

**«...Igor Sikorsky KPI has revived traditions of flying machines advancement, which were laid in the early twentieth century in works of professor M.B. Delone, elaborations of aircraft designer I.I. Sikorsky and the spaceship designer S.P. Korolev. All of them were the legendary students of the KPI...»**



## **INFORMATION PACKAGE**

## **EDUCATIONAL AND RESEARCH INSTITUTE OF AEROSPACE SYSTEMS**



**Kyiv, 2022**

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**\*\*\* Information is current as for the 2022/2023 academic year. In the next academic year, there may be minor changes in the list of specialties and educational programs.**



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## 1. GENERAL DESCRIPTION OF THE INSTITUTE

The establishment of the **Educational and Research Institute of Aerospace Systems (IAS)** as part of the Igor Sikorsky KPI was a completely logical result of the



development of aviation and rocket and space technology, given that Ukraine is a space country with a rich past and has a confident potential for the future.

**IAS** is the newest institute of the University. It was founded in 2019 according to the decision of the University Academic Council at the initiative of the Rector, Academician M.Z. Zgurovsky. One of the initiators and founders of this decision was the company NOOSPHERE (USA) jointly with the space rockets company FIREFLY (USA), to revive a new level tradition of flying machines advancement, which was laid in the early twentieth century in works of professor M. B. Delone, elaborations of aircraft designer I. I. Sikorsky and the spaceship designer S. P. Korolev. All of them were students of KPI.

Today, the sphere of the institute's activity has gone far beyond national boundaries.

The Institute trains highly qualified, competitive specialists in the aerospace and rocket, and space sectors through the systematic interaction of practical researchers with students and teachers. The combination of theory and practice at the Institute of Aerospace Technologies creates a platform for unlocking the creative potential of students and young professionals while attracting the younger generation to the design process of the future.

Throughout their studies, students receive education at the level of the best universities in the world. Graduates have fundamental knowledge in the design, creation, and operation of new aerospace and rocket, and space equipment using modern software, hardware, computer and computerized systems, and information technologies of design, both special and general-purpose, for various branches of science and industry.



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## 2. STRUCTURE

The **IAS** consists of three graduating departments:

**1. Department of Space Engineering and Rocketry**

**2. Department of Aircraft Control Systems**

**3. Department of Space Engineering, as well as:**

- ✈ **Educational and Research Center for Space Engineering and Technology;**
- ✈ **Educational and Research Laboratory for Aerospace Programs and Research;**
- ✈ **Educational and Research Center for Flying Marine Fleet Engineering;**
- ✈ **Interdisciplinary Educational and Research Center "RHYTHM"**
  - *Educational and scientific laboratory of metrology and standardization;*
- ✈ **Educational and Research Center of Space Technologies**
  - *Education and Research Laboratory of Nanosatellite Technologies*
  - *Education and Research Laboratory of Spacecraft Thermal and Vacuum Testing*
  - *Education and Research Laboratory "Mission Control Centre";*
- ✈ **Education and Research (Experimental) Laboratory of Critical Technologies.**

## 3. EDUCATION PROGRAMS

**Levels of Higher Education.** Training of students in **IAS** is carried out at three levels of higher education.

At the first level (undergraduate education, I-IV courses) students acquire fundamental knowledge in physics, mathematics, mechanics, computer engineering, computer science, and special disciplines. In the fourth year, they defend their undergraduate work and receive a bachelor's qualification.



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At the second level (master's program, I-II courses) training is carried out according to the master's program, students undergo special training and acquire relevant practical skills in laboratories. Applicants prepare and defend master's theses, they are awarded a master's degree.

Third, educational and scientific level (graduate school, I-IV courses). Applicants prepare and defend dissertations; they are awarded the educational qualification of Doctor of Philosophy (Ph.D.).

Specialists are trained on a full-time and part-time basis.

**Terms of training:** Bachelor – 4 or 3 years; master's degree (educational-professional program) - 1.5 years; Master (educational and scientific program) - 2 years, Ph.D. - 4 years.

