MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

National Aerospace University N.E. Zhukovsky
«Kharkiv Aviation Institute»

APPROVED
scientific council
National Aerospace
University. N.E. Zhukovsky
Kharkiv Aviation Institute
"28" August 2020, protocol № 1

EDUCATIONAL PROFESSIONAL PROGRAM

Autonomous navigation and adaptive control systems for aircraft

Level of higher education - second (master's)

Specialty 173 Avionics

Branch knowledge 17 Electronics and telecommunications

Qualification: Master's degree in avionics in the educational program "Autonomous navigation systems and adaptive control of aircraft"

The educational program is put into operation
with "01" September 2020

Rector of the National Aerospace
University. ME Zhukovsky Kharkiv
Aviation Institute

_____ MV Nechiporuk
order № -a from 01.09.2020

Kharkiv 2020

LETTER OF APPROVAL
educational and professional program

Approved by the scientific and methodological commission of the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute" in the fields of knowledge "Mathematics and Statistics", "Information Technology", "Automation and Instrumentation", "Chemical Engineering", "Electronics and Telecommunications"

Protocol № ____ from "____" _____2020

Chairman _____ O.V. Zabolotny
(signature)

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PREFACE

The educational and professional program "Autonomous Navigation Systems and Adaptive Control of Aircraft" in the specialty 173 "Avionics" for the preparation of masters was developed by a working group of the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute" consisting of:

a) project team:

1	Guarantor of the educational program	Kulik AS	- Dr. Tech. Sciences, Professor, Department of Aircraft Control Systems
2	Project team members:	Barsov VI	- Dr. Tech. Sciences, Professor, Department of Aircraft Control Systems
3		Dergachev K. Yu.	- Cand. tech. Sciences, Associate Professor, Senior Researcher, Department of Aircraft Control Systems

b) members of the working group:

1	Dergachev VA	- Cand. tech. Sciences, Associate Professor, Department of Aviation Instruments and Measurements
2	Bidyuk IA	- Cand. psycho. Sciences, Associate Professor, Department of Psychology
3	Bondareva TI	- Cand. tech. Sciences, Associate Professor, Department of Management
4	Dzhulgakov VG	- Associate Professor, Department of Aircraft Control Systems

INTRODUCTION

According to Art. 1 "Basic terms and their definitions" of the Law of Ukraine "On Higher Education" from 01.07.2014 № 1556-VII (as amended) educational program - a system of educational components at the appropriate level of higher education within the specialty that determines the requirements for the level of education persons who can start studying under this program, the list of disciplines and the logical sequence of their study, the number of ECTS credits required for this program, as well as the expected learning outcomes (competencies) that must be mastered by the applicant.

The educational program is used during:

– accreditation of the educational program, inspection of educational activity by specialty and specialization;
– curriculum development, curricula and practices;
– development of diagnostic tools for the quality of higher education;
– determining the content of training in the system of retraining and advanced training;
– professional orientation of applicants for the specialty.

The educational and professional program takes into account the requirements of the Law of Ukraine "On Higher Education" dated 01.07.2014 № 1556-VII (as amended), the Resolution of the Cabinet of Ministers of Ukraine "On approval of the National Qualifications Framework" dated 23.11.2011 № 1341 and establishes:

– volume and term of master's studies;
– general competencies;
– professional competencies;
– program learning outcomes;
– the list and volume of academic disciplines for mastering the competencies of the educational-professional program;

– requirements for the structure of academic disciplines.

Educational and professional program is used for:

– drawing up curricula and working curricula;
– formation of individual plans of students;
– formation workers programs of academic disciplines, practices;
– determination of the information base for the formation of diagnostic tools;
– accreditation of educational and professional program;
– internal and external quality control of training;
– certification of masters in the educational and professional program "Autonomous navigation and adaptive control systems for aircraft"In specialty 173" Avionics ".

Users of the educational and professional program:

– applicants for higher education studying at the National aerospace university them. ME Zhukovsky "Kharkiv Aviation Institute";

– scientific and pedagogical workers who train masters in the educational and professional program "Autonomous navigation and adaptive control systems for aircraft"In specialty 173" Avionics ";

– examination commission of specialty 173 "Avionics";

– Admissions Committee of the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute".

