AI in civil aviation

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What is ICAO view on the potential for Artificial Intelligence (AI) in civil aviation?

New technological innovations such as AI hold significant potential for civil and commercial aviation worldwide. The differentiating factor of an AI system from a standard software system is the characteristic ability to learn, improve, and predict. Through training, an AI system can generate knowledge and apply it to novel situations not encountered before.

In ICAO today it is foreseen that these AI capabilities and other emerging areas of innovation hold the potential to drive very positive benefits in terms of aviation safety, security, efficiency, and sustainability performance.

And what about for ICAO itself and its community of national regulators?

AI innovations can also be leveraged toward more efficient and streamlined aviation regulatory processes, making it vital that the international civil aviation sector take timely action to monitor and evaluate these developments.

ICAO is doing just that today through a series of partnerships and arrangements with key innovators in this area. Our goal is to maximize the potential of these innovations as rapidly as possible, and such that no country is left behind as these capabilities mature.

Can you provide some examples of the types of partnerships being explored?

One involves ICAO partnering with the Interdisciplinary Center for Mathematical and Computational Modelling of the University of Warsaw and several ICAO member States. This is endeavouring to develop algorithms that can be used to optimize global air transport connectivity given various frequency, affordability, flight time, and fuel burn (emissions) constraints.

We also partnered on the UN AI for Good Annual Global summit, where we convened a working session on AI in aviation, collaborated with the XPrize Foundation by providing AI challenges and participating in the Global Initiative on AI and Data Commons, and we are currently exploring the creation of an *AI in Aviation* focus group under the International Telecommunication Union (ITU) to address issues relating to compliance and certification.

The above activities are in addition to our outreach with local AI innovators and universities in the Montreal, Canada, where our HQ is based, as it is currently seen as a leading global centre for AI research and development. We are also hosting internships and developing in-house deep-learning models showcasing natural language processing techniques for aeronautical information management and document summarization.

Does ICAO foresee a role for AI with respect to the fundamental air traffic management (ATM) needs of today's global network?

Absolutely. In fact during our most recent and 13th Air Navigation Conference, during its agenda item focused on Emerging Issues, a working paper was presented specifically on AI which explored the work now underway in Singapore to develop AI-based applications for ATM.

The ATM Research Institute (ATMRI), under the auspices of the Civil Aviation Authority of Singapore's Centre of Excellence for ATM, is researching the development of an Air Traffic Control Officer (ATCO) decision-making tool that leverages AI to learn and predict traffic management strategies for en-route operations. When mature, this tool will help controllers to better organise air traffic flows, reduce interventions needed from executive surveillance controllers, and allow the planning controller to focus much more on strategic-level planning.

Are there any other initiatives which ICAO is aware of?

There is much more going on as well, of course, and even to the point last Spring where we saw how a new AI tool had landed a small plane carrying passengers by sight alone at an Austrian airfield. This university-led initiative didn't need to rely on the radio signals provided by existing Instrument Landing Systems (ILS), which as you know many smaller airports cannot often afford.

In addition to developing solutions to support en-route operations, AI can be applied in speech recognition to detect read-back errors, the synchronisation of aircraft ground movements, or predicting optimal runway configurations to maximise throughput. It also permits a substantial increase in existing airspace capacity without significantly increasing the demand on the limited number of controllers available and their respective cognitive capabilities.

AI systems therefore have high potential in ATM, specifically in areas which involves decision making under uncertainty (e.g. conflict detection and resolution) and prediction with limited information (e.g. trajectory prediction). These approaches can provide human operators with timely and dynamic information on atmospheric hazards, traffic fluctuations, and airspace utilisation.

How urgently needed are these types of solutions for global civil aviation today?

Today's air traffic system is clearly reaching its operational limits.

Simply put, accommodating future air traffic growth will be a challenging task for air navigation service providers (ANSPs) unless new capabilities are brought to the fore which permit more aircraft to be safely managed in the world's finite airspace.

What are some of the main challenges ICAO foresees as this innovation continues?

Certainly the opportunities outnumber the challenges where AI is concerned, but a very basic challenge we're confronted with, from the onset, is to develop the competencies of the specialists who must assess and ultimately certify AI-based systems for operational applications.

Another very key challenge, with AI and all digitally oriented innovations today, are the cyber vulnerabilities they present from both an information and operational security standpoint.

There is also a clear need to coordinate the researchers, academia, industry, State regulators, and service providers involved in this process, and fortunately the Singapore example I mentioned above has taken this path and provides an important best practice for other States and regions considering similar initiatives.

This function can be replicated at the global level to keep pace with other industries that are leveraging technological advancements enabled through the fourth Industrial Revolution, and I've been encouraged by how proactive the ICAO Secretariat has been in this regard.

Ultimately the promise of intelligent automation for aviation can only be realised through a globally coordinated approach, and I am confident that ICAO is very well-placed to lead that coordination among such diverse public and private stakeholders, consistent with its mission and role.

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