Training of bachelors with a reduced term of study of 3 years is carried out based on the educational and qualification level "junior specialist" (after graduating from college). Short-term training is conducted both full-time and part-time.

### **Dual education**

Training programs are being developed that envisage joint training with the NOOSPHERE company (USA) (represented in Ukraine by the Public Organization "NOOSPHERE ASSOCIATION") to train the masters for the space rocket company FIREFLY (USA) (represented in Ukraine by the FIREFLY AEROSPACE UKRAINE LLC). At the same time, future masters will combine their studies with work at the Center of FIREFLY AEROSPACE UKRAINE LLC, working on real projects for the development of light rocket carriers that will deliver cargo to outer space (satellites).

Program participants can become graduates of any higher technical educational institution in Ukraine with a bachelor's diploma, who will be interviewed by representatives of the "Association NOOSPHERE", "FIREFLY AEROSPACE UKRAINE LLC" and the Igor Sikorsky KPI, as well as those who entered the Igor Sikorsky KPI in the master's program according to the relevant educational program.

Classes are held in Igor Sikorsky KPI and Rocket and Space Design Center LLC FIREFLY AEROSPACE UKRAINE (Dnipro city).



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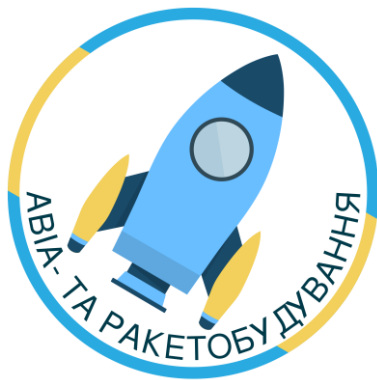
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**1. Department of Space Engineering and Rocketry** provides training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
<b>134</b> Aviation and Aerospace Technologies	Airplanes and Helicopters	Bachelor EPP	Master EPP	–
	Aviation and Aerospace Technologies	–	Master ESP	PhD

*Comment: EPP – Educational-Professional Program  
ESP – Educational-Scientific Program*



Training is carried out in three areas: aerodynamics, the strength of aircraft structures, and design and modeling in CAD systems. During the first year, there are additional free classes in higher mathematics and physics, focused on the specialty. The level of computer training of students allows them to work as software developers and database administrators. The opportunity has been created to receive the educational and qualification level of a bachelor with a reduced training period for qualified junior specialists. Graduates work at leading enterprises in the industry.

**2. The Department of Space Engineering** provides training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
<b>134</b> Aviation and Aerospace Technologies	Aerospace and Rocket Systems Engineering	Bachelor EPP	Master EPP	–
	Aviation and Aerospace Technologies	–	Master ESP	PhD

*Comment: EPP – Educational-Professional Program  
ESP – Educational-Scientific Program*

The professional activity of the graduates of the department is aimed at creating space-rocket systems and complexes using modern information technologies. Future



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engineers get the opportunity to study according to the dual education system, combining their studies with work at the Center of FIREFLY AEROSPACE UKRAINE LLC, working on real projects to develop light rocket carriers that will deliver cargo to outer space (satellites).

**3. Department of Aircraft Control Systems** was established as the Department of Instruments and Control Systems of Aircraft in 1993 as part of the Faculty of Aviation and Space Systems. The department was renamed after the reorganization in 2018.

The department provides training under the following Educational Programs:

Specialty	Educational Program	Levels of higher education		
		First	Second	Third
173 Avionics	Control Systems of Flight Vehicles and Complexes Engineering	Bachelor EPP	Master EPP	PhD
			Master ESP	

*Comment: EPP – Educational-Professional Program*

*ESP – Educational-Scientific Program*

Among the disciplines of the curriculum – Theory and modern methods of automatic



control; Digital automatic control systems, intelligent systems; Modern navigation systems; Mathematical methods of modeling and system analysis; Microprocessor systems and computing devices; Algorithmization and computer design methods; Geoinformation systems and information technologies of aerospace systems.

