



International Civil Aviation Organization

WORKING PAPER

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ASSEMBLY — 42ND SESSION

TECHNICAL COMMISSION

Agenda Item 25: Other issues to be considered by the Technical Commission

HIGHER AIRSPACE OPERATIONS

(Presented by Oman)

EXECUTIVE SUMMARY

As global interest in high space operations expands ranging from lunar infrastructure to deep space exploration and strategic orbital assets the demand for robust, responsive, safe and secure capabilities is rising.

This working paper identifies the emerging challenges, opportunities for safely integrating new types of operations into the airspace above conventional flight levels and it reflects Oman's dedication to advancing its space exploration capabilities and fostering international collaborations in the aerospace sector.

Action: The Assembly is invited to:

- note the content of this working paper; and
- ICAO to establish a higher airspace operations (HAO) Task Force to provide guidance and review Standards and Recommended Practices (SARPs) for amendment or expansion as necessary, to facilitate HAO within a global and harmonised framework

<i>Strategic Goal:</i>	This working paper relates to the Strategic Goal <i>Every Flight is Safe and Secure</i> .
<i>Financial implications:</i>	The activities referred to in this paper will be undertaken subject to the resources available in the 2022-2025 Regular Programme Budget and/or from extra-budgetary contributions
<i>References:</i>	Doc 10184, <i>Assembly Resolutions in Force</i> (Resolution A40-7) Doc 10088, <i>Manual on Civil-Military Cooperation in Air Traffic Management</i> The fifty-ninth meeting of the North Atlantic Systems Planning Group (Paris, France, 27 to 29 June 2023) The 41st Session of the ICAO Assembly EASA High-Level Concept of Operations for Commercial Space Operations (HAO)

1. INTRODUCTION

1.1 Higher Airspace Operations (HAO) refer to aerospace activities that occur above the altitudes typically used by conventional commercial air transport (often defined as above Flight Level 550). This operational domain is growing due to several technological developments, including:

- a) Space launches and re-entries: Commercial and scientific space operations that transit through or operate partially in the higher airspace.
- b) Suborbital, supersonic, and hypersonic flights: Emerging transport concepts that require different performance standards and separation criteria.
- c) High Altitude Platform Systems (HAPS): Long-endurance unmanned systems and other advanced platforms that may operate for extended durations at high altitudes.
- d) Integration of unmanned aircraft and advanced air mobility (AAM): While many unmanned aircraft currently operate in lower altitudes under UTM (unmanned aircraft system traffic management), there is also increasing interest in their capabilities at higher altitudes.

1.2 Rocket launch operations serve as the foundational capability for all space activities. In the context of emerging high space missions, the policy environment must evolve to address new demands for frequency, responsiveness, safety, security and coordination. This working paper evaluates the current landscape, strategic imperatives, and policy pathways to strengthen global/national and allied launch capabilities.

2. BACKGROUND

2.1 Oman has been actively developing its space capabilities, marked by significant milestones in recent years. In December 2024, Oman achieved a historic feat by successfully launching its first experimental rocket, named "Duqm-1," from the Etlaq Spaceport located near the Special Economic Zone of Duqm. The launch took place on 5 December 2024, at 10:05 AM local time. Following this achievement, the Etlaq Spaceport announced plans to host five rocket launches in 2025. The schedule includes launches by international partners such as Advanced Rocket Technologies and Kuwait Space Rockets, as well as additional missions in the Duqm series.

2.2 These initiatives aim to position Oman as a key player in the regional space industry and to attract global aerospace collaborations.

2.3 In line with this vision, Spanish company PLD Space signed an agreement in February 2025 to conduct launches of its Miura 5 small launch vehicle from the Etlaq Spaceport, with operations expected to commence as soon as 2027. This partnership underscores Oman's strategic location and its potential to become a hub for space launches in the Middle East.

2.4 These developments reflect Oman's dedication to advancing its space exploration capabilities and fostering international collaborations in the aerospace sector.

2.5 A growing number of space operations are interfacing with civil and military aviation operations and air traffic management at all airspace levels and the Current framework do not facilitate HAO within a global, harmonised framework, therefore, Sultanate of Oman recognising that there is an increasing need at the ICAO Assembly to consider the following ideas and thoughts expressed in the discussion working Paper.

3. **DISCUSSION**

3.1 Regulatory frameworks for high airspace operations

- a) Development of global standards and guidelines for the safe use of high-altitude airspace, especially considering new and emerging technologies.
- b) As activity in high space accelerates, the lack of a comprehensive legal and policy framework for this domain is becoming more apparent.
- c) Coordination between different airspace users (commercial, military, UAVs, etc.) and the establishment of appropriate separation standards.

3.2 Airspace management, safety and risk management

- a) Proposals for managing traffic in high airspace, especially with increasing congestion as new aircraft types enter the space.
- b) Establishing legal delimitation between the airspace and the outer space,
- c) Enhanced air traffic control procedures to address the complexity of high airspace operations.
- d) Establishing “safety zones” around infrastructure may improve operational safety, but also raises questions about de facto sovereignty, freedom of access, and possible exclusionary practices and without clear rules, misunderstandings could escalate into conflict.

3.3 Environmental impact

- a) Consideration of the environmental implications of operations at high altitudes, including Space debris, noise pollution, emissions from new aircraft types, and their effect on the atmosphere.
- b) Integration of environmental goals into the regulation of high airspace.

3.4 Technology and infrastructure development

- a) Exploration of new technologies (e.g., advanced radar systems, automated flight management systems) that could support the safe and efficient management of high airspace.

- b) Infrastructure requirements to support the growing demand for high-altitude operations, including landing and take-off sites for new aircraft types.

3.5 Space agencies

- a) Agencies are developing capabilities such as launch vehicles, autonomous landing systems, cislunar navigation, and lunar ISRU (in-situ resource utilization) technologies all vital for high space logistics and operations.

3.6 International collaboration

- a) Encouraging international collaboration between governments, aviation authorities, and private stakeholders to develop a harmonized approach to high airspace operations and where necessary identify needs for ICAO provisions.
- b) Proposals for creating a global framework for the use of high airspace to ensure the seamless integration of various aviation sectors.

3.7 Market and economic considerations

- a) Exploration of the economic opportunities arising from high-altitude airspace operations, including potential new commercial services like supersonic flights or space tourism.
- b) Assessment of market readiness for high-altitude operations and the necessary investment in infrastructure.

4. CONCLUSION

4.1 Oman acts as a key player in the regional space industry. ICAO can foster collaboration among States to adopt common policies and procedures for higher airspace operations, ensuring a consistent approach across different countries.

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