# FOURTEENTH AIR NAVIGATION CONFERENCE

**Montréal, Canada, 26 August to 6 September 2024**

**Agenda Item 3: Air navigation system performance improvement**
**3.3: Eighth Edition of the Global Air Navigation Plan (GANP)**

## GLOBAL STRATEGIC LEVEL OF THE GANP: NEW ENTRANTS AND OTHER NEW CONCEPTS

(Presented by the Secretariat)

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### Continued support of social wellbeing worldwide

Aviation supports the growth of the global economy. Over half of the world's tourists who travel across international borders each year are transported by air. Air transport carries some 35 per cent of world trade by value. ~~More than 90~~ 80 per cent of cross-border business-to-consumer (B2C) e-commerce is carried by air transport.[~~10~~1] This results in more than ~~65.5~~ 87.7 million jobs and USD ~~2.7~~ 3.5 trillion in annual economic activity.[~~11~~2]

Moreover, the aviation industry provides personal and social benefits. It is the safest and fastest means of transportation available, overcoming oceans and borders to bring people together – families, friends and business colleagues. It gives people the freedom to be almost anywhere in just 24 hours and has turned a big planet into a small world filled with enormous potential and endless opportunity.

**FACTS AND FIGURES**
**(201~~7~~9 in USD)[~~13~~3]**

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|---|---|
| **$~~2.7~~ 3.5 trillion** | Global economic activity supported by aviation |
| **~~65.5~~ 87.7 million** | Jobs worldwide supported by aviation |
| **~~1,303~~ 1,478** | Commercial airlines |
| **3,7~~59~~ 80** | Airports with scheduled commercial flights |
| **~~31,717~~ 33.299** | Commercial aircraft in service |
| **1~~70~~ 62** | ANSPs |
| **~~45,091~~ 48,044** | ATS routes |
| **~~20,032~~ 21,187** | Unique city-pair ATS routes |
| **4.~~1~~ 5 billion** | Passengers |
| **4~~1.9~~ 6.8 million** | Scheduled commercial flights worldwide |
| **~~7.75~~ 8.68 trillion** | Passenger kilometres |
| **6~~2~~ 1 million** | Tonnes of cargo |

1 IATA - Value of Air Cargo
2 aw-oct-final-atag_abbb-2020-publication-digital.pdf (aviationbenefits.org)
3 aw-oct-final-atag_abbb-2020-publication-digital.pdf (aviationbenefits.org)

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|---|---|
| **$6.5 trillion** | Value of transported cargo |
| **35%** | Of all international trade by value |

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**Accommodation of increasing demand and new types of demand**

Greater prosperity around the world means that air travel is becoming accessible to more people. Likewise, the ongoing trend towards economic globalization will further increase the need to move high-value goods quickly around the world, creating a growing market for air cargo. Within the next 15 years, the necessary infrastructure should therefore be in place to accommodate a expected increase in air traffic of 3 per cent per annum[4], as passengers and goods travel globally. In addition, the global general aviation (GA) market was valued at USD ~~21.1~~ 33.28 billion in ~~2017~~ 2024 and is estimated to register an annual growth rate of 4.41~~0.~~ per cent during the forecast period of ~~2016~~ 2024 to ~~2024~~ 2030.

~~Air traffic growth will be boosted by new types of aircraft and vehicles, ranging from small unmanned aircraft to autonomous urban air taxis, high-altitude balloons, commercial space vehicles or upper-atmosphere supersonic and hypersonic flights. Some of these users, although labeled as new entrants, have in fact been in the system for several years. The availability of technology has increased both the ease and cost of manufacture, as well as the ease of operations of new entrants. This in turn has expanded the nature of their missions, including surveying, delivering products and proving telecommunications. Perhaps the greatest change has been the shift of some operations from State to commercial and non-commercial operators. These new entrants, with significantly different operational characteristics and needs, will be increasingly used to provide new services to society, serving new locations and/or providing existing services in a new or more cost-effective way. Employment is expected to grow rapidly to support these new airspace users and aircraft types.~~

~~New entrants, including UAS, operating at the lowest and highest altitudes, are not expected to be provided with the same services as manned commercial aircraft or even manned GA, but are expected to have easy access to the airspace. Neither the infrastructure in place for manned operations nor ANSPs currently meet the needs of operations at the lowest altitudes or endurance operations at the highest altitudes. In order to accommodate the growing demand for access to the airspace by UAS and their operations, an airspace management system based on the paradigm of shared information for managing cooperative separation needs to be developed.~~

~~Commercial space and larger UAS operators operating spacecraft in traditional airspace expect to access airspace through reservations, and their separation is managed in the same way as conventional manned aircraft. In order to accommodate the increasing numbers of these operators transiting the airspace, the definition of space flight capabilities as well as the initiation and cessation of airspace reservations will need to be improved. In addition, to be managed, the risk volume will need to be more precisely defined in collaboration with the commercial spacecraft operator community.~~

The term “New entrants” encompasses a variety of aircraft and mission types such as, but not limited to, electric or solar powered, vertical lift, unmanned, airships, balloons and a variety of flying operations below, above and within the range of altitudes generally used by aviation today. Many of these aircraft are in the developmental phase, and it is anticipated that their operations will experience exponential growth in the coming years. They are expected to be piloted and managed in novel ways, and are entering into the airspace with new modes of operations.

