



WORKING PAPER

FOURTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 26 August to 6 September 2024

Agenda Item 3: Air Navigation System Performance Improvement

3.1: Proposals to improve the efficiency of air navigation services contributing to LTAG

AIR NAVIGATION PRIORITIES TO SUPPORT SAFE AND EFFICIENT INTEGRATION OF HIGHER AIRSPACE AND TRANSIT OF SPACE OPERATIONS

(Presented by Hungary on behalf of the European Union¹ and its Member States, the other Member States of the European Civil Aviation Conference², the European Organisation for the Safety of Air Navigation (EUROCONTROL), and by Bolivia, Chile, Costa Rica, Cuba, Ecuador, Honduras and Mexico)

EXECUTIVE SUMMARY

This working paper presents priorities required to support the safe and efficient integration of aerospace vehicles used for higher airspace and space operations. Where these aerospace vehicles transit through controlled airspace, prioritised action is necessary to support the growth of this industry while ensuring the safety and efficiency of existing traffic networks. Longer term objectives should be incorporated into the ICAO work programme, including to ensure good cooperation between the space and aviation sectors.

Action: The Conference is invited to agree on the recommendation in paragraph 3.1.

1. INTRODUCTION

1.1 New and reinvigorated types of operations into airspace and above are growing quickly by numbers due to technical advancements. These new operations are important for the connectivity of society and growth of global and regional economies. The aviation industry is on the verge of an evolution and will adapt over time to integrate these new operations into the air traffic management (ATM) system considering their modernisation potential.

1.2 As with most new technologies, there are challenges to overcome. The operational integration of 'new entrants' is complex since they perform in a significantly different way compared to conventional aircraft. Some move with extremely slow velocity while others transverse entire airspaces in

¹ Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden

² Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, North Macedonia, Norway, San Marino, Serbia, Switzerland, Türkiye, Ukraine, and the United Kingdom.

a matter of minutes, and where climb-to-height times can vary from seconds to hours. This difference in performance is the primary challenge in accommodating the transit through the more congested airspace to their operating environment above. These technologies are still emerging, but some of the operations may have the potential to significantly influence or even disrupt the global ATM system. Such an evolution could also present new security challenges if used with malevolent intentions. This calls for extended civil – military collaboration, in particular for information sharing supported by robust cyber-security measures.

1.3 Assembly Resolution A41-9: *New Entrants* recognizes the need for measures ensuring a standardized and globally harmonized approach for higher airspace operations. Presently, the regulatory authorisation, certification, and operational challenges posed by these entities are under extensive scrutiny. Some operational and regulatory aspects require (the continuation of) research activities at national and regional level.

1.4 There is an increase of space launch and re-entry activities. Those are not considered as higher airspace operations (HAO) activities and fall under the Outer Space Treaty³ and the related Conventions. Their impact on air navigation safety and efficiency needs to be assessed and mitigated. In particular, the risk of space debris damaging an aircraft has become a growing concern to the aviation community.

1.5 As discussions are still ongoing regarding the precise definition of the term “Higher Airspace Operations”, this working paper will not try to define it. One of its focus areas will be on the wider concept of aviation (including HAO) and space operations when they conduct operations in or transit through airspace. The introduction of extremely high-speed and low-speed vehicles⁴ – both horizontally and vertically – presents new challenges due to the significant speed differences and airspace requirements of these operations. In this paper, these operations will be referred to using a generic term “aerospace vehicles”.

2. DISCUSSION

2.1 The successful integration of these new aerospace vehicles into the existing airspace management system is important to maintain the present high aviation standards in terms of safety and efficiency. This integration demands innovative airspace strategies to ensure that operations with considerable differences in velocity, or those entering controlled airspace only for transition, can merge with the present and future demands of other operations in controlled airspace.

2.2 While the upper limit of the airspace is viewed differently and subject of a global debate and with the space community, the safety and efficiency of civil aviation with no doubt falls within the scope of ICAO competence. Therefore, the immediate focus should be on accommodating the transit of these aerospace vehicle operations through the ATM system while maintaining and possibly increasing safety and efficiency.

2.3 While many issues related to new entrants in space and higher airspace operations require further consideration, there are certain pressing needs that must be addressed with priority. It is therefore logical to distinguish short term needs, which require urgent action, from longer term objectives, which need to be addressed as part of the work programme of ICAO for the next triennium.

³ On Principles Governing the Activities of States in the Exploration of Outer Space, including the Moon and Other Celestial Bodies.

⁴ Such vehicles include for instance supersonic or hypersonic aircraft, high altitude balloons and other Lighter or Heavier Than Air stratospheric platforms. The vehicle used to conduct of commercial space launches and re-entry events may also fall within the scope of this.

2.4 There is an urgent need to address the challenges regarding the transit of new aerospace vehicles through controlled airspace, in particular since extensive airspace reservations are required for their operations. These reservations impact the efficiency of conventional air traffic, increasing delays, fuel burn, and emissions. Flexible and scalable airspace management and information-exchange procedures or protocols are needed. This will minimise the inefficient use of airspace as the relevant mission progresses. Similarly, contingency measures must be in place to enable rapid coordination in the event of a non-nominal situation to ensure the safety of air traffic. In many areas this will require clear cross-border coordination protocols and near real-time data-sharing of safety-critical data.

