



WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 5: Emerging issues

5.1: Operations above Flight Level 600

COORDINATION OF FLIGHTS THROUGH CONTROLLED AIRSPACE FOR SPACE AND NEAR SPACE OPERATIONS

(Presented by the Civil Air Navigation Services Organisation (CANSO))

EXECUTIVE SUMMARY

Of the many new technologies sharing our skies today, perhaps the most hopeful and innovative is the increasing use of airspace above FL600. The Civil Air Navigation Services Organisation (CANSO) and its members are working closely with two prominent innovators, Google's Project Loon, which operates balloons to provide Internet access, especially in remote areas; and Facebook's Aquila project, which operates unmanned solar powered aircraft also to provide Internet access. This paper highlights the successful cooperation that CANSO and its members have achieved in safely operating these systems through controlled airspace. However, since more and more States and entities are initiating these sort of operations to space and near space, global guidance is needed by ICAO to allow safe and efficient sharing controlled airspace used for international civil aviation. Further study is required to better understand the impact these operations have on efficiency and safety, as well as potential growth in this industry and to provide guidance to air navigation services providers (ANSPs) regarding the increased demand these operations are placing on air traffic management (ATM) resources.

Action: The Conference is invited to urge ICAO to:

- a) create guidance material to determine and facilitate the necessary coordination of travel for space and near space operations through controlled airspace;
- b) further study the impact of travel through controlled airspace for space and near space operators. The study on outer space operators should be done in coordination with the United Nations Office for Outer Space Affairs (UNOOSA);
- c) clarify the sovereignty and responsibility of States for future international civil aviation above FL600 until 100 km and the role of ICAO in this;
- d) create Recommended Practices or guidelines regarding equipage of the vehicles, necessary to safely and effectively operate through controlled airspace (surveillance and communications);
- e) consider the work and outcomes of already successfully conducted operational trials by Google and Facebook in developing guidance material and recommended practices; and
- f) develop guidelines to negate the necessity of closing large portions of airspace without decreasing safety and incorporating "acceptable level of risk".

1. INTRODUCTION

1.1 Historically, aircraft operations in controlled airspace flow from a departure location to a destination. Today, there are more operations that intend to flow through controlled airspace in an effort to operate at altitudes above traditional aviation. These operations are passing through the efficient aviation system we enjoy today. States, State-sponsored operators and commercial operators are operating into space and near space. There are unmanned aircraft, including unmanned free balloons, operating for days and months at a time above FL600; and they are growing in numbers and frequency.

1.2 The airspace between FL600 and 100 km is currently undefined by many States. Above 100 km the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (the "Outer Space Treaty") and four other treaties/conventions have been developed by the Committee on the Peaceful Uses of Outer Space (COPUOS).

1.3 Until recently, only a few States possessed the resources to launch spacecraft. As the desire to reach space increases and the economic incentives increase, more States and commercial entities are pursuing the capability. Commercial space operations are growing in numbers, complexity and launch frequency. Unmanned aircraft, including unmanned free balloons, are also moving through controlled airspace to high/ultra-high altitudes as the technology to do so moves from theory to test to application.

1.4 From the start operators like Google's Project Loon and Facebook's project Aquila have worked together with CANSO and its ANSP members to provide a safe operation and full coordination with air traffic management. Individual State standards and procedures, approved by the respective State regulatory authority, were established. These procedures and standards could be used as an example of how separation can be established. This will enable equal opportunities for all airspace users.

2. BACKGROUND

2.1 On 30 March 2017, the American company SpaceX, achieved the world's first reuse of an orbital class rocket. The company's goal is to continue to launch, recover and reuse orbit capable rockets. This indicates that there are increasing efforts to fly through controlled airspace by air or spacecraft that are no longer flowing from point A to B, but climbing or descending vertically through the normal route structures. SpaceX intends to fly numerous cargo resupply missions to the International Space Station (ISS) and is planning for at least twenty flights in future years. SpaceX has secured over 100 missions to its manifest, representing over 12 billion USD in contracts, thus securing commercial space as a viable and growing industry. SpaceX is continuing to develop reusable rockets. This means that, for ATMs, rockets will no longer burn up on re-entry, but will need to be accounted for during their controlled descent through controlled airspace. On 7 February 2018, SpaceX successfully launched its Falcon Heavy rocket, detached its external rockets, and safely (simultaneously) landed two out of three booster engines on a predetermined location. This launch and re-entry was coordinated closely with the Federal Aviation Administration (FAA) after a thorough evaluation and approval process.

