

**58th CONFERENCE OF
DIRECTORS GENERAL OF CIVIL AVIATION
ASIA AND PACIFIC REGIONS**

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AGENDA ITEM 3: AVIATION SAFETY

**REGULATORY REQUIREMENTS FOR HIGHER AIRSPACE
OPERATIONS (HAO) TO MITIGATE SAFETY RISKS**

(Presented by Bangladesh)

SUMMARY

Higher Airspace Operations (HAO) include operations that are carried out in the higher airspace, but not in the outer space (supersonic, hypersonic, suborbital, aero-launching, vertical launching into orbit, and re-entry from orbit). These operations are in airspace above altitudes (typically FL 600) where the majority of air services are provided today.

But, the absence of a legal boundary between airspaces, where states may exercise their sovereignty over their territory, according to the Chicago Convention, and within outer space that cannot be subject to national appropriation by claim of sovereignty has been long felt.

States in the Region strongly need ICAO's intervention in a functionalist approach on regulating the specific operation(s), on the face of the risks that some States may develop their own rules on HAO creating "de facto" standards, which may be difficult to modify and harmonize afterwards.

REGULATORY REQUIREMENTS FOR HIGHER AIRSPACE OPERATIONS (HAO) TO MITIGATE SAFETY RISKS

1. INTRODUCTION

1.1 Higher airspace or the area above FL 600 is becoming a new frontier in aviation. The emergence of new airspace users and operations with highly connected and automated vehicles in this higher airspace do bring us to the threshold of a new frontier. But at the same time these operations, will bring in new challenges that will have to be addressed, for the aviation sector and in specifically air traffic management (ATM) systems. The present day aviation system will need to evolve if we want to accommodate aviation growth along with higher airspace operations, in a safe, orderly, environmental friendly and sustainable manner. The representation of the airspace and outer space altitudes are depicted below in **Figure-1**.

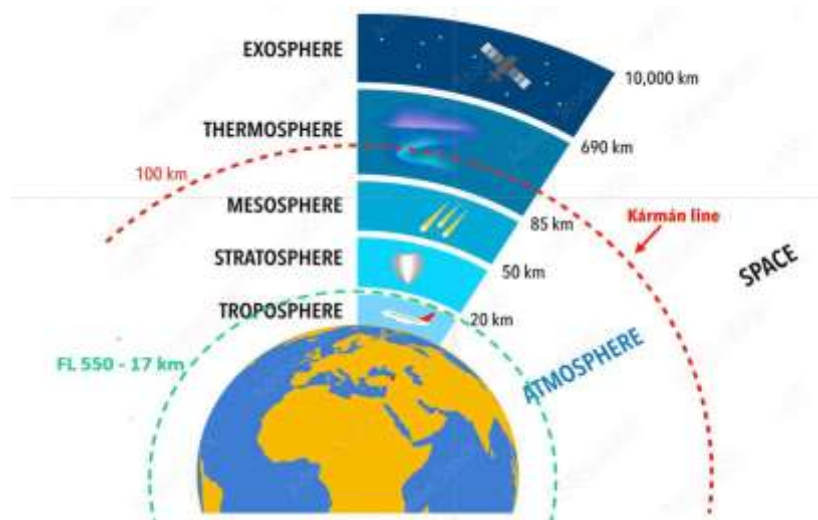


Figure-1

1.2 There is a need to comprehend the emerging new technologies, their operational characteristics and requirements, their possible impact on existing regimes and potential interactions within the aviation system in order to identify the appropriate framework conditions and concept of operations.

1.3 Since the beginning of the space age in 1957, tons of rockets, spacecraft and instruments have been launched into space. Initially, there was no plan for what to do with them at the end of their lives. Since then, numbers have continued to increase and explosions and collisions in space have created hundreds of thousands of pieces of dangerous debris.

1.4 The space environment beyond low Earth orbit (LEO) is teeming with space debris. These debris are mostly the remnants from human-made objects such as dead satellites, used rocket stages, and particles from the collision of other debris. Space debris was not considered an issue around 50 years ago because little was known about the practical applications of space above the stratosphere. But now has become a major area of concern.

1.5 States must also consider as to what to do with the space debris (tons of rockets, spacecraft and instruments, remnants from human-made objects such as dead satellites, used rocket stages, and materials from the collision of other debris) that are existent in the low Earth orbit (LEO). Space debris was not considered an issue before but now has become a major area of concern.

