TO THE QUESTION OF DISTANCE LEARNING IN AEROSPACE INDUSTRY

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К ВОПРОСУ О ДИСТАНЦИОННОМ ОБУЧЕНИИ В АЭРОКОСМИЧЕСКОЙ ОТРАСЛИ

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This article contains an information about the possibilities of applying distance learning in the educational process in order to earn bachelor's degree or master's degree, or to obtain a certificate of passing the educational course in the field of aerospace engineering. The advantages and disadvantages of e-learning in the aerospace field are also mentioned. Comparative analysis of various distance learning programs in foreign countries was made according to the main criteria: tuition fee, duration and course content, student requirements, etc. In addition, the prevalence of online learning in the aerospace industry in Russia and possible problems of implementation of distance learning in aerospace engineering are covered.

Данная статья содержит информацию о возможности применения дистанционного обучения в образовательном процессе для получения степени бакалавра или магистра, либо для получения сертификата о прохождении образовательного курса в области аэрокосмической инженерии. Также рассматриваются преимущества и недостатки электронного обучения в аэрокосмической сфере. Проводится сравнительный анализ различных программ дистанционного обучения в зарубежных странах по основным критериям: стоимость обучения, продолжительность и содержание курса, требования к студенту и т.д. Кроме того, изучена распространённость онлайн обучения в аэрокосмической отрасли в России и выявлены возможные проблемы реализации дистанционного обучения в аэрокосмической инженерии.

In a century of modern technologies, the problem of new learning methods becomes more and more popular. One of the prospective method is called e-learning or distance learning. E-learning provides access to studying when the source of information and the learners are separated by time and distance. This method is convenient for those students, who have no opportunity to attend classes in case of being involved into working process or because of other personal reasons. During this type of education learners communicate with the faculty and other students via e-mail, electronic forums, videoconferencing and other forms of computer-based interaction [1]. The development of distance learning appeared due to modern achievements in the field of technology. It uses such advances as a computer and information technology, educational television, satellite communications systems, the proliferation of computer-based training programs, DVDs and etc.

Distance education has become widespread relatively recently, but has already allowed identifying the obvious benefits of the process:

1) Flexibility

An independence from schedule is the greatest advantage of distance learning. Students need only a few hours of free time, personal computer and an access to the internet. In addition, e-learning is a good training for self-organization and motivation.

2) No need for campus attendance

Doing learning tasks at home or any other place is much more comfortable and less stressful for students. Non-local learners save money related to accommodation and transportation.

3) An engineering graduate degree from a prestigious university

After successful completion of the studying program, each student gets an accredited diploma or certificate, which has the same value as degree, earned offline.

4) Enhancing your career opportunities

Getting E-learning certificate or diploma helps to raise chances to make career advancement and makes possible to increase personal competitiveness.

5) Improving professional skills

Fully online self-paced study offers employed students the time flexibility needed to balance work and studies and allows achieving new competencies, broadening expertise and expanding knowledge [2].

A characterization of e-learning cannot ignore what has been called the negative sides of the method.

Possible disadvantages of distance learning in aerospace sphere are:

1) High price

Not every student can afford to study by the distance learning program. Sometimes the tuition fee can reach great amount of money. Fortunately, most recognized universities provide all diligent students with scholarships.

2) An absence of human interaction

Social contact and direct communication with professors play an important role in studying process, especially in aerospace engineering. Some e-courses are unable to provide online video chats with tutor. This fact may lead to low quality of individual preparation due to lack of guidance and explanations [3].

3) Self-motivation problem

The success and quality of studying depend not only on well-structured courses but also on student's responsibility and ability to manage time. Some learners may face with a problem of self-motivation. The ability to do tasks before deadline is very valuable and necessary, especially at work.

4) No guarantees about future employment

Despite of positive influence of distance learning, it has no guaranty that student will get desired job position.

5) A lack of practical knowledge of working with real instruments and equipment.

Each specialist must have an experience of working with equipment, knowing the construction and properties is mandatory. Those skills allow better conduct research, design and develop vehicles and systems for air, space, or any fluid environment.[4] Without such knowledge, aerospace engineer is going to have difficulties on the future job.

All degrees of high education are graduated on 3 groups:

1) Bachelor
2) Short course
3) Masters

Bachelor degree in aerospace engineering belongs to blended type of studying. It means that course includes both online training and practice in campus. Master's degree and short courses might be blended or fully online. The most important requirement for entry in master's and short courses is a bachelor degree in aerospace engineering or related sphere. Aerospace engineering courses are such a popular evidence in Netherlands.

