration Jammer Tracking & Engagement Missile Direction Target Assessment Target Detection Target Illumination Track While Scan Weather (upgradeable option)
Air-to-Ground Modes	Beam Mapping Doppler Beam Sharpening Mapping GMTI SAR Mapping
Air-to-Surface Modes	MMTI Surface Surveillance Target Detection

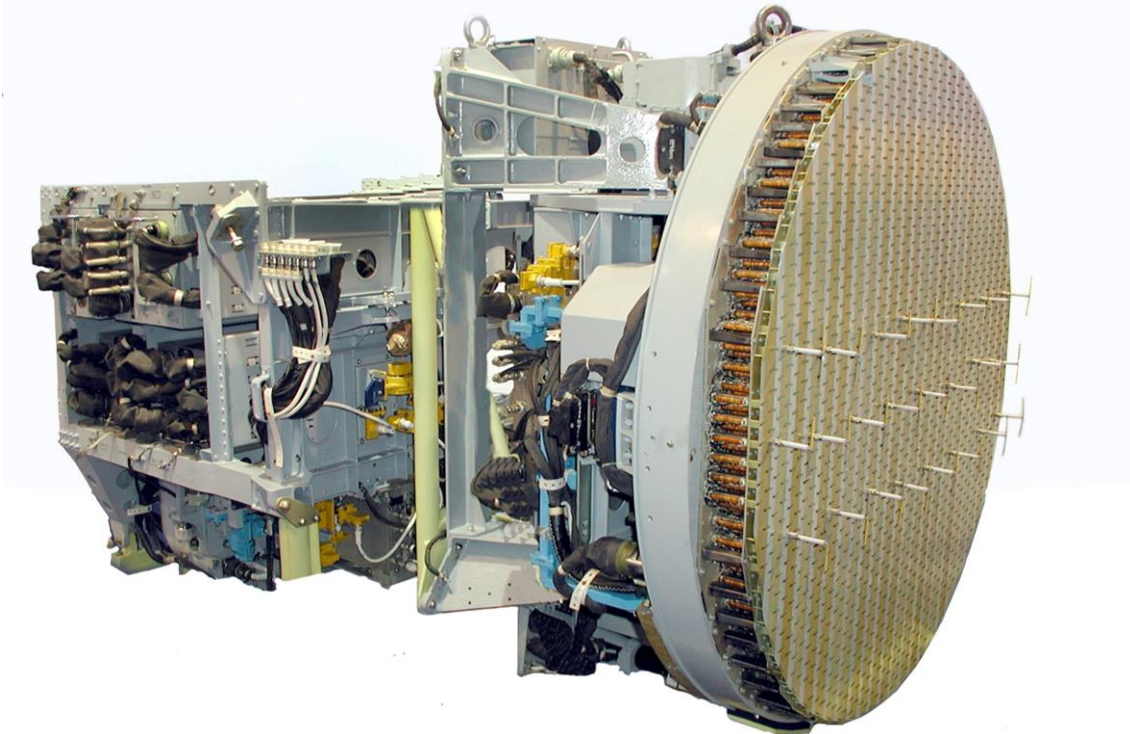
Design Features. Few details are known about the N011M Bars radar. Technical details are kept secret by Russia as well as customers (Algeria, India, and Malaysia). In fact, during a 2007 exercise with U.K. Royal Air Force pilots, the Indian Air Force (IAF)

did not use its Bars radar. In addition, during a Red Flag exercise in 2008, Indian pilots used the Bars radar in a "training" mode, which limits the radar's range and spectrum of capabilities.

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The Bars is a pulse-Doppler system utilizing phased-array technology. The system handles 15 targets in track-while-scan mode and one to four targets in the discrete tracking mode. It can simultaneously track 15

aerial targets, and can engage four at a time. The radar classifies up to 10 targets as aircraft, helicopters, or cruise missiles.



The Bars Radar

Source: Irkut

Variants/Upgrades

Bars-29. The Bars-29, also known as Barsik, is a smaller variant of the Bars radar. It was designed to equip light fighters such as the MiG-29 and Dassault Mirage 2000. In Russian, Barsik is the diminutive form of panther (Bars).

Bars-130. The Bars-130 is under development to equip Yak-130 variants and other aircraft of that size.

Irbis-E. This radar has a passive electronically scanned array (PESA) design, but is considered an evolution of Bars. According to *Military Technology* (October 2009), the Irbis-E can track up to 30 targets in TWS mode and can simultaneously engage up to eight of them. It is expected to equip the Su-35, and perhaps the developmental Sukhoi PAK-FA.

Program Review

Background. Tikhomirov NIIP derived the Bars radar from its RLSU-27M radar, primarily to equip Sukhoi fighters being sold on the international market. The new radar design had to meet Indian Air Force requirements while still fitting inside the Su-30MKI.

In 2005, Tikhomirov unveiled an upgraded version of the radar, Bars-29, which is smaller and can equip fighters such as the MiG-29 and Mirage 2000.

A Trio of Buyers

Algeria, India, and Malaysia are known to have ordered the Bars radar. Malaysia has equipped its Su-30MKMs with the system. Malaysia accepted its first two Su-30s at a ceremony in Russia in May 2007, and the aircraft were delivered to Malaysia the following month. Overall, 20 aircraft were delivered to the country in 2007 and 2008.

