AIR DEFENCE AND ELECTRONIC WARFARE

DEFTECH GLOBAL

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SAFETY. PROTECTION. RELIABILITY.

PREFACE

Established in 2012, Deftech Global Ltd. has evolved into a renowned world-wide provider of a wide range of special purpose goods and equipment. Additionally, our company offers qualified services on repair, modernization and life extension of the relevant products. Deftech is closely connected with leading OEMs in Ukraine and other post-Soviet and East European countries.

Deftech unique experience is based on its long-existing multinational ties and numerous customers all-around the world both in governmental and private sectors. We are also proud to have such a willing and highly-professional team of employees with the extensive backgrounds in different contiguous spheres and markets.

Deftech is definitely a customer-oriented company striving to build and maintain close companion relationships, which stand on trust and mutual understanding.

As a reliable partner, we focus on delivering high-quality products and services adjusted to the customer needs at competitive prices within shortest periods.

We also consider our strength to be in an ability to work in tight time schedule conditions within certain budget restrictions while maintaining the highest standards and providing the optimal results.

Deftech has the honour to present this deliberately complained brochure which embraces our capabilities in the sphere of air defence and electronic warfare, suggesting up-to-date products and solutions.

Additionaly, in case you are interested in a full list of the production offered by our company, we kindly suggest to pay your attention to Aviation, Navy, Land Forces and Law Enforcement catalogues as well.

CONTENT

RADARS

3D AIR SURVEILLANCE RADAR 80K6M

OVERVIEW

Mobile 3-D air surveillance radar is designed to detect low, medium and high altitude target coordinates and may be used as:

- a part of anti-aicraft missile units to provide targeting information to anti-aircraft missile complexes;
- an information link in the air forces and air defense units for air traffic control.

RADAR SYSTEM PROVIDES

- detection, tracking and measurement of the airborne target coordinates and their ground speed under the conditions of no interference, natural noise and active or passive jamming as well as under their combined effect;
- recognition of the aircraft IFF-equipment, individual and flight information gathering from friendly aircraft, data representation and transferring to users;
- jamming station direction finding in elevation and azimuth;
- data transferring to off-line display facilities;
- interactions with command posts of regional and higher national ACP.

OPERATING FREQUENCY RANGE

Operating frequency range:	S
minimum, km	6
maximum, km	400
in azimuth, deg	360
in elevation (mode 1), deg	0...35
in elevation (mode 2), deg	0...55
in altitude, km	40
Scanning interval, s	5 or 10

Target detection range, RCS=3-5 m^2, At P=0.8, $F=10^{-6}$	
In-flight altitude 100 m	40
In-flight altitude 1000 m	200
In-flight altitude 10.. .30 km	300-350
Clutter suppression, dB	>50
Simultaneously track capability	150-200
IFF equipment	built-in
Number of transport units	1
Deployment/closing time, hour	<0,1

3D AIR SPACE SURVEILLANCE RADAR 36D6-M1

OVERVIEW

Mobile 3D air surveillance radar 36D6-M1 is designed to be used as a part of modern automated Air Defence systems and Anti-Aircraft Missile complexes. What is more, this system was constructed to detect low flying air targets under active and passive jamming as well as for Air Traffic Control both for military and civil needs.

36D6-M1 Radar provides primary surveillance of air space, identification, selection of the most foreground target, automatic tracking and targeting to AD Control Post of aviation or AAMC, can operate as stand-alone control post.

TRANSPORTATION BASE AND OVERALL CHARACTERISTICS OF «36D6-M1»

Description	Type of body	Length	Width	Height	Weight, t	Transport vehicle
Radar	СПП-15	13830	2890	3350	20	KrAZ-6446
Power station	КП-10	9040	2870	3300	10,8	KrAZ-6322

3D AIR SPACE SURVEILLANCE RADAR 36D6-M1

CHARACTERISTICS

- High probability of detection of small air targets, hovered helicopters and targets slowly moving tangentially to the radar
- Extremely accurate positional information
- Exceptional interference immunity against jammers of all types
- Capability of jamming station direction finding
- Automatic association of echo signals with return signals of the built-in IFF equipment
- Capability to transmit radar information and targeting over narrow band communication channels
- High reliability
- High mobility
- Extreme stability of transmitter with true coherency

SPECIFICATIONS

Operation band	S
Instrumented range	90,180,360 km
Detection range for low flying targets: RCS -1 m^2	
in-flight altitude 50m	31 km
in-flight altitude 100m	42 km
in-flight altitude 1000m	110-115 km
RCS - 0.1 m^2 (cruise missile) in-flight altitude 50 m	27 km
Azimuth coverage	360°
Elevation coverage	-0,5°...30°
RPM	6 and 12 rev/min
Suppression factor	>48 dB
Accuracy:	
range	50 m
azimuth	0.2°
altitude	400m

Resolution:	
range	300m/at range of 90km
azimuth	3,5°
Track capability	>200 tracks
Environmental conditions:	
temperature	-40°C...+50°C
humidity	98%
height	3000m
MTBF	>800 hours
MTTR	<30 min

2D VHF SURVEILLANCE RADAR P-180U

OVERVIEW

Ground-based long-range VHF surveillance radar P-180U is presented as a modernized follow-on to its prototype, the analogue P-18.

As a result of modernization the radar's detection performance is efficiently improved.

Modernized radar features automatic tracking capability as well as data receiving from other radar sensors. Data can be transferred over a variety of communication channels.

DEPTH OF MODERNIZATION:

- Radar equipment cabin has been fully modernized. Frequency range is expanded to 140 - 180 MHz, number of working frequencies increased from 4 to 200, capability of instantaneous electronic frequency agility is added. Radar transmitter and receiver feature solid-state components only. Transmitter has a modular design and provides 'soft-failure' redundancy: failure of individual module leads to partial performance degradation.
- Antenna-mast assembly is equipped with new asynchronous motor drive assembly controlled by frequency inverter.
- P-180U radar remains a two-dimensional system and is used to find azimuth and range. Altitude can be obtained by interfacing modernized height-finding radars. Parameters of transmitted signal as well as parameters of signal processing after reception can be set at the operator workstation. Secondary processing and tracking are performed at the remote workstation. Both workstations are installed in equipment cabin.
- P-180U radar features efficient protection against pulse interference and active jamming. Level of interference is continuously monitored and graphically represented to operator. Jamming protection is achieved through the expansion of dynamic range of the signal processor and capability of electronic frequency agility. Passive interference is rejected through digital adaptive MTI and generation of clutter map.
- Number of vehicles in standard configuration has been decreased from 4 to 2. Two power generators are accommodated in an individual compartment of the antenna-mast assembly vehicle. Other design options are possible: radar equipment can be placed on a single semitrailer or on trailers without vehicle chassis. Power generators can be placed on separate vehicles. Modernized P-18MA radar is adopted by MoD of Ukraine for its Armed Forces.

P-180U RADAR FEATURES:

- metric band for «counter-Stealth» capability;
- maximum use of COTS components;
- stable, fail-soft, modular solid-state transmitter;
- built-in test equipment;
- no special adjustments required during operation;
- largely simplified maintenance;
- engineered for minimum cost of ownership.

2D VHF SURVEILLANCE RADAR P-180U

SPECIFICATIONS

PARAMETER	VALUE BEFORE MODERNIZATION	VALUE AFTER MODERNIZATION
Range of working frequencies, MHz	150-170	140-180
Frequency agility:		
method for frequency agility	electromechanical	electronic
discreet steps	4 fixed frequencies	200 kHz
frequency setting accuracy	n/a	±10 kHz
Types of transmitted probing pulses:		
short pulse	6 µs	6 µs
phase shift keyed signals:		
13-bit		13 x 6 µs
28-88 bit		(28 – 88) x 6 µs
Transmitter pulse power	300 kW	8 kW
Capability of instant probing signal power and structure changes	Not implemented	Implemented
Detection range for a target with RCS of 2.5m², P=0.5 at antenna height of ha=6.35/10.35:		
min range	-	2,7 km
at altitude of H=100 m	28/30 km	30/32 km
at altitude of H=500 m	50/60 km	60/70 km
at altitude of H=1000 m	65/75 km	70/80 km
at altitude of H=3000 m	90/110 km	110/120 km
at altitude of H=10000 m	175/250 km	300/360 km
Detection accuracy:		
range	1400 m	180 m
azimuth	1.50	0.40
Resolution:		
range	2000 m	1100 m
azimuth	80	80
Range of adaptive MTI	-	0-400 km
Clutter suppression ratio	-	> 40 dB
Dynamic range of receiver and digital signal processor	-	> 100 dB
Automatic control of modernized height-finders	-	Implemented
Number of controlled height-finders	-	up to 4
Start-up time	8 min	3 min
Power consumption	10 kW	up to 6 kW

2D RADAR FOR LOW-ALTITUDE TARGET P-190U

OVERVIEW

2D Surveillance Radar for low-altitude target detection P-190U implements all of the modern design methods.

P-190U is a result of the longstanding experience of Ukrainian OEMs in manufacturing up-to-date high-tech equipment for Air Defense, Air Force and Air Traffic Control customers from many countries around the globe. Customers who have P-19 radars that have seen their service life expire can now extend it with this P-190U modernization program.

MAIN FEATURES:

- full coherence is implemented, due to the significant improvements in radar performance;
- a wide range of narrow and broadband probing signals enabling radar adaptation to various combat conditions;
- digital signal processing, including matched filtration, clutter and active jamming suppression, target detection and coordinate measuring, target tracking and data distribution to consumers;
- practically approved reliable software with user-friendly interface;
- only COTS components are used from renowned suppliers - this coupled with quality system approval guarantees the high level of reliability.

ADVANTAGES OF P-190U:

- large number of probing signals, ability to choose the best depending on the air situation, jamming and combat conditions. For instance, narrow band for near field (good detection against clutter background), broadband for long range (large detection range, especially for smaller size targets);
- parameters of probing signal - working frequency, modulation type, waveform - are all reconfigurable;
- reconfiguration of signal parameters can be carried out via program or randomly (plus, reconfiguration of probing signal parameters does not affect the quality of clutter suppression);
- increase of signal to noise ratio due to matched filtration of received signals, increase of detection range and accuracy;
- significant (up to 100dB) increase of a dynamic range resulting in high jamming immunity and suppression of clutter and weather formations;
- efficient algorithms for clutter suppression with wind speed compensation;
- automatic combining of amplitude and coherent channels which decreases signal loss and increases detection range and accuracy;
- implemented functions of a radar extractor for post-detection signal processing (detection, location measuring, plots generation, clutter map, scan-to-scan processing, stabilization of false target generation, processing of identification signals, data distribution to consumers);
- low power consumption;
- user-friendly design for easy operation (maintenance) of radar;
- efficient monitoring system of all components.

DEJAMMING CAPABILITIES

A range of hardware and software solutions are implemented in the radar P-190U enabling suppression of the following kinds of jamming:

- nonsynchronous and chaotic pulse noise;
- response pulse noise;
- active noise jamming.

Suppression of pulse noise is implemented in software and enables full suppression of pulse noise.

For suppression of active noise jamming including interfering from TV centres, radios and other sources the following steps are implemented:

- automatic monitoring of active noise conditions and automatic adaptive working frequency hopping 0.4 MHz discreet;
- high dynamic range of signal processing system (of the receiver and digital signal processing unit) - 105dB;
- extra expansion of dynamic range (by 30 dB) through automatic gain control;
- 4-channel dejammer of active jamming is offered as an option, providing jamming suppression of 32 dB (at SNR of 40 dB).

2D RADAR FOR LOW-ALTITUDE TARGET P-190U

RADAR DESIGN

Design of the radar can be changed in accordance with customer requirements. Radar equipment can be placed on ZIL, KrAZ, KAMAZ vehicle chassis (and similar) or in a fixed-position shelter. As an option, this equipment can be installed in a modified hardware compartment of the P-19 radar. A partition is inserted in this configuration in order to separate hardware and operating personnel. The advantage of this option is that it lowers the price of the radar.

All the equipment has been installed in one compartment. Hardware is mounted on the walls on specially designed frames providing easy access to all composite elements and easy maintenance.

There are operator working positions and remote working position with seats for operating personnel.

The mast antenna assembly is placed on a separate vehicle (trailer). Power supply system is placed on a separate trailer(s) or on the antenna trailer. Power from industrial mains can also be arranged.

SPECIFICATIONS	VALUE
Frequency band	820-890 MHz, 0.4 MHz discreet
Measured parameters	azimuth, range
Radar coverage:	
min range	1.5 km
max range	300 km
Location accuracy:	
range	90 m
azimuth	0.3˚
bearing of active jammers	1.5˚
Resolution:	
range	550 m
azimuth	5˚
Jamming immunity:	
Against active jamming:	
automatic monitoring of clutter conditions and automatic adaptive working frequency hopping 0.4 MHz discreet	+
high dynamic range of signal processing system (of the receiver and digital signal processing unit) - 105dB	+
extra expansion of dynamic range (by 30 dB) through automatic gain control	+
4-channel dejammer of active jamming is offered as an option, providing jamming suppression of 32 dB (at SNR of 40 dB)	option
Against passive jamming:	
clutter suppression ratio (factor)	not less than 50 dB
working zone of the MTI system	0-300 km, adaptive MTI, clutter map
Against nonsynchronous pulse jamming:	full suppression
Target detection mode, tracking:	
plots per scan	up to 1000
number of tracks	up to 150
active jammer tracking	up to 36
Height-finder control mode (option):	fully automatic, on condition of installation of height-finder extractors
number of controlled height-finders	up to 4
FA guidance modes and ADMS targeting (options):	+
Operating conditions:	
temperature	-40˚... +50˚
relative humidity	95%
max asl	2500 m
Combat crew	3
Start-up time	40 sec.
Set-up/tear down time	up to 20 min
Power consumption	5 kW (without air conditioning system)

RADAR P-18-MR

OVERVIEW

Ground-based, mobile, jamming protected radar for aerial and maritime target designation P-18-MR has been developed for digital processing of the data obtained in regards to aerial and maritime targets designation, identification and tracking.

The radar is able to automatically designate the target's current coordinates (azimuth, slant range, direction, speed and altitude) and trajectory of the stealth targets.

Radar complex includes crew training simulator facilities.

The radar is protected against active and passive jamming. Automatic elimination of radar signal radiation zone ensures increased survivability of the radar.

SPECIFICATIONS

Frequency band		145-175 MHz
Number of air targets pursued simultaneously by the radar		256
Range of small size low flying targets identification (altitude 300 m)		100 km
Maximal height of target identification		20 000 m
Maximal range of identification		500 km
Minimal distance of target designation		5 km
Fixed frequency shifting time		≤ 0.005 sec
Remote control unit distance from the radar complex		≤ 5000 m
Breakdown operation time		≥ 3000 hours
Turn-on time radar		≥ 3 min
Deployment time (5 persons crew)		45 min
Power consumption		≤ 7 kW
Weather conditions		-40° - +50°C
RMS error of target coordinates designation while no jamming conditions	range	180 m
	azimuth	0.4°
	speed	12 m/sec
Resolution capability	as per distance	1200 m
	as per azimuth	≤ 6°
	as per speed	3 m/sec
Radar work site Altitude (compared to the sea level)		≤ 3000 m

MOBILE COHERENT-PULSE ALL-ROUND SURVEILLANCE RADAR «DELTA»

OVERVIEW

«DELTA» is a modern mobile twodimensional pulse coherent solid-state radar for surface and air surveillance, which has got low probability interception of its electromagnetic radiation. It delivers in a fully automatic way the current coordinates of any target located within its detection area.

This mobile radar could be installed on transport vehicles (automobiles, armored personnel carriers, infantry combat vehicles etc.) which allow arranging its operation in uplands in order to assure necessary viewing conditions.

«DELTA» analyzes space in azimuth by the continuous rotation of its aerial system, which is mechanically driven.

MAIN PURPOSE:

- observation of air and ground situation in the zone of location of particularly important objects;
- monitoring of economic and customs zones with the aim to prevent smuggling and terrorist actions.

RADAR PROVIDES:

- automatic detection and tracking of airplanes, helicopters, deltaplanes, ground and surface targets at any time of day and year, at rain, fog, dust, and sandstorms;
- recording of selected paths of targets and transmission of data to police, border guard, customs, and security agencies as well as generation of alarm signal.

MAIN FEATURES:

- solid-state transceiver;
- digital generation of complex-modulated sounding signals;
- digital processing of signals and information on paths;
- high efficiency of detection of moving targets under exposure of intensive passive interferences;
- application of non-parametric algorithms of automatic detection, making it possible to get rid of false target blips regardless of the existing interference situation;
- automatic measurement of coordinates and generation of routes of moving targets;
- visual display of radar-derived situation on a LCD screen;
- automated control of operating modes from a portable computer;
- documenting of operation results.

RADAR TECHNICAL FEATURES

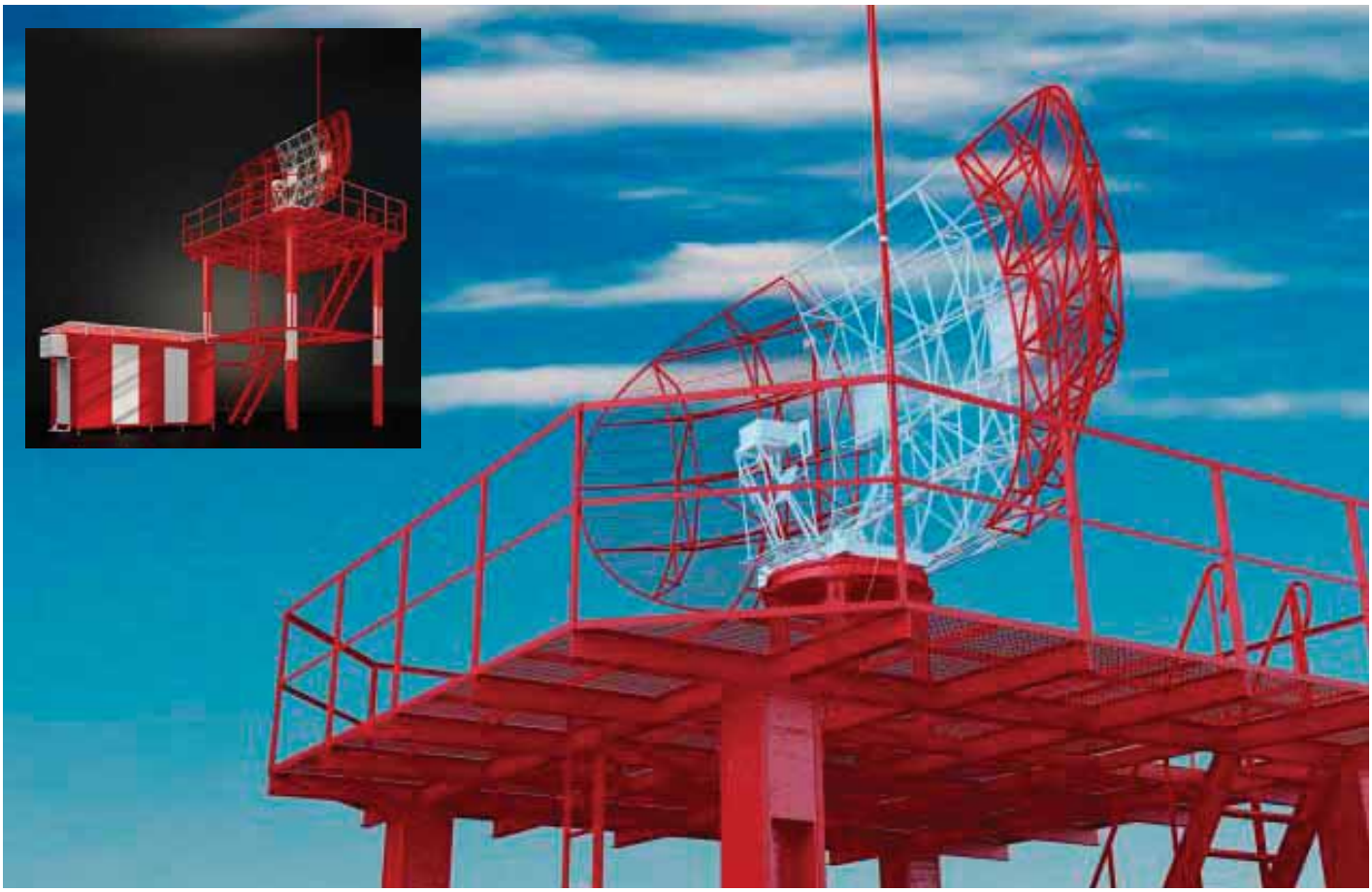
- Low peak power radiated;
- Peak power stepped control;
- Coherent pulse train radiated;
- Coherent echo signal integration;
- Serviceability monitoring – fully automatic;
- Solid-state transmitter;
- Sounding signal forming – digital on IF;
- Signal processing - digital on IF;
- Clutter suppression - digital MTI plus FFT;
- Extractor - automatic digital with CFAR;
- Tracking filter - Kalman type filter;
- High reliability;
- Display - multicolour LCD panel;
- Easy installation.
- Sounding signals – pulses with linea frequency modulation;
- Mulfunction detection – semi automatic up to plug-in units;
- Frequency oscillation – generation by digital synthezators;

MOBILE COHERENT-PULSE ALL-ROUND SURVEILLANCE RADAR «DELTA»

SPECIFICATIONS

Frequency	I band
Bandwidth	150Mhz
Coverage	up to 96 km - in range
	360˚ - in azimuth
Resolution:	50...60 m - in range 1,0...1,5˚- in azimuth
Maximum detection range:	
• small air target	8...20 km
• small surface target	up to horizon
Accuracy	20...40 m - in range 4...6 mrad - in azimuth
Tracking target number	up to 50
Noise figure	3dB
Peak Power	from 8 W up to 80 W
Pulse width	64; 32; 16; 4 sec
Signal bandwidth	about 5 MHz
PRF	about 1,4 2,5 3,8 6,7 kHz
Antenna gain	32 dB
Antenna beamwidth	0,8...1,2˚-in azimuth
	about 10˚ - in elevation
Polarization	horizontal
Rotating rate	20; 10; 5 rpm
Signal processing	Digital with PLM
Extracting	automatic digital with CFAR
Data processing	digital with PLM
Serviceabilitty monitoring	fully automatic in work process
Mulfunction detection	semi automatic up to plug-in units
Data registration	up to 50 trajectories
Interface	RS-422; Ethernet; CAN 2.0
Readiness time	up to 2 minutes
Power consumption	up to 500 W (50 Hz, 220 V)
Equipment mass	up to 300 kg

AERODROME SURVEILLANCE RADAR ASR-22/AL



Aerodrome surveillance radar ASR-22/AL is intended for surveillance and air traffic control within terminal airspace. ASR-22/AL combines primary and secondary channels working on the same antenna as well as sidelobe suppression channel for improvement of detection capability. Primary channel of ASR-22/ AL operates in L-band (ICAO), secondary channel uses standard frequencies for RBS (interrogation – 1030 MHz, response – 1090 MHz) and optionally Eastern IFF (interrogation – 1030 MHz, response – 740 MHz).

PRINCIPLES OF MODERNIZATION

Radar features automatic tracking capability as well as data receiving from other radar sensors. Data can be transferred over variety of communication channels. Radar transmitter and receiver feature solid state components only. Transmitter has modular design and provides 'soft-failure' redundancy: failure of individual module leads to partial performance degradation.

Parameters of transmitted signal as well as parameters of signal processing after reception can be set at the operator workstation, secondary processing and tracking are performed at remote workstation. Remote workstation can be positioned in a Control Tower. ASR-22/AL can be remotely controlled from Tower.

