VNIIRA.

AIR TRAFFIC MANAGEMENT
SYSTEMS AND AIDS

Complexes of Air Traffic
Control Automation Aids

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

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
office@vniiraovd.com
www.vniira-ovd.com

AIR TRAFFIC MANAGEMENT
SYSTEMS AND AIDS
SINCE 1946

Airspace surveillance aids

Multi-positional surveillance system MERA **(MERA MSS)**

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.

Multi-positional surveillance systems (MSS) based on multi-positional (multilateration) technologies for processing of signals from 1,090 MHz SSR transponders (RBS, S and ADS-B modes) are actively used as high-precision information sources for air situation in airport, airfield and route areas of air traffic control.

Mera MSS from VNIIRA is designed to meet all modern requirements for airspace surveillance systems.

The system can be installed both at airports and landing sites as well as in places with rugged topography (buildings, mountains, etc.).

MERA MSS

Operating principle of multi-positional surveillance system MERA

Receiving stations (sensors) of Mera MSS receive signals from aircraft transponders, decode them and transmit messages containing a decoded reply and a signal reception time to the MSS server multiplexer.

Transmitting stations (interrogators) interrogate aircrafts in A/C, S modes in response to commands from the server multiplexer.

Time is synchronized using the global navigation system satellites and own synchronization signal source – a test and reference transponder.

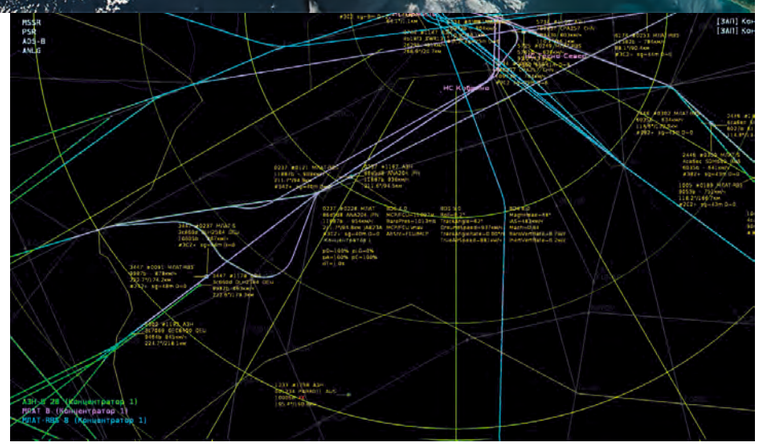
The server multiplexer calculates aircraft coordinates by way of multilateration as a difference in times of their detection by receiving stations. At least 4 receiving stations are needed to calculate coordinates by way of multilateration.

Mera MSS made by VNIIRA is a modern surveillance facility

The latest world-scale advances in hardware components, design and engineering practices and production allowed enhancing the equipment integration drastically and reducing overall dimensions of the station without compromising its functionality. This approach made it possible to improve consumer properties on a qualitative basis: reliability and cost. The system represents an optimal combination "price-quality".

Today, Mera MSS is a multistatic radar operating in S mode with ELS, EHS capabilities:

- A high accuracy of aircraft coordinate measurements.
- Low installation and minimum operating costs.
- Application in all existing modes: A, C, S, ES.
- Small dimensions in combination with low energy consumption and use of different power sources.
- An easily extendable and updatable platform.
- Fault detection and diagnostics.
- High reliability and guaranteed service quality.



MSS use:

- Where a secondary radar is difficult to operate (mountainous area).
- Where a higher update rate or higher accuracy is required (approach and landing area).
- Where there is no secondary radar but infrastructure is available.

Components of multi-positional surveillance system MERA

Receiving station

Receiving stations allow receiving signals from aircraft, decode them and transmit obtained information and test data to server multiplexer. In order to perform measurements receiving stations enable precision time system, receiving and transmitting stations are synchronized by GNSS signals.

