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THE CENTRAL CIVIL AVIATION SAFETY REGULATORY AND GUIDANCE LIBRARY OF THE RUSSIAN FEDERATION

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ABSTRACT

Flight safety is the key focus of the activities of all aircraft enterprises and civil aviation institutions. One related risk factor is a lack or untimely receipt or use of outdated versions of the required information on regulation of the civil aircraft operating processes. For this reason, information support is the increasing focus of all aspects of the aviation services sector.

Establishment of the civil aviation regulatory and guidance library is among the main means for providing information and library support in this area.

Key words: flight safety, airworthiness, The Central Civil Aviation Safety Regulatory and Guidance Library (CCASRGL), library collections, CCASRGL users, AC component authenticity assessments, and airworthiness monitoring information and analysis system.

1. INTRODUCTION

Flight safety describes the condition of the aviation system or company in which the risks of aviation operations connected with maintenance of aircraft or direct support for such operations are reduced to an acceptable level and properly controlled (Exhibit 19. Flight Safety Management. — Edition 1. — Montreal: ICAO, 2013. — 44 c. — ISBN 978-92-9249-239-7.)

Flight safety is a comprehensive descriptor of an aircraft and aviation operations measuring their capacity for risk-free flight performance.

Maintenance of aircraft (AC) airworthiness constitutes a complicated issue requiring the joint efforts of civil aviation equipment manufacturers (both developers and producers), AC operators and other participants in organization and performance of air transfers, including air traffic control, airport activities, staff training and many other areas (so called aviation service providers).

In the civil aviation sector, airworthiness is the key issue of national importance which is consistently addressed by the Russian Government. In this context, it would be relevant to mention the State Civil AC Safety Management Program approved by Order No. 641-r of the RF Government on 06.05.2008. Implementation of this State Program in the Russian Federation will facilitate smooth integration of Russia in implementation of the Global Aviation Safety Plan maintained by the International Civil Aviation Organization (ICAO) and provide strong capacity for improving our positions in determining the key development areas for international civil aviation as crucial for successful social and economic development of the Russian Federation itself.

2. THE CENTRAL CIVIL AVIATION SAFETY REGULATORY AND GUIDANCE LIBRARY

In 2009, according to the aforementioned State Program and Order of the Federal Air Transport Agency (FATA, or Rosaviatsia), the Federal State Unitary Enterprise "State Research Institute of Civil Aviation" (FGUP GosNII GA) established the Central Civil Aviation Safety Regulatory and Guidance Library (CCASRGL).

CCASRGL was established both for implementing the State Civil AC Safety Management Program and in furtherance of the ICAO recommendations (DOC 9760, Airworthiness Manual. Third (3) Edition, PART II "AIRWORTHINESS ORGANIZATIONAL STRUCTURE AND STATE RESPONSIBILITIES", Chapter 4 "Airworthiness Organization", paragraphs 4.9.1 – 4.9.5), as well as requirements of the Russian Federation Air Code and aviation legislation [1].

The CCASRGL Establishment and Development Concept and the CCASRGL Policy provide that its establishment is aimed at improving information and analytical services in civil aviation (CA), using front-end technologies, innovative forms and methods for expanding the CA library collections as a key to the improved system of state control and regulation of aviation equipment (AE) operation and its airworthiness (AW) [2].

The tasks pursued by CCASRGL include providing aviation authorities and other CA subjects with updated information for compliance with international standards and best practices of flight safety, maintenance of AC airworthiness at each stage of its lifecycle, improvement of air transport services and practical efficiency of aviation companies.

To achieve these goals, CCASRGL:

- completes the library collections;
- maintains the library collections in digital format and up-to-date condition;
- arranges long-term storage and safekeeping of library collections in digital format;
- Facilitates user access to the library stock.

