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TELEINFORMATYKA W EDUKACJI INŻYNIERII AWIACJI

Streszczenie. Bezpieczeństwo pasażera oraz personelu kabinowego jest głównym wymaganiem w obsłudze statku powietrznego. Ciągłe zwiększanie bezpieczeństwa jest nie tylko zadaniem biur projektowych, producentów samolotów, sektora usługowego ale również przedmiotem szkoleń i edukacji. Poniższy artykuł koncentruje się na analizie potrzeb i metod związanych ze zmniejszaniem ryzyka w obsłudze statku powietrznego, szkoleń dotyczących inżynierii awiacji oraz edukacji w ramach EASA (European Aviation Safety Agency) Module 12, Part 66 - titled as “Helicopter aerodynamics, structure and systems” – moduł 12, część 66 zatytułowana „Aerodynamika, struktura i systemy helikoptera”. Tematyka tej pracy wynika z potrzeby wdrożenia technologii edukacyjnej do programu edukacyjnego uniwersytetów, a także indywidualnego przygotowania służb utrzymania danego statku powietrznego. Praca składa się z dwóch części – papierowej i multimedialnej. Część papierowa stanowi analizę powiązań pomiędzy bezpieczeństwem, edukacją oraz systemem maszyna-człowiek-środowisko. Część multimedialna składa się z Modułu 12 z tekstem, danymi liczbowymi, video, zdjęciami oraz testami interaktywnymi.

ICT IN AVIATION ENGINEERING EDUCATION

Summary. The passenger and aircraft crew safety is the major requirement of the aircraft operation. Its continuous enhancement is the major task not only for design bureaus, aircraft manufacturers, services, but is also the subject of training and educational activities as well. Presented article focuses on analysis of needs and methods application, regarding risk mitigation in aircraft operation, considering aviation engineering training and education in compliance with EASA (European Aviation Safety Agency) Module 12, Part 66 - titled as “Helicopter aerodynamics, structure and systems”. Topicality of the contribution results from necessity of implementation educational technology into university education as well as individual preparation of aircraft maintenance staff. The contribution has two parts – paper and multimedia form. Paper form is analysis of the connection among safety, education and ergatic system (machine-man-environment). Multimedia form consists of Module 12 with its text, figures, videos, photos and interactive tests.

1. INTRODUCTION

One of the most developing areas of science, engineering and technology is aeronautics. Spur development of aviation requires need of new professionals in this kind of extremely perspective mean of transport.

Complexity of technical systems used in aviation engineering, shall ensure high level of reliability and safety of air transportation, which inevitably calls for professional preparation of future technicians. Using up-to-date technologies in aviation is inevitably connected with new technology in education and training. This is the only way how educational institutions will be able to keep up with science and technology development.

Growth of pressure for enhancement and modernization of university education and need for ICT (The Information Communications Technology) using is notable. Nowadays we are witnessing a boom of information (known as The Information Age) which brings us to a new stage of mankind development – to information society, that can be reached with using of new ICT only.

The next trend in education is its globalization which is very progressive in area of staff preparation in aviation engineering. All member states of the European Union have been preparing new joint regulations consisting syllabuses of modules under the shield of EASA. This system enables implementation of joint requirements for comprehension and deepness of student knowledge without any differences relating to country where preparation of future specialist is carried out.

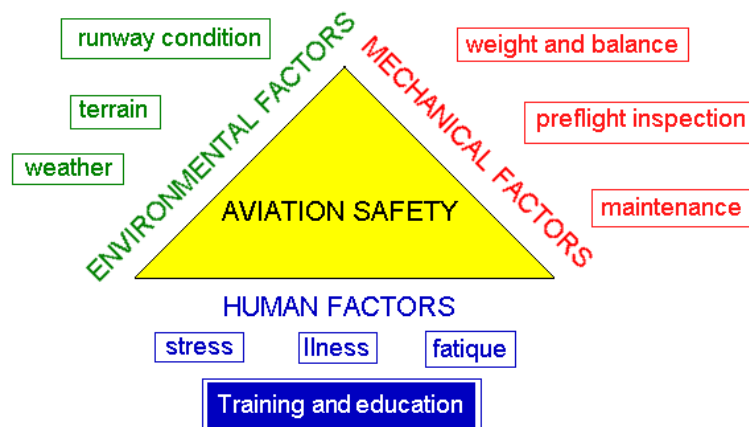
The term technology of education is a pedagogical branch of science which integrates and uses theoretical knowledge and methods of other branches of science, first of all pedagogy, cybernetics and informatics.

