



ASSEMBLY — 41ST SESSION

TECHNICAL COMMISSION

Agenda Item 30: Aviation Safety and Air Navigation Policy

30.2 Latest developments related to the Global Air Navigation Plan (GANP)

THE NEXT ERA OF AIR TRAFFIC AND AIRSPACE MANAGEMENT

(Presented by the International Coordinating Council of Aerospace Industries Associations (ICCAIA), Civil Air Navigation Services Organisation (CANSO))

EXECUTIVE SUMMARY

New concepts of operation are rapidly becoming available across the aviation industry sector. Many of these innovations are possible through advancements in automation enabled by technologies such as big data, robotics, and artificial intelligence. Foundational change will be needed in the future to benefit from innovation and accommodate the anticipated growth in air transport as well as the integration of new and emerging forms of air transport at all strata of airspace. These innovations carry significant potential in improving aviation safety, security, sustainability, accessibility and affordability across the globe. It is vital that there is global consensus on a concept of operations (CONOPS) for the next era of air traffic management. ICAO is uniquely positioned to lead this process and achieve global consensus. This paper outlines the needs and the attached draft Assembly Resolution proposes an action plan for ICAO, its member States and the industry.

Action: The Assembly is invited to adopt the Assembly Resolution proposed in the Appendix to this paper.

<i>Strategic Objectives:</i>	This working paper relates to all Strategic Objectives.
<i>Financial implications:</i>	The activities referred to in this paper will be subject to the resources available in the Regular Programme Budget and/or from extra budgetary contributions. The financial implication to ICAO can be reduced through the advancements of studies and draft provisions prepared by the industry.
<i>References:</i>	<i>Convention on International Civil Aviation</i> (Doc 7300) <i>Global Air Navigation Plan</i> (Doc 9750) <i>Global Aviation Safety Plan</i> (Doc 10004) <i>Global Aviation Security Plan</i> (Doc 10118)

¹ English Arabic, Chinese, French, Russian and Spanish versions provided by ICCAIA.

1. INTRODUCTION

1.1 Aviation technology has developed through a process of continuous change and improvement. Throughout this evolution, ICAO has played a central role in achieving international consensus for the adoption of Standards that facilitate the implementation of globally harmonized and interoperable systems. While this evolution has been continuous, it has also been punctuated by periods of key transformational changes. Examples include: the introduction of long-range airplanes that ushered in an era of transcontinental and transoceanic air transportation; the emergence of turbojet airplanes that fundamentally changed international air transport; and the advent of satellite-based communications, navigation and surveillance systems. During these times of transformational change, ICAO has played a key role by using its unique ability to convene meetings of civil aviation stakeholders to build the global momentum needed to adapt to rapid change.

1.2 Today, the civil aviation community is facing new and complex challenges. Emerging forms of air transport are now mixing with conventional air traffic and operating in new airspace environments with different stakeholders. Drones, urban air mobility, commercial space operations and other types of higher altitude operations are rapidly becoming the norm and not the exception. Airspace is a finite resource, and the existing capacity of the global aerospace system will eventually limit air transport growth. It is widely recognized that we will eventually reach the limit of what current technologies can do and innovative approaches are needed to safely allow air transport to grow. Finally, it will be essential that any future developments prioritize the need for sustainable development of the sector. A holistic analysis of air traffic and aerospace management is needed to enable the continued advancement of civil aviation globally. This analysis must cover all strata of airspace and include both conventional aviation operations and the operations of emerging airspace users.

2. DISCUSSION

2.1 To date, the main role of automation was to provide information that can help humans (for example, pilots and air traffic controllers) carry out all cognitive functions, from routine tasks such as continuous monitoring in normal conditions to decision making and manoeuvring traffic in abnormal conditions. Advancements in big data, artificial intelligence, and robotics will essentially change our concepts of what automation can do. Automation is expected to evolve and become more focused on critical and decision-making tasks, as well as monitoring for non-normal events, as opposed to actively flying/controlling. The judicious use of the automation will be essential to accommodate the growth of conventional air traffic, as well as new modes of air transport in a safe, secure, and sustainable manner. To reach this future operational end state, fundamental changes to the airspace structure, the services and infrastructure, and the procedures and rules governing how it is used are required.

