

# *Education and Training Needs for Aviation Engineers and Researchers in Europe*

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**Abstract**— Last years it is the air transport industry which took over aerospace and has the leading role. This is demonstrated by number of employees and created GDP. However, from a global perspective aviation in Europe is losing its position especially with respect to the Middle East and Asian companies. We should ask whether the existing support of air transport education and research is adequate and what should be done to change the situation.

**Keywords**—education; training; needs; air transport; Europe

## I. BACKGROUND

How does the current air transport employee base around the Europe looks like? What is the average employee age? What are the skills needed at the present? Which skills and knowledge would be needed in seven to ten years? Answering these questions by industry can give academia outlines for their next decade development.

Within a frame of FP 7 European Project AirTN NextGen and the task 3.2 the University of Zilina aims to identify Air Transport Industry needs in the field of specialised aviation education. To bring academia and industry experts together the “Workshop on Education and Training Needs for Aviation” had been organized on 23 September 2015 in Brussels’ Covent Garden. More than 40 experts from 24 European countries and from different areas of aviation industry and academia have registered and attended the workshop. Within them universities, airport operators, airline companies and last but not least maintenance organisations. The cooperation between universities and industry have been found crucial for past couple years in terms of identifying the educational needs for air transport. As the field of air transport is wide; indeed it is understandable that we should evaluate training and educational requirements by each group of stakeholders.

## II. EUROPEAN AVIATION INDUSTRY SITUATION

Accordingly to the Air Transport Action Group the European aerospace industry created 378 thousand jobs in 2012. On the other side airports, airlines, air traffic management there were circa 800 thousand employees in Europe in total.[1] If we include also 1.43 million jobs in group “other on airports” (e.g. catering companies, shops, aviation fuel suppliers, construction companies, travel agencies) the number of jobs in the European air transport industry exclude aerospace increases to circa 2.23 million jobs.

Table below shows breakdown of European aviation related job positions in thousands for year 2012.[1]

TABLE I. EUROPEAN AVIATION RELATED POSITIONS (IN THOUSANDS)

Airports	Other on-airport	Airlines	Aerospace	Air Traffic Management
156	1 430	576	378	64
6%	55%	22%	14.5%	2.5%

The following chart represents the trend in employment between years 2004 and 2012. It is clearly visible that employment rates are increasing and decreasing in areas of Airports, Aerospace and Airlines. On the other hand the area “Other on-airport” employment is increasing rapidly. Even though these jobs include also lower educated staff such as shopping assistants, these positions induce managerial positions and put increased load on for example security etc.

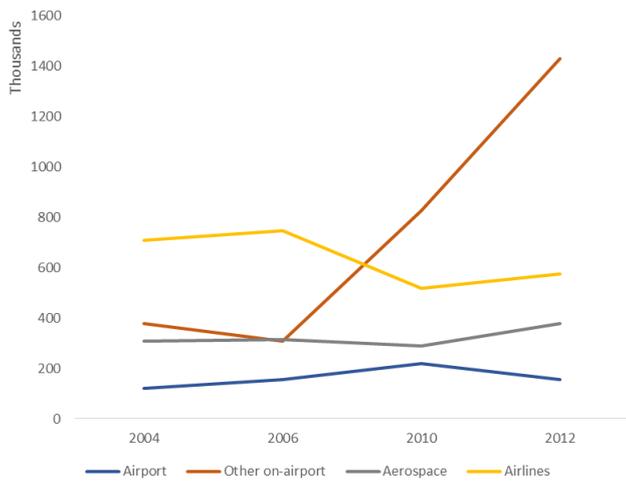


Fig. 1. European aviation employment trend [2]

The total GDP of the world aviation sector with direct economic impact in Europe reached \$210 billion in 2012. In total air transport supports 11.7 million jobs and \$860 billion in GDP in Europe- However, the latest study from 2012 does not include the breakdown of GDP for each sector.

