



2019_RECOMMENDATIONS

**EDUCATION AND PERFORMANCE
IN AVIATION: REALIZING
AND SUSTAINING BENEFITS**



2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION: REALIZING AND SUSTAINING BENEFIT

Introduction

Air traffic is expected to double in the next twenty 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.

Having the above in mind, three main issues and questions emerge with respect to education and human resource management in the future world of aviation, i.e.:

- **What are the challenges set by automation and artificial intelligence for the future of aviation education and training?** Expected developments in technology may have important implications for aviation jobs in the future. Unmanned and remotely controlled aircraft may question the need to train pilots; robots may be able to undertake many operational tasks currently undertaken by people; blockchain technology may reduce errors and the need for control; while artificial intelligence may render data analysts and managers less important if not redundant. How can aviation ensure that people who are currently (or in the next ten years) educated and trained in the sector can be usefully re-deployed or re-trained? How can the acquisition of educational skills prove flexible enough to accommodate technological disruptions in a service sector such as aviation?
- **How do education and industry dynamics shape the future of industrial relations and human resources management in the aviation sector?** In a liberalized and commercialized environment, knowledge of economics, management, marketing and soft skills becomes of essence to effectively run a business in aviation. At the same time, commercialization also sets pressures on increasing the effectiveness of operations. This may also have important connotations for gender balance in the aviation workplace since the percentage of women involved in STEM-related jobs remains small. Having this in mind, what should be the

2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION: REALIZING AND SUSTAINING BENEFITS



educational background of future aviation managers? Is there a clash between operations/technical-oriented and soft-skills oriented organizational culture or is there real room to explore educational synergies to improve the effectiveness of management? How can education and training in aviation affect sectoral gender balance and industrial relations in the future?

- **Who will bear the cost of education and training in the aviation sector?** In an increasingly marketized environment of post-secondary education, governments in many countries become reluctant to keep funding studies at undergraduate and predominantly postgraduate levels - same is the case for vocational training. As air transport education and training may prove costly predominantly in the case of flight crew but also in the case of other operational and managerial skills, interested youth may have to become heavily indebted to fund their studies if they cannot rely on their families. In this context, are the aviation industry stakeholders willing to become more proactive partnering with existing educational institutions and/or setting up their own academies? Can such a proactiveness not only increase their contribution in the educational curriculum design but also help young people to realize their potential thus avoiding a gap in skills?

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



INTERVIEW

R19-I/01
09/04/2019

Education and Performance in Aviation: Realising and Sustaining Benefits

Dr. O.B. Aliu, ICAO Council President

Who will bear the cost of education and training in the aviation sector?

Globally the circumstances relating to educational and training subsidization are too diverse to suggest any sort of single response to this question. Country-to-country there will naturally be variance in how much the individual student, corporate stakeholders in the sector in question, and government bodies will assume the costs.

Apprenticeships and internships relating to more specialized aviation responsibilities, for example pilots and controllers, are often assumed by industry operators who see a clear value in investing in the assurance of a sustainable future workforce with the skills and capabilities they project to be needed. An airline or air navigation service provider, for example, will often carefully select ab initio cadets who are trained to their organizational specifications, as well as to meet specific licensing requirements for these positions.

ICAO also encourages greater public sector investment in national or local human resources development for aviation, mainly as countries also stand to benefit socio-economically when their local workforce is suitably skilled and prepared to ensure that local air operations are up to ICAO standards.

Are aviation industry stakeholders willing to become more proactive partnering with existing educational institutions and/or setting up their own academies?

For those specialized operational jobs like pilots and air traffic controllers - absolutely. And it is not just for those jobs. For example, some airports are expanding and including an onsite training facility for a wide range of aviation jobs as part of an “airport as a community” concept.

With an expected doubling of both air passenger and freight traffic volumes by 2035, airlines, airports and air navigation service providers are placing increased value on people development. They know that the steadily increasing air traffic will generate significant risks and that they need to have a competent workforce capable of meeting the needs and challenges of the global aviation community into the future. With the current focus on competency-based training and assessment for aviation professionals, in order to integrate technical skills development with those related to judgment and people management, many aviation organizations today are either enhancing their own course curricula or developing courses with universities or aviation training institutions.

2019_RECOMMENDATIONS

**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



INTERVIEW

R19-I/01
09/04/2019

ICAO is also partnering with various universities and other aviation educational institutions throughout the world to offer e-learning and certificate courses, and to establish graduate and post-graduate courses in such areas as Aviation Safety Management and Data-driven Decision-Making. Such activities support the mission of ICAO's Next Generation of Aviation Professionals (NGAP) Programme to ensure that the global aviation community, States, and service providers, have sufficient numbers and types of competent aviation personnel with the adaptability and flexibility to maintain safe, secure and efficient operations in a rapidly evolving air transportation system.

And there are increasingly more examples of international and national aviation associations partnering not just with universities, but with education and government departments to offer aviation learning opportunities to younger people still in secondary, or even elementary school, because they have recognized the need to be proactive in order to attract the best and brightest.

One example of this would be how the U.S. Aircraft Owners and Pilots Association is presently developing a four-year high school STEM program that falls along two tracks – flying and unmanned aircraft systems or drones. This will see high school kids undertaking real-world applications of STEM subjects as they work towards completing their secondary school education – and with the possibility of a certification or industry-accepted test when they finish, all before they enter university or the job market. Many of these students would not have even considered the possibility of a career in aviation without such exposure, which speaks to the value of these approaches.

As part of ICAO's Next Generation of Aviation Professionals (NGAP) Programme, we are looking at ways to foster further partnerships and facilitate similar approaches in other countries.

Part II

How do education and industry dynamics shape the future of industrial relations and human resources management in the aviation sector?

Educational dynamics play an important role in the future of Human Resources Management. For the first time, industry is experiencing a workforce composed of several generations, and the dynamics within the current educational system needs to address this.

Industry dynamics will shape the future as well. The aviation industry is competing with numerous sectors to attract today's best and brightest candidates, and will need to focus on aspects such as branding, establishing strong employee propositions, embracing diversity and inclusion, and increasing the progressiveness of management relations, in order to address this.

What should be the educational background of future aviation managers?

This depends on the aviation specialization in question and the specific managerial level. However as with every role in air transport there will be a need for a reasonable level of technical knowledge and awareness, which in combination with strong business competencies will generally result in well-prepared aviation managers.

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



INTERVIEW

R19-I/01
09/04/2019

Is there a clash between operations/technical-oriented and soft-skills oriented organizational culture or is there real room to explore educational synergies to improve the effectiveness of management?

There's not just room for synergies between an operations/technical-oriented and soft-skills oriented organisational culture – there's an absolute need for it.

The so-called “soft skills” are the ones that make for a more engaged, committed and positive workforce. They also help ensure that a necessarily standards- and procedures-driven industry is more flexible and adaptable while keeping the aviation system safe.

The days of becoming a manager by being the best or most senior technical officer are, or should be, over. Effective management today is defined by the application of appropriate “soft skills” that build on a clear understanding of operational context, and buttressed by a solid system-wide perspective.

How can education and training in aviation affect sectoral gender balance and industrial relations in the future?

The aviation sector is in general a male dominated industry today. But with the level of attrition and expansion now forecast, and in light of how significant our need for new recruits is, the gender gap is expected to decrease because we will absolutely need large numbers of both women and men to address the current and expected shortfalls.

This speaks to why cultural norms and biases need to be addressed to lay down the foundation for girls to aspire to educational paths leading to skilled careers. That means we need to work to see more gender equal access and encouragement for these educational objectives, including programmes related to Science, Technology, Engineering and Mathematics (STEM). Continued training and development for women already in the sector is also necessary in order to retain and promote women.

In 2016, the ICAO Assembly reaffirmed its commitment to gender equality and the promotion of women in the global aviation sector through States' endorsement of the *ICAO Gender Equality Programme*.

Part III

What are the challenges set by automation and artificial intelligence for the future of aviation education and training?

While the demand for air travel continues to expand exponentially, the rate of change in the aviation system and increasing levels of automation make it difficult to know what the aviation jobs of the future will actually look like. I expect there will be many that we can't even imagine yet.

For this reason, aviation employers will need to recognize the importance of a comprehensive educational foundation and not just specialized training if tomorrow's air transport human resources are going to be resilient and flexible enough to respond to the accelerating changes in aviation-related technologies and operations.

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



INTERVIEW

R19-I/01
09/04/2019

As technologies have become more advanced and complex, the human role has begun to shift from one of an operator to that of a supervisor. Supervisory control has been a great advance in human-machine interaction, but rather than simply reducing human workload, it has shifted the onus from manual to cognitive demands. Ironically, the more advanced the automation, the more crucial the human contribution, because humans are left to do the tasks which could not be automated. What's more, human resources must be prepared to intervene when automation fails, or when it encounters conditions it hasn't been programmed to accommodate.

So the future education and training challenges set by automation relate not just in understanding the algorithms on which the outputs are based, and what they mean operationally, but also in dealing with the unexpected and systems thinking, with a focus on managing change within the aviation system.

How can aviation ensure that people who are currently (or in the next ten years) educated and trained in the sector will not become unemployed in thirty or forty years' time?

To produce the next generation of aviation professionals, educational institutions will need to adapt their curricula to provide students with the resilience and flexibility needed to respond to the rapidly-changing aviation system. This is that educational foundation I just mentioned.

At the same time, the aviation industry will need to place a large emphasis on continual upskilling and upgrading of competencies across an individual's career wherever they are in the aviation occupational spectrum. Lastly there is a personal onus upon every professional to maintain their relevancy and effectiveness through proactive skills upgrading as their area of specialization evolves around them.

Education and Performance in Aviation: Realising and Sustaining Benefits

Presented by Arab Air Carriers Organization - AACO



AACO's Views on Education and Performance in Aviation

Introduction:

While the aviation sector is unique in its dynamics as compared to other service sectors, the issue of educating and training human resources in a way that would cater for the expected technology disruptions/ automation is a challenge faced by most sectors around the world. The World Economic Forum has recognized that the ongoing gap in skills as technology further reshapes business needs should be addressed, and highlighted three key areas that should be part of a systemic change in education and training in order to address this issue as follows:

1. Connecting education and employment

Employers need to collaborate with schools and universities on the development of curricula and a shared practical knowledge of the market. The education system also needs to change to allow a focus on lifelong learning.

2. Improving forecasts

Better forecasting of industry and labor-market trends is vital to allow governments, businesses and individuals to react quickly to change. Big data is likely to prove pivotal in developing more accurate predictions of where the jobs market is moving and where the skills shortages are expected to lie.

3. Disrupting education and labour policy

Education and labour policy need to be re-examined to make them more reactive and relevant to the ever-changing market realities.

AACO's Opinion:

Reflecting on the three key areas above as highlighted by the World Economic Forum, we believe that the aviation sector, including all its relevant stakeholders (public and private), can work according to the following roadmap in order to address the challenges that Artificial Intelligence (AI) and Automation bring to the future of aviation jobs, and also to make use of the new promises that these two developments bring as new occupations emerge.

1- Working with governments (early education years)

Aviation Stakeholders can start advocacy at a national level with the public sector/ governments to focus on enhancing and changing the school systems to improve basic skills that would be much needed for employees to be able to adapt to the changing business needs resulting from technology disruptions. Emphasis can be on creativity, critical and systems thinking, and adaptive and life-long learning.

2- Working with higher education institutions (higher education years)

When it comes to higher education, aviation stakeholders can establish partnerships with education institutions to train students (through internships) seeking future jobs in the aviation sector. This way, starting with the basic skills acquired at schools that would help students adapt their skills and knowledge with technology disruptions, followed by some knowledge from the sector during higher education years would put future employees on the right track in their aviation careers.

Partnerships and continuous dialogue between aviation stakeholders and higher education institutions is also very important in adapting the curricula to include studying material that is relevant to aviation jobs.

3- Working with aviation technology providers (when on the job)

Partnerships also need to be established with technology providers in the aviation sector to provide the needed training for employees to adapt to incoming technologies.

Aviation technology providers should be asked by the technology users to provide forecasts of incoming technologies and share those with the technology users (airlines, airports, etc...) so that the latter prepare for a smooth transition of workers' skills and can as well do their own internal forecasts. On the other hand, aviation technology providers should also establish links with education institutions and share technology forecasts in the aviation sector so that the latter would adapt their curricula to provide the required skills for students to cater for future business needs.

4- Working with Policy Makers:

Airlines and other aviation stakeholders might choose to establish their own aviation academies or continue enhancing their partnerships with training institutions, but before getting creative on more ways to spend money on human resources, advocacy with governments is essential to create incentives for stakeholders to invest in human capital and job creation. These incentives could be as follows:

- a. Tax benefits: on one side to reduce taxation in general on the aviation sector so that it plays its role as a driver to the economy, and on the other side to advocate for receiving tax benefits on everything related to educating and training employees. For example, tax and customs exemptions for imported simulators to train pilots.
- b. Removing restrictions on investments (national and cross-border): opening the market for the private sector to invest in aviation entities (airlines, airports, etc...) would help aviation entities receive the proper financing to invest in educating and training their employees.
- c. Removing regulatory burdens: Removing regulatory burdens, opening up markets for the free flow of people and goods, easing visa restrictions to stimulate demand on travel are few of the elements that could help airlines and other aviation entities be profitable enough to re-invest money in enhancing human resources.

5- Embracing Technology:

While it might sound contradictory, but embracing technology is also one of the key areas that the aviation entities need to do. New occupations would emerge as a result of new technologies. New technologies used for training purposes would also help in educating and training personnel. Tools for e-learning is one example.

