SPACE RESEARCH INSTITUTE CONTRIBUTION TO DEVELOPMENT OF THE AIR SOVEREIGNTY OPERATION CENTER OF BULGARIA

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Space Research Institute contribution to the development of the air sovereignty operation center of Bulgaria *The paper presents results from conducting research and development activities in last years at specialists from SRI-BAS for creation of Air Sovereignty Operation Center (ASOC). It has been described developed and implemented devices and systems for collecting, processing, archiving and displaying of flight data. It has been shown place of those systems in structure of ASOC, described their functional possibilities and technical specifications.*

At the Space Research Institute (SRI) at Bulgarian Academy of Science (BAS) section Airspace Control System (ASCS) scientific research and experimental constructive work on inventing and introducing systems for collecting, tracking, distribution and displaying the radar and flight data has been going on for many years. Experts from the Institute worked in many areas of interest to Ministry of Defence and Bulgarian Air Force and for a while they worked on setting up the Air Sovereignty Operation Centre (ASOC) of Bulgaria. (фиг.1).

The first real radar information received in ASOC was from civil trace and airport radar on State Enterprise ATC. It has been possible by developed from SRI specialists unites "Luch-TA" and "Luch-LA" – modules for re-protocol of radar information.

Those products are assigned for receiving, process, fuse and re-protocol of radar information from civil trace and airport radar on State Enterprise ATC located in airport radar centers Sofia, Varna and Burgas and track radar centers "Cherni Vrach" and "Varbishki prochod" in ASTERIX format according to ASOC - ICD - 001, Revision 3,15March 1999 [3].

The intend and character of sources and users of radar information defined main operational and technical requirements for devices. It was very important to provide uninterruptible mode of work and get reliable radar information to ASOC 24 hours day and night. Modes of work of those devices were in real time and delay for combination and reprotocol of radar information was less than 1s for track radars and

0.5 s for airport radars. The device is developed on standard processor and work in dialog mode by command from operator and did not need from specialized maintenance and uninterruptible work with operator.

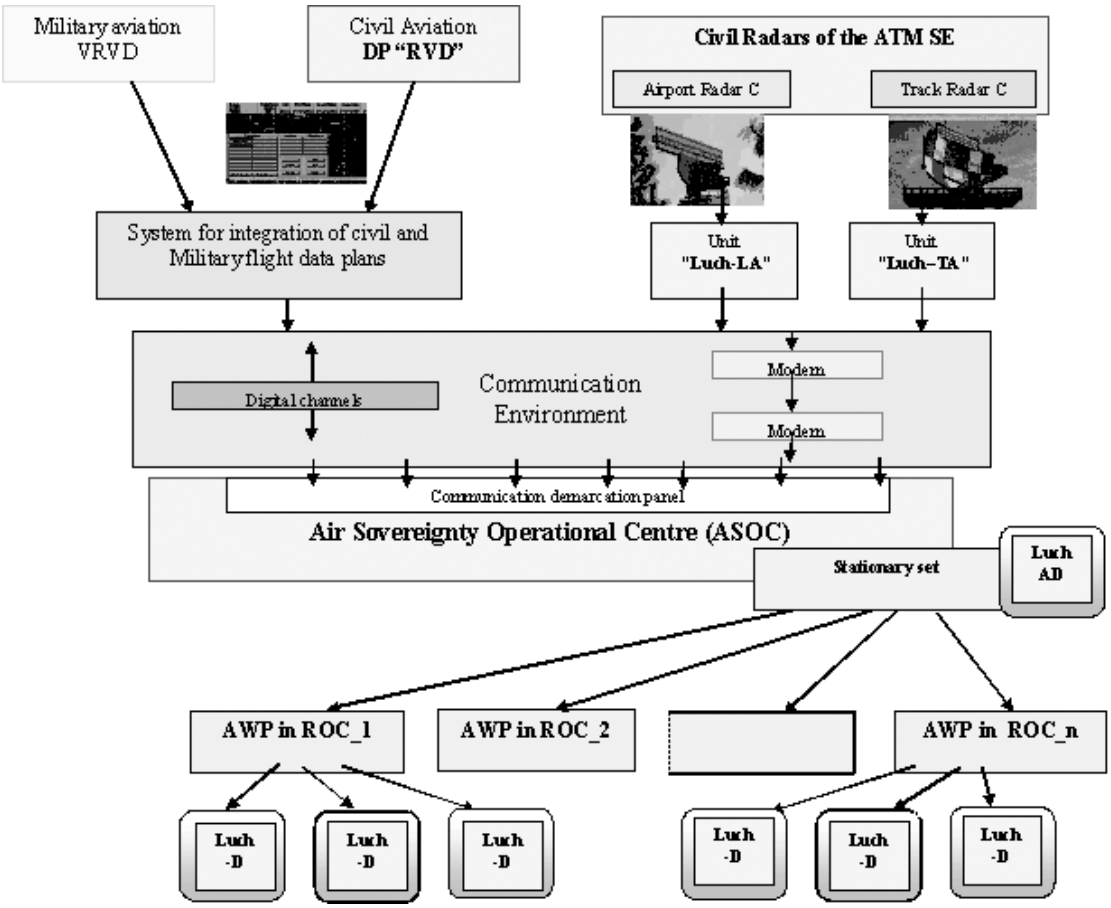

Fig. 1. Structural shame of the systems developed by the scientists of SRI-BAS used for the creation of ASOC