ASR-22/AL is intended for 24/7/365 operations and is equipped with UPS guaranteeing 10 minutes of operational time in case of mains failure.

All air situation is automatically recorded with playback capability in passive and interactive modes.

COMPOSITION

ASR-22/AL is structurally divided into two parts and consists of equipment shelter and antenna-feed system with rotary support connected by set of cables.

JAMMING AND INTERFERENCE PROTECTION

ASR-22/AL features efficient protection against pulse interference and active jamming. Level of interference is continuously monitored and graphically represented to the operator. Jamming protection is achieved through expansion of the dynamic range of the signal processor and capability of electronic frequency agility. Passive interference is rejected through digital adaptive MTI and generation of clutter map.

AERODROME SURVEILLANCE RADAR ASR-22/AL

SPECIFICATIONS

	PSR	SSR
Range of working frequencies, MHz	1250 – 1350	1030 – interrogation 1090 – RBS response
Frequency agility:		
- method for frequency agility	electronic	–
- discreet steps	400 kHz	–
Types of transmitted probing pulses:		
- AM, μs	1.5	Interrogation code in modes A and C tP= 0.8 μs
phase shift keyed signals:		
- 13-bit	19.5 μs	
- 28-88 bit	(28 – 88) x1.5 μs	
Transmitter pulse power	4 kW	1 kW
Detection range for a target with RCS of 2.5m2, P=0.5:		
- minimum range	1000 m	2.7 km
- maximum range	100 km	150 km
Detection accuracy:		
- range	100 m	100 m
- azimuth	0.4°	0.4°
Resolution:		
- range	250 m	150 m
- azimuth	5°	5°
Range of adaptive MTI		0-160 km
Clutter suppression ratio		> 35 dB
Dynamic range of receiver and digital signal processor		> 40 dB
Start-up time		3-5 min
Power consumption		less than 10 kW

STAND-ALONE MOBILE SECONDARY RADAR «TRACE-1»

OVERVIEW

Mobile stand-alone automatic solid-state secondary surveillance radar with phased-array antenna operates in radar surveillance systems of NATO Mk XA (Mk XII) «Parol», international RBS ATC systems and «friend-or-foe» systems, delivering radar information to radio-technical units of Air Defence, Air Force, AAMS and ATC.

The radar can be transported by road, rail and sea. KrAZ chassis is used as prime mover vehicle.

The radar is deployed and closed down without use of any auxiliary lifting mechanisms.

PURPOSES

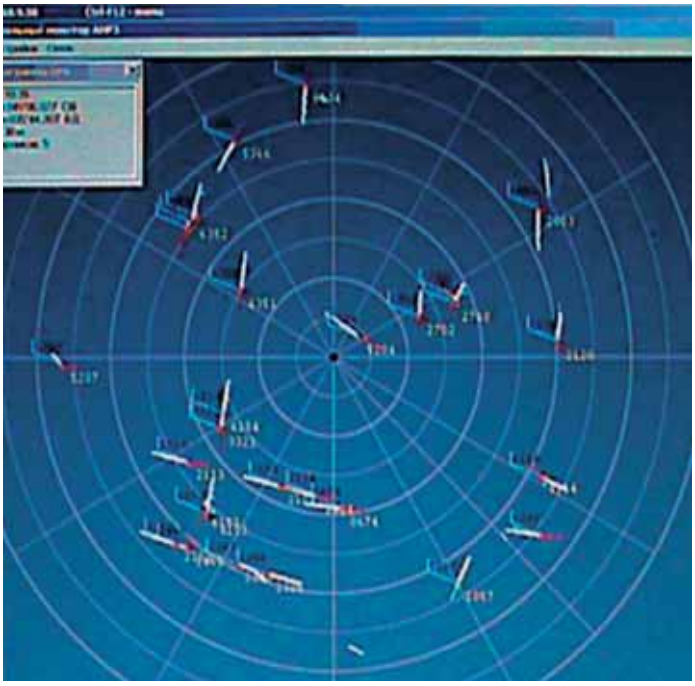
Automatic detection, coordinate determination,tracking and identification of airborne targets, equipped with transponders of secondary radar and identification systems RBS «Parol» and MK XA (MKXII).

FEATURES

- Two-band phased antenna array RBS, «Parol», MK XA;
- Solid-state modular transmitter;
- High-efficient computing means of primary and secondary information processing based on signal processors and industrial computers;
- High-efficient automatic BITE system with a failure indication of each LRU.

SPECIFICATIONS	VALUE
Coverage:	
range, km	2-360
azimuth, deg	360
height, km	25
Coordinate determination error:	
range, m	100
azimuth, min	<50
Qualitative indices of track information:	
tracking quality ratio	0,95
false track ratio	0,0001
Throughput capacity, minimum «TRASSA»	250
Output information	track
Data read-out and transfer	Automatic

STAND-ALONE MOBILE SECONDARY RADAR «TRACE-1»



SPECIFICATIONS

TECHNICAL DATA	VALUE
Band	dm
Power consumption, kW	8-10
Deployment time, min	30
Road transport speed:	
highway, km/hour	60
country road, km/hour	30
Number of transport units	1
MTBF, hours	1000
MTTR, minutes	30
Continuous operation time, hours	72
Turn-on time, minutes	3
Electric power supply system	automatic (with stand-by), industrial supply mains
Environmental conditions:	
ambient temperature, °C	-40...+50
relative air humidity, %	98% at 25°C
altitude, m	3000
wind speed, m/s	30

WEAPON DETECTION RADAR 1L220U / 1L220U-KC

OVERVIEW

1L220U (1L220U-KC) battlefield phased-array fire-control radar is designed to establish the coordinates of hostile artillery, mortars, multiple-launch rocket systems and tactical missile batteries, provide targeting data for counter-fire operations and monitor friendly fall of shot. The system's phasedarray, electronics, operator workstations, navigation and communications subsystems and power supply are installed aboard the armoured tracked chassis, with a second cross-country wheeled 'spares and accessories' vehicle providing support. Other system's functions include threat-type identification, impact-point forecasting, collection of battlefield reconnaissance data and information hand-off to higher commands and associated weapon systems.

THE COMPLEX IS CAPABLE TO QUICKLY AND ACCURATELY ACCOMPLISH THE FOLLOWING:

- identification of the firing system class: mortars, MBRL, artillery, tactical missiles;
- forecasting of the enemy impact points;
- collection of reconnaissance data concerning the battlefield, estimation of width and depth of enemy batteries location (orientation) and transfering of reconnaissance data to the command posts of the Higher Command and to the command posts of the cooperative fire units.

IT IS DESIGNED FOR:

- reconnaissance by the first shot of enemy artillery, Multi Barrel Rocket Launcher (MBRL) Fire Position (FP) coordinates, enemy tactical missiles Launching Positions (LP) coordinates, and transmission of target designation signals to friendly units;
- check of impacts and adjustment of the friendly fire means.

EMPLOYMENT OF COMPLEX 1 L220U (1 L220U-KC) AND ARTILLERY OR MBRL BATTALIONS ENABLES:

- effective firing activity under the conditions of reduced visibility and enemy electronic counter-measures;
- increase of reconnaissance and killing area by 8 to 10 times comparing to battalions equipped with standard facilities;
- reduction of fire mission execution time by 1,5 to 2 times;
- reduction of the ammunition depletion by 2,5 to 3 times;
- creation of reconnaissance fire and reconnaissance-attack systems.

COMPLEX 1L220U (1L220U-KC) IS MULTIFUNCTIONAL. IT IS PROVIDED WITH FLEXIBLE HARDWARE AND ALGORITHMIC FACILITIES THAT MAY BE EASILY ADAPTED FOR EXECUTION OF VARIOUS COMBAT MISSIONS IN CASES OF:

- wide-spread conflicts involving considerable concentration of forces and armament in complicated radio electronic and target situation;
- limited intervention aimed to suppress the wide-dispersed fire means;
- peacekeeping operations intended to control the fire halt observance over a large territory.

WEAPON DETECTION RADAR 1L220U / 1L220U-KC

SPECIFICATIONS

DESCRIPTION	1L220U	1L220U-KC
Reconnaissance/check range of fire positions, km		
artillery	30	
mortars	30	
MBRL	30/50	
tactical missiles	55/80	
Electronic surveillance sector, deg.	60	90
Deployment/Closing time, min	5/3	10/15
Crew per shift, persons	3	5
MTBF	h>100	h>400

WEGHT AND OVERALL CHARACTERISTICS

TYPE	LENGTH, MM	WIDTH, MM	HEIGHT, MM	WEIGHT, T	CHASSIS TYPE
1L220U-KC	11500	3250	3350	39,5	ГМ 5951
1L220U	9214	3160	3800	23,5	KrAZ 63221

SURFACE SHORT RANGE RADAR 112L1 «BARSUK»

OVERVIEW

Portable radar 112L1 Barsuk was designed for detection of moving personnel and vehicles (patrol version) with the aim of reconnaissance or protection of territory.

It provides detection of the targets round the clock under the low visibility conditions (rain, fog, snow etc.).

Detected targets are reflected on built-in indicator in form of amplitude of the signal with mark of range.

Recognition mode allows to specify range and azimuth of the target and classify it by acoustic spectrum (single person, group of persons, animal, vehicle).

Solid-state transmitter of the radar is implemented in microstrip version.

Low weight of the radar allows it to carry on the operator's chest and survey area of view by body rotation. This radar is handy for search and pursuit of intruders.

SPECIFICATIONS

TECHNICAL DATA	VALUE
Coverage:	
azimuth	0-360°;
range	0-2 km
Detection range of targets with radial velocity 2-50 km/h:	
single person	1200 m
vehicle	1600 m
armored vehicle	2000 m
Resolution:	
azimuth	1,5°
range	25 m
Frequency	36 GHz
Transmitter power	60 mW
Antennae aperture	90 mm
Power source - built-in rechargable battery	12 V, 3 Ah
Power consumption	8 W
Operating temperature range	- 30 ... + 50°C
Wind speed	up to 15 m/s
Weight with battery	5,5 kg

SURFACE SHORT RANGE RADAR 112L1-A «BARSUK-A»

OVERVIEW

112L1-A «BARSUK-A» is a surface radar of remote guarding, mounted on a support-rotating device with remote control of azimuth and elevation angles, which provides automatic detection and recognition of personnel, ground and surface moving vehicles. It also keeps security of specified responsibility zone round the clock and all the year round under limited visibility conditions.

RS-422 (485) is used for data transfer.

Targets detection and identification happens in automatic mode, at the same time targets marks displays at monitor. Targets data are automatically logged specifying their number, range, azimuth and class (personnel - vehicle) snap to map. There is a possibility to choose high alert and blank areas manually.

Possibility of recognition via sound channel is provided.

The radar outputs electronic alarm information to the monitor of central guard console.

The radar operates in millimeter band , which practically harmless for human body and does not interfere with other radio means or with the other same product if operating at the distance more than 50.

SPECIFICATIONS

TECHNICAL DATA	VALUE
Coverage:	
by azimuth	360˚
by elevation	±15˚
by range	0 - 1.6 km
Detection range of targets moving with radial velocity of 2-50 km/h:	
single person	1.2 km
vehicle, ship	1.6 km
armoured vehicle	1.6 km
Radar resolution:	
by angle	3˚
by range	25 m
Frequency	36 GHz
Transmitter's power	60 mW
Rotation speed	(4-20)%
Type of radiated signal	continuous with phase code modulation
Antennae aperture	90 mm
Operating temperatures	from - 30 to + 50˚C
Relative humidity	up to 100%
Wind speed	up to 25 m/s
Weight	10 kg

SURFACE AND LOW-FLYING SLOW TARGETS DETECTION RADAR 111L1 «LIS»

OVERVIEW

111L1 LIS Radar is designed for detection of moving people and vehicles, slow low-flying and surface targets in order to maintain security and reconnaissance support.

The radar provides automatic detection and location of targets at any time of the year under the conditions of rain, fog, precipitation, smoke or dust, in abscence of optical visibility. All the targets are displayed on the LCD indicator along with azimuth and range data.

Digital forming methods of signal, filtering, automatic detection and coordinates measurement are used.

Target recognition mode allows to specify full target range, its direction and to make further classification of the target (such as man, group, vehicle, helicopter, jam etc.), after listening to the specific sound spectrum of a signal.

Basic version of the radar offers its installation on vehicles and includes facilities for automatic antenna system leveling, using data from built-in accelerometric horizon sensors. The radar can be installed on APC or ACV.

The radar operation is harmless to the human body. Millimetre bandwidth doesn't create interferences with other radio-technical systems. It is also not influenced by interferences of other systems, because there is no equipment working in this bandwidth. Millimetre bandwidth beam is less influenced by water surface than the beam of centimeter bandwidth, which enables more precise small-target detection of surface targets.

SPECIFICATIONS

TECHNICAL DATA	VALUE
Coverage:	
by azimuth	-60...+60˚ with possibility of random sector reducing
by range	0 - 15 km with possibility of random scan zone selection within a given range
Full Scan Time (120˚, 15 km)	25-30 sec
Target detection range (radial speed 2-50 km/h):	up to 15 m/s
single person	5 km
vehicle	10 km
armored vehicle	10km
ship	10 km
Radar resolution range:	
bearing	1˚
range	15
Power consumption	not more than 65 W
Operation temperature range	-30˚C...+60˚C (-20˚C...+50˚C for remote display)
Radar weight with leveling platform	not more than 40 kg
Setting-up procedure	does not exceed 5 min.

SURFACE TARGETS DETECTION RADAR 111L2 «MANGUST»

OVERVIEW

111L2 MANGUST is developed for surface and low-speed (low-flying) target detection. It can be easily used for securing of land and water frontier areas as well as to combat fields observations. Hardware of this portable radar can be transported in two carrying cases and operated by two men.

The radar provides targets search, detection and mapping automatically in continuous radiation mode (millimeter band). Target detection and localization are processed by operator's console processor. The console display shows circle diagrams and tables, featuring number of the target, together with range and azimuth. High alert and blank area can be set up by operator.

The radar operation is completely harmless to human body. Millimetre bandwidth doesn't create interferences with other radio-technical systems. In addition to this, it is not influenced by interferences of other systems, because no equipment exists to work in this bandwidth. Millimetre bandwidth beam is less influenced by water surface than the beam of centimeter bandwidth, which enables more precise small-target detection of surface goals.

SPECIFICATIONS

TECHNICAL DATA	VALUE
Coverage	360° and sector scan
Detection range (km):	
person	5
car	7
armored vehicle	10
ship	10
Resolution:	
azimuth (deg)	1
range (m)	15
Operator's console:	Notebook
Power source:	
primary source	accumulator 12 V
power consumption (W)	65
Operational conditions:	
temperature (°C)	-30...+50
Mobility:	
weight	40 kg in two packs, 20 kg each
setting-up time (min)	5
remote control distance (m)	50

MOBILE AUTOMATED COMMAND POST «MODULE»

OVERVIEW

MODULE Mobile Automated Control Post (C2 system) is the basic component of Automated System of reception, processing and transmitting of the radar data.

It is designed to provide automated collection, processing and displaying of data from radar positions (primary and secondary, analog and digital) and radio height finders; transmitting of processed and integrated information about air situation to the high-leveled Command Posts.

«MODULE» is a modern processing system capable to input, handle and combine data from several sources. It provides connection of virtually all types of radar stations, including old-fashioned analogue, without degradation of their technical parameters. The processed data can be used for target allocation/designation, and transmitting of control and direction commands to AD missile and fighter-interceptor units.

FUNCTIONS

- automatic extraction and processing of radar data from 2-coordinates analogue radar stations;
- automatic (automated) extraction and processing of data from radio height-finders with analogue output;
- automatic reception and processing of data from the connected radar positions with digital output;
- automatic initiation and maintenance of target trajectories (up to 200 simultaneously);
- automatic correlation, combining and trajectory processing of coordinate information from all channels of the connected radar;
- automatic combining and correlation of trajectory information from different connected radar sources;
- input and processing of data from cooperating CP and other automated data sources;
- displaying of air situation, command and diagnostic data to the operative staff;
- generating and transmitting of the required information to the higher, cooperating and supported CP (ADM, FA units);
- generating and transmitting of commands and instructions to the subordinated radar facilities and command posts (including height-finder control commands);
- reception, processing, displaying and transmitting of messages about combat readiness and combat actions of the controlled and subordinated units and facilities;
- recording (registration) of air situation data, control commands, combat readiness messages, information about combat actions and technical state of the facilities;
- voice data recording;
- automated preparation and compilation of reports;
- automated complex and independent training of combat crews;
- automatic online control of system functioning and online diagnostics of technical state of the equipment.

ADVANTAGES

- Module design principle;
- Unification of hardware, data processing tools and facilities;
- Capability of connection and usage in automatic mode of different types of radar data sources - analog and digital radars;
- Easy upgradeability and extendibility according to customer requirements.

MOBILE AUTOMATED COMMAND POST «MODULE»

SPECIFICATIONS

TECHNICAL DATA	VALUE
Number of simultaneously tracked and controlled targets (including active jammers)	200 (40)
Operation Limits:	
coordinates (km)	1600
height (km)	0-99
speed (km/h)	to 3600
Accuracy parameters:	
coordinates (m)	200
height (m)	10-300
Height information renewal period	corresponds to the revolution period of main radar
Target initiation and tracking mode	automatic
Track initiation period	3 revolution periods of the main radar
Interfaced radar types:	
analogue	P-18, P-14, 5N84, 5N84A, 44G6, 5N87, P-37
digital	19G6, 35D6, 22G6, 55G6 and similar
Interfaced radio height-finders	PRV-9, 11, 13, 16, 17
Number of simultaneously connected radar data sources:	
remote	8
local	8 (including up to 4 height-finders)
Number of simultaneously interfaced users	no limitations
Data transmitting rate in the data line (bps)	9600
Types of interfaced automation complexes:	
Electronic Reconnaissance	68K6, 5N60, 5N93M, 5D91, 86G6, 5U69
Air Defense Missiles	5N75, 5S99, 5N37, 73N6, 9S52, 9S52M
Fighter Aviation	5K34
Data Exchange protocols with interfaced facilities and command posts	ASTERIX; other protocols - as required by interfaced unit
Speakerphone and Telephone	Provides operative and command speakerphone
Communication Equipment	and telephone connection, and transceivers control
Mean time between failures (MTBF) (hours)	10000
Power consumption (kW):	
main equipment and facilities	up to 2
supplementary equipment (light, heating, conditioning)	up to 4
Time of deployment (hours)	less than 1
Time of closing down (hours)	less than 1
Number of transportation units	1
Operating personnel:	
engineer	1
maintenance technician	1
driver-electrician	1

MODERNIZATION AND LIFE EXTENSION

P-19 AND P-18 RADAR MODERNIZATION

OVERVIEW

P-19 and P-18 radars modernization is intended to restore radars performance characteristics after long-term service. Modernization is carried out by high-skilled specialists on flexible conditions to meet customers needs.

NEW POSSIBILITIES AND ADVANTAGES:

- significant increase of detection range, accuracy, jamming immunity, numbers of plots and tracks, reliability;
- significant (up to 100dB) increase of a dynamic range resulting in high jamming immunity and suppression of clutter and weather formations;
- implemented functions of a radar extractor for post-detection signal processing (detection, location measuring, plots generation, clutter map, scan-to-scan processing, stabilization of false target generation, processing of identification signals, data distribution to consumers);
- large number of probing signals, ability to choose the best one depending on the air situation, jamming and combat conditions;
- reconfigurable (via program or randomly) parameters of probing signal - working frequency, modulation type, waveform;
- efficient algorithms for clutter suppression with wind speed compensation;
- automatic combining of amplitude and coherent channels that decreases signal loss and increases detection range and accuracy;
- implementation of automatic built-in diagnostic system.

Fully automatic primary processing of the radar data eliminates from the process one of its weakest links - a human-operator - and allows the separation of radar and command post by distance, this significantly increases system survivorship and minimizes the threat of being destroyed by homing missiles.

THE FOLLOWING EQUIPMENT IS INSTALLED IN A HARDWARE COMPARTMENT REPLACING THE EXISTING EQUIPMENT:

- solid-state transmitter;
- solid-state receiver;
- digital signal processing system;

IN ADDITION, THE FOLLOWING EQUIPMENT CAN BE SUPPLIED ON CUSTOMER REQUEST:

- 4-channel dejammer;
- height-finder control software and equipment;
- software for guiding fighter aviation;
- software for targeting ADS;
- equipment for documentation.

FEATURES:

- all solid state design;
- improved combat performance features;
- improvement of radar maintenance;
- extension of radar service life;
- full coherence;
- operator working position;
- remote working position;
- air conditioning system;
- power and lighting distribution unit;
- fire-control system;
- switchboard.

P-19 AND P-18 RADAR MODERNIZATION

No.	Specification	P-19		P-18	
		Before	After	Before	After
1	**Frequency band**	830-882 MHz	825-890 MHz,	150-170 MHz	140-180 MHz,
2	**Measured parameters**	azimuth, range			
3	**Radar coverage zone:**				
	min range	10 km	1.5 km		
	max range	140 km	300 km	270 km	up to 360 km
4	**Location accuracy:**				
	range	2,000 m	100 m	1,800 m	200 m
	azimuth	2°	0.3°	1.5°	0,4°
	bearing of active jammers	3°	1.5°	4°	2°
5	**Resolution:**				
	range	2500 m	600 m	2,000 m	1,200 m
	azimuth	8°	6°	8°	8°
6	**Jamming immunity:**				
	4.1 **Against active jamming:**				
	working frequency hopping	manual	automatic adaptive, 0.4MHz discreet	manual	automatic adaptive, 0.2 MHz discreet
	dynamic range of signal processing system	32dB	105dB	30dB	105dB
	extra expansion of dynamic range through automatic gain control	18dB	+30 dB	18dB	+ 30 dB
	4-channel dejammer of active jamming	-	option	-	option
	4.2 **Against passive jamming:**				
	clutter suppression ratio	26dB	not less than 50 dB	20dB	more than 50 dB
	working zone of the MTI system		0-150 km, adaptive MTI, clutter map	0-255km, manual	0-360 km, adaptive MTI, clutter map
	4.3 **Against nonsynchronous pulse jamming:**	10 times	full suppression	10 times	full suppression
7	**Target detection mode, tracking:**	-	auto	-	auto
	plots per scan	up to 10	up to 1,000	up to 10	up to 1,000
	number of tracks	-	up to 150	-	up to 150
	active jammer tracking	-	up to 36	-	up to 36
8	**Height-finder control mode** (on condition of installation of height-finder extractors): (option)	-	fully automatic	-	fully automatic
	number of controlled height-finders	-	up to 4	-	up to 4
9	**FA guidance modes and ADMS targeting: (options)**	-	+	-	+
10	**Operating conditions:**				
	temperature	-40… +50°C			
	relative humidity	95%			
	max asl	2500 m			
11	**Combat crew**	5	3	5	3
12	**Start-up time**	180sec	40 sec.	180 sec	90 sec.
13	**Set-up/tear down time**	20min		1 hour	
14	**Power consumption**	8 kVA	8 kVA	10 kVA	up to 10 kVA

P-14 (5N84 «OBORONA», 5N84A) RADAR MODERNIZATION

OVERVIEW

Modernization of early-warning VHF radar 5N84A (5N84, 44Zh6 or P-14) offers the best (in terms of efficiency/cost ratio) alternative to restoration or repair of legacy prototypes.

As a result of modernization the radar's detection performance is efficiently improved. Modernized radar features automatic tracking capability as well as data receiving from other radar sensors. Data can be exchanged over a variety of communication channels.