Students learn methods and means of designing, manufacturing, and operating systems and sensors for controlling and navigating moving objects (airplanes, missiles, satellites, unmanned aerial vehicles, cars, ships); programming languages C, C++, Java, Assembler, CAE; Matlab, Mathcad, LabView, Autocad, SolidWorks systems. This allows you to develop designs and algorithms for automatic control systems and their sensors; program microcontrollers; to calibrate sensors (gyroscopes, accelerometers, etc.).



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### **Students of IAS receive practical skills at the enterprises:**

- SE State KDB LUCH, Kyiv;
- State Enterprise of Special Device Engineering "ARSENAL", Kyiv;
- Space Research Institute of NASU and SSAU, Kyiv;
- State enterprise "ANTONOV", Kyiv;
- Branch of SE ANTONOV – "Production Facility "Antonov", Kyiv;
- Ukrainian Research Institute of Civil Protection, Kyiv;
- Center for the Transfer of Civil Protection Technologies, Kyiv;
- LLC "BOEING Ukraine"
- LLC "ABRIS-DG"
- LLC "FAYRFLAY AEROSPACE UKRAINE"

Graduates work as researchers, design engineers, and programmers in rocket and space and aviation companies, including DB Luch, State Enterprise "Antonov", Arsenal Design Bureau, Boeing, Lufthansa, Lyon Central School, and other enterprises involved in the creation and operation of aircraft, electronic equipment, automated systems, and sensors.

### **Students acquire knowledge and skills in:**

Design of unmanned and light manned aircrafts, technology of flying vehicles manufacturing

Design of systems for orientation and stabilization of satellites

Electronics, microprocessor, measuring and computer technology

Tools and software for testing of object and systems

Computer modeling of objects and processes, computer design of technical systems

Information processing, GIS

### **Students study:**

- Fundamentals of modern control theory;
- Methods and means for design and research of control systems;
- The using the computer systems for the design of hardware and software and the work with computer networks (Autocad, P-CAD, OrCAD, MicroCad, P-Spice, VHDL, OC FreeBDS, Internet-programming, Arc Net, Ethernet, Novell OC);



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- Information protection in computer networks, database design, and knowledge of an expert and search computer systems (SQL, Oracle, Fox Pro, Paradox, Access, CASE-technology);
- Software and hardware for microprocessor technology and computer information processing;
- Aerodynamics and flight theory;
- Fundamental principles applied methods, and hardware for the design and manufacture of aircraft;
- The basics of the development, manufacture, and the use of measuring instruments;
- Work with the main means of computer processing of information, means for the development of applied algorithmic and software of computer systems (MS Office, FreeBSD, Pascal, Delphi, C / C ++, C, Java, Assembler, Mathematica, Matlab, Math CAD, LAB View, LAB Windows, InTouch, etc.).

## 4. TRAINING AND LABORATORY BASE

The lecture halls of the faculty meet all the requirements for conducting classes using modern multimedia technologies. There are several computer classrooms; laboratory and practical classes are conducted in special laboratories equipped with full-scale copies of aircraft using both elements, systems, the avionics of existing aircraft, and technological equipment. Laboratory equipment allows for conducting scientific research on technological processes of production and operation in the field of aircraft and rocket science, and avionics.

Student's scientific clubs successfully operate at the faculty, namely "Aviation and Rocket Engineering", "Robotics", and "Dron Racing" in which students have the opportunity to carry out innovative projects in the scientific areas of the department.

## 5. RESEARCH WORK

### Scientific directions of the Department of Space Engineering and Rocketry

- Methodology for the integrated design of aircraft structures (including the methodology for calculating the strength elements of aircraft structures)
- Study of the problems of flight dynamics and control of technical objects (including studies of simulating the effects of accelerations and dynamic stands of flight simulators).



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- Investigation of new aerodynamic schemes of aircraft and methods for their calculation (including studies of the properties of composite materials and methods of forming structures from them).