3. COLLECTION OF LIBRARY STOCK

CCASRGL draws its stock from the following sources: The Russian Federation Government, Ministry of Transport, Ministry of Industry and Trade, Federal Air Transport Agency (FATA,

or Rosaviatsia), Federal Agency for Transport Supervision (FATS, or Rostransnadzor), official global aviation organizations (ICAO, EASA, FAA etc.), International Aviation Committee (IAC), developers/ manufacturers of AC and its components, as well as other AE [3].

The most prominent AC manufacturers include Airbus, Boeing and other foreign corporations, United Aircraft Corporation (UAC), Helicopter Service Company (HSC JSC) and United Engine Corporation (UEC JSC) [4].

Various CA training and research institutions, AC certification centers, airports and many other entities, institutions and aviation companies also contribute greatly to collecting the CCASRGL stock.
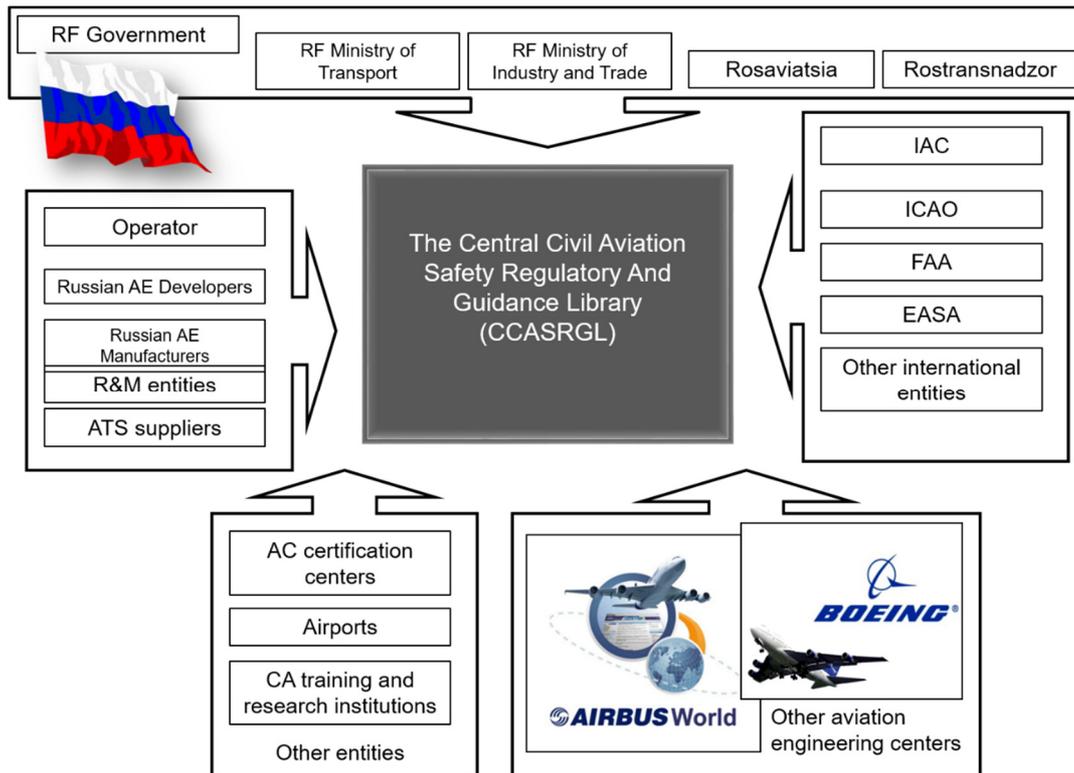
Figure 1. How CCASRGL cooperates with other entities to enhance its collection.

The library stock is divided into subject areas.

The main sections of CCASRGL are:

- industrial organizational and directive (statutory) documents covering all areas of CA operations (more than thirty areas);
- AC operation and maintenance documents for AC registered in the State Register of Civil Aircraft, Aviation Engines (AEng), Air Propellers (AP), Helicopter Gearboxes (HG) and other AC components;
- documents issued by international entities (ICAO, FAA, EASA, IAC and others);
- industrial rules and standards and
- periodicals.