The educational and professional program extends to the departments of the University involved in the training of specialists with a master's degree in the educational and professional program "Autonomous navigation and adaptive control systems for aircraft"In specialty 173" Avionics ".

1 REGULATORY REFERENCES

The educational and professional program is developed on the basis of the following regulations and recommendations:

1.1 Law of Ukraine "On Higher Education". № 1556-UII dated 01.07.2014 (as amended).

1.2 Resolution of the Cabinet of Ministers of Ukraine "On approval of the National Qualifications Framework" dated 23.11.2011 № 1341.

1.3 Resolution of the Cabinet of Ministers of Ukraine "On approval of the list of branches of knowledge and specialties in which the training of higher education seekers" from 29.04.2015 № 266.

1.4 Resolution of the Cabinet of Ministers of Ukraine "On approval of the Regulations on the procedure for exercising the right to academic mobility" dated 12.08.2015 № 579.

1.5 National Classifier of Ukraine. Classifier of professions DK 003: 2010, approved by the order of Derzhspozhyvstandart of Ukraine dated 28.07.2010 № 327 (as amended).

1.6 Methodical recommendations for the development of standards of higher education, approved by the higher education sector of the Scientific and Methodological Council of the Ministry of Education and Science of Ukraine Minutes of 29.03.2016 № 3

1.7 Regulation "On the organization of the educational process" SUYA KHAI-NOV-P / 005: 2016 of the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute", approvedAcademic Council of the University from 18.05.2016, protocol № 10.

1.8 A Tuning Guide to Formulating Degree Program Profiles Including Program Competences and Program Learning Outcomes. -Bilbao, Groningen and The Hague, 2010.

1.9 A TUNING-AHELO conceptual framework of expected / desired learning outcomes in engineering. OECD Education Working Papers, No. 60, OECD Publishing 2011.http://dx.doi.org/10.1787/5kghtchn8mbn-en

1.10 National Qualifications Framework. Appendix to the Resolution of the Cabinet of Ministers of Ukraine of November 23, 2011 № 1324.

1.11 Development of educational programs. Methodical recommendations /

Author: VM Zakharchenko, VI Lugovyi, Yu.M. Рашкевич, Ж.В. Talanova / Ed. V.G. Flint. - Kyiv: State Enterprise "Priorities", 2014. - 120 p.

1.12 Order of the Ministry of Education and Science of Ukraine "On the peculiarities of the introduction of the list of branches of knowledge and specialties for which higher education is approved, approved by the Cabinet of Ministers of Ukraine dated April 29, 2015 № 266" dated 06.11.2015 № 1151.

1.13 Classification of economic activities: DK 009: 2010. - Valid from 01.01.2012. - (National Classifier of Ukraine).

1.14 Classifier of professions: DK 003: 2010. - Valid from 01.11.2010. - (National Classifier of Ukraine).

1.15 National educational glossary: higher education / 2nd ed., Revised. and ext. / Author: VM Захарченко, C.A. Kalashnikov, VI Луговий, A.B. Stavytsky, Yu.M. Рашкевич, Ж.В. Talanova / Ed. V.G. Flint. - Kyiv: Pleiades Publishing House LLC, 2014. - 100 p.

1.16 Draft Standard of higher education for master's degree in specialty 173 - Avionics / 2018. - 22 p.

2 PROFILE OF THE EDUCATIONAL PROFESSIONAL PROGRAM "AUTONOMOUS NAVIGATION SYSTEMS AND ADAPTIVE CONTROL OF AIRCRAFT" FROM THE SPECIALTY 17