2.2 A primary objective of ICAO, as specified in the Convention on International Civil Aviation, is to foster the “planning and development of international air transport”. The ICAO Global Plans for air navigation, safety and security have become core mechanisms to meet this objective. While the ICAO Global Air Navigation Plan (GANP) takes into consideration the implications of automation and emerging forms of air transport, it does so in a modular fashion (i.e., the Aviation System Block Upgrades – ASBUs) that are implemented by States on a voluntary basis. The GANP acknowledges the challenges and opportunities associated with new users, increasing automation and connectivity, however, the strategic vision and conceptual roadmap represent small evolutions from the current state. The fundamental change required to realise this new vision is not supported by the current evolutionary approach. The application of high levels of automation to increase airspace capacity and safely integrate

emerging forms of air transport across all strata of airspace will require a system wide and holistic planning strategy, including safety, environmental and security aspects of such systems.

2.3 A global consensus on the characteristics for the next era of air traffic and aerospace management system, or CONOPS, will be an essential underpinning to guide the further development of the ICAO Plans. There is already a significant amount of work in different States and Regions underway to develop, define, and advance an airspace and ATM operational concept to support the rapidly evolving needs of aviation. Individual States, driven by local needs and opportunities, are rapidly advancing concepts and solutions without much needed guidance on the conditions necessary for long term global interoperability. While the resultant solutions may be optimal to local needs, broader opportunities to enhance safety, efficiency and scalability and leave no country behind at a regional or global level are potentially lost.

2.4 The aerospace industry has undertaken an initial analysis of the initiatives that are underway in several States. Most initiatives use a concept that could be characterized as cooperative air traffic management in some strata of airspace. Under this concept, automated systems allow aircraft, operators and air traffic services units to electronically share desired flight profiles and using this information, allow the aircraft in normal operations to self-separate so they can achieve an optimum or preferred flight trajectory. This re-distribution of functions between operator, pilot and air traffic control has been referred to by the industry as cooperative or “Integrated Air Traffic Management”. The industry has also been an integral part of the development of these concepts given its first-hand knowledge of existing aircraft capabilities and those intended for emerging vehicles. The initial analysis made by the industry showed that the various CONOPS under development are consistent in terms of most of the operational concepts. However, the rationale, use-cases and operational benefits are not always consistent. There is a need for global leadership to ensure that a future CONOPS is appropriate to the global need and ability to implement such systems including in new operating environments (for example in urban areas) where traditional ATS technologies, concepts and rules may not be fit for purpose. Without action, the inevitable convergence of these plans may reveal irreconcilable incompatibilities between underlying operational concepts and technical implementations. The industry stands ready to assist in this effort.

2.5 A highly automated air traffic management system will require a different approach to regulations. The focus will need to shift to specifying the required operational outcomes accommodating shorter innovation cycles, and new technologies to be tested in real-life environments while still maintaining a high standard of safety. This will require a change in the standards making process and offers opportunities for new global platforms, which include industry members as well as regulators, to help drive innovation. The current standards development cycle of six years hampers innovation with contemporary technology update rates starting to be measured in terms of months. Inclusion of all stakeholders is necessary to achieve a favourable outcome, but this is not happening in all cases. Using the industry to progress some of the much-needed work will also offset the limitations in resources for ICAO. A new working mechanism, new engagements and working with a broader range of stakeholders will also ensure a meaningful participation of all the diverse players in current and future airspace.

2.6 In the future, ground-based facilities and aircraft will need to share operationally critical information to fully exploit the benefits of automation. A significant amount of work is already underway at ICAO in this area such as the creation of a globally harmonized aviation trust framework. However, the plans for cyber security and safety will need to be looked at in the context of an overall operational concept that utilizes high levels of automation.

2.7 Since the introduction of air traffic control in 1920, visual flight rules (VFR) were sufficient to allow for safe operations. At that time, separation from other aircraft, obstacles and meteorology were the responsibility of the pilot. As air traffic increased and technology evolved, instrument flight rules (IFR) enabled pilots to fly in all-weather conditions when needed and the responsibility for preventing collisions moved to ATC due to increased surveillance capabilities and communications advancements. The use of high levels of automation and consequential re-distribution of some functions between operator, pilot and ATC will require the aviation community re-visit systems and assumptions to ensure that airspace remains safe, efficient and provides equitable access.