The realized device "Lach–TA" ("Lach – LA") displayed statistical information for received, processed (combined) and transmitted radar plots (tracks) from separate channels for cycles 1s and 1 round of antenna. Moreover it was displayed number of received datagram's (sequences) from separate channels from primary and secondary track radars (radar processors of airport radars), percentage of mistakes during receive from that channels and number of transmitted (sequences).

The modules for re-formatting of radar data from the radars of State Enterprise Air Traffic Service Authority have passed the tests successfully, were set up in 2001

on the position of all En-route and Approach radars and transmit radar data to ASOC of Bulgaria.

The Air Sovereignty Operations Center (ASOC) presents complex multifunctional system and her normal function requires not only radar information but also data for flight plans. On this base is created so called Identified Picture (IP) of an air situation.

Specialists from SRI–BAS developed system project of "System for unification of civil and military flight plans" for needs of ASOC [6].

The aim of the research was to make clear up the scientific, technological, program, designing and financial problems in development and implementation of such up to date system designed for purposes of the ASOC.

All flights in the Bulgarian air space, civil (international and domestic) and military one, is permitted only after the flight plan is presented, electronically or on hard copy, to the respective government institutions. So first we completed the assessment of the status, requirements and specific operation characteristics of the present system for civil and military air traffic planning. It was described the order for flights permission in the Bulgarian sky. They were analyzed and assessed the approved systems for planning and distribution of the Bulgarian sky for civil and military aircraft flights. The content and the ways of how to develop and to disseminate the flight plans were analyzed too.

It was clarified that flight applications for civil and military aviation are prepared by authorized bodies and services from SE ATC and MATC. Terms for perpetration of flight plans are different and vary from 14 days (for flights with repeated flight plans) to 60 min before time for taking off.

The information, containing in flight plans has dynamic character and can be changed or cancelled according to established order and in special cases from aircraft commander during the flight.

It was synthesized block diagram of system for unification of civil and military flight plans for needs of ASOC. Bodies and services of system and their location are - Flight Information Region (FIR) Sofia, located in Regional Center for Air Traffic Maintenance (RCATM) Sofia, (FIR) Varna, located in RCATM Varna, Military Air Traffic Control, Section "Planning and Military Utilization of Air Space", Center for Coordination Utilization of Air Space (CCUAS).

There were developed technical and soft ware support for system for integration of civil and military flight data plans and general requirement for them [4].

The functional means of the system are:

- Automatic receiving of the active flight plans of the air space of Bulgaria used by civil and military aircrafts;
- Automatic combining of the data of the active flight plans from the available civil and military sources;
- Archiving of the received messages from different sources;

