



**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**

**5.2: Operations below 1000 feet**

**5.3: Remotely piloted aircraft system (RPAS)**

**5.5: Other emerging issues impacting the global air navigation system including unmanned aircraft systems (drones), and supersonic and commercial space operations**

**NON SEGREGATED UAS OPERATIONS**

(Presented by Austria on behalf of the European Union and its Member States<sup>1</sup>,  
the other Member States of the European Civil Aviation Conference<sup>2</sup>;  
and by EUROCONTROL)

**EXECUTIVE SUMMARY**

This paper presents the key issues concerning the integration of unmanned aircraft systems (UAS) with manned aviation considered by the European Union to be important for ICAO to address. Since the work of the Remotely Piloted Aircraft Systems Panel (RPASP) is quite advanced regarding instrument flight rules (IFR) RPAS integration, the paper highlights the issue which is considered to be the most urgent: detect and avoid (DAA). The paper then presents a range of issues needing consideration by ICAO to make the unmanned aircraft systems traffic management (UTM) concept a reality, and to support integration of operations above FL 600, and makes specific recommendations, including the need to review some of the fundamental principles of aviation.

The Conference is invited to agree to the recommendations in paragraph 6.

<sup>1</sup> Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

<sup>2</sup> Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Republic of Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

## 1. INTRODUCTION

1.1 Recent times have seen a significant growth in the demand for small unmanned aircraft systems (UAS) to be allowed to perform an increasing range of applications in unsegregated airspace. Many States in Europe and around the world have already produced their own regulations for the conduct of such operations, and the European Aviation Safety Agency (EASA) is taking an increasing role in relevant regulatory work. Notwithstanding this activity, there is a need for ICAO to take action in order to facilitate global harmonisation and standardisation of UAS traffic management (UTM)<sup>3</sup>.

1.2 The introduction of non-segregated UAS will have an impact on many long-standing, fundamental elements of ATM, such as airspace classification, flight rules and automation. ICAO will need to take the lead in these areas, in collaboration with States and regions, to ensure that any such changes meet the needs of the global aviation community.

1.3 The future of aviation will require manned and unmanned aircraft to integrate together within the same airspace, unlocking potential operations which will traverse both UTM and air traffic management (ATM) environments. There are two distinct threads to UAS integration: instrument flight rules (IFR) remotely piloted aircraft systems (RPAS) operations; and UTM. The IFR RPAS operations will be almost transparent to the ATM system. UTM services are anticipated to be initially deployed in airspace below 500 feet which, although largely in uncontrolled airspace, is not unmanaged. Consequently, UTM needs to safely and securely interface and integrate with ATM. This paper focusses on four areas and, for all four areas, it is essential that ICAO, in collaboration with State and regional ATM modernisation programmes, provide timely and effective provisions.

## 2. INTERNATIONAL COOPERATION

2.1 Many of the developments in the UAS domain are led by the new-entrant industries, and it is evolving very quickly, as was presented during the ICAO Second Global Air Navigation Industry Symposium (GANIS/2) and First Safety and Air Navigation Implementation Symposium (SANIS/1) held in December 2017. In order to expedite the significant amount of work that will be necessary to enable UAS integration, and to ensure that full account is taken of the opportunities presented by these new entrants' industrial developments, it is at the same time necessary for ICAO to explore new opportunities for working with these new-entrant industries and industry associations, some of them new to aviation. To ease the inclusiveness of these new entrants in ICAO activities, ICAO would need to make the fullest possible use of links between these groups and ICAO to connect with activities planned and ongoing in State and regional ATM modernisation programmes. This would allow the facilitation of operational trials and validation of standards and ICAO provisions, exploring as well as in finding the full synergies offered by ICAO working together with civil and military industry, States and regions (see also AN-Conf/13-WP/35 on the global air navigation plan (GANP) and AN-Conf/13-WP/39 on civil-military cooperation).

## 3. UAS TRAFFIC MANAGEMENT

3.1 The UTM environment will be very different from the existing manned aviation environment. Although the concept is still being defined, the model will comprise a set of UTM services,

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<sup>3</sup> In line with internationally-accepted conventions, the term 'UAS' is here used as the over-arching term to describe unmanned aircraft systems of all types. 'RPAS' is used specifically to refer to those UAS that will operate IFR, representing the focus of ICAO Panel efforts to date. Although not an officially-defined term, this paper uses the term 'drone' to refer to those typically small UAS that will operate below 500', remotely-piloted or otherwise, in receipt of UTM services. This is for convenience in this Paper and is not a recommendation for future adoption of that term.

provided by UTM service suppliers, supported by extensive automation on the drones themselves. The communications, navigation, and surveillance (CNS) technologies and radio spectrum required to enable this will combine established aviation technologies with those from other domains, such as the telecommunications and automotive industries (see also AN-Conf/13-WP/37 on integrated CNS).