1 - General information	
Full name of the higher educational institution and structural subdivision	National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute" Department of Aircraft Control Systems
Degree of higher education and title of qualification in the original language	Degree of higher education - master Qualification: Master's degree in avionics according to the educational-professional program "Autonomous navigation systems and adaptive control of aircraft" Qualification: Master in avionics on Educational Program “Systems of autonomous navigation and adaptive control of aircrafts ”
The official name of the educational and professional program	Autonomous navigation and adaptive control systems for aircraft Systems of autonomous navigation and adaptive control of aircrafts
Type of diploma and scope of educational and professional program	Single 90 ECTS credits / 1 year 4 months
Availability of accreditation	Certificate of accreditation: Series ND-IV № 2172053, issued on 02.09.2014 on the basis of the order of the Ministry of Education and Science of Ukraine dated 15.07.2014 № 2642l Accreditation period: 10 years (Re-accreditation in 2014)
Cycle / level	The second (master's) level NRC of Ukraine - level 7
Prerequisites	A person has the right to obtain a master's degree if he has a bachelor's degree
Language (s) of instruction	The language of instruction is the state language. In order to create conditions for international academic mobility, it may be decided to teach one or more subjects in English and / or other foreign languages, while providing knowledge to applicants. relevant discipline in the state language.
Validity of the educational and professional program	Ten years
Internet address of the permanent placement of the description of the educational-professional program	http://k301.info
2 - The purpose of the educational program	
1. To provide theoretical knowledge and practical skills sufficient for successful performance of professional duties under the educational-professional program "Autonomous navigation and adaptive control systems for aircraft ", specialty 173" Avionics ". 2. Formation of the personality of the specialist capable to use professional-profile knowledge and practical skills for the decision of innovative problems in the field of the automated and automatic control systems of aeronautical and rocket-space objects and systems.	

3 - Characteristics of the educational and professional program	
Subject area	Objects of study and activity: automated and automatic control systems for aerospace and rocket and space objects and systems. Objectives of training: training of specialists with skills of development, design, production and certification of control systems for aircraft and rocket and space technology. Theoretical content of the subject area: concepts, concepts, principles in the field of flight dynamics, theory of automatic control, information and electronic systems, modern automatic control systems, modern programming tools, design of avionics systems and modern navigation systems. Methods, techniques and technologies: methods, techniques and technologies of analytical, numerical and experimental research of avionics systems, methods and technologies of automated development of on-board aeronautical navigation systems and aircraft control systems, transmission, processing and display of information. Tools and equipment: stands and simulation software for modeling avionics systems; automatic control devices and systems, computers, microprocessor control systems for onboard and ground equipment.
Orientation of the educational-professional program	Educational and professional
The main focus of the educational and professional program (specialization)	The educational-professional program establishes qualification requirements to social and production activity of graduates of higher education institution in the specialty 173 "Avionics" of educational degree "master" and state requirements to properties and qualities of the person who has received a certain educational level of the corresponding professional direction under the educational-professional program "Autonomous navigation systems and adaptive control of aircraft.
Features of the program	The practice is carried out at enterprises of various industries
4 - Suitability of graduates for employment and further study	
Suitability for employment	Masters in the specialty 173 "Avionics" can hold positions in accordance with the National Classification of Occupations of Ukraine: Classifier of Professions (DK 003: 2010) and International Standard Classification of Occupations 2008 (ISCO-08)).
Further training	A person has the right to continue education at the third (educational and scientific) level to obtain the degree of Doctor of Philosophy.
5 - Teaching and assessment	
Teaching and learning	Lectures, multimedia lectures, laboratory work, practical classes in small groups, independent work based on textbooks and abstracts, consultations with teachers, preparation of master's thesis. Student-centered learning, self-study, problem-oriented learning aimed at the development of critical and creative thinking, learning through laboratory practice, distance education and more.
Evaluation	Written exams, practice reports, presentations, current (modular) control, project (master's) work and its defense.
6 - Program competencies	
Integral competence	Ability to solve complex problems and problems in a particular field of professional activity or in the learning process, which involves research and / or innovation and is characterized by uncertainty of conditions and requirements.
General	ЗК1. Ability to abstract thinking, analysis and synthesis.