Compact, small-sized ADS-B 1090 ES ground station NS-1A, which provides surveillance of aircrafts equipped with equipment carrying out automatic dependent surveillance functions – ADS-B 1090 ES and transmitting date to the Air traffic control centers, is used as a receiving station of Mera MSS.

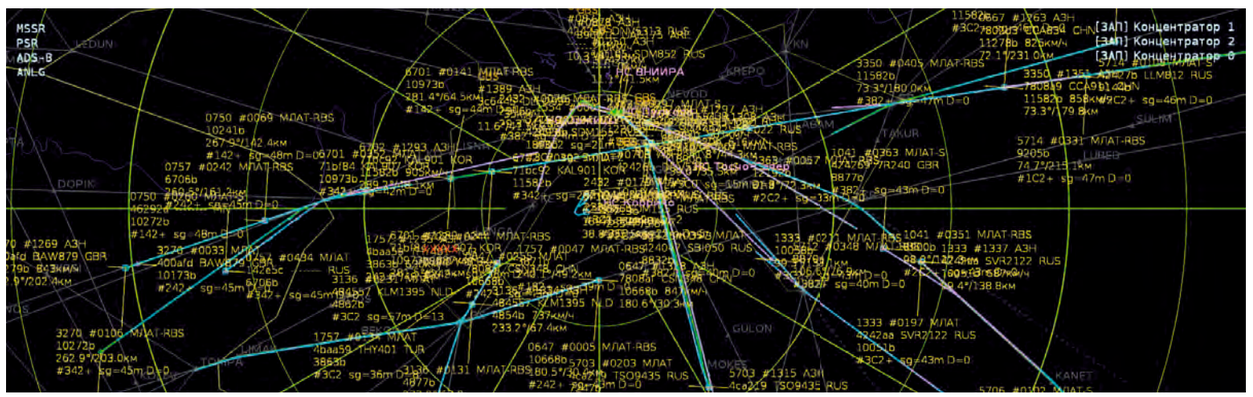
Type No. 559 certificate issued by the airdrome and equipment certification commission attached to the International Aviation Committee (IAC) was obtained for ADS-B 1090 ES ground station NS-1A. Technical characteristics of ADS-B 1090 ES ground station NS-1A comply with the requirements of EUROCAE ED-129 document "Technical specifications for ADS-B 1090 ES ground station" and with those of EUROCAEED- 102A/RTCA DQ-260B.

Technical characteristics ground station NS-1A

Parameter	Value
Standards	ED-129, DO-260B
Sizes	380 × 321 × 157 mm
Temperature	–50...+65
Protection	IP66
Surveillance range	0.25...465 km (within line-of-sight)
Maximum altitude	20,000 m
Elevation angle	0.3...45 degrees
Maximum number of targets	1,000
Output data update probability	>0.99 for 4 s
Output data update rate	0.5...15 s with an increment of 0.5 s
Output formats	ASTERIX Cat 21, 23
Number of consumers	8, with an individual user profile
Receiver sensitivity (MTL)	Over –90 dBm
Test, configuration and control protocol	SNMP

Receiving station supports processing of signals with a number of no less than 250 targets at a distance up to 450 km

Displayed aircraft data: mode attribute, mode A code (for RBS targets), track number, ICAO target address, ICAO identifying index, flight altitude, ground speed, azimuth, aircraft-to-receiver distance etc.



Transmitting station

MSS transmitting station is intended to shape, amplify and control the power of coded high-frequency pulse signals in response to commands transmitted by the MSS server multiplexer through MSS receiving stations and to transmit them to the antenna-feeder line.

Transmitting station receives control signals from RCM and interrogates AC in A/C/S modes with a distance of 300 km min. and maximum power of at least 1.6 kW.

