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AN INTEGRATED APPROACH REALIZATION FOR THE REMOTE PILOTAGE AIRCRAFT SYSTEMS DEVELOP- MENT AT THE NATIONAL AVIATION UNIVERSITY

В.П. Харченко, Д.Е. Прусов. Реалізація комплексного підходу до розробки дистанційно керованих авіаційних систем у Національному авіаційному університеті. Розглядаються основи комплексного підходу та визначення принципів побудови експериментальних дистанційно керованих авіаційних систем на базі низки розроблених безпілотних повітряних суден, оснащених сучасним високотехнологічним обладнанням з управлінням на основі новітніх інформаційних технологій, підготовлених до льотних випробувань та пристосованих до відповідних завдань застосування в різних галузях економіки.

Ключові слова: дистанційно керовані авіаційні системи, безпілотні повітряні судна.

В.П. Харченко, Д.Э. Прусов. Реализация комплексного подхода к разработке дистанционно управляемых авиационных систем в Национальном авиационном университете. Рассматриваются основы комплексного подхода и определения принципов построения экспериментальных дистанционно управляемых авиационных систем на базе ряда разработанных беспилотных воздушных судов, оснащенных современным высокотехнологичным оборудованием с управлением на основе новейших информационных технологий, подготовленных к летным испытаниям и приспособленных к соответствующим задачам применения в различных отраслях экономики.

Ключевые слова: дистанционно управляемые авиационные системы, беспилотные воздушные суда.

V.P. Kharchenko, D.E. Prusov. An integrated approach realization for the remotely piloted aircraft systems development at the National aviation university. The integrated approach basis and determine the principles of construction has been considered for the experimental remotely piloted aircraft systems developed using a variety of unmanned aerial vehicles with modern high-tech equipment managing on the advanced information technologies, that are prepared for flight testing and adapted to the relevant tasks used in various sectors of the economy.

Keywords: remotely piloted aircraft systems, unmanned aerial vehicles.

The integration problems of the civil remote piloting aircraft systems (RPAS) into the common aviation system are concerning all the issues to be addressed and establishes a step-by-step approach to address them, aiming at an initial RPAS integration by 2016, in three main areas: a Regulatory Approach, a Strategic Research Plan, and a Study on the Societal Impact. In particular, a Strategic R&D Plan identifying the technology enablers and the research activities necessary to achieve a safe integration of RPAS.

Safety integration of remotely piloted aircraft systems in uncontrolled airspace is a long work, that involves multi-stakeholder involvement and their expertise in the following areas such as development of airframe, engines, avionics and navigation complex, issuing certificates of crew members and medical examination of RPAS-crew, creating systems to detect and prevent the use of spectrum (including the protection against accidental or unlawful interference), providing separation for other aircraft, as well as working out a reliable legal framework, creating the necessary theoretical basis.

In terms of International Civil Aviation Organization (ICAO) objective consideration of the characteristics in addressing unmanned aviation is to provide the fundamental international regulatory framework through Standards and Recommended Practices (SARPs), with supporting Procedures for Air Navigation Services (PANS) and guidance material, to underpin routine operation of RPAS throughout the world in a safe, harmonized and seamless manner comparable to that of manned operations.

One of the important factors of efficiency of industrial-economic complex of Ukraine is the development of remotely piloted aircraft systems. Such systems can effectively resolve a wide range of problems from agricultural oriented tasks to environmental monitoring, condition of pipelines, protection of state borders etc. Worldwide experience of RPAS using confirms their high efficiency, profitability, and feasibility of increasing their share in the overall structure of both civilian and military aviation.

The theoretical investigation and development the own remotely piloted aircraft systems, necessary equipment, a comprehensive national regulatory for its application, the development of international cooperation and coordination on RPAS regulation is important for Ukraine as a country, which includes the full cycle of development, production, operation of aerial vehicles, training of aviation specialists and has significant potential for development, manufacture and operation of its own remotely piloted aircraft systems, as well as exporting them overseas.

National priorities for own unmanned aircraft systems application is the operation in various sectors of the economy and in military affairs .

