



# International Federation of **Air Traffic Controllers'** Associations (IFATCA)

## **Next Generation of Aviation Professionals**

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## Craft to Science

It could be said that ATC today is a craft.

The craft is evolving into the science of air traffic management.

The science of management of multiple-trajectories, a form of temporal resource allocation, that seeks continuous system-wide optimization despite uncontrollable events (such as weather).

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ATC today leaves me sad on the one hand - but excited on the other.

I am sad to see the craft of ATC coming to an end. A craft in which there were individual solutions to individual problems, essentially hand crafted with discrete heading, speed and level instructions. However the increase in the volume of traffic and the demands of economic and environmental efficiency will move us toward a more mass-produced solution for ATC.

I am excited because this mass-produced solution is leading to a better scientific understanding of the role of air traffic control, or as it is now called air traffic management. Previous understanding of air traffic control usually erred in thinking that ATC was simply about "avoiding collisions between aircraft" – but ATC has always been about smooth orderly flows of traffic and determining order of access to resources.

Aircraft today are very capable – but all their trajectory calculations are based on if they were the only aircraft in the sky. Therefore Air Traffic Management will, for the foreseeable future, be the management of multiple trajectories, with orderly access to finite runway and airspace resources, despite uncontrollable events such as weather.



## Human Automation Synergies

Human is not only an emergency back-up.

Using strengths, minimizing weaknesses.

Controller will be an active decision-maker -  
“managing” rather than “controlling” the traffic.

Open-System (uncontrollable events).

Continuous Transition.

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The future of ATC does not have to be some of the negative things it could be. For example, the human in automation should not be there as only an emergency back-up system.

The human and the automation will need to work together, using the strengths of both and minimizing the weakness of both (for automation has weaknesses too). The human and automation need to support each other in a synergistic manner.

In IFATCA's view, the future controller will still be an active decision-maker in the system - however much that is done manually today will be delegated to automation for the execution of the task - perhaps like an auto-pilot is for pilots. So rather than using discrete instructions to control heading, level and speed the controller (supported by automation) will manage the traffic flows and trajectories.

So assuming that systems can be built that controllers, and indeed all involved in aviation safety, can trust – then some tasks will be delegated by the controller to automation, some tasks may be assigned to automation as part of system design and even some aspects of separation and sequencing will be done by automation. However understanding of ATM processes is not very advanced, and much work will be required to develop such systems. With such automation it can be asked if we still need the human. The answer for the next 20 years at least is yes because the ATM system is not a closed system where every event can be predicted and every event controlled. The selection of a runway to land on or take-off from still depends on which way the wind blows. The exact nature and severity of severe weather that is incompatible to flight operations is still something that we must react to and that we are not able to control. The human is there for their ability to rationally handle unforeseen or uncontrollable events.

The transition phase will be the key to the future successes. For those currently in the job we need to be able to transition to the future working environment and the challenges in an acceptable way. The new generation will have to be trained in issues like change management and tools will have to be developed to make the new generation understand the processes they have embarked upon. The transition phase will be over many years and will in practice be a series of transitions – or in a continuous, seemingly unending, transition phase.



# Staffing

10% short, another 15% needed for transition.

No longer “job for life”.

## Recruiting

- Make Aviation an early option.
- Allow transitions.

## Retention Challenge

- Adapt to benefit from a mobile workforce.

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IFATCA considers that there is a global shortage of air traffic controllers of about 10% and that to transition to future ATM systems (such as SESAR and NEXTGEN) will require an additional 15% for many years. Transition requires extra staff to provide for changes to methods of operating, including validation of those changes, and for releasing operational staff for conversion training to new procedures and systems. Some States have significant age profile issues, with a significant percentage of controllers due to retire soon.

Traditionally, ATC has been seen as a “job for life”, where the individual controller would expect to serve his or her entire career with the one employer. Our industry has had problems ‘retaining’ younger generations, some have seen it as an interesting job for a few years but then seek new opportunities in other industries, using the skills they have gained within ours.

I do not expect there to be a problem finding recruits for controllers - however it must be provided as an option early on in the education process and provided it will be possible to transfer into controlling later in a career. We will need to decide on what pre-existing qualifications recruits can use to transfer to controlling from other industries.

Retaining controllers has been an issue for Air Navigation Service Providers (ANSPs). Recent years has seen an increasing number of controllers moving between ANSPs for both personal and professional reasons. A challenge for both ANSPs and controllers in the future is whether we can accommodate the modern mobile workforce in our operations. Perhaps we need to explore ways that aviation professionals can have opportunities to move between locations and ANSPs at various times in their careers. Such flexibilities could bring considerable benefits to the individuals and ANSPs, by broadened life and work experiences, expert knowledge sharing and skills development. But will our future systems and administrations be able to accommodate such a ‘sharing’ of professionals, like air traffic controllers, engineers and system administrators? How would such moves be accommodated with regard to maintenance of salary and conditions and pensions? Just how far is our industry willing to cooperate to retain our unique professionals? Perhaps the problem will be retention of aviation professionals for the next generation in the industry, not just with a single ANSP.