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A total of 50 Su-30MKIs, produced in Russia by Irkut, had been delivered to the Indian Air Force by the end of 2007. Under an October 2007 deal valued at around \$1.6 billion, an additional 40 Su-30MKIs would be acquired.

Algeria began taking delivery of its Su-30MKAs in March 2008 as part of a \$1.5 billion contract with Russia. The agreement calls for 28 aircraft.

Trying to Keep Bars 'Under the Radar'

Russia and Bars customers are very secretive about the radar. They do not want to expose the frequencies used by Bars to track enemy targets and launch offensive weapons. In 2007, when India sent six Su-30s to the U.K. to participate in Indra Dhanush II, a joint exercise between the British and Indian air forces, pilots switched off the radar. In 2008, India sent six Su-30MKIs to the United States to participate in the Red Flag exercise. India did use its radar this time, but only in "training" mode, which reduces the range and capabilities of the system.

Number One Customer – India

The Indian Air Force remains the Bars radar's most important customer. *Kanwa Asian Defence Monthly* reported in June 2011 that the Indian firm HAL was assembling 140 Su-30MKI fighters in a program that was to be completed by 2014; this averages out to 15 to 20 aircraft per year. Forecast International's "Sukhoi Su-27/30/34/35 Series" report states that including these 140 aircraft, a total of 272 Su-30MKIs were ordered for the Indian Air Force. Production of these aircraft was completed by March 2020, marking the completion of all Su-30MKIs ordered for the service up to that time. Fifty of the aircraft were produced in Russia by Irkut, and the remaining 222 Su-30MKIs were assembled in India by HAL.

In July 2020, India's Defence Acquisition Council (DAC) approved a proposed acquisition of 12 additional Su-30MKIs.

Follow-On Order for Algeria

Under a deal signed in early 2010 with the Russian arms export agency Rosoboronexport, Algeria acquired 16 Su-30MKAs to add to its fleet of 28 of the aircraft. Deliveries of the 16 aircraft were scheduled to begin in 2011 and be completed in 2012.

Competing on the Platform

The Sukhoi Su-30M can be fitted with different radars, depending on customer requirements. Other possible radars that fit the Sukhoi Su-30M are believed to include the NIIP N001VE, the older NIIP N001, and the Phazotron N010 Zhuk. Therefore, an Su-30M sale does not automatically guarantee an order for the Bars radar.

AESA for the Future

Some countries are now requiring active electronically scanned array (AESA) radars as a part of their avionics packages. *Kanwa Asian Defence Monthly* had reported in June 2011 that a proposal to install AESA on the Su-30MKI for India was under discussion.

AINonline (August 2011) reported that India and Russia had reached an agreement on the technical specifications of the new version of the Sukhoi Su-30MK, or Super 30. The Bars radar would be replaced with the Phazotron Zhuk-A (AESA) radar or a new Tikhomirov AESA radar. The report added that Tikhomirov had demonstrated an improved version of the AESA radar at the Moscow Air Show (MAKS 2011) in August.

In November 2013, in an interview published in *Take Off* magazine, Tikhomirov NIIP Director General Yuri Bely revealed that Tikhomirov would be replacing the Bars' passive phased array with an AESA. No timetable was given. In 2015, India stated that in Phase One of an upgrade program, it would upgrade its Bars radars that were currently in the PESA configuration. In Phase Two of the program, the Bars radars would be replaced or upgraded with an AESA option.

Contracts/Orders & Options

The Bars radar is typically sold along with the Su-30MKI and its variants. Because contracts cover a complete package of aircraft, avionics, and engines, awards for individual subsystems cannot be determined.

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These Indian AF Su-30MKIs all carry the Bars radar.

Source: U.S. Air Force – Airman 1st Class Ryan Whitney

Worldwide Distribution/Inventories

The Bars radar has been operated by **Algeria, Armenia, Belarus, India, Kazakhstan, Malaysia, and Russia** on Sukhoi Su-30MK and Su-30SM aircraft.

Forecast Rationale

It is projected that some variants of the Sukhoi Su-30MKI fighter jet and its derivatives will remain the only platforms to potentially host the Bars radar, thus limiting the radar's potential customer base.

Most fighter programs now specify active electronically scanned array fire-control radars, while the Bars utilizes a hybrid passive electronically scanned array architecture. Therefore, any numbers are speculative.

India, historically the radar's most prolific customer, publicly stated that it would pursue an AESA replacement for its existing Bars. Most other operators

with the financial wherewithal are expected to follow suit.

In this respect, some have speculated that the Irbis-E may take the place of Bars as the preferred AESA replacement for Su-30s.

Forecast International believes that a market for the slightly outdated Bars radar can still be found. The targets would be militaries hoping to bolster their jet fleets with an affordable, slightly lower-tech but still capable fighter/radar option.

Bars Archived FEB**Ten-Year Outlook**

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
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Bars <> Armed Services <> Worldwide <> Su-30 MK/SM												
	22	14	15	16	14	12	8	6	0	0	0	85
Bars <> Kazakhstan <> Air Force <> Su-30 SM												
	30	4	2	0	0	0	0	0	0	0	0	6
Bars <> Russian Federation <> Armed Services <> Su-30 SM												
	182	5	4	0	6	10	0	1	2	1	0	29
Subtotal	234	23	21	16	20	22	8	7	2	1	0	120
Total	234	23	21	16	20	22	8	7	2	1	0	120