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AEROSPACE STUDIES AT THE TECHNICAL UNIVERSITY OF KOSICE IN PAST 15 YEARS

Marek Košuda[1], Peter Korba[1], Miroslav Kelemen[1], Rudolf Andoga[1] & Anna Čekanová[1]

[1]Faculty of Aeronautics, Technical University of Kosice, Rampova 7, 041 21 Kosice, Slovak Republic

Abstract

The paper presents the development and trends in bachelor´s, master's and doctoral studies in aviation and aeronautical engineering at the Technical University of Kosice, Faculty of Aeronautics. The article presents a view on the last 15 years and promising topics for cooperation with partners within Pegasus - Aerospace Engineering Universities and the Ulysseus European University consortium.

Keywords: aviation education, training, pilot, aviation technician, research project

1. General Introduction

The Faculty of Aeronautics of the Technical University of Kosice (FA TUKE) was established in February 1, 2005 as the ninth faculty of the Technical University of Kosice. The establishment of the faculty was the result of a long-term transformation of air force education in the Slovak Republic and was associated with efforts to preserve the long and rich traditions of flying and higher education of aviation professionals in Kosice since 1959 (former Czechoslovakia). Its graduates have profiled themselves as pilots of aircraft / helicopters and experts in the fields of aviation management, aeronautical engineering, and electrical engineering.

The Technical University of Kosice (TUKE) was founded in 1952, but its roots are traced back to the deep past. As early as 1657, the Universitas Cassoviensis was founded in Kosice, but technical education was raised to the level of a university only in 1762, when the Mining Academy in Banská Štiavnica was founded by the Austro-Hungarian ruler Maria Theresa. It provided education and developed research activities in a whole complex of scientific disciplines, from ore mining to the production and processing of metallic materials. The start of technical higher education in Kosice dates back to 1937, when under the Act No. 170 of the Czechoslovak Republic the State Technical University Dr. Milan Rastislav Štefánik in Kosice was established. Teaching process began in the school year 1938/39, but pre-war events after the Vienna Arbitration forced it to move first to Prešov, then to Martin until it was finally settled in Bratislava and laid the foundation of today's Slovak Technical University in Bratislava [1].

The actually the Technical University of Kosice was established under the Government Regulation No. 30/1952 Coll. of 8 July 1952 with three faculties, namely the Faculty of Heavy Engineering, the Faculty of Mining and Metallurgy. In 1969 the Faculty of Electrical Engineering was added and in 1976 the Faculty of Civil Engineering.

A significant event happened when the school was renamed to the Technical University of Kosice under the Slovak National Council Act of 13 February 1991. In 1992, the Faculty of Professional Studies was established in Prešov that in 1996 was transformed into today's Faculty of Production Technologies. The Faculty of Economics was also established in 1992 so the university stopped dealing with purely technical disciplines, and this trend continued in 1998, when the Faculty of Applied Arts was established.

2. Past and present of study programs at FA TUKE

2.1 Past study programs

As part of accredited study programs, it offers university education for aviation professionals in all three levels of education - bachelor's, engineering and doctoral while respecting the requirements of national and European aviation legislation. The educational process at the Faculty of Aeronautics is organized and guided in the context of the goals set in the accredited study programs [2].

In the field of transport management, there are four bachelor's degree programs:

- Professional Pilot,
- Air Traffic Controller,
- Air Transport Management,

and in an engineering study program:

- Air Transport Management.

In the technical studies, three bachelor's degree programs were implemented:

- Aircraft operation,
- Avionic systems,
- Aeronautical and Aerospace technology

and two engineering study programs:

- Aircraft operation,
- Sensors and Avionics Systems.

All activities related to educational activities and study results were electronically registered in the Modular academic information system MAIS.

In the past, study programs were accredited in various fields of study. Due to the integration of human potential, the Faculty of Aeronautics has decided to focus on the accreditation of study programs in only one field of Transport:

Changes of study fields at the Faculty of Aeronautics					
Old study fields		**New study fields**		**Study field of FA TUKE from 2020**	
Name	**Identificator**	**Name**	**Identificator**	**Name**	**Identificator**
Motor vehicles, rail vehicles, ships and aircraft	5.2.4.	Mechanical engineering	2381	**Transport 3772**	
Electronics	5.2.13.	Electrical engineering	2675		
Aerospace Engineering	5.2.61.	Transport	3772		
Transport	5.2.59.	Transport	3772		

Figure 1 – Study fields at FA TUKE

2.2 Present study programs

In the field of education, two very important activities have taken place over the last 5 years, which are largely related to the field of education [2].