DEPTH OF MODERNIZATION:

Radar's equipment cabin has been fully modernized. Metric band is preserved, however the number of working frequencies has been sufficiently increased from 4 to 200, the capability of instantaneous electronic frequency agility has been added as well. The radar transmitter and receiver feature solid-state components only. Transmitter has a modular design which provides 'soft-failure' redundancy: failure of individual module leads to partial performance degradation.

Antenna-mast assembly is equipped with the new asynchronous motor drives controlled by frequency inverters.

Modernized 5N84AMA radar remains a two-dimensional system and it is used to find azimuth and range. Altitude can be obtained by interfacing modernized height-finding radars. Parameters of the transmitted signal as well as parameters of the signal processing after reception can be set at the operator workstation, while secondary processing and tracking are performed at remote workstation. Both workstations are installed in the equipment cabin.

As an option, ground interrogator can be controlled in auto- and semiautomatic modes with assigning aircraft state identification status. All air situation is automatically recorded with playback capability in passive and interactive modes.

Modernized 5N84AMA radar features efficient protection against pulse interference and active jamming. Level of interference is continuously monitored and graphically represented to operator. Jamming protection is achieved through expansion of the dynamic range of the signal processor and capability of electronic frequency agility. Passive interference is rejected through digital adaptive MTI and generation of clutter map.

Equipment of 5N84AMA can be installed on a semitrailer or in two standard sea containers mounted stationary or on a vehicle.

MODERNIZATION OF 5N84A FEATURES:

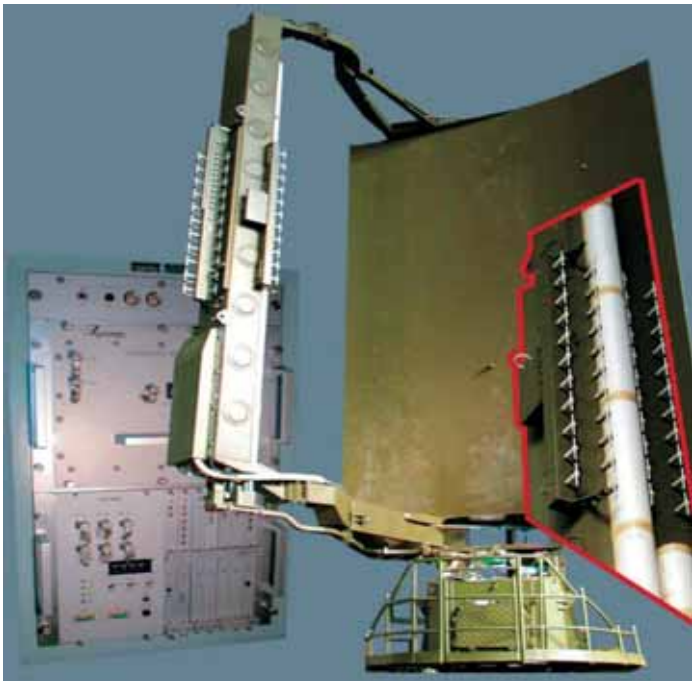
- metric band for «counter-Stealth» capability;
- maximum use of COTS components;
- option of containerized solution (two 20ft ISO);
- stable, fail-soft, modular solid-state transmitter;
- built-in test equipment;
- no special adjustments required during operation;
- largely simplified maintenance;
- engineered for minimum cost of ownershipt.

P-14 (5N84 «OBORONA», 5N84A) RADAR MODERNIZATION

SPECIFICATIONS

PARAMETER	VALUE BEFORE MODERNIZATION	VALUE AFTER MODERNIZATION
Range of working frequencies, MHz	170-190	160-200
Frequency agility:		
method for frequency agility;	electromechanical	electronic
discreet steps;	4 fixed frequencies	200 kHz
frequency setting accuracy.	n/a	±10 kHz
Types of transmitted probing pulses:		
short pulse;	10 μs	10 μs
phase shift keyed signals:		
13-bit		13 10 μs
28-88 bit		(28 – 88) 10 μs
Transmitter pulse power	700 kW	30 kW
Capability of instant probing signal power and structure changes	Not implemented	Implemented
Detection range for a target with RCS of 2.5m2, P=0.5:		
min range	-	2,7 km
at altitude of H=100 m	30 km	37 km
at altitude of H=500 m	85 km	105 km
at altitude of H=1000 m	110 km	130 km
at altitude of H=3000 m	185 km	220 km
at altitude of H=10000 m	290 km	340 km
Detection accuracy:		
range	1000 m	270 m
azimuth	0.80	0.40
Resolution:		
range	3500 m	1600 m
azimuth	80	80
Range of adaptive MTI	-	0-500 km
Clutter suppression ratio	-	> 40 dB
Dynamic range of receiver and digital signal processor	-	> 100 dB
Automatic control of modernized height-finders	-	Implemented
Number of controlled height-finders	-	up to 4
Start-up time	8 min	3 min
Power consumption	60 kW	up to 40 kW

LIFE EXTENSION & UPGRADE OF ST-68U (19ZH6) RADAR



MODERNIZATION ENABLES:

- Increasing a detection range;
- Improving a coordinate measurement accuracy;
- Improving target detection against clutter and noise background;
- Automation of tracking and initialization processes;
- Adaptation of a rejection zone to interference situations;
- Applying color raster display workstations;
- Realization of various protocols, formats and standards for radar data processing;
- Applying electronic recording of the output data and radar operation modes;
- Providing operation at elevation up to 3000 m;
- Reducing the false plots during operation in mountain terrain;
- Introducing the target identification channel or the international secondary channel (IFF channel MK-X type);
- Ensuring high effective trajectory processing

To increase a range, a number of processed range bins has been increased in the processing equipment of the modernized Radar 19Zh6 (ST-68U) as well as a number of phase filters is increased from 8 to 16. It allowes to increase a radar coverage range from 150 km to 180 km in the «rare» triggering mode, substantially improve target tracking under combined effect of clutter, passive and active jamming, implement capability to determinate radial velocity of targets.

In order to detect large-size targets at the range up to 360 km, a new triggering mode has been introduced.

BUILDING-IN THE IFF SYSTEM COMPARTABLE WITH NATO STANDARDS

The upgraded radar antenna makes it possible to radiate the IFF signals in the range of 1030/1090MHz. Large vertical dimensions of the reflector permit to shape an elevation antenna pattern of Cosec type with a sharp bottom edge 1,4 dB/deg. The antenna pattern width in the azimuth plane is 6,5°.

The antenna system also provides realization of SLS modes in interrogation and response. The interrogator MK-X (MK-XII) type is set in the radar cabin.

The interrogator control is done from radar workstations. In the processing equipment the IFF output signals are associated with echo-signals and tracking according to the IFF response signals is ensured. All data coming from the IFF is displayed on the workstations.

RADAR OPERATION IN MOUNTAINOUS TERRAIN

For the radar operation in mountainous terrain the electric strength of the microwave channel is increased: increased pressure in the output microwave channel is maintained; new pulse transformer is installed in the transmitter; new zone switch is installed in the antenna.

When radar operates in mountainous terrain essential decrease of false plots level is achieved due to shaped out of oscillations of one stable generator.

NEW WORKSTATIONS

New radar workstations are based on LCD panels. They allow displaying all radar data, radar status and map information. The radar is controlled from the workstations. Twisted pair lines are used for communications between radar and workstations. Up to four workstations can be connected.

Maximum radar remote distance amounts to 300 m. If the workstations are power supplied from an independent power source, the remote distance reaches up to 500m. Data playback and analysis of the recorded data is possible at the workstation as well as control for environment simulation for the personnel training.

UPGRADE OF LIQUID COOLING SYSTEM

- Protects the cooling channels against blocking by electrochemical corrosion products
- Improves endurance of the cooling devices (klystron, circulator, solenoid, equivalent).

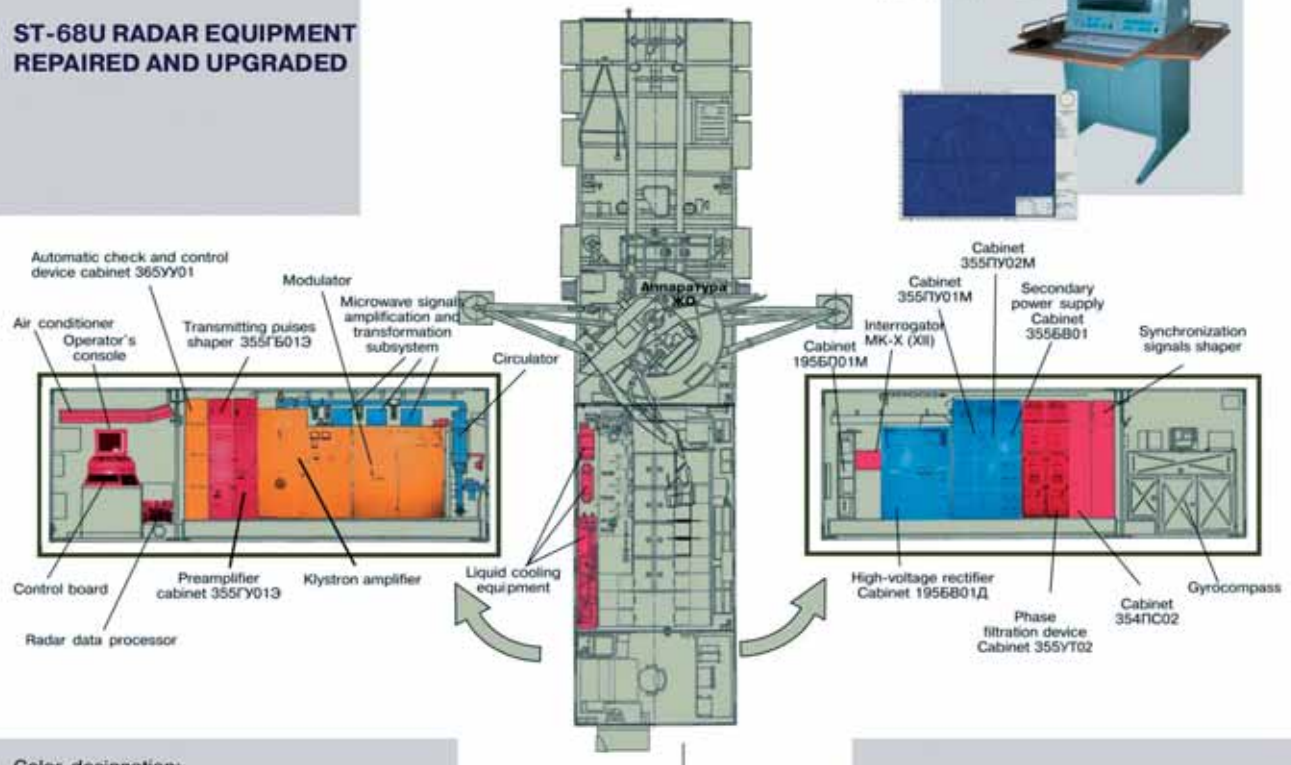
LIFE EXTENSION & UPGRADE OF ST-68U (19ZH6) RADAR

Upgrading of ST-68U data

№ п\п	Parameters	Before upgrade	After upgrade
1	Maximum detection range, km Tringgening mode «Frequent» Tringgening mode «Rare» Tringgening mode «Super rare»	 75 150 -	 90 180 360
2	Radar detection range in free space		Increased by 10-15%
3	Data output to up - to-date automatic control systems in format ASTERIX or in formats by user´s request	Not available	Available
4	Refection zone control in strobes assigned by an operator	Not available	Available
5	Identification of targets equipped with transponders according to NATO standarts	Not available	Available

№ п\п	Parameters	Before upgrade	After upgrade
6	Tracking according response data of identification system	Not available	Tracking is provided according to response signals alongside with processing of the i dentification number data and barometric height data
7	Automatic detection of radar location	Not available	Provided by GPS receiver
8	Operators´ training	Using auxiary cabinet УЦ-10	Training function in consoles using data logging results and electronic data bases of training scenarioes
9	Radar data logging	Photorecording	Data recording in to electronic mediums and subsequent data display at operator´s console or Transferring data recorded to archive facilities
10	Recording operators´ commands and radar operation parameters	Not available	Provided simultaneously with radar data recording
11	MTBF	200 hours	>800 hours

ST-68U RADAR EQUIPMENT REPAIRED AND UPGRADED



Color designation:

- Equipment exchangeable for a new one to extend life-time and to gain unification
- Equipment with new characteristics installed to extend life-time
- Equipment exchangeable for a new one to gain new characteristics

MODERNIZATION OF RSP-10 RADAR

OVERVIEW

Modernized Ground-Controlled Approach (GCA) system RSP-10MA is intended to ensure flight safety of aircraft and helicopters within terminal airspace, obtain positional information and guide aircraft to a safe landing in normal and adverse weather conditions. RSP-10MA combines primary and secondary radars, and Precision Approach Radar (PAR).

As a result of modernization the radar's detection performance has been efficiently improved. Modernized radar features automatic tracking capability as well as data receiving from other radar sensors. Data can be transferred over a variety of communication channels.

Primary channel of RSP-10MA operates in L-band (ICAO), secondary channel uses standard frequencies for RBS (interrogation – 1030 MHz, response – 1090 MHz) and Eastern UVD (interrogation – 1030 MHz, response – 740 MHz). Primary and secondary channels work on a common antenna. Precision Approach Radar performs vertical and glide path guidance and operates in X-band.

Transmitter and receiver of PSR/SSR feature solid-state components only. Transmitters have modular design and provide 'soft-failure' redundancy: failure of individual module leads to partial performance degradation. Antenna system of PSR/SSR is equipped with a new asynchronous motor drive assembly controlled by frequency inverter.

Radar includes PSR/SSR operator workstation and PAR operator workstation equipped with air situation displays and radio control panels.

All air situations are automatically recorded with playback capability in passive and interactive modes.

RSP-10MA is powered from two independent power supplies: from three-phase industrial mains (380V, 50 Hz) and from diesel power generators.

RSP-10MA features efficient protection against pulse interference and active jamming. Level of interference is continuously monitored and graphically represented to operator. Jamming protection is achieved through expansion of the dynamic range of the signal processor and capability of electronic frequency agility. Passive interference is rejected through digital adaptive MTI and generation of clutter map.

SPECIFICATIONS

PARAMETER	AZIMUTH	ELEVATION
Range of working frequencies	X-band	
Coverage:		
Azimuth	from -15° to +15°	from -15° to +15°
Range, at least	25 km	25 km
Elevation	from -3° to 15°	from -1° to 8°
Mean square error:		
Range, less than	20 m	
Azimuth, less than	0.030	
Range resolution	80 m	

MODERNIZATION OF RSP-10 RADAR

SPECIFICATIONS

PARAMETER	VALUE PSR	VALUE SSR
Range of working frequencies, MHz	1250 – 1350	1030 – interrogation
	125 frequencies with step	1090 – RBS response
	0.8 MHz	740 – UVD response
Frequency agility:		
method for frequency agility	electronic	-
discreet steps	800 kHz	-
Supported modes	-	RBS, UVD and Mk XA
Types of transmitted probing pulses:		
AM, μs;	1.5	Interrogation code
phase shift keyed signals:		in modes A and C
13-bit;	19.5 μs	tP= 0.8 μs
28-88 bit.	(28 – 88) x1.5 μs	
Transmitter pulse power	4 kW	1 kW
Detection range for a target with RCS of 2.5m^2, P=0.5		
minimum range	1000 m	2.7 km
maximum range	100 km	150 km
Detection accuracy:		
range	100 m	100 m
azimuth	0.4°	0.4°
Resolution:		
range	250 m	150 m
azimuth	5°	5°
Scanning period, s	5	5
Range of adaptive MTI	-	0-160 km
Clutter suppression ratio	-	> 35 dB
Dynamic range of receiver and digital signal processor	-	> 100 dB
Start-up time	3-5 min	
Power consumption	less than 16 kW	

AIR DEFENCE SYSTEMS

UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

INTRODUCTION

Classic modification of any automated control system (ACS) provides capability to:

- collect and transmit the information;
- process and display the information;
- analyze and output the control actions;
- transmit the actions.

The subsystem of collection and transmission of the information intended for control system of Air Force (AF CS) includes:

- radar means of information collection;
- radio means of information collection;
- means of visual information;
- means for reception and transmission of telecode information.

Other ACS subsystems remain in the classical modifications, except for the subsystem of transmitting control actions. The mentioned subsystems include:

- means for reception and transmission of telecode information;
- means for reception and transmission of voice information.

Radar stations (RS) for airborne target detection belongs to the radar means of information collection of AF CS. Depending on the frequency of radiated sweeping signal, RS are divided into:

- RS of VHF-band (P-18);
- RS of UHF-band (P-15, P-19);
- RS of S-band (36D6, PRV-11).

The rest of the elements belongs to the subsystem of collection and transmission of information and includes equipment for visual surveillance and radio-stations of reception and transmission of telecode information.

Maintenance of AF CS high efficiency directly depends on the quality of subsystem's operation for information reception and transmission, where its basic elements are RS which detect airborne targets. Due to the upgrade of the mentioned RS, a number of the important problems may be solved. These issues are connected both with the improving RS performance characteristics and with the support of reliability, controllability and reparability of their equipment.

Upgrading of anti-aircraft missile systems (AAMS) provides significant increasing of their operating characteristics, as well as:

- enhancement of the combat performance capabilities of AAMS, including the expansion of realized lethal envelopes of air targets under the conditions of intensive jamming support;
- decrease of AAMS response time in case of detecting and destroying air targets;
- support of information-and-control interaction with adjacent AAMS and with the higher commanding point (HCP);
- survivability rising of AAMS facilities under the conditions of high-precision weapon (HPW) use;
- expansion of AAMS mobile properties.

Besides the AAMS upgrade, can support introduction of

UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

modes on simultaneous tracking of several air targets and on their simultaneous engagement.

AAMS upgrading version solves the problem of cost efficiency, providing demanded quality with minimal costs.

All works intended for the S-125M AAMS upgrade are connected with repair of the missile guidance radar (MGRS). Enhancement of the combat performance capabilities of SNR-125 will provide following results:

- increase in detection and air-target range tracking;
- increase in distant limits of target lethal envelopes, due to improvement of methods used for detection and measurement of targets coordinates and of anti-aircraft guided missiles (AAGM) under the conditions of clutters;
- increase in efficiency of AAGM jammers firing of generated clutters, owing to the implementation of coordinate support modes, special trajectory of fired AAGM missiles and special algorithms of target selection against the background of non-stationary clutters;
- improvement of the clutter protection, emission security and, consequently, survivability of the AAMS.

In addition to this, reducing AAMS's response time, in case of detection and destruction of air targets, following results will be achieved:

- decrease of operational time of the AAMS, owing to the automation of processes connected with detection and target locking for tracking the aid of SNR-125, including the performance of these operational chains under the conditions of jamming;
- decrease of the number of errors when target tracking is potential not only in the search mode, owing to upgrading of anti-feeding channel.

Conducting repair and modernization works on information-and-control subsystems will result in achieving:

- supporting of the information-and-control interaction of the AAMS with neighboring radio-engineering subunits;
- supporting of the mutual interaction of the AAMS with neighboring air bases, specifically in cases of distributing efforts while destroying air targets.

UPGRADING OF UNV CABIN

On the basis of the UNV cabin equipment the following devices are upgraded:

- high-frequency element of receiving devices (UV-40M);
- transmitting device of target-sighting channel (UV-20M);
- television-optical sight (9W33);
- electromechanical drive for rotation of upper side of radar head (head of assemblies equipped with current collector) according to azimuth (UV-2105); electromechanical drive for movement of head of assemblies, according to angle of elevation (UV-210E).

Upgrading of high-frequency part of receiving devices

On the basis of its assignment, the mentioned high-frequency part of receiving device will support:

- reception of signals reflected from targets;
- reception of signals of missile transponders;
- frequency selection, amplification and conversing of received radio-frequency pulses;
- gating and adjusting for amplification of received signals.

According to the receiving-device upgrade (the UV-40M cabinet) the following renovations will be completed:

- Replacement of UHF-assemblies (the UV-420M and UV-42R assemblies) with upgraded semiconductor low-noise amplifiers (LNA) of reduced noise factor;
- Replacement of mixers assemblies (including preamplifiers of intermediate frequency - UV-51-I and UV-51-II assemblies) with upgraded semiconductor assemblies;
- Replacement of the detection assembly and preliminary amplification of video-signals of missile transponders (the UV- 52M assembly) with the upgraded semiconductor assembly;
- Replacement of assemblies of quick automatic fine tuning control of target (UV-47 and UV-48 assemblies) with upgraded semiconductor assembly;
- Replacement of assemblies of the UV-141 power-supply and the UV-142 power-supply stabilizer with upgraded assemblies of solid-state technology.

Use of the upgraded receiving device SNR-125 allows to extend parameters of the AAMS lethal envelope by 11%. Comparative characteristics of S-125 AAMS lethal envelopes in vertical plane are presented in Fig. 1.

Comparative characteristics of S-125 AAMS lethal envelopes in horizontal plane are represented in Fig.2.

Lethal envelopes are created for targets that fly with speed of V_4 < 300 m/second.

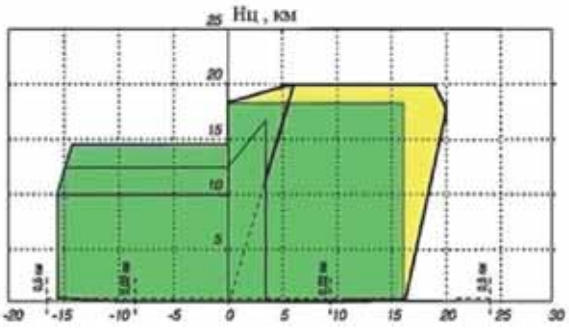


Fig.1 - Lethal envelope of S-125 AAMS in vertical plane
X - Range to target, km; Y - target altitude, km

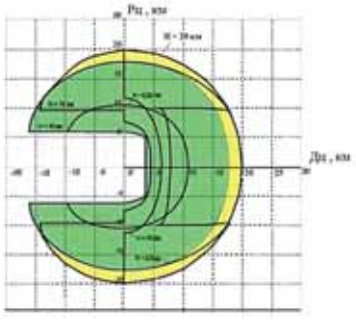


Fig.2.- Lethal envelope of S-125 AAMS in horizontal plane.
X - Range to target, km; Y - target altitude, km

There such designations on figures as:
^ - range of lethal envelope;
Нц - altitude of lethal envelope;
Рц - course parameter of target

UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

UPGRADE OF TRANSMITTING TARGET SIGHT CHANNEL DEVICE

Upgrading program of transmitting device of target sight channel could be conducted with two options:

- with replacement of the magnetron generator with multiple-beam klystron;
- without the replacement of the magnetron generator;

On the basis of general demands, with the respect to MGS, this transmitting device provides a number of characteristics given in the Table below.

UV-20M upgraded cabinet for SNR-125

COMPARATIVE CHARACTERISTICS OF TRANSMITTING DEVICE

number of fixed frequencies	2	50 at least
frequency separation between adjacent fixed frequencies	5 MHz	10 M Hz
average output power	60 kW	4 kW
pulse relative duration (at average)	20	20
output pulse power	170 kW	80 kW
minimal pulse duration	0.26 ps	0.4 ps
maximal pulse duration	-	160 ps
maximal pulse repetition frequency	100 kHz	100 kHz
high voltage	25 kW	25 kW
efficiency coefficient of transmitter	> 15 %	> 20 %

UPGRADING OF DEVICE FOR TRANSMISSION OF MISSILE COMMANDS

The presented upgrading of the receiving-transmitting device SNR-125 (second option) allows to extend parameters of the AAMS lethal envelopes by 28%. Comparative characteristics of lethal envelopes of the S-125 AAMS in vertical plane are represented in Fig.3

Comparative characteristics of lethal envelopes of the S-125 AAMS in horizontal plane are represented in Fig.4.