The aerospace sector contributed almost one third of the total GDP in 2006 with almost the same number of employees as the other on-airport sector, which only contributed around 13% GDP. The GDP increased significantly in 2010 and 2014. This significant change is likely due to a new approach of what was included in the industry with direct economy impact; however, no detailed information is available.[3] The airlines made the greatest contribution to the economy, and if airports are also included, it is clear that the air transport sector is much bigger than the aerospace industry.

The following figure shows breakdown of GDP produced in Europe by each aviation sector in 2006.[4]

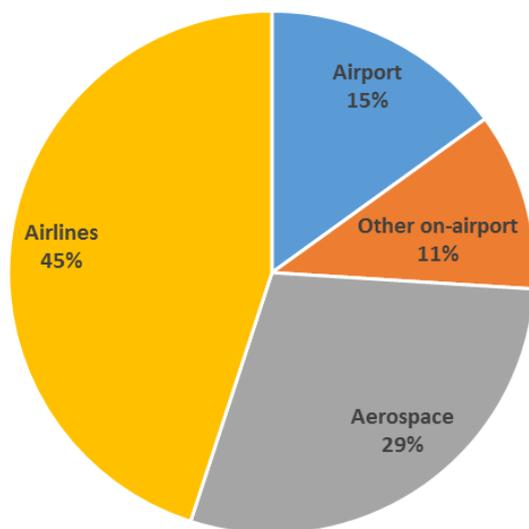


Fig. 2. European aviation GDP breakdown 2006

Compared to the aerospace the air transport in Europe is in terms of jobs growing annually three times faster. This approximation is based on data from a period between 2004 and 2012.[1][2][4] Air transport industry is therefore seeking for a new workforce; workforce composed of young, skilled and well educated people of both genders. In the present Europe is struggling with the lack of educated and trained professionals in different fields of air transportation.

Academia always reacted on the industry needs. Therefore the oldest aerospace courses could be traced back to 1910 but most of the air transport courses were opened after the WWII only as they responded to the fast growth of air transportation which boomed after 1950.

Thanks to the longer history and significant industry lobbying the European aviation research and education is today dominated by the aerospace. However, it doesn't match the external conditions and air transport industry needs.

### III. INDUSTRY NEEDS

#### A. Aircraft Operators / Airlines

According to the presentations of Workshop participants each sector of air transportation has different needs. To start with the aircraft operators, their requirements are different and dependent on the size and the business model. Airlines have different needs compared to business aviation. Each of these companies need both pilots and operational staff. But the educational requirements could be different. For example some of operators doubt if pilots need a university degree and prefer engage professionals without higher education to keep labour costs low.

According to MRO organisations it is also the case of technicians involved in heavy maintenance. However, business aviation companies are struggling with different needs. The world of business aviation is not the same as the world of large traditional airlines. Pilots working for business aviation have to be highly reliable professionals but on the other hand also educated and good managers and to have good communication skills.

The same requirements of higher education apply also for another aircraft operator employees involved in the administrative, planning or management processes. The current need is to have a flexible staff with knowledge of air transport and language. Accordingly to Workshop participants, a good knowledge of project management, general knowledge of air transport and standard working level of foreign language provide robust background for a candidate. Therefore main task for academia is to provide such a package.

To address these requirements a complex education and training model known as iPOP™ could be used. The model includes education, motivation and training from “a cradle to a grave” in line with the industry needs.[5] There must exist a continual support of the employee life-long development to ensure following: retain existing employees; promote existing employees; establish future employee pipeline; “to build” the future employee; recruit and retain future employee; to get new skills and certifications. Communication and cooperation

between academia and industry is therefore critical for success in all these areas.

### *B. Heavy Maintenance / MRO*

Compared to the aircraft operators, Maintenance and Repair Organisations (MRO) have slightly different employees structure therefore requirements and needs. Current practice is that some of MRO companies are moving from the “old” European states to the Central or Eastern Europe to cut down labour costs. Needless to say such changes cannot jeopardise the air transport safety levels.