The table 1 below shows some examples of short-time courses at Delft University of Technology.

Table 1. Online aerospace engineering short courses

The name of the course:	Spacecraft Technology [5]	Smart Structures[6]	Advanced Design & Optimization of Aerospace Structures [7]
Tuition fee	1000 euro per year	600 euro per module	800 euro per module
Duration time	3 months	3 months	2 months
Educational variant	Full-time	Full-time	Full-time
Entry Level	Bachelor	Bachelor	Bachelor
Student interaction	Individual work/assignments (with online group discussions), Online group works/assignments	Online group works/assignments	Online group works/assignments
Teacher support	Continuous support with feedback on request	Continuous support with feedback on request	Continuous support with feedback on request
Course Content	• Satellite Bus Platform; • Rocket & Onboard Propulsion; • CubeSat Design Workshop.	• Introduction to smart structures; • Structures and materials for smart structures; • Actuation, sensing and control of smart structures; • Morphing structures; • Biomimetic structures; • Integration of smart structures, multifunctionality and multidisciplinarity.	• The basic components of an airframe structure; • The realities of composite design such as the effect of material scatter, environmental knockdowns, and damage knockdowns.
Requirements	• Expected Level of English: TOEFL score 90+; IELTS overall Band score of at least 6.5; University of Cambridge: "Certificate of Proficiency in English" or "Certificate in Advanced English"; • A CV which describes your educational and professional background; • CV; • A copy of relevant transcripts and diplomas.	• Expected Level of English: TOEFL score 90+; IELTS overall Band score of at least 6.5; • Expected prior knowledge: A BSc in Aerospace or equivalent.	• Expected Level of English: TOEFL score 90+; IELTS overall Band score of at least 6.5; University of Cambridge: "Certificate of Proficiency in English" or "Certificate in Advanced English"; • Prior knowledge in aerospace engineering; • A clear and relevant essay in English (1,000 - 2,000 words); • Two reference letters in English: 1) from your professor, 2) from your employer.
Type of degree	Certificate	Certificate	Certificate

The table demonstrates that conditions and requirements are rather similar, but there are some differences in course's costs and studying programs. Each course provides fully online process of studying, a feedback from tutor and certificate as a result of working. Requirements show that the level of English must be high; TOEFL or IELTS or Cambridge tests have to be passed. Tuition fee depends on quantity of academic hours, course's relevance and duration time. Students do not need work experience to participate in the course program.

The highest quantity of master's degree suggestions are at USA universities. Table 2 shows three different aerospace engineering programs.

Table 2.Online aerospace engineering master's degree

The name of the course:	Aerospace Engineering [8]	Mechanical & Aerospace Engineering (Dynamics & Control) [9]	Space Studies [10]
University	Georgia Institute of Technology, USA	University of Florida, USA	University of North Dakota, USA
Tuition fee	$1421 per credit	$12680 total cost of program	$843 per module (for international students); 352$ per module (for national students).
Duration time	5 years	2 years	2 years
Educational variant	Full-time	Full-time	Part-time
Student interaction	Online works/assignments	Online group works/assignments	Online group works/assignments
Teacher support	Continuous support with feedback on request	Continuous support with feedback on request	Continuous support with feedback on request
Course Content	• Viscous Fluid Flow • Unsteady Aerodynamics • Computational Fluid Dynamics • Rotary Wing Aerodynamics • Rotary Wing Aerodynamics • Rotorcraft Design I • Aircraft Design II • Propulsion System Design I • Kalman Filtering and etc.	• Analytical Dynamics I • Geometry of Mechanisms and Robots I • Principles of Engineering Analysis I • Numerical Methods of Engineering Analysis I • Control System Theory • Structural Dynamics • Robust Control Synthesis • Nonlinear Control	• Study of near-Earth and main-belt asteroids • Solar astronomy • Spacesuit and spacecraft simulator design, construction & testing • Development of a Lunar/Mars base • Remote sensing of the environment • Aerospace payload development [11]
Requirements	• All graduate programs at Georgia Tech require an online application.	• Expected Level of English: TOEFL paper-based test score 600; • A bachelor of science degree in mechanical or aerospace engineering with a cumulative undergraduate GPA of at least 3.0 on a 4.0 scale; • Satisfactory scores on the general portion of the Graduate Record Examination (GRE) with a minimum score of 1100.	• English Language Requirements IELTS Take IELTS test 6.5 TOEFL paper-based test score 550 TOEFL iBT® test (read more) 76; • Bachelor's degree from an accredited college or university with an overall grade point average (GPA) of 2.75 or better, or a GPA of at least 3.0 for the junior and senior years of undergraduate work; • The General Record Examination (GRE) General Exam if you plan on seeking funding (graduate assistantship, tuition waivers) via the department or a faculty member. Otherwise, it is not required for admission to the MS program.
Type of degree	Master of science degree	Master of science degree	Master's degree