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/02
30/03/2019

Education and Performance in Aviation: Realising and Sustaining Benefits

Presented by IATA



**IATA Aviation Human Resources Report
2018**

Exploring recruitment, retention and staff
development in the aviation industry

Table of contents

Executive summary	4
Part 1: Setting the scene	7
Part 2: Employee numbers are taking off	9
Part 3: Attracting and retaining talent - the challenges	15
Part 4: Attracting and retaining talent - the solution	19
Part 5: Improving training and development	23
Conclusion	27
Methodology	28

Executive summary - Five key findings

The aviation industry is rapidly evolving. As it does, the demand for talent within the industry – from customer service to ground operations – will also evolve. But what does the future demand for talent look like, and how well prepared is the industry to conquer upcoming challenges?

This report is based on a survey of over 100 leading industry HR professionals at airlines, airports and ground service providers. These professionals are responsible for the training and development of staff around the world, representing all geographic regions and a range of organizational sizes.

Here are 5 key things you need to know from what they told us:

1. Significant growth in jobs is forecast

Staff numbers in the industry are set to soar both in the short- and the long-term, driven by a strong increase in passenger numbers. Three job roles emerged as having the highest anticipated growth in demand.

- Ground operations
- Customer service
- Cabin crew

2. Finding new talent is a much bigger challenge than dealing with retirements.

48% of HR professionals in the industry say that recruitment is the biggest challenge they face compared to just 5% saying retirement. Specifically, the biggest recruitment challenges are:

- The availability of applicants with the right skill levels and qualifications
- The salary demands of new applicants

With recruitment already a major challenge, strong retention of talent (quoted as the biggest challenge by 25%) will be vital to prevent this becoming further heightened.

3. Current training initiatives are not effective enough.

In addition to their salary, job applicants prioritize training and career development opportunities as most important. However, HR professionals do not think the aviation industry is adequately meeting this demand. In particular, the quality of training programmes is not seen to be good enough: only 28% of HR professionals say that current training is very effective. Many organisations report that they will be looking for increased help from external partners to improve the effectiveness of training.

4. Providing training in safety and customer service skills are higher priorities than IT and digital skills.

As basic digital skills become commonplace in the market, twice as many HR professionals say that safety and customer service skills are priorities for training and development compared to IT and digital skills.

5. Technology is changing, not replacing, the customer service role.

With self-service options on the rise, traditional customer service roles of check-in and gate agents will evolve and remain an integral part of the industry as organisations seek to deliver a smooth, hassle-free and enjoyable experience throughout the entire passenger journey.



Since expected pilot and maintenance shortages have been widely covered in the industry already, this report chose to assess jobs outside of these areas.

Part 1:

Setting the scene

2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION: REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/02
30/03/2019

In the future, what might the passenger experience in the aviation industry look like?

- 'Robot guides' in terminals, on-hand to answer passenger questions and provide traveller assistance?
- Passengers using mobile apps to pre-order food and gifts for collection at the airport or to be served on their flight?
- Biometric identification automating customs and border control to simplify and speed-up journeys?
- Electronic, re-usable, bag tags, linked to mobile apps, enabling passengers to automatically check-in their bags whilst also avoiding paper waste?

It might surprise you to know that all of these are already happening. And furthermore, whilst these developments are set to become mainstream, they barely begin to even scratch the surface of the potential changes in the industry.

Prospective game-changing innovations in aviation are numerous and rapidly evolving. Driven by technological, societal and environmental pressures, IATA's [Future of the Airline Industry](#) report outlines various scenarios that might affect the aviation landscape in the next twenty years.

Whatever the industry ends up looking like though, one thing is certain: these changes will have significant impacts on the personnel who work in aviation. And not just pilots (who often dominate the headlines) but cabin crew, ground staff, customer service teams, administrators, financial staff and many more. With around 10 million people directly employed by the global air transport industry, the list goes on.

To best prepare the industry for the coming changes, it is therefore vital that we understand the long-term trends, priorities and challenges related to staffing. This report is based on a survey of over 100 leading industry HR professionals at airlines, airports and ground service providers. These professionals are responsible for the training and development of staff around the world, representing all geographic regions and a range of organizational sizes

We hope you find this report interesting and useful.



Part 2:

Employee numbers are taking off

2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



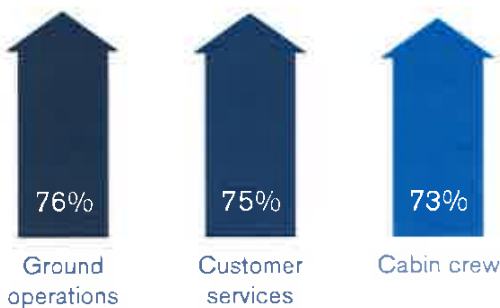
POSITION PAPER

R19-PP/02
30/03/2019

Let's start with the view from 35,000 feet: in terms of pure numbers, the aviation industry is set to become a much more crowded workplace over the coming years. Across a wide spectrum of job roles – from ground operations to customer service, finance to security – the respondents to our survey overwhelmingly indicated that they expect staffing numbers to increase over the next two years.

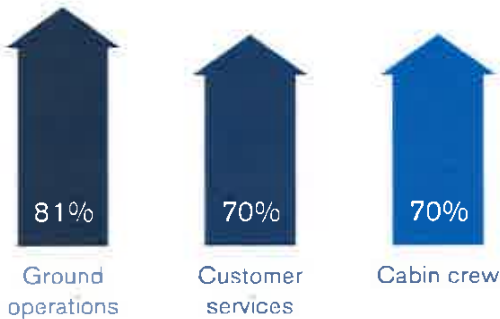
In particular, there are three areas where especially high growth in job numbers are expected: ground operations staff, customer service professionals and cabin crew.

Percentage of respondents expecting growth in each area in the next 2 years:



And this growth is not just a short-term spike. Our interviewees were adamant that job growth is here for the long term. In addition to the job roles outlined above, the need for regulatory and security roles is also expected to surge over the next 10 years.

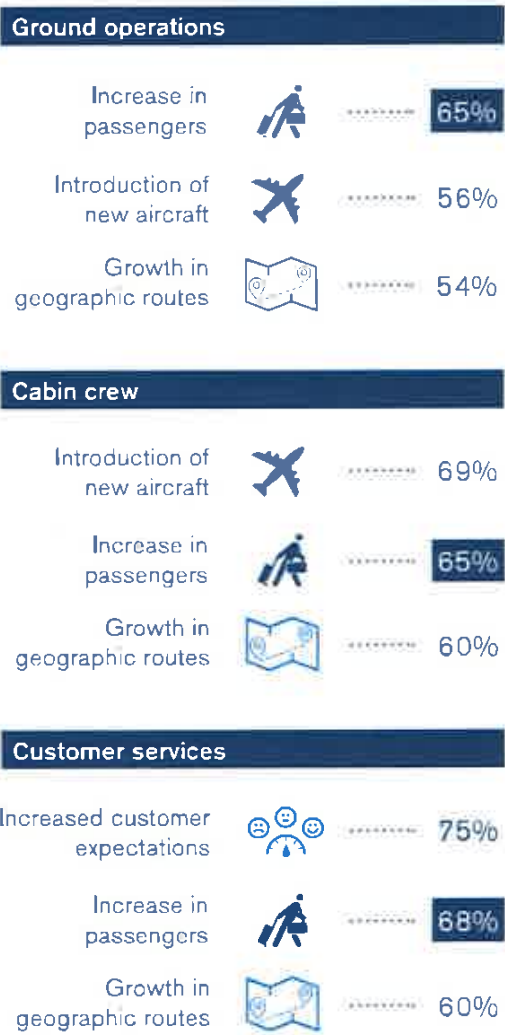
Percentage of respondents expecting growth in each area in the next 10 years*:



*Respondents also expect growth in Regulatory (63%) and Security (65%) in the next 10 years.

So what is causing this growth? Job growth and demand is dependent upon a wide myriad of interlinked factors, which can differ depending on the exact job role in question. However, one consistent driver of growth across all job role areas in aviation is seen to be the anticipated increase in passenger numbers. Over the next 20 years, IATA forecast a near doubling of the number of passengers flying today, i.e., an additional 3.8 billion, and the respondents to our survey are clear that this will result in the need for significant numbers of additional staff.

Factors that cause an increase in job roles in each area:



2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/02
30/03/2019

The regional view:



The need for additional cabin crew, ground operation staff and customer service staff is expected to grow particularly strongly in Africa, Asia-Pacific and Middle East. These are also the regions with the highest predicted growth rates according to the [IATA 20-year passenger forecast](#).

Passenger growth and job growth is not a perfectly linear relationship though. Cost-reduction initiatives and the introduction of more efficient practices both have the potential to decrease job numbers in some areas.

According to our interviewees, the job roles most at risk are Management, and Finance & Accounting. When it comes to Management roles, 57% of interviewees believe cost reduction initiatives may lead to job cuts, whilst, for Finance & Accounting, 61% of interviewees think the introduction of more efficient practices could reduce staffing levels. Key here, as stated in the [IATA report Supporting Airline Industry Achievement of Sustained Financial Health](#), is upskilling finance personnel to transform the role from what might currently be considered an 'administrative' one to more of a 'value-add'.



Self-service will change customer service, not destroy it

One area in the midst of a significant change is customer service, as new self-service systems and technologies take hold. According to the 2016 SITA Airline IT Trends Survey, 'three out of four airlines have already made check-in and boarding passes widely available through mobile apps and these services will become almost universal - surpassing the 90% mark – by 2019'. There is also significant growth expected in the coming years around baggage and boarding self-service solutions.

In our survey, 68% of HR professionals expect that the greater use of customer self-service options on passenger mobile phones to reduce demand for customer service workforces. 59% say the same for in-airport self-service options.

Given this rise of automation and self-service, how is it that customer service roles overall are set to increase in number? The answer is that the rise of self-service and automation isn't eliminating customer service roles, rather it is changing the job description – arguably making it more important than it has been historically.

In 2014, the US Bureau of Labor Statistics reported that employment of customer service representatives was projected to grow 10% from 2014 to 2024, faster than the average for all occupations. They attributed this growth to an expansion of what it means to be a customer service professional.

A good example of where we have already seen a technology-driven change in the job description of customer service staff is the retail industry. In many stores, previously till-based staff have become more flexible, moving around the shop, interacting with customers, answering queries and taking payments, all on-the-go with the help of mobile devices.

As traditional customer service roles (such as check-in) are automated or become self-served, fewer staff will be needed behind fixed desks. Instead, customer service in aviation is set to become much more about interacting with customers at any point in their journey, answering complex questions on the spot, and improving their overall in-airport and in-flight experience.

In the next
10 years
check-in
personnel and
gate agent roles
are expected
to transform,
according to
aviation HR
professionals

EDUCATION AND PERFORMANCE IN AVIATION: REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/02
30/03/2019

“

With new technology, I don't think customer service professionals will ever become obsolete; instead, their roles will change. Often people talk about how the check-in agent will disappear as technology takes over and allows the customer to check themselves in. But what you will still need is people available to guide and help the customer and to advise them when they need help. Technology on its own is not enough to provide excellent customer care.

I remember in the early days when self-check-in machines first came in, a customer survey asked people if they'd prefer to be checked-in by a machine or a person. The preference was for a machine but the really interesting bit was the reason given: it was because the machine couldn't be rude to them! That was a big wake up call to me. It proved that customer service is the single most important thing in the air travel experience. What this doesn't mean is that 'technology is always the answer' but rather that customers want to deal with people who will be nice with them!

As an airline, we need to find out where the new touchpoints are that we can bring in customer service to support and complement technology to make the overall customer experience quicker and more enjoyable.

”

Brendan Noonan
Vice President - Talent Development
Qatar Airways Group

Simultaneously, technology also opens-up new customer service channels. Queries and complaints continue to migrate away from in-airport desks and phone lines, through websites and emails, and on to social media and mobile communication apps like Twitter and WhatsApp. Who would have predicted a decade ago that Twitter would now be the most prevalently used platform for airline customer relations?

Unlike the original channels, these new platforms are 24/7 channels, that not only enable comments to be made but also make them instantly available to the wider public (and therefore potential news stories and brand influencers). As such, they must be constantly monitored and managed by highly skilled customer service professionals – as a January 2018 [Financial Post article](#) explains.

The check-in agent may be facing the threat of extinction, but the customer service role lives on stronger than ever.

Part 3:

Attracting and retaining talent - the challenges

2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



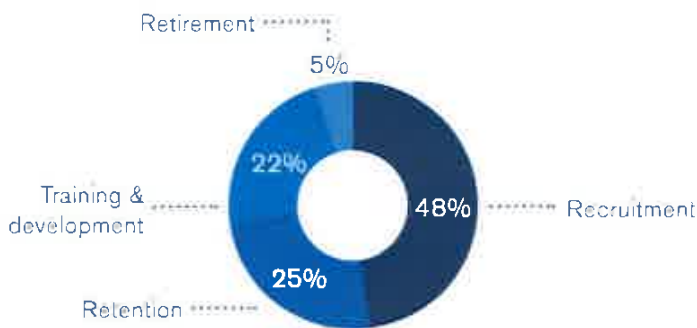
POSITION PAPER

R19-PP/02
30/03/2019

Staffing demands in aviation are set to rise. This makes retaining and upskilling staff especially important so that the deficit doesn't grow. However, even should perfect retention be achieved, there would still be an urgent need for additional human resource to meet the increasing demand.

The challenge facing the industry is that recruitment is tough. Compared to dealing with retention, training and development and retirements, recruitment is by far the biggest challenge across every region of the world.