Lethal zones are created for targets which fly with the speed V_4 - 300 m/second.

Reverting to the upgrading of missile-sighting of radio-transmitter and radio-transmitter of control commands, following adjustments have been made:

- replacement of all the vacuum lamp assemblies with the upgraded solid-state or semiconductor assemblies;
- replacement of the assemblies of high-voltage rectifiers (UK-124 and UK-121 assemblies) and power-supply assembly (UK-122 assembly) with the upgraded assemblies of solid-state technology.

New assemblies of solid-state technology enhance reliability and reduce weight-dimensional characteristics.

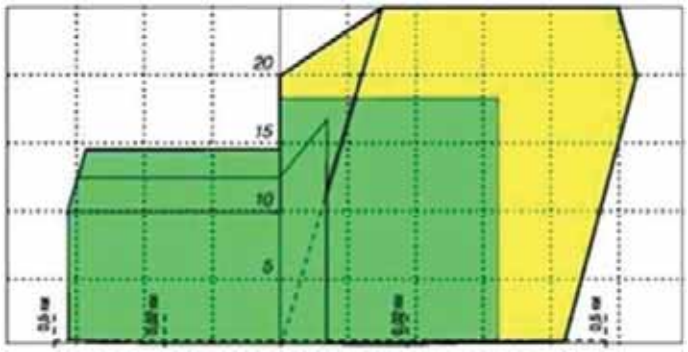


Fig.3 - Lethal envelope of S-125 AAMS in vertical plane
X - Range to target, km; Y - target altitude, km

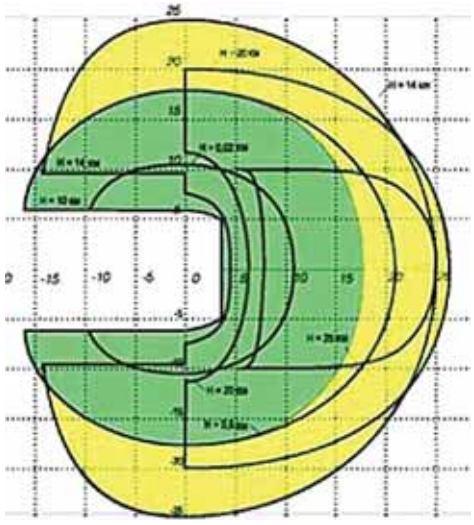


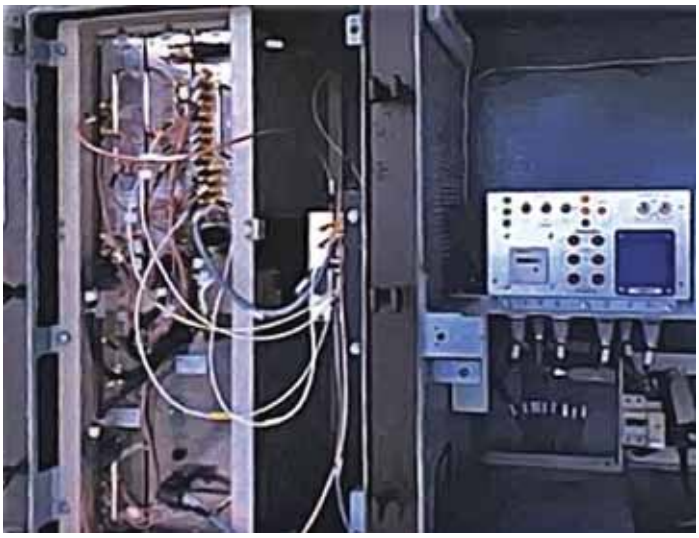
Fig.4.- Lethal envelope of S-125 AAMS in horizontal plane
X - Range to target, km; Y - target altitude, km

UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

NAME OF CHARACTERISTICS	EXISTING RRD	UPGRADED RRD
operating range	f_0 (+0.05) MHz	f_0 (1+0.05) MHz
number of receiving channels	2	3
noise factor of receiving channels	7 dB at most	6.5 dB at most
transmission coefficient of receiving channels	20^25 dB	25^28 dB
suppression of radio-receiver sensitivity on mirror frequencies	-	70 dB at least
suppression level of generated noise interferences that exceed power of own noises of radio-receiver		20 dB at least
time of auto-equalization	-	100 ps at most

UPGRADING OF DEVICE FOR TRANSMISSION OF MISSILE COMMANDS

The UK-20M and UK-20H upgraded cabinets have been demounted out of the UNK cabin and, lately, mounted in the UNV antenna head together with UV-12 antenna equivalents (UK-14 assembly and UK-15 assembly) and summation device (the UK-12 assembly).



Upgraded cabinets named as UK-20M and UK-20N located in UNV antenna head

EQUIPMENT UPGRADING FOR TELEVISION-AND-OPTIC SIGHTING

Within the upgrading 9W33 (9W38), TOS is replaced with the new combined optical-and-electronic system, which consists of:

1) television camera;
2) thermal imaging optical sight;
3) equipment of automatic target tracking;
4) equipment for information displaying.

The upgraded equipment for television-and-optic sighting is intended for fulfillment the following tasks:

- detection of low-sized, low-contrast air targets under the conditions of poor light, which are locate in the field of view of television camera and thermal imaging optical sight (TIOS);
- transmit the signal of digital video image of air targets into the computing system of the UVK cabin;
- shaping a video image on monitor screens of operators in the UVK cabin;
- fulfil an automatic detection of target blip and its automatic tracking;
- fulfil a manual tracking of target blip.

Comparative characteristics of existent and updated equipment for television-and-optic sighting are presented in the Table below.

Updated TOS and TOIS of UNV antenna head

NAME OF CHARACTERISTICS	9W38 TOS	UPDATED	UPGRADED RRD
Detection range (if optical visibility is available)	20 km	100 km	30 km
Switched fields of view:			
Wide	4°50' x 3°38'	4°18' x 3°12'	6.2°
Narrow	1 °27' x 1 °5'	1°18' x 1°00'	1.45°
Digital enlargement (without reducing information quality and angular resolution)		x2	x8
Dynamic range of video-signal receiver	-	68 dB	-
Detector sensitivity	-	0,0012 Lux	-
Operating range of waves	-	-	3...5 mm
Temperature sensitivity (NETD)	-	-	25,000 K

UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

Introduced working stations.

UPGRADING OF YHK CABIN

Within the first stage of the upgrading the UNK equipment, cabin is fallen under the circumstances of substantial changes together with the introduction of digital processing of radio-signals in the UNV cabin. Specialized electronic computing machinery is mounted in the UNK equipment cabin. It is designed to implement following algorithms:

- digital processing of radar signals in proper modes (SMT);
- recalculation of target-designation coordinates in the position of AAMS deploying and their extrapolation;
- automatic targets locking for tracking on the basis of target-designation data and information retrieved from searching sectors;
- automatic and semi-automatic tracking of target on the basis of angular coordinates (01 and 02) and range;
- automatic tracking of two guided missiles on the basis of angular coordinates (01 and 02) and range;
- generation of control commands for AAGM guidance;
- preparation of recommendation for AAGM launch (launch device).

What is more, working stations of the members of combat crew are completely replaced with the automated working stations (AWS). AWS has been implemented on the basis of standard color monitors with keeping of basic operator controls and their placement on consoles, similar to the old working stations. Besides, all functions on control of S-125 AAGM operation remain unchanged.

External appearance of launcher 5P73.

UPGRADING OF 5P73 S-125M AADMS LAUNCHER

Purpose and composition

5P73 launcher is intended for prestart preparation and for launch guidance of 5V24, 5V27, 5V27U or 5V27D missiles.

Hereby, the launch is designed on the same basis that missiles are. The external appearance of the launcher is presented on picture.

The launcher consists of the following components:

- tipping unit;
- electric adapter (4 pcs.);
- cradle;
- platform;
- basement;
- vertical guidance mechanism (electric DC motor MM-52);
- horizontal guidance mechanism (electric DC motor MM-42);
- prohibited areas mechanism;
- electrical equipment.

TECHNICAL SPECIFICATIONS

NAME OF CHARACTERISTICS	VALUE
limits of horizonting	± l°30'
loading angle in vertical plane	from 8°20' to 11°
limit missile launch angles:	
- in vertical plane	from 4°30' to 64°30'
- in horizontal plane	No limit
period of transition from transport mode to combat mode	1 h.

UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

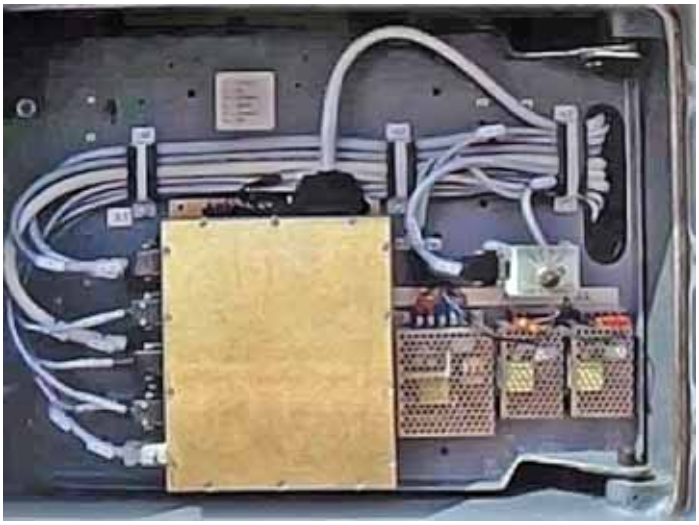
UPGRADED ELEMENTS OF 5P73 LAUNCHER

Electrical equipment and devices, located inside the launcher, are included into the set of devices which provide remote and local control over drives of vertical and horizontal guidance mechanisms, launch control system testing without missile as well as preparation and launch of the missiles. Hereby, within the upgrading of 5P73 launcher, it will be modified for the application of upgraded missile 5V27D-M.

Electrical equipment of launcher compiles:

- control unit BU-M;
- digital electric drives of horizontal and vertical guidance mechanisms;
- local sensors;
- topographic positioning equipment.

CONTROL UNIT BU-M



External appearance of BU-M unit.

Control unit BU-M is intended to control the launcher operations in all modes and data interchanges with combat control cabin UNK-M. The control unit BU-M includes:

- launch automation equipment;
- equipment for linkage with UNK-M cabin;
- ground power sources.

Launch automation equipment and ground power source, located in control unit BU-M, together with equipment located in UNK-M cabin are intended for prestart preparation and missile launch by commands received from UNK-M cabin, as well as for input of prestart preparation data into the UNK-M cabin.

Herewith, it provides:

- preparation of launcher and missiles 5V24 and 5V27 for launch in the modes «Stand-by 2» and «Stand-by 1»;
- preparation of launcher and missiles 5V27U and 5V27D for launch in the modes «30 sec» and «Stand-by 1»;
- preparation of launcher and upgraded missile 5V27D-M for launch, initial setting of inertial system and transfer of flight task;
- power supply of equipment of missiles located on launcher with DC current 26V, single-phase AC current 60V with 1000 Hz frequency, single-phase AC current 115V with frequency 1000 Hz, three-phase AC current 36V with frequency 1000 Hz.

Equipment of interfacing with the UNK-M cabin, besides the abovementioned functions, must provide:

- transfer of flight task data from the UNK-M cabin to the upgraded missile 5V27D-M;
- output of data about the pre-launch preparation process of 5V27D-M to the UNK-M cabin.

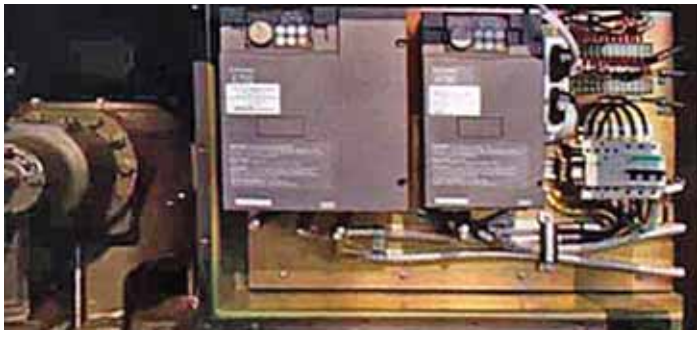
DIGITAL ELECTRIC DRIVES OF HORIZONTAL AND VERTICAL GUIDANCE MECHANISMS.

Electric drive of vertical guidance mechanism.

Upgrading of guidance drives means their transferring to digital control principle. Hereby, the executive DC electric motors are replaced for asynchronous AC electric motors.

Control over executive drive motors is performed by guidance unit, driven by commands and received from the BU-M control unit.

Application of digital electric drives of horizontal and vertical guidance mechanisms allows considerable increase in dynamic and accuracy parameters of the drives. Comparative parameters of standard and upgraded drives are presented in the Table below.



Electric drive of vertical guidance mechanism

UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

COMPARATIVE CHARACTERISTICS OF STANDARD AND UPGRADED GUIDANCE DRIVES

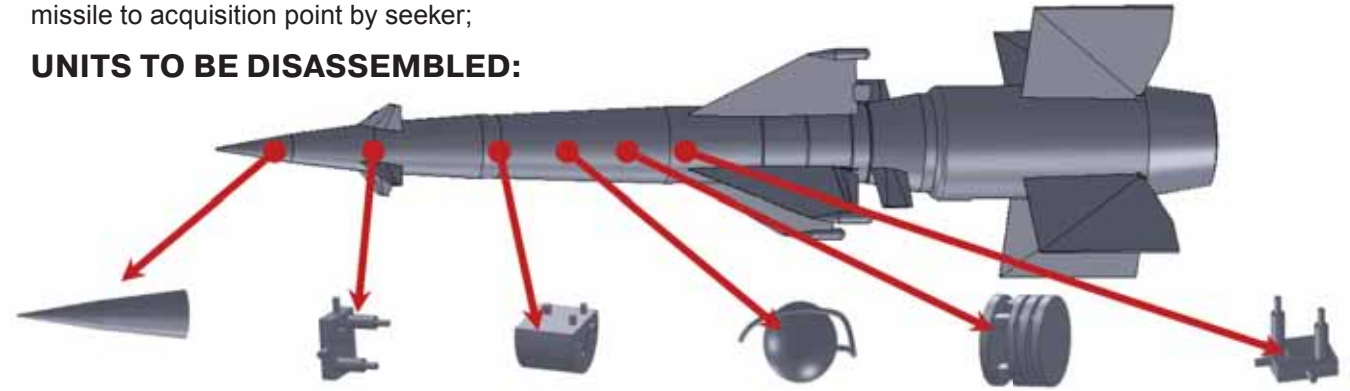
TECHNICAL PARAMETERS	5P73 LAUNCHER	UPGRADED LAUNCHER 5P73
speed of drive in guidance mode:		
- in horizontal plane	not more than 3 deg/s	not more than 3 deg/s
- in vertical plane	ot more than 3 deg/s	not more than 3 deg/s
dynamic component of drive error in guidance mode:		
- in horizontal plane	14 min	11 min
- in vertical plane	19 min	15 min
dynamic component of drive error ar reverse:		
- in horizontal plane	22 min	19 min
- in vertical plane	27 min	23 min
time of transfer:		
- in horizontal plane from 0˚ to 179˚	18 sec	15 sec
- in vertical plane from 3˚25’ to 64˚55’	16 sec	14 sec
static error of drive in horizontal and vertical planes:		
- by voltage	not more than 7 min	not more than 5 min
- by scales	not more than 15 min	

UPGRADING OF 5V27D MISSILE WITH APPLICATION OF SEMI-ACTIVE SEEKER

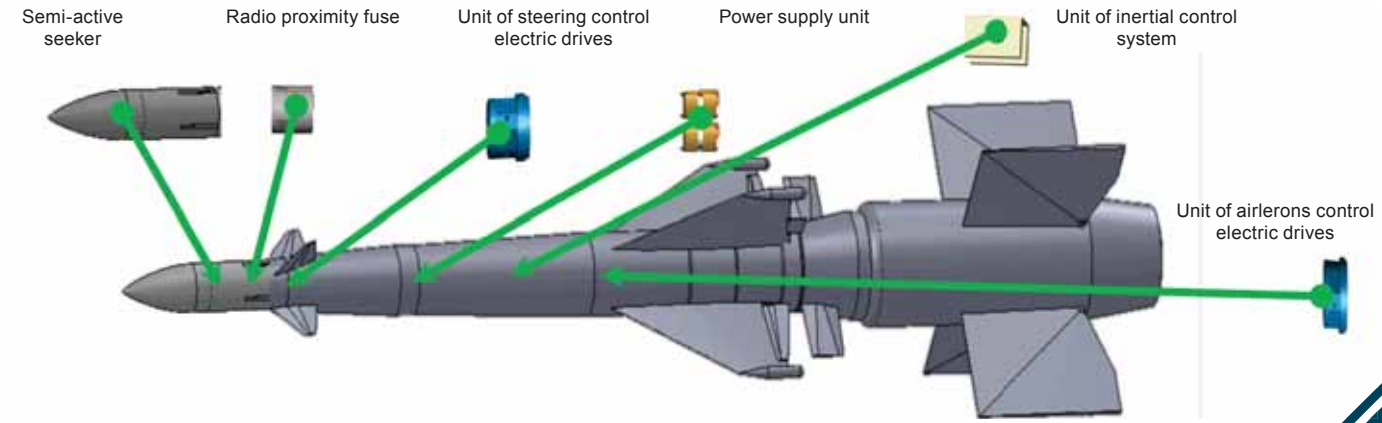
Within upgrading of this type of missile, the following renovations will be performed:

- replacement of the pneumatic steering gear and airleron drives for electric ones, that reduces the weight of unit and increases its control properties;
- installation of semi-active seeker;
- installation of platformless inertial system for guiding the missile to acquisition point by seeker;
- upgrading of the radio receiving unit for providing receiving and deciphering of corrective signals on inertial guidance area (target coordinates in antenna port coordinate system);
- installation of radar proximity fuse based on new component base;
- installation of new missile control unit.

UNITS TO BE DISASSEMBLED:



NEW UNITS TO BE INSTALLED:



UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

Within the upgraded 5V27D-M1 missile with semi-active seeker, the combined guidance method is achieved:

- on the initial phase of trajectory, an inertial guidance at predicted point with radio correction is applied, with the characteristics from SNR-125M of its velocity and position at target maneuvering;
- on final phase of trajectory, a semi-active self-guidance, after target acquisition with illumination from SNR-125M, is applied.

Such an upgrade will provide an increase of 5V27D missile far damage envelope up to 40 km (against high-speed and maneuvering targets) and up to 45 km (against small-speed targets).

Characteristics of S-125M-2UM AADMS damage envelope in vertical and horizontal planes, for targets flying with speed V_t < 300 m/s (Effective reflective area=1 m^2), are presented on Fig. 5 and 6.

AADMS in vertical and horizontal planes for targets flying at speed V_t - 700 m/s (Effective reflective area = 1 m^2) are presented on Fig. 7 and 8.

Characteristics of damage envelope of C-125M-2UM AADMS in vertical and horizontal planes against targets flying with speed V_t < 900 m/s (Effective reflective area =1 m^2) are presented on Fig. 9 and 10.

-Area of 5V27D -Area of 5V27D-M1

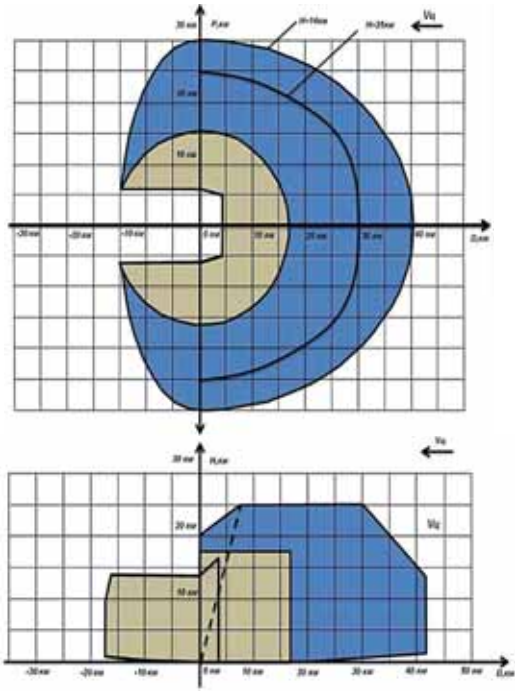


Fig. 5-6. Damage envelope of C-125M-2UM AADMS (Vt < 300 m/s).

BASIC SPECIFICATIONS OF SEMI-ACTIVE SEEKER:

TECHNICAL PARAMETERS	VALUE
angle rate of target indication processing, deg./sec	50
range of target approach speeds, m/s	300...2400
weight of semi-active seeker components, kg, not more than	15
diameter, mm, not more than	200
length, mm, not more than	400
duration of radio correction path, ms	30,72
mean time between failures, hrs, not less than	500

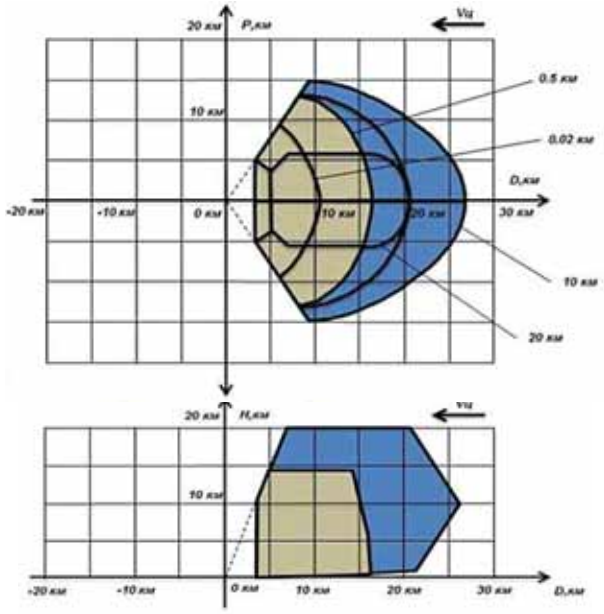


Fig. 7-8. Damage envelope of C-125M-2UM AADMS (Vt < 700 m/s).

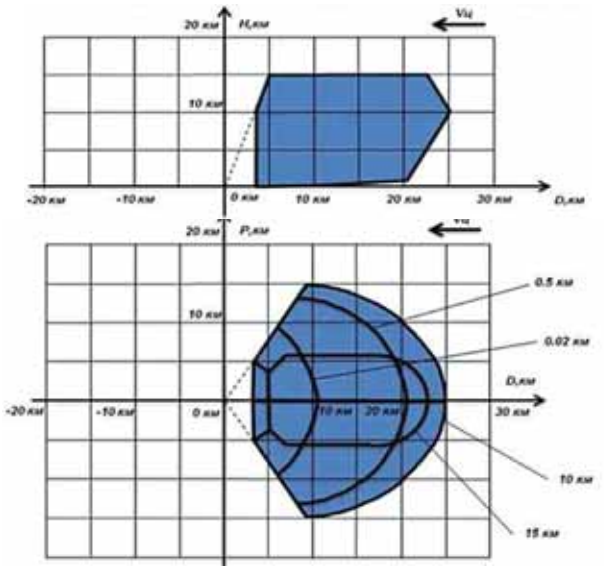


Fig. 9-10. Damage envelope of C-125M-2UM AADMS (Vt < 900 m/s).

UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

Target hitting probability by one upgraded missile 5V27D-M1 comprises - p = 0,8. Target hitting probability by two upgraded missiles 5V27D-M1 will be determined by formula:

$p = 1 - (1 - p)^2 = 1 - (1 - 0,8)^2 = 0,96$.

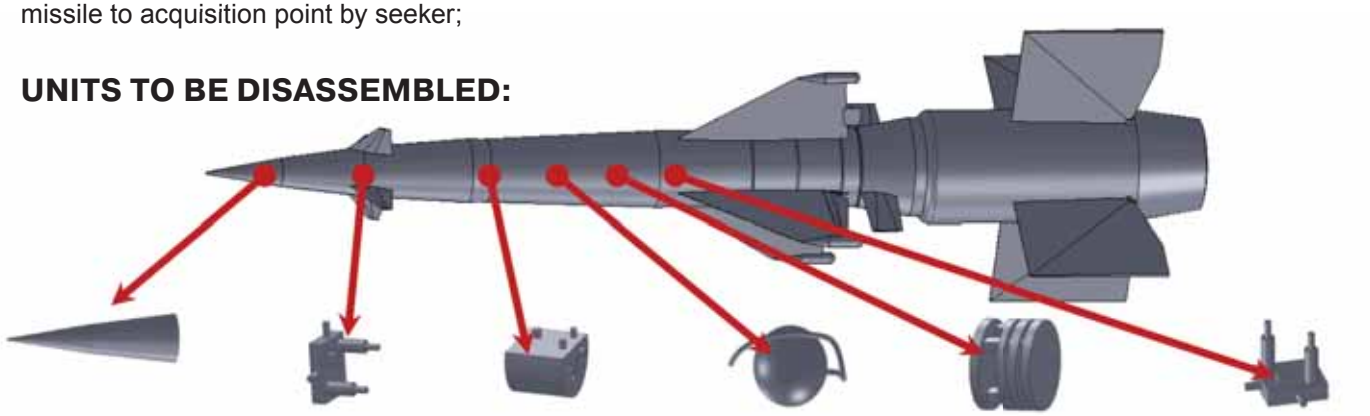
Application of upgraded missiles 5V27D-M1 allows increase in S-125M AADMS potential in simultaneous tracking of targets and missiles guided at them. The upgraded equipment of antenna post UNV-M and cabin UNK-M provide detection and **up to 3 targets** tracking, within the beam of SNR- 125M. Upgrading of missile line-of-sight radio transmitter and control command radio transmitter allows for **controlling over 6 missiles 5V27D-M1 simultaneously**.

UPGRADING OF 5V27D MISSILE WITH APPLICATION OF ACTIVE SEEKER

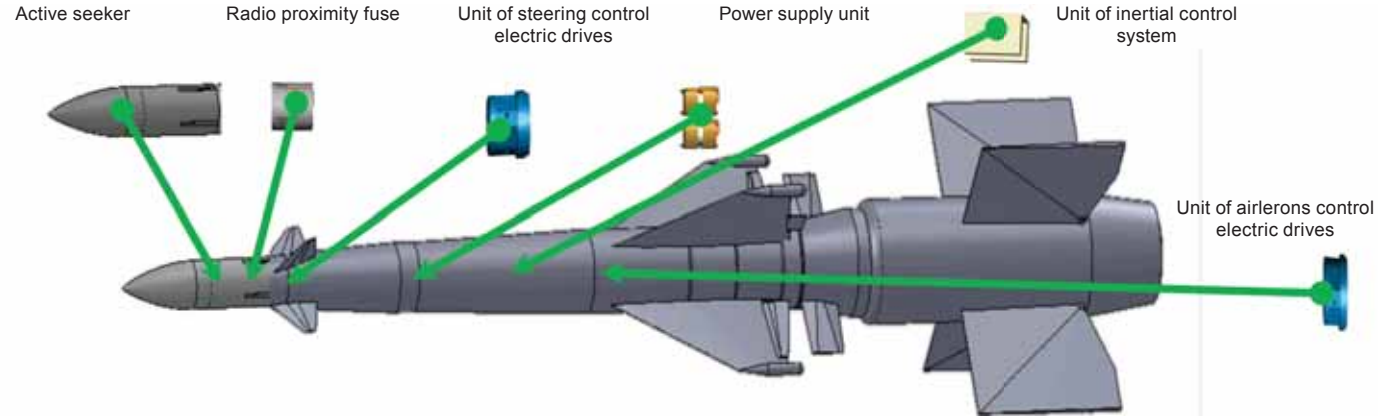
Within the upgrading of the missile, the following alterations will be performed:

- replacement of pneumatic steering gear and airleron drives with electric ones, which reduces the weight of unit and increases its control properties;
- installation of active seeker;
- installation of platformless inertial system for guiding the missile to acquisition point by seeker;
- upgrading of the radio receiving unit for providing receiving and deciphering of corrective signals on inertial guidance area (target coordinates in antenna port coordinate system);
- installation of the radar proximity fuse based on the new component base;
- installation of the new missile control unit.

UNITS TO BE DISASSEMBLED:



NEW UNITS TO BE INSTALLED:



UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

BASIC SPECIFICATIONS OF ACTIVE SEEKER:

TECHNICAL PARAMETERS	VALUE
number simultaneously attacked targets	1 4
search area, degrees:	
- by azimuth - by elevation	± 35° ± 25°
angle rate of target indication processing, deg./sec	50
range of target approach speeds, m/s	300 2400
search area by distance, km.	0,1 20
air target acquisition distance (target of mig-29 type), km, not less than	20
weight of active seeker components, kg, not more than	15
diameter, mm, not more than	200
length, mm, not more than	400
duration of radio correction path, ms	30,72
mean time between failures, hrs, not less than	500

Within the upgraded missile “5V27D-M2” equipped with the active seeker, proportional modified target guidance method has been achieved:

- inertial guidance with radio correction from SNR-125, on initial stage of missile flight and active radar guidance on the final stage;
- inertial guidance without radio correction on the initial stage of missile flight and active radar guidance on the final stage.

This kind of upgrade provides increase in far damage envelope of 5V27D missile up to 40 km against high-speed and maneuvering targets; and up to 45 km against small-speed targets.

The damage envelope is intended for targets which flying speed is amounted to V_t < 300 m/s (Effective reflective area = 1 m^2), are presented on the Fig.11 and on the Fig.12.

Damage envelope S-125M-2UM AADMS characteristics, in vertical and horizontal planes for targets flying at speed Vt < 700 m/s (Effective reflective area = 1 m^2), are presented on the Fig.13 and on the Fig.14.

S-125M-2UM AADMS damage envelope characteristics, in vertical and horizontal planes against targets flying with speed V, < 900 m/s (Effective reflective area = 1 m^2), are presented on the Fig.15 and 16.

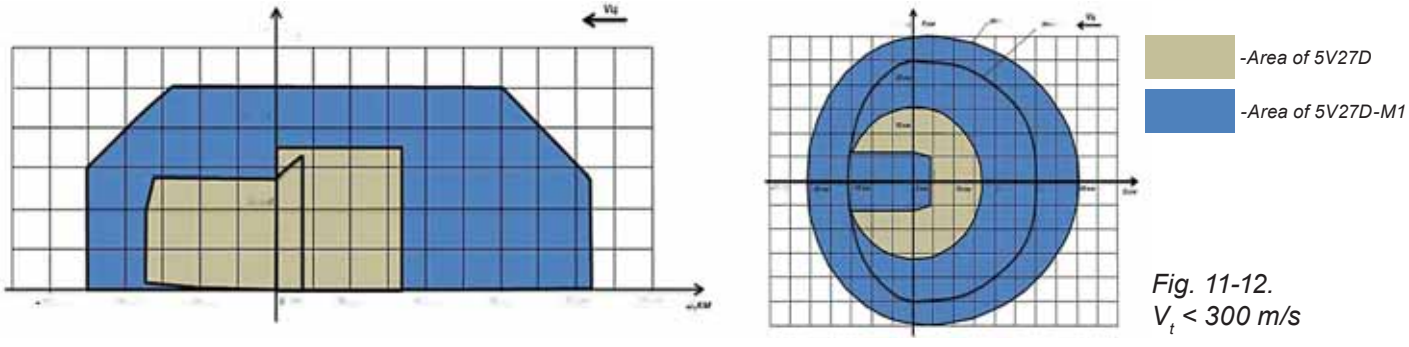


Fig. 11-12.
V_t < 300 m/s

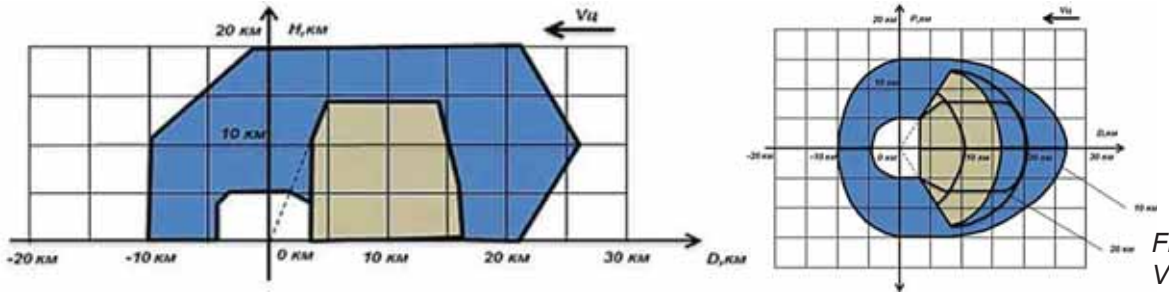


Fig. 13-14.
V_t < 700 m/s

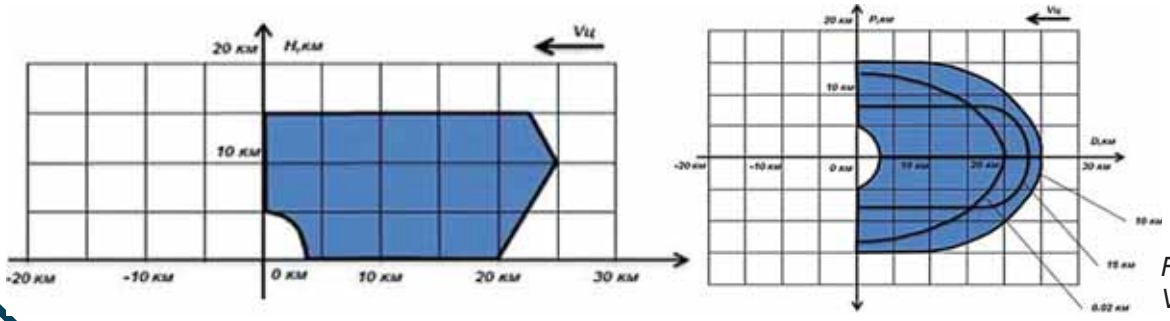


Fig. 15-16.
V_t < 900 m/s

UPGRADING OF S-125M (PECHORA) ANTI-AIRCRAFT MISSILE SYSTEM

Target hitting probability by the one upgraded missile 5V27D-M2 comprises - = 0,85. Target hitting probability by the two upgraded missiles 5V27D-M2 may be determined by formula:

$P2 = 1 — (1 - P)^2 = 1 - (1 - 0,85)^2 = 0,977$.

Application of the upgraded missiles 5V27D-M2 allows to increase S-125M AADMS potential in simultaneous tracking of targets and missiles guided at them. In addition, application of the upgraded missiles 5V27D-M2 provides fundamental upgrading of S-125M AADMS. Hereby, the antenna post of the cabin UNV-M has been deleted from the composition of S-125M AADMS and replaced by the standard three-dimensional Radar Station of 36D6 type and radio correction equipment on each launcher. The target detection data is submitted to a digital form to the cabin UNK- M and to the correspondent launcher in the form of usual flight task data. The control of missile during the flight is completed by missile sighting transponder, placed on the launcher.

Three-dimensional warning radar station provides detection and tracking of 8 targets (target channels). The launch control system allows controlling over 16 missiles 5V27D-M2 simultaneously.

The use of the complex phase-code modulated sequence as a sweeping signal of an active HH allows essential reducing of the intentional jamming action on the mentioned missile home head, which definitely provides high probability (more than 0.9) of target hitting.

Applying the radio-correction system and active homehead of the 5B27fl missile instead of the radio-command control system, gives an opportunity to realize the principle of simultaneous target handling capacity, in other words, simultaneous launching of several (4 at most) missiles at different targets in the zone of main lobe of antenna diagram of active HH.

REPLACEMENT OF 5S45 TAKE-OFF BOOSTER

Replacing the 5S45 take-off booster, solid-fuel charges have to be already are replaced. Besides, 14 cylindrical single-channel explosive cartridges, with usual gunpowder charge, have been replaced with the same single-channel cartridges with combined charge. In comparison with the usual gunpowder charge, the advantage of explosive cartridges with combined charge is the increased time of cartridge burning, while characteristics of developed boost thrust remains the same.

Applying the cartridges with the combined charge allows flights with the aid of take-off booster along all-ballistic trajectory, within the initial trajectory phase of the 5B27fl missile flight. Thereupon, the zone edge of lethal envelope of C-125M AAMS amounts to 45 km.

Profound upgrading of the 5V27D anti-aircraft guided missile permits to prolong its life service up to 10 years. Indeed, this is a fairly preferable alteration, concerning the fact of a long-storing of these missiles, which were manufactures in the former USSR.

SHORT RANGE SHIPBORNE AIR DEFENSE SYSTEM «ARBALET-K»

OVERVIEW

Short range shipborne air-defense missile system «Arbalet-K» is primary intended to destroy jet, propjet and propeller-driven aircrafts and helicopters at head-on, pursuiting courses under the conditions of target direct visibility with the use of air-defense guided missiles «Igla».

THE «ARBALET-K» SYSTEM CONSISTS OF:

- ground basis with actuators;
- control panel;
- guidance device and thermal imager;
- traverse platform;
- two launching units with two air-defense missiles of «Igla» type, mounted on each unit;
- spares and accessories kit;
- operational documentation set.

SPECIFICATIONS

Target destruction range, m	500 - 5000
Maximum altitude for targets destruction, m:	256
jet aircrafts:	
- at head-on courses	2000
- at pursuit courses	2500
helicopters and propjet aircrafts:	
- at head-on courses	3000
- at pursuit courses	3500
Minimum altitude for targets destruction, m	10
Targets speed, m/s:	
- at head-on courses	360
- at pursuit courses	320
Targets detection range, km	12
Traverse platform angles of rotation, ...°:	
- heading angle	from minus 15^0 to+15^0
- elevation	from minus 25 to +60
- roll angle	±25
Weight, kg	1140
Overall dimensions, mm	1730x2245x1590
Operating temperature range, °C	from minus 40 to +60

DIRECTION FINDING AND PASSIVE RECONNAISSANCE SYSTEMS

MULTIFUNCTIONAL TARGET DESIGNATION RADAR COMPLEX «MINERAL-ME»

OVERVIEW

The complex provides long-range over-the-horizon detection of surface targets, reception and processing of surface situation data received from coastal complexes, tactical group vessels, equipped with «Mineral» type complexes (systems) and also from aircraft and helicopters that transmit data using regular means of radio communication, develops and presents information on target coordinates to weapon system of a vessel and tactical group vessels, provides guidance for joint combat actions.

It represents multipurpose information and control system that operates using heterogeneous data detectors (active, passive, remote air and ship observation stations) within the integrated information field and provides detection of over-the-horizon surface targets and targets designation.

COMPLEX COMPOSITION

- active radar for surface targets detection and target designation (ARS);
- passive radar for surface targets detection and target designation (PRS);
- station of mutual information exchange,mutual vectoring (orientation) and joint surface targets data processing (MEI-MOR station).

DEPLOYMENT OPTIONS

- Vessel-based;
- Stationary (coastal);
- Portable on the mobile chassis.

BATTLE TASKS

- detection and coordinates setting of surface targets in active and passive modes of detection for possible use of weapons;
- automated acquisition, processing and an information display from PRS (passive radar), ARS (active radar), vessel remote sources of information acquisition equipped with «Mineral-ME» complexes (systems), and information received via regular radiocommunication means from air remote observation posts;
- target classification;
- vectoring (orientation) of vessels combined into a tactical group;
- automated data exchange between flagship (FS) and the group vessels (GV);
- command and control of joint combat actions (C2JCA) of vessels.

ARS (ACTIVE RADAR) ENSURES:

- detection and tracking of surface targets , their coordinates setting;
- classification of detected targets;
- elaboration and delivery of information on a target designation to the automated command and control system.

MULTIFUNCTIONAL TARGET DESIGNATION RADAR COMPLEX «MINERAL-ME»

SPECIFICATIONS

Radar		Active	Passive	MEI-MOR
Frequency band		I	I, G, E/F, D	I
Scanning zone	Through azimuth	360 °	360 °	360 °
	Through range	Up to 250 km	Up to 450 km	Up 30 km
Number of targets tracked	Detection mode	-	Up to 50	-
	Target designation mode	-	Up to 10	-
Number of targets processed		-	-	Up to 200
Number of interacting ships		-	-	Up to 9

PRS (PASSIVE RADAR) ENSURES:

- reception, detection, bearing and parameters measurement of impulse signals of radiating radars within the frequency bands I,G, E/F, D;
- classification of received signals;
- coordinates setting (bearing and range) of radiating radars by means of one maneuvering vessel or a group of two-three vessels interacting through the MEI-MOR station;
- transfer of data on target designation to the automated command and control system.

MEI-MOR STATION ENSURES:

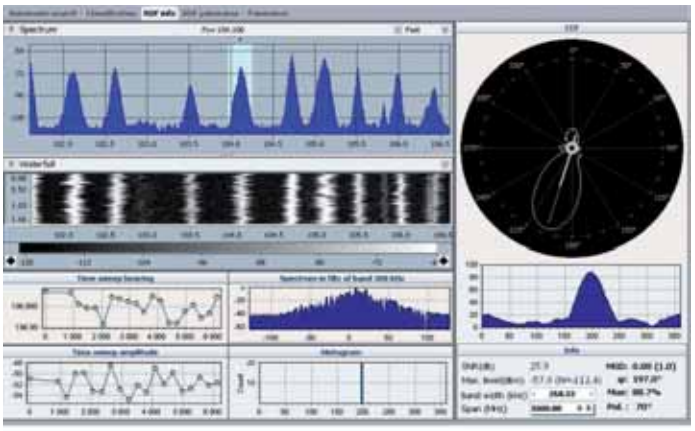
- identification, mutual information exchange and mutual vectoring (orientation) between the tactical group vessels, equipped with «Mineral-ME» type complexes (systems);
- adaptive information exchange between the tactical group vessels;
- gathering and joint information processing on surface targets by means of a single vessel and by means of the tactical group;
- formulation and transfer of information on the tracked targets to the combat information-command-and-control system;
- processing and delivery of information on target designation to the automated command and control system.

MOBILE COMMUNICATION INTELLIGENCE COMPLEX «COMINT»

OVERVIEW

Mobile VHF-UHF Communication Intelligence (COMINT) Complex is intended for position finding and recording of the radio signals within the frequency range of 30 MHz – 3000 MHz.

Complex consists of three identical Mobile COMINT Stations mounted in the shelter, which can be installed on the platform of truck or on trailer.



Displaying of the progress and results of direction finding

COMPOSITION OF THE STATION

The Mobile COMINT Station includes:

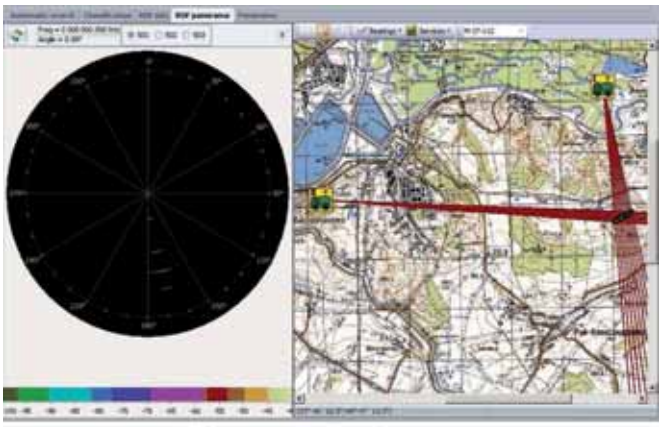
1. Direction finding (DF) antenna system. Which is implemented on the basis of two 9-element ring antenna arrays operating within the frequency range 30-600 MHz and 600-3000 MHz. The mast with the antenna system is automatically raised into position;
2. Conversion and digital signal processing block;
3. Automated workstations of operators;
4. Power supply and air conditioning system;
5. Radio communication equipment;
6. Surveillance control equipment.

MAIN FUNCTIONS OF COMPLEX

- Automatic detection and analysis (measurement of parameters) of radio signals in preset frequency band.
- Automatic direction finding of detected radio sources.
- Generation of amplitude-frequency spectrum of the whole range or the separate bands, as well as the amplitude-frequency- time spectrum (in the 5 MHz band).
- Generation of DF (amplitude-frequency-azimuth) panorama of the whole range or separate bands.
- Calculation of the radio sources coordinates and the generation of radio environment map on the basis of terrain map.
- Demodulation of radio signals in real time or previously recorded.
- Generation of database with results of detection, analysis, demodulation, direction and position finding.

MOBILE COMMUNICATION INTELLIGENCE COMPLEX «COMINT»

The interior of the body with the operator's workstations



DF panorama and radio environment map

SPECIFICATIONS

Operating frequency range	from 30 MHz to 3000 MHz
Maximum scanning speed for operating frequency range at the detection of radio signals	not less than 1000 MHz/s
Field sensitivity at the direction finding with mean square error 1° and 20 ms measurement cycle: not more than 10 mV/m.	
Minimum duration of radiation for directional signal	500 ms
Single signal dynamic range	not less than 80 dB
Discrete control of attenuation on the input	from 0 to 30 dB with spacing 2 dB
Dynamic range by intermodulation of 3rd and 2nd levels	not less than 70 dB
Intermediate frequency band on digital converter output (band of instant review)	5 MHz
Directional radio signal band	3 ... 500 kHz
Automatic measurement of the following signal parameters at the signal-to-noise ratio not less than 10 dB is provided:	
medium signal frequency (carrier)	with resolution capability 10 Hz
signal-to-noise ratio	10...30 dB with resolution capability 0.5 dB
symbol modulation rate	10...64000 baud with resolution capability 10 baud
signal bandwidth	3...500 kHz with resolution capability 10 Hz
with error no more than:	
average frequency	10% of the signal bandwidth
SNR	± 1.5 dB
symbol modulation rate	10%
signal bandwidth	10%
Power supply:	
built-in petrol electric generator	
or external single-phase alternating current electric system of voltage 220 V ± 10 V with frequency 50 Hz ± 2 Hz	
or built-in storage batteries of voltage 24 V	
Operational temperature range	from -20°C to +50°C

VHF-UHF MOBILE RADIOMONITORING STATION «BARVINOK-M»

OVERVIEW

VHF-UHF mobile radiomonitoring station «Barvinok-M» is intended to provide detection and direction finding of signals within the frequency band of 25 – 3000 MHz. Station provides scanning of preset VHF-UHF frequency band, spatial search and localization of radio source position by surface wave of vertical polarization.

Equipment of «Barvinok-M» station is mounted inside Customer's vehicle (minivan). VHF-UHF direction finding antenna feeder system is mounted on top of the vehicle under radiotransparent streamlined antenna cover.

GENERAL INFORMATION

Station is operated by a single operator. «Barvinok-M» software is developed using modern computer technologies. Built-in self-testing system allows to detect malfunction up to the faulty assembly.