Server multiplexer

MSS server multiplexer is a computing system, which

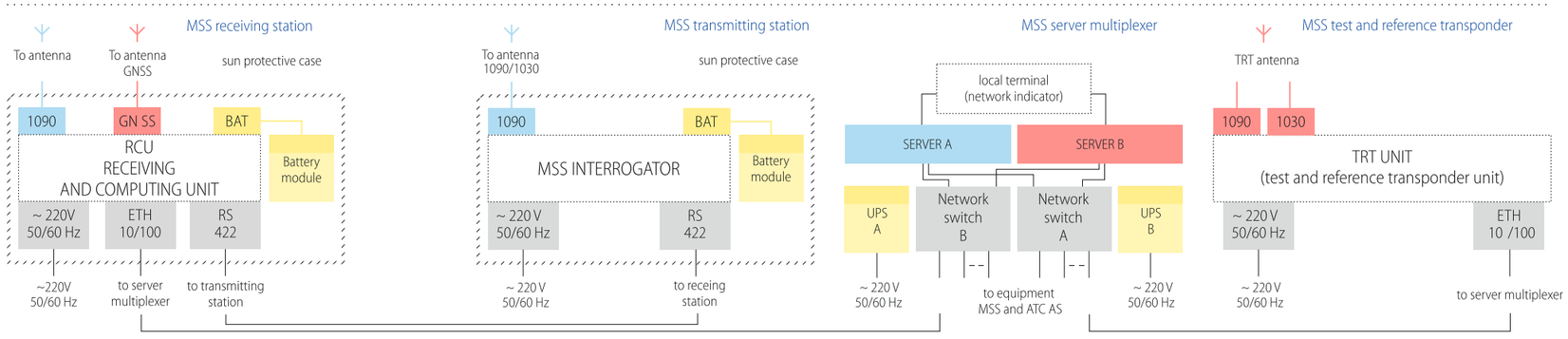
- monitors and controls Mera MSS,
- calculates aircraft coordinates by way of multilateration,
- keeps tracks,
- outputs information to terminals and processes terminal operators' inquiries,
- monitors and tests Mera MSS equipment for faults,
- outputs information to ATC AS,
- continuously registers data on system equipment status,
- continuously records all outgoing information to consumers.

TRT

Test and reference transponder (TRT) comprises TRT unit and TRT antenna. It is used to test MSS system serviceability as a while as well as to synchronize receiving stations in time. The article is an airborne radar transponder simulator operating in RBS, S, and ADS-B modes and performing the following functions:

- receiving and decoding interrogation signals from MSS interrogator;
- shaping, coding and transmitting response signals to MSS.

TRT unit is intended to operate in the open air. The article can be tested and controlled remotely.



MSS server multiplexer performance characteristics

Parameter	Value
Maximum number of receiving stations	24
Maximum number of transmitting stations	8
Maximum number of consumers	4
Maximum number of remote Terminals / indicators	2
Formats	ASTERIX Cat 19, 20, 21, 23
Power consumption	up to 4 kW 220 V 50/60 Hz
Dimensions (W × H × D)	595 × 1,135 × 1,020
Weight	250 kg max.

Multilateration-principle based systems (MSS) – Mera MSS (An experimental zone in the area of Pulkovo airport)

Surveillance zone

Wide area Mera MSS was deployed to arrange for air space surveillance in the area of Saint Petersburg, in 2012.
Wide area MSS is deployed on the base of five receiving stations.
It includes two transmitting stations (interrogators) and test and reference transponder.
It covers approach and hold zones within an area of about 200 km.