The main request of today's university education is to change actual approach in education from learning education to science education in compliance with the Bolognese declaration.

One of the scientific and research activities at the Faculty of aeronautics of Technical University of Košice for the next period is to improve quality of education by using a modern educational technology and to participate in international unification and certification of aviation education.

2. SAFETY IN AVIATION OPERATION

Air safety is a term encompassing the theory, investigation and categorization of flight failures, and the prevention of such failures through regulation, education and training. It can also be applied in the context of campaigns that inform the public as to the safety of air travel (Fig. 1).



Rys. 1. Czynniki związane z bezpieczeństwem lotniczym
Fig. 1. Aviation safety factors

According to Oxford dictionaries the safety is the condition of being protected from or unlikely to cause danger, risk, or injury.

When speaking about machine safety we have to consider system consisting of: man – machine – environment. When considering a term – man, someone could imagine just a pilot, but the system includes all persons (i.e. staff) directly connected with aircraft operation. The system includes all crew members, technicians, aviation control personnel, meteorologists etc. In larger context the system include all people engaged in aviation. For example designers, constructors, maintenance, operational and management staff should be included in the system also.

The system safety level is measured by the safety level of the weakest element of the system. The literature extensively describes influence of aircraft manufacturing, operating, maintenance and other factors in aircraft safety whereas less is spoken about influence of training and education in aviation safety. Neglecting of this, the training and education could be the weakest element of the system safety (Fig. 2).



Rys. 2. Główne komponenty bezpieczeństwa lotnictwa
Fig. 2. The weakest element of the system safety

In Europe, Aircraft Maintenance Certifying Personnel have to comply with Part 66 Certifying Staff of EASA. Part 66 is based on older JAR system and the required training level follows the ATA 104 system. There are 3 levels of authorization:

- Category A (Line Maintenance Mechanic),
- Category B1 (Mechanical) and/or B2(Avionics) (Line Maintenance Technician),
- Category C (Base Maintenance Engineer).

EASA Part 66 is oriented to theoretical and practical education in context to improve level of aviation safety (Fig. 3).



Rys. 3. EASA Part 66

Fig. 3. EASA Part 66

Part 66 certificate holder may migrate as a labour force not only in Europe but all over the world as well (e.g. New Zealand, Australia). From this point of view joint requirements defined by Part 66 are imposed to education of engineering personnel. The regulation, moreover, defines requirements to 17 modules. The subject of this article is to present – Module 12: Helicopter aerodynamics, structures and systems.

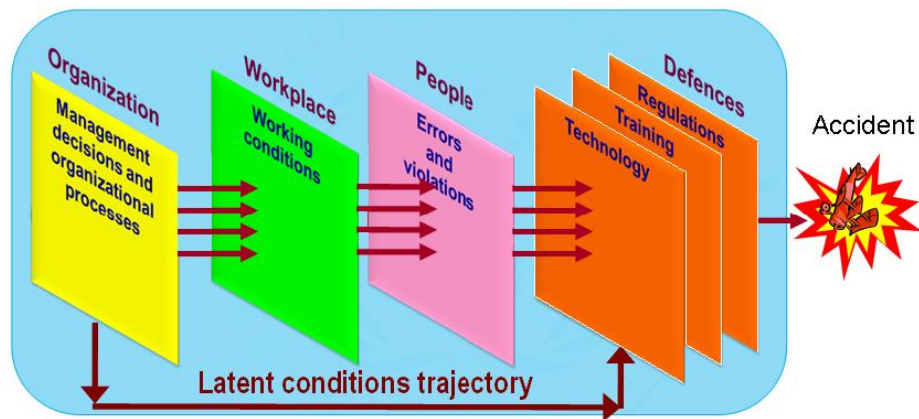
3. TRAINING AND EDUCATION AS A PART OF AVIATION SAFETY

Growth of aircraft complexity and automatization of airframe systems makes the maintenance more and more critical towards operation safety. Today's aircraft maintenance staff have to be able master great volume of aircraft system theory, carry out system monitoring and diagnostics, provide repair and lot of other tasks connected to electronic systems.

Information systems for the New Millennium are heading to the area of increasing cognitive knowledge of man with aim to enhance its productivity in information society. Contrary to mechanical automatization, which had to reduce man manual labour, automatization of information systems takeover mental load when using complex systems?

Classical system education of today's transport aircraft is from economic, capacity, volume, safety and other factors very complicated and almost impossible. New technologies in aviation call for new technology in training and education. Theoretical training is carried out in modern classrooms equipped with ICT, multimedia and simulators.