Advantage of the Central and Eastern Europe lies in skilled workforce and good craftsmanship. Technicians do not need to have a university degree, but the leading staff do. The leading personnel should have mechanical engineering background to understand the technology which backdates in decades; followed by learning the leadership skills in combination with project management to effectively control scarce resources of the MRO company. The common training and educational need for MRO and aircraft operators/airlines are the management skills of a candidate and a good level of aviation knowledge in combination with language.

### *C. Airport*

Large airports are often perceived as small cities. Each organisation or company based around or at the airport have different requirements on employees. Staff majority working at the airport do not need higher education to deliver their work right. But airport operations cover also high number of staff which needs university degree. The reason is not certainly a requirement to have a title; but be educated, trained and skilled in certain area of the air transport.

Accordingly to industry experience, the graduates do not have all skills needed by the industry, in particular communication and negotiation competences and leadership skills

There is also an emerging need to unify training courses for specific positions of handling staff to increase mobility of skilled personnel. These airport employees do not need university degree, but their knowledge and skills need to be gained and trained. To date there are no certification courses in Europe for such positions as air-bridge operator, tug vehicle driver, de-icing trucks operators, fire-fighters etc. These positions require staff with appropriate knowledge, but each airport or handling agency must to train their workers accordingly. Courses providing certification for highly specialized positions could support employees in their career when changing positions and also decrease handling agencies training costs. These advantages are emerging especially in today’s deregulated market environment.

### *D. Air Traffic Management*

The area of Air Traffic Management covers a wide range of organisations and companies; starts with ANSPs, going thru State Regulators and finishes by consulting companies. Accordingly to the Eurocontrol experience the way forward

lies in close cooperation between academia and the industry. This cooperation can feed industry by motivated students. These students are often relieved of the corporate uniformity and therefore more likely bringing new ideas into the fusty corporate environment.

Basic knowledge and skills needed are fluent English so all employees can communicate together and analytical and critical thinking, which supports robust decisions and conclusions; and last but not least the computer literacy though employees are able to work with IT technologies on a required level and reasonable speed. Important skills to be taught and trained are also presentation and communication skills. Communication skills are often supported by analytical and critical thinking.

## IV. MISSING SKILLS ORIGINS AND PREDICTED SHORTAGE OF STAFF

### *A. Absence of leadership skills*

“If companies think their junior staff lack leadership skills, maybe the real problem is a lack of visible role models within the company.” For 30 years Roy Franklin ran what became San Juan (community) airlines, without a single fatality or serious injury, despite appalling island winter weather and hazardous fire-fighting mountain flights. The passengers who were often his neighbours were entrusting their lives to the sound-judgement of the pilot. Roy earned this respect by placing passenger safety first when deciding when to fly and on occasion, by knowingly placing his own life in danger to fly a seriously ill patient to the regional hospital during appalling weather.[7] Roy’s background was as a Naval Pilot, where rapid decision-making required extensive pre-flight scenario-thinking. Roy’s mental fly-the-flight BEFORE physically making the flight, along with a post flight debrief approach passed on valuable expertise to other less experienced pilots. Roy didn’t talk about leadership, he lived it and provided a visible example to enable younger pilots to model themselves on.

### *B. Are so individualist that they are unable to work in teams*

If the airline industry is stating that they would prefer staff candidates who have a more holistic view of their position within the company and society in general, the future may involve making staff selection decisions using a decision-weighting based more on staff attitude and being less fixated on best-in-class technical aptitude. Professor Geert Hofstede viewed individualism as one component in the dimensions of national culture. Hofstede defined individualism as having a preference for “a loosely-knit social framework in which individuals are expected to take care of only themselves and their immediate families. Its opposite, collectivism, represents a preference for a tightly-knit framework in society in which individuals can expect their relatives or members of a particular in-group to look after them in exchange for unquestioning loyalty”.[8]

C. *Absence of theory-based feedback loop after practical experience (absence of introspection)*

By focusing on the commercial pilot market and only taking on students who are willing to simultaneously pursue an aviation management degree on-site, Airline Training solutions are delivering a more rounded graduate, one who better comprehends the chain of factors involved in safe decision-making. Hayden Malone of Airline Training solutions (Jacksonville, Florida) has shown that even small-scale training schools can enhance the theory-practice feedback loop in pilot education by linking up with globally-accredited third level education organizations such as Embry-Riddle Aeronautical University.[9]