Percentage of respondents ranking each area as the greatest challenge:

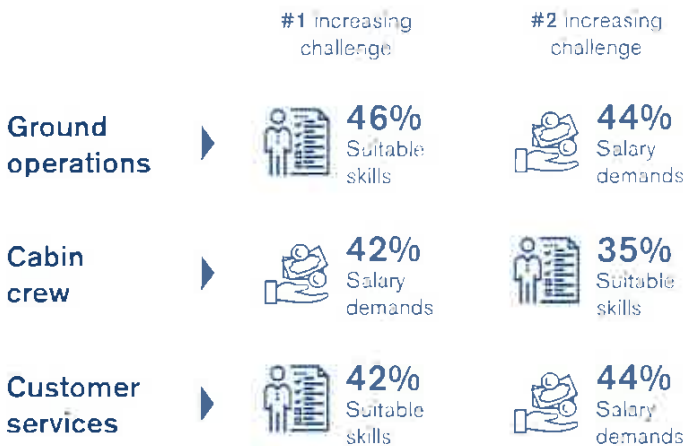


Two things in particular make recruitment difficult in the industry:

- The availability of applicants with the right skill levels/qualifications (39%)
- The salary demands of new applicants (28%)

In other words, the industry is struggling to afford the people they desperately need.

Skills and salary challenges in recruitment are not just a niche trend for specific job roles. Rather they are also perceived to be the challenges that will get more severe for each of the three highest growth job roles in the future.



Airline pilot retirement



The emphasis on recruitment over retirement for most aviation industry roles comes in stark contrast to pilots, where the CAE [Airline Pilot Demand Outlook report](#) pulls out retirement as a key challenge facing the industry.

"The aviation industry is an attractive industry for young people, especially in China - it's a dream to fly. Young people are so curious about the industry, they think the industry is active and exciting. However, the aviation cargo industry is quite traditional, particularly when it comes to rules and regulations, making it a less attractive or exciting career prospect when compared to other industries, such IT or Finance."

Li Wang
Deputy General Manager of H
Air China Cargo

2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



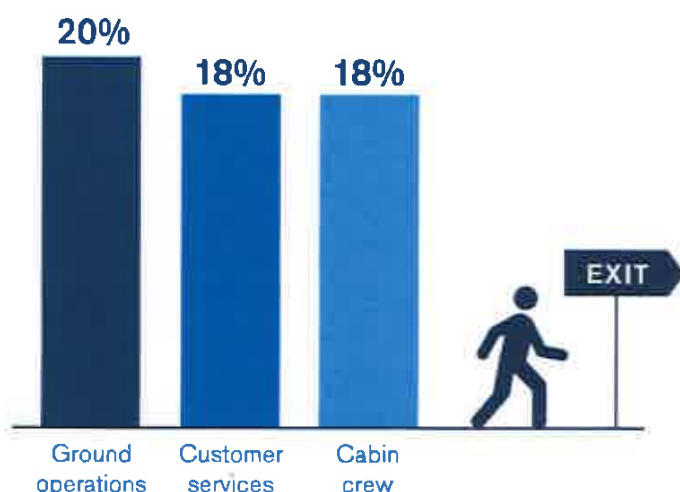
POSITION PAPER

R19-PP/02
30/03/2019

With recruitment a major challenge, retention of current employees becomes even more critical. It's of no overall benefit bringing in new staff if just as many leave during the same time. The volume of talent leaving the industry therefore needs to be kept to a minimum – retention must be a priority.

It is worrying that our survey respondents not only confirmed that there is significant staff turnover, but that this is highest in the three areas most in need of additional staff: ground operations, customer services and cabin crew.

Staff turnover in key areas per year:



Volume of applications 

An additional challenge that is unique to those managing cabin crew recruitment is an 'overload' in the pure volume of applicants. Over one in three of our survey respondents (35%) expect dealing with the volume of applications received for cabin crew roles to become more challenging over the next few years (higher than in any other job role). As a result, some airlines are already turning to technology to help streamline application processes: Emirates, for example, have introduced a new candidate screening process that utilises digital technologies including online tests and video interviewing.

If the challenge wasn't already great enough, over three quarters of our survey respondents (77%) also said that it is becoming even more difficult to retain talent.

This perhaps shouldn't come as a surprise. A common trend noted about the new millennial workforce is greater fluidity: a [2016 LinkedIn study](#) suggests that graduates now work at twice as many companies within their first five years of employment than was the case twenty years ago.

So, what can the industry do to ensure that people aren't tempted away?

77% of respondents say that it is becoming harder to retain talent

Our research suggests that focussing on the training and development of staff is an excellent place to start.

Part 4:

Attracting and retaining talent - the solution

2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/02
30/03/2019

A high-quality training and development programme is fundamental to attracting and retaining staff. After basic salary, our survey reveals that the most important factors for new applicants to the aviation industry are career progression and development & training opportunities.

Percentage of respondents selecting each factor in the top 3 requirements of new applicants:



70%
Salary and
benefits
package



49%
Career
progression
opportunities



33%
Development
and training
opportunities

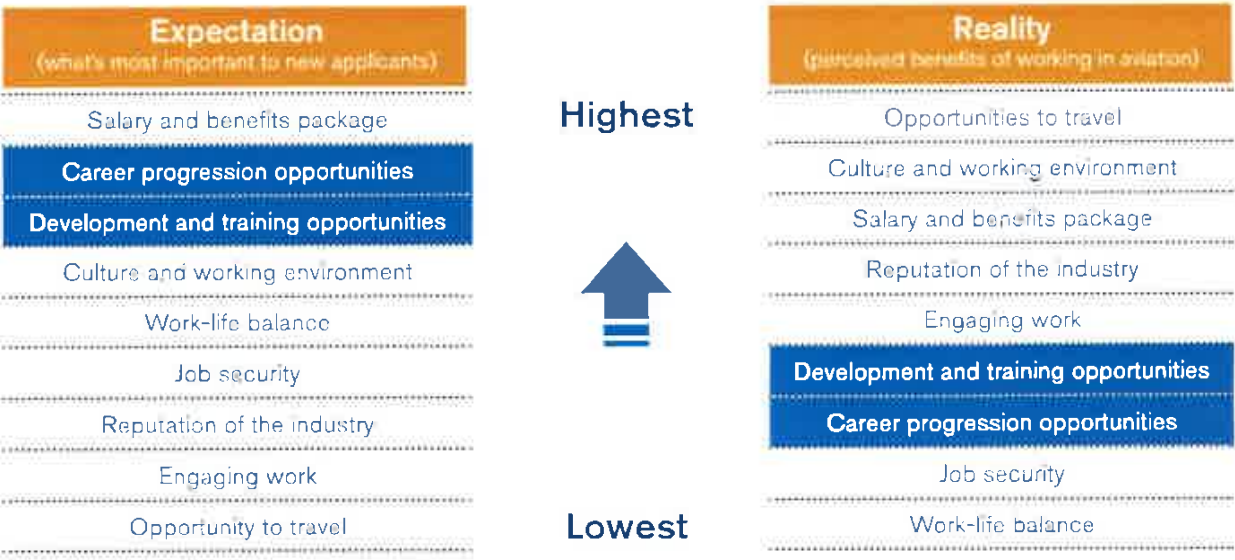
"When we're recruiting from the labour market, we are obviously being compared directly with other companies. One of the key areas that we are being compared on is career development. They are always asking how long it will be until they can get to the next level."

Li Wang
Deputy General Manager of HR
Air China Cargo

As a recent [Gallup study](#) confirms, development and training are of particular importance to the younger workforce generation: 59% of millennials report that opportunities to learn and grow are "extremely important" to them when applying for a job, compared to 44% of Gen X and 41% of Baby Boomers.

A strong training and development offering could therefore hold the key to solving future staffing challenges in the industry. However, HR professionals worry that the industry may not be able to live up to this mantle unless changes are made.

When asked what important advantages there were to a job in the aviation sector as opposed to other sectors, both career progression and development opportunities scored relatively poorly.



2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/02
30/03/2019

The aviation sector needs to ensure that attractive training and development programmes, which enable career progression, are prioritised if the sector is to remain competitive in the race to attract the best talent.

Not only will improved training and development help attract and retain staff, it will also help reduce the challenge - and expense - of finding new employees with the right skill sets (and at the right salary) by promoting internal talent.

This is highlighted by the HR and training professionals we surveyed who see building staff capabilities in new and emerging skill sets as a far greater challenge than the loss of existing skills amongst workforces:

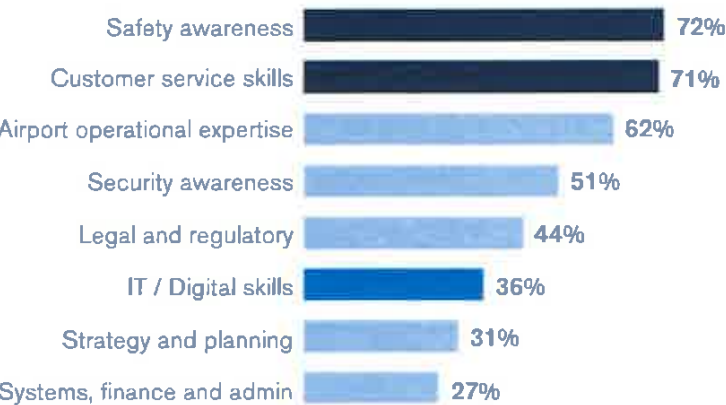
Percentage of respondents that consider each of the following a 'greater challenge'



So what skills should training be focusing on? We could assume that the starting place is technology and digital skills.

To an extent, this would be a good assumption. The world is now digital and, as such, digital literacy – if not proficiency – is a basic requirement for almost any job role. For instance, the [New Work Order](#), a 2017 report from the Foundation for Young Australians, forecasts that 90% of Australia’s workforce will need to have digital skills by 2022.

However, perhaps because digital literacy skills are now considered a basic requirement for any job, HR professionals in the aviation industry do not identify IT and digital skills as their number one priority area for training. Instead, two very different areas emerge at the top of the list: **Safety Awareness and Customer Services.**



“From an operations perspective, the skills we need to see an increase in, regardless of level and role, are critical thinking and situational awareness. As automation and self-service take on simpler jobs, we need staff to be able to deal with more complex scenarios. This is what we’re looking for when hiring staff, but it’s also becoming an increasingly important part of our training. For example, in cabin crew, it is becoming a focus both during initial training and then it’s re-enforced in annual training. We’re introducing more scenario-based learning to ensure staff have the skills to react and respond to these increasingly complex situations.”

Darlene Marmelic
Director of Learning & Development
WestJet Airlines



Safety awareness

Safety is the number one priority in the aviation industry. Safety awareness is therefore essential, and must underpin everything staff do in the industry; not just training new employees to be safe themselves, but to also to challenge a lack of safety in others.

"There's so many dangers in the airport, right down to the airplane itself. From the airplane engine to airplane movements and the risk of someone being run over. If a person is not safety conscious and they don't always apply the best principles, the chances of injury or even death are very real. So, we're looking for people who are safety conscious themselves but who are also willing to make the tough decisions. You may be operating safely, but when someone else around you is not, you need be able to recognise this and have the strength and willpower to say something. I really appreciate those people. They are the people who are most difficult to find and retain, but they are also the people that I want to invest in."



Krish Chand

Training and Development Manager
Swissport

Customer service

Customer service is rapidly evolving. Staff who previously may never have interacted with a customer before are being asked to do so, whilst existing customer service professionals are being taken out of their comfort zones. As such, skill development and training needs become heightened.

"Customer service is the single biggest area where we'll need new skills sets in the coming years. There is an expectation level from customers and we have to meet that. But when you look at new entrants to the workforce, many don't have the necessary courtesies or customer service skills. So, we have to rebuild them. We have to help them become more focused on the needs of our customers. It's about training people in the right way, using the right technologies, and re-building people to be more service-orientated."



Brendan Noonan

Vice President - Talent Development
Qatar Airways Group

Compounded by heightened customer expectations, the challenge becomes even more pronounced. Whilst the forecasted uplift in staff numbers across the aviation industry is primarily attributed to the growth in passenger numbers, in customer service roles, 'increasing customer expectations' is cited as an even greater driver. With more passengers, and more demanding passengers, learning customer service skills becomes ever more important for keeping flyers happy.