Economic changes and influence of globalization on information eliminate borders in education, what can be seen in university education. Specific role in world and European education system have sectors where high level of safety and risk mitigation is required. Volume, quality and level of knowledge results from legislation standards and regulations, what makes not only high level of safety but also migration of labour power on the labour market.



Rys. 4. Koncepcja uwarunkowań wypadku
Fig. 4. A concept of accident causation

Education of staff in aviation engineering is typical example of globalising education. It results from international aviation regulations where requirements for level and volume are exactly defined to given category of engineering staff.

High level of education is one assumption of air transport safety and quality. Training and education in aviation is a part of Safety Management System (SMS) according to ICAO.

Education has to be considered as an equal part of the SMS. The need of continued enhancement of aviation engineering staff results from complexity of today's aircraft design.

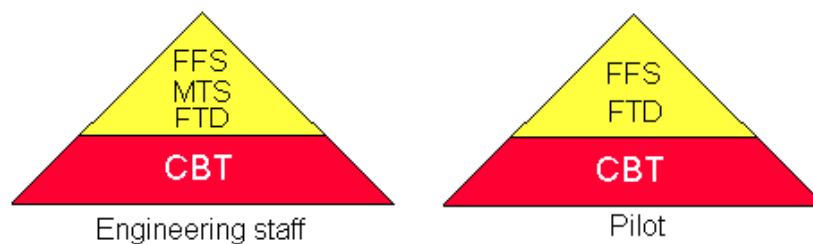
Training and education in the system might be triggering factor of an accident (Fig. 4).

4. AVIATION COMPUTER BASED TRAINING (CBT)

Computer based training (CBT) is "the use of computers to provide an interactive instructional experience" in which the computer is seen "as the primary mode of instruction".

Among basic applications of CBT include (Fig. 5):

1. CBT for pilots,
2. CBT for engineering staff.



Rys. 5. Piramida treningowa dla pilota i obsługi inżynierskiej. CBT - trening komputerowy, FTD - urządzenia szkoleniowe dotyczące lotu, MTS - symulator treningu służb utrzymania, FFS - symulator pełnego lotu

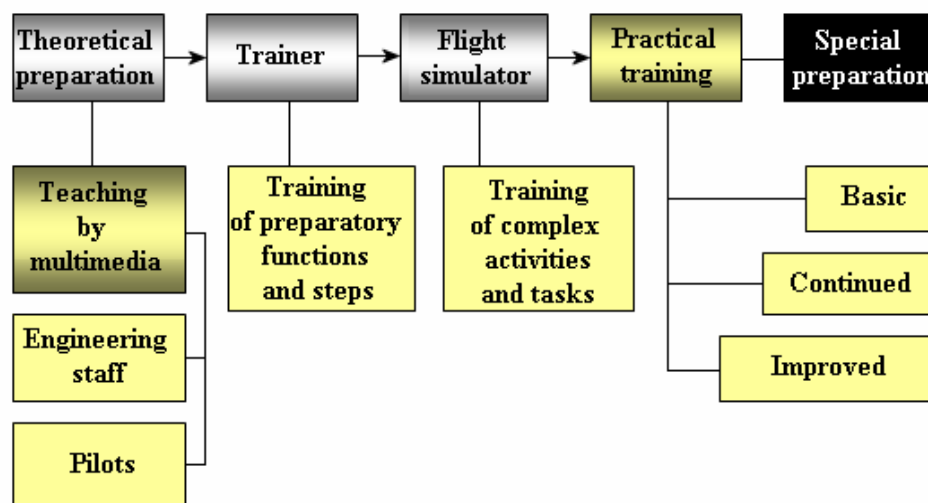
Fig. 5. Training pyramid for pilot and engineering staff. CBT - computer based training, FTD - flight training devices, MTS - maintenance training simulator, FFS - full flight simulator

The largest producer of MTS is "Airbus industries" a "Flight Safety Boeing Training International". For aircraft airframe teaching CBT can be used by "Web Based Training – WBT" and distance learning by "Distance Learning". As aviation designer programs „Advanced Aircraft Analysis” and „RDS Aircraft Design Software” are used.

Preparation of aviation specialists is modular. Modules and tasks are defined in requirements for education. A chain of preparation runs over procedures of individual modules which in the process of preparation might be considered as individual elements (Fig. 6).