competence (LC)	ЗК2. Ability to apply knowledge in practical situations. ЗК3. Ability to communicate in a foreign language. ЗК4. Ability to conduct research at the appropriate level. ЗК5. Ability to learn and master modern knowledge. ЗК6. Ability to search, process and analyze information from various sources. ЗК7. Ability to generate new ideas (creativity). ЗК8. Ability to make informed decisions. ЗК9. Ability to work in a team. ЗК10. Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge). ЗК11. Ability to work autonomously. ЗК12. Safe activities skills. ЗК13. Ability to show initiative and entrepreneurship. ЗК14. Definiteness and persistence in terms of tasks and responsibilities.
Professional competencies of the specialty (FC)	ФК1. Ability to use basic knowledge of basic national, European and international regulations in the field of avionics in order to continuously improve their professional activities. ФК2. Ability and ability to use the achievements of science and technology in professional activities, to argue the choice of methods for solving specialized problems in the analysis and synthesis of avionics systems. ФК3. Ability to plan, evaluate and implement hardware and software-algorithmic tools to increase the accuracy, reliability, survivability, resources of control systems and other qualities of the aircraft. ФК4. Ability to develop technical tasks for the design and manufacture of control systems for aircraft, non-standard equipment and technological equipment, to choose equipment and technological equipment. ФК5. Ability to prepare teaching materials, planning and conducting training sessions in educational organizations, including in a foreign language. ФК6. Ability to purposefully analyze avionics systems of varying complexity, to form the architecture of automatic control systems for aircraft, to identify subsystems and objects that are part of the system, and the relationships between them. ФК7. Ability to determine the structure and parameters of test equipment for experiments to determine the characteristics of instruments and control systems of aircraft, the parameters of their components and products, as well as to develop specifications for their design. ФК8. Ability to prepare applications for inventions and industrial designs, to organize work on the implementation of author's supervision in the manufacture, installation, commissioning, testing, operation of facilities and products. ФК9. Ability to organize the development of creative initiative, rationalization, invention, implementation of the achievements of domestic and foreign science, technology, use of best practices that ensure the effective operation of the unit, enterprise. ФК10. Ability to assess the technical and economic efficiency of design and manufacture of control systems for aircraft and complexes, equipment, systems, processes.

	ФК11. Ability to create quality management systems at the enterprise, to prepare business plans for the production and sale of promising and competitive products.
7 - Program learning outcomes	
	ПРН1. Apply different forms of representation of avionics systems and describe by different methods (verbally, graphically, formally) complex avionics systems and situations that may arise in terms of their functioning. ПРН2. Use basic knowledge of basic national, European and international regulations in the field of avionics in order to continuously improve professional activities. ПРН3. Use the achievements of science and technology in professional activities, argue the choice of methods for solving specialized problems in the analysis and synthesis of avionics systems. ПРН4. Apply modern technologies to automate the design and construction of information and control systems in the field of avionics and be able to create hardware and software-algorithmic tools to increase accuracy, reliability, survivability, resources of control systems and other qualities of aircraft. ПРН5. To develop technical tasks for the design and manufacture of control systems for aircraft, non-standard equipment and technological equipment, to choose equipment and technological equipment. ПРН6. To develop educational and methodical materials, to plan and carry out educational employment in the educational organizations, including in a foreign language. ПРН7. Analyze and create the architecture of automatic control systems for aircraft of varying complexity, identify subsystems and objects that are part of the system, and the relationships between them. ПРН8. To determine the structure and parameters of test equipment for conducting experiments to determine the characteristics of instruments and control systems of aircraft, the parameters of their components and products, as well as to develop specifications for their design. ПРН9. Prepare applications for inventions, organize work on the implementation of author's supervision in the manufacture, installation, commissioning, testing, operation of facilities and products. ПРН10. Organize the development of creative initiative, rationalization, invention, implementation of the achievements of domestic and foreign science, technology, use of best practices that ensure the effective operation of the unit, enterprise. ПРН11. Evaluate the technical and economic efficiency of design and manufacture of control systems for aircraft and complexes, equipment, systems, processes. ПРН12. Create quality management systems at the enterprise, prepare business plans for the production and sale of promising and competitive products. ПРН13. Use modern information and communication technologies in the field of avionics. ПРН14. Develop laws of automatic motion control of helicopters, airplanes, UAVs, compile and investigate differential equations of their motion, compile and analyze complete and linearized equations of motion of a microsatellite, analyze the motion of artificial satellites, solve problems of trajectory measurements. ПРН15. Develop design and technological documentation of avionics devices and systems.

