



WORKING PAPER

COUNCIL — SPECIAL MODEL SESSION

Subject No. XX: Training of the future Air Traffic Controllers with an increased use of simulators

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EXECUTIVE SUMMARY

This paper outlines the evolution of the ATM system to cope with the increasing air traffic demand. It analyses the future needs of air traffic controllers and addresses the issue of training in a cost-effective way considering the future ATM environment

Action: The Council is invited to:

- a) Consider the information in the paper
- b) Direct the Secretariat to develop guidance material on new methodologies to design and deliver training for air traffic controllers taking into consideration new technologies such as simulators.
- c) Encourage Member States to implement the new methodologies associated with training and knowledge development.

<i>Financial implications:</i>	Although simulators require a high initial investment, the recovery of this investment is expected to be short and profitable, attending to potential use and life cycle. However, a cost-benefit analysis should be performed before incurring the investment.
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<i>References:</i>	Doc 9868, <i>Procedures for Air Navigation Services — Training</i> State letter AN 12/48-14/53, Proposal to restructure the <i>Procedures for Air Navigation Services — Training</i> (PANS-TRG, Doc 9868) and to include competencies for ATCOs and ATSEPs
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1. INTRODUCTION

1.1 Air traffic continues growing worldwide despite the global economic recession according to ICAO projections. Scheduled passenger traffic around the world is expected to more than double from 2013 to 2030. The challenge for the aviation community is thus to accommodate in a globally-harmonized way the continued increasing demand for air travel by increasing capacity, improving efficiency, enhancing security and facilitation, and minimizing the environmental effects of civil aviation activities, in a safe and economically-viable way.

1.2 In order to achieve this goal, new technologies, procedures and concepts of operations must be developed and implemented in a coordinated manner, as stated in the *Global Air Navigation Plan* (Doc 9750). It is worth noting that the human being is and will continue to be fundamental to provide the services required by the aviation industry. As such, the availability of the required qualified human resources is crucial to operate, manage and maintain the future international air transport system.

1.3 To this end, ICAO launched the next generation of aviation professionals (NGAP) initiatives in 2009. These initiatives seek to develop strategies, best practices, tools, standards and guidelines as necessary, and to facilitate information sharing activities that assist the global aviation community in attracting, training, educating, and retaining the next generation of aviation professionals.

1.4 Among these aviation professionals, this paper focuses on air traffic controllers and highlights the need for new training methodologies to prepare them for their essential role in maintaining a safe and efficient system managing an increasingly complex and congested airspace.

2. BACKGROUND

2.1 Air traffic management is the dynamic, integrated management of air traffic and airspace (safely, economically and efficiently) through the provision of facilities and seamless services in collaboration with all parties, as defined in ICAO *Global Air Traffic Management Operational Concept* (Doc 9854). Thus, the ATM system is a system that provides air traffic management through the collaborative integration of humans, information, technology, facilities and services, supported by air, ground and/or space-based communications, navigation and surveillance. The ATM system is based on the provision of services; namely, air traffic control.

2.2 The first attempts of air traffic control (ATC) appeared in the twenties: radio communication allowed organizing departures and arrivals at the airport. The thirties saw the proliferation of those radio equipped aerodrome control towers but also the establishment of en-route traffic control. By the fifties, the appearance of radar brought a new generation of ATC, allowing further improvements in arrival and departure operations. Traffic growth and the development of computer technology in the last decades have shaped the current state of ATC, with several solutions for each task and an increasing degree of automation. With this increasing complexity the level of required training for air traffic controllers has also become more demanding.

3. CONSIDERATION OF ISSUES

The Future ATM system

3.1 The increasing air traffic congestion poses further challenges that request solutions enabled by the most recent technological advances: satellite navigation, data link communication, automatic surveillance, system-wide information management, etc.

3.2 The foreseen global solution to address the needs of the future ATM system, in a performance-based framework is based on two principles, pillars of future trajectory-based operations: the airspace user shall plan their preferred 4-dimensional trajectories and the ATM system should provide the means to allow those trajectories by modifying them to the minimum extent possible.

3.3 Although the current focus on the ATM system is on technology, human factors principles apply to the safe operation of the system and need to be properly addressed.

Future Air Traffic Controllers Profile

3.4 Despite the technological changes, the future controller will still be an active decision-maker in the system; however, as stated before, much that is done manually today will be delegated to automation for the execution of the tasks. So rather than using discrete instructions to control heading, level and speed, the controller will be requested to manage traffic flows and trajectories.

