

VNIIRA.

AIR TRAFFIC MANAGEMENT  
SYSTEMS AND AIDS



JSC VNIIRA

19, Shkiperskiy Protok,  
Saint-Petersburg, 199106  
Tel.: +7 (812) 356-06-11  
Fax: +7 (812) 352-37-55  
info@vniira.ru  
www.vniira.ru



VNIIRA-OVD Ltd,  
exclusive representative  
of JSC VNIIRA  
in export markets

19, Shkiperskiy Protok,  
Saint-Petersburg, 199106  
Tel.: +7 (812) 356-01-40  
Fax: +7 (812) 356-01-41  
support@vniiraovd.com  
www.vniira-ovd.com



AIR TRAFFIC MANAGEMENT  
SYSTEMS AND AIDS

Air Surveillance Aids

# MODE S MSSR WITH ADS-B 1090 ES FUNCTION «AURORA»

Air Surveillance Aids

Navigation and  
Landing Radio Systems

Weather Radar Systems

Airborne Navigation and  
Landing Equipment

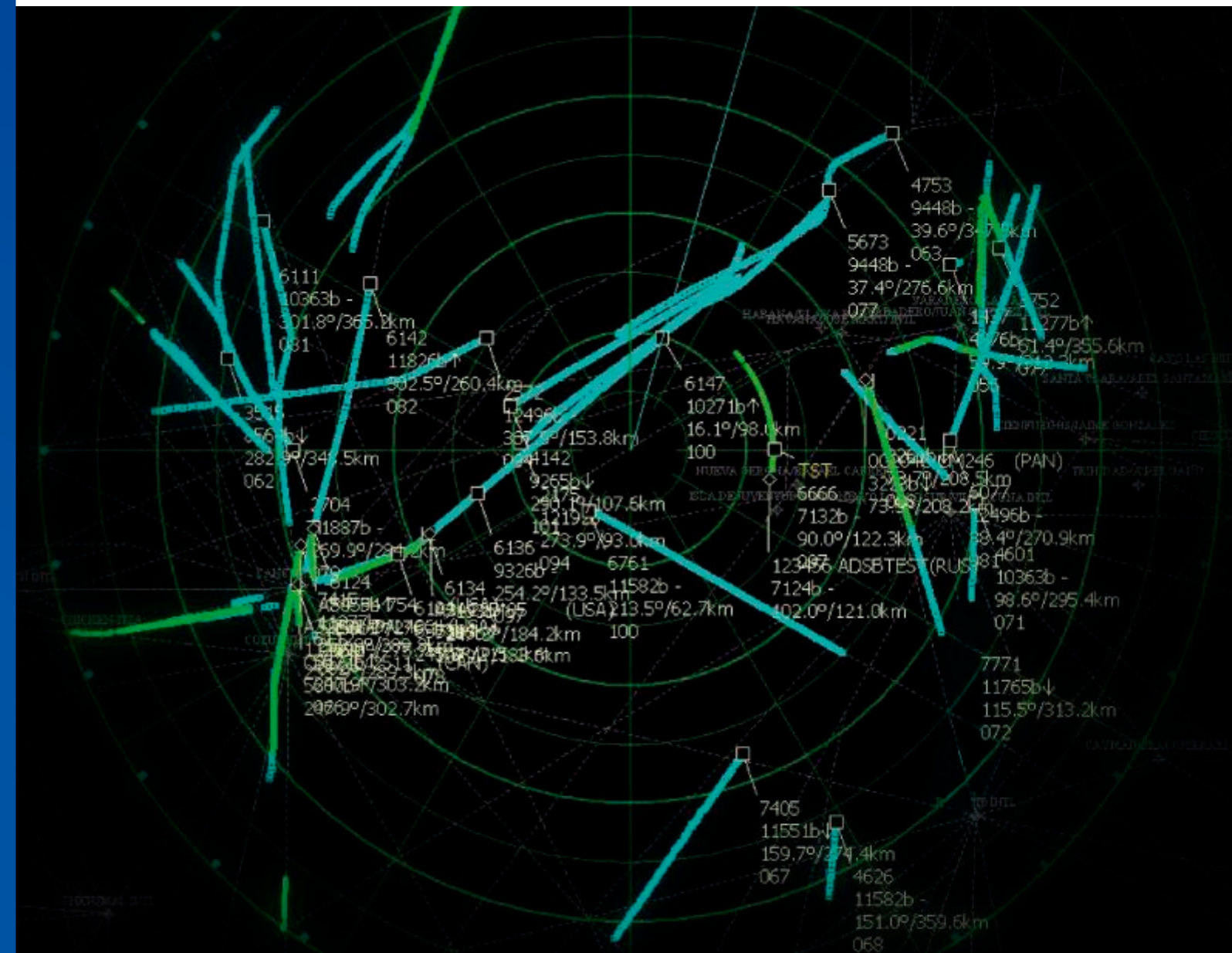
Antenna and Feeder  
Systems and Devices