Part 5:

Improving training and development

2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS

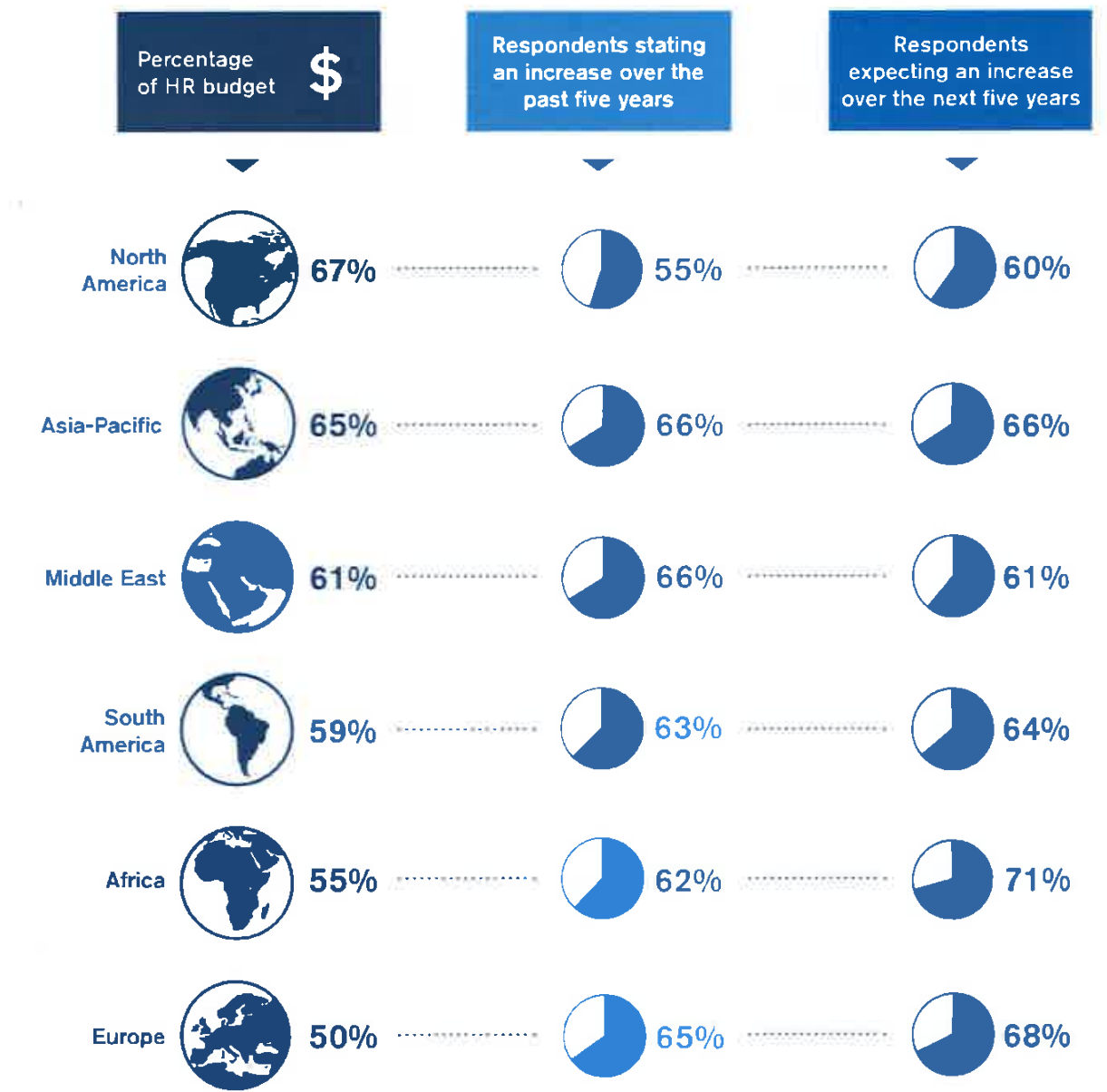


POSITION PAPER

R19-PP/02
30/03/2019

Training and development of staff must be a key focus for the aviation industry. The good news is that – to an extent at least – this appears to have already been recognised and is being addressed. Our survey respondents reported that training budgets are larger than they were five years ago, and now account for almost a quarter of overall HR spend. This trend is also expected to continue over the next five years.

Regional view: HR budgets and growth expectations



2019_RECOMMENDATIONS

EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/02
30/03/2019

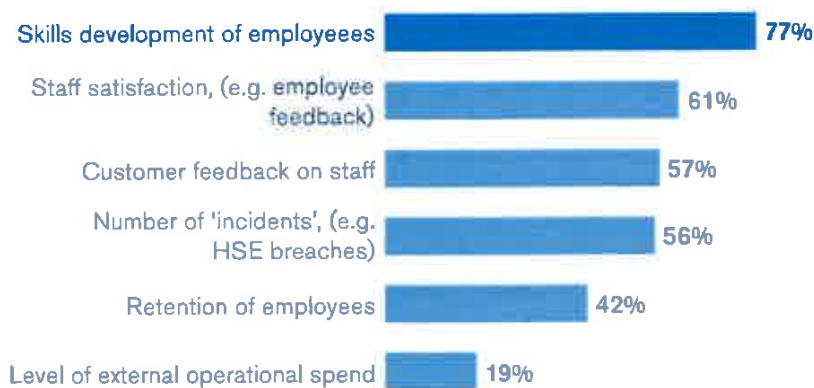
This willingness to commit budget to the training and development of existing staff is promising. However, there is an issue. Whilst money is being assigned, the quality of training and development programmes are not currently seen to be up to par: 56% of HR professionals say that their training is only 'quite effective', and a further 16% think it is not very effective at all.

28% of respondents say current training and development plans are 'very effective'

To tackle the problem, we first need to understand why training is currently only 'quite effective'. Thinking about what training should achieve, over three quarters of HR professionals in the industry report that they look for evidence of tangible skills development.

77% of respondents say that 'skills development of employees' are how they measure their training effectiveness

Percentage of respondents selecting each training effectiveness metric:



As the majority of training is currently only 'quite effective', this suggests that staff are often not developing skills as quickly or adeptly as HR professionals may wish.

Leveraging training specialist expertise could help. Currently, 29% of training budgets are spent with external providers.

"We need to eliminate human error in training. To do that you need to have very good infrastructure, like training management systems, learning management systems and online assessments. And the three of these should of course be integrated. We also gather pre- and post-assessment information on our trainees and apply a formula to calculate how effective the training was. This helps us to see the contribution and the quality of every training course, and every part of the training course. You can then revise the content of the parts of courses that need most improvement accordingly."

Prof. Kemal Yüksek,
Senior Vice President, Training
Turkish Airlines

2019_RECOMMENDATIONS

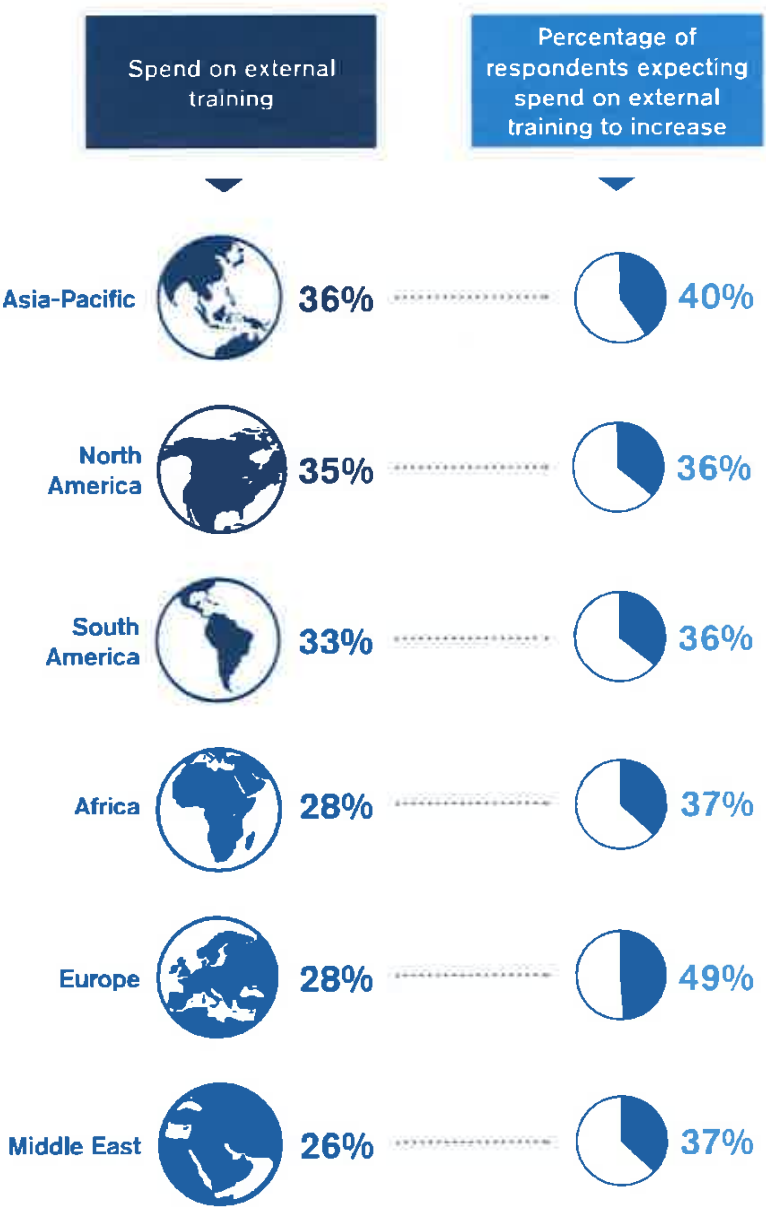
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/02
30/03/2019

Regional view: external spend on training



"There's definitely been a benefit when we've used external suppliers for training, particularly in areas like leadership and mentoring. Bringing people in from the outside provides a new pair of eyes and a different perspective, which helps staff to think differently. Essentially, using external training partners can help you to avoid groupthink. Doing everything internally means it can be hard to pinpoint where problems are and you struggle to find innovative solutions"

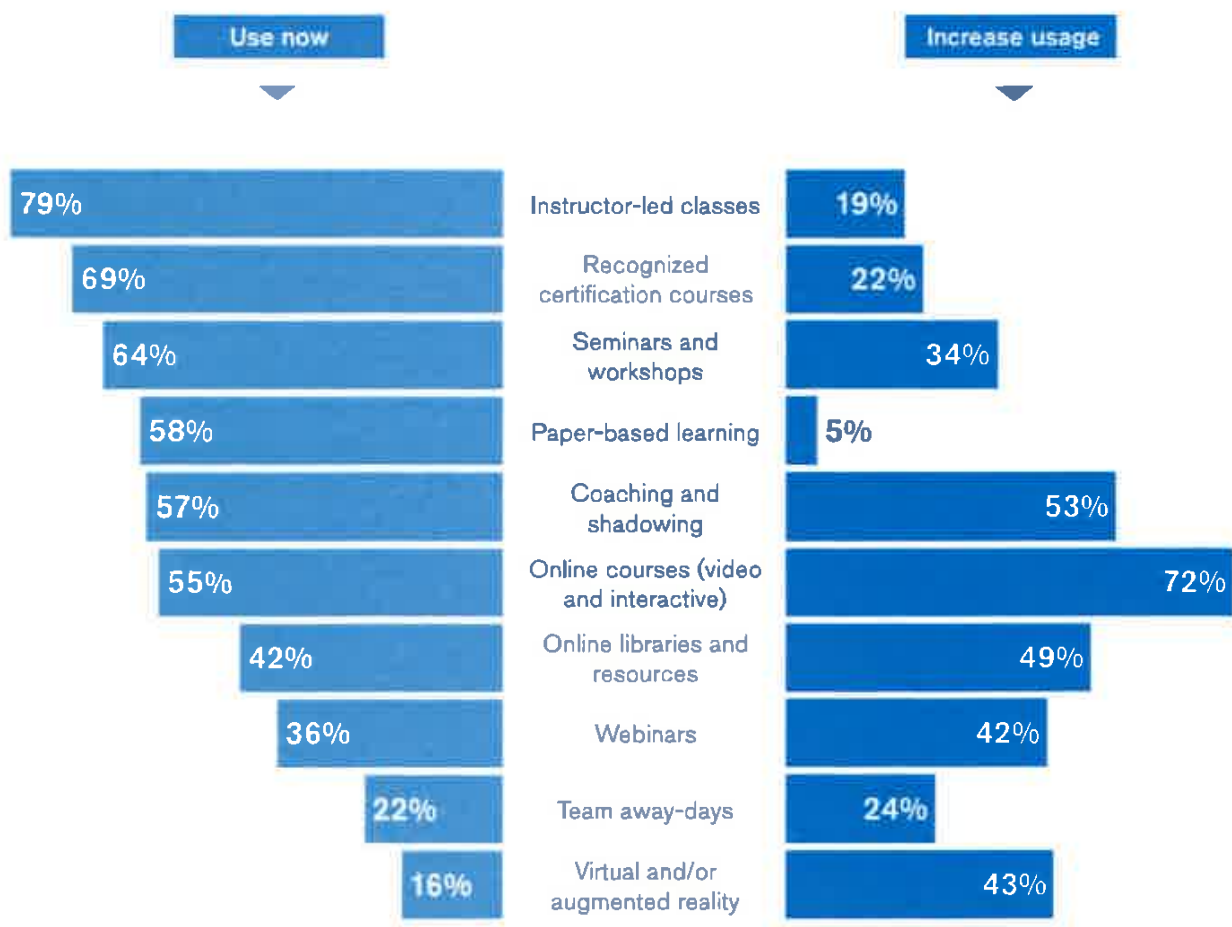
Dr. Mbithe Anzaya
Head of Learning Development
Kenya Airways

However, respondents to the survey indicate that they expect this proportion to increase going forward as specialist training assistance is sought. Across every region, over one-third of the survey respondents expect their businesses to spend more on external training over the next few years.



Current training formats

Training is only effective if it is delivered through an appropriate medium. Currently, more traditional methods of training – such as instructor-led classes, certification courses and seminars/workshops – are most popular. However, this is set to change. Technology is being used more all the time to provide online courses and libraries, whilst coaching and shadowing will also provide more intimate training environments.



HR professionals hope that this will spark an increase in the effectiveness of training, in turn reducing the recruitment burden and making a career in the industry more attractive to both candidates and existing staff.

EDUCATION AND PERFORMANCE IN AVIATION: REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/02
30/03/2019



Conclusion

Passenger numbers are set to grow rapidly and staffing levels must keep pace. This will not be easy. In testing economic times, the aviation industry must compete for talent in a highly competitive market, overshadowed by the tech giants.

Against this backdrop, training and development will play a vital role. From ensuring that a career in aviation is appealing to millennial workforces, to upskilling and retaining existing talent, training and development is arguably more important now than it has ever been.

And whilst IT and digital skills continue to be crucial, it is safety and customer service skills that top the agenda for HR professionals in the industry. Customer service takes on particular significance as automation and digitisation, far from eliminating the customer service role, change the job description and skills required, redefining its scope.