The first of these was the new system of study fields of the Slovak Republic; the Faculty of Aeronautics has been working on since mid-2018. The process of creating a new system of study fields culminated in great efforts by the Dean of the Faculty of Aeronautics and members of the working group in the first half of 2019. The new system of study fields of the Slovak Republic came into force in September 1, 2019.

The second important activity in the field of education was the accreditation of new study programs. The process of accreditation of new study programs began at the beginning of 2018. In September 2018, one new study program was accredited. In 2019, preparations for the accreditation of other study programs continued, they were successfully accredited in October and December 2019.

The aim of the revision of the system of study fields (SF), the design, and subsequent adoption of a new system of schools in Slovakia was to define the relevant study fields without unnecessary overlap and the profiles of graduates. The intention was to define the outcomes of education, knowledge, union, cross-sectional, and transferable skills and competencies of graduates and the content of the framework in terms of the specifics of a particular field of study with a link to the National Qualifications Framework of the Slovak Republic.

The clearer system of study fields should be the result that would create a wider space for universities within the individual study fields for the creation of study programs. Some of the descriptions did not correspond to current needs in relation to education outcomes and practically became a brake within higher education innovations.

In October 2018, the Ministry of Education appointed the Dean of FA TUKE and the Dean of the Faculty of Operations and Economics of Transport and Communications of the University of Žilina in Žilina as persons responsible for the elaboration of a draft description for individual fields of study. In creating a draft description of the new study field of Transport the employees (working groups) of both of these faculties, who have been developing their study programs in the study field of Transport as well as in all its subordinate study fields, also closely cooperated with the deans.

After the end of the inter-ministerial comment procedure, the legislative process was completed on 22 July 2019 and subsequently the Decree of the Ministry of Education, Science, Research, and Sports of the Slovak Republic (MŠVVaŠ SR) No. 244/2019 Coll. on the system of study fields of the Slovak Republic with effect from 01/09/2019. MŠVVaŠ SR according to § 50 par. 3 of Act No. 131/2002 Coll. on University Education and on Amendments to certain Acts, as amended, established 48 new fields of study by the Decree in which university education institutions in the Slovak Republic may provide university education and accredit specific study programs.

The process of creating new study programs began in the beginning of 2018 with the preparation of the bachelor's study program Aerospace Technology that was accredited in September 2018. In this new study program, graduates are specialized in Avionics Systems and Aircraft Operation and Construction.

In October 2019, the second-degree study program in Aerospace Engineering and the third degree (PhD.) study program in Aerospace Systems were successfully accredited.

In December 2019, the bachelor's study programs Pilot, Air Traffic Control, Air Traffic Management, and the engineering study program Air Transport Management were successfully accredited.

Graduates of the bachelor's study program in Aerospace Engineering will be able to continue in the new engineering study program in Aeronautical and Aerospace Engineering that will replace the study program Aircraft Operation and the study program Sensory and Avionics Systems. Graduates of the Aeronautics and Aerospace Engineering program can continue in the third degree in the new Aeronautical and Aerospace Systems study program.

Graduates of the bachelor's study programs Pilot, Air Traffic Control, and Air Transport Management can continue in the second degree of study in the new engineering study program Air Transport Management.