8 - Resource support for program implementation	
Staffing	**Research and teaching staff involved in the teaching of professionally oriented disciplines have academic degrees and / or academic titles and meet licensing requirements.**
Material and technical software	**Training is carried out in training laboratories, computer classes (list which are available)**
Information and educational and methodical software	**The use of virtual learning environment of the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute" and author's developments of the teaching staff.**
9 - Academic mobility	
National credit mobility	**Based on bilateral agreements between the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute" and technical institutions of Ukraine.**
International credit mobility	**Based on bilateral agreements between the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute" and educational institutions of partner countries.**
Training of foreign applicants for higher education	**Education of foreign citizens is carried out in the state or English languages. If education is conducted in the state language, then in certain cases it may be decided to teach one or more subjects in English and / or other foreign languages, while providing knowledge to applicants.** relevant discipline in the state language.

3 LIST OF COMPONENTS OF THE EDUCATIONAL PROFESSIONAL PROGRAM (COP) AND THEIR LOGICAL SEQUENCE

3.1 List of OP components

COP code	Components of the educational program (academic disciplines, course projects (works), practices, qualification work)	Number of credits	Form final control
1	**2**	**3**	**4**
Mandatory components of the OP			
OK1	Intellectual Property	4	test
OK2	Organization and management of production	4	test
OKZ	Psychology and pedagogy of high school	4	test
OK4	Research work of the master	5	test
OK5	Scientific and pedagogical internship	5	test
OK6	Design of autonomous navigation systems for ARCT objects	4	exam
OK7	Modern theory of automatic control	8.5	exam
OK8	Pre-diploma practice	10	diff. test
OK9	Diploma design	23	defense of qualifying master's thesis
The total amount of mandatory components:		**67.5**	
Selective components of OP			
Selective unit 1			
WB1.1	Microprocessor means in air navigation service systems	4	exam
WB1.2	Microprocessor means in systems of air navigation service (KP)	2	diff. test
WB1.3	Aerobatic and navigation complexes	4	exam
WB1.4	Modern satellite navigation technologies	4.5	exam
WB1.5	Management in conditions of uncertainty	8	exam
Selective unit 2			
WB2.1	Design of unmanned systems	4	exam
WB2.2	Design of unmanned systems (DF)	2	diff. test
WB2.3	Aviation security management	4	exam
WB2.4	Automated air traffic control systems	4.5	exam
WB2.5	Modern programming technologies	8	exam
The total amount of sample components:		**22.5**	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		**90**	

3.2 Structural and logical scheme of OP

The structural and logical scheme of the educational program reflects the sequence of studying its components and is given in Appendix A. The scheme contains mandatory components and components of sample block 1, because this block for this educational program is the basic (priority). If another sample unit is selected as the applicant for higher education, the individual trajectory of study is determined and an individual plan is drawn up.

