

Education and Performance in Aviation: Realising and Sustaining Benefits

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Introduction

Globally Air traffic is expected to double in the next twenty years, and in the Latin America and the Caribbean we expect to have doubled the market in 10 years. This will inevitably create new challenges in terms of equipment (e.g. aircraft) and infrastructure (e.g. IT systems, airports) that are necessary to meet this increased demand level in an environment of changing competitive dynamics. As aviation is characterized by a complex supply chain, further pressure will be exerted on the system and therefore, radical measures should be introduced to ensure long term sustainability of operations. In this context, education and training in the sector (both of technical and managerial nature) should not be seen as a cost but as the roadmap to competitiveness and success in the marketplace. Putting people first is of essence in an increasingly automated sector and appropriate policies should be designed to address the various knowledge and skills gaps.

Moreover, it is important to reach the appropriate scale of sector-educated and trained people to realize and sustain benefits for all involved stakeholders. In fact, education offers a first-class opportunity for aviation supply chain participants to focus on their synergies rather than their conflicts and build the necessary people-oriented transformational strategies for a brighter future.

Supply vs demand and quantity vs quality

There is a relevant gap of talent in global air transportation industry and the tendency shows us that the gap will increase annually unless immediate proactive actions are taken to address the problem in all levels of education and training organizations of the industry.

Industry needs talent and they need it now and the demand will keep growing it in the future. Nowadays there are a lot of complaints about new graduates and their lack of important skills required for them to survive and succeed in the business. The digital revolution that we are experiencing is transforming the aviation industry in terms of technology and productivity, demanding skills, practical and theoretical, that previously were not necessary to the newcomers.

To close this formation gap, we need to build training tools to offer a fast track to learning and qualification. The more traditional approach of supplying human resources to the industry is no longer valid. And the industry is reacting as we see a reduction in number of academic institutions and an increase of corporate training centers/academies, showing a new tendency of attracting and preparing new talent for the business.



It is important to remember that the economic growth that leads to a continuous rise in aviation demand also generate a demand of talent for other type of business, creating a competition for human resources. And the aviation high cost of entry generates a barrier that is really important to consider. The time and money spend, in the traditional academic system, to prepare aviation talent is one of the reasons that we have a lower supply of human resources in a growing demand environment and that is the problem that corporate academy is trying to address.

From internet research we find that *“according to the Boeing Long-Term Market Forecast (2016-2035), the global aviation industry will need to hire more than 2 million aviation personnel. It is estimated that 617,000 commercial pilots, 679,000 maintenance technicians, and 814,000 cabin crew will be required. It is no surprise the Asia-Pacific region will have the highest demand for aviation personnel followed by North America and Europe then a distant Middle East, Latin America, Commonwealth of Independent States (CIS), and Africa. These statistics don’t include all the “other” types of positions that need to be filled and certainly don’t account for the creation of new types of career opportunities that will emerge with the advancement in technology and other factors we are not aware of yet.”* (Source: internet article by John Wensveen PhD – Professor of Air Transportation at Purdue University)

The industry needs to really think this problem thoroughly and try to find a solution to reduce, in a first moment, and solve, with more decisive actions, the talent gap challenge. The solution must consider a partnership between the traditional academic system and the industry, in order to find new paths to close the actual gap of knowledge and innovative skills.

New trends to address new challenges

The recruit system used nowadays try to hire talents from universities, training providers, military, and sometimes, from other aviation providers and we know that this “buck of talents” is not sufficiently big to “feed” everyone in the business. Also, the lack of proper preparation/education aforementioned in this document, need to be addressed by the contractor meaning a lot of retraining which requires massive training Departments and absorbing a workforce that could be used in the main line, where the revenue is generated.

To solve this problem a huge number of organizations are creating their own Corporate University and trends are showing that these number are on the rise, to a point that, in the future, might surpass the number of traditional universities.

From internet research we find that companies like Disney, Apple, McDonald’s, Oracle, JetBlue, Southwest Airlines, and Boeing, just to mention some of them, are investing approximately 2.5% of payroll in their own education and training system to reduce the gap of knowledge that we are seeing nowadays and looking to benefit in the long term. They realized that sharing the organization’s strategy and vision, since the beginning of the formation process, allows alignment of the syllabus with organization’s initiatives,



corporate culture, and leadership thinking, allowing quicker adjustments in the education process when needed, especially in the technology aspect which is the most change sensitive subject of all.

But to make this kind of initiative sustainable, in the long term, Corporate Universities need to find partners in the academic world to also offer proper accreditation, which will allow them to solve the problem in the long term, being able to attract new talent, recruiting students in the traditional way (giving full education), and retain them in the future.

Technological progress

Other huge challenge for the education of the aviation industry is the transformation that we are seeing regarding the arrival of automation linked to artificial intelligence (AI). This new disruptive technology will transform the workplace and the nature of work forever. Most of the machines will be able to perform tasks that today is done exclusively by humans, this will result in three different kind of jobs, done by machines: those that complement the work of humans; those that can replace the tasks done by humans; and those that go beyond human capacity, doing tasks impossible to humans. As a practical result, we will see the dawn of certain types of jobs, the rise of different types of jobs and, as the most common result, the change in the way the job is done.

This transition will be significant and will bring a huge disruption in the work market. Displacement, dislocation, extinction, those are words that will be heard among workers in their workplace. Most of the changes are occurring in automated systems, sensors and software, where AI has made huge advancements lately.