To achieve training and development success, the best programmes are dynamic and forward-thinking. They use new and innovative training techniques – from virtual reality to artificial intelligence – to complement and support more traditional learning formats. And they leverage their own internal resources, combining them with external training experts to give their learners the best possible chances to succeed. This not only creates job satisfaction for staff, it better prepares the industry for its unprecedented growth.

We would like to offer our sincere thanks to everyone who took part in this research and hope this report helps you in planning your organisation's approach to talent, learning and development in the coming years.

2019_RECOMMENDATIONS

**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/02
30/03/2019

Methodology

This report is based on a survey of over 100 leading industry HR professionals at airlines, airports and ground service providers. These professionals are responsible for the training and development of staff around the world, representing all geographic regions and a range of organizational sizes. The survey was conducted during January and February 2018.

The respondents we spoke to:

- Were all responsible for training and development at their organisations.
- Often had responsibility across multiple regions or globally.
- Overall, we spoke to more than 25 individuals per region.
- Certain individuals were responsible for multiple regions or had global responsibility.
- Regions were identified as follows: Europe, Asia-Pacific, Africa, North America, Middle East and South America & Caribbean.

The research was conducted for IATA by independent B2B research agency, [Circle Research](https://www.circle-research.com), in accordance with ISO 20252:2012 standards (Certificate Number 0504).

About IATA

The International Air Transport Association (IATA) is the trade association for the world's airlines. IATA represents some 290 airlines, or 82% of total air traffic.

IATA's mission is to represent, lead and serve the airline industry.

For more information please visit:

<https://www.iata.org>

About Circle Research

Circle Research is a global B2B research consultancy, dedicated to helping our B2B clients understand how business decision-makers behave and think. All research is conducted to ISO20252:2012 standard (Certificate No. 0504). For more information, visit:

<https://www.circle-research.com>



2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/03
01/04/2019

Education and Performance in Aviation: Realising and Sustaining Benefits

Presented by AFRAA

EXECUTIVE SUMMARY

Air traffic is expected to double in the next twenty years. 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.

This AFRAA position paper examines main issues and questions emerging with respect to education and human resource management in the future world of aviation.

1. What are the challenges set by automation and artificial intelligence for the future of aviation education and training?

Aviation provides air services to connect people and supplies logistic support to deliver valuable goods to customers worldwide. Future traffic volumes welcome the effective contribution of both automation and artificial intelligence in the supply chain naturally. However, people will remain the most important asset in the air transport system to ensure that aviation meet and exceed customers' expectations. The forecasted volumes stimulate increasing needs for automation and the use of artificial intelligence to assist operational staff members.

Future operational personnel will still have to learn and acquire operational skills to appreciate, observe, and check the tasks that automation executes; and the training of these categories of air transport workers will also have to secure competencies in safety, security and customer services.

The good news is that youngsters assimilate exposure to the use of technology consistently.

- The first training challenge is to develop further the automation logic in the mind of the youth embracing operational jobs in air transport. This mindset will assist in recognizing any deviation in the outcomes of automated tasks.
- While automation performs well repetitive operational tasks cost-effectively, the second training challenge is how to ensure that trainees master the interpretation of artificial intelligence suggestions to succeed in the enforcement of safety and security in the air transport operations. The proficiency skills acquired through the second challenge shall also ensure that future technical workers in such circumstance, be capable to eventually take-over and perform the tasks manually, as efficiently as possible. The innovation spirit of unlawful passengers will continue to challenge future operation personnel even well-equipped with advanced artificial intelligence. Staff built AVSEC experience coupled with excellent artificial intelligence support will make a great difference.

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/03
01/04/2019

- Beyond the technical skills, the third training challenge is the need to grant the next aviation generation staff with the knowledge of customer services to create an outstanding travel experience for the travelers. Customer satisfaction is vital to maintain existing clients and attract new ones.
- In a nutshell, for future training to be effective, it must facilitate that the trainees acquired multitasking skills to:
 - Understand, monitor, make use efficiently of the support of automation and artificial intelligence;
 - Take-over and perform professional tasks normally done automatically and ;
 - Interact proficiently with customers to improve their safety, security and exceed their travel experience expectations.

2. How do education and industry dynamics shape the future of industrial relations and human resources management in the aviation sector?

In the regional perspective in Africa, human resource development will be growing fast. Indeed, the industry forecasts that air traffic will continue to grow at around 5% per year in Africa for the next ten years. At this pace of growth, there are promising perspectives for education and training to support aviation human resource development in Africa.

African Development Bank publishes a visa openness index annually among the African States. The 2018 edition of the report indicates that overall, when compared to 2017, Africans do not need a visa to travel to 25% of other African countries (up from 22%); can get visas on arrival in 24% of other African countries (same as the previous year); and need visas to travel to 51% of other African countries (down from 54%).

By the end of February, 49 States signed for the African Continent Free Trade Area (AfCTA); of which 10 States ratified their commitment to the regional free trade area. The accord implementation requires that 22 States ratify it.

By next decade, AfCFTA implementation together with increased openness among the African States will enhance the regional integration and probably induce a double-digit growth rate of the air traffic.

According to the African Development Bank 2019 economic outlook, Africa needs to create about 12 million new jobs every year to prevent unemployment from rising.

There are actual opportunities for education and training, to develop young human resource and bridge the gaps in the increasing demand for aviation professionals in the Region and beyond.

Based on the three challenges identified to meet multitasking profile of next-generation air transport, academic education could develop soft skills such as leadership, integrity, etc., while aviation training institutions add the relevant technical and operational skills. Technical and operational staff with soft sound skills are those who will achieve great results in automation and

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/03
01/04/2019

artificial intelligence environment. Hence, a smart partnership between academic education institutes and specialized aviation training centers would be way forward to overcome the challenges relating to the training of next-generation aviation professionals.

Air transport remains the most suitable mode of transport to support the planned regional integration through trade. Strategically, the development of African economies through industrialization and trade will rely on effective development of affordable air transport. Only well-trained next-generation aviation professionals will manage the effective development of efficient air transport in Africa. Booming African economies will increase the number of middle-class citizens and generate additional air traffics. The financial assistance of the youth in the African perspective triggers a virtuous cycle impacting positively first air transport, then African economies. Strengthened economies generate additional demands for air transport ensuring jobs for the trained youth creating new training need for aviation. Employed youth will clear their financial dues. In case of a slowdown for any reason, professionals will secure employment outside Africa and pay back financial credits for their training.

Therefore, international financial institutions should support the funding of Africa next-generation aviation professionals to ensure that they reach their objectives as economic development champions while triggering and entertaining the virtuous cycle running through the air transport growth and the economic development.

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/04
03/04/2019

Education and Performance in Aviation: Realising and Sustaining Benefits
Presented by AIRLINES ASSOCIATION OF SOUTHERN AFRICA (AASA)



AIRLINES ASSOCIATION OF SOUTHERN AFRICA

Position Paper prepared for : Hermes Air Transport Organization

**“EDUCATION AND PERFORMANCE IN AVIATION: REALIZING AND SUSTAINING BENEFITS – THE
SOUTHERN AFRICAN PERSPECTIVE”**

“Global passenger traffic will double by the year 2035”. This widely quoted statement is accepted by the majority of aviation experts, airlines, aircraft manufacturers and service providers and is based on an annual passenger growth rate of 4.4%. In Africa, the anticipated growth is 5.6% per annum and this will lead to a doubling of passenger traffic in Africa by 2031. A further significant observation is that according to the United Nations Department of Economic and Social Affairs “2017 World Population Prospectus” report, Africa is the fastest growing continent in terms of population and will add the equivalent of the present population of China, to Africa, in 33 years.

African Aviation does face a number of additional challenges. These include its failure to fully reform market access, either through the Yamoussoukro Decision (YD), or the new Single African Air Transport Market (SAATM), (although this is currently receiving focused attention through action plans by the African Union (AU), the African Civil Aviation Commission (AFCAC) and many other industry organizations), high US Dollar driven operating costs (including fuel), taxes, charges, the need to embrace climate change initiatives and reduced carbon emissions, fast moving technological developments, and maintaining constant focus on the highest standards in safety and security of aviation operations.

If African Aviation was to address its many challenges in terms of sustainability and profitability and respond to the demand for an enhanced integrated network with the introduction of more airline operations serving more destinations for its growing population, the above forecasted African growth rate of 5.6% per annum could and should be higher. Africa must be able to improve its 3% market share of global air passenger traffic, given that it occupies 20% of the world’s land mass and (an increasing) 15% of the world’s population.

These current projections for 2035 bring with it a significant increase in the demand for Commercial jet aircraft expected to add 40000 new aircraft worldwide with 1160 new aircraft destined for Africa. In addition, 635000 pilots will be required worldwide, 23000 of them for Africa, and 622000 technicians will be required worldwide, with 25000 of them for Africa. Whilst much focus is placed on the demand for pilots, aviation engineers and technicians, further skills shortages are being identified in the positions of executive leadership and management, revenue and yield management, e-commerce, distribution and systems management, scheduling, analysts and ground operation personnel.

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/04
03/04/2019

There are several factors leading to these shortages and an increased demand for aviation professionals. These include retirement of the current generation – the aviation industry is dominated by a generation of individuals over the age of 40 to 45. In addition, a disturbing trend for aviation enthusiasts is that the aviation profession is not attractive to many potential candidates with other industries competing for their skills. There is also insufficient training capacity to meet demand and aviation needs to be responsive to evolving learning styles. High costs of training, for example for pilots, including high cost cadet pilot schools, raises affordability concerns and accessibility to training both from an individual and airline company perspective. Within Africa, there are concerns about the lack of harmonization of training in aviation disciplines between States. Finally, with the demands noted above, the growth of the industry is outpacing the ability to supply aviation professionals.

Whilst needing to address its challenges and considering these requirements in Africa and indeed Southern Africa, the question to be asked is how the aviation industry responds to these demands and prepares itself to be able to compete in the global aviation market?

Our region is complex. Economic and demographic factors, legacy issues, government policies on matters such as education, trade & industry, economic empowerment, transformation and labour relations, socio-political imperatives and of course, moral obligations, all have to be addressed. These factors either represent a massive additional burden on our industry, or a golden opportunity to positively and proactively shape our industry's future. However, it is noted that aviation is not the only industry facing a human capital development challenge nor is our region the only region facing these challenges.

It is acknowledged that our industry is facing a skills development crisis and needs to find solutions to meet the increasing demand and challenges mentioned. From a country and industry perspective, we need to start at the beginning – at school. In several States, including South Africa, whilst strides are being made to make basic education accessible to all children, it is noted in the South African National Development Plan (NDP) 2030 that “the legacy of low quality education in historically disadvantaged parts of the school system still persists”. High dropout rates by the end of primary school add to the number of potentially talented people who will be unable to study and pursue careers in aviation – or other sectors – which place a premium on the STEM subjects of Science, Technology Engineering and Mathematics. However, aviation does not only require people with STEM subjects. People with skills in the arts, communication, customer relations, marketing, sales and operating environment are critical to the aviation business. People with all these backgrounds can also be further trained by the aviation organization to obtain specialist skills or gain experience under supervision in areas where shortages have been identified as noted above.

Initiatives are in place in certain States and regions to create an awareness and enthusiasm of aviation amongst young people. In addition, systems need to be put in place to identify and track the development of those with an interest to pursue a career in whichever field of aviation. An example of such an initiative is Wonders of Aviation in South Africa, supported by many aviation organizations which exposes the magic of flight to communities not previously exposed to aviation. A further initiative includes outreach programs to young girls and women through for example Women in Aviation, which focuses on the critical need of attracting more women into leadership and the varied careers in aviation.

Once through primary and secondary school education, the next challenge is to ensure capacity for tertiary education and training in Universities or Technical Colleges. There are some universities

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/04
03/04/2019

and colleges offering streams for aviation in, for example, Aeronautical Engineering as part of a Mechanical Engineering degree, Honours in Transport Economics, and MBA's. However, tertiary institutions in Africa do not have extensive specialist aviation degrees or diplomas. Consequently, students are required to consider attending universities elsewhere, such as in USA, UK, Canada or Europe at considerable cost. This has prompted ICAO, IATA and several Aviation Academies and Institutions to develop and offer accredited aviation courses.

ICAO has established the Next Generation of Aviation Professionals (NGAP) outreach to ensure sufficient qualified and competent aviation professionals are available to operate, manage and assure the future of the international air transport industry. In addition, the African Aviation Training Organization (AATO) was established in 2013 through ICAO to promote cooperation among its members in Africa through collaboration of Aviation Training Organizations (ATO's). Its aim is to be a link between training organizations, airlines, maintenance organizations, airports, air navigation service providers and the regulators across borders and build capacity for training across Africa. IATA through the its Airline Training Fund (IATF) and other training courses, is a provider of airline specific training to its members.

Once trained, the next step is to retain skills in Africa and to effectively transfer skills to the new generation of aviation professionals. Airline executives and African aviation authorities are concerned about the exodus of skilled aviation professionals from Africa to so called greener or "sandier" pastures. With the high growth and development of aviation in the Middle East, Gulf and Asia, there is a demand for highly trained professionals and the attraction of good hard currency packages is hard to resist.

In the USA, who also has an ageing population of aviation professionals, (nearly 50% of pilots and commercial employees are over 50 years and 49 years old respectively), the need to source younger pilots and people with commercial skills is becoming critical. Even in the USA, affordability to train the young professionals is a challenge. The USA is also experiencing a decline in the attractiveness of aviation as a profession given the competition from other industries for skills.