3.3 The structure of the curriculum by semesters and the content of the components of OP

№ for / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies	
				common	professional
And the semester					
1	**OK1**	**Intellectual Property**	**Goal:** deep mastering of knowledge on the legal regulation of relations that take place during the emergence, use and protection of intellectual property rights. **Task:** formation of students' professional knowledge on the general provisions of intellectual property law, its institutions, concepts and types of objects and subjects of intellectual property law, the grounds, conditions and procedure for using its results, the procedure and methods of protection of infringed rights.	ZK1 ZK4 ZK6 ZK7 ZK8 ЗК11 ЗК14	FC8 FC9
2	**OK2**	**Organization and management of production**	**Goal:** teaching students the basics of organization and management of production at the enterprises of mechanical engineering and instrument making and obtaining special knowledge to solve organizational and managerial tasks necessary for practical activities in the field of production. **Task:** providing students with knowledge about the theory and practice of production organization; instilling skills in designing the organization of production and activities for organizational improvement in industrial enterprises; acquisition of skills to solve in the relationship of the problem of improving the organization of production to increase the economic efficiency of production activities in associations and industrial enterprises; formation of students' knowledge necessary for solving professional issues	ZK1 ZK2 ZK3 ZK5 ZK6 ZK7 ЗК8 ЗК9 ЗК10 ЗК12 ЗК13	FC1 FC4 FC9 FC10 FC11
3	**OK4**	**Research work of the master**	**Goal:** formation of knowledge about the principles and stages of scientific research, processing the results of scientific research, the rules of compiling a report on scientific work, its structure and content; rules for registration of master's theses. **Task:**mastering theoretical material (textbooks, monographs, articles, etc.) and consideration and solution of practical problems that arise during scientific activities; mastering the psychophysical foundations of mental activity, methods of experimental research, processing of the	ZK1 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 ЗК10 ЗК11	FC1 FC2 FC6 FC9

№ for / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies	
				common	professional
			obtained results, development and submission of materials on invention or utility model		
4	**OK7**	**Modern theory of automatic control**	**Goal**: formation of students' knowledge, skills and abilities necessary to perform research and calculation work to create special (optimal, adaptive and intelligent) aircraft control systems based on computer technology. **Task**: obtaining the skills and abilities required to perform research and calculation work to create special (optimal, adaptive and intelligent) aircraft control systems.	ZK1 ZK2 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 3K10 3K11	FC2 FC6 FC9
	WB1.1	**Microprocessor means in air navigation service systems**	**Goal**: mastering of engineering methods of structure design and circuit implementation of distributed microprocessor information-control complexes and modern technologies of software development and testing of controllers. **Task**: obtaining skills of analysis of the technical task for the development of distributed microprocessor information and control systems, a reasonable choice of means of circuit implementation and coordination of interfaces; mastering the principles of development and testing of multimodule software of information-control complexes for data collection and processing and formation of control signals in real time.	ZK1 ZK2 ZK5 ZK6 ZK7 ZK8 ZK9 3K11 3K14	FC1 FC3 FC4 FC6
6	**WB1.5**	**Management in conditions of uncertainty**	**Goal**: gaining knowledge of theoretical and practical aspects of processing various signals and images in control and automation systems using both classical Fourier transform and modern methods of wavelet analysis using Matlab. **Task**: definition of the purposes, ways, tasks and processes of the automated computer modeling of processing of various signals and images by means of modern software products (Matlab with use of packages Simulink, Wavelet Toolbox, Image Processing Toolbox). Introduction and study of modern digital algorithms for analysis and processing of signals and images, methods of their use	ZK1 ZK2 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 3K14	FC2 FC6 FC7 FC9
II semester					

№ for / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies	
				common	professional
3	**OK3**	**Psychology and pedagogy of high school**	**Goal**: revealing the features of the pedagogical process in the interaction of student and teacher in order to form professional qualities, skills and intellectual abilities. **Task**: to show the characteristics of the pedagogical process of higher school, to reveal the forms of organization of the educational process and the use of pedagogical technologies, to form the ability to interact with the student audience	ZK1 ZK4 ZK5 ZK6 ZK7 ZK8 ZK9 3K10 3K12 3K13 3K14	FC5 FC9
7	**OK5**	**Scientific and pedagogical internship**	**Goal:** in-depth research in one of the scientific fields, development of professional knowledge and formation of managerial competencies in a separate field of professional activity. **Task**: collection and analysis of scientific and technical sources, scientific and patent literature on the topic of master's final qualification work; acquiring skills of structured written analysis of research results; acquiring skills of public speaking and conducting pedagogical activities	ZK1 ZK4 ZK5 ZK6 ZK7 ZK8 ZK9 3K10 3K12 3K13 3K14	FC2 FC5 FC9
	OK6	**Design of autonomous navigation systems for ARCT objects**	**Goal**: study of methods of obtaining information about the location of the aircraft and its trajectory on the basis of various navigation methods and principles of operation of autonomous navigation systems. **Task**: study of mathematical methods and structures that model the processes of obtaining navigation information based on systems for measuring navigation parameters of different physical nature and provide autonomous movement of aircraft from one point in space to another on trajectories due to the nature of tasks and time.	ZK1 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 ZK9 3K10 3K11 3K12	FC1 FC2 FC3 FC4 FC6 FC10
8	**OK7**	**Modern theory of automatic control**	**Goal**: formation of students' knowledge, skills and abilities necessary to perform research and calculation work to create special (optimal, adaptive and intelligent) aircraft control systems based on computer technology. **Task**: obtaining the skills and abilities required to perform research and calculation work to create special (optimal,	ZK1 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 3K10	FC2 FC6 FC9