2.2 As recovery of spacecraft increases, ANSPs must consider airspace segregation for recovery operations' controlled descent through controlled airspace. Spacecraft launches currently require the reservation of a large amount of airspace. National Aeronautics and Space Administration (NASA) rocket boosters separate at an altitude of approximately 45 km (24 nautical miles) and descend on parachutes to land in the ocean. This airspace must be restricted for both launch and through the duration of the planned descent of the boosters. The State works with ANSPs to define the size of the restricted area, creates a temporary flight restriction (TFR), and publishes a notice to airmen (NOTAM).

The size of the restricted airspace for a typical NASA Shuttle launch was 30-40 nautical miles long and wide, closing off approximately 1,500 square miles to commercial and general aviation.

2.3 The airspace closure is for both the safety of the aircraft in the area due to the potential of falling debris in case of launch failure and the safety of the launch vehicle. Additional airspace also needs to be protected around the launch site. In the event of an intrusion or interruption to the launch, there needs to be enough buffer to ensure the protection of any approaching aircraft, namely by alerting and/or re-routing them. Airspace protection areas can extend for nearly 30 miles around the launch sites. Further, aircraft hazard areas (AHAs) are developed to protect aircraft from launch and recovery activities. This buffer is not calculated to ensure there is enough time to contact the aircraft. The buffer simply protects aircraft from launches and recovery operations calculated to a prescribed level of risk.

2.4 In addition to governmental and commercial spacecraft operators, companies like Google's Project Loon have a significant interest in operating in upper airspace. Project Loon is creating a network of unmanned free balloons traveling and operating in near space, to extend Internet connectivity to developing areas of the world. It is launching a fleet of balloons, using its capability to launch a new balloon every thirty minutes. As the balloons ascend to altitude, others will also come down. Each balloon is intended to remain airborne for 190 days. Project Loon tracks the location of every balloon using Global Positioning System (GPS); however ANSPs need to be able to see and track those systems as they ascend and descend through controlled airspace. Project Loon states, "When a balloon is ready to be taken out of service, the lift gas keeping the balloon aloft is released and a parachute deploys automatically bringing the balloon to the ground in a controlled descent." Close coordination with ANSPs in advance is essential to clear the necessary airspace. These constant ascents and descents need to be coordinated with ATMs and each has to be handled as a unique event.

2.5 Additionally, Facebook has been developing a large unmanned aircraft system (UAS), named Aquila, at very high altitude, from 60,000 to 90,000 feet. These solar-powered UAS, powered by lithium ion batteries climb to 90,000 feet during the day using solar power and float down to around 60,000 feet during the night using the stored power in the battery. Although they stated they will not deploy the UAS themselves they indicated they will sell the concept to interested parties.

3. CONCLUSION

3.1 As the number of transitions through controlled airspace increases, it becomes more important for ANSPs to be even more actively involved in the planning and operation of these endeavours. The challenge is that as these flights become more common there will be increased workload for ANSPs and ATCOs to coordinate each flight safely. Additionally, these operations will eventually affect capacity. States, commercial operators and ANSPs will need clear operating standards for these missions, Standards and Recommended Practices (SARPS) and guidelines for the training of personnel and established codified procedures need to be established for these events. It is essential to create defined equipment requirements for these air and spacecraft, to ensure they are compatible with current surveillance and communication systems

3.2 While many outer space operations are currently State-sponsored, the industry is growing internationally and in all cases, there is international airspace involved. Because of this, the conference is asked to recommend that ICAO creates guidance material that determines and facilitates the necessary coordination of travel for space and near space operations through controlled airspace. Further, it should create guidelines regarding equipment of the vehicles (surveillance and communications). These guidelines are meant to allow reductions in separation and negate the necessity of closing large portions of airspace without decreasing safety and incorporating "acceptable level of risk".

3.3 The development of international civil aviation in the airspace between FL600 and 100km requires clear definitions of sovereignty, oversight and management. Currently there is no consensus on this while future operations of for example hypersonic flights needs the same protection and oversight we have today for international civil aviation.

3.4 The ICAO Space Learning Group (SLG) should continue its coordination with the United Nations Office for Outer Space Affairs (UNOOSA) to ensure a common understanding of the needs, for both ANSPs and the emerging commercial space industry.

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