«Barvinok-M» detector-finder refers to the class of the systems with spatial signal processing and it provides signal detection by signal spatial features along with assessment of direction towards radio source using correlation vector method of bearing computation.

VHF-UHF antenna system consists of two ring antenna arrays each containing 7 monopoles covering frequency sub bands of 25-1000 MHz and 1-3 GHz respectively.

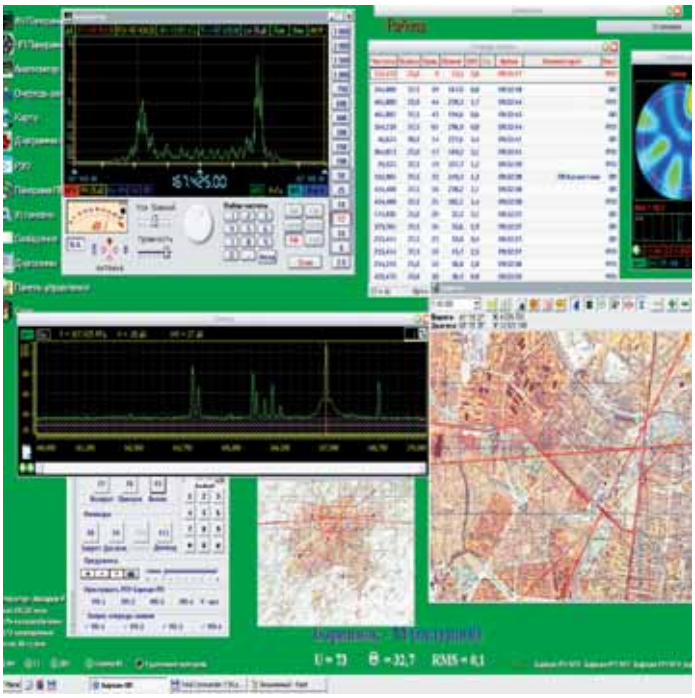
Navigation equipment (GPS-receiver) with radio communication equipment provides possibility of synchronous work of mobile stations «Barvinok-M» both as Salve and Master station.

Power supply of station is provided through UPS from industrial network with given voltage 220 V, frequency 50 Hz from independent source that is mounted in the rear section of the vehicle.

STATION PROVIDES:

- Panoramic view with signal detection and direction finding in the frequency band of 25 - 3000 MHz with 10 GHz/s rate
- Automatic detection and direction finding of emission sources of modern communication systems (Conventional & Frequency Hopping) using correlation vector method
- Coordinates computation with displaying them on the digital map
- Network classification and signal parameters measurement
- Signal reception and digital registration
- Audio and visual control over detected signals
- Radio electronic environment (REE) data storing and processing
- Inside direction finding network with time synchronization by GPS navigation system
- Coverage range: up to 20…30 km in the 25 - 500 MHz frequency band
  up to 5…10 km in the 500 - 3000 MHz frequency band

VHF-UHF MOBILE RADIOMONITORING STATION «BARVINOK-M»



PURPOSE

Mobile VHF-UHF station for radiomonitoring «Barvinok-M» provides the following:

- REE monitoring over the territory in view of 20-30 km in the band of 25-500 MHz and up to 5-10 km in the band of 500-3000 MHz;
- Search, detection and direction finding of new radio emission sources within given segment of VHF-UHF (25–3000 MHz) frequency bands;
- Network classification and measurement of signals parameters of the RES detected;
- Monitoring over already known sources put under surveillance;
- Computation of radio source coordinates with its indication on digital map;
- Parameters and operation modes control, data gathering from Slave stations of the direction finding network;
- Automated processing and documentation of REE data;
- Data communication with stations from the composition of the complex.

SPECIFICATIONS

Sensitivity by EM-field (SNR=10 dB, BW=12.5 kHz):	
in 25-50 MHz frequency band	15 - 40 μV/m
in 50-1000 MHz frequency band	3 - 15 μV/m
in 1-3 GHz frequency band	10 - 30 μV/m
Realtime BW	2.5 / 10 MHz
Probability of detection and direction finding of signal with 100 ms duration when scanning in 200 MHz frequency band	> 0.9
Probability of detection and direction finding of FH signals	> 0.9
Minimal duration of the signal to be detected and for its bearing to be determined	1 ms
Sensitivity of receiving sections (SNR=10 dB, BW=12.5 kHz)	0.7-1.0 μV
Dynamic range of received signal levels	120 dB
Suppression of spurious channels	> 80 dB
Relative frequency instability	2x10-7
Tuning time of receiver's frequency synthesizer	200 μs
Spectral density of heterodyne noise (given detuning 25 kHz)	– 100 dBc/Hz

Quality assessment of signal detection and direction finding	RMS Θ/U dBμV
VHF-UHF equipment of tracking and signal registration:	
Number of receiving channels:	1 tracking and registration channel
Operating frequency band	25-3000 MHz
Sensitivity (SNR=10 dB, BW=12 kHz)	0.7 - 1 μV
Dynamic range of received signal levels	> 120 dB
Tuning time of receiver's frequency synthesizer	1 ms
Frequency tuning step	10 Hz
Frequency analysis and digital registration band	2,5 kHz - 3 MHz
Time of signal registration (is set automatically depending on the frequency band and detector-finder request queue	10...100 s
Total duration of continuous signal record of a signal given frequency band 300 kHz to HDD	4 hours

MOBILE HF BAND DIRECTION FINDING STATION «BERKUT»

OVERVIEW

Composition: direction finding antenna-feeder system on the basis of HF-loop antennas, receiving and measuring device based on three-channel DSP receiver with narrowband tunable analogue preselector (196 equivalent filters), scanning receiver, Laptop, GPS-receiver, GSM-modem, data transfer and communication UHF radio station, power supply unit with automatic accumulator charging system, two accumulator sets.

Digital LF-signal registration, in-band and polarization signal selection from several radio sources, automatic measurement of signal parameters, remote control as a part of direction finding network (UHF-channel or GSM-channel).

Station can be operated by one person.

- Operating frequency band: 1–30 MHz,
- Sensitivity: 10-30 μV/m,
- Direction finding method: Watson-Watt,
- Instrumental bearing error 1°...2° (RMS),
- Range of received signal levels > 100 dB,
- Minimal signal duration for its bearing to be determined: 10 ms,
- Frequency bandwidth of direction finding 0.3–8 kHz,
- Bearing timing accuracy ±125 ms,

MOBILE VHF-UHF BAND DIRECTION FINDING STATION «SCORPION»

OVERVIEW

Composition: direction finding antenna feeder system on the basis of 16-element ring antenna array, omnidirectional antenna, receiving and measuring device on the basis of one channel receiver with direction finding processor, operator's panel on the basis of Laptop, GPS-receiver, data transfer and communication UHF radio station, power supply unit with automatic accumulator charging system.

Digital LF-signal registration, remote control in the composition of direction finding network (UHF-channel).

- Operating frequency band: 30-1000 MHz,
- Sensitivity: 5-30 μV/m,
- Direction finding method – phase (quasi-Doppler),
- VHF-UHF panoramic frequency scanning with 150 MHz/s rate,
- Instrumental bearing error: 2°...3°,
- Range of received signal levels: >100 dB,
- Minimal signal duration for its bearing to be determined: 200 ms,
- Frequency band of bearing determined: 5 – 150 kHz,
- Timing bearing accuracy: ±125 ms

MOBILE STATION FOR RADIOMONITORING OF HF FREQUENCY BAND «UKOL»

OVERVIEW

Coverage range: 0…50 km and 150…2000 km and more.

Signal reception with vertical and circular polarization.

Composition: antenna-feeder system consisting of one ring antenna array with diameter of 40...70 m, unit of wideband input devices, rack of digital 9-channel detector-radio direction finder, tracking receiver «Galaktika-M», operator panel on the basis of Core 2 Quad 2.8 GHz server with interface boards, operating control keyboard, UHF radio station, WLAN-equipment for external jamming station remote control.

Manual and automatic signals direction finding at the distance up to 40…50 km, 150 … 2000 km and more with wave signal elevation angle 0…85°.

Coherent (mono-pulse) principal of direction finding signal processing provides bearing of short-time signals with duration of 3…100 ms and more (including Frequency Hopping signals). Direction finding station is operated by single operator. Time of station deployment – 30 min (crew of 4 persons). Station equipment may be installed on automobile with high off-road capability, such as KrAZ, KAMAZ and on other vehicles (on request of customer). VHF/UHF (30-3000 MHz) equipment may be installed optionally.

Frequency range	1.5-30 MHz
Sensitivity	3-5 μV/m
Dynamic range of signal level	> 120 dB
Dynamic range (two tone intermodulation)	> 85 dB
Frequency setting	1 Hz
Direction finding instrumental accuracy	1° (RMS)
Scanning speed	10-300 MHz/s
Direction finding frequency resolution	100-500 Hz
Minimum required signal duration	3-5 ms
DF processing bandwidth	400 kHz
AF processing bandwidth	0.3-8 kHz
Recording and automatic classification of type modulation	AM, ASK, SSB, Multi-Channels, FSK2, PSK2, PSK4, frequency hopping (20-300 hop/s) and recognition of up to 32 types of special signals
Direction finding method	correlative interferometer
Method of Location Emitters	SL. Manual and Automatic

THE MOBILE RADIOMONITORING SYSTEM «ARGUS-M2»

The Mobile Radiomonitoring System (MRMS) «ARGUS-M2» is designed for automated monitoring of radio-frequency spectrum, measurement of different parameters of electromagnetic emissions and radio signals, and for online direction finding of transmitters and radioelectronic systems outside the availability zones of fixed DF and radiomonitoring stations.

MRMS «ARGUS-M2» is based on high-performance measurement equipment of the ROHDE & SCHWARZ (Germany) company:

- R&S FSP30 spectrum analyzer;
- R&S EB200 monitoring receiver;
- R&S EBD195 direction finder processor;
- R&S HE010 and R&S HE500 monitoring antennas;
- R&SADD195 and R&SADD071DF antennas;
- R&S AC008 microwave directional antenna;
- R&S HE200 portable directional antenna;
- R&S ARGUS-IT spectrum monitoring and management software;
- R&S Map View geographic information software.

MRMS «ARGUS-M2» ensures achieving following tasks:

- systematic monitoring and measurement of the radio stations parameters (level, frequency, offset, deviation, field strength and power flux density, bandwidth, modulation parameters);
- measurements for EMC (electromagnetic compatibility);
- identification of the interference sources.

SPECIFICATIONS

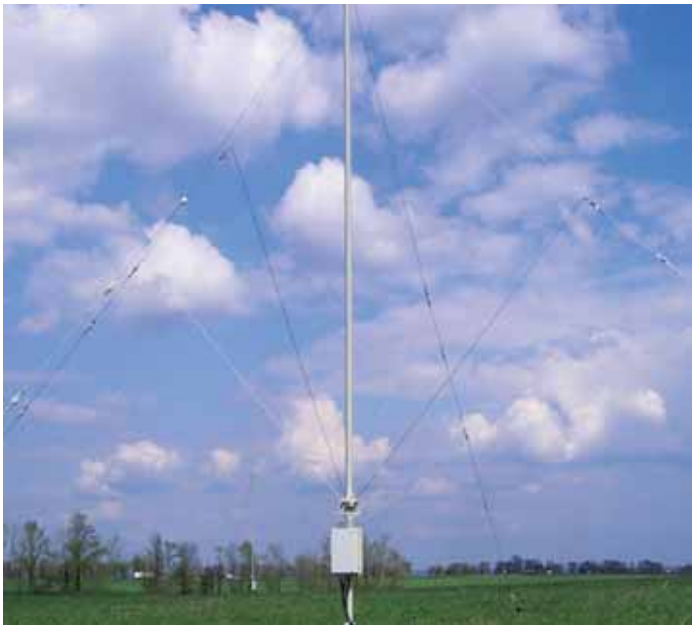
Operating frequency ranges:		
direction finding mode		20.. .3 000 MHz
radiomonitoring mode		20... 26 500 MHz
Instrumental error of DF in frequency	20... 80 MHz	2 degree
	80.. .1 300MHz	1 degree
	1,3. ..3 GHz	2 degree
Sensitivity at frequency of 1 GHz		-145 dBm
Average positioning error		less than 15m
Power supply systems: in the mobile mode in the fixed mode		12V/ 24V DC 220 VAC (external
Max power consumption		1000W
Time to establish an operating mode		less than 15 min
Operating temperature (inside a car)		+5...+55˚C
Maximum dimensions, WxHxD		2242 x 2650 x 5290 mm
Maximum height with deployed mast		9450 mm
Weight with driver		2870 kg

COMPLEX FOR DETECTION AND DIRECTION FINDING «VOSTOK-OP»

OVERVIEW

- Complex for detection and direction finding of HF band signals «VOSTOK-OP»
- Composition:
  - antenna-feeder system that consists of two ring antenna arrays with diameter of 120 m and 50 m,
  - unit of wideband input devices,
  - 9-channel panoramic receiver of detector-radio direction finder,
  - tracking receiver,
  - operator panel on the basis of Core 2 Quad 2.8 GHz server with interface boards,
  - operating control keyboard.
- Coverage range: 0…50 km and 150…2000 km and more.
- Receiving of signals with vertical and circular polarization.
- Operating frequency range: 1.5-30 (0.5-30) MHz,
- Sensitivity: 1-5 μV/m,
- Dynamic range with respect to intermodulation > 90 dB,
- Range of signal levels > 120 dB,
- Frequency bandwidth of simultaneous scan: 2400 kHz,
- Panoramic frequency scanning rate: 0.1-1 GHz/s,
- Frequency resolution of detector-finder: 100-500 Hz,
- Instrumental bearing error: 1° (RMS),
- Minimal signal duration for its bearing to be determined: 1 ms,
- Analyzed frequency band: 0.1 - 12 kHz,
- Frequency resolution: 1 Hz,
- Automatic signal classification: AM, ASK, SSB, FM2, PM2, FM4, FH (20-1000 hops per second).
- Simultaneous measurement of azimuth and elevation angle of radio wave detection gives an opportunity to provide assessment of radio source location basing on single point (SSL) method.

STATIONARY DIRECTION FINDING STATION «VOSTOK-RP»



OVERVIEW

Composition:
- antenna-feeder system that consists of two ring antenna arrays with diameter of 120 m and 50 m,
- unit of wideband input devices,
- 9-channel receiver,
- operator board on the basis of Core 2 Quad 2.8 GHz server with interface boards,
- operating control keyboard.
- Coverage range: 0…50 km and 150…2000 km and more.
- Receiving of signals with vertical and circular polarization.
- Operating frequency range: 1.5-30 (0.5-30) MHz,
- Sensitivity: 0.5-3 μV/m,
- Dynamic range with respect to intermodulation > 90 dB,
- Range of received signals' levels > 120 dB,
- Frequency resolution: 1 Hz,
- Instrumental bearing error: 1° (RMS),
- Frequency bandwidth of signals those bearings are being determined: 4 or 8 kHz.
- Coherent (monopulse) principal of signal receiving and signal processing provides bearing determination of pulse and FH signals with duration of 1…100 ms.
- Simultaneous measurement of azimuth and elevation angle of radiowave detection gives an opportunity to provide assessment of radio source location basing on single point (SSL) method.

VHF-UHF BAND RADIO RECEIVING DEVICE «GALAKTIKA-U»

OVERVIEW

«Galaktika-U» RRD (radio receiving device) is to be operated in the composition of VHF-UHF centers or autonomously. It provides reception and demodulation of a wide range of signals in frequency band of 20-3000 MHz. Computer control (USB 2.0 interface),traditional LF outputs.

SPECIFICATIONS:

- Antenna inputs: 20-1000 MHz and 1-3 GHz – 50 Ohm,
- SWRin <2.0,
- Sensitivity: (SNR=10dB, BW=12kHz) 0.5-1.0 μV, single-signal dynamic range > 90 dB,
- Dynamic range with respect to intermodulation > 80 dB,
- Frequency pass band: 2.5…3000 kHz (for audio reception 2.5…300 kHz),
- Selectivity by neighboring channel > 80 dB,
- Input attenuator: 0..30 dB, step 10 dB,
- AGC depth 120 dB,
- ADC capacity 16 bits, suppression of spurious channels >90 dB,
- Frequency instability 0.5•10-7,
- Frequency tuning step – 1 Hz,
- Spectral density of heterodyne noise (f=25 kHz) –102…–110 dBs/Hz,
- Signal demodulation: AM, FM, CW, USB, LSB, BFO setting 0…±3 kHz with 10 Hz step,
- Power supply: AC 220V/50 Hz (DC 20…32 V),
- Power consumption: 65 W.

STATIONARY VHF-UHF BAND DIRECTION FINDING STATION «RUBEZH»

OVERVIEW

Antenna-feeder system consisting of two ring antenna arrays with diameter of 2.8 m and 0.6 m, lifting mast, unit of wideband input devices and switching, receiver, digital processing unit, connection controller, modem, power supply unit, UHF-transmitter with antenna.

- Operating frequency band: 30-1000 MHz,
- Sensitivity: 5-35 μV/m,
- Range of received signal levels 100 dB,
- Instrumental bearing error: 1° (RMS),
- Minimal signal duration for its bearing to be determined: 200 ms,
- Frequency bandwidth: 5-150 kHz,
- Bearing timing accuracy: ±125 ms

MANPORTABLE DIRECTION FINDER «FILIN»

OVERVIEW

Provides searching, signal detection and position determination of RES operating in frequency band of 1.5 – 1300 MHz.

COMPOSITION:

Receiving and measuring device with AGC-processor and signal level indicator, carrier with indicator device and with set of attachable modules of directional antennas HF, V, U, 20dB HF-attenuator, headphones; receiving and measuring device cover, Khaki-colored bag.

SPECIFICATIONS:

Antenna modules V3 and U3 of concealed carrying.

Operational error of RES direction finding in field conditions:

- in frequency band 1.5–30 MHz not more 10˚
- in frequency band 30–500 MHz not more 20˚
- in frequency band 500–1300 MHz not more 10˚
- sensitivity: 20-100 μV/m
- signal level measuring limits –10...120 dB
- time of continuous operation from accumulator not less than 6 h

PANORAMIC SIGNAL DETECTOR OF VHF-UHF BAND «PANORAMA»

OVERVIEW

Panoramic signal detector of VHF-UHF band «PANORAMA» efficiently detects signals of modern broadband communication systems including Bluetooth, Wi-Fi and others.

Composition: Unit of panoramic receiving device; executive radio receiver IC R8500-M; operator board on the basis of laptop; special software of signal detection; carrying bag.

Operating frequency range:

- detection 20 - 3000 MHz
- reception and registration 30 - 2000 MHz

Threshold sensitivity of radio section of signal detection (SNR=10 dB, ΔF=12.5kHz):

- in frequency band of 20 – 1000 MHz 0.8 μV
- in frequency band of 1 – 3 GHz 1.0 μV
- Signal detection with minimal duration of 300 μs
- Detection of broadband signals with frequency band more than 150 kHz

HF BAND RADIO RECEIVING DEVICE «GALAKTIKA-M»

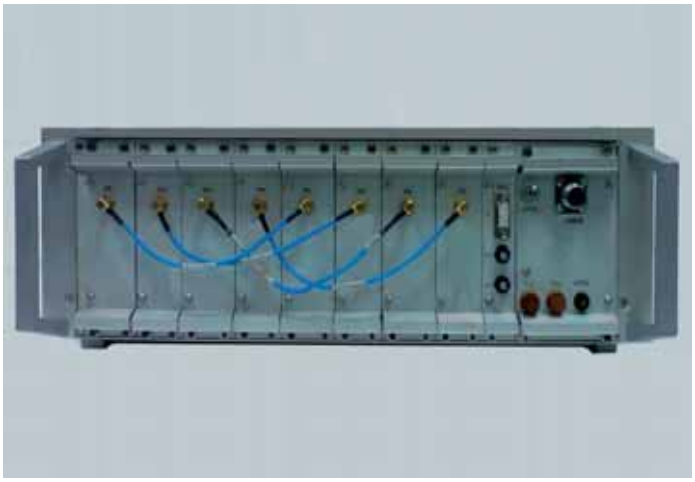
OVERVIEW

«Galaktika-M» receivers are purposed for operation in the composition of HF band radio complexes or autonomously. They provide reception and demodulation of wide range of signals in frequency band of 1-30 MHz. Computer control (USB and RS-232 interfaces), traditional LF and telegraph outputs, and digital outputs of I/Q-samples provide wide range of functional capabilities.

SPECIFICATIONS:

- Antenna input: 50 Ohm, SWRin <1.8,
- Sensitivity (SNR=10dB, BW=3kHz): 0.3 μW,
- Single-signal dynamic range >126 dB,
- Dynamic range with respect to intermodulation > 90 dB,
- Frequency pass band 0.03..12 kHz (setting step 1 Hz),
- Selectivity by neighboring channel > 80 dB,
- Input attenuator 0..45 dB, step 3 dB (or 0..42 dB, step 6 dB),
- AGC depth: 120 dB,
- ADC capacity: 16 bits,
- Suppression of spurious channels >90 dB,
- Frequency instability: 0.5•10-7,
- Frequency tuning step – 1 Hz,
- Spectral density of heterodyne noise (Δf=1 kHz) –120 dBs/Hz,
- Signal demodulation: AM, ASK, CW, FM, FSK2, PSK2, USB, LSB,
- Beat frequency oscillator setting (BFO) 0…±3 kHz with 10 Hz step,
- Power supply: AC 220B/50 Hz (DC 20…32 V),
- Power consumption: 55 (30) W.

HF BAND MULTICHANNEL RADIO RECEIVING DEVICE «GALAKTIKA-4K»



OVERVIEW

«Galaktika-4K» device is to be operated in composition of HF radiocenters. It provides signal reception by four independent channels in 1-30 MHz frequency band and also afford signal transmission in analogue or digital (I/Q-samples) form to the consumer. Computer control (USB interface), traditional LF outputs and digital outputs of I/Q-samples provide connection of consumer equipment on subcarrier frequency.

SPECIFICATIONS:

- Four antenna inputs of 50 Ohm,
- SWRin <2.0, Sensitivity: (SNR=10dB, BW=3kHz) < 0.5 μV,
- Single-signal dynamic range >126 dB,
- Dynamic range with respect to intermodulation > 90 dB,
- Frequency pass band 0.03..12 kHz (setting step 1 Hz),
- Selectivity by neighboring channel > 80 dB,
- Input attenuator 0..42 dB, step 6 dB,
- AGC depth 120 dB,
- ADC capacity 16 bits,
- Suppression of spurious channels >90 dB,
- Frequency instability: 0.5•10-7,
- Frequency tuning step – 1 Hz,
- Spectral density of heterodyne noise (Δf=1 kHz) –120 dBs/Hz,
- Signal transmission in analogue form on BFO frequency 0…±5 kHz with 10 Hz step or in digital form with Fs=22.050 kHz (I/Q-samples: 16 or 24 bits),
- Power supply: AC 220B/50 Hz (DC 20…32 V),
- Power consumption: 65 W.

JAMMING SYSTEMS

AUTOMATED RADIOCOMMUNICATION JAMMING COMPLEX «MANDAT-B1E»

OVERVIEW

Radio-communications jamming complex Mandat-B1E is an automated data acquisition and data procession system. It gathers data on emission sources and radiates aimed barrage jamming signals within monitoring area.

The complex allows to reveal enemy grouping in operational and tactical depth, to locate position of military units, divisions, their terrain coordinates and relocation based on enemy radio command lines and radio networks.

Within the covered area (60km depth and 90km front) and within the operating frequency range

(1,5-1000 MHz) the complex effectively jams up to 80 fixed frequency radio channels or up to 6 radio channels with FH technique – that allows to ruin the management of enemy forces.