These changes are generating huge value in systems, products and services. Many organizations use AI to upgrade and personalize their processes, generating unique advancements that adds significant value to their business. From research on the internet, we found that *“the most advanced deep learning techniques deploying artificial neural networks could account for as much as \$3.5 trillion to \$5.8 trillion in annual value, or 40 percent of the value created by all analytics techniques.”* (Source: internet article by James Manyika and Kevin Snelder)

AI in aviation

Automation has made a huge difference improving aviation in the past. Although the human has been the main performer in aviation (pilots, air traffic controllers, mechanics) automation changed the path of aviation and made the air transportation system the safest way to travel in the world. System changed the way pilots fly the aircraft, the way air traffic controllers can handle an increasing demand in air travelling, the way we commercialize, process and control air tickets, the way we process the necessary security



screening of passengers luggage, and the way we check and properly maintain our aircrafts.

Voice recognition applications, Global Telecommunication Systems, touchscreen navigation screens, are only small examples of the huge improvements we have seen in the past in the place where the most significant changes occurred: the cockpit.

Now we can see new systems, based on AI, that can continuously monitor published weather forecasts and compare them with the aircraft's flight plan. These systems can calculate optimal descent profiles, based on the weight and airspeed, that can avoid heavy weather and remain efficient, saving fuel and time, or provide the proper alternate airport to the flight crew. Currently, we are seeing systems limitations, like FMS capacity, to enjoy the full benefits of an AI assistant, challenge that will be addressed and solved by the industry in the near future.

Another great example of Big Data and Deep Learning algorithms use in aviation, that increased the safety levels of the aviation is the runway overrun prevention systems, where a software can use the aircraft height, airspeed, weight, compare to a runway database and use the local weather condition to calculate, through a mathematical model the distance required for landing. If the calculations show insufficient length, the system alerts the pilot, giving alert message calls.

Implementation barriers for Deep Learning

Dario Martinez, in his article about the aviation revolution and deep learning said that: *“the challenge to introduce AI into aviation industry does not stem from technological limitations, but rather defining the right safety cases that will convince certification and regulatory authorities along with the associations of involved professionals. Furthermore, introducing AI-based technologies to onboard equipment is more challenging than applying the technologies to ground software or air traffic management initiatives.”*

Safety is the first priority in the aviation business. Any accident or incident brings a lot of attention to industry practices and creates a lot of skepticism to the client base. Introducing new technology brings new challenges. We are seeing, right now, with Boeing 737 MAX situation that a new technology, when not properly explained and processed through the training pipeline can be deadly and draw back instead of pushing the industry forward.

This is the main barrier to new technology, based on deep learning. Every new system is made to take from the pilot the authority to properly fly the aircraft, which can be a very useful tool, but can also bring a lot of problems, when the flight crew is not properly trained to use and deal correctly with the systems malfunctions.



Again, citing Dario Martinez, *“the first issue stakeholders may detect in applying Deep Learning models into real safety aviation problems is the black-box problem in Artificial Neural Networks (ANNs). A neural network is a black box in the sense that while it can approximate any function, studying its structure won’t provide any insights on the structure of the function being approximated. This means that you can predict a safety event with 99% accuracy but won’t know the contributing factors.”*

So, the question remains: how can we predict that reactions of the machines, based on deep learning systems, will perform the way it should? These are the main challenges for the civil aviation authorities to give the airworthiness approval for these systems.

Competency-Based Training Programs

Now, how can we connect all these dots? We addressed the education/training programs and the AI systems in aviation. Where these two subjects meet?

On the traditional educational system, the training is based on contents and the delivery has a time frame and needs an instructor to provide the classes. The syllabus contents are based on defined training objectives and the examination system establish the level of expected knowledge from the participants. In this kind of program, the previous competencies of the participants are rarely evaluated before attending the training. That is why the industry came up with a solution, based on a new system where the training is based on needs to perform defined tasks and it is learner-centered. This new system is called Competency-Based Training (CBT).

To establish a system like this, we need to analyze the training needs, defined by the gap existing between the competencies needed to perform determined tasks compared to a standard (quality and expected performance). In a system like this, the training is individual and needs an initial assessment of every participant to establish the expected outcome of the training session. Next, the training method will be defined to bridge the competency gaps in every aspect: knowledge, skills and attitude.

According to Ilias Lappas and Kyriakos I. Kourousis, the expected benefits of CBT are:

- *“More focused training: training needs for each individual are identified and the training focuses on filling the specific knowledge, skill and attitude gaps of the individual;*
- *Addressing particular job requirements: due to the wide variation of the tasks involved throughout the life cycle support of a modern air platform, no single training program can satisfy the training requirements of the aerospace workforce. A variety of training programs that reflect the different job requirements in the various fields of the air platform’s life cycle have to be established. CBT moves away from content and instructor-centered training to student and competency-centered programs.”*

Conclusion



To summarize this position paper, we need to establish that before we start exploring new technology, we must mull how will the industry train their future professionals and what is the ideal type of learning system they will use.

We already agree that the traditional education system is not working properly for aviation business. The organizations are creating solutions to address the problem, using corporate universities to bridge the knowledge and practical gaps existing today.

But we still need the traditional education system to bring accreditation to this corporate university system, so a partnership between the academy and the industry is fundamental to close the gaps and give sustainability to the system, addressing the problem in the long term and retain their talents.

On the other hand, AI and Deep Learning System came to cause a disruption that need to be taken care of. The old training methods, based on defined training objectives and examination systems that establish the level of expected knowledge from the students, are becoming rapidly outdated and need to evolve to a system where the approach to technology must be correctly addressed and the competencies must be the center of the learning system, where an individual approach to training can bring future benefits to the industry.

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