Affordability and the high cost of aviation training is a barrier to entry into the industry. Airlines in Africa operate at an aggregated loss and those that are profitable are on slender margins. As a result, what funds are available also have to cover items such as fleet replacement in addition to operating costs. Depending on the airline, pilots account for between 8% to 10% of total airline headcount. Pilot training and development costs are high – estimated at over US\$100000 to take a pilot from initial training to a full Airline Transport Pilots Licence qualification. Carriers also require funds to provide statutory and general training for the other 90% of their staff and therefore funding for pilot development is limited. Funding solutions need to be established and identified for pilots through Government, public and private initiatives. Sight must also not be lost of the rest of the employees who need to be trained and have recurrent training to perform their functions.

Improved collaboration and partnership between Government and Industry needs to be explored and developed to ensure that the most optimal solution is found to train all aviation professionals required to serve the industry. With the exception of anticipated requirements for aircraft, pilots, and aviation engineers and technicians, (as provided primarily by the aircraft manufacturers through their outlooks), it is not clear whether the industry has fully assessed the potential shortage of other aviation professionals. It is important to confirm the skills shortage numbers as presented for pilots, aviation engineers and technicians and to assess the numbers of other expected shortages. We must avoid a scenario where new professionals are trained but are unable

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/04
03/04/2019

to obtain jobs in the industry. The use of state facilities or infrastructure not currently used optimally, as well as a coordinated program between the public and private sector needs to be developed. Incorporation into programs run by ICAO and IATA as mentioned above, together with other regional initiatives should also be considered.

Besides stemming the exodus of young blood, we also have to ensure there is a pipeline of talent ready to take over from those people leaving the industry through retirement over the coming years. This will require the structured and coordinated transfer of skills to the new generation of aviation professionals. As the older airline professionals move out of the industry, and the new young professionals move into more senior positions, it is necessary for a structured mentorship program to be put in place to support the transfer of skills - particularly in those critical and scarce skills areas identified above.

The world is changing at a rapid pace and so are employee needs especially as the younger generation of millennials come into the work space, bringing with them a refreshing new perspective on their ideal working environment and career. However, whilst leaders are adapting to new organizational models, Human Resources are struggling to keep up with technological developments.

The rapidly advancing technology in aviation is challenging every branch or sector of the aviation industry. Entrepreneurs, inventors, and industry specialists are constantly looking for improved, better, automated systems and methods to improve their product offerings and enhance operating efficiencies and effectiveness. With these new products and developments come the need to develop product specifications and the standards and recommended practices for incorporation into States' civil aviation regulations and technical standards for introduction into the main stream use in the aviation industry. This includes development of enhanced air traffic management systems together with communication, navigation and surveillance innovation, remote pilot aircraft systems (RPAS), next generation aircraft, new passenger facilitation processes, enhanced self-service options, biometrics, digitization, robotics, artificial intelligence, blockchain and big data processes. This is the era of continuous disruptive innovation, with the traditional industry not knowing what could come next.

New advanced training courses will need to be developed and accredited for implementation. Human resource specialists need to effectively reinvent themselves to be able to cope with the new specialist training requirements, including combination of training with or without instructors, e-learning, and training methods which may not at this stage even have been devised. With the possible need to redeploy certain employees due to new technology making existing positions redundant, the need to be ready to re-train these employees for appointment to different positions or new portfolios is important.

An even greater challenge arises for the safety regulators which provide oversight on all aviation operations. With the increasing rate of technological development, are they able to keep pace with the new developments, and fully understand the capabilities of the new technology and formulate standards, recommended practices, regulations and standards to ensure continued safety and reliability of aviation operations? This would largely depend on the calibre of person employed by them to work in this field. Ideally, regulators should employ people who have had experience in the field of technological development, or who have the capacity to quickly study and understand the new concepts being proposed. The question of regulation or self-regulation and the extent to which one or the other is acceptable, requires discussion. At the same time, it is important that these new initiatives are assessed as quickly as possible to enable them to be

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/04
03/04/2019

considered by the users or operators and for the entrepreneur to be in a position to market and sell his / her new product.

Automation and technological development are moving at a rapid pace and improved productivity, efficiency and performance is a priority. Skills shortages have been identified and must be quantified and confirmed as far as is possible. Education and training systems to develop a new breed of aviation professionals to perform existing and new job functions will become a priority to equip them to serve their organization with excellence. This is not a task to be left for the Human Resource department but must also receive the attention and support of the top executives and senior management of the organization. An aviation organizations' success will significantly depend on the effectiveness of the leadership of the organization and the quality of the team supporting the leadership to implement the organization's strategy and sustainably achieve their business goals.

Chris Zweigenthal
Chief Executive
Airlines Association of Southern Africa

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/05
04/04/2019

Education and Performance in Aviation: Realising and Sustaining Benefits

Presented by EUROCONTROL

How to make automation a good solution to the current problems in ATM?

Fabrice Drogoul¹ & Philippe Palanque²

¹Safety Unit, EUROCONTROL Agency, Brussels

²ICS Team, IRIT - Université Paul Sabatier, Toulouse, France

fabrice.drogoul@eurocontrol.int, palanque@irit.fr

Abstract. The present paper is concerned with training and competencies. These elements are the enablers of human performance in automated systems. Among the many methods and processes that are currently in use, the first one to be widely exploited was Instructional Systems Development (ISD), and its variants, which are part of the Systematic Approach to Training (SAT) instructional design family. One of the key features of these processes is Instructional Task Analysis, particularly the decomposition of a job into its tasks and sub-tasks to determine what knowledge, skills and attitudes the trainee must acquire. In the context of automation, this paper advocates the need to accurately establish the human-machine collaboration and to carefully define the allocation of functions, the allocation of responsibility and the allocation of authority. It is important to note that these allocations are required to be dynamic in order to cope with the evolution of the context and the environment, such as human or system failures. Efficient and thorough training is one of the key element to ensure system and operators' tasks congruence even under adverse circumstances especially when interacting with dynamic and partly autonomous systems. This said, the first step is to have well designed automations and a fit for purpose advanced tools. This includes designing how operators will work with automation (e.g. trigger, supervise or stop) as well as how takeover and handover will be performed. We cannot expect training to compensate for design deficiencies or wrong automation goals. It is therefore important to remind the main goal of automation, the different possible levels of automation and the impact of such automation solutions.

1. Introduction

Increasing automation as a mean of improving productivity and quality is what remains in the collective memory from the industrial revolution. However, this automation from the early days, came with a set of drawbacks ranging from fragility (if one of the supply chain component fails, the entire production system collapses), the need to educate the population to higher levels of knowledge and qualifications (thus making them unproductive for extended training period) and the consumption of non-renewable natural resources to produce both products and factories [2].

In the ATM domain we have reached the limits of conventional solutions (re-sectorisation, reduced separation, increased precision ...) to absorb an ever increasing demand and therefore we expect a lot from new technologies and automations. Often we even expect perhaps too much, having our needs and desires blinding us from the true possibilities of automation design and technology. We tend to forget the lessons from past and expect that limitations or difficulties of automation deployment will not hit you as they did in other domains.

Early approaches dealing with automation and Human-Computer Interaction were focusing on the human factors aspects of users interacting with automation. Generic functions to be performed were listed and allocated to the best player between the machines and users (e.g. Fitts' approach called Machines Are Better At - Men Are Better At [13]) and refined for computers by Carver and Turoff [19]. These lists were supposed to support the design of function allocation and produce better systems, by applying best player allocation per function. Another view was to design automation at different levels of human or machine authority and for different processing stages, such as information acquisition, information analysis, decision making, and action implementation [14]. Other approaches proposed high-level metaphors to design automation [16] at a high-level of abstraction and ended up never being implemented in systems.

The current drive in automation is towards fully autonomous systems (e.g. Tesla [17] or Waymo self-driving technology¹) which raises critical design, implementation and training issues such as:

¹ <https://waymo.com/mission/>

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/05
04/04/2019

- How to ensure dependability of fully autonomous systems and how to test them?
- How to make it possible for users to foresee future states of the automation?
- How to disengage automation?
- How to re-plan automation after disengagement?
- How to carry on activity and overall service provision under automation degradation?
- How to ensure usability and understandability of the information flow from automation?
- How to learn how to use automation?
- How to not de-skill operators that are using automation?
- How to ensure that the system is serving the user and not the opposite?
- How to address legal issues (e.g. responsibility) raised by safety concerns (both for users and the environment)?

This list of questions is far from being exhaustive but provides an idea of some critical aspects of automation design, implementation and use, beyond the feasibility aspect that are trying to address. Some of these questions address the predictability of automation, others question transparency and controllability [15] (which are typical HCI problems) while others relate to dependability and software engineering aspects similar to the ones for interactive systems [26]. These questions demonstrate that automation brings additional complexity at the design, specification, development, validation and deployment phases.

2. Goals of automation

The fantasy goal of automation is to replace humans, and in so doing eradicate human error and ultimately improve safety. There are a few such successful examples as autonomous train but we must keep in mind the fact that they operate in one dimension and that the environment is fully controlled. We usually forget that those processes are still controlled by humans supervising the entire system and if the supervision fails, we suspend the service (example of the ORLYVAL). The hope is that such examples can be translated in other context, more dimensions, with increased complexity, because this is where the benefits of “good” automation are higher. The latest example of this approach is the concept of autonomous cars. Designers have taken the human out of the loop (and out of the driver’s seat). A car driving by itself amazes everyone but nothing is mentioned about overall performance of the transportation system involving those cars. Clearly, transportation performance would decrease with autonomous cars, as the main goal is to be safe by reducing accidents from human drivers. However, autonomous cars get lost, get deadlocked, get involved in (sometimes fatal) accidents demonstrating they are not yet ready for deployment. The autonomous taxi in Paris were planned for next summer but deployment was recently delayed for at least four years (within an initial test period of two years). Even lower level of automation has required a very long lasting testing and development phase. A good example in aviation is the development of the Autoland functions in civil aircraft. The first prototypes of the Autoland system were designed in the early 1940s, but the first certification was only performed on the 28th December 1968 for the Caravelle (Airbus) aircraft. To get to certification was a succession of improvements such as AutoPitch, AutoThrust and AutoRoll, that all needed to perform a “full” Autoland. In this case, the automation was developed to enable a task to be performed (landing) that was otherwise not possible (due to low visibility conditions for instance). With the introduction of the Autoland system, additional tasks for pilots to supervise the system, understand the system and operate it correctly were introduced. Autoland also came with operational limitations such as no landing with a tailwind above 10 knots. Training needed to be modified to ensure that pilots understood and respected these limitations. Incremental design, development, certification and deployment was needed to automate a single function.

Even in the case of successful automation we have to recall that it didn’t go all smooth and not without delays... the example of autoland in aircraft is a nice illustration of that. We now can judge it as a success and may praise its success story... but it took almost three decades to design and implement and there are still many limitations for its use thus requiring the presence and the constant involvement of operators. In

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/05
04/04/2019

terms of drawbacks, Autoland introduces complacency and deskilling thus reducing its use in normal conditions.

Instead of attempting to replace the operator, the goal of automation should be directed towards better overall socio-technical system performance [18] by:

- Supporting humans who are performing demanding tasks or activities that humans are not able to perform e.g. flying, mentally computing Pi number precisely, detecting infrared signals, etc., and thereby supporting the perceptive, cognitive and motoric capabilities of humans.
- Executing low level, well-defined tasks that likely to be error prone for humans (counting the number of zeros on a directory page), monitoring and surveillance tasks that humans fail to perform reliably [6].
- Performing tasks that humans are reluctant to do because they are repetitive, not attractive or degrading (e.g. washing clothes). However, for these tasks, it is quite possible that the automated performance may be lower than when undertaken by human operators.

There is significant pressure to deploy automation to improve the performance of global systems. In the case of ATM, this is to increase the capacity in sectors, make the aircraft routing more efficient and improve KPIs. In this context it is easy to forget the purpose of automation and the drawbacks that come with the benefits.

3. Reality of automation

As argued above, automation will require additional tasks to be performed by the operator, for instance to establish the parameters of the automation (e.g. setup your alarm clock, setup a TV recorder, ...), to supervise the execution of the automation (checking that there is still electricity for the alarm clock) and understand automation (check that the time, the day and the sound have been properly setup). These additional tasks may impose strong constraints on the automation design that go beyond the functional requirements (e.g. the alarm clock should be able to produce a sound at a given time). These non-functional requirements will require good usability, good user experience and be easy for the operator to learn and to remember (just to name a few).

Without taking into account these non-functional constraints, operators will not have the possibility to know and understand what the automation is doing and why it is doing it, so as to infer how to behave according to what the automation is currently doing and what it will do in the future. These problems are known by researchers and referred to as automation transparency [15] but might not be known by the engineers who design and implement partly autonomous systems. These discrepancies comes from the fact that non-functional requirements are associated with disciplines such as Human Factors, Human-Computer Interaction and Psychology that are not core to engineers training. To close this gap, EUROCONTROL has recently decided to add to their training program a training course (called HUM-DESIGN²) that complements other course on Human Factors and addresses issues of competitive goals, issue of technological drive of automation when decoupled from operational goals

More importantly, adding automation to a system usually fundamentally changes the nature of the work, transforming the role of the operator from an active actor to a more passive supervisor of the system. These changing roles require different levels of knowledge, different skills and different training. A good supervisor will need in-depth knowledge about the functioning and the environment of the supervised system. This is why pilots learn about aircraft physics, aircraft systems and weather conditions during their training.

