Agenda Item: C.10.6   **INFORMATION PAPER**   LWP No: 167
IFATCA'25

Advancing ATC Simulation with AI

Presented by Emirates Aviation Association (EAA)

SUMMARY

This paper outlines the potential applications of Artificial Intelligence (AI) in air traffic control (ATC) simulation environments, focusing on practical uses such as AI-driven speech recognition for pseudo pilots, intelligent scenario generation, and enhanced performance analysis. It highlights the ongoing developments in the UAE and emphasises both the benefits and challenges of integrating AI, including data availability, sensitivity, and cost uncertainty. The paper concludes with a call for IFATCA to proactively shape the safe and controller-focused use of AI in simulations through guidance, collaboration, and advocacy.

1.   INTRODUCTION

1.1. The accelerating development and adoption of AI is influencing air traffic management (ATM). AI offers powerful tools for enhancing safety, efficiency, and predictability in airspace operations. Simulation environments, which are integral to training, validation, and research in ATM, present an opportunity for leveraging AI technologies. This paper explores how AI can be applied in simulation environments, shares developments in the UAE, and urges IFATCA to guide the safe integration of AI in these environments.

2.   DISCUSSION

AI Applications in Simulation Environments

2.1. AI technologies can enhance simulation environments in multiple ways, including:

2.1.1.   AI-Driven speech recognition: AI-driven speech recognition can assist Pseudo-Pilots by parsing controller input, auto-filling HMI elements, and quick execution with minimal input. This should reduce the pilots' workload, enhance efficiency, and result in a more realistic environment.

2.1.2.   Scenario Generation: Machine learning can be used to create diverse and challenging traffic scenarios for controller training based on real traffic data or custom-tailored scenarios for targeted training, like conflict resolution, emergency handling, high-density traffic, etc. It could even develop scenarios with different training objectives for each trainee.

2.1.3.   Simulation Results: AI can change the way we review training results by accepting queries in natural language. The AI can collate the data and display it to

the reviewer, providing highlights and drill-down capabilities that could be used to improve future training.

    2.1.4.   Performance Analytics: AI tools can evaluate trainee performance with high granularity, provide feedback on decision-making and situational awareness, and recommend training areas if needed, thus enabling the trainer to further tailor the training to the trainee's specific needs.

2.2. Challenges:

    2.2.1.   Developing and training AI requires a huge amount of data, which may not be available. Starting to collect the data now should assist in developing AI solutions in the future. Having the data in open format removes the need for having that specific vendor involved.

    2.2.2.   Data sensitivity is another challenge that could be mitigated using on-premises cloud solutions, with the AI being developed on-premises. Access to this data could also be an issue, with a possible mitigation being the use of Non-Disclosure Agreements (NDAs).

    2.2.3.   As the development of AI in new domains remains a mystery, the development and deployment costs are difficult to determine before the start of the journey. This may be a hurdle for decision makers to start investing in AI, as the results may vary. Another hurdle for the development of AI is the lack of guidance material, specifically within Air Traffic Control.

3.   CONCLUSION

3.1. The integration of Artificial Intelligence into simulation environments offers a transformative opportunity for air traffic control training and operational readiness. From enhancing scenario realism to streamlining post-simulation analysis, AI can significantly improve efficiency and performance. However, the journey requires careful planning, investment in data infrastructure, and a strong focus on controller-centric design. Given the fast-paced evolution of AI, it is essential for the ATC community, guided by organisations like IFATCA, to proactively shape its adoption to ensure safety, transparency, and human oversight remain at the forefront.

4.   DRAFT RECOMMENDATIONS

4.1. It is recommended that IFATCA establish a dedicated task force to monitor global developments in the use of AI within simulation environments and assess their implications for air traffic controllers.

4.2. It is recommended that IFATCA collaborate with ICAO and regional organisations to develop guidance material for the safe, effective, and human-centred integration of AI in ATC training and simulations.

4.3. It is recommended that IFATCA encourage ANSP's to invest in data collection and management strategies now, to support future AI development while respecting data sensitivity and security.

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