[4] https://aviationbenefits.org/economic-growth/the-future/

The objective is for a safe and efficient integration of these aircraft in the airspace while ensuring capacity meets the increased demand. Until a means is found to fully integrate these aircraft, they are or will be, accommodated into the airspace and the current air traffic management (ATM) system, when applicable. Since accommodation is into the current environment (e.g., airspace classification and flight rules), operations may have limitations in volume and location. These limitations are due in part to the available communications, navigation, and surveillance (CNS)/ATM technologies.

Achieving seamless integration, involves mitigating these limitations and paving the way for more resilient and scalable operations. Beyond a certain degree of automation and their new modes of operations, what these new entrants have in common is the need to rely on robust information networks built upon a high degree of connectivity. This connectivity opens the door, and is critical, to the development of new operational methods enabled by more automation and autonomy based on the continuous information exchange between the aircraft and the rest of the infrastructure.

To support operators to meet their mission goals, authorized service providers, will provide new traffic management methods for the provision of conflict management, demand capacity balancing, time-based management, and potential use of new flight rules, initially in designated airspace. The new flight rules and methods are expected to be gradually applied to the entire airspace.

In higher airspace, advanced performance-based infrastructure, continuous information exchange and novel practices will overcome operational limitations, particularly those stemming from limitations with current CNS/ATM technologies.

In the lowest airspace information exchange and novel traffic management, together with automation and autonomy, allows operations beyond the limits of human sight, replacing visual observation with alternative procedure, to provide the scalability needed for those emerging operations, and the safe and efficient operation of all aircraft.

In the increasingly dense middle levels, information exchange and associated procedures and automation may allow for a volume and complexity of operations that exceed the limits of current operational methods to provide for a safe and efficient integration.

Over time this connectedness, automation and new operational methods will provide opportunities for all aircraft to digitally collaborate and expand participatory management in ways that improve flight efficiency and achieve holistic integration.

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**Use of advanced technologies**

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**Automation and artificial intelligence**

The future of the air navigation system will rely increasingly on higher levels of automation to safely and efficiently manage the growing diversity and complexity of aircraft operations and airspace management. <u>It is also expected that future automation will leverage </u>artificial intelligence to enhance the capability of automation to effectively support nominal, off-nominal and contingency operations, improving resilience and adaptability. The primary driver is to optimize total system performance by keeping the human in the loop. Alignment with social expectations and business needs are also important considerations.

Given the international nature of aviation it is imperative that processes and frameworks for the safe incorporation of automation and artificial intelligence be harmonized to support the efforts of both developers, users and implementers. The safe, secure and responsible use of artificial intelligence in the air navigation system requires adherence to an agreed set of principles. The United Nations (UN) has defined the following principles[5] for using artificial intelligence in the UN system:

- do no harm;
- defined purpose, necessity and proportionality;
- safety and security;
- fairness and non-discrimination;
- sustainability;
- right to privacy, data protection and data governance;
- human autonomy and oversight;
- transparency and explainability;
- responsibility and accountability; and
- inclusion and participation.

These principles aim to ensure that the use of artificial intelligence within the United Nations is beneficial, ethical and aligned with the core values of human rights, peace and sustainable development. These principles can be adapted to guide the use of artificial intelligence in the air navigation system.

In addition, the increasing use of automation and incorporation of AI in the air navigation system requires a common understanding of the levels of automation. The nature of the decision to be supported will determine the level of automation required.

1. **Manual or human-controlled automation**

   Foundational level with human control.

   - Humans retain full control; automation assists.

   - Tasks simplified; workload reduced.

2. **Assisted or supervised automation**

   Intermediate level where automation operates with greater autonomy under human supervision.

   - Humans set parameters; intervene when needed.

   - Collaborative approach for human-automation teaming.

3. **Autonomous automation**

   Advanced level where automation can make independent decisions based on data and rules.

   - High autonomy; capable of adapting to various scenarios.

   - Humans set goals, but system manages tasks independently.

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[5] These principles are outlined in the document titled "Principles for the Ethical Use of Artificial Intelligence in the United Nations System", endorsed in September 2022.

It is also crucial to recognize the importance of comprehensive and accurate localized data necessary for the development of artificial intelligence suitable for one's specific needs. This should be considered when planning for the incorporation of artificial intelligence in support of automation.

**Human capability and capacity**

Human capital is a critical and integral element in the air navigation system. Even in an increasingly automated or autonomous environment, humans remain a critical part of system design and management. Since the operational environment is complex and dynamic, system designers cannot anticipate all possible situations. Humans are necessary for real-time innovations that meet unique situational demands, which the air navigation system, as designed and anticipated, cannot address. The adoption of automation continues to extend and expand the human capability of the aviation community. Even now the community continues to learn how humans and machines can collaborate most effectively in complex environments where trust and compatibility are crucial.

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