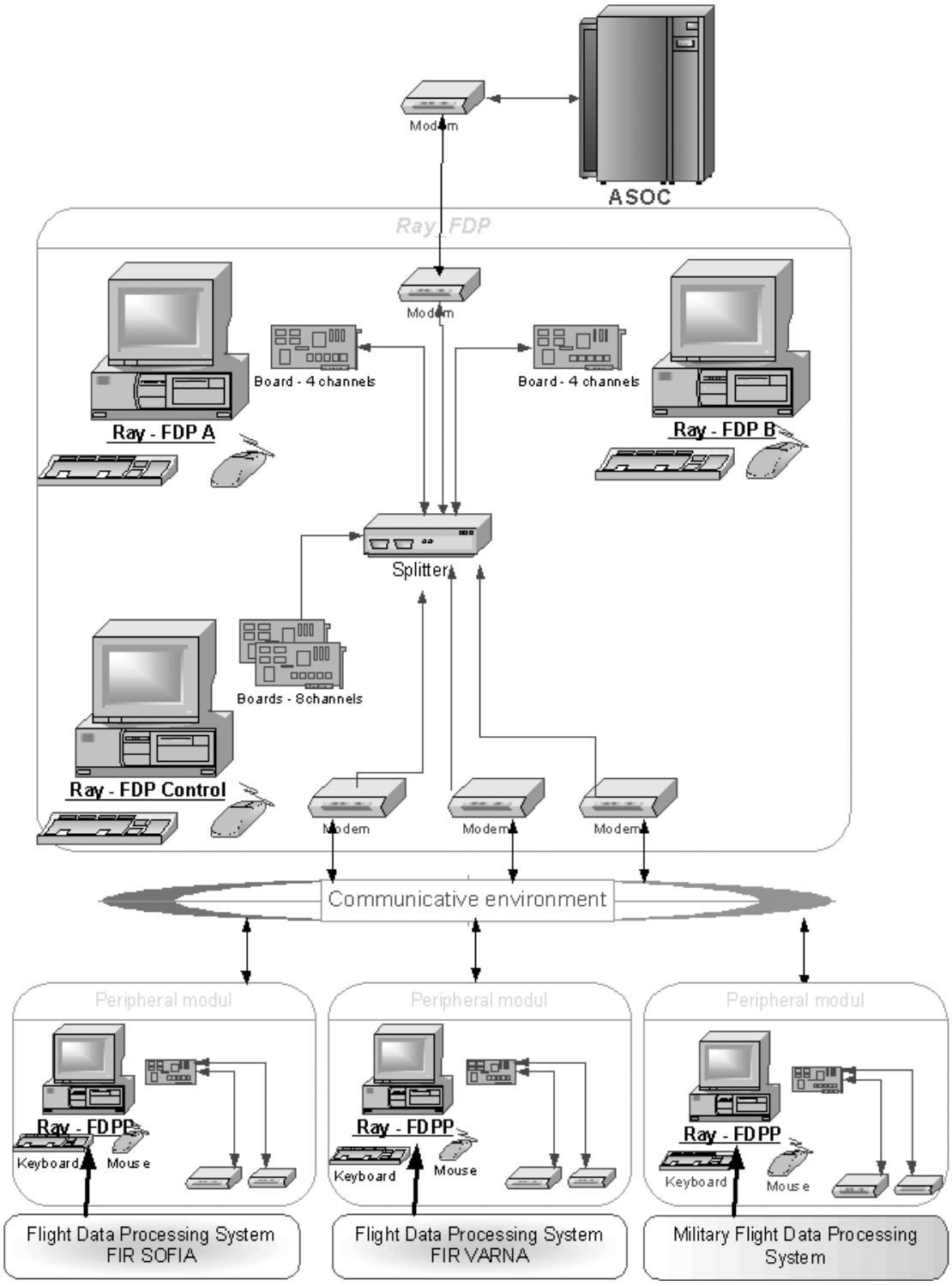

Fig.2. Structural diagram of System for Integration of Civil and Military Flight Plans for Aims of ASOC.

- Displaying of the whole data of active flights;
- Automatic re-formatting of the data for the active flight plans in format suitable for the ASOC;
- Analyzing the received and transmitted flight data in real time and its record and playback;
- Printing of the data or parts of it on paper and its long term archiving on CD ROM (or DAT);
- Preparing of statistic reference data based on different criteria;
- Protecting the information and preventing unauthorized access to the system;
- Automatic transmitting of the combined immediate plan data to the ASOC in real time.

For conformation of System project it was developed laboratory model of system for unification of civil and military flight plans. The designated Module of the System for combining civil and military flight plans is put into work since 14th Jan 2003. The module receives, re-formats and transmits the flight plans from FIR Varna to the ASOC.

To be finished whole cycle of ASOC activity it is necessary created IP to be dismissed to final users – all centers and official persons from management system of Air Force, Land Force and Navy.

By that reason it was necessary to be created and implemented reliable and independent but integrated with them automated system for distribution and visualization of IP from ASOC [5].

Structure of that system involved:

- Set of technical and program means based in the ASOC and destined to control, observe and transmit common situation picture to the Regional Operation Centres (ROC);
- Set of technical and program means based in the ROC and destined to control, observe and transmit common situation picture to the end-users;
- Working position that include technical and program means for receiving and displaying of COP to the users.

Functional potentialities of the system:

- Receiving the COP from ASOC through communication interfaces to the provided channels of the communication system;
- Displaying of the COP on the screen in real time;
- Assuring the necessary Human Machine Interface;
- Controlling, monitoring and archiving of the COP with the possibility of future playback of the data;

- Assuring the execution of basic composition of analytically deciphered functions and measurement based on time and distance (measured vectors).

As a result from long time experience in use of radar information and users requirements of that information it was developed radar display.

Components of displayed static information were cursor, geographic map, navigation points and airports, scale, air routes, zones, geographic net.

Components of displayed real radar information were symbols, stickers, vectors of velocity, tracks and measured vectors.

Moreover for automation of the all functions of activities of operators it was developed communication and applies interfaces.

Specialists from SRI-BAS had a readiness and possibilities no only to create separate programme-technical modules for display of radar information but the all system for dissimination of IP of an air situation.

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