Most aviation work performed in agriculture, construction, environmental protection, health care, aerial search of mineral resources, study the earth and water surfaces, fighting floods, oil and gas industry, fire protection, participation in disaster mitigation and man-made disasters, for internal affairs field, and others.

At the same time the economic efficiency of remotely piloted aircraft systems for these tasks in comparison with classical manned aircraft is much higher, confirming the relevance of creating their own experimental RPAS based on the two-engine unmanned aircraft equipped with modern nano-engineering equipment with control based on new information technologies.

Implementation of works in this area provides a comprehensive approach to creating and using of RPAS.

Ukraine is one of the few countries that has a powerful air-industrial potential. The development of air-design sectors allows to overcome the lag in the creation, production and operation of competitive unmanned aircraft systems. Existing in the National Aviation University scientific, technical and technological capacity facilitates the establishment of attractive conditions for public funding and investment in projects on modern RPAS creation.

In general, implementation of scientific and technical programs and projects in high-technology air-construction, appearance in the internal market competitive technology, equipment and tools, increasing export potential is one of the priorities of Ukraine's economic development.

The difficult economic situation causes to look for less costly areas of work. One of the ways that allows to realize new ideas and professional experience as a final product is a small size unmanned systems design. Unmanned aviation is used extensively in the civilian sphere to perform the following functions: the border security, the law maintaining, deal with the consequences of natural disasters or technogenic accidents, the environment ecological condition monitoring, etc.

The problems of unmanned aircraft equipment are not connected with the unmanned aircraft, because they are only a part of remotely piloted aviation complex, which includes aircraft, modern special on-board equipment and ground control systems, launch and landing. Thus, remotely piloted aviation complex is a sophisticated aviation technical system which includes one or more unmanned aircraft, control point and communication facilities, equipment startup and rescue service, as well as transportation.

The elaboration of these components in the construction of remotely piloted aviation system requires high development of aircraft design, electronics, information and other technologies. Therefore, many countries haven't got a complete cycle of this unique manufacture, beginning with the construction of the aircraft and its equipment and finishing with the target ground control points.

Along with the elaboration, manufacture and application of remotely piloted aircraft systems regulatory base of common use of airspace by the remotely piloted aircraft systems and by the manned one is forming in the world.

Lack of systems to prevent collisions between unmanned aircraft with other aircraft, high probability of uncontrolled fall to the ground make the flights of unmanned aircraft impossible in the same space with other aircraft as well as their application in the areas of settlements. As a result the benefits from the

use of civil remotely piloted aircraft systems are lost, and the application of RPAS in the airspace with busy air traffic and in the areas of settlements is completely impossible.

In such civil areas of application as the Earth remote probing, communications and control of borders, relaying signals remotely piloted aircraft systems reduce the cost of production of services in comparison with traditional space and aeronautical systems.

Concepts of certification, standardization and regulation of unmanned aircraft flights at the level of international governmental and nongovernmental organizations have been creating. (ICAO, 2011).

In Ukraine the domain of unmanned aircraft develops very quickly. National Aviation University was one of the first institutions in Ukraine, which drew attention to the problem of development of unmanned aviation complex of civil purposes. Currently in Ukraine there are no such important components as the classification of remotely piloted aviation complex according to the common terminology, tactical and technical requirements to the complexes from potential customers, regulatory base for creation, testing and operation of the remotely piloted aviation system, funding from the concerned central authorities.

The use of remotely piloted aviation system in the national economic sector, in the interest of environmental authorities, enterprises of fuel and energy complex and other subjects of the national economy, in the problems of emergency situations, as well as for air surveillance and border security, for the monitoring of the situation on the highways, in the interests of regional bodies of economy, the bodies of land utilization, municipal and regional administrations, etc., which will improve the effectiveness of operational control by means of various departments during the performance of assigned missions in money saving with a help of creation of unified remotely piloted aviation system are very important. Ukraine for a short term can receive national advanced unmanned aviation complex of civil purposes with a help of joint efforts of relevant authorities of executive power and their focus on main areas is a topical issue.

According to all listed industry problems Ukraine has a serious technical base, and all the necessary resources to create effective automation unmanned systems. More attention both from the government and business representatives is paid to the projects of remotely piloted aviation systems creation.