Automated Flight  
Test System (ASLK)

ATC Training Systems



AIR TRAFFIC MANAGEMENT  
SYSTEMS AND AIDS





**VNIIRA.** AIR TRAFFIC MANAGEMENT  
SYSTEMS AND AIDS

## Information about the Company:

All-Russian Scientific Research Institute of Radio Equipment (JSC VNIIRA) has specialized in the development, production, commissioning and maintenance of navigation and landing systems and aids, air traffic control automation, airborne equipment and weather radars.

Areas of activities:

- | automated ATC and ATM systems and facilities for various control areas and for large regions and separate countries;
- | simulator systems for AT controllers;
- | surveillance, approach control, secondary, and weather radars;
- | ground and airborne equipment of short-range radio navigation systems and instrument landing systems;
- | airborne equipment of range measuring, aircraft (A/C) collision avoidance, and early ground proximity warning systems, and transponders;
- | onboard integrated navigation and landing systems;
- | ground and airborne aids of the Automatic Dependent Surveillance-Broadcast (ADS-B).

In 1999 JSC VNIIRA has got a status of the Federal Scientific Production Center.

In 2004 JSC VNIIRA has joined JSC «Concern PVO «Almaz-Antey».

When working out a solution, VNIIRA specialists prove again and again that they are capable of achieving more, inasmuch as each follow-on development surpasses the previous one. The long experience and our Customers' acknowledgements confirm it.

VNIIRA is far more than:

- | 65 years of the successful performance for the benefit of air safety;
- | 150 prototypes of radio-technical systems and the complex of ground and airborne radio instruments;
- | 1 300 Inventor's Certificates;
- | 60 complexes of ATC automation systems and facilities for airports and regional centers of Russia and other countries;
- | 100 types of home-produced aircrafts and helicopters employ the airborne equipment, navigation and landing facilities developed by VNIIRA;
- | 1 600 employees including 11 Doctors of Engineering Science and 68 Candidates of Engineering Science.



*«AURORA» MSSR – new generation of surveillance aids developed by All-Russian Scientific Research Institute of Radio Equipment (VNIIRA).*

*«AURORA» MSSR – 12-year experience in development and operation of earlier MSSRs and future transition to automatic dependent surveillance (ADS-B).*

JSC VNIIRA has proved effective in creating and introducing up-to-date radars. In particular, 49 sets of MSSR-JAC autonomous monopulse secondary radars are successfully employed in Russia, Kazakhstan, Kyrgyzstan. The Republic of Cuba and Kyrgyz Republic started operating five «AURORA» autonomous monopulse secondary radars.

«AURORA» MSSR ensuring advanced surveillance in ADS-B 1090 ES mode is a new generation of surveillance facilities developed by All-Russian Scientific Research Institute of Radio Equipment (VNIIRA). The radar development factors in the 12-year experience in development and operation of earlier MSSRs and future transition to automatic dependent surveillance (ADS-B).

According to «Global Air Navigation Plan for CNS/ATM Systems» (Doc. 9750 ICAO), key element of the advanced surveillance system will be automatic dependant surveillance-broadcast (ADS-B). By 2015–2020, it is planned to have civil airports equipped with ADS-B 1090 ES systems. «AURORA» is an MSSR with ADS function combining radar source and ADS-B reception station. VNIIRA offers an effective secondary radar for the period of transition to automatic dependent surveillance.