№ for / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies	
				common	professional
			adaptive and intelligent) aircraft control systems.	3K11	
9	**WB1.2**	**Microprocessor means in systems of air navigation service (KP)**	**Goal**: mastering of engineering methods of structure design and circuit implementation of distributed microprocessor information-control complexes and modern technologies of development and testing of controller software for a certain object of automatic control. **Task**: obtaining skills of analysis of the technical task for the development of distributed microprocessor information and control systems, a reasonable choice of means of circuit implementation and coordination of interfaces; mastering the principles of development and testing of multimodular software of information-control complexes for data collection and processing and formation of control signals in real time for a certain object of automatic control.	ZK1 ZK2 ZK5 ZK6 ZK7 ZK8 ZK9 3K11 3K14	FC1 FC3 FC4 FC6
10	**WB1.3**	**Aerobatic and navigation complexes**	**Goal**: study of the principles of construction of aerobatic navigation systems and their algorithmic support for different stages of flight of the aircraft, which allow to conduct research on qualitative characteristics. **Task**: study of structures, methods of obtaining mathematical models, algorithms for information processing and operation of aerobatic navigation systems for different stages of aircraft flight.	ZK1 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 ZK9 3K10 3K11 3K12	FC1 FC2 FC3 FC4 FC6 FC7
12	**WB1.4**	**Modern satellite navigation technologies**	**Goal**: study of general principles of construction and operation of global satellite navigation systems. **Task**: study of principles of construction of systems and equipment of consumers of satellite navigation, functional additions of systems of satellite navigation, modern methods of navigation-time definitions and processing of signals in satellite systems, application of technologies of satellite navigation for the decision of applied problems of aviation	ZK1 ZK2 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 ZK9 3K10 3K11 3K12	FC1 FC2 FC3 FC4 FC6 FC7

№ for / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies	
				common	professional
13	**WB1.5**	**Management in conditions of uncertainty**	**Goal**: gaining knowledge of theoretical and practical aspects of processing various signals and images in control and automation systems using both classical Fourier transform and modern methods of wavelet analysis using Matlab. **Task**: definition of the purposes, ways, tasks and processes of the automated computer modeling of processing of various signals and images by means of modern software products (Matlab with use of packages Simulink, Wavelet Toolbox, Image Processing Toolbox). Introduction and study of modern digital algorithms for analysis and processing of signals and images, methods of their use	ZK1 ZK2 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 3K14	FC2 FC6 FC7 FC9
III semester					
15	**OK8**	**Pre-diploma practice**	**Goal**: acquisition and consolidation of skills of independent research and engineering work in production and research teams of enterprises and organizations. **Task:** consolidation of theoretical knowledge and skills, mastering the methods of research and conducting experiments in real conditions of practical activity of specialists of this level, development of creative abilities, ability to apply the acquired knowledge in practice, collection of materials necessary for master's thesis	ZK1 ZK2 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 ZK9 3K10 3K13	FC1 FC2 FC6 FC7 FC9 FC10 FC11
16	**OK9**	**Diploma design**	**Goal:** determining the level of student readiness to solve a set of modern scientific and applied tasks in accordance with the generalized object of activity based on the application of a system of theoretical knowledge and practical skills acquired during the entire period of study in accordance with the standard of higher education. **Task:** systematization, consolidation and expansion of theoretical knowledge gained in the educational process under the educational-professional program "Autonomous navigation systems and adaptive control of aircraft" training specialist master's degree, and their practical use in solving specific scientific,	ZK1 ZK3 ZK4 ZK5 ZK6 ZK7 ZK8 3K10 3K11 3K14	FC1 FC2 FC3 FC4 FC6 FC7 FC8 FC9 FC10 FC11