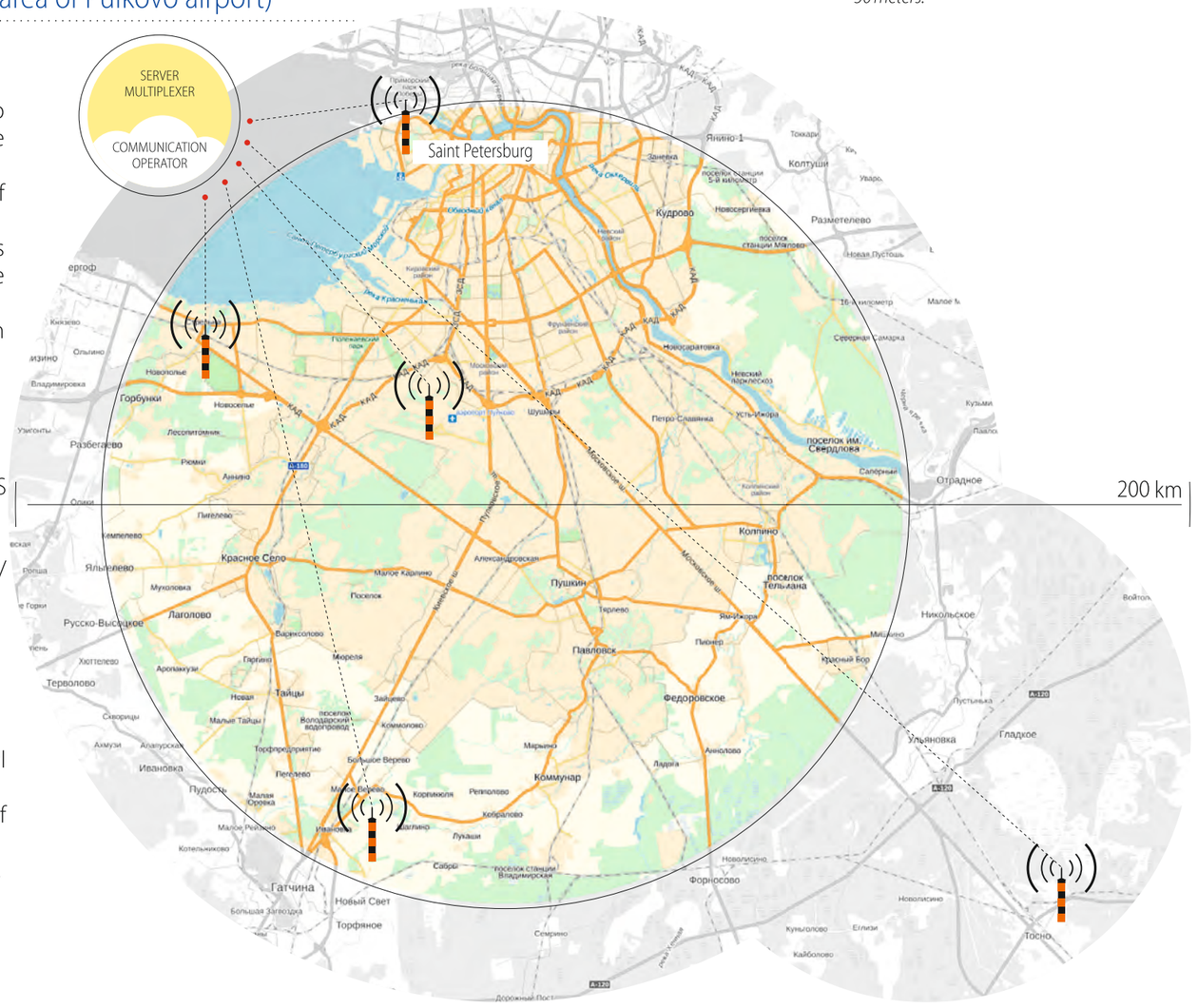
Version

The current version of Mera MSS includes:

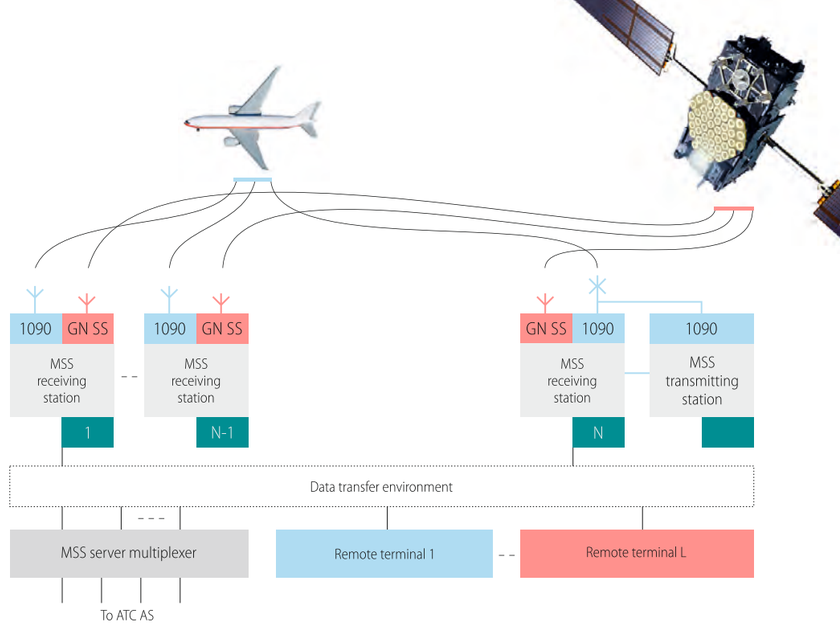
- Server multiplexer + remote terminal / test indicator;
- 5 receiving stations (sensors);
- 1 transmitting station.

Features

- System synchronization using global navigation system satellites.
- Ready infrastructure of communication channels.
- Minimum capital and operating costs.
- Easy expansion of existing system.



Note: The equipment of receiving stations includes antennas, PD equipment. Design height of antenna installation on antenna mast facilities is 30 meters.



Performance characteristics:

Range	200 km, max.
Data acquisition in modes	A/C, S (ELS, EHS), 1090 ES
Horizontal accuracy	50 meters RMS
Maximum number of targets	not less than 250
Detection probability	over 0.99 for 4 seconds
Update rate	adjustable, from 1 second

Sensors

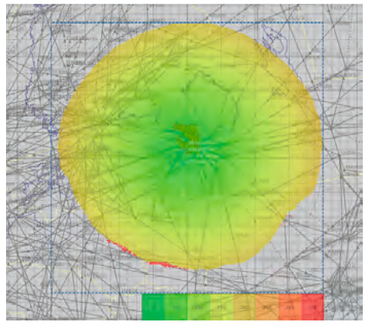
Name	Coordinates	Range	Azimuth	Altitude above relief
Orzhitsy	59°44'56,32"N 029°42'10,53"E 115 m	36.0 km	75.0°	10 m
Tosno-North	59°34'17,90"N 030°49'05,99"E 57 m	36.0 km	325.0°	20 m
VNIIRA	59°56'05,46"N 030°13'41,38"E 17 m	36.0 km	178.3°	12 m
Pulkovo	59°46'52,49"N 030°16'45,01"E 38 m	36.0 km	9.0°	10 m
Kobrino	59°26'12,01"N 030°08'04,01"E 87 m	36.0 km	0.0°	15 m

Interrogators

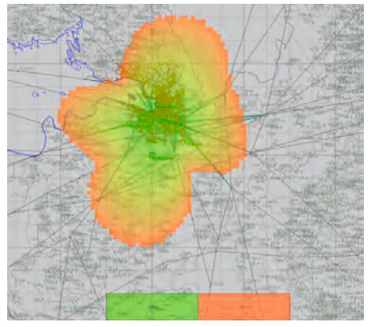
Kobrino	59°26'12,01"N 030°08'04,01"E 82 m	36.0 km	0.0°	10 m

Surveillance zone

Accuracy – active mode



Accuracy – passive mode



It is planned to develop wide area Mera MSS further up to an integrated wide area MSS, which will allow:

- improving accuracy of aircraft (AC) and special motor transport (SMT) location within the airdrome territory providing for reliable control over ground traffic;
- enhancing AC and SMT traffic safety in any weather conditions at any airfield point.