



ICAO

**INTERNATIONAL CIVIL AVIATION ORGANIZATION**

**Twenty seventh Meeting of the Africa-Indian Ocean Planning and Implementation Regional Group (APIRG/27) and Tenth Meeting of the Regional Aviation Safety Group for the Africa-Indian Region (RASG-AFI/10), Joint sessions**

**4 and 8 November 2024**

**Agenda Item 3: APIRG and RASG-AFI Coordination**

**3.4. AFI Airspace Monitoring**

**RE-ENTRY OF SPACE OBJECTS AFFECTING AFRICAN AIRSPACE.**

*(Presented by South Africa)*

<b>SUMMARY</b>	
<p>This working paper presents the potential impact the re-entry of space objects has on AFI Region expanding on the discussions emanating from APIRG/26 and highlighting aspects for consideration by APIRG.</p>	
<p>Action by the Meeting is provided in Paragraph 3 of this paper.</p>	
<i>Strategic Objectives</i>	<p>This working paper relates to the Strategic Objectives A, B, D and E</p>

**1 INTRODUCTION**

- 1.1 During AFI Planning Implementation Regional Group (APIRG) 26 meeting held in Cotonou, Benin, between 6 – 10 November 2023, the Federal Aviation Administration (FAA) informed APIRG of the requirements for coordination to mitigate safety risks to airspace users resulting from space launch and re-entry operations.
- 1.2 The information highlighted the significant increase of space launch and re-entry operations in recent years.
- 1.3 Noting the impact of these operations is not limited to one country or Flight Information Region (FIR), the Federal Aviation Administration (FAA) highlighted the need for coordination with various stakeholders in the identification and communication of Aircraft Hazard Areas (AHA) in the form of danger areas to affected FIRs, and the use of NOTAM to disseminate information to airspace users.

- 1.4 The FAA requested the meeting to urge the States affected by the operations to offer feedback to further refine and improve the coordination process, to consider establishing a single email distribution list to assure all concerned parties are aware of impending space activities affecting the airspace and recommended that States conducting or supporting space launches consider coordination using direct email and AMHS in addition to diplomatic notifications, as well as for ICAO to include Space Coordination contact information into the current regional experts list.
- 1.5 APIRG therefore developed the following conclusion to support the requirements highlighted by FAA:

***APIRG/26 & RASG-AFI/9 Conclusion 5/01: Space Launch Activities***

“That to ensure adequate coordination during space launch activities,

- a) States conducting, supporting space launches or affected by the launches, consider establishing a single email distribution list to ensure all concerned parties are aware of impending space activities affecting the airspace;
- b) States launching or supporting the launches should establish a direct email and AMHS in addition to diplomatic notifications for coordination; and
- c) ICAO to include Space Coordination contact information in the current regional experts list.”

- 1.6 During the 14th Air Navigation Conference held in Montreal between 26 August to 6 September 2024, various papers were presented by States addressing aspects such as “Space transport operations” and “Higher airspace operations”. The following recommendations were therefore developed by the Conference:

- 1.6.1 ***“Recommendation 3.1/6 – Addressing the safe integration of space transport operations into the airspace system,*** That ICAO:

- a) work with Member States to identify, compile and publish best practices, as necessary, related to the safe and efficient air navigation of aircraft around space transport operations; and
- b) consider the development of guidance material for air navigation services providers related to the integration of space transport operations, including NOTAM dissemination, stakeholder communication associated with specific operations, air traffic flow management, and data-sharing for real-time updates on the status of the airspace, excluding telemetry data of launch vehicles.”

- 1.6.2 ***“Recommendation 3.1/7 – Higher airspace operations,*** That ICAO:

- a) develop a holistic vision and global concept for higher airspace operations, including regulatory approval, coordination responsibilities and liability, for inclusion in its work programme for the next triennium; and
- b) develop provisions related to the safe and efficient transit of aircraft through controlled airspace and separation management in higher airspace, including air traffic management procedures contingency planning and risk assessment and monitoring methodologies, especially for uncontrolled descents.”