Also, the Library includes separate options such as:

- model flight manuals (RFM) for reference by aviation enterprises;
- daily and regular flight safety advice; and

- AC type certificates and company compliance certificates.

All sections include search systems and pop-up tips for user convenience.

The flexible architecture of the library database allows for its further development and addition of further subject areas, as appropriate [5], [6], [7].

To complete its section of daily and regular flight safety advice, CCASRGL maintains close cooperation with the International Aviation Committee (IAC) and the Rosaviatsia Flight Safety Inspectorate (i.e. with the Incident and Industrial Accident Investigation Archives (IIAIA) developed and implemented by the Inspectorate).

IIAIA was established to provide information support to the Incident and Industrial Accident Investigation Commissions and ensure that the bodies and entities concerned might access the results of such investigations in order to take preventive measures against aviation accidents, and provides strong support to the Flight Safety section of CCASRGL [8], [9].

CCASRGL offers methods for seeking and selecting information based on AC type and other criteria meeting the ICAO recommendations and opening access to information that might be helpful in developing preventive measures in the key flight safety areas.

CCASRGL provides for ongoing integration of daily flight safety data, orders of Rosaviatsia based on investigations into aviation events, running flight safety information, flight incident and industrial accident investigation reports.

Currently the library includes more than 31 thousand up-to-date industrial documents and covers more than 150 types and modifications of domestic and foreign AC. The library stock is supplemented daily with newly issued and archive documentation.

The CCASRGL database is registered with the Federal Service for Intellectual Property, Patents and Trademarks, Registration Certificate No. 2011620368 of 16.05.2011.

Particular attention is focused on keeping its stock up-to-date (by including the most recent revisions of documents in the CCASRGL database).

The documents are updated through integration of relevant amendments or notices of cancellation. Updating is based on relevant information received by CCASRGL and always refers to the document on the basis of which the CCASRGL document is updated.

One priority focus for CCASRGL is procuring safekeeping of its stock, security of its database, prevention of unauthorized access to CCASRGL collections and maintenance of user confidentiality [10], [11], [12].
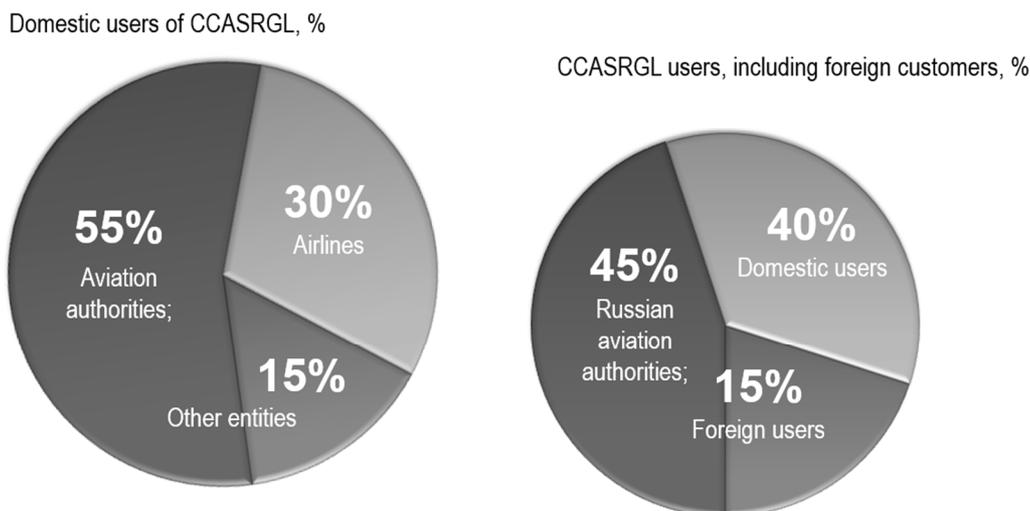
For this purpose, CCASRGL maintains a multi-level storage system including the active (user) collection for use of library stock, archive (backup) collection and reserve (remote) collection and their copies on portable media.

