INTERNATIONAL CIVIL AVIATION ORGANIZATION

Second Meeting of the Africa - Indian Ocean Aviation System Planning and Implementation Group (AASPG/2)

Livingstone, Zambia, 2 - 6 November 2026

Agenda Item 4: Implementation of safety and air navigation goals, targets and indicators, including priorities set in the Regional Aviation Safety and Air Navigation Plans

4.9. Other Aviation Safety and Air Navigation initiatives

The Next Generation of Aviation Professionals (NGAP) and the Future Air Traffic Controller (ATCO) Workforce

(Presented by IFATCA Africa and Middle East (AFM) region)

SUMMARY
This paper examines the impact of automation, artificial intelligence, and traffic growth on the ATCO profession in the AFI region. While these technologies are expected to enhance controller performance rather than replace ATCOs, they also introduce new workforce and competency challenges. The paper proposes updates to NGAP, staffing models, and training guidance to prepare a future-ready ATCO workforce. Action by the Meeting at **Paragraph 3.**

References	• ICAO Doc 9868-Procedures for Air Navigation Services -Training; • CANSO (2022). Standard of Excellence in Human Performance Management; • ICAO Doc 10056, Manual on Air Traffic Controller Competency-Based Training and Assessment; • ICAO Circular 361 is the Automation Study Report; • EASA. Artificial Intelligence Roadmap 2.0: A Human-Centric Approach to AI in Aviation; EUROCONTROL. (2022). Aviation Outlook 2050: The Future of the ATM Workforce; • IFATCA. (2023)-IFATCA Technical and Professional Manual: Controller Fatigue and Rostering Systems.
Strategic Goals	A. Every Flight is Safe and Secure B. Aviation Delivers Seamless, Accessible, and Reliable Mobility for All.

INTRODUCTION

1.1. The Next Generation of Aviation Professionals (NGAP) initiative established by ICAO to train successor aviation professionals, to fill current skills gaps and emerging competency requirements in the industry has gone a long way globally in achieving its goals.

1.2. However, with the fast evolution of the industry, rapid post pandemic growth, and the technological revolution, ushering in automation in the industry and the transition to artificial

intelligence (AI)) presents new challenges and opportunities for air navigation services providers, requiring the NGAP programme to be adapted to ensure better outcomes considering these changes.

1.3. These changes are occurring faster than ANSPs and regulators can adapt the skills, competencies and regulatory frameworks needed to support them.

1.4. These challenges are particularly relevant to the Africa and Indian Ocean region, where differences in infrastructure, training capacity, operational environments and workforce availability continue to affect the ability of States and ANSPs to develop and sustain the next generation of aviation professionals.

1.5. This paper aims to provide the AASPG/2 meeting with an assessment of the future ATCO profession profile and to propose adjustments to present guidance material to ensure the NGAP framework provides relevant skills and competencies for the region's future.

1. DISCUSSION

The Evolving role of the ATCO in an Increasingly Automated ATM Environment

2.1 The traditional ATCO competency model, primarily defined by the ICAO Doc 9868 (Procedures for Air Navigation Services — Training), focuses heavily on individual ability to provide air traffic separation based on surveillance and voice communication.

2.2 However, the global implementation of Trajectory-Based Operations (TBO), emerging use of digital systems for air traffic flow management (ATFM), adoption and integration of artificial intelligence as well as the transition to System Wide Information Management (SWIM) is shifting the controller's role from tactical intervention to strategic monitoring and exception management.

2.3 In addition, with the implementation of Air Traffic Flow Management and the increasing complexity of busier and already congested airspace, automated decision-support systems will increasingly support ATCOs in the performance of routine and repetitive tasks, while preserving the ATCO as a key element of the ATM system and retaining appropriate human oversight and intervention capabilities.

2.4 The rapid integration of artificial intelligence (AI) in all facets of life will not spare air traffic management and again will need the industry to adapt and evolve its skills and competency requirements for ATCOs in advance of introduction of the systems within the region.

2.5 For the present-day ATCO, increasing automation and AI may progressively support routine tasks such as conflict detection, trajectory monitoring and decision support. Such systems should augment rather than replace the ATCO, who should retain the authority and capability to monitor, assess and intervene when required. The future ATCO should therefore be viewed not simply as a system supervisor, but as a technology-enabled operational decision-maker working in partnership with increasingly capable automated systems.

2.6 Such a shift in responsibility, if not planned for well, creates a risk of what ICAO has defined as automation surprise where an automated system requires an unprepared human is expected to intervene and skills obsolescence where controllers may lose proficiency in traditional procedural control and manual vectoring due to automation dependency.

2.7 The European Union Aviation Safety Agency (EASA) has also identified this as a key risk in its AI Roadmap 2.0, noting that human oversight of AI requires a new and distinct set of cognitive competencies that are not currently prioritized in ab-initio training.

2.8 While the region and the rest of the global ATM industry are already facing a critical shortage of ATCOs, with the region estimated to require 2000 more ATCOs by 2034 in accordance with CAE in their 2025 Aviation Talent Forecast, it is timely to work towards training sufficient replacements with the skills required to operate safely in this changing environment.

2.9 This challenge is particularly significant in the AFI region, where limited and uneven training capacity remains a constraint on the timely development of new ATCOs. Strengthening regional training capacity and cooperation will therefore be essential to meet both the projected

workforce demand and the emerging competency requirements.