On the system side, engineering systems with automation becomes always more complex. Even if we expect a machine to learn using Artificial Intelligence technology (AI) called machine learning, there is a need to observe experts for a huge amount of repetitions. Therefore we need users in the loop until skills and practice are fully copied, tested and validated. For dependability, they require mechanisms to ensure that the probability of failure of the automation is acceptable and that the system has been thoroughly tested, covering all the cases that the automation will face. Therefore, during those very long development

² Approaches [HUM-DESIGN]" here <https://bit.ly/2C7ilzw> .

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/05
04/04/2019

phases of complex systems, users must remain in the loop, increasing the complexity as the automation must explain its behaviour and can be disengaged by the operator/s at any time.

While automated systems perform functions that are impossible or difficult for humans to perform (or augment or assist the human operator), these systems also impose additional workload [21]. Operators of automated systems must be skilled in anticipating system malfunctions, in system level problem solving and in responding to anomalies quickly and effectively.

When we consider the impact of automation on future systems in a specialised domain like ATM, these considerations should start from selection. For years, we have targeted assertive and proactive people who are able to take decisions in dynamic environments where there is a lot of uncertainty. If automation introduces new tasks that require new capabilities (e.g. monitoring vs direct action), then the profile and abilities of future ATCOs should be revised. Sadly, this is not always the case. Even in SESAR, where automation is considered with the human in the loop, the only part that has been stated not to be changed is the selection of controllers.

Automation of industrial processes tends to expand rather than eliminate problems for the human operator. Human factors is now, more than ever, important in the ATM domain as developments in automation are increasingly showing the 'classic' approach of leaving the operator with the responsibility for managing abnormal conditions (such as automation failures [25]). These failures are likely to occur due to the complexity of engineering automation [26], which requires the integration of knowledge and practices from human factors, human-computer Interaction, design and software engineering disciplines. This approach is not new and was already highlighted in 1983 by Bainbridge as ironies of automation [22]. Bainbridge described how automation fundamentally altered the role of the human operator in system performance. Requiring the operator to oversee an automated system that could function more accurately and more reliably than he/she could, can affect system performance in the event that operator intervention is needed. Furthermore, taking over when automation fails, is beyond what can be expected from operators. As seen in the aviation domain, as the degree of automation increases, there is an increased risk that performance following return to manual control will be degraded [23].

We can also observe that research projects are not consistently considering integration of future technology (an in particular automation) for ATM.

The AUTOPACE³ (Facilitating the AUTOMation PACE) project suggests that air traffic controllers can learn new competences through psychological training, biofeedback training and non-nominal training on simulators that can prepare them to face the challenges of automation scenarios as defined by SESAR for 2050. The problem is that one of ATCO competencies required for future work with automation is concerned with the ability to identify a system malfunction, and recover any non-nominal situations. This means that there will be a requirement to maintain the current competencies but without the same level of proficiency, because in nominal cases the automation is doing most of the task and acquiring new ones. Even in those research projects that are not constrained by technological limitations, the improvement in the performance of the human machine couple, is predicated on the human operator being able to assume more task responsibilities and adaptations to current responsibilities.

Conversely, STRESS⁴(Human Performance neurometrics toolbox for highly automated systems design) a recent SESAR project involving EUROCONTROL, ENAC, DEEP BLUE, Sapiensa University and Anadolu University, concluded in 2018 that we can rely on technology to better support human capabilities and limitations. The project had a number of outcomes, including 'guidelines for the design of innovative technologies that are compatible with human capabilities and limitations.' However, arguably the most important development of the project is a neurophysiological measurement toolbox, which can assess the impact of future ATC scenarios on controllers. The STRESS technology could be used by ANSPs during the testing and validation of new automation. Controllers would be able to objectively show whether new tools/ automated systems were, in fact, increasing their workload beyond a reasonable limit.

³ <http://autopace.eu/>

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/05
04/04/2019

The SPAD⁵ (System Performance under Automation Degradation) SESAR research project studied how performance of the overall ATM system might be influenced by automation degradation. More precisely the project studied the propagation of automation degradation and aimed at

- understanding, modelling and estimating the propagation of automation degradation in ATM;
- evaluating and estimating the consequences of degradation propagation on ATM performances;
- supporting an effective intervention for the containment of automation degradation.

This is one of the very few projects that considered automation degradation at a critical element to be studied. Unfortunately, detecting faults, tolerating or removing faults was not part of the project objectives.

These three projects illustrate some of the challenges of automation research that brings highlighting the need to address jointly human factors and engineering and the dilemma of whether to adapt the technology to the human, or whether we expect the human to adapt to the technology development.

4. Position and Conclusions

The concerns regarding controller capacity and performance in a highly automated future environment suggest that new training approaches may be required. In the same way that pilots had to learn and develop new skills for dealing with cockpit automation, so now must controllers also expand their repertoire to include new skills, perform new tasks, and acquire new knowledge to operate, understand and monitor the automations that are polymorphic per nature. According to Hopkins [24], humans will have a central role in future ATC systems because their problem solving skills will be needed and it is also clear that they will be the ones in charge of handling unforeseen circumstances. Training techniques must be designed and implemented to ensure that controllers work effectively as managers of automated systems but also remain capable of handling traffic in case of automation degradation or failure.

In terms of automation acceptance [28], the challenges introduced by automation are caused by the lack of knowledge of what automation is in reality (see section 3) and should not be there only to replace the human. Automation alters the performance of some tasks with new tasks and procedures, which in turn changes the training needs. The co-evolution of operators, systems and training is thus required as identified in other domains such as ground segments of satellites [27].

Most of the current challenges of automation are not new and can potentially be managed by better understanding of the relationship between operators and the system they are managing. The design, implementation and validation of systems featuring automation raises a lot of challenges that must be addressed at research and operational levels prior to deployment. More globally, better consideration of human needs and capabilities is required in order to make those systems trustable and reliable. Training operators to understand the behaviour of those systems, to get the best of them and to ensure safe and efficient operations remains one of the most critical challenges that must be addressed in the near future.

A big question remains: what kind of research should be carried out to solve problems that have not been solved in the last two decades? The purpose of this paper was to highlight some directions but also some dead ends based on experience in ATM but also learning from other domains like aviation.

5. References

1. Bart P. Knijnenburg, Martijn C. Willemsen: Understanding the effect of adaptive preference elicitation methods on user satisfaction of a recommender system. RecSys 2009: 381-384
2. Allen, Robert C. *The British Industrial Revolution in Global Perspective*. Cambridge and New York: Cambridge University Press, 2009.
3. S.W. A. Dekker and D. D.Woods. 2002. MABA-MABA or Abracadabra? Progress on Human-Automation Co-ordination. Cognition, Technology & Work 4, 4 (2002), 240-244.

⁵ https://www.sesarju.eu/sites/default/files/E.02.17_SPAD_D0.10_D14_final_report_v4.pdf

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/05
04/04/2019

4. R. Parasuraman, T. B. Sheridan, and C. D. Wickens. 2000. A Model for Types and Levels of Human Interaction with Automation. *Trans. Sys. Man Cyber. Part A* 30, 3 (2000), 286–297.
5. Byom Lindsey, Mutlu Bilge. Theory of mind: mechanisms, methods, and new directions. *Frontiers in Human Neuroscience*, vol. 7, 2013, p. 413.
6. Mackworth, N. H. (1948). The breakdown of vigilance during prolonged visual search. *Quarterly Journal of Experimental Psychology*, vol. 1, pp.6-21
7. ECSS-Q-HB-30-03A – Human dependability handbook (14 July 2015), European Space Agency (ESA) - <https://ecss.nl/hbstms/ecss-q-hb-30-03a-human-dependability-handbook-14-july-2015-good-one/>
8. Scott, D.W., Growing a Training System and Culture for the Ares I Upper Stage Project, NASA Technical Report, Number: IEEEAC Paper 1550.
9. U.S. Department of Defense Training Document (1975). Pamphlet 350-30. August, 1975.
10. U.S. Army Field Artillery School (1984). A System Approach To Training (Course Student textbook). ST - 5K061FD9
11. Hollnagel, E. (1999). From function allocation to function congruence. In S.W.A. Dekker and E. Hollnagel (Eds). *Coping with computers in the cockpit*(pp. 29-53). Aldershot, UK: Ashgate.
12. S.W. A. Dekker and D. D.Woods. 2002. MABA-MABA or Abracadabra? Progress on Human–Automation Co-ordination. *Cognition, Technology & Work* 4, 4 (2002), 240–244.
13. Paul M Fitts. 1951. Human engineering for an effective air navigation and traffic control system. National Research Council, Washington, DC
14. Parasuraman R (2000) Designing automation for human use:empirical studies and quantitative models. *Ergon* 43:931–951
15. R. Bernhaupt, M. Cronel, F. Manciet, C. Martinie, and P. Palanque. 2015. Transparent Automation for Assessing and Designing Better Interactions Between Operators and Partly-Autonomous Interactive Systems. In *Proc. of the 5th Int. Conf. on Application and Theory of Automation in Command and Control Systems (ATACCS '15)*. ACM, 129–139.
16. F. Flemisch, C. Adams, S. R. Conway, K. Goodrich, M. Palmer, and P. Schutte. 2003. The H-Metaphor as a guideline for vehicle automation and interaction. NASA TM, 2003-212672
17. Tesla Motors, “Autopilot,” https://www.tesla.com/en_GB/autopilot, 2017.
18. Martina Ragosta, Célia Martinie, Philippe A. Palanque, David Navarre, Mark-Alexander Sujan. Concept Maps for Integrating Modeling Techniques for the Analysis and Re-Design of Partly-Autonomous Interactive Systems. In *Proc. of the 5th Int. Conf. on Application and Theory of Automation in Command and Control Systems (ATACCS '15)*. ACM, 41-52
19. Liz Carver, Murray Turoff: Human-computer interaction: the human and computer as a team in emergency management information systems. *Communications of the ACM* 50(3): 33-38 (2007)
20. Célia Martinie, Philippe A. Palanque, Martina Ragosta, Mark-Alexander Sujan, David Navarre, Alberto Pasquini. Understanding Functional Resonance through a Federation of Models: Preliminary Findings of an Avionics Case Study. *International Conference on Computer Safety, Reliability and Security (SAFECOMP) 2013*: 216-227
21. Wickens, C. D. (1984). Processing resources in attention. In R. Parasuraman & R. Davies (Eds.), *Varieties of attention* (pp. 63–101). New York: Academic Press
22. Lianne Bainbridge, Ironies of automation, *Automatica*, Volume 19, Issue 6, 1983, Pages 775-779, ISSN 0005-1098.
23. Mica R. Endsley, Esin O. Kiris: The Out-of-the-Loop Performance Problem and Level of Control in Automation. *Human Factors* 37(2): 381-394 (1995)
24. Hopkin V.D 1991, closing remarks in Wise J. A; Hopkin, V.D. and smith M. L. (eds), *Automation and systems issues in air traffic control* pp553-559, Berlin:Springer-Verlag, NATP ASI series Vol F73.

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/05
04/04/2019

25. Célia Martinie, Philippe A. Palanque, Alberto Pasquini, Martina Ragosta, E. Rigaud, S. Silvagni: Using complementary models-based approaches for representing and analysing ATM systems' variability. ATACCS 2012: 146-157
26. Philippe A. Palanque: Engineering Automations: From a Human Factor Perspective to Design, Implementation and Validation Challenges. EICS 2018: 2:1-2:2
27. Célia Martinie, Philippe A. Palanque, David Navarre, Marco Winckler, Erwann Poupart: Model-based training: an approach supporting operability of critical interactive systems. ACM conference on Engineering Interactive Computing Systems (EICS) 2011: 53-62
28. Davis, F. D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", MIS Quarterly, **13** (3): 319–340

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/06
15/04/2019

Education and Performance in Aviation: Realising and Sustaining Benefits

Presented by ALTA



Panamá, April 15th 2019.

Education and Performance in Aviation: Realizing and Sustaining Benefits

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.

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/06
15/04/2019

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,

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/06
15/04/2019

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 Sneader)

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

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/06
15/04/2019

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 runaway overrun prevention systems, where a software can use the aircraft height, airspeed, weight, compare to a runaway 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.

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/06
15/04/2019

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

2019_RECOMMENDATIONS
**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



POSITION PAPER

R19-PP/06
15/04/2019

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.