The authorized access system allows users to access the library in general and its separate sections or individual documents and ensures that users' data are kept confidential. The information and library services are based on a flexible system of discounts and bonuses, which improves engagement of a variety of CA companies and institutions in enhancing the library stock.

The range of users includes aviation administrations, as well as companies and institutions engaged in building and developing the library stock, as well as other stakeholders.

More than 200 different entities enjoy the services of CCASRGL in Russia, the CIS and foreign countries (through more than 1,800 connections).

CCASRGL covers over 30 countries.

Domestic users of CCASRGL, %

CCASRGL users, including foreign customers, %

55%
Aviation
authorities;

30%
Airlines

15%
Other entities

45%
Russian
aviation
authorities;

40%
Domestic users

15%
Foreign users

Note:
For this purpose, aviation authorities means the Ministry of Transport of Russia (the National CA Policy Department), Rosaviatsia (headquarters and interregional territorial administrations), Rostransnadzor (headquarters and territorial aviation and transport safety supervision departments)

Figure 2. Users of CCASRGL

A unique hardware and software system (HSS) was originally developed and implemented for fully-fledged functioning of CCASRGL.

CCASRGL is run by the Ruby on Rails software platform based on the AJAX technology user interface, which, in substance, as applied to the library's website, allows the Internet-channel and server to be loaded with useful work, while the user merely types the search query.

The database is implemented in freely distributed DBMS MariaDB with open source codes. The freely distributed Linux Ubuntu Server operating in a virtualization environment on a fail-secure server cluster is used as the server operating system [13].

The library's interface is developed so as to facilitate comprehensively the search for documents in its collections and their convenient use. The ergonomic elements and intuitive search used in the interface, as well as the pop-up tip system, enable users to enjoy the available information resources with the utmost efficiency and comfort.

CCASRGL is provided with hardware and licensed software sufficient for prompt high quality copying and scanning of documents, efficient expansion of library stock and provision of information and library services to users of CCASRGL [14].

The library's HSS is improved and upgraded on a constant basis.

Since its establishment, the library has proved itself as a useful and high-performing information resource. CCASRGL was founded by Russian aviation authorities, so the library serves as a statutory sources of industrial information. Use of up-to-date AC operation and maintenance documentation and other official instruments constitutes a mandatory requirement for appropriate resolution of airworthiness maintenance issues and guarantees of flight safety[15].

Aviation companies are recommended to use the library by letter No. 03.9-314 of Rosaviatsia dated 20.09.2010 "On use of the database of RF CA organizational, directive and statutory documents" and the minutes of Conference of AC Airworthiness Maintenance Departments in Krasnoyarsk dated 11.10.2017.

In addition to its main use for providing information and library services to its users, CCASRGL takes part in solving a number of applied issues, such as AC component authenticity assessments, functional support for the AC airworthiness monitoring information and analysis system (AC AMIAS), etc.

4. AC COMPONENT AUTHENTICITY ASSESSMENTS AND LIFE-CYCLE MONITORING

Authenticity assessments are designed to ensure the safety of flights and are intended, as such, for supporting maintenance of AC airworthiness at an acceptable level for state registration of such AC in accordance with the applicable statutory instruments.

The purpose of authenticity assessments is to validate the AC component life cycle, check compliance by each assessed AC component with the then effective specifications and whether it originates from an approved ATS supplier [16].

This purpose is achieved through establishment of the Single Information Environment in RF CA for supporting AC operations based on the AC airworthiness monitoring information and analysis system (AC AMIAS), which includes AC component authenticity assessments as its integral part.