2.5 Vertically launched aerospace vehicles introduce a unique set of airspace management challenges due to their ballistic trajectory, which sees them ascend through and sometimes return to controlled airspace within a short time frame. This vertical integration of airspace use requires novel management approaches to ensure that these vehicles can coexist with horizontally transiting aircraft. The management complexity is further compounded by the need for contingency and emergency measures in the event of off-nominal launches/take off /lift off, including *ad-hoc* coordination with relevant aviation and space stakeholders and potential airspace closures. The rapid transit ascent and descent of suborbital vehicles may necessitate the establishment of dedicated corridors, reserved areas or dynamic volumes that follow the vehicles along their trajectory to minimize conflict with commercial and State air traffic, along with precise timing and coordination with ATM systems to ensure that airspace is cleared for their passage.

2.6 The resurgence of high-altitude operations and supersonic projects and research on hypersonic vehicles introduces environmental, logistical, and operational challenges, such as managing sonic booms and high-speed vehicle energy consumption. Whilst there is a considerably body of experience related to supersonic flight that could be leveraged for those aerospace vehicles, hypersonic operations will be entirely new. The operational speeds of these aircraft would also dramatically shorten the time available for air traffic control to resolve potential airspace conflicts, pushing the limits of current surveillance and communication technologies. Moreover, the vastly different speed capabilities of these aircraft compared to subsonic flights demands a re-evaluation of existing separation minima and air traffic management protocols, to ensure that all aircraft can coexist safely within the same airspace sectors.

2.7 These issues should be addressed by ICAO expert Panels, with a task of the immediate development of guidance material. As an initial step, this would provide a structured approach to addressing the nuanced challenges presented by aerospace vehicles. A proactive, coordinated approach led by ICAO is critical to laying the groundwork for future solutions and harmonizing airspace management practices globally.

2.8 State's aviation and space authorities should agree on cooperation and coordination mechanisms to ensure coherence of the respective policies. ICAO should organize with United Nations Office for Outer Space Affairs (UNOOSA) a high-level conference with State's space and aviation authorities to discuss this matter.

2.9 State's aviation and space authorities should consider mitigating the impact of un-controlled re-entries on international civil aviation and better managing the associated safety risks. Following the 40th Session of the ICAO Assembly Resolution A40-26: *Commercial Space Transport (CST)* and Montreal Recommendations on Aviation Safety and Uncontrolled Space Object Re-entries⁵, ICAO together with UNOOSA should work with these authorities on the provision of an assessment on the safety implications of uncontrolled re-entries to aircraft in flight (Rec A.1), on defining requirements for aviation as regards re-entry information capabilities that will support States in their decision-making to mitigate the risk of airspace closures (Rec A.3), and on how to respond to these precautionary warnings in a harmonized and coordinated manner (Rec B.1).

⁵ <https://outerspaceinstitute.ca/osisite/wp-content/uploads/Montreal-Recommendations-on-Aviation-Safety-and-Uncontrolled-Space-Object-Reentries.pdf>

2.10 In December 2023, several governments released a joint statement⁶ calling for ICAO to develop a holistic vision on HAO. Such vision should address design, production and maintenance, operations, air navigation services, aerodromes/stratoports, personnel licensing, drones, security, interoperability, environment, contingencies and civil military cooperation. It should go beyond the segregation and accommodation practices and drive the need for a network-centric and collaborative approach to the integration of new entrants. Higher airspace should be an incubator for the ongoing modernisation of aviation as part of a coherent, digitally connected airspace continuum. The vision should also ensure that the HAO traffic management practices and enabling infrastructure are continuously monitored to ensure continuous performance improvements.

2.11 Finally, such a vision should be developed by a dedicated multidisciplinary expert group and pave the way for the development of a global concept of operations. This will drive the update of the global plans and support identification of the need for ICAO provisions. It should be developed considering the research activities that are on-going or planned by States and regions.

3. CONCLUSION

3.1 To effectively address the short-term challenges in airspace and contingency management, and medium to long-term objectives to integrate HAO in a safe, secure and sustainable manner in the aviation system and minimize the impact of space operations on air navigation safety and efficiency, the Conference is invited to agree on the following:

Recommendation 3.1/x — Air Navigation priorities for the safe and efficient integration of higher airspace and transit of space operations

That the Conference:

- a) request ICAO to prioritise the development of guidance material related to the safe and efficient transit of aerospace vehicles through controlled airspace. Focus should be directed to the appropriate expert groups on airspace management coordination, air traffic management procedures, and near real time data-sharing to facilitate efficient use of airspace, minimise impact on other airspace users, and safely manage non-nominal contingency situations or uncontrolled debris;
- b) request ICAO, in coordination with United Nations Office for Outer Space Affairs (UNOOSA), to develop guidelines to assess and mitigate safety risks posed by uncontrolled space re-entries and providing a coordinated response to those events;
- c) request ICAO to incorporate into its work programme for the next triennium to start developing an ambitious holistic vision and a global concept for higher airspace operations by a multidisciplinary expert group, including approval and coordination responsibilities and liability; and
- d) request ICAO to convene a high-level conference in coordination with UNOOSA to address the impact of space operations on air navigation safety and efficiency.

— END —

⁶ https://transport.ec.europa.eu/news-events/news/joint-statement-higher-airspace-operations-hao-2023-12-18_en