1.6 To ensure the safe and implementation of higher airspace operations using risk- and performance-based approaches to innovation and regulation, appropriate requirements for safety, security, contingency and resilience of operations for all phases of flight need to be established.

1.7 As the sector is in its nascent phase, there are very few reliability and occurrence data available. As such it might be not easy to set effective detailed requirements for different types of vehicles that are brought into play.

2. DISCUSSION

2.1 It is imperative that the emergence of new airspace users and operations with highly connected and automated vehicles in the higher airspace of new commercial and state space operations will create new businesses and social benefits. At the same time these operations will open up an arena of challenges with great impact on the aviation sector and particularly in the Air Traffic Management (ATM) systems.

2.2 **Challenges:** Let us now comprehend the challenges that this new operations bring in. These are but not limited to:

- a) coordination between air law and space law;
- b) sharing responsibility among the Member States;
- c) integrating the future HAO regulation with the existing and under development drone regulation;
- d) regulating new services in the higher airspace and defining the limiting the altitude;
- e) setting up of new Rules of the Air suitable for different vehicles' performances;
- f) assuring a fair and equitable access to higher airspace;
- g) setting up of an appropriate level of safety for different vehicles and operations categories taking into account the technology's state-of-the-art mechanism and
- h) setting up of effective interfaces and coordination between ATM and STM, which is important to avoid collision with active space objects and space debris.
- i) tackling environmental issues by evaluating the impact both at the surface (e.g. at take-off and landing sites) and for the atmosphere (troposphere, mesosphere and thermosphere).

2.3 Industrial developments in Europe and America as well as operational demonstrations in developing countries indicate that more Higher Airspace Operations (HAO) would bring in a new category of airspace users in the near future. The test launch in January 2023 of a Virgin Orbit air-launch-to-orbit operation from the UK could make orbital space operations a new reality for continental Europe. The launching of the Lunar Mission "Chandrayaan" by India and its success indicates that more such operations are forthcoming in the APAC Region.

2.4 Special attention will have to be paid to those traditional space operations such as vertical launching and re-entry that fall in principle under national space laws. Another area of concern will be, whether the new HAO regulations should also deal with the safety of spaceflight occupants (e.g. in a re-entry flight), or if this aspect will remain under the remit of the States. In this respect, the clarification of the vehicle's legal status (along with registration requirements) in the different phases of its operational life will be of particular importance, especially when it does not always behave as an aircraft or when it can be considered a space object.

2.5 There is no agreement at global level on the physical delineation between airspace and outer space which makes it difficult to define whether some vehicles and operations are aviation related or space related. The conventional and informal limit of 100 km is often referred to as separating air and space operations but there is no consensus at a global level. For the space community, space operations seem to mean operations aimed at going to or placing an object in orbit. (Refer to **Figure -1**).

2.6 States will need regulatory assistance in accommodating the transiting traffic of HAO and its interaction with conventional air traffic at lower altitudes (civil-military, commercial and non-commercial operations, comprising of transport, specialized and experimental types). In the future, we are expecting a growing number of HAO or space launches and re-entries, taking off from inland areas with higher density of population and air traffic.

2.7 The traditional ATM/ANS facilities and services are not adequate enough to handle these new operations. It will have to design new solutions, to ensure an orderly and safe traffic at higher altitude. There are airports, used for co-located HAO Operations - which will be impacted, since they would have to accommodate different types of take-off/landing operations and potentially have to meet different requirements. In the recent space launch of **Luna 25** by Russia, an entire village Shakhtinskyi settlement in Russia's Khabarovsk region were evacuated to cater for dangers from the falling rocket boosters after they separate from the spacecraft. Just to anticipate what to expect in case of fallen debris ! (Refer to the **Figure-2** as shown below).



Figure-2

2.8 Space and Outer Space activities in APAC Region are gathering momentum. Some of the notable activities are, Solar Mission (Aditya 1) subsequent to the success of third lunar mission Chandrayaan 3, by the Indian Space and Research Organization's (ISRO), China's launching its reusable spacecraft in 2027, reentry of a reusable Chinese spacecraft after staying in orbit for 276 days, China's launching of the world's first methane-liquid oxygen rocket into orbit on July 12, SpaceX's multiple sub-orbital test flights in Texas, USA, Russia's long-awaited and delayed robotic re-introduction to moon exploration (Luna-25) and so on.