Some AC component authenticity assessment criteria are based on conformity of specific documentation with the established rules and requirements. These criteria are set forth in both the RF CA guidelines ("The AC Component Authenticity Assessment Guidance" 24.10-966ГА (2nd edition)) and ICAO recommendations (DOC 9760-AN/967 "Airworthiness Manual", Chapter 9. "Maintenance of Airworthiness" paragraph 9.10. Authenticity and serviceability of aircraft parts [17].

Some examples of RF CA requirements are provided below:

- a manufacturing or repairing facility must obtain relevant authorization for serial manufacture or repair of a particular type of AC component;

- any maintenance, repair, adjustments and bulletin services are to be performed in accordance with the operational documentation;

- the resource of an AC component must comply with resources established for this type of product;

- the numbering of documentation, where appropriate, must comply with GOST R 27692-2012, 27693-012, PKD-83, NTERAT-93;

- during any AC component maintenance work, the numbered documentation must be maintained in accordance with NTERAT-93 and other organizational and directive documents (ODD).

ICAO recommendations contain quite similar authenticity criteria.

All these questions are also answered in the CCASRGL sections of ODD, OMD, compliance certificates and so on.

Consequently, CCASRGL provides the benchmark information and constitutes an integral part of AC component authenticity assessments and life-cycle monitoring processes [18].

The AC airworthiness monitoring information and analysis system (AC AMIAS) consists of the specifications, hardware, software and algorithms for processing information flows related to the AC and AC component life-cycle and supporting ongoing control and analysis of AC airworthiness within the framework of a single information environment covering government supervision, development, manufacture, shipment, operation and repair of aircraft.

The development of this system stems from the idea of a single information environment for supporting aviation equipment operations in civil aviation and the aviation industry based on the integrated distributed network of local information management systems AC AMIAS and the uniform regulatory environment.

The development, support and performance of AC AMIAS are governed by the following national standards: GOST R 54080-2010, 55251-2012, 55254-2012, 55256-2012, 55257-2012, 55258-2012.

The structure of AC AMIAS is based on the idea of a single information environment (SIE) providing for maximum completeness and relevance of the information shared within it, as well as authorized access for participants in AC AMIAS processes.

The following parties are users of AC AMIAS:

- aviation authorities;
- manufacturing and repair enterprises;
- AC operators; and
- other aviation entities.

AC AMIAS has a modular structure based on six key user modules (UM): UM Developer, UM Manufacturer, UM Supervision, UM Operator, UM R&M, and UM Leasing. Each UM addresses certain sets of information tasks for the purposes of AC fleet operation support. Based on each UM type, software packages (SP) were developed to this end, including the following sections: Electronic Logbook, Electronic R&M Program, and Electronic Operation Documentation.

The integration of CCASRGL with AC AMIAS automatically provides users with up-to-date regulatory and operational documentation for fulfilling specific industrial tasks, thereby significantly facilitating and improving operation and maintenance processes.

The development of CCASRGL continuous. Now it is mapping out various opportunities for cooperation with third party organizations and institutions and integration with their information systems (databases). The key issues it is currently considering include integration with refueling facilities, electronic libraries and databases of Rosaviatsia Interregional Territorial Administrations and Rostransnadzor State Aviation Supervision (Territorial Administration of State Aviation Supervision) and Transport Safety Maintenance Supervision Departments in Federal Districts.

Integration with the knowledge base of the National Research Center "Zhukovsky Institute" is also among the key development areas for CCASRGL today.

The National Research Center "Zhukovsky Institute" was established in accordance with Federal Law No. 326 of 04.11.2014 and provides for centralized management of domestic applied sciences in the aviation sector with the aim of building up a strong research capacity based on interdisciplinary convergence of sciences and cross-sector integration of technologies.

The action plan of the National Research Center "Zhukovsky Institute" (a federal state-funded institution) includes a range of interrelated long-term objectives and performance indicators, priority research areas and development goals for aviation research and technologies, as well as a schedule of mid-term events of a research, organizational and compliance control nature for the period up to 2030.