«Mandat-B1E» is intended for jamming ground-based communication facilities using any kind of modulation and operating either on fixed frequencies or with frequency hopping (FH) technique within HF and UHF frequency bands. Selective jamming (both on time and frequency) as well as barrage jamming is used to jam all previously detected frequencies.

FULL COMPOSITION OF COMPLEX:

- R-330RD - automated reconnaissance station (HF & UHF bands) - 1 unit;
- R-330KV1 – automated jamming station (HF band) - 2 units;
- R-330UV1 – automated jamming station (UHF1 band) - 2 units;
- R-330UV2 – automated jamming station - 2 units.

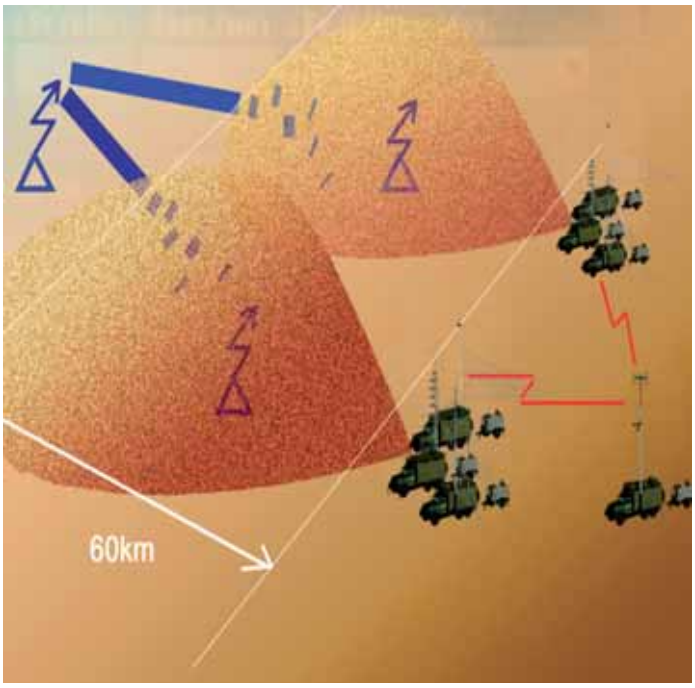
ONE POST CONSISTING OF AUTOMATED HF, UHF JAMMING STATIONS ENABLES TO SOLVE THE FOLLOWING MAIN TASKS:

- scanning within a 1,5-1000MHz frequency range;
- automatic detection of up-to-date radio communication systems and sources of emission, including those with FH technique;
- automatic classification and measurement of signals parameters;
- acoustic and visual monitoring of all signals;
- received signals data accumulation and procession;
- received data documentation;
- effective jamming within a range of 1,5÷1000 MHz of up to 40 fixed frequency communication channels and data transfer;
- channels or up to 3 networks with FH technique;
- monitoring all high priority communication channels and data transfer links;
- received and accumulated data transfer to a command post.

COMPLEX CONSISTING OF 2 POSTS AND A RECONNAISSANCE STATIONCAN ADDITIONALLY PERFORM THE FOLLOWING TASKS:

- determination of coordinates within coverage area (up to 60km depth, up to 90km front);
- effective jamming of up to 80 fixed frequency communication channels and data transfer channels or up to 6 networks with FH technique;
- situational awareness data accumulation and procession;
- received data documentation.

AUTOMATED RADIOCOMMUNICATION JAMMING COMPLEX «MANDAT-B1E»



OVERVIEW

The equipment of each station is located inside the specially designed shelters, mounted on high cross-country capability trucks of KRAZ type. All UHF jam-ming stations are mounted on the armored vehicles and inside the armored shelters in order to protect personnel and equipment from bullets and fragmentation dam-age. All units of complex are equipped with air conditioning, heating and ventilation systems ensuring normal working conditions for operators and equipment in any climate zone at ambient temperatures ranging from -50°C up to +50°C and wind speed up to 30 m/sec.

SPECIFICATIONS

	R-330RD	R-330KV1	R-330UV1	R-330UV2
Application	Reconnaissance station HF, UHF	Jamming station HF	Jamming station UHF2	Jamming station UHF1
Operating frequency range, MHz	1,5 ÷ 1000	1,5 ÷ 30	30 ÷ 230	225 ÷ 1000
Time before jamming from the moment of signal detection, ms	-	2 (28,5M Hz)	0,3 (80MHz)	0,3 (80MHz)
Coordinates determination accuracy, % of the range	5 ÷ 1 0			
Jamming signal strength, kW	-	1,0	2,0	2,0
Coverage area (front), km	up to 90			
Coverage area (depth), km	up to 60			
Communication range between units of the complex, km	up to 30			
Situational awareness display	available			
Navigation system	NAVSTAR GPS, GLONASS			
Power supply system	Autonomous electric power station, industrial power supply system 380V, 50 Hz			

MOBILE GROUND RADIO JAMMING SYSTEM «LIMAN»

OVERVIEW

The modern concept of the operation management conducts the significant role to the radio reconnaissance, communication and control systems of armies and application of the High Accuracy Weapon (HAW). The high efficiency of modern arms provides the defeat of the majority of the ground and air targets in the first air operation.

The blocking of the information channels of the enemy air control by the means of radio countermea-sure is an effective counteraction in military occasions.

The mobile ground system «Liman» is intended for the radio countermeasure of the radio communication and control links.

The distinctive feature of the system is the effective radio countermeasure of the modern jam proof radio channels using Frequency Hopping (FH) mode and FH in a combination with spread spectrum radio signal (FHSS). It has been reached due to high speed radio reconnaissance means of the system, application of original correlation methods of the noise like radio signals detection, high energy potential of the jamming signal.

THE OBJECTS OF THE SYSTEM «LIMAN» RADIO COUNTERMEASURE ARE:

- all kinds of the VHF and UHF radio communications and guidance channels in the frequency ranges 100-400 MHz used for the interaction of crews during air operation; for guidance of the aircrafts on air and ground targets by the air and ground control stations; for transmission of a reconnaissance data from the aircraft to the control station; for guidance of the aircrafts on ground targets by the forward air controller (FAC);
- the communication, control and navigation channels in the frequency range 960-1215 MHz (JTIDS, TACAN types).

The system «Liman» authentically detects the radio channel signals of the air control station on a distance up to 450 km. After this, onboard radio means – the receivers of the information and commands – reliably suppressed on distances up to 200 km with radiation of powerful jamming in the frequency ranges 100-400 MHz and 960-1215 MHz.

The creation of the high energy potential jamming signal based on technology of the phased array providing the value near 10 kW in a low and 60 kW in a high frequency bands, that in ten times exceeds the energy potential of the analogous jamming stations.

The energy potential of the system «Liman» jamming station provides the radio countermeasure for the control channels on distances when the attack aircraft cannot independently to detect and strike the targets that provides significant decrease in efficiency of the enemy air activities.

THE SYSTEM «LIMAN» STRUCTURE INCLUDES THREE TYPES OF THE STATIONS:

- control station – the product «Liman-ПУ» – 1 unit;
- jammer of the band 100-400 MHz – the product «Liman-П1»;
- jammer of the band 960-1215 MHz – the product «Liman-П2».

The control station is intended for the analysis and processing of the reconnaissance information received from jammers, effective distribution of the total resource of the jammers over suppressed radio links, automated calculation of the current overall efficiency of the system, synchronization of operational modes of the jammers, communication with superior command post.

The jamming station (jammer) of the band 100-400 MHz is intended for the radio reconnaissance and jamming of the voice radio links and data transmission links with amplitude and frequency modulation operating on fixed operating frequencies (FOF), and using Frequency Hopping (FH).

The jammer of the range 960-1215 MHz intends for the radio reconnaissance and jamming of the links, using noise-like radio signals and Frequency Hopping with Spread Spectrum radio signals (FHSS).

The communication of the control station with jammers is carried out by the radio channel on distances up to 10 kms, or by the cable channel on the distances up to 5 kms.

MOBILE GROUND RADIO JAMMING SYSTEM «LIMAN»

SPECIFICATIONS

1	Operating frequency bands for:	«Liman-П1»	100-400 MHz;
		«Liman-П2»	960-1215 MHz.
2	Jamming objects:		
	• in frequency band 100-400 MHz – all kinds of the VHF and UHF radio communications and guidance channels used for interaction of crews during air operations; for guidance of the aircrafts on air and ground targets by air and ground control stations; for transmission of reconnaissance data from the aircraft to control station; for guidance of aircrafts on ground targets by forward air controller (FAC);		
	• in frequency band 960-1215 MHz – communication, control and navigation channels (JTIDS, TACAN types)		
3	Kinds of jamming signals:		
	• jamming of radio channels with fixed operating frequencies (FOF) mode over frequency band 100-400 MHz		spot jamming signal on time and frequency;
	• jamming of radio channels over frequency band 100-400 MHz using FH mode with minimal duration of radiation on one frequency more than 13 ms		spot jamming signal on time and frequency;
	• jamming of radio channels over frequency band 100-400 MHz using FH mode with minimal duration of radiation on one frequency less than 13 ms		barrage jamming signal in frequency band;
	• jamming of radio channels over range 960-1215 MHz using FHSS mode.		barrage jamming signal in frequency band
4	Single jammer energy power:	«Liman-П1»	up to 10 kW
		«Liman-П2»	up to 60 kW
5	Range of jamming area		up to 200 kms
6	Range of the air control station (ACS) and long radar detection (LRD) transmitters finding		up to 450 kms
7	Automatic analysis and determination of radio signals parameters, classification of radio signals and selection of jamming objects, selection of type and parameters of jamming signals, jamming signals forming for radio networks with FOF and FHSS.		
8	Jamming signal radiation by means of phased array (PA) transmission with automatic compensation of the non-identical phase of amplifiers over frequency bands 100-400 MHz and 960-1215 MHz		
9	Electronic scanning of transmitting PA antenna pattern maximum over frequency bands 100-400 MHz and 960-1215 MHz in horizontal plane		–30 degrees 0 +30 degrees
10	Response time of the system:		
	• at jamming for the radio channels with FH mode, no more		0.3 ms;
	• at jamming for the radio channels with FOF mode, no more		0.5 s
11	Maximum number of jammers («Liman-П1» and «Liman П2») in the system		12
12	Capability of independent operation of «Liman П1» and «Liman П2» jammers.		Present

MOBILE FULL-BAND RADIO-ELECTRONIC JAMMING STATION MODEL JYT-MJ01

Mobile station JYT-MJ01 is intended for the area and motorcades guarding at the explosives' defusing locations to provide antiterrorist conditions.

PARAMETERS:

Coverage: radius 100-500 metres (75dBm depending on the base radio station distance);

Power transfer: complete package ≥ 1100W 50-140W per channel;

Supported signal types: GSM900, CDMA800, CDMA2000, DCS1800/1900, 3G, 4G;

Other signal types: remote controls, remote-piloted spies, wireless microphones, wireless telephones, pagers, car control consoles, GPS, satellite phones, WLAN, Bluetooth, Wi-Fi, etc.

Number of output channels: 12.

FUNCTIONS:

- Car installed; wide coverage, continuous signal jamming within 20MHz – 3000MHz range;
- Easy settings change due to its modular design; autonomous control of each channel; separate adjustment of the control panel and driver to provide more convenient operation;
- Frequency separation provides the optimal interference effect at different frequencies
- Effective energy distribution minimizes power loss and improves efficiency; energy supply is adjusted by means of a special mechanism;
- The system of antennas with a high gain factor ensures more precise signal;
- Integrated «intelligent» thermostat guarantees long operating period;
- Modern fabrication techniques; waterproof and shockproof casing;
- ISO 9001:2008 quality system certification.

MOBILE FULL-BAND RADIO-ELECTRONIC JAMMING STATION MODEL JYT-MJ01

CHARACTERISTICS

Frequency parameters are adjusted according to the customer's terms and requirements.
Standard parameters are given in the table.

	Channel	Frequency	Power
	Remote control	25-60 MHz	80W
	Civil PPT	135-174 MHz	100W
	PPT	200-300MHz	100W
	PPT/Car control	312-318 MHz	100W
	PPT/CDMA450M	400-500 MHz	100W
	CDMA	850-894 MHz	120W
	GSM	925-960 MHz	120W
	DCS/PHS	1805-1920 MHz	100W
	D/WCDMA/CDMA2000	2010-2170 MHz	100W
	Other signals	1100-1300 MHz	50W
	GPS/ Satellite phone	1520-1580 MHz	50W
	Wi-Fi/Bluetooth/4G	2400-3000 MHz	100W
		Power	1120W
Total weight	88 kg		
Antenna dimensions	Antennas total:12 НЧ:1530 Ф 16 ВЧ:700 Ф35		
Power supply	Portable generator (5000 W)		
Ambient temperature, ˚C	-20^{0}C – 50^{0}C		
Humidity	≤80%		
Antenna parameters	Omnidirectional antenna; amplification 7dBi		
Design	Shockproof casing, resistant to compression, detachable for a quick dislocation		
Dimensions, mm, no more	9100x2500x3600		

INSTALLATION ON VEHICLES

Antenna installation

1) Considering low-frequency antenna length, it is recommended to install this antenna at the car rear.
2) High-frequency antenna is installed on the car roof. The antenna movable mechanism makes it possible to fold it while in waiting mode
3) It is recommended to install the set on crossover / SUVs to guarantee its efficiency.

Power supply

1) The portable battery is required for this device operation.
2) The output power of the power supply source in use shall not be less than 50000KVA.
3) It is recommended to use BUFFALO battery.

Cooling and ventilation

1) The device is equipped with proper cooling and ventilation systems.
2) It is recommended to provide the air inlet to ensure optimal air circulation when installed on cars.

JAMMER «SOKOL-3»

POWER SUPPLY UNIT INCLUDING CONTROL CABLE AND POWER CABLE

MICROWAVE UNIT

SOKOL-3 Multi-Frequency Microwave Generator is controlled by computer. It has complex characteristics of time and amplitude for examination of chaos in electronic devices for the frequency from 15 MHz to 10 600 MHz SOKOL-3 with additional satellite downlink frequencies blocking modules and it is intended for the radio countermeasure of various radio means, radio communica-tion channels of stationary, mobile and man-pack radio set, military radio-controlled armament systems, mobile phones reception paths of cellular communications systems, and also for protec-tion of mobile vehicles (moving truck trains and single vehicles) and stationary objects by prevention of radio-controlled firing explosives (mines, high-explosive charges, etc.). The given problem has been solved by the radiation of jamming radio signal in all frequency range, where the use of the specified control radio links is possible.

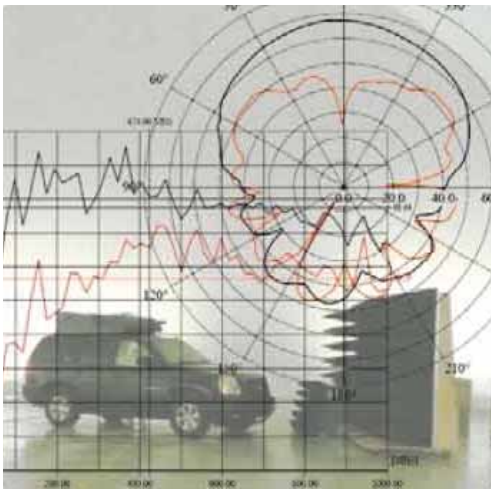
The system is developed on the basis of operating experience of the product similar to the destination which is used by the USA peace-making contingent in the Middle East. The use of this product has already allowed neutralizing some attempts of radio-controlled firing at the movement of the truck trains (explosions have taken place after passing by the truck trains of the radio-controlled charge position outside of the radio countermeasure zone).

PLACE OF INSTALLATION:

- SUVs;
- APCs;
- VVIP Cars.

APPLICATIONS:

- VVIP Protection;
- Force Protection;
- Vehicle Convoy Protection;
- EOD Operations;
- Event, Base or Venue Protection;
- Communications Jamming.



TESTED AND PROVED EFFECTIVE RANGE OF PROTECTION OF SOKOL-3 JAMMER IS 1000 METERS

JAMMER «SOKOL-3»

SOKOL-3 Jammer consists of the following components:

1. Microwave Unit:
   - Twenty-seven generating channels;
   - Separate generating C and Ku-bands units;
   - Four of broadband microwave TWT power amplifier;
   - Six multi-managed switch;
   - Unit of measurement and display of output parameters;
   - A computer control unit;
   - Antennas system
2. Power supply units;
3. Batteries unit;
4. Power cable;
5. Control cable.

ALL COMPONENTS OF THE SYSTEM ARE CERTIFIED IN ACCORDANCE WITH MILITARY STANDARDS

ENVIRONMENTAL CONDITIONS OF OPERATION:

- Temperature range (outside) – from - 50 to 60^{0}C
- Humidity – up to 95 %
- Atmospheric pressure – from 630 to 800 mm mercury column

EACH OF 27 FREQUENCY CHANNELS OF THE JAMMER:

1. Has a generator of harmonic signals, tunable in the frequency band corresponding to the channel number;
2. Has a noise generator, overlapping the frequency band of the concerned channel;
3. Has a separate noise generators for c-band and Ku-band up to 14 800 MHz;
4. Has a separate generator of harmonic signals, tunable in the frequency band corresponding to the C-band and Ku-band up to 14 800 MHz.

TECHNICAL PARAMETERS:

- Jamming range – from 15 MHz to 18 500 MHz
- Output power – not less than 1050 Watt
- Accuracy of frequency setting – not less than 1 MHz
- Range of adjustment of the output power – 0 ... 20 dB
- Parameters of the pulse signals:
- Minimum signal duration – 50 nanosecond
- The minimum pulse period / pulse repetition cycle – 100 nanosecond
- Maximum number of the pulses during one cycle – 1024
- The level of suppression of higher harmonic – min 40 dB
- Power supply – not more than 2 000 Watt
- Dimensions microwave unit – 485x470x380mm
- Dimensions C and Ku-band unit 485x470x380mm
- Weight of the microwave unit – 35 kg
- Weight of the C and Ku-band unit – 32 kg
- Dimension of the power supply unit – 485x470x380mm
- Weight of the power supply unit – 30 kg
- Weight of TWT amplifier unit – 150 kg
- Weight of power supply TWT amplifier unit - around 150 kg
- Total Weight of the SOKOL-3 Jammer – around 450 kg

SOKOL-3 JAMMERS PROVIDES:

- Real-time jamming / suppression through the complete frequency range;
- Field programmability for rapid adjustment;
- Modular construction for easy maintenance, repair and upgrade;
- Efficient power management and power supply

THE MULTI-FREQUENCY GENERATOR SOKOL-3 IS CAPABLE TO OPERATE CONTINUOUSLY NOT LESS THAN 20 HOURS WITH SUBSEQUENT BREAK ON 1 HOUR

ANTI-BOMB RADIO JAMMING SYSTEM «GARANT»

OVERVIEW

Anti-bomb radio jamming system «GARANT» is intended for countermeasure and suppression of radio control channels within frequency band 20-2500 MHz of various radio means, stationary, mobile and man-pack radio set radio communication channels, cellular phones, as well as for protection of mobile vehicles (moving truck trains and single vehicles) and stationary objects by prevention explosion of radio-controlled mines, high-explosive charges, etc.

Radio signal jamming is performed in all frequency ranges used for specified radio control channels.

The «GARANT» system can be installed on a vehicle practically of any type. For example, it can be installed on the armoured personnel carrier or on the roof of the automobile body-van or on tank.

SPECIFICATIONS:

The system «Garant» consists of 4 units of radio suppression (RS): RS-1, RS-2, RS-3, RS-4. Each unit consists of the four jamming transmitters and one high effective broadband antenna with the directional pattern in horizontal plane. RS-4 unit consists of single transmitter and single broadband antenna. The whole system includes 13 transmitters (the frequency range of jamming radio signal is divided into 13 bands) and 4 antennas.

Used broadband antenna by its characteristics have no analogs. The efficiency of the antennas in broad frequency band is reached due to the use of special optimized inductance-capacitor inclusions along conductor of the antenna.

MAIN TECHNICAL FEATURES

1)	Jamming radiation frequency band	20 – 2500 MHz
2)	Type of jamming	wideband barrage
3)	Total integral output jamming power	230 W
4)	Distance of radio suppression (depending on parameters of the suppressed radio channel)	75 – 5000 m
5)	Power supply voltage	11.5 – 14 V
6)	Power consumption	1 kW
7)	Operating temperature of an environment	from –40°C up to +60°C

GPS / GLONASS JAMMING SYSTEM «KUPOL»

OVERVIEW

System is designed for impeding operation of the equipment which uses GPS/GLONASS signals to determine current location by imitating structure navigation signals.

SPECIFICATIONS:

- Working bandwidth: 1210-1260 MHz for channel 2 and 1550-1620 MHz for channel 1;
- Approximate jamming range – up to 15 km (using omni-directional antennae) and up to 250 km (using directional antennae).
- Transmitted power – no less than 10 W on each of two channels;
- Power consumption – less than 280 W, optional power source – AC (110…250 V, 50…60 Hz) or DC (12V or 24V);
- Full weight – less than 24 kg, approximate dimensions (excluding antennae and cables) – 380x290x180 mm;
- Operating temperature (-20°C…+60°C);

DIRECTIONAL ANTENNA SPECIFICATION

- Gain factor of directional antennas no less than 12 dB;
- Antenna weights less than 2 kg, direction diagram 40°x40°.

OMNI-DIRECTIONAL ANTENNAS SPECIFICATION

- Antenna weights less than 2 kg, direction diagram 360°.

SYNTHESIS AND CONTROL UNIT REQUIREMENTS

- Unit synthesizes signals capable to jam GPS/GLONASS equipment and sends these signals with transmission parameters (frequency band, time structure of the signals, on-load power) through coaxial cables to PAU1 and PAU2;
- Unit allows to control power and jamming type;
- Unit provides overall system diagnostic with indication of operation mode and detected system malfunctions;
- Weights less than 2 kg, dimensions (200x120x100) mm;
- Power consumption – less than 10 W DC +24 V;
- Output signals:
- HF signals to PAU1 and PAU2 (0,1 mW …1 mW), low-power mode selection signals for PAU1 and PAU2 (logic level);
- Input signals: diagnostic signals from SCU and SPSU (logic level).

MOBILE OPTOELECTRONIC COUNTERMEASURE SYSTEM «KASHTAN-3M»

OVERVIEW

Mobile automated optoelectronic countermeasure system KASHTAN-3M is designed to protect all types of combat and auxiliary surface ships and especially important military and civil ground objects against precision guided munitions (PGMs) – missiles, shells and air bomb, equipped with semi-active laser homing systems (SALHS).

The complex solves the task of protection by setting of laser decoy targets (LDT), created at safe distance from protected objects on ground or surface.

The complex is available in navy and army versions.

SYSTEM PROVIDES:

- Enemy laser emission devices detection and bearing such as enemy laser designators;
- Laser decoy target (LDT) setting against High-Precision Weapon (HPW) with laser guidance;
- Target designation receipt from external information systems;
- Information data delivery to higher Air Defense ACS;
- Defense tactics selection depending on HPW configuration and number;
- Registration and documentation of information about tactical situation, laser designators radiation parameters;
- Personnel training;
- System operability automated checking and fault tracing with defective module indication.