# Competencies

Define Competencies – no small task.

No effective global standards.

ICAO Standards are needed for:

- Training
- Licensing
- Refresher Training
- On going competence validation.

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It is readily accepted that we need to define the competencies required of controllers – and that the future is competency-based training. However it is hard to exaggerate how big a task this is. With all due respect to ICAO, and Annex 1, there are no effective global standards for air traffic control training and on going competency. States do not even have to issue air traffic control licences to controllers, even those controllers responsible for international traffic. There is some expectation of “equivalent training” for controllers, but this is where the “craft”, or individual concepts of air traffic control are still very strong. Many States have their own understanding of what air traffic control training requires, and what is required after an “authority to act” as a controller is given. For example some States have no checks that a controller remains proficient at their task and/or provide no on-going refresher training in emergency or abnormal procedures. There are only a few service providers who make use of normal operations audits to ensure humans (and automation) are performing as expected. We now have a split in many States between Regulators and Service Provision. I know at least one Regulator who appears overly-involved in training and rating of controllers – but such Regulators are rare. The norm is for Regulators to seem to have too little oversight in regards to the training and competence of controllers. States need to work with ICAO to ensure that global standards determines the appropriate role of Regulator, Service Providers – and indeed the appropriate use of the wider education community – in the education, training, licensing, rating and on-going competence of controllers and other aviation professions.



## Controller Attributes

Can anyone do ATC? - or 5% of anyone?

**Multi-task** – but a particular type:  
focused, working to completion several tasks,  
while still processing interruptions.

**Action Takers** – even with incomplete data or  
when protocols not followed action must  
occur.

**Innate Aptitude** – ease and competence.

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I used to think that anyone could be taught to do some aspect of air traffic control – not any and all controller tasks but at least some control task. Mind you I was dealing with the results of a selection process so I was only dealing with less than 5% of applicants.

I have found over the years that some trainees found it almost impossible to multi-task. Multi-tasking should not be treated as just one single type. Some forms of multi-tasking are more like being distracted by multiple sensory inputs or thoughts. Controller multi-tasking is a focused application to achieving specific objectives, often as a team effort – however there are several uncompleted tasks towards those objectives that must be completed in parallel and to completion. It must also frequently allow priority interrupts to tasks in progress and reassessment of how that new information received during the interruption affects all tasks, including the priority of their completion.

I also found too that it was very difficult for some trainees to be able to make decisions at critical times. Some for example wish to debate that correct procedures had not been followed rather than take action to address a serious problem. There is no point in saying that the flight plan should have been filed or a label should have been correlated with a radar return – if that radar return is a threat to other aircraft. Corrective action is required. Other trainees seem to want to continually wait for more data but there is often the need for controllers to act with incomplete data.

I have also seen qualified controllers, some who found it easier than others - and observed this difference persisted even over decades of controlling. It was not a case of being slower to learn, just the level of ease in doing the job. Perhaps it is comparable to learning to drive. Most people can learn to drive a car. However not everyone who learns to drive is capable of being a good bus driver or a pursuit driver. I am not saying that there are not acquired or learned aptitudes – clearly much of what a controller does is from skills developed during education and training. However an attitude that a controller trainee should have unlimited time to qualify can actually create a liability, and an unpleasant work experience for the individual concerned, for those who do not have a certain ease and competence in controlling.





## 100% Pass Mark

To err is human – so why 100% pass mark?

Some tasks require 100% average performance.

Aviation is intolerant of error.

System defenses against error expect low error rate.

Exceptional performance of routine tasks.

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I hope I can convey this important point to you.

Controllers, being human, make lots of mistakes. Given a busy shift, I am sure that there are several errors in a shift per controller. However the important thing is that they are errors of little consequence. For example, an item may be temporarily forgotten but the working technique used may recall it to memory within an acceptable time. The majority of errors are expected to be self-detected and self-corrected by the controller themselves and the system defenses are designed to catch the few that are not self-corrected.

To put it another way, when a State first went from in-house training of controllers to externally provided training the course was initially designed by the external facility so that trainee air traffic controllers could still qualify even though they had failures in separation during their final simulator sessions. This caused problems when those trainees went to field training. However the previous in-house training required no failures in separation during the final assessments - essentially a pass mark of 100%. This reflects the working environment where such performance is expected every shift. It is not acceptable for an air traffic controller to in a shift to separate 90%, 95% of even 99% of traffic – 100% is the expected average performance. It is therefore appropriate to expect even in training for 100% performance in some tasks.