3. CONCLUSION

3.1 The global aviation system is in need of, and on the precipice of, foundational change. A holistic analysis of the needs of a growing and evolving air transport sector is needed to enable such change. To that end, it is important for the Assembly to recognize the need for ICAO to take the lead in this critical formative period and to advance the development of a global consensus on the next era of air traffic and aerospace management.

APPENDIX

DRAFT RESOLUTION FOR ADOPTION BY THE 41ST SESSION OF THE ASSEMBLY

Resolution A41-x: A new global airspace operational concept

Whereas Article 44 of the *Convention on International Civil Aviation* states that among the aims and objectives of ICAO are development of the principles and techniques of international air navigation and fostering of the planning and development of international air transport so as to meet the needs of the people of the world for safe, regular and economical air transport;

Recognizing that the use of high levels of automation are needed to increase airspace capacity and safely integrate emerging forms of air transport across all strata of airspace and the implementation of such systems will require a system wide and holistic planning strategy, including safety, environmental and security aspects of such systems;

Whereas several ICAO Conferences have recognized the real and potential benefits and challenges that innovation can bring to the safety, efficiency, security, facilitation and to the economic and environmental sustainability of air transport and that Member States should be provided the opportunity to realize these benefits in a manner that leaves no country behind;

Recognizing that there is a need for global leadership to ensure that a future concept of operations for the next era of air traffic management is essential to promote harmonization and interoperability and that without such action, the inevitable convergence of these plans may reveal irreconcilable incompatibilities between underlying operational concepts and technical implementations;

Recalling that the 40th Assembly instructed the Council to continue developing the Global Air Navigation Plan (GANP), keeping it current with evolving technology and operational requirements and to use the guidance in the GANP to develop and prioritize the technical work programme of ICAO in the field of air navigation;

Recognizing that broader use of automation in air traffic and aerospace management will represent foundational changes for the ICAO Global Plan and provisions;

Recalling that the 40th Assembly directed the Council, inter alia to assess the need to evolve the processes of the Organization, including its working methods with the industry in order to keep pace with innovations that affect the sustainable development of civil aviation;

Recognizing that ICAO provisions apply to all civil airspace users, and the absence of normative activity at the global level may hamper the realization of innovative technological solutions and prevent the materialization of their benefits in aviation; and to that end ICAO can benefit from continued interaction with industry to identify the latest technological developments and their timely integration; and

Recognizing that the nature and pace of innovations require regulators at the national, regional and global level avail themselves of new methodologies that facilitate the timely evaluation and assessment of technological developments.

The Assembly:

1. *Instructs* the Secretary General to work with States and the industry to enable the development of, as a priority, a new global airspace operational concept that facilitates the use of high levels of automation to increase airspace capacity and safely integrate emerging forms of air transport across all strata of airspace;
2. *Instructs* the Secretary General, in cooperation with the initiatives of industry, to develop an implementation roadmap to support the new global airspace operational concept;
3. *Instructs* the Secretary General to work with States and the industry to develop proposals to update the Global Planning frameworks (GANP, GASP and GAsEP) to take into account fundamental changes that will be needed to facilitate the use of automation and the consequential changes to the roles and responsibilities for air traffic management, as a means to adapt the processes to meet the needs of a growing and evolving air transport system in new operating environments with different stakeholders;
4. *Directs* the Council to develop mechanisms that would enable ICAO to engage industry to access expertise, share and leverage ongoing research and development, as well as lessons learned from demonstrations to help accelerate the development of a new global airspace operational concept;
5. *Directs* the Council to consider the nature of Standards to ensure that they facilitate the implementation of interoperability automated systems; establish system performance requirements; are not prescriptive about specific technologies and will allow shorter innovation cycles, and new technologies to be tested in real-life environments while still maintaining the high standard of safety;
6. *Instructs* the Secretary General to assess the appropriateness of existing work programmes in cyber-security/safety, as well as the suitability of visual and instrument flight rules to support a next era of air traffic management; and
7. *Directs* the Council to report ICAO's progress in this work to the next Regular Session of the Assembly.