The purpose of the complex approach is the construction and design principles establishment for the relevance experimental RPAS creating based on the two-engine unmanned aircraft equipped with modern engineering equipment with automation control based on new information technologies. The purpose implementation is to obtain and implement new knowledge in the field of remotely piloted aviation system, focused on the UAV use in the economy of Ukraine and other countries. The main use of unmanned aircraft can be defined aerial photography, real-time video surveillance and patrolling of linear and planar objects. The obtained results can allow to Ukrainian developers and manufacturers of unmanned aircraft to get the effective tools for the development of remotely piloted aviation system of national production.

An integrated approach to the remotely piloted aircraft system developing with unmanned aerial vehicle involves the following objectives:

- the construction principles determination of remotely piloted aviation system on the methodology “The safety management system” according to the international requirements;
- the hybrid composite materials development and production based on the strength criterion;
- the nano-technical complex development and manufacturing for the RPAS on-board and ground equipment;
- the control complex development and production for the board and ground RPAS systems;
- the scheme-technical solutions development for automation flight trajectory based on new information technologies;
- the methods and algorithms development and implementation for the automation UAV landing on network signals of orbiting satellite systems;
- the information protected data channel "board-to-land, land-to-board" development, the flight control system design, and standardization of protocols recommendations;

- the RPAS standard model design, production, and testing with energy efficient avionics equipment;
 - the training programs development for UAV operators and RPAS ground personnel;
 - the normative and technical documentation development for RPAS certification.
- Purposes and objectives are achieved by performance of works in the following areas:
- development and manufacturing the two-engine unmanned aircraft;
 - development the automation system for optimal control of remotely piloted aviation system with elements of self-adaptation;
 - investigation the hybrid composite materials on strength criteria for use in the unmanned aircraft;
 - establishment the automation landing system of unmanned aircraft;
 - design and production of the experimental equipment model for secure transmission of radiotelemetry data and video surveillance;
 - development and manufacturing the integrated navigating complex for unmanned aircraft;
 - development the scientific and methodological support and technical measures for ground personnel training of remotely piloted aviation system;
 - development the normative and technical documentation for certification manufacturing of the remotely piloted aviation system.

At the present stage of aviation development the remotely piloted aviation system form a new component of general aviation system, and now the International Civil Aviation Organization ICAO, numerous regional and national organizations such as the European Aviation Safety Agency EASA, the European Organisation for the Safety of Air Navigation EUROCONTROL, the European Defence Agency EDA, the European Space Agency ESA, the European Organization for Civil Aviation Equipment EUROCAE, the North Atlantic Treaty Organization NATO, the U.S. Federal Aviation Administration FAA, the National Aeronautics and Space Administration NASA, the Radio Technical Commission for Aeronautics RTCA, and other organizations are working related to remotely piloted aviation system study, performance and ultimately integration.

These systems are based on the latest developments in the field of aerospace technologies to implement new, more sophisticated uses of aircraft in civil, commercial, military purposes and to improve flight safety and efficiency of civil aviation in general.

However, removal of the pilot from the aircraft board defines important technical and operational issues, the nature of which requires long study of active and continuous monitoring of the aviation community.

Given the above, National Aviation University in recent years has refined theoretical principles, concepts, technical and technological solutions for the program implementation of remotely piloted aviation system into the practice of Ukraine civil airlines.

For this purpose, were organized a series of works devoted to optimizing the UAV dimension-type, construction, and structure of its air-navigation, telemetry, radiocommunication, and other vital systems, and also personnel training. At the National Aviation University are developed a number of remotely piloted aviation system types to address a wide range of tasks most civilian and military.

In terms of Ukrainian aviation market development is extremely important to develop its own remotely piloted aviation system and national laws – the legal basis of RPAS use, that should be based on the modern international norms and standards. In order to combine different groups efforts and research of the National Aviation University scientists and experts according comprehensive implementation of these strategic objectives for the country the performers team has been formed for the research and development the complex work on a remotely piloted aviation system prototype generation. This work is a priority direction in the world market regarding the scientific and technical prospects.

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