



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

HIGHER AIRSPACE OPERATIONS (HAO)

(Presented by Saudi Arabia)

EXECUTIVE SUMMARY

The Assembly Resolution A41-9: New Entrants, “directs ICAO to review Standards and Recommended Practices (SARPs) relating to, inter alia, the rules of the air, air traffic services, certification, licensing, liability and the environment, for amendment or expansion as necessary, and to develop specific concepts and guidance to facilitate the operation of New Entrants within a global, harmonized framework, taking into account regional frameworks and practices.” This Resolution defines the term “New Entrants” as higher airspace operations (HAO) and unmanned aircraft system (UAS) traffic management (UTM) operations.

This paper provides an overview of the key elements and principles that should be considered in establishing an ICAO framework related to HAO. It also provides information on Halo Space's first HAO test flight, which will be conducted in Saudi Arabia in September 2024.

Action: The Conference is invited to:

- a) note the information provided in this paper;
- b) call upon ICAO to prioritize and expedite higher airspace operations in its work programme and accelerate the development of Standards and guidance for manned and unmanned aviation traffic in higher airspace;
- c) urge all Member States that have experience conducting HAO and that have evolved their regulatory methods to better evaluate and assess the safety risks of HAO to share their experience with other States through ICAO; and
- d) call upon States to support ICAO in progressing the HAO work programme through the secondment of experts and subject matter experts (SMEs) in this area.

1. INTRODUCTION

1.1 The Assembly Resolution A41-9: New Entrants, “directs ICAO to review Standards and Recommended Practices (SARPs) relating to, inter alia, the rules of the air, air traffic services, certification, licensing, liability, and the environment, for amendment or expansion as necessary, and to develop specific concepts and guidance to facilitate the operation of New Entrants within a global, harmonized framework, taking into account regional frameworks and practices.” This Resolution defines the term “New Entrants” as higher airspace operations (HAO) and unmanned aircraft system (UAS) traffic management (UTM) operations.

1.2 Under the discussion of an initial work programme for the orderly development of HAO Standards and harmonize all on-going activities including overflight of balloons and spacecraft, ICAO held two sessions on

HAO at the ICAO Air Navigation World (ANW) 2023– Shaping the Skies of Tomorrow event organized at ICAO Headquarters, from 28 to 31 August 2023.

1.3 To gather information on the status of HAO and planned activities by States, ICAO circulated on 8 February 2024 a survey related to higher airspace operations (State letter AN1/71-24/10, dated on 8 February 2024 refers). The survey is divided into four parts: 1. High altitude platform systems (HAPS), which include long-endurance unmanned balloons and other aircraft; 2. Supersonic and hypersonic aircraft; 3. HAO-related strategies and priorities; and 4. Identification of focal points and experts. A copy of the survey is available under the following link: <https://www.icao.int/airnavigation/HAO/Pages/default.aspx>.

2. DISCUSSION

2.1 The higher airspace is described as the volume of airspace typically above altitudes where the majority of air traffic services are provided today (typically FL 550) and where HAO are carried out. It is foreseen that higher airspace operations will be conducted by several different types of manned or unmanned aircraft systems with various flight profiles, such as balloons, supersonic/hypersonic aircraft, suborbital aircraft, re-entry of aircraft, sounding rockets, spacecraft etc., some of them flying or cruising in that airspace with others simply transiting through it. It is expected that the HAO will be limited to airspace where atmospheric density can no longer sustain lift through aerodynamics or buoyancy, therefore, any ICAO global framework for HAO should focus on this region as the most diverse set of operations will be within and through this volume where the highest need for cooperative traffic management services is needed for conflict resolution.

2.2 The diversity of ongoing innovation, testing, and the development of new technologies supporting the HAO show the need for global and common standards to support safe, secure and sustainable civil aviation operations in higher airspace, typically above the flight levels used by conventional aircraft operations.

2.3 The variation in performance of New Entrants used for higher airspace, i.e. aerodynamic characteristics, speed, and flying altitudes and the growing demand for applications, such as offering telecommunications and internet services in remote areas, enhancing current weather Observation capabilities to monitor the climate change, and enabling transportation of people and goods, should be considered in setting the required priority for the development of ICAO HAO framework.

2.4 While HAO may expand the international aviation ecosystem, it will pose serious safety risks when transiting through the current air traffic management (ATM) operations in the airspace below the higher airspace or when cruising in the higher airspace. That is why, a global approach should be adopted to address the HAO and to set an appropriate framework covering airworthiness, qualifications and licensing, sitting, ground operations, identification, detection, monitoring, communication between stakeholders, flight paths tracking and protection, and unusual events and emergencies to ensure that aircraft operating in higher airspace do not impact the safety of the current civil aviation flights.