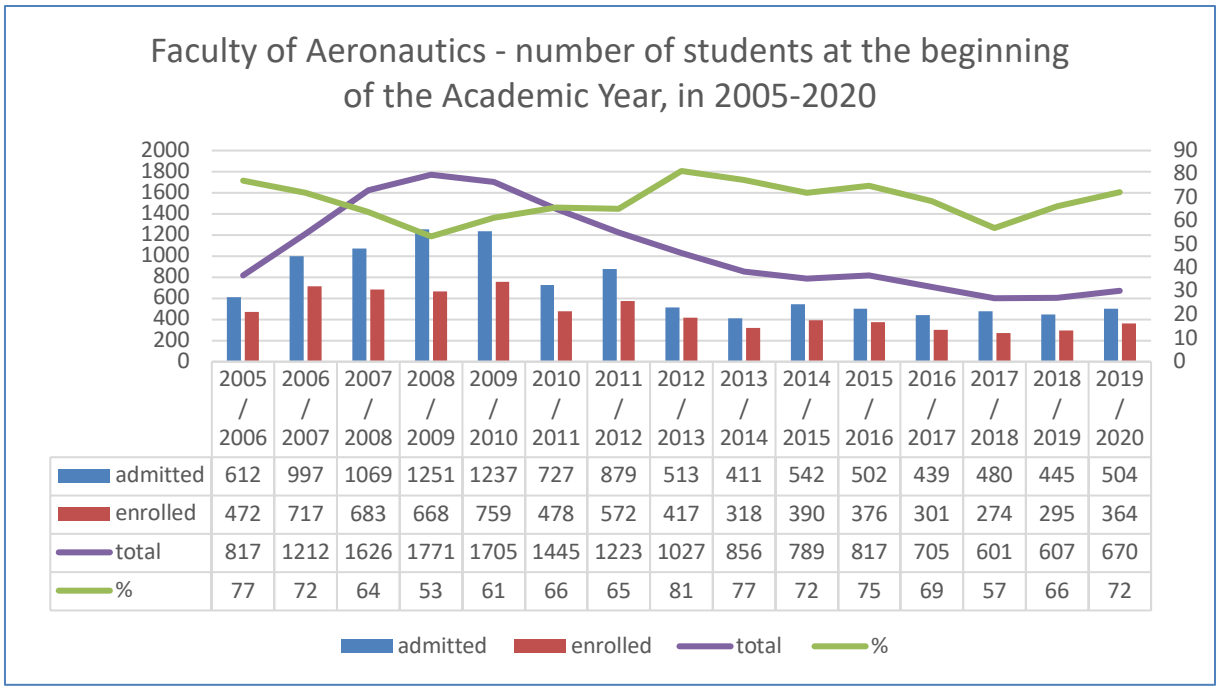
The following table shows the list of the new study programs at the Faculty of Aeronautics accredited

in 2018 and 2019. At present, they are all included in the study field of Transport.

Study program	Study degree	Form of study/ study language
Aerospace technology	1 (Bc)	daily - external / Slovak / English
Pilot (specializations: Aircraft piloting/Air Traffic Control)	1 (Bc)	daily / Slovak / English
Air Transport Management	1 (Bc)	daily - external / Slovak / English
Air Transport Management	2 (Ing)	daily – external / Slovak / English
Aerospace Engineering	2 (Ing)	daily / Slovak / English
Air Transport Management	3 (PhD)	daily – external / Slovak / English
Aerospace Systems	3 (PhD)	daily – external / Slovak / English

Figure 2 – Study programs at FA TUKE

The number of students from the beginning of the Faculty of Aeronautics from 2005 to 09/2021; the actual number of students is 687 (2021).



	2005 / 2006	2006 / 2007	2007 / 2008	2008 / 2009	2009 / 2010	2010 / 2011	2011 / 2012	2012 / 2013	2013 / 2014	2014 / 2015	2015 / 2016	2016 / 2017	2017 / 2018	2018 / 2019	2019 / 2020
admitted	612	997	1069	1251	1237	727	879	513	411	542	502	439	480	445	504
enrolled	472	717	683	668	759	478	572	417	318	390	376	301	274	295	364
total	817	1212	1626	1771	1705	1445	1223	1027	856	789	817	705	601	607	670
%	77	72	64	53	61	66	65	81	77	72	75	69	57	66	72

Figure 3 – Number of students at FA TUKE

3. Suggestions for cooperation

3.1 Digitization and internationalization of aviation education

The University of Seville (USE) and TUKE are members of the ULYSSEUS European University and at the same time of the PEGASUS - Aviation Engineering Universities Consortium. The consortium participates as a supporting association in ALICANTO - International Association of Aviation and Aerospace Education (at ICAO, Montreal, Canada). We would like to develop common goals in aviation education in cooperation with other partners [3, 4, 5].