According to Order No. 2489-r of the RF Government dated 4 December 2015, the National Research Center "Zhukovsky Institute" includes the leading Russian research institutes in the aviation sector, as follows: Zhukovsky Central AeroHydrodynamic Institute (TsAGI, Central Institute of Aviation Motors after Baranov (CIAM), State Research Institute

of Aviation Systems (GosNIIAS), Siberian Research Aviation Institute after Chaplygin (SibNIA), and State Public Research Aviation System Testing Facility (GkNIPAS).

These institutions are all unique in nature and have a great history and huge aircraft engineering capacity. The integration of CCASRGL with these strong information resources on conditions of strict confidential treatment and security of information, and personalized and protected access will bring CCASRGL to a new level of information and library servicing of civil aviation market participants and other stakeholders both in their daily operations and when facing issues of AC airworthiness, flight safety and management system maintenance, as well as the aviation security system in general [19].

5. CONCLUSIONS

In order to implement the State program for ensuring the safety of civil aviation aircraft, approved by Decree of the Government of the Russian Federation of 06.05.2008 No. 641-p and ICAO recommendations (DOC 9760, etc.), Decree of the Federal Agency of Air Transport of 15.01.2009 no. GK-Z -r in the Federal State Unitary Enterprise GosNII GA established TSNMB GA.

For the implementation of information and library services, the electronic database of the TsNMB GA was formed and registered with the Federal Service for Intellectual Property, Patents and Trademarks (Certificate dated May 16, 2011 No. 2011620368)

The database (it's also the library's funds) contains up-to-date organizational and administrative documents of civil aviation, operational and technical documentation of aircraft and their components, other industry norms and rules, as well as documents of international organizations that regulate the activities of aviation enterprises and organizations in the field of civil aviation.

In accordance with the recommendations of the Ministry of Transport of the Russian Federation and the Order of the Federal Agency of Air Transport dated August 17, 2009 No. GK-154-p, the main source for the formation of funds for the TSNMB GA is the Directorate of Rosaviation. Thus, TSNMB GA - one of the official sources of information of civil aviation of the Russian Federation.

Library funds contain documents on more than 30 areas of civil aviation activity, as well as information on more than 150 types and modifications of domestic and foreign aircraft (over 30 thousand electronic editions of relevant industry documents, a list of which can be found on the website at http:// http: //mlgvs.ru/lib.html).

One of the priorities of ZNMB HA (Decree of the Federal air transport Agency dated 20.04.2009 No. GK-68-R) is the provision and maintenance of a reference of RLE to conduct independent verifications of the airlines and other interested organizations.

Specialists of more than 200 various organizations and enterprises in Russia and in the countries of the near and far abroad (more than 1800 connection points) use the services of the Central Library of National Security.

Ergonomic search interface of documents tailored to the most complete facilitate the search of documents in the library and ease of use.

Applied in interface elements ergonomics and intuitive search and provided a hint system in the form of pop-UPS, allow us to find interesting documents in the shortest possible time in the on-line system 24/7, comfortably and effectively use the information resources.

During its existence, the library has established itself as a useful and effective information resource. The use of relevant maintenance documentation, aircraft and official documents is

one of the essential conditions that determine the quality of work on the maintenance of airworthiness and flight safety.

REFERENCES

[1]   Brusnikin V.Yu., Koval S.V., Nikolaev A.L. Regulation of the combating illicit trafficking in aircraft and its components product. *Scientific Bulletin of The State Scientific Research Institute of Civil Aviation*, **16**, 2017, pp.27-36.

[2]   Brusnikin V.Yu., Konkov A.Yu., Sharypov A.N. On some results of work on the assessment of the authenticity of aircraft components in the monitoring of airworthiness. *Scientific Bulletin of The State Scientific Research Institute of Civil Aviation*, **311**, 2010, pp.132-138.