«AURORA» MSSR is certified by Interstate Aviation Committee (IAC).

*Eurocontrol and FAA (USA) – by 2015–2020 plan to equip civil airports with the ADS-B 1090 ES systems to be used as the primary source of information in air traffic control systems.*

## ADS-B 1090 ES «AURORA»



## Overview of MSSR ensuring advanced surveillance in ADS-B 1090 ES «AURORA» mode

The radar incorporates both traditional RBS surveillance interrogation channel (modes 1, 2, 3/A, C) and separate surveillance channel — ADS-B 1090 ES, thus combining customary MSSR and 4-channel ground station ADS-B 1090 ES.

The radar fully complies with ICAO requirements, Annex 10, vol. 4 regarding MSSR and DO-260A RTCA USA – regarding ADS-B 1090 ES.

The «AURORA» MSSR uses up-to-date digital technologies and has no analogous adjustment.

### ADS-B 1090 ES channel

The ADS-B channel has a dedicated 4-sector antenna system and separate receivers which ensure surveillance of aircrafts via the ADS-B channel with the antenna stopped or MSSR transmitter switched off during scheduled operations.

The ADS-B channel allows receiving advanced surveillance data with an update rate of up to 1 sec.

Aircraft positioning accuracy is not affected by distance between them and ADS-B ground equipment.

Receiver setup and use of special algorithm ensuring digital processing of signals providing high probability (over 0.99 per 4 sec.) of detecting up to 500 targets.

Additional comparative monitoring of MSSR data and ADS-B information regarding air targets permits verifying validity of surveillance data.

## Why Customers opt for VNIIRA?

Currently, the secondary radar system is the primary surveillance aid utilized by the automatic traffic control system. No information via the secondary channel permits only low-efficient procedural control.

It took three years to implement the idea of combining independent and dependent

surveillance in radar. During this period, we ran all necessary testing, certification and launched production of the «AURORA» MSSR.

The first Russian «AURORA» MSSR was installed at radar station in the city of Ryazhsk. **VNIIRA has produced already more than 25 radars for radar stations**

**in Sochi, Moscow, Samara, Petrozavodsk and others.** Six «AURORA» MSSRs were delivered to the Republic of Cuba, and one radar of this type was fitted at the Issyk Kul lake, Kyrgyz Republic.

*Why customers choose us?*

*First, we perform like the leading world*

*companies across-the-board. Secondly, we offer competitive radar delivery and maintenance costs. Thirdly, no one could offer radars equipped with ADS-B channel. It appeared to be as good as it gets!*



## Monitoring and control system

The monitoring and control system is developed based on latest advances in this area and allows monitoring over 98 % of components, interfaces, characteristics, and parameters of MSSR.

The system ensures accurate diagnostics of irregularities or deviations in radar operation with their classification.

The system permits connection of up to 3 terminals, two of which may be at whatever distance.

The terminals may be connected both via the telephone line by means of DSL connections at a distance of up to 15 km and via IP router.

MSSR may be operated without permanent attendance by maintenance personnel provided remote control.

A broad range of software tools utilized by the system provide any data regarding real-time operation of radar in the form of user friendly graphs and tables, including information regarding control elements, temperatures, and supply voltages of the entire radar in the form of online diagram updated in real time.

Information regarding status and operation of the radar is logged in archive so that the status archive may then be viewed using special visualization tools and necessary data be picked.



## Receiver

Increased sensitivity of the MSSR receiver compared to other earlier radars ensures high target detection probability.

Digital receiver warrants stability of parameters of reception channels in time which ensures steady operation of the radar during the entire service life without extra maintenance.

100 % repetition of receiver characteristics from item to item ensures exchangeability on the spot.

For online monitoring of radar status during operation, level of sensitivity is continuously measured and phase stability of high-frequency path of all receivers is controlled.

To check radar operation as a whole, «high frequency» of «Test target» capability is implemented at input of respective receiver.

## Transmitter

Single-module solid-state transmitter offering high reliability.