D. *Predicted future staff shortages*

Is there really an emerging shortage of pilots?...or is there growing evidence of a flawed training system failing to deliver the quantities of graduating pilots which the industry requires? An 83% dropout rate for student pilots is evidence that something is seriously wrong.[10] Perhaps the weakness is in the absence of a marketing budget which would enable the flight school to charge more profitable fee rates, which in turn would enable them to hire and retain only those instructors whose students don't drop out at alarming rates. Flight training schools should market themselves based on their graduation rates and subsequent graduate employment rates instead of merely matching the cheapest flight rate per hour in the region.

V. CONCLUSIONS

Further discussion between academia and industry could be recommended to understand better each other and to fit student's profile to industry needs.

The Air Transport Department (ATD) of the University of Zilina has already started a research aimed at better understanding of the air transport industry needs. The research is based on The Survey on Quality of Aviation University Courses in Europe and The Survey on Aviation Students' Internships and its Status in Europe.

The Survey on Quality of Aviation University Courses in Europe evaluates the aviation university courses against the needs of the aviation industry. Outcomes of the survey will be used to redesign the academic courses so that more students are attracted to aviation; so that graduates are more easily dovetailed into aviation related careers and so that the academic institutions can strengthen their role in meeting the global aviation challenges.

The Survey on Aviation Students' Internships and its Status in Europe evaluates internship placements and compares requirements on students, aviation companies and legislative statuses within different member states' participants. Outcomes of the survey will be used to redesign the internship requirements so that more students are supported in their aviation courses and future careers; so that graduates are more easily dovetailed into aviation related careers and so that the academic institutions can strengthen their role in meeting the global aviation challenges.

Accordingly to the majority of experts the cooperation between the air transport industry and academia is of the highest importance. Industry-academia alliance can give an answer to the question from the beginning: "Which skills and knowledge would be needed in seven to ten years?" However, not all needs could be fulfilled by accredited courses because of the "big moment of inertia" and long time needed for changes.

The following figure represents the ideal flow of education, theory and industry needs within all sides involved.

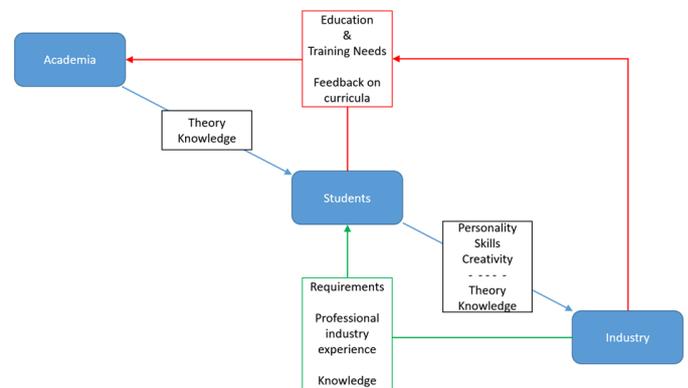


Fig. 3. Optimal knowledge flow within aviation network

It is doubtful if the High-Level Target Concepts defined in ACARE SRA2 could be reached by improvements in technologies. For example jet engines are at the top of the technology cycle and in energy efficiency, and environmental impact technology allows only small improvements. On the other hand we can cut down fuel consumption, flight times and emissions in tens of percent by operational and flight procedures. However, from a global perspective aviation in Europe is losing its position and we should ask whether the existing support of air transport education and research is adequate and if it should get more attention and resources.

Many times the graduates do not have all skills needed by the industry, in particular communication and negotiation competences and leadership. Followed by theoretical knowledge, computer literacy or project management skills etc.

At present the way forward therefore could lie in gradual increase of cooperation between academia and industry. Students - interns who cooperate on different basis with the industry can bring valuable information to academia; while on the other hand also appreciated new concepts and knowledge to the industry.

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