

GROUND IFF SYSTEMS STREAMLINING ACCORDING TO NATO'S REQUIREMENTS

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Key words: *IFF systems, modernization of IFF, secondary surveillance radar*

Abstract: *The project aims to support the streamlining of Bulgarian Air Forces in the process of upgrading their IFF capabilities according to the Bulgarian Army goals and the recent NATO and ICAO requirements. The project involves comprehensive hardware and software upgrade of obsolete Russian type stand-alone IFF systems and provides options for the systems to be integrated as medium- to long-range sensors in all types of modern autonomous and centralized air defence and ATC systems.*

Bulgaria started activities associated with modernization of its national IFF system in 1995 and those activities were focused on the particular needs for flight security, air space surveillance and participation in combined action NATO military forces.

The activities that have been considered include:

- Transponder installation on airborne platforms to operate in IFF Mode 3 A/C;
- Modernization of Russian radar P37 for ASOC air space surveillance requirements;
- Modernization of MiG-29 Transponder and Interrogator;
- Modernization of the Russian radar P18 for air space surveillance for ATC and Air Defence Systems;
- Modernization of the Russian radar P14 for air space surveillance for Air Defence Systems;
- Modernization of Mi-17 and Mi-24 Transponders;
- Modernization of Graf Ignatievo and Krumovo military air bases with new surveillance secondary ATC radar and modernization of the Russian radar RSP10.

The fundamental technical requirements for IFF systems are defined by STANAG 4193 and ICAO documentation. Analysis on trends of development and existing IFF system shown that there no benefit in adopting an IFF Mk XA capable system only as all modern equipment is capable of IFF MkXII with only a crypto unit to be added for Mode 4.

At the moment development and implementation of the Bulgarian National System for IFF is one of leading and important goals of Armed Forces. For that reason it is necessary to look for suitable approaches for its realization and modernization of existing equipment IFF system is very convenient for that purpose.

In paper are presented results of modernization of the one ground Russian type of IFF system 1L22 without NATO and ICAO capabilities, realized by working team from Space Research Institute at the Bulgarian Academy of Sciences and Bitova Elektronika AD company.

In modernized system like integrated equipment is implemented EADS MSSR 2000 I secondary surveillance radar (fig.1). The project includes deep hardware and software upgrade of obsolete Russian type stand-alone IFF system and provide capabilities, systems to be integrated as medium to long range sensor in all types of modern autonomous and centralized air defence and ATC systems.



Fig. 1

The used MSSR 2000 I meets current FAA, STANAG 4193 p. I-IV, ICAO Vol.III Annex 10 and EUROCONTROL EMS Functional Specification v.3.08 standard requirements for Monopulse Secondary Surveillance Radars with Mk XII and Mode S capabilities.

The MSSR 2000 I is a newly developed interrogator system aimed at replacing military and civil interrogators. In addition, it fulfils requirements for Mode S systems and holds provisions for the military Mode 5.

The MSSR 2000 I interrogator incorporates own data processing and tracking functions delivering IFF/ATC Mode S track data. Hence the MSSR 2000 I can be operated autonomously within its area of coverage. If linked to a radar data network, it is capable of receiving and executing interrogating requests and disseminating corresponding results. Its modular architecture, its digital programmable signal processing, its software controlled post-processing and system management concept supports customized configurations and performance optimization for application in different systems – military and civil ATC, air defence radars, airport approach control radars and mobile air surveillance vessels.

Surveillance and identification modes:

- Military – 1, 2, 3, 4;
- Civilian – 3/A, C, Mode S;
- Monopulse mode;
- Mode 5 – upgradeable.

Directed interrogation

For military applications, it may be essential to reduce the HF emission as far as possible. To fulfill such requirements the MSSR 2000 I is not only able to provide silent sectors but can also be run with directed interrogations. These externally commanded interrogations guarantee a selective identification with every combination of interrogation modes MkXII and Mode S.

Power management

For each interrogation the transmission power is individually selected out up to six different power levels (2 dB steps). Using Mode S the optimal transmission power is selected, depending on the range of target to be interrogated. For MkXII modes, a transmission power map (16 sectors, 6rings) can be programmed to optimally adapt the transmissions power to environmental boundary conditions.

BASIC TECHNICAL SPECIFICATION

- Transmit frequency -1030 MHz nominal;
- Centre receiver frequency -1060 MHz nominal
- Output power at antenna port - 500 W (2000 W option);
- Target load capability - 1500 targets in 360° ;
 - 400 targets in 45°;
 - 75 targets in 3.5°;
- Range resolution - ≤ 75 m;
- Azimuth resolution - ≤ 0.72 °;
- Solid State Transmitter with output power management;
- Electronic Countermeasures & Anti jamming Capabilities;
- 14 bit azimuth encoder resolution;
- programmable sector mode;
- 220/360 V, 50 Hz standard power source;
- integration in centralized air defence systems;

Modernized subsystems

Antenna system (fig.2)



Fig. 2

- 3 - channel monopulse;
 - SUM,DIF,OMNI –channels;
 - 50 Ohm impedance;
 - 4.5° main beam width;
- Antenna rotation system*
- digital loop stabilization;
 - 2kW / 3-phase inverter;
 - up to 8 min⁻¹
- On board GIS system*
- digital 3D terrain based on radar position;
- Positioning and time standards*
- GPS time/positioning subsystem
- MSSR module integration (fig.3)*
- 19" Rack-Mount standard
 - Structured cable system
 - Anti-FIRE signalization
 - Interfaces and synchronization
- Communication interfaces and HI-level systems integration*
- HDLC, ASTERIX, ASOC-ICD Ver.03 communication protocols;
 - Dedicated protocol converter;



Fig. 3

- Ethernet 10/100 Mbps;
- TCP/IP, UDP protocols
- Cable and Fiber Optical Interfaces to the civilian and military ATC systems;

- Frequency management
- VoIP and teleconferencing capabilities.

Power Supply

- 6 kVA UPS and diesel generator

The modernized systems type BT-1, BT-1- 01 and ST- 68YM-BT was successfully tested by Bulgarian Military Executive Agency

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