The Innovation Hub TUKE is built at our university: **Digitization**

The aim of Hub is to maximize the potential of digital education and the digital economy.

Proposed activities within the Hub:

Digitization and internationalization of aviation education

Partners: TUKE / USE, in cooperation with the ULYSSEUS Digital Platform at UCA - UNIVERSITÉ CÔTE D'AZUR, France, etc.

Outputs:

Creation of digital content of virtual courses (study subjects) based on the transfer of selected national courses and creation of new courses for the benefit of international aviation education of ULYSSEUS Pegasus consortium students, support of virtual mobility and research activities of students / lecturers in aviation education. The partners will make agreement on the number of courses (study subjects) for ULYSSEUS / Pegasus consortium students.

Long-term goal:

Support of Erasmus + mobility and achievement of joint diplomas in a selected study program (according to European Join Degrees) within ULYSSEUS / Pegasus, with emphasis on Ph.D. students, supporting real and virtual mobility of students and teachers in aviation education.

Request for colleagues:

We would like to know the opinion of colleagues from ETSI (USE) / Pegasus consortium whether there would be interest in joint implementation of the activities such as digitalization, and internationalization of aviation education. It focuses on creating a digital content of virtual courses (subjects), based on the transfer of selected national courses and creation of new courses for the benefit of international aviation education of ULYSSEUS / Pegasus students, support of virtual mobility and research activities of students / lecturers in aviation education, within the activities of ULYSSEUS European University, resp. Pegasus.

Current project that supports this activity:

- Project title: **Integrated laboratory for digital aviation education in selected subjects of flight training**

  Project number: KEGA 051TUKE-4/2021

  Solution time: 2021 - 2023

  Responsible researcher for LF: Dr.h.c. prof. Ing. Miroslav Kelemen, DrSc.

The project is supported by a grant from ***the Cultural and Education Grant Agency of the Ministry of Education, Science, Research and Sports of the Slovak Republic (KEGA).***

The main motive for project elaboration was to contribute to increasing the quality of teaching and individual study results by creating digital content of aviation education (education, training, training) within a specialized laboratory and increasing the level of educational process at the Technical University in Košice in selected areas of flight training, focusing for the teaching of study programs in the bachelor's degree of university studies of future pilots and air traffic controllers. The activities of the laboratory will be focused on areas defined by the needs of the company and aviation practice, primarily in the area of solving operations at small airports with a limited number of movements with reduced visibility values using satellite navigation systems.

The laboratory will offer the student in the subject Air Navigation, Air Regulations and Air Law direct access to the hardware and software equipment of the laboratory and thus theoretically in the laboratory and practically in the field in the airport to evaluate the application of the most advantageous approach using satellite navigation systems with respect to the specific configuration terrain, obstacle and operational situation around the aerodrome on the basis of ICAO PANS-OPS and FAA TERPS standards.

For students of Aeronautical Meteorology, the laboratory will offer direct access to meteorological information, teaching and testing programs. The built-in aeronautical meteorological station will

enable continuous acquisition of meteorological information and practice its postprocessing. In the medium term, the basic meteorological characteristics of the measurement site can be created from the obtained data. This will make it possible to improve the methodology of measurements and its processing and to refine local forecasts with the aim of safe operation even in worsened weather conditions.

This knowledge will be transformed by students within the didactic system of aviation education in accordance with applicable aviation legislation.

The main result of the project will be to improve the teaching and individual learning outcomes of LF TUKE students through a specialized integrated laboratory focusing on teaching selected subjects of flight training in the 1st level of university study, using to support and develop students' scientific professional activities and processing final theses. A significant part of the project outputs will be the results of creating digital content of selected flight training subjects, integrated in the laboratory in 3 forms: in the form of a course in the Learning Management System (LMS) - TUKE Moodle, using electronic books on subjects and further in the form of a set of presentations for use within the video conferencing platform Cisco Webex meetings / resp. Microsoft Teams, used at the Technical University in Košice, including a set of tests for the mentioned platforms, or in the docs.google environment. Digital content enables the repetition of educational processes, as well as an individual approach to the student to increase the quality of individual study performance.