Tuition fee ranges differently according to University terms, duration time and studying plan. All those universities support scholarships and grants, which may be awarded on a competitive basis. The students will be given an access to assignments and to the group's and teacher's chats. The requirements of entire is exact, English language must be confirmed by one of the international tests, University of North Dakota requires Bachelor's degree GPA of 2.75 or better, University of Florida wanted GRE with a minimum score of 1100. Five-year course of aerospace engineering in Georgia University consist of 56 different disciplines, distributed evenly between semesters. At the end of the each course student earns Master of Science degree.

Talking about the Russia, fully online distance learning in aerospace sphere does not exist now. However, blended type of studying program is widespread all over the country. Students get online their science books and pass mandatory tests, but they are obliged to attend some practical classes before and during the session time. The absence of total online aerospace course in Russia is easy to explain by the old methodic of education, a lack of teacher's computering and programming skills and practice-based specialty. Nevertheless, the system of education changes, the progress goes on, e-learning becomes more and more perspective and slowly penetrates into educational process.

Overall, earning degree of aerospace engineering online is impossible for beginners because all existing online courses suggest the presence of previous learning in aerospace sphere such as Bachelor's degree. It means that without any basic knowledge about constructing, designing, principle of spacecraft working student is prohibited to take part in distance learning course. The best way to get this knowledge is to go to study aerospace engineering at the university's campus classes. But for those, who wants to continue studying in aerospace sphere, e-learning is the most comfortable way of learning, especially for employees who combines work and study.

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ENSURING ACCURACY OF GYROSCOPIC SYSTEMS. MODERN METHODS AND APPROACHES

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ОБЕСПЕЧЕНИЕ ТОЧНОСТИ ГИРОСКОПИЧЕСКИХ СИСТЕМ. СОВРЕМЕННЫЕ МЕТОДЫ И ПОДХОДЫ

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In the modern world the interference in production exact instrument making requires more and more. Precision instrument making one of the most important components of scientific and technical progress. The instruments which are a part of different systems and complexes on traffic control, instruments of navigation and orientation, instruments of sea navigation, space, aviation instruments and so on. At the same time quality of execution of such instruments which are manufactured of the modern materials and is combined by elements of exact mechanics, optics, high-voltage electronics, and determine the instrumental accuracy, reliability and a resource of operation of complexes. Gyro instruments bright representatives of products of exact instrument making are also used both in systems of navigation, and in the navigation systems without platform and stabilizing of spacecrafts. Accuracy and reliability of the modern gyroscopic systems in many respects depend on stability of the form, the geometrical sizes, durability of materials and methods of receiving materials of the details which are a part of construction of high-precision nodes. In this operation methods and methods of support of accuracy of gyroscopic systems depending on the used material in details namely for an alloy 40HNYU-VI will be considered.

В современном мире все больше требует вмешательство в производство точное приборостроение. Точное приборостроение одно из важнейших составляющих научно-технического прогресса. Приборы, входящие в состав различных систем и комплексов по управлению движением, приборы навигации и ориентации, приборы морской навигации, космические, авиационные приборы и так далее. При этом качество выполнения таких приборов, которые изготавливаются из современных материалов и сочетают в себе элементы точной механики, оптики, высоковольтной электроники, и определяют инструментальную точность, надежность и ресурс работы комплексов. Гироскопические приборы яркие представители изделий точного приборостроения и используются как в системах навигации, так и в бесплатформенных системах ориентации и стабилизации космических аппаратов. Точность и надежность современных гироскопических систем во многом зависят от стабильности формы, геометрических размеров, прочности материалов и способов получения материалов деталей, входящих в состав конструкции высокоточных узлов. В данной работе будут рассмотрены методы и способы обеспечения точности гироскопических систем в зависимости от использованного материала в деталях, а именно, для сплава 40ХНЮ-ВИ.

The modern technological level of precision instrument making defines application in different constructions of the metal materials satisfying to a difficult complex of physics and mechanics properties: high mechanical characteristics, corrosion resistance, the required coefficient of thermal extension, sized stability in time.