№ for / n	Code COP	The name of the OP component	The purpose and objectives of the OP component	Formation of competencies	
				common	professional
			applied, engineering, economic, social and production issues in a particular field of professional activity; development of skills of independent work, mastering of a technique of researches and experimentation, physical or mathematical modeling, use of modern information technologies in the course of the decision of problems which are provided by the task on diploma designing; determining the compliance of the level of training of the graduate with the requirements of the educational characteristics of the specialist,		

4 HIGHER EDUCATION CERTIFICATION FORM

Certification of a graduate in the educational-professional program "Autonomous Navigation Systems and Adaptive Control of Aircraft" in the specialty 173 "Avionics" is carried out in the form of defense of a master's thesis and ends with the issuance of a standard document awarding him a master's degree. -professional program "Autonomous navigation systems and adaptive control of aircraft".

Certification is carried out openly and publicly.

5 MATRIX OF CONFORMITY OF SOFTWARE COMPETENCIES TO THE COMPONENTS OF THE EDUCATIONAL PROFESSIONAL PROGRAM

Software tence	Components of the educational program													
	OK1	**OK2**	**OK3**	**OK4**	**OK5**	**OK6**	**OK7**	**OK8**	**OK9**	**WB1.1**	**WB1.2**	**WB1.3**	**WB1.4**	**WB1.5**
ZK1	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ZK2		+					+	+		+	+		+	+
ZK3		+		+		+	+	+	+			+	+	+
ZK4	+		+	+	+	+	+	+	+			+	+	+
ZK5		+	+	+	+	+	+	+	+	+	+	+	+	+
ZK6	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ZK7	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ZK8	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ZK9		+	+		+	+				+	+	+	+	
ЗК10		+	+	+	+	+	+	+	+			+	+	
ЗК11	+			+		+	+		+	+	+	+	+	
ЗК12		+	+		+	+						+	+	
ЗК13		+	+		+			+						
ЗК14	+		+		+				+	+	+			+
FC1		+		+		+		+	+	+	+	+	+	
FC2				+	+	+	+	+	+			+	+	+
FC3						+			+	+	+	+	+	
FC4		+				+			+	+	+	+	+	
FC5			+		+									
FC6				+		+	+	+	+	+	+	+	+	+
FC7								+	+			+	+	+
FC8	+								+					
FC9	+	+	+	+	+		+	+	+					+
FC10		+				+		+	+					
FC11		+						+						

6 MATRIX OF COMPLIANCE OF THE PROGRAM LEARNING RESULTS (PRN) WITH THE RELEVANT COMPONENTS OF THE EDUCATIONAL PROFESSIONAL PROGRAM

Program learning outcomes	Components of the educational program													
	OK1	OK2	OK3	OK4	OK5	OK6	OK7	OK8	OK9	WB1.1	WB1.2	WB1.3	WB1.4	WB1.5
PRN1	+			+	+	+	+		+			+	+	+
PRN2	+		+	+	+			+	+			+	+	
PRN3				+		+	+		+	+				
PRN4					+	+		+	+	+	+	+	+	+
PRN5		+				+			+			+	+	
PRN6			+		+									
PRN7				+	+	+	+		+	+	+	+	+	
PRN8						+		+	+	+	+			
PRN9	+			+										
PRN10	+	+	+	+				+						
PRN11		+						+	+					
PRN12		+						+	+					
PRN13				+		+	+		+	+	+	+	+	+
PRN14				+		+	+		+			+	+	+
PRN15							+		+		+			

Appendix A
STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROFESSIONAL PROGRAM