3.2 The environment in which drones operate is of key importance when considering how their operations should be managed. These operating environments should be defined and classified to support the definition of appropriate standards for operation in each environment making effective use of work that is already being done in existing programmes, such as the Federal Aviation Administration (FAA) UTM programme and the U-space initiative in Europe<sup>4</sup> (see also AN-Conf/13-WP/51 on European integration of UAS).

3.3 Even if UTM services are provided in airspace below 500 feet, they cannot exist in isolation, since there are existing manned airspace users active in that airspace. Moreover, given that highest demand for UTM services will likely be in urban areas where most major airports are located, it is inevitable that there will be a demand for drone operations within controlled airspace. The interface between UTM and ATM is, therefore, of prime importance. With drones operating alongside manned aviation, this emphasises the need for aligning the principles of service provision in the same airspace.

3.4 Conflict management for UAS resembles its ATM equivalent, but there are important differences. The need for strategic deconfliction and for collision avoidance (CA) are greater but, in principle, the same as for manned aviation. However, as the need for separation provision is less clear, the detect and avoid (DAA) performance will be of prime importance, especially if the UTM concept allows self-separation and CA to all hazards.

3.5 The introduction of such a disruptive concept as UTM will challenge the long-held fundamental principles of ATM. To mitigate any risks of implementing such fundamental changes, it is essential to review the current flight rules, altitude reference, airspace classification and automation principles, as well as the global economic impacts, including charging for such services.

3.6 It is very likely that small UAS will never be able to equip to full IFR specifications due to cost and size, weight and power constraints, and they will need to operate within a clearly-defined framework of rules, which may resemble a combination of IFR and VFR, although not the same as either one.

3.7 UAS operations will be enabled by a significant increase in automation, especially if the concept allows for the move from a one pilot/one UAS, to fleets of highly-automated drones managed by one or several operators. To support this, the nature and role of automation and autonomy in aviation needs to be standardised with a generic automation model (see also AN-Conf/13-WP/35 on the Global Air Navigation Plan (GANP) and AN-Conf/13-WP/38 on trajectory-based operations (TBO), to ease the transition and to keep the human in the loop.

## 4. IFR INTEGRATION

4.1 One of the key elements needed to enable RPAS integration is DAA. The broad spectrum of DAA functionality across all UAS domains makes this a very complex problem to solve but, for RPAS medium-altitude, long-endurance (MALE) missions, the problem is more manageable. The key function needed is the CA function, as a safety net supports the pilot's responsibility for the safety of the flight, in all airspace classes, and requires a capability against cooperative and non\_cooperative targets.

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<sup>4</sup> Helsinki Declaration, November 2017.

4.2 Visual flight rules (VFR) pilots are responsible for remaining well clear of other aircraft, maintaining their own separation from IFR traffic. In some parts of the world, under some circumstances, the IFR pilot can perform a remain well clear (RWC) manoeuvre against VFR traffic perceived as being a threat before speaking to air traffic control (ATC); this is not applicable in Europe. The definition of the RWC function for RPAS requires international harmonisation to ensure that concepts and systems meet the needs of different regions. ICAO should prioritise the harmonisation and standardisation of DAA capabilities, specifically the CA and RWC functions and to seek to gain benefit from States and regional modernisation programmes, where the development of civil-military dual-use technology is actively pursued.

## 5. OPERATIONS ABOVE FL600

5.1 There is an increasing demand to enable routine operations by high altitude long endurance (HALE) UAS. These UAS typically have very poor climb and manoeuvring performance, and remain on station at very high levels, above FL600 (but below the Karman line), for days, weeks or even months. This type of operation presents new challenges for integration similar to other suborbital operations during the climb and descent and for the management of very long missions in airspace where there is currently very little or no standard application of ATM.

5.2 Many States and regions have considerable experience in trialling and operating these UAS with suborbital operations, often for State or military purposes, and ICAO should take advantage of the experience and lessons learned from these initiatives and thereby provide opportunities to support the evolution in the process of development of ICAO provisions and Standards.(AN-Conf/13-WP/5 and AN-Conf/13-WP/16 refers).

## 6. CONCLUSION

6.1 The Conference is invited to agree on the following recommendations:

That the Conference:

- a) encourage ICAO to make use of the new entrants' wider pool of unmanned aircraft systems (UAS) stakeholders beyond those stakeholders who participate at a State level in ICAO forum, and to closely collaborate with State and regional air traffic management (ATM) modernisation programmes to facilitate trials and validations involving these new entrants;
- b) call upon ICAO to define and promote core principles for unmanned aircraft systems traffic management (UTM) and for interoperability between UTM and ATM. This shall include review of the applicability of current flight rules, altitude reference, airspace classification and automation principles, as well as the global economic impacts, including charging for such services;
- c) call upon ICAO to prioritise the harmonization and standardization of detect and avoid (DAA) capabilities required by instrument flight rules (IFR) remotely piloted aircraft systems (RPAS), specifically the collision avoidance and remain well clear functions; and
- d