References:

<https://www.mckinsey.com/featured-insights/future-of-work/ai-automation-and-the-future-of-work-ten-things-to-solve-for>

By James Manyika and Kevin Sneader

<https://datascience.aero/aviation-revolution-ai-deep-learning/>

By Darío Martínez

<https://www.unitingaviation.com/strategic-objective/capacity-efficiency/the-future-of-technology-in-aviation-training/>

By Dr. Suzanne Kearns

<https://www.internationalairportreview.com/article/26445/aviation-talent-gap-john-wensveen/>

By John Wensveen PhD (Professor of Air Transportation: Purdue University)

Airbus (2015) Future by airbus; [accessed 2016 Jan 7]. <http://www.airbus.com/innovation/future-by-airbus/> [Links]

Article: Anticipating the Need for New Skills for the Future Aerospace and Aviation Professionals http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2175-91462016000200232 By Ilias Lappas and Kyriakos I. Kourousis

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/06
15/04/2019

Allen IE, Seaman J (2013) Changing course: ten years of tracking online education in the United States; [accessed 2016 Jan 7]. <http://www.onlinelearningsurvey.com/reports/changingcourse.pdf> [[Links](#)]

Assessment and Teaching of 21st Century Skills (2016) About the project; [accessed 2016 Jan 7]. <http://www.atc21s.org/> [[Links](#)]

European Aviation Safety Agency (2015) ANPA 2015-10: introduction of a regulatory framework for the operation of drones; [accessed 2016 Jan 7]. <https://www.easa.europa.eu/documentlibrary/notices-of-proposed-amendment/npa-2015-10#group-easadownloads> [[Links](#)]

European Commission (2010) An agenda for new skills and jobs: a European contribution towards full employment; [accessed 2016 Jan 7]. <http://ec.europa.eu/social/BlobServlet?docId=6328&langId=en> [[Links](#)]

Eurostat (2015) Unemployment statistics; [accessed 2016 Jan 7]. http://ec.europa.eu/eurostat/statistics-explained/index.php/Unemployment_statistics [[Links](#)]

Federal Reserve (2015) Statistical release. Consumer credit - G.19; [accessed 2016 Jan 7]. <http://www.federalreserve.gov/releases/g19/20160108/> [[Links](#)]

Future of Flight Foundation (2016); [accessed 2016 Jan 7]. <http://www.futureofflight.org/> [[Links](#)]

Gee JP (2008) Learning and games. In: Salen K, editor. The ecology of games: connecting youth, games, and learning (John D. and Catherine T. MacArthur Foundation series on digital media and learning). Cambridge: The MIT Press. [[Links](#)]

Green F, James D, Ashton D, Sung J (1999) Post-school education and training policy in developmental states: the cases of Taiwan and South Korea. J Educ Pol 14(3):301-315. doi: 10.1080/026809399286369 [[Links](#)]

Griffin P, Care E, McGaw B (2012) Assessment and Teaching of 21st Century Skills. Dordrecht: Springer. [[Links](#)]

Hofstede G, Hofstede GJ, Minkov M (2010) Cultures and organizations: software of the mind. 3rd ed. New York: McGraw-Hill. [[Links](#)]

International Labour Organization (2013) Global Employment Trends for Youth 2013: a generation at risk; [accessed 2016 Jan 7]. http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_212423.pdf [[Links](#)]

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/06
15/04/2019

Kaufmann H (2003) Collaborative augmented reality in education; [accessed 2016 Jan 7]. <https://www.ims.tuwien.ac.at/publications/tuw-137414.pdf> [[Links](#)]

Lee JJ, Hammer J (2011) Gamification in education: what, how, why bother? Acad Exchange Q 15(2):1-5. [[Links](#)]

Leu DJ, McVerry GJ, O'Byrne JI, Kiili W, Zawilinski C, Everett-Cacopardo L, Kennedy H, Forzani E (2011) The new literacies of online reading comprehension: expanding the literacy and learning curriculum. J Adolesc Adult Literacy 55(1):5-14. doi: 10.1598/JAAL.55.1.1 [[Links](#)]

Mantovani F (2001) VR learning: potential and challenges for the use of 3D environments in education and training. In: Riva G, Galimberti C, editors. Towards cyberpsychology: mind, cognition and society in the internet age. Amsterdam: IOS Press. [[Links](#)]

McKinsey & Company (2014) Education to employment: getting Europe's youth into work; [accessed 2016 Jan 7]. http://www.mckinsey.com/insights/social_sector/converting_education_to_employment_in_europe [[Links](#)]

Organisation for Economic Co-operation and Development (2016) PISA 2012 results; [accessed 2016 Jan 7]. <http://www.oecd.org/pisa/keyfindings/pisa-2012-results.htm> [[Links](#)]

Platform for Unmanned Cargo Aircraft (2016); [accessed 2016 Jan 7]. <http://www.platformuca.org/> [[Links](#)]

Prensky M (2001) Digital natives, digital immigrants. Part 1. On the Horizon 9(5):1-6. [[Links](#)]

Roussos M, Johnson A, Moher T, Leigh J, Vasilakis C, Barnes C (1999) Learning and building together in an immersive virtual world. Presence 8(3):247-263. [[Links](#)]

The Hofstede Centre (2016); [accessed 2016 Jan 7]. <http://geerthofstede.com/countries.html> [[Links](#)]

U.S. Department of Education (2015) National Center for Education Statistics. The Condition of Education 2015 (NCES 2015-144). Institutional Retention and Graduation Rates for Undergraduate Students. Washington: U.S. Department of Education. [[Links](#)]

World Economic Forum (2014a) Education and Skills 2.0 Report: new targets and innovative approaches; [accessed 2016 Jan 7]. http://www3.weforum.org/docs/GAC/2014/WEF_GAC_EducationSkills_TargetsInnovativeApproaches_Book_2014.pdf [[Links](#)]

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



POSITION PAPER

R19-PP/06
15/04/2019

World Economic Forum (2014b) Global Risks 2014: ninth edition; [accessed 2016 May 16]. http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2014.pdf [[Links](#)]

2019_RECOMMENDATIONS

**EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS**



REPORT
Education and
Performance in Aviation

R19-R

Education and Performance in Aviation: Realising and Sustaining Benefits

Highlights

- Air traffic is expected to double over the next twenty years. Hiring and retaining aviation personnel is therefore essential.
- Education and training in aviation should be considered as an investment based on three major factors, namely cost, return and risk.
- Major industry challenges include: Meeting the needs of a growing industry, competing for and retaining personnel, filling the gender gap and addressing training in automation and artificial intelligence.
- It is important for the industry to conduct studies in order to gain comprehensive situational awareness of its status and future needs.
- Effective industry-education partnerships must be developed to provide a framework for addressing future educational and training priorities.
- Best practices should be adopted from other industry settings for the aviation industry to successfully compete for personnel.
- Training and education programs should be developed so that current aviation employees can be usefully re-deployed or re-trained.
- Education and training in aviation must address diversity imbalances in order for the industry to attract and retain the required personnel.

1. Introduction

Air traffic is expected to double over the next twenty years. This will inevitably create new challenges in terms of equipment (e.g. aircraft) and infrastructure (e.g. IT systems, airports), but also in terms of hiring and developing personnel. In this context, education and training in the sector (both of technical and managerial) should not only 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 realise and sustain benefits for all involved stakeholders. Addressing, therefore, the issue of education and training in the sector becomes of major importance from both a quantitative (i.e. number of educated employees) and qualitative (i.e. in terms of bridging the skills gap between what is needed by the market and what is offered by education service providers) perspective.

In this report, we discuss education and training as an investment, outline challenges faced by the aviation industry in recruiting and retaining personnel, and detail actions that may be undertaken by the industry in improving its training and educational strategy.

2. Education and Training in Aviation as an Investment

In this context, it is useful to consider education and training in aviation as an investment based on three major factors, namely cost, return and risk. To the individual seeking training and

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



REPORT
Education and
Performance in Aviation

R19-R

development, the cost has two major components; that is, the monetary aspect in terms of tuition fees and the time dimension related to the time spent on being trained. Returns refer to the salary, career progression and non-pecuniary benefits (such as health insurance and benefits-in-kind, such as free flights) that may be received from an aviation career. Risks refer to the possibility of not gaining employment after having received the education and training, as well as the possibility of being locked into a sub-optimal career progression path due to low transferability of the acquired skills. There are also costs, benefits and risks to the aviation organisation. The organisation may incur costs either directly through in-house training or by subsidising training at partner or third-party organisations. Benefits include improved performance from trained personnel and increased retention of personnel. Risks include the possibility of trained personnel leaving the organisation, perhaps even to competitors.

With the above in mind, if education and training in aviation is to progress and thrive in the future, the following should be seriously considered. First, who should bear the cost of training and education? Should the cost be borne by the trainee, by the aviation service provider (i.e., airline, airport, ANSP, etc.) or even by the government? In an increasingly market environment of post-secondary education, governments in many countries may be reluctant to fund industry-specific training. As aviation education and training may be costly to provide, predominantly in the case of training flight crews, but also with other operational and managerial skills, interested individuals may choose other less-costly careers. In fact, many aviation service providers, and especially airlines, operate with low profit margins, thus reducing their capacity and their inclination to fund training, especially if skills can be easily transferred to other organisations. Similarly, governments may be reluctant to subsidise aviation training, even external benefits from the aviation sector (e.g., to trade and tourism) given other spending priorities and negative externalities from the sector, such as carbon emissions.

Second, the aviation sector may not be as appealing to new recruits, as was the case in the past. Many people in the Generation Y and Generation Z age groups may be attracted by firms perceived to be operating in more dynamic industries, such as, start-ups in the IT sector, characterised by potentially very large returns and the excitement of working in “cutting-edge” positions. Furthermore, the aviation industry may be seen as not as “green” as other industries given its contribution to greenhouse gas emissions. Young recruits may prefer to work in industries considered to be better for the environment.

Finally, given the rapid changes in technology, risks in aviation education and training may be rising. Labor in this industry may be replaced by technology, as key positions, such as air traffic control, are transformed due to technology. Unless training organisations are at the cutting edge of technology, it may be that the skills and education gained by students will be obsolete in the near future.

3. Challenges to Meet

Given the above discussion, the following challenges emerge with respect to education and training in the aviation industry:

a) *Meeting the needs of a growing industry*: The aviation industry is projected to continue to grow over the upcoming years, with growth faster in some areas of the world, such as Asia-Pacific and Africa. This growth will generate increasing needs for personnel in all areas of the aviation sector.

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



REPORT
Education and
Performance in Aviation

R19-R

b) *Competing for personnel:* Aviation must compete with other industries for available personnel. As populations age in many areas of the world, there are fewer “young people” as a proportion of the population. Traditionally, the aviation industry has relied on travel benefits as incentives for attracting new recruits to the industry. However, these may not be the primary benefits demanded by the younger generation. They may be more interested in personal development and growth opportunities. Moreover, much of the aviation industry has traditionally not been as profitable or provided the job security as other industry sectors. So, based on pay, personal growth and development, and job security, the industry may find it difficult to compete for personnel with other more attractive and higher-paying industries.

c) *Retention:* Related to the challenges of hiring new personnel, is the problem of retaining personnel. Given the needs for personal growth, the industry will have to develop in-house training programs and partner with educational providers in order to facilitate this growth. Retention is especially a problem in regions of the world with lower pay levels, as personnel may migrate to higher paying positions outside the region. Therefore, creating growth opportunities within these lower-paying areas is especially important.

d) *Providing Training Opportunities:* The aviation industry, itself, cannot fully meet its training needs. Therefore, it needs to partner with educational institutions and other training providers. It may be that traditional educational institutions are best suited to providing the “soft-skills” needed by the industry. However, the aviation industry will need to compete with other industries for these new hires. There are ways that the aviation industry may increase the probability of hiring new recruits from these educational institutions, such as offering internships, working with the placement offices in the educational institutions, and volunteering as guest speakers in classes. On the other hand, training in the technical skills may best be offered in-house or in partnership with specialised training organisations. Traditional higher educational institutions generally do not have the expertise needed to provide this type of training.

e) *Filling the Gender Gap and Addressing Diversity:* In a liberalised and commercialised environment, knowledge of economics, management, marketing and soft skills become essential to effectively running a business. Recruiting personnel in these areas, as well as in more technical areas, is essential. As a result, the industry must look to recruit individuals currently underrepresented in aviation. In particular, recruiting more women will be required, since the percentage of women in the industry is relatively low, compared to the percentage of women in the workforce, in general.

f) *Automation and Artificial Intelligence:* Aviation education should be pursued as a STEM field, focusing on helping recruits and current employees discover science and technology fundamentals. Expected developments in technology may have important implications for aviation jobs in the future and the training of personnel to undertake these positions. Unmanned and remotely controlled aircraft may question the need to train pilots; robots may be able to undertake many operational tasks currently undertaken by people; blockchain technology may reduce errors and the need for control; while artificial intelligence may render data analysts and managers less important if not redundant.

2019_RECOMMENDATIONS
EDUCATION AND PERFORMANCE IN AVIATION:
REALIZING AND SUSTAINING BENEFITS



REPORT
Education and
Performance in Aviation

R19-R

4. Recommendations

First, it is important for the industry to gain comprehensive situational awareness of its status and future needs. This can be gained through a series of studies and needs-analyses that focus on current industry standing and future prospects. These will include but not be limited to: salary levels, levels of technology penetration, employee satisfaction and mobility (inter and intra). Specific policies and recommendations can be more effectively drawn and produce tangible and systematic results in the long run if they are based on comprehensive data gathered through these studies. International organisations will be of importance in assisting with data gathering and helping to shape the questions addressed by these studies.

Second, effective and systematic industry-education partnerships must be developed at national, regional and even global levels that will provide a framework for addressing future educational and training priorities of the industry. A framework such as the above-mentioned can provide for a flexible and sustainable means to address future industry needs.

Third, it is important that the aviation industry examine best practices found in other industry settings in regard to effective training and education regimes, industry-education partnerships, as well as employee satisfaction and retention. Otherwise, the aviation industry may be outcompeted for the best talent by industries perceived as providing better opportunities for employment and advancement.

Fourth, it is important to ensure that current aviation employees can be usefully re-deployed or re-trained. The acquisition of educational skills should prove flexible enough to accommodate technological disruptions in a service sector such as aviation. At the same time, the aviation industry must hire recruits with the soft skills, such as customer service, that are so important in the industry. Moreover, education and training in aviation should address gender imbalances. Finally, aviation industry stakeholders should become more proactive in partnering with educational institutions, both traditional and more specialised. Effective industry education partnerships can be built in two ways: (a) Through direct partnerships between aviation businesses/organisations and academic institutions/training centres. These partnerships can focus on specific skills that need to be developed in the industry. (b) Through networks that include government, academia and industry that can address skills required by the aviation industry, as well as many other industries.

2019 Hermes Report Committee

Chairman

Professor Martin Dresner, University of Maryland & President, ATRS

Members

-Robert Deillon, VP, Hermes - Air Transport Organisation

-Professor Triant Flouris, Provost, Hellenic American University

-Professor Dr Andreas Papatheodorou, Editor-in-Chief, Journal of Air Transport Studies

- END -