3.2 Research projects

The Faculty of Aviation participates in several scientific projects [6], such as:

- Project title: **Innovative Flight Speed Measurement of Non-Traditional Flying Devices**
  Project number: APVV-20-0546
  Solution time: 2021 - 2024
  Responsible researcher: doc. Ing. Ladislav Főző, PhD., Ing.Paed.IGIP
- Project title: **Applied Research and Development of a Working Substance for Decontamination, Disinfection and Deactivation Applied to Cold Plasma at Atmospheric Pressure, for Transport Services**
  Project number: PP-COVID-20-0002
  Solution period: 2020 - 2021
  Responsible researcher for LF: Dr. h. c. prof. Ing. Miroslav Kelemen, DrSc., MBA, LL.M.
- Project title: **Dynamics of Domain Walls and Skyrmions in Thin Magnetic Layers**
  Project number: APVV-17-0184
  Solution period: 2018 - 2021
  Responsible researcher: RNDr. Kornel Richter, PhD. (UPJŠ in Kosice)
  Responsible researcher for FA TUKE: doc. Ing. Pavol Lipovsky, PhD.
- Project title: **Intelligent Belt Conveyors**
  Project number: APVV-18-0248
  Solution period: 2019 - 2022
  Responsible researcher: doc. Ing. Karol Semrad, PhD.
- Project title: **Small Unmanned Aircraft - a Platform for Education in the Field of Intelligent Avionics Systems**
  Project number: KEGA 044TUKE-4/2019
  Solution period: 2019 - 2021
  Responsible researcher: doc. Ing. Rudolf Andoga, PhD.
- Project title**: Computer Model of Integration of Chemosensory Modules and Motor**

Module of Neural Network C. Elegans

Project number: VEGA 2/0043/17

Solution period: 2017 - 2020

Responsible researcher: Ing. PhDr. Marek Dobeš, Ph.D. (SAV)

Responsible researcher for the FA: doc. Ing. Rudolf Andoga, PhD.

- Project title: **Research into The Usability of Modern Built-In Non-Contact Micro Sensors to Increase the Operational Safety of Aerospace Composite Structures**

  Project number: VEGA 1/0374/17

  Solution period: 2017 - 2019

  Responsible researcher: Ing. Miroslav Smelko, PhD.

From the other projects, we would like to highlight the following project: GRBAlpha nanosaelite that is the second „international satellite“ followed on from the first skCUBE nanosatellite project and entered the Earth's orbit. The GRBAlpha satellite is important mainly because of its scientific contribution - the detection of gamma-ray bursts.

The GRBAlpha satellite is an international scientific project in which, in addition to the Faculty of Aeronautics of the Technical University of Kosice and Spacemanic, Hungarian, Japanese and Czech partners participated. The Nanosatellite Project (CubeSat Category 1U) won in 2019 at the International Astronautical Congress in Washington D.C. in the competition for the launch of a satellite announced by the International Astronautical Federation in cooperation with the Russian company GK Launch Services second place and reducing the cost of launch - start.

The satellite underwent an environmental test and was delivered to Moscow, where was integrated by its contractors into a discharge container. Subsequently, GK Launch Services secured its launch into Earth's orbit from the Baikonur Cosmodrome. The satellite was launched in orbit on March 22, 2021.

As part of the project of another satellite, international partnerships between academia and business have been established. It is a necessary precondition for the country's path to creating a successful "space sector".

The project represents a comprehensive technology from the design, construction, and launch into space, control, and subsequent processing of the satellite's unique scientific data.

4. Conclusion

Aviation education in Kosice, currently represented by the Faculty of Aeronautics of the Technical University in Kosice, has had 10,290 graduates for 62 years, working in 27 countries around the world.

The staffs of the Faculty of Aeronautics appreciates the opportunity to be part of the aviation community within Pegasus - Aerospace Engineering Universities and the Ulysseus European University consortium in which they are ready to develop international cooperation in aviation education and in solving joint scientific projects.

5. Contact Author Email Address

Mailto: marek.kosuda@tuke.sk

6. Copyright Statement

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