# PRINCIPLES OF ORGANIZING THE ARCHITECTURE OF PERSPECTIVE ONBOARD DIGITAL COMPUTING SYSTEMS IN AVIONICS

**Kovalenko Yu.B.**[1]
*[1]National Aviation University, Kyiv*

Onboard digital computing systems (ODCS) modern aircraft (MA) are complex technical design objects that solve various functional tasks as part of MA: determination of flight and navigation parameters in takeoff, level flight, MA landing; tracking the technical condition of onboard equipment; coordination of the work of all onboard subsystems; collection, storage, processing and delivery to the pilot on the means of indication of objective information received both from the information-measuring system MA and from the controls of the information-control field of the cockpit.

Common technical solutions in the architectures of perspective ODCS offered by developers are 4 principles - architecture openness, modularity, unification and standardization, functional and hardware integration. However, there are also differences that affect the effectiveness of the use of various versions of the BCVS architectures in solving applied onboard problems.

Essential for ODCS quality indicators is the type of intra-system interface used in them. ARINC664 (Gigabit Ethernet 1000Base-SX, AFDX), CompactPCI (PICMG 2.0, D3.0), PCI Express, RapidIO, VME64x, etc.interfaces are used in the projects of domestic ODCS models known today [4–6].

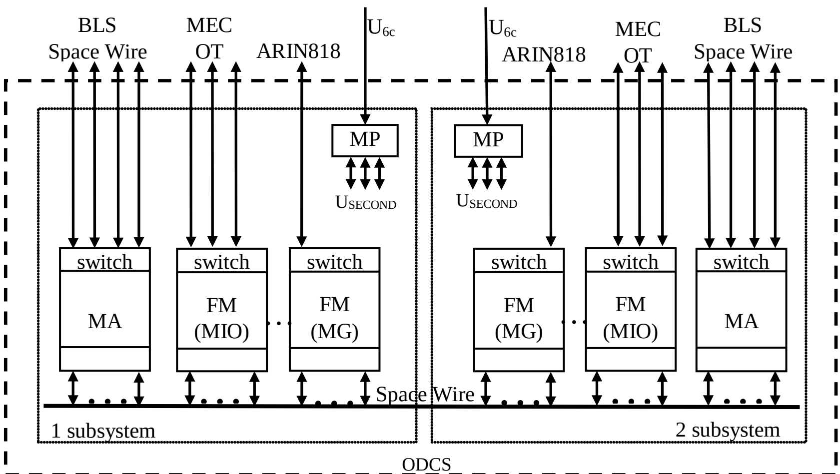


Fig. 1. ODCS block diagram (FM - functional module; MIO – input-output module; MG - graphic module;MP – power supply module; BLS – onboard local area network; U onboard – voltage of the on-board network; U secondary – secondary voltages)

The constructive-functional module (KFM) is used by modules of different purpose:

– computing modules that perform complex calculations for MA flight control;

– I / O modules providing functions of information exchange via serial link (SL), via multiplex exchange channels (MEC), one-off teams (OT) exchange;

– graphic modules that process the image for its output to on-board display facilities, for example, via the ARINC 818 interface (Fiber Channel 1x);

– mass memory modules intended for storing functional software in their read-only memory and entering it into the random access memory of modules during ODCS initialization - computing module (CM);

– power supply modules that convert the voltage of the on-board redundant network into the secondary voltages required for the power supply of the KFM.

As follows from the figure, ODCS contains two subsystems, consisting of modules FM, MIO and MP for various purposes. Duplication of subsystems provides a level of redundancy of onboard equipment sufficient to achieve the MTBF required according to the terms of reference. Each structural and functional module KFM contains a non-blocking switch of the SpaceWire interface, made on the element base of the kit.

The advantages of using SpaceWire channels as part of ODCS as an in-system interface for SpaceWire channels are:

– increasing the reliability of the internal data exchange network thanks to the redundancy of communication channels due to the KFM ODCS connection according to the "double star" topology;

– reaching the maximum level of throughput of the intersystem interface in the the number of connected components in a "fully mesh" topology;

– providing software-controlled execution of functional tasks of avionics by connecting the definition of ODCS components on a "mesh network" topology.

**References:**

1. Konakhovych H., Kozlyuk I., Kovalenko Y. (2020) Specificity of optimization of performance indicators of technical operation and updating of radio electronic systems of aircraft. *System research and information technologies*, no. 3, pp. 41-54.

2. Kovalenko Y., Konakhovych H., Kozlyuk I. (2020) Specificity of optimization of performance indicators of technical operation and updating of radio electronic systems of aircraft. *International Journal of Engineering Research and Applications (IJERA)*, vol. 10 (09), pp. 48-58.

3. Kozlyuk I., Kovalenko Y. (2020) Functional bases of the software development and operation in avionics. *Problems of Informatization and Management*, no. 63, pp. 49-63.

4. Bogatyrov V., Bogatyrov S. (2009) Ob'edinenie rezervirovannyih serverov v klasteryi vyisokonadezhnoy kompyuternoy sistemy. *Informatsionnyie tehnologii*, no. 6, pp. 41-47.

5. Vidin B., Zharinov I., Zharinov O. (2010) Dekompozitsionnyie metodyi v zadachah raspredeleniya vyichislitelnyih resursov mnogomashinnyih kompleksov bortovoy avioniki. *Informatsionno-upravlyayuschie sistemy,* no. 1, pp. 2-5.

6. Gatchin Yu. (2010) Modeli i metodyi proektirovaniya integrirovannoy modulnoy avioniki. *Vestnik kompyuternyih i informatsionnyih tehnologiy*, no. 1, pp. 12-20.