TECHNICAL FEATURES

- Enemy laser designators radiation detection probability is not less than 0,9
- Probability of the ammunition drift (re-aiming) on LDT is 0.6—0.8
- Time from the moment of the enemy laser designator radiation detection to the moment of the LDT setting is no more than 1 s
- Continuous operation time (enemy laser designators detection and bearing) is 24 hours
- Start-up time to stand-by mode is no more than 3 min
- Switching time from stand-by mode to combat mode is no more than 7 s
- Operating wave length is 1,06 mm
- Light-sensitive cells sensibility is no worse then 5—1011 J/cm^2
- Detection angle sector:
  - horizontal angle from 0 to 360˚
  - elevation bearing -15 to +90˚

JAMMING SYSTEM «VOYAGE»

OVERVIEW

It is intended to form jamming signal in order to block receiving channels of mobile means of communications, operating in frequency range of analog and digital standards of cellular communications systems. Device can be used for protection of objects against possible realization of terrorist acts involving explosive devices, activated by radio channels of mobile cellular communications, as well as for blocking communication networks' subscribers during special operations.

The operating principle of the product is based on the formation of the broadband barrier frequency modulated (FM) jamming signal in each of two frequency sub-bands of the product.

The main distinctive feature and advantage of this product is the usage of dual-band planar antenna array with high amplification factors ~ 10-12 dB. This allows to implement high energy potential of 30-45 W in the direction of maximum of radiation pattern and, consequently, increasing the distance of suppression in a given direction.

«Voyage» product is implemented in two versions, differing in jamming signal frequency band, forming and radiation.

Thus, «Voyage 0918» is intended to block operation of mobile communication devices operating in frequency range of 925-960 and 1805-1880 MHz, and the product «Voyage 0819» - in frequency range of 869-895 and 2125-2170 MHz.

The system is produced in the form of portable briefcase with a built-in plane antenna array. The product operates from internal battery and 220 V, 50 Hz AC network. Continuous battery life is up to 8 hours depending on the type of battery used. The product does not require tuning and adjustment, and, after power switching on, it is ready for operation.

COMPOSITION:

- dual band antenna
- jamming signals formers
- power amplifiers of appropriate frequency bands
- power supply unit.

AIRBORNE RADIOMONITORING AND ELECTRONIC WARFARE STATION

OVERVIEW

The station is intended for radio reconnaissance of radio-relay, satellite and tropospheric radio channels, as well as for jamming countermeasures on operational and tactical control level.

The station operates at areas of helicopters basing in two operation modes: radio reconnaissance and radio countermeasures.

In the radio reconnaissance mode the station detects and classifies radio signals of means of communication, and calculates their coordinates, generates a list of frequencies for radio countermeasures.

In the radio countermeasures mode, the station emits jamming signals as well as conducts further reconnaissance of the new radio communication channels.

SPECIFICATIONS:

Operating frequency range, GHz	2,25-9,0
Power consumption, kW (At output power of boosters not less than 400 W)	600-6000
DP width in transmission and reception mode, both in horizontal and vertical planes:	
• at a frequency of 2.25 GHz, degree	7,0-9,0
• at a frequency of 9,0 GHz, degree	1.5-2.0
Azimuth scanning sector, degree	±30
Scanning resolution, degree	1,5-2,0

INFRA-RED COUNTER-MEASURE SYSTEM «ADROS» KT-01 AVE

OVERVIEW

Protection of helicopters and airplanes from guided missiles with infrared (IR) homing heads is one of priorities at the time due to high efficiency of such missiles. Last decades of local war experiences shows that approximately 90% of all aircraft losses in military conflicts are caused by guided missiles with IR seekers.

SPECIFICATIONS

Wavelength band	1,8-5,5 μ and 8-10 μ
Source	Wide band IR source
Coverage	Azimuth: 360˚
Jammer range	at least 5 km
Ability to jam the missile seekers of the type	Instantaneous and simultaneous jamming of seekers with amplitude-phase, frequency-phase, time-pulse modulation
Jamming protection for	First, second and third generation missile seekers
Communication interface	RS 422/1553B
Jamming code software	Software is designed in Assembler programming code and is flexible for reprogramming and future upgrades
Pointing accuracy	The system jams all the missiles with IR seeker in the field of coverage that makes it unnecessary to calculate coordinates of a specific missile
Power consumption	Max 4 KW. There is no stand by mode for the system. It operates continuously within the entire mission ensuring stable and permanent protection of the aircraft / helicopter.
Power supply	Standard power supply existing at helicopters / aircraft 28 v dc / 115 V / 208 V 3 φ
Environmental condition	Compliant to MiL-STD-810E
EMI/EMC compliance	Compliant to 461 D
Mounting on the aircraft	Mounting interface for easy mounting on the helicopter / aircraft is available

Electro-optical jamming station «Adros» KT-01AVE provides active protection of helicopters from guided missiles with infrared homing heads. «Adros» station counteracts to infrared homing heads with PPM, frequency-phase (FPM), time-pulse (TPM) modulation and to the seekers with high noninterference.

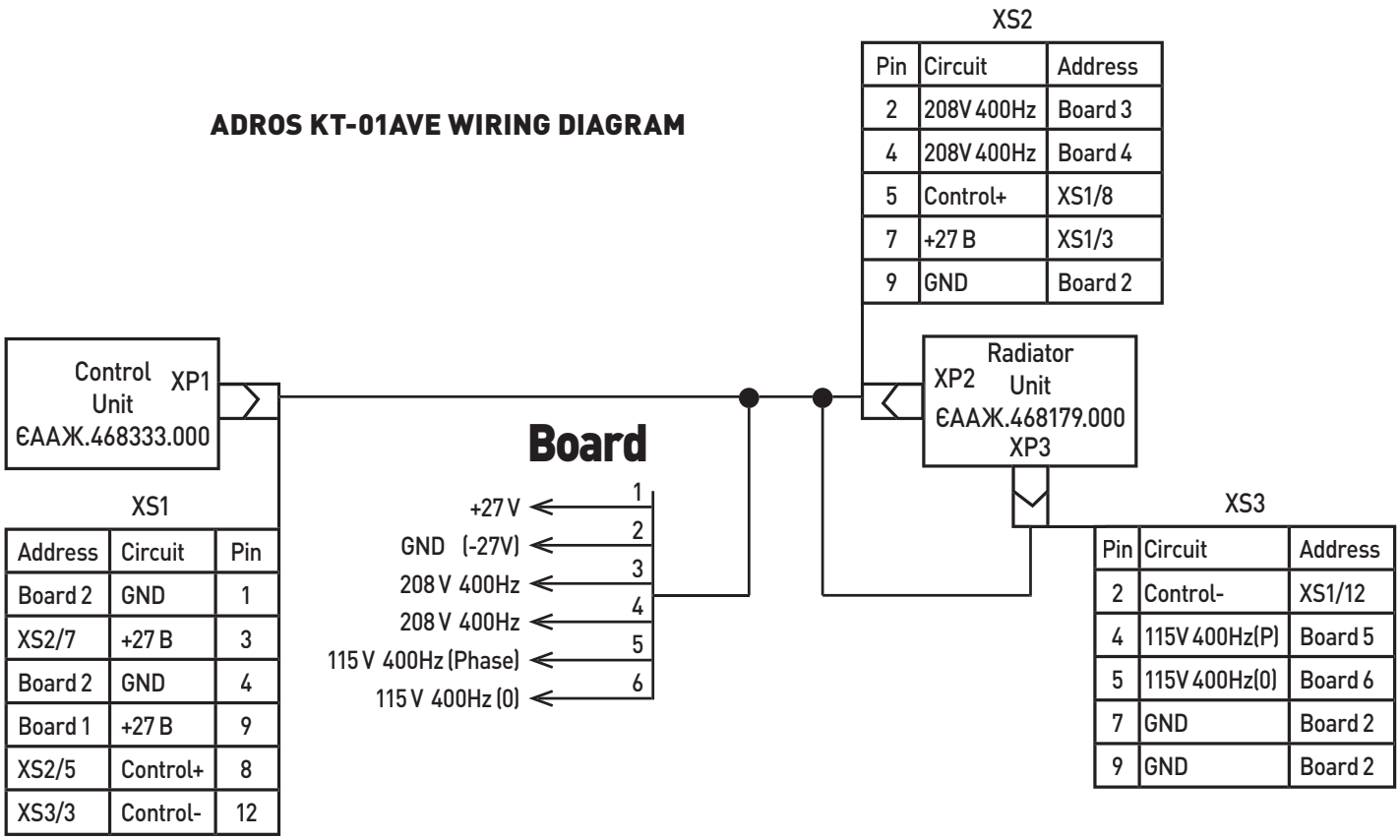
«Adros« KT-01AVE cracks a trajectory of such missiles, as «Stinger» (FPM), «Igla» (SA-18, TPM), «Igla-1» (SA-16, FPM), R-60 (FPM), R-60M (FPM), R-73 (TPM), «Sidewinder» (PPM, FPM) and others. Thus interference signal excess over the target signal is not required.

THE MAIN ADVANTAGES OF «ADROS» KT-01AVE:

1. Station does not require information on type and frequency of approaching missile seeker.
2. It works without missile warning system.
3. Station does not require approaching missile tracking system.
4. Station provides circular and permanent protected zone.
5. It has rather simple design and, as a consequence, high reliability and the reasonable price.

INFRA-RED COUNTER-MEASURE SYSTEM «ADROS» KT-01 AVE

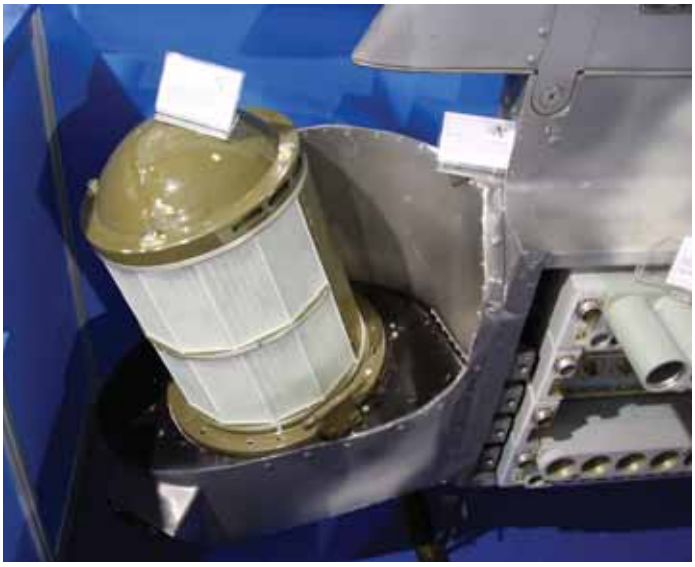
ADROS KT-01AVE WIRING DIAGRAM



Cable from connector XS1 to connectors XS2, XS3 should be covered with braided screen. Braided screen should be grouded. Wires from pins 8, 12 of XS2, XS3 splitting should be intorted with a step of 30-40 mm, then covered with braided screen. After splitting wires from these pins should be covered with braided screen. Braided screen should be grouded.

ADROS KT-01AVE LOCATION

STATION FOR OPTICAL-ELECTRONIC SUPPRESSION «ADROS» KT-03 UE



OVERVIEW

The station is installed on helicopters and aircraft equipped with two turboprop engines. The station does not need any information regarding type of suppressed missiles and successfully functions without any launch detection system. In order to provide the most effective protection of aircraft the system must be used in combination with exhaust shields and / or flare dispensers.

SPECIFICATIONS:

Power supply:	
– DC	+ 27 V;
– single-phase voltage	115 V, 400 Hz;
– two-phase voltage	208 V, 400 Hz.
Power consumption:	
– 208 V, 400 Hz – not more than	5000 VA;
– 115 V, 400 Hz – not more than	500 VA;
– 27 V – not more than	500 W.
System weight – not more than	40 kg.

OPERATING CONDITIONS:

– normal environment temperature from +20°C to –15°C;
– elevated environment temperature: operating +60°C, short-term operating +70°C;
– lower environment temperature -50°C;
– elevated relative air humidity 98% (temperature +35°C).

The system consists of radiation unit and control unit.

Protection zone: by azimuth – 330°, by elevation – from – 20° to + 30°.

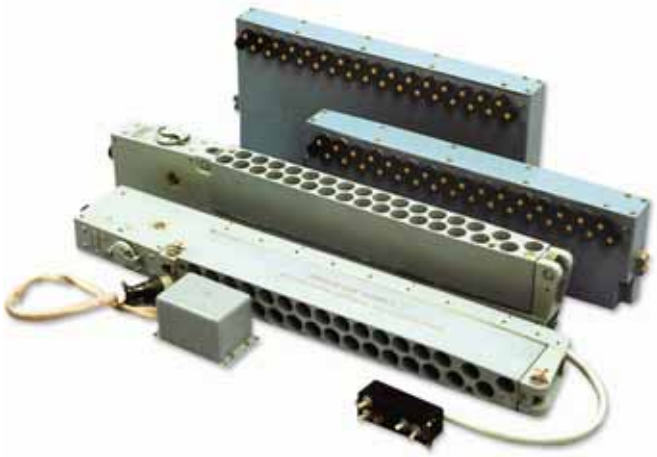
Start-up time – not more than 5 minutes.

SOES «Adros» KT-03UE ensures protection (missile attack failure):

- of helicopter – with probability 0,85;
- of aircraft – with probability 0,75.

Among additional features there are: built-in automatic test, re-programmability, unification (interchangeability of units), automated unified working mode.

ASO-2V / ASO-2VM / ASO-2E / ASO-2E-E7R
AUTOMATIC RADAR AND INFRARED JAMMING DEVICES



Jamming is performed by series of 4 and 16 charges with intervals of 2 - 4 sec / 2 - 6 sec (for ASO-2V) and 1 - 0,3 sec (ASO-2E)

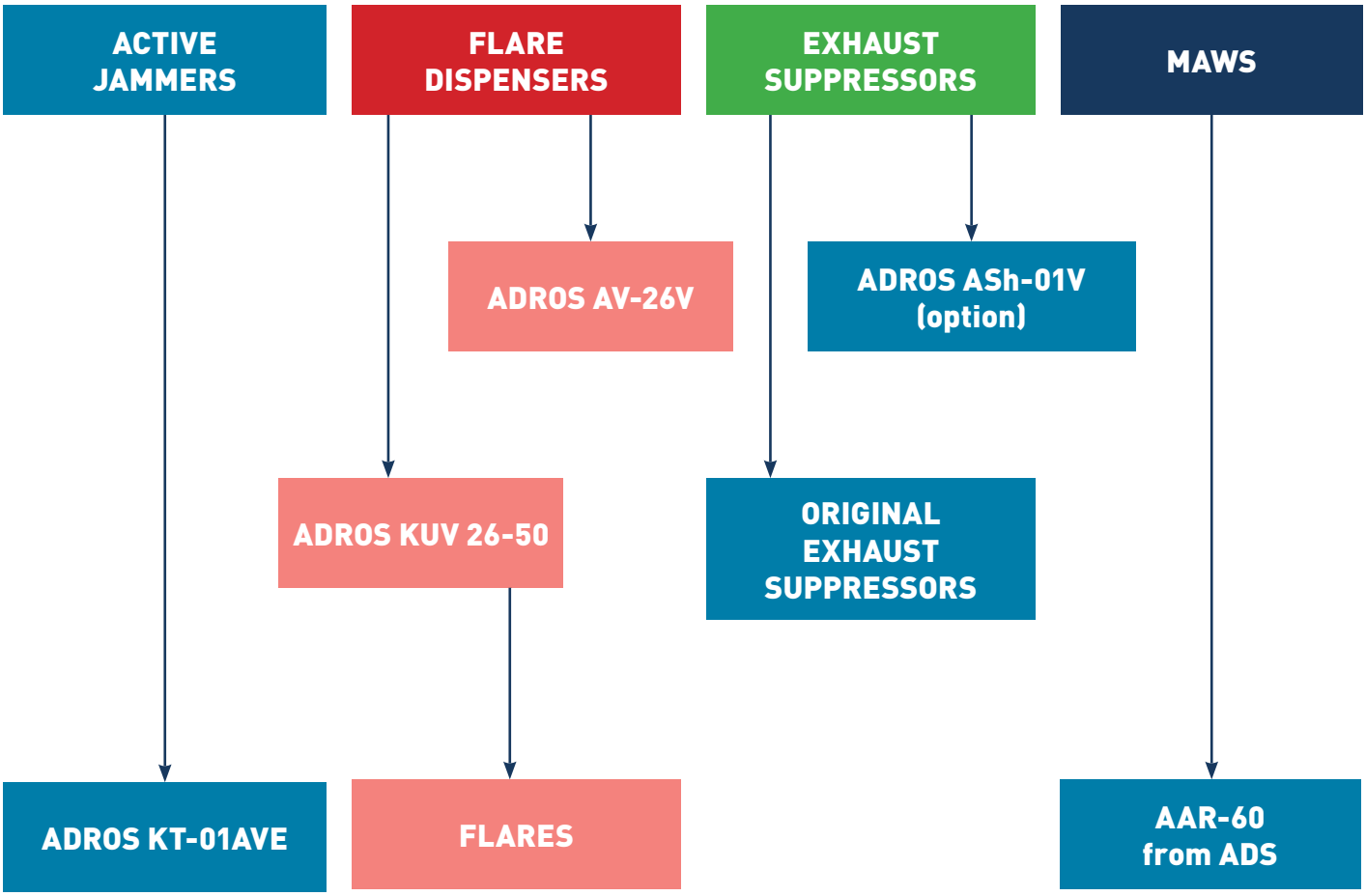
Besides, ASO-2VM.0000-0-02 produces jamming with volley of 2, 4 and 8 shells.

ASO-2V.0000-0-01 and ASO-2VM can shoot when barrel is directed upwards or downwards, and others just with barrel directed downwards.

SPECIFICATIONS

Operating voltage, V	27(±10%)
Overall dimensions of the girder without connectors, mm	768,5x1255x60,5
Weight, kg	
ASO-2V 0000-0	12,7
ASO-2V 0000-0-01	11,28
ASO-2V 0000-0-02	37,8
ASO-2V 0000-0-04	12,7
ASO-2VM 0000-0-02	12,7

COMPLEX AIRCRAFT PROTECTION SYSTEM



SYSTEM GENERAL DESCRIPTION

The system combines separate components to a complex, which performs helicopter protection probability up to 95%.

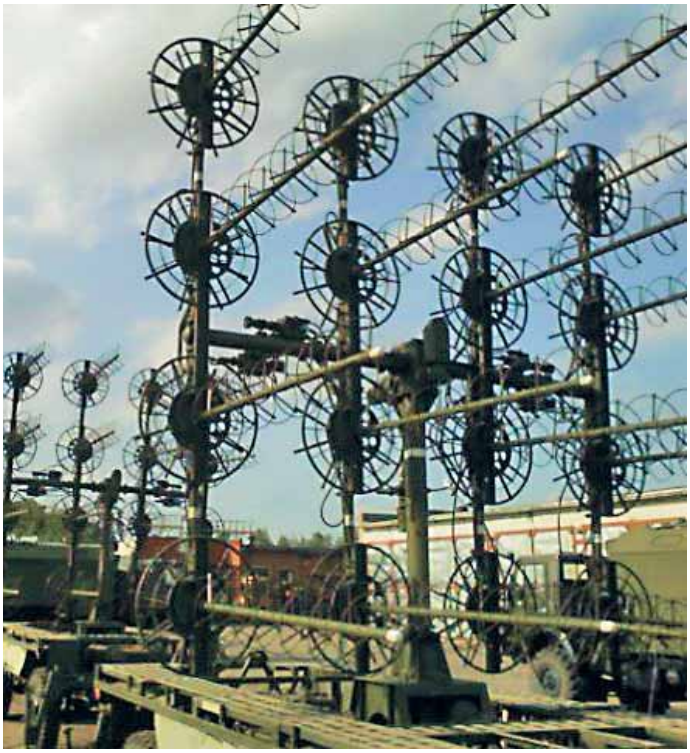
Active jammer Adros KT-01AVE is the main component, which radiates specially organized disturbance IR signal to interfere IR homing heads operation.

Another important component is KUV 26-50 (or AV-26V) flare dispenser. Specially organized flares deceive any IR homing head (including two-color and pulse-length modulated).

Exhaust suppressors decrease helicopter IR visibility and accordingly decrease IR missile allowed launch range.

MAWS allows to detect the threat and to save flare ammunition.

SATELLITE RADIO JAMMING STATION SPS-1



OVERVIEW

Station is intended for reception, automatic detection and technical analysis of radio channels signals in the frequency ranges of 225-400 MHz, as well as for forming and setting of interferences to satellite radio communications.

The station is designed based on the use of the advanced technology of reception, detection and analysis of radio signals, advanced digital signal processing and computing.

SPS-1 STATION PROVIDES:

- radio and demodulated signals spectrums displaying, as well as frequency, spectrum width, modulation type and manipulation rate measurement;
- possibility of data transfer by means of telecode communications in the UHF band using a modem with transmission rate of 1.8 Kbs;
- automated control of the station units and blocks operability;
- gathering and recording of information about the modes and the results of the station operations, displaying of identification and analysis results;
- possibility to operate in standalone mode, as well as in centralized mode in conjunction with command post with the use of telecode communications.

SATELLITE RADIO COMMUNICATION SUPPRESSION STATION

OVERVIEW

The station is designed for countermeasures to satellite communications, organized via geostationary radio relay satellites in the following frequency ranges:

Channel Earth - Satellite: 7900-8400 MHz

Channel Satellite - Earth: 7250-7750 MHz

Satellite radio communication suppression station ensures reception of the radio signals from satellites in the frequency range 7250-7750 MHz and radiation of interfering radio signals to the satellite in the frequency range 7900-8400 MHz

Satellite radio communication countermeasures station is capable of simultaneous radio signal reception and transmission.

MAIN OPERATION MODES:

«**POINTING**» mode comes to pointing the antenna system (AS) of the product on a given relay satellite.

The given mode provides possibility to receive radio signals frequencies panorama displaying that allows operator to execute fine-tuning of antenna system (refinement of the coordinates manually), obtaining maximum rating of total power of accepted signals.

«**PANORAMA**» mode is intended for detection of Satellite-to-Earth channel radio signals, forming of database on relay satellite basic RF channels traffic and the dynamics of its changes. As a result of detection a list of radio signals is formed, which is further replenished by their exact characteristics, measured in the «Analysis» mode.

«**ANALYSIS**» mode is intended for automatic technical analysis of radio signals (parameter measurement) and recording of the measurements results to the database. As the result of analysis of the radio signals the following parameters are defined: center frequency, band, modulation format, signal/noise ratio, modulating figure duration. Carried out analysis of radio signal allows to classify radio signals of FDMA networks with BPSK and QPSK modulation. In the CDMA net analysis, there are simultaneously several radio signals with different parameters. This mode provides possibility to automatically detect the code compaction and to measure parameters of the expansion code.

«**EXPLORATION**» mode is intended to measure the frequency spacing of relay satellite basic RF channels and the delay of signal on a route Station-Satellite-Station. In this mode the operator sets the reception frequency of the retransmitting probe-signal, power and frequency of the radiation. Detection of the received probe signal, measurement of frequency spacing and delay are implemented by using the correlation functions of frequency and time at the level of the received signal less than the noise level.

«**JAMMING**» mode is intended for formation and radiation of interfering signal on one or more frequencies. Radiation frequency is calculated from the frequencies of radio signals, chosen by the operator from the database for jamming, taking into account frequency spacing of relay satellite basic RF channels. Irradiation of jamming radio signals on several (up to 8) frequencies is implemented quasi-simultaneously.

Type of jamming signal is set from the selection: FSK, BPSK, QPSK with manipulation by pseudo-random law with a given symbol rate, or noise with a specified width of the radio spectrum. Simultaneously with irradiation of jamming signal, suppressed signal from the satellite is received, by characteristics of which the effectiveness of jamming is evaluated.

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