To adapt radar characteristics to operation at specific position, the radar makes use of:

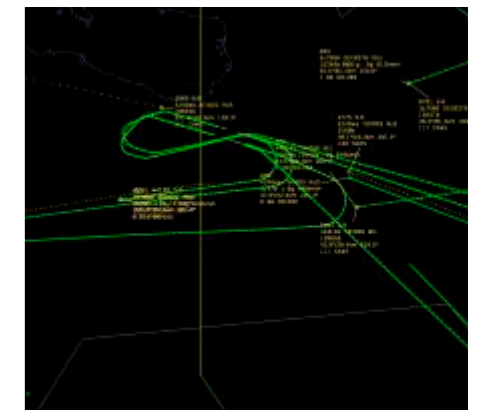
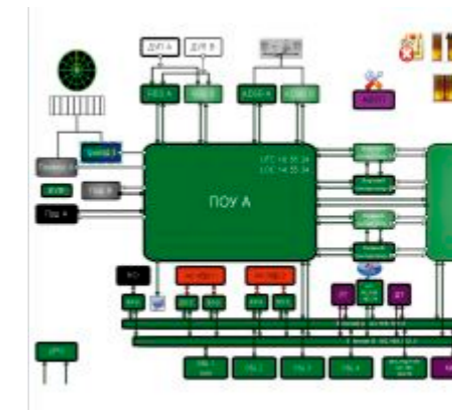
- Independent power adjustment in interrogation and suppression channels;
- «Power map» capability – up to 32 azimuth sectors with individual power levels for interrogation and suppression channels.

Actual power emission levels in interrogation and suppression channels are measured real-time.

Status of high-frequency transmission paths of interrogation and suppression channels are continuously monitored during radar operation through power and SWR measurement.

Special software tools make it possible to capture measurement results online on the control terminal in the form of user friendly graphs.

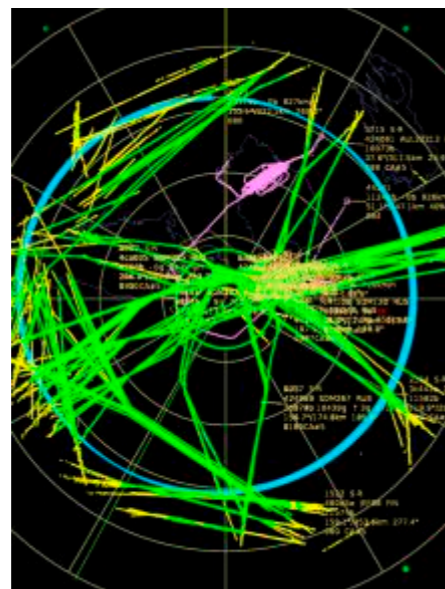




## Plan position indicator (PPI)

Captures targets of MSSR and ADS-B.

To ensure additional monitoring of radar operation, display of digital target data is supported with display of analogous data received via standard Ethernet card. Archiving and subsequent playback of records are ensured so that playback does not interfere with recording of current information. The display systems permits connection of up to 4 test indicators, three of which may be at whatever distance. The test indicators may be connected both via the telephone line by means of DSL connections and router.



## Interaction with consumers and other data sources

The radar uses all known data transfer protocols, including those meeting standard ASTERIX Cat 34, 48, 21, 23) by EUROCONTROL.

Protocol is selected from the control terminal.

MSSR and ADS-B data may be transferred via digital channels customizable from the terminal.

For standard ASTERIX categories, a Protocol builder is provided which makes it possible to select only desired data elements for transmission.



## Main performance data of modified MSSR-JAC

Characteristic	ICAO standard	ADS-B
Coverage area	RBS mode	1090 ES
Max range, km	465	465
Min range, km	1	0,25
Altitude, km	20	20
Elevation angle, degree	0,3/45	0,3/45
Number of targets	>1000	>1000
Modes	1,2,3/A,C,S,ATC	
Accuracy (root mean square error)		
Azimuth, min	<3	
Range, m	20	
Detection probability		
Update rate, s	>0,98	>0,99 (per 4 sec.)
Analogous data transfer lines	4...20	1...4
Digital data transfer lines	4 reserve lines	
Plan position indicator (PPI)	8	8
Protocol	Asterix cat. 1, 2, 34, 48	Asterix cat. 21, 23