2.5 Recalling that ICAO's role is to provide global policies and develop the provisions that will support gradual and safe HAO during all phases of the flights. To enable the standardization, global harmonization, interoperability, safe and efficient HAO, there is a need to consider the guiding principles and the following factors, which are described in the ICAO *Global Air Traffic Management Operational Concept* (GATMOC, Doc 9854):

- a) the airspace organization should accommodate diverse types of vehicle characteristics and capabilities including transiting space-vehicles those with limited ability of some vehicles to dynamically change trajectory;
- b) the ATM should consider the trajectory of a manned or unmanned vehicle during all phases of flight and manages the interaction of that trajectory with other trajectories or hazards to achieve

the optimum system outcome, with minimal deviation from the user-requested flight trajectory, whenever possible;

- c) the ATM processes should accommodate diverse and dynamic flight trajectories and provide optimum system solutions for all airspace users both manned and unmanned; and
- d) when traffic segregation is needed, the size, shape and time of reserved airspace should be set to minimize the impact on airspace users.

3. **FIRST HAO IN KSA**

3.1 The Kingdom of Saudi Arabia has been selected as one of the four global bases by Halo Space, a renowned near-space tourism company based in Spain, and it aims to commence commercial operations by 2026. The Halo Space uses a prototype capsule to test and validate space travel by viewing Earth from the stratosphere. To materialize this project, Halo Space has conducted several tests of its prototype capsules. The sixth test flight is planned in Saudi Arabia in September 2024 to an altitude of 35 kilometres above the Earth's surface. This test is considered a significant milestone for Halo Space and for the development for Saudi Arabia's growing space industry. As part of its Vision 2030, Saudi Arabia aims to be an international hub for space activities and has been progressively investing in space technology.

3.2 The Halo Space's test flight in Saudi Arabia will launch a real-size prototype capsule 35 kilometres above the Earth's surface. The capsule will be attached to a helium balloon that will gradually ascend to the stratosphere and then gradually descend back to Earth. This test will be the first instance of simultaneous testing of all technologies behind Halo Space's zero-emission flight. The entire flight experience will last about 4 to 6 hours, including 1 to 2 hours at peak altitude.

3.3 To authorize the planned test flight, the General Authority of Civil Aviation (GACA), in coordination with all concerned government agencies and the Saudi Space and Technology Commission, issued an approval with several technical and operational conditions to protect the safety of aircraft operations within Jeddah FIR. The main conditions can be summarized as follows:

- e) ascension of the prototype capsule must be conducted in the reserved volume of airspace centered on the site of launch with a rectangular shape offering sufficient protection around the capsule. A NOTAM must be published, and the area must be plotted on the affected air traffic controller working positions;
- f) re-entry of the prototype capsule must be conducted in the dynamic, reserved volume of airspace centered around the capsule and offering sufficient protection around the predicted landing site. A NOTAM must be published, and the area must be plotted on the affected controller working positions.
 - a) close monitoring of weather forecasts must be conducted to determine and update the impact of wind direction and speed or any other phenomena on the planned flight profile of the capsule;
 - b) launching site must be selected in a remote area to minimize the impact on the air traffic and on the ground.

4. CONCLUSION

4.1 The ICAO provisions apply to all civil airspace users, and the absence of HAO standardization activities at the global level may hamper the introduction of HAO innovative technological solutions, prevent the materialization of their benefits in aviation and prevent their timely integration into the ecosystem.

4.2 The ICAO Assembly 41st Session and the Air Navigation World 2023 have recognized the real and potential benefits and challenges that HAO can bring to the safety, efficiency, security, and to the economic and environmental sustainability of civil aviation.

4.3 As ICAO has a key role as a forum and facilitator for the development of frameworks and knowledge sharing on the operations of Higher Airspace Operations, it can bring together States and industry stakeholders at both the global and regional levels to set SARPs, develop guidance material, share best practices on the concept of higher airspace operations, and establish requirements for the safe and efficient integration of HAO in the aviation ecosystem.

4.4 The ongoing development of HAO and the diversity of new entrants and targeted applications are very complex and multidisciplinary challenges. With the contribution of States, stakeholders, and the industry, ICAO has the capabilities and a strong leadership and knowledgeable regulatory establishment, allowing the organization to lead the development of framework, Standards, and guidance supporting the gradual evolution of higher airspace operations.

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