[3]   Brusnikin V.Yu., Glukhov G. E., Garanin S. A. Optimization of information exchange process between air enterprises within a single information space *Scientific Bulletin of The State Scientific Research Institute of Civil Aviation*, **17**, 2017, pp.27-33.

[4]   Brusnikin V.Yu., Gubanov O.V., Karapetyan A.G., Sharypov A.N. Operational documentation. Updating and maintenance *Scientific Bulletin of The State Scientific Research Institute of Civil Aviation*, 20, 2018, pp.30-39.

[5]   Brusnikin V.Yu., Sharypov A.N., Gubanov O.V., Koval S.V., Davydkin D.V., Kuznetsov E.I. Evaluation of risk factors related to operation of dubious and unapproved aircraft components of helicopters Mi-8. *Scientific Bulletin of The State Scientific Research Institute of Civil Aviation*, 21, 2018, pp.42-50.

[6]   Shapkin V. S., Brusnikin V. Yu., Glukhov G. E., Chernikov P. E., Garanin S. A. Modern approaches to the problems of protection of aviation equipment products from falsification and counteraction to illegal turnover of aviation industry products. *Scientific Bulletin of the State Scientific Research Institute of Civil Aviation,* **22**, 2018, pp. 59-68.

[7]   Brusnikin V. Yu., Glukhov G. E., Chernikov P. E. Life cycle of aviation equipment at the stage of operation in the information and analytical system of aircraft airworthiness monitoring. *Scientific Bulletin of The State Scientific Research Institute of Civil Aviation,* **15,** *2016*, pp.33-39.

[8]   A. Sharypov, V. Brusnikin, S. Koval, G. Glukhov, O. Gubanov Aircraft components life cycle monitoring as a tool for identifying inauthentic aviation equipment items. International Journal of Mechanical Engineering and Technology (IJMET), Volume 9, Issue 7, July, 2018, pp. 612-620, Print: 0976-6340 and ISSN Online: 0976-6359.

[9]   A. Blagorazumov, P. Chernikov, G.Gluhov, A.Karapetyan, V. Shapkin and L.Elisov The background to the development of the information system for aviation security oversight in Russia. International Journal of Mechanical Engineering and Technology (IJMET), Volume 9, Issue 11, November 2018, pp. 341-350, ISSN Print: 0976-6308 and ISSN Online: 0976-6316.

[10]   Brusnikin V. Yu., Glukhov G.E., Bykova V.V., Chernikov P.E., Koval S.V., Konkov A.Yu. User module "Supplier" of the information and analytical system for monitoring the airworthiness of aircraft: topicality to develop and main functions. *Scientific Bulletin of the State Scientific Research Institute of Civil Aviation,* 23, 2018, pp. 41-51.

[11]   DOC 9760, Airworthiness Manual. Third (3) Edition, PART II «AIRWORTHINESS ORGANIZATIONAL STRUCTURE AND STATE RESPONSIBILITIES».

[12]   Exhibit 19. Flight Safety Management. Edition 1. Montreal: ICAO, 2013. 44 c. ISBN 978-92-9249-239-7.

[13]   Order No. 641-r of the RF Government dated 06.05.2008 "The State AC Flight Safety Program".

[14]   Letter No. 03.9-314 of Rosaviatsia dated 20.09.2010 "On use of the database of RF CA organizational, directive and statutory documents".

[15]   AC Component Authenticity Assessment Guidelines 24.10-966GA (2nd edition).

[16]   GOST R 54080-2010, 55251-2012, 55254-2012, 55256-2012, 55257-2012, 55258-2012.

[17]   Federal Law No. 326 of 04.11.2014 "On the National Research Center "Zhukovsky Institute".

[18]   Order No. 2489 of the RF Government dated 4 December 2015 "Approval of the range of entities in respect of which the FGBU NIC the National Research Center "Zhukovsky Institute" may act as founder and owner on behalf of the Russian Federation".