3.5 The ATM system is not a closed system where every event can be predicted and controlled; this is necessarily why air traffic controllers must always be ready to deal with the unexpected, to think quickly and to take decisions that would not be possible for a computerised system to adequately perform. For this, air traffic controllers need to be properly trained to provide exceptional performance of routine and non-routine tasks, in order to avoid incidents and accidents and at the same time, improve the efficiency of operations.

Training: methodologies to design and deliver

3.6 In terms of recruiting, the personality traits or skill sets required from the new generation of air traffic controllers are not likely to be significantly different from the ones required nowadays. But the training required could be substantially different. And because each operational environment is different, the idea of a global standard and/or single training common for all air traffic controllers is a utopia. Thus the focus should not be in finding this unique training that will suit all operational environments, but in defining a set of standard competences and training methodologies in a way that is adaptable to every operational environment of all States and regions, and scalable to meet specific needs.

3.7 Within this context, fundamental competences expected from air traffic controllers to standardized performance have just been defined and included in a proposal for amendment to PANS-TRG (State letter AN 12/48-14/53). However, there is one element of this proposal, which requires further consideration by the Council. This is the question of how the competencies required might be both taught and tested, especially with respect to management of non-routine situations and how these skills might be taught as refresher courses to existing controllers.

3.8 The biggest change in the air traffic control system of the future will be the shift from a tactical system where priority is set primarily in the air on a real time basis, to one where the priority for aircraft is established through a number of collaborative-based decisions that include certain capabilities to allow the application of the “Best-capable, Best-served” principle. This approach will allow the maximization of technology investments to increase system capacity, but will increase planning workload of both operators and air traffic management.

Use of training simulators, or synthetic training devices

3.9 A recent advance regarding training has been the use of simulators, now common in the training of aviation professionals such as pilots. ATC training simulators are not very different, being a combination of computers and equipment that replicate the working environment and provides visual displays that emulate air traffic and ground movements.

3.10 Simulators provide a realistic training experience in a particular operating environment while removing the risk of giving real ATC responsibilities to an unexperienced trainee. They also allow

testing unexpected non-routine situations that would actually appear only very infrequently or new procedures in development but not yet implemented.

3.11 For example the proposed competencies require the ability to train in the management of emergency and unusual situations related to aircraft operations; and, the recognition, from the information available, the possibility of an emergency or unusual situation developing. Since these events are unlikely to happen on a daily basis, it seems unrealistic that they could be adequately taught in on the job training or by standard teaching methods. By comparison, aircraft pilots make extensive use of simulators to train, in a cost effective way for rare, but potentially life threatening upsets. This will ultimately contribute to increase the levels of operational safety.

3.12 These four applications (basic training, training for ratings, procedures under development and none-routine situation training) acknowledge simulation technology as the basis for a methodology to achieve the different competencies required for basic, rating and adaptable training. Due to its nature of global interoperability but at the same time scalability, simulators constitute an important tool for training international professionals in a harmonized way.

4. FINANCIAL IMPLICATIONS

4.1 The process towards deploying a new fully qualified air traffic controller in its simplest form can be described in three key phases: recruitment and selection; basic skills training; and on-the-job training (OJT). There are multiple issues in each of these phases but the largest bottle-neck by far in the ATC personnel area is OJT, mainly due to the limited number of operational OJT positions available at any one time and the value of the OJT time consumed by trainees. Simulators emulating location-specific ATC environments with real world traffic scenarios to enhance specific skill sets can address these issues while increasing the quality of training outcomes.

4.2 Though simulators require an initial investment by the stakeholders involved, there are several financial advantages once they are implemented. Firstly, they reduce the aforementioned bottle-neck, as the training in a simulator should decrease the amount of OJT necessary. Moreover, the experience obtained in the simulator decreases the risk of assigning real world responsibility to the barely experienced controllers, thus increasing safety and decreasing the potential costs related to those risks. Furthermore, it indirectly acts as a potential tool to be used during the recruitment process or for the validation of new procedures from the start.

4.3 A cost-benefit analysis has not been performed yet and should be done in the future. No significant financial implications for States or for ICAO are expected.

5. CONCLUSION

Air traffic demand continues increasing at an overwhelming rate. In order to accommodate this demand, maintaining or enhancing the level of performance new technologies, procedures and concepts of operations have been developed and implemented. Currently and for the near future, every event in the ATM system cannot be predicted and controlled: thus, humans and specifically air traffic controllers are essential to the safe operation of the system. Nowadays ATC training is long and expensive and should be adapted to accommodate required future competencies, which, together with the increasing demand of air traffic controllers, require the consideration of new cost-effective methodologies and tools for training such as the increased use of simulators.