## 2. DISCUSSION

- 2.1 The global reliance on space-based technology for its daily functioning is ever increasing. Satellite technology supports a wide variety of industries including aviation, defense, maritime, agriculture, science, etc.
- 2.2 The advantages of satellite technology within the aviation industry are significant, however another consideration becoming more prevalent for aviation is the potential risks associated with the re-entry of space objects associated with satellite technology (re-entry of rockets used for launching of satellites, de-orbiting of satellites reaching end of life, and other space objects created from satellites damages by other space debris).
- 2.3 Rocket re-entry within South African area of responsibility is coordinated through the Central Airspace Management Unit (CAMU) through the Flexible use of Airspace (FUA) application process. The process includes submission of the required information on FUA application form and coordination with South African Civil Aviation Authority (SACAA) and affected Johannesburg Oceanic (FAJO) for approval and promulgation of the appropriate NOTAM.
- 2.4 In April 2024, an application was made for the re-entry of the RUSSIAN ANGARA A5 within the FAJO area of responsibility between 9th – 10th April 2024. The FUA process was followed, and NOTAM generated as per below:
- (A1210/24 NOTAMN  
 Q)FAJO/QWMLW/IV/BO/W/000/999/5152S01651E999  
 A)FAJO B)2404090930 C)2404101100  
 D)DLY 0930-1100  
 E)AREA BOUNDED BY (293145S 0060345W, 302835S 0045700W, 341955S 0092250W, 334945S 0100000W, 325640S 0100000W): RUSSIAN ANGARA A5  
 ROCKET RE-ENTRY OPS TAKING PLACE.  
 APPLICABLE AIRSPACE DOWNGRADED TO CLASS G.  
 F)SFC G)UNL)
- 2.5 Through coordination with South African National Space Agency (SANSA), ATNS established that the scheduled launch on 9th April did not take place which in turn would delay the re-entry operations. ATNS engaged the applicant who advised that the launch was postponed to 10th April and that the re-entry and sinking of the fragments was planned for 11th April. The potential impact of not amending NOTAM would have been that aircraft are routed through the airspace where the re-entry operations are planned without having any notification of the intended operations.
- 2.6 South Africa developed a working paper for consideration by the ICAO 39th session of the Legal Committee to address the Re-entry of space objects affecting International Air Navigation.
- 2.7 In the working paper, it is highlighted that the satellite tracking website “<https://orbit.ingnow.com/>” listed 9,900 active satellites in various Earth orbits, namely Low Earth Orbit (“LEO”), Medium Earth Orbit (“MEO”) and Geostationary/Geosynchronous orbit

- (“GEO”). It has been estimated that the satellite numbers could grow to several hundred thousand by the year 2027, which would resultantly mean significant increase from the current 9,900 active satellites in the various Earth orbits. Most of the satellites are found in the LEO with the near-Earth environment already starting to get congested.
- 2.8 The paper further highlighted that considering the current number of satellites in orbit, and the expected growth of the industry, that it could be anticipated that the number of rocket launches needed to maintain these orbiting constellations will also increase, which in turn would increase the number of re-entry operations associated with miscellaneous debris left in orbit such as abandoned rocket bodies, damaged and inactive satellites, and other debris fragments.
- 2.9 Because objects orbiting at low enough altitudes continue to be affected by the topmost parts of Earth's atmosphere, a drag is created that eventually causes a re-entry, leading to uncontrollable re-entries. There are many elements that make it difficult to predict these re-entries, including fluctuations in the atmosphere itself.
- 2.10 Most of the new rocket elements are designed to disintegrate (burn -out) with re-entry operations, however one of the recorded incidents according to the American Institute of Aeronautics and Astronautics, on Christmas Day, 1996, an object they believe was no bigger than a marble impacted the windshield of a Boeing 757 at a typical cruising altitude of just over 30,000 feet. Although the Boeing 757 windshield impact case was a rare event, over the course of 2022, there were several occasions when Civil Aviation Authorities around the world had to react to, and manage, similar associated safety risks. One country even went so far as to consider closing part of its airspace to mitigate the risk posed by a potential hazard.
- 2.11 Annex 19 of the Chicago Convention, which relates to Safety Management, defines safety itself as:
- “The state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level.”
- 2.12 With ICAO's drive towards Trajectory Based Operations (“TBO”), the conjunctions between uncontrollable/controllable re-entries becomes critical including the ability to share this information across a wide range of stakeholders, ensuring a real time picture.
- 2.13 The United States “ConOps for Upper ‘Class E’ Traffic Management (ETM)”, and the “European Union’s Concept of Higher Airspace Operations (ECHO)” are some of the guidance that can be considered for development of AFI plan in this regard.
- 2.14 There is a need to strength current agreements, processes and procedures associated with space object re-entry operations from a South African perspective with all relevant stakeholders.
- 2.15 There is furthermore a need to identify and develop mechanisms (systems) to ensure the coordination and management of these operations, especially the conjunctions between uncontrollable/controllable re-entries and airspace users within AFI Region area of responsibility which can seamlessly be introduced into the ATM system in an automated way. (Leveraging on UTM concept).

**3 ACTION BY THE MEETING**

- 3.1 The meeting is invited to:
- 3.1.1 Take note of the information and the potential impacts associated with re-entry of space objects affecting AFI Airspace including the recommendations.
  - 3.1.2 Consider the processes adopted by South Africa in managing these operations through the Central Airspace Management Unit (CAMU) and Flexible Use of Airspace (FUA).
  - 3.1.3 Support the establishment of Project Team to launch Higher Airspace Operations Project for AFI Region.
  - 3.1.4 The Higher Airspace Operations Project to identify, plan and develop mechanisms (systems) to ensure the coordination and management of these operations, especially the conjunctions between uncontrollable/controllable re-entries and airspace users within AFI Region.

***APIRG/27 Decision xx/xx: Establishment of the Higher Airspace Operations Project Team***

**That, considering the impact of Higher Airspace Operations on ATM within the AFI Region, and to coordinate a harmonized approach to the management of Space Object Re-Entry for AFI Region:**

- a) The AAO and IIM SG to coordinate the establishment of a Higher Airspace Operations Project Team which includes technical experts from States, ANSPs, Airspace users and other concerned international organizations by xx February 2025; and**
- b) The Project Team to establish framework for the launching of Higher Airspace Operations Project and to conduct a workshop to provide awareness on Higher Airspace Operations developments to the AFI Region.**