### **Scientific directions of the Department of Aircraft Control Systems**

- Methods and tools for the development and research of navigation instruments and control systems of increased accuracy;
- Methods and tools for determining the orientation of moving objects;
- Investigation of local processes that occur during the collision of bodies; static and dynamic contact problems of the theory of elasticity;
- Vision and pattern recognition systems as sensors of navigation and control systems;
- Methods of measuring physical quantities;
- Development and generalization of the theory of laser gyroscope;
- Development of a mathematical model and simulation of the dynamics of the output signal of a laser gyroscope;
- Information technologies in complexes of manned and unmanned moving objects (space vehicles, aircraft, helicopters, surface ships and submarines, land vehicles): information processing, simulation, optimization, and control in aircraft flight and navigation systems;
- Processing of aerospace observation information;
- Automated control systems for moving objects. Motion control systems for a group of objects;
- Development, improving the accuracy and use of linear navigation accelerometers and measuring systems based on them;
- Study of development trends of avionics tools and systems in the context of forming lists of domestic critical technologies;
- Automatic flight control systems, autonomous and integrated navigation and orientation systems;
- Methods and means of ensuring the reliability of navigation sensors, devices, and systems;
- Hardware for remote sensing of the Earth from space;
- Development of electric drives with improved technical characteristics;
- Methods to improve the accuracy of navigation devices.



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Teachers and students of the department developed projects for light multi-purpose aircraft, unmanned aircraft, microsatellites, robotic systems, integrated and satellite navigation systems, control systems for moving objects and aircraft, navigation devices, and navigation and information systems for aircraft, which are used in various industries.

Based on the department there were created the Scientific and Analytical Center for Critical Technologies of Navigation Instrumentation, the Scientific Research Institute "Rhythm" and The Student's Design Bureau of Small Aviation and Onboard Equipment was created.

## 6. INTERNATIONAL PROJECTS AND COOPERATION

Students and employees of the **IAS** constantly take part in educational projects, as well as in academic mobility projects of the European Union ERASMUS, ERASMUS +, among them:

**EWENT** – mobility program for students and university staff;

**ACTIVE** – mobility program for students, graduate students, and teachers;

**CRIST** – a project to reform educational programs in the field of space technology;

**NETCENG** – the program for the development of a new model of the 3rd educational level – Ph.D.

The faculty maintains educational, scientific, and technical relations with many countries of the world: Germany, Lithuania, Poland, France, Slovakia, Georgia, Belarus, Italy, Spain, Great Britain, China, and Turkey.

The faculty regularly holds international scientific and technical conferences, including for students and young scientists: "Gyrotechnology, navigation, movement control, and aerospace technic engineering", "Intelligence. Integration Reliability" together with the Warsaw University of Technology, Hainan University (Seoul, Korea), as well as other world-famous educational institutions.

### Double Degree Programs

#### Universities:

- Warsaw University of Technology (Poland),
- University of Trento (Italy),
- Budapest University of Technology and Economics (Hungary),
- Central School of Nantes (France),
- University of the Basque Country (Spain).



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### Agreements:

- The Agreement on the partnership, cooperation, and scientific exchanges, joint educational and scientific projects, double master's degrees between the Igor Sikorsky KPI and the Central School of Lyon (France), signed in 2017;
- The Agreement on the development of scientific research, training Ph.D. with the possibility of obtaining a double diploma between the Igor Sikorsky KPI and the Warsaw Institute of Aviation (Poland), signed in 2015;
- The Agreement on the partnership, cooperation, and scientific exchanges, joint educational and scientific projects, double master's degrees between the Igor Sikorsky KPI and Nantes Central School (France), signed in 2017;
- The agreement on cooperation on the principles of partnership and common interests in the field of educational and scientific-technical activities with the public organization "ASSOCIATION OF NOOSPHERE" and LLC "FIERFLAY AEROSPACE UKRAINE" was signed in 2019.



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