Workforce Resilience and Fatigue Management

2.10 The post-pandemic traffic rebound has been uneven and volatile in many jurisdictions, characterized by rapid peaks in traffic flows rather than steady and predictable increase in operational demand.

2.11 This operational instability has increased the cognitive load on ATCOs, with the International Federation of Air Traffic Controllers 'Associations (IFATCA) reporting elevated stress levels linked to unpredictable rostering and staffing shortages.

2.12 While ICAO has done well through Annex 11 on Air Traffic Services and Doc 9966, Fatigue risk Management Systems (FRMS) Manual to provide guidance on Fatigue Risk Management Systems (FRMS), they are premised on a predictable and relatively stable rostering environment.

2.13 The current shortages of ATCOs driven by the training pause of the pandemic, retirements, regional and international mobility of skilled personnel as well as the limited training capacity in the region, which cannot match the current vacancies and the rate of attrition, does not help the current outlook, resulting in excessive reliance on overtime to keep airspaces open.

2.14 This has led to elevated levels of fatigue and poor work life balance, which are critical repel factors for the target group of potential recruits, to an industry that is both perceived and known to be demanding to its professionals.

2.15 In hindsight, the AASPG must consider that the next generation of ATCOs enters the workforce with different psychological perceptions and expectations regarding work-life balance and mental health support needs as the major drivers of job loyalty.

2.16 Evidence from Air Navigation Service Providers (ANSPs) attrition data published by CANSO in 2022 in their Standard of Excellence in Human Performance, suggests that retention is now a greater threat to capacity than ab-initio recruitment failure.

The "Digital Natives" and Competency-Based Training

2.17 This transformation will require training programmes to evolve, incorporating new technologies while maintaining the safety principles and operational discipline of traditional ATM training.

2.18 The incoming generation of ATCOs are digital natives who will easily adapt to the new digital and automated ATM environment with not many issues.

2.19 However, high fidelity simulation studies indicate a potential vulnerability in "basic airmanship" and manual backup skills, due to the lack of traditional perception horned in present day controllers through procedural and surveillance-based air traffic control.

2.20 The ICAO Doc 10056 (Manual on Air Traffic Controller Competency-Based Training and Assessment) emphasizes evidence-based training (EBT); however, the evolving operational environment suggests that the Threat and Error Management (TEM) model should be reviewed to ensure that it adequately addresses threats arising from automation itself, including AI-generated recommendations and decision-support outputs.

2.21 It is important to note that as we transition into this era of high automation the risks associated with the various decision support systems are assessed and audit trails are embedded in such

systems to ensure that the route along with the reasoning to a decision is traceable, especially in cases where AI is used.

2.22 Furthermore, any training associated with such systems should emphasize on the critical importance of cyber-awareness to the next generation of ATCOs who lack the advantage of past exposure and experience of the ATM system before it became highly automated.

Strategic considerations for the NGAP framework

2.23 To future-proof the ATCO workforce, the AASPG/2 is invited to consider the following principles, taking into account the diversity of operational environments, levels of technological maturity and available training resources across States and ANSPs in the AFI region. A one-size-fits-all approach may not adequately address the different workforce and competency needs of the region.

2.24 Competency evolution is required where a transition from the traditional model of high dependence on purely psychomotor skills (voice/tactical) toward cognitive flexibility, systems thinking, and cyber-situational awareness is emphasized.

2.25 Adopting a data-driven staffing model that encourages ANSPs to move away from raw traffic count metrics toward complexity-weighted staffing models that account for automation oversight duties in addition to the traditional factors.

2.26 Fostering continuous learning by continuously updating Doc 10056 to mandate recurrent training on Automation Failure Management, ensuring controllers maintain manual recovery skills and other emerging competency requirements.

Conclusion

2.27 The ATCO profession is moving from tactical intervention to strategic monitoring and exception management, with the adoption of Trajectory-based operations, digital ATFM, SWIM and the integration of AI driving this shift, and it is happening faster than ANSPs and regulators can adapt their training and competency frameworks.

2.28 The next generation of ATCOs will be digital natives, but they may be less well grounded in basic airmanship and manual backup skills. Training must therefore build cognitive flexibility, systems thinking, cyber-situational awareness and automation failure management alongside traditional skills.

2.29 Retention is now a greater threat to capacity than ab-initio recruitment, while fatigue, over-reliance on overtime and unmet expectations on work-life balance and mental health support push away both current and prospective controllers.

2.30 Adapting the NGAP framework and the guidance in Doc 9868 and Doc 10056 is therefore necessary to ensure the region's future ATCO workforce can operate safely and effectively in an increasingly automated environment and the proposed NGAP study item on the impact of automation and AI on ATCO training, licensing and rating requirements is a practical first step.

3 ACTION BY THE MEETING

3.1. The Meeting is invited to:

a) Note the rapidly evolving nature of the ATCO role as described in this paper.
b) Recommend that ICAO initiate a study item under the NGAP programme to review the impact of automation with major emphasis on artificial intelligence and general automation on ATCO training, licensing, and rating requirements, with a view to updating Doc 9868 and Doc 10056.

c) Acknowledge the emerging needs of the next generation of ATCOs whose expectations on work-life balance and mental health are very different to current and past generations.
d) Recommend that the evolution and integration of automation and artificial intelligence in ATM be guided by human-centred design principles, ensuring that technology enhances ATCO performance, preserves meaningful human oversight and intervention capabilities, and supports safe and resilient ATM operations.

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