So this brings us to a problem which is not so easy to solve. There have been recent incidents and accidents which have highlighted the need for better training and better fatigue management. Both of these are very important. However there is something else - pilots, air traffic controllers and some non-aviation professions too - have a high requirement for making the right decision the first time (not right after repeated attempts). When I was learning to fly, in the flying-club there was a picture of a crashed aircraft and printed over it was "aviation is intolerant of error". Well that was many years ago and much work has been done on error management and ways of having system defenses against error - but I still think the aviation system is designed around a low number of errors by front-line operators. This means that exceptional performance of the human is required for the ordinary execution of routine tasks.

So the hard question to ask and to answer is: are some of these incidents and accidents not related to training or fatigue – but on the selection of someone able to execute routine tasks in an exceptional way, and make the right decision the first time?

So a word of caution. As the ATM system works today and most likely in the future too, there is a requirement for exceptional performance of routine tasks by controllers.



## 100% System Performance

Some tasks require 100% average performance – human and system

Aviation is intolerant of error.

Exceptional performance of routine and non-routine tasks is expected.

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As I mentioned earlier, the future ATM system seeks to have the Human and the Automation working together in a synergistic manner. This need for exceptional performance of routine tasks applies to the automation also. In a similar way that modern aircraft fly-by-wire systems must have exceptional performance, so critical ATM systems should also have exceptional performance for ATM system are managing trajectories of many aircraft. In other words, the human, the automation and the combination of human and automation must all deliver exceptional performance of routine, and non-routine, tasks. This is what the public expects of aviation. This is what all involved in the industry must seek to deliver.





## Creating the Future

“The future is not some place we are going, but one we are creating.” - John Schaar

### IFATCA

More than anything else, a comprehensive solution requires a **high level of co-operation** between all members of the ATM Community.

### CANSO

WAS: Working with Aviation Stakeholders.

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IFATCA agrees with John Schaar. IFATCA considers our actions, or lack of action, will shape the future.

IFATCA considers that more important than any other aspect of Future ATM, including technological development, is the need for a high-level of cooperation between all members of the ATM community – and this includes education and training providers.

Late in 2009 at the annual CANSO Safety Conference a revolutionary change was introduced: “WAS” which stand for “**W**orking with **A**viation **S**takeholders with IATA, IFATCA, ACI and ICAO participating based on the conviction we can only be better together and that we have lots of things to learn from each other. CANSO has decided to drive the close exchange with its aviation partners and will strive for international cooperation in order to propose recommendations to commonly approach obstacles in order to be successfully set-up for our future challenges.

CANSO and IFATCA are working together on the future aviation professionals in ATM. You will have received a small booklet that was jointly developed for this meeting.

We are of course all here working with ICAO.



## Conclusions

CANSO and IFATCA agree:

Future aviation professionals will have to work together, defining requirements, opportunities, constraints, roles, etc.

Human contribution will be critical.

Key drivers:

- Safety
- Performance-based ATM.

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CANSO and IFATCA have agreed:

Future aviation professionals will have to work together, defining requirements, opportunities, recognizing constraints, obtaining knowledge of each other's roles, recognizing technological/ institutional developments as well as environmental and economic facts.

The human contribution will be crucial to run the future aviation business in a safe and efficient way, because the human component is the most flexible and adaptive component in the aviation system

The key drivers in the future will be Safety and Performance-based ATM.



## Next Steps

CANSO and IFATCA agree we need to:

- Gain a better insight into the new workforce generation.
- Understand the new roles and responsibilities in the ANSP sector.
- Promote best practices, especially in the management of safety and in human-automation synergies.
- To raise the awareness that the “Next Generation of ATM Professionals” comprises all ATM professions.

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CANSO and IFATCA have agreed the next steps are:

Gain a better insight into the new workforce generation, the culture they form and their needs to ensure that ANSP professions are attractive work choices

Understand the new roles and responsibilities in the ANSP sector comprising the Controllers, ATSEP (engineers) and administrative professions and how they are linked to pilots, airline and airports tasks and responsibilities

Promote best practices, especially in the management of safety and in human-automation synergies

To raise the awareness that the “Next Generation of ATM Professionals” comprises the professions of ATSEPs, managers, procedure designers, regulators, approval organization staff, and many others, of equal importance to the controller profession. The same applies to the wider aviation industry: besides pilots, engineers and maintenance people, managers and UAS operators as well as remote operated tower (services) operators must be considered. Therefore, the aviation community should follow a more holistic approach when discussing the next generation topic.

You are all invited to work with us, as we hope we will be able to work with you, in creating the future and making sure that there are sufficient competent professionals to ensure a continuing bright future for aviation.

Thank you.



## THANK YOU

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