2.9 In line with the **Article 9** of the UN Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies there exists intense collaborations among the various space agencies. The recent launching of the third lunar mission **Chandrayaan 3**, is an example of extensive and cross border collaboration with various space agencies including European, Australian and US counterparts of Indian Space and Research Organization (ISRO). All of these agencies were collaborating in tracking in real time the exact location of the **Chandrayaan 3** and were providing the feedback to India, which played a definitive role in the success of the mission. Such cooperative efforts will definitely take the emerging technologies way forward.

2.10 **ICAO Initiatives:**

- a) In the 13th Air Navigation Conference, a paper was presented on “Emerging issues: operations above FL 600” for the 13th Air Navigation Conference (2018), drawing the global attention of this emerging issue;
- b) In the 40th Assembly (2019), a paper was presented on “New entrants” which led to Resolution A40-7 calling upon ICAO to consider the need for modifications to the ICAO provisions including, inter alia, the rules of the air, airspace dimensions, airspace classification, liability, licensing, environment and certification to accommodate UAS and higher airspace operations;
- c) The 3rd ICAO High level Safety Conference (May 2021) stressed the urgency for ICAO to organize a global dialogue on this subject;
- d) The 41st session of the ICAO Assembly (2022) urged ICAO to take action on the emerging HA Operations;
- e) The ICAO Secretariat is now going to provide a follow-up on the recommendations adopted during the 41st session of the General Assembly in September/October 2022.

2.11 ICAO may kindly take note of the fact that some States are developing their own rules on HAO creating “de facto” standards, which may be difficult to modify and harmonize afterwards. As for example, UK, and Italy, have already developed their national regulation in this domain having benefitted from the FAA experience in the US. The need for a global and unified policy guideline is even more needed and is a sheer necessity.

2.12 There are research works being undertaken by EU, European Space Agencies (e.g. national, ESA, EUSPA), European Commission in cooperation with EUROCONTROL, the European Union Aviation Safety Agency (EASA), the SESAR Joint Undertaking (SJU), the European Defense Agency (EDA) and the European Space Agency (ESA). ICAO may kindly take into consideration these efforts while making the policy guideline.

2.13 Considering the novelty of the HA vehicles and operations and the absence of a binding/regulatory requirement, ICAO is requested to consider establishing a target level of safety and possible safety requirements that should be imposed on these operations. These are well justified by the necessity to support the emerging industry by analyzing the safety risks of the operations.

2.14 The safety risks of HAO need to be assessed and mitigated vis-à-vis the other aviation traffic, the possible occupants of the vehicles/aircraft and the persons and facilities on the ground (land or sea). In the transiting phase from the ground to higher airspace and from higher airspace to the ground), the HA vehicles will interfere with the currently existing civil and military aviation traffic. The acceptable maximum safety risks to third persons and properties on the ground would also have to be analyzed and mitigated, taking into account the technical characteristics and performance of the different categories of HAO, their launching and landing patterns, as well as the specificity of the densely populated territory.

2.15 The High Altitude Operations (HAO) is no longer an emerging issue globally nor in the APAC Region. The success of the Lunar Mission “**Chandrayaan 3**” by India is an eye opener. It is for the first time a nation has been able to land on the south pole of the moon. While we take this opportunity to congratulate India on this giant step and joining an elite group of States e.g. USA and Russia and China who have successfully carried out moon missions, we are now able to foresee a steep increase in these type of operations in the near future. And now is the time consider the risks and mitigation suggestions that have been made for a safe, orderly, environmental friendly and sustainable aviation.

2.16 We have observed fundamental changes in the way we are using space. To continue benefiting from the science, technology and data that operating in the space brings, it is vital that we achieve better compliance with existing guidelines in spacecraft design and operations and need

further safety guidelines. It cannot be stressed enough that this is essential for the sustainable use of space.

3. ACTION BY THE CONFERENCE

3.1 The Conference is invited to:

- a) Consider the ideas and thoughts expressed in the Discussion Paper;
- b) Urge ICAO to consider the risk analysis and mitigation processes detailed in the Discussion paper; and
- c) Urge ICAO to study further along with other space agencies and UN bodies dealing with space operations before providing a guideline for regulatory framework.

— END —