Advanced aviation education is based on the knowledge of modern science. The Faculty of aeronautics, Technical University of Kořice is legal successor to former Air Force Academy of General M. R. řtefanik in Kořice, that had long-time experience in preparation of students for engineering practise and pilot personnel not only domestic one's but also number of international students. Military aircraft education was realized in specialized classrooms or directly at the airbases where military aircraft were held. Specialized classrooms were fully equipped with particular aircraft systems, avionics, cutaways, panels, three dimensions facilities, etc. (MiG-23, MiG-29, MiG-21, L-29, L-39, Mi-2, Mi -17, Mi-24, and others). Education and training at that time was at high level. The Air Force Academy of General M. R. řtefanik in Kořice was well-known in many foreign countries.

Today's Faculty of aeronautics is a civilian educational institution and its main task is to prepare aviation specialists for civilian sector, i.e. civil airliners (Boeing, Airbus, helicopter companies - Mil, Bell, etc.). Russian language based teaching materials for military aircraft for today's use (in teaching process) for civilian purposes is unthinkable. New questions emerge about how to save quality of teaching civil transport airplanes and helicopters. To equip classrooms with modern aircraft is inconceivable for a lot of reasons.



Rys. 6. Modularnoř przygotowania specjalisty ds. awiacji

Fig. 6. Modularity of aviation specialist preparation

New trends in education are based on using of ICT. They offer very powerful tools of education reform provided that is properly used (Fig. 7).



Rys. 7. Klasa multimedialna i potrzebny sprzęt
Fig. 7. Multimedia classroom and equipment

Educational institutions of developed countries use for aviation teaching specialized educational program packages (e. g. multimedia, animations, simulations, interactive files, tests) that can fully substitute classrooms equipped with real aircraft and systems which seems to be old-fashioned teaching method in some ways.

5. EASA MODULE 12, PART 66 IN MULTIMEDIA FORM

EASA Module 12, Part 66 had been prepared in multimedia form (created in Multimedia builder program - MBB) at the Faculty of aeronautics (Fig. 8). The program consist of text, full colour graphics, photos, interactive tests, videos, helicopter gallery and others.



Rys. 8. 12 EASA część 66 w multimediach
Fig. 8. Module 12 EASA Part 66 in multimedia

The textbook is based on the module and is approved by Czech and Slovak civil aviation authorities. Multimedia CD has AutoRun program. On the left side of the main menu are virtual push buttons of all chapters under Part 66. The FAA publication - Rotorcraft (in English language), gallery of best-known helicopters and syllabus of the Module 12 are situated on the upper side of the main menu.

6. CONCLUSION

Old Latin saying „Errare Humanum Est“ (To err is human) cannot apologize many accidents when a lot of people had fallen. Unfortunately, human factor always had been the main reason of accidents which results from final reports of commissions for aircraft accident investigation.

Safety is one of basic requirements demanded from all kinds of transportation. Safety of rotary wing aircraft is an actual problem regarding its rotor dynamics, design, flight control system and many other differences in comparison to fixed wing aircraft.

Applying new technology in aviation education on the basis of ICT appears as very useful, since combination of different means, videos, simulations, internet, flight simulators, conference discussions via internet and many other similar methods can make study more interesting and at same time respect individual capability and background of particular student and his/her individual needs.

Opened and creative education expects different approach from side of teachers, because student is not motivated only by his/her personality but is also influenced by appropriate training method and/or educational environment.

Rapid knowledge development which is outcome of new technologies, is heading to necessity of lifelong education that must be every time and everywhere available for everyone. ICT helps us to save time, avoid routine activities and they arrive with new services.

Bibliography

1. Douglas A.: A human errors approach to aviation accident analysis. Aldershot, England 2005.
2. John D., Mac Arthur C.: The future of the learning institutions in digital age. The MIT Press Cambridge, London 2009.
3. Kelemen M.: Ergatické systémy a bezpečnosť v letectve: Liptovský Mikuláš: Edukácia a inteligencia zručností v leteckej prevádzke. Akadémia Ozbrojených Síľ, Liptovský Mikuláš 2009.
4. Klecun R.: Nové trendy vo vzdelávaní leteckých odborníkov. Vojenská Letecká Akadémia, Košice 2003.
5. Malindžak D.: Manažment spolupráce univerzít s praxou. Bratislava, Centrum d'alsieho Vzdelávania Economickej Univerzity v Bratislave, Projekt Tempus-phare UM_JEP-13003-98.
6. Neštrák D., Piřa J.: Aerodynamika, konštrukcia a systémy vrtuľníkov. Učebné texty podľa nariadenia komisie ES číslo 2042/2003, Part 66, Akademické nakladateľství CERM, s.r.o., Brno 2006.

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