57th CONFERENCE OF DIRECTORS GENERAL OF CIVIL AVIATION ASIA AND PACIFIC REGIONS

Incheon, Republic of Korea
4 – 8 July 2022

AGENDA ITEM 3: AVIATION SAFETY

UNAUTHORIZED ENTRY OF UAVS INTO THE NATIONAL ATM, NEED FOR RESTRUCTURING OF AIRSPACE

Presented by Bangladesh

INFORMATION PAPER

SUMMARY

The UAVs or commonly known as drones are the technological advancements, which for its ease of availability has impacted the civil aviation and, in many cases, has even disrupted the normal aviation activities. The present airspace structures as prescribed by ICAO need to be modified so that UAVs can be accommodated with the required level of safety and flexibility. A new airspace classification and structure need to be evolved based on appropriate performance metrics with more focus on the coexistence of manned and unmanned Urban Air Mobility (UAM) vehicles and associated Communication, Navigation and Surveillance (CNS) infrastructures. The present airspace structure based on manned aircraft operations needs to be remodeled to accommodate the unauthorized entry of UAVs into the national ATM Structure

UNAUTHORIZED ENTRY OF UAVS INTO THE NATIONAL ATM, NEED FOR RESTRUCTURING OF AIRSPACE

1. INTRODUCTION

1.1 Current Air Traffic Management (ATM) systems nor the ICAO approved airspace structures have not been designed to handle the encroachment of unmanned aircraft traffic into the national airspace. Integration of unmanned aircraft in the national airspace using conventional means may require unmanned aircraft to be equipped with bulky and expensive hardware, which is neither feasible nor advisable. The CAAs require the creation of a separate, modern, and primarily software based, automated UAS Traffic Management (UTM) system which may subsequently be integrated into traditional ATM systems.

2. DISCUSSION

2.1 The ability to identify and track an unmanned aircraft flying in the national airspace is a critical requirement while enabling high-density and complex unmanned aircraft operations. Real-time Identification and Tracking (RIT) of the unmanned aircraft are required to enable sharing of the identity of the UAS and its location to other airspace owners and people on the ground. This would also provide stakeholders situational awareness and allow law enforcement and security agencies to track unmanned aircraft, where required.

2.2 The main challenges are to identify roles and responsibilities of the ATM Service providers in terms of the level of service provided and service responsibility (should the two overlap), development of operational procedures and coordination processes and establishing separation standards between unmanned aircraft as well as between manned aircraft and unmanned aircraft.

2.3 States should also consider several other technological aspects such as to support collision avoidance, automation to support traffic management and transitions between UTM to ATM, information exchange capabilities between UTM and ATM systems for operations planning purposes and to enable situational awareness and capabilities to meet performance requirements needed to achieve interoperability (e.g., CNS requirements).

2.4 Although some UAS are unable to comply with the Convention on International Civil Aviation (Doc 7300), signed at Chicago on 7 December 1944 and amended by the ICAO Assembly, at the 39th Session, CAAs face the challenge of managing the increasing number of UAVs operating in low-level airspace that might conflict with manned aviation. States need a global baseline of provisions and guidance material for the proper harmonization of UAS regulations that remains outside the international instrument flight rules (IFR) framework.

3. Encroachment of UAVs into the national airspace:

3.1 The management of UAVs that encroach the national airspace impacting the existing airspace is dependent on the harmonization of risk- and performance-based regulations and oversight including the emerging technological solutions for efficient management of airspace and operation of aircraft based on principles of airspace design. As the intensity of operation of the UAVs grow and the unavoidable fact that the UAVs will need to coexist with manned aircraft but with the existing aviation systems within finite airspace resources the CAAs are finding difficulties in meeting challenges in privacy, security, reliability, and the environment issues in the absence of a Standardized Guideline.

3.2 Two basic UAV operations requirements e.g., visual line-of-sight (VLOS) or beyond visual line -of -sight (BVLOS) operations do not effectively support the current airspace classification as developed for manned aviation. This necessitates modification of current classes of airspace to include new flight rules applicable to UAS conducting VLOS and BVLOS operations or to create new classes of airspaces to accommodate the range of needs brought by UAV operations.

3.3 ICAO Annex 2 — Rules of the Air, specifies right-of-way, altitude above people and obstructions, distance from obstacles and types of flight rules, all of which, are compatible with the intended operations within UTM systems but procedures specific to the UTM system, including normal, emergency, and contingency scenarios, are needed to be developed.

4. Cyber Security and Navigation considerations

4.1 The States should take into consideration the significant cybersecurity risks and vulnerabilities. A robust security framework will be needed to address potentially malicious attacks to communications systems, including C2 Link disruptions, Global Navigation Satellite System (GNSS) jamming or spoofing attacks, and the manipulation of information exchanged between UAVs and between UAVs and UTM systems, may result in erroneous advisories, unwanted changes in flight paths and increased risk of collision. ICAO has already published a new Annex 10 Volume VI on this C2 link which may be of substantial use when CAAs want to address malicious attacks on the C2 link disruptions.

4.2 GNSS is in fact not only the most widely employed source of absolute positioning for UAS operations but as recognized by ICAO, GNSS is also the key element of all Communications, Navigation, and Surveillance/ATM (CNS/ATM) system. Most UAS navigation systems employ a Global Navigation Satellite System (GNSS) receiver as the primary source of positioning in a global frame. This is typically supplemented by fusion with other sensors including inertial sensors and visual sensors to obtain a full navigation state estimate.

4.3 Performance is also dependent on environmental characteristics that are different from those encountered in manned aircraft operations. For example, GNSS performance is highly degraded in urban environments owing to signal multipath and obscuration relative to conventional manned aircraft operations. Therefore, greater reliance on augmentation with visual sensors and intelligent fusion algorithms will be necessary.

5. CONCLUSIONS

The envisioned spread of Urban Air Mobility (UAM) and low altitude UAV operations do prompt the need to introduce new airspace structures and classifications, particularly in dense urban and suburban areas. The paper suggests the need for a methodology for airspace structuring while maximizing the efficiency of airspace resource exploitation by accommodating unmanned aircraft with diverse avionics. It is expected that the progressive transition from an RNP-based formulation to a full CNS performance-based approach, including other parameters from the communication system (e.g., signal to noise ratio, bit error rate, etc.), will offer significant benefits in all planning needs. In this perspective, the proposed airspace restructuring will contribute significantly to enhance decision making support for demand-capacity balancing and dynamic airspace management in low-level ATM operations.

6. ACTION BY THE CONFERENCE

6.1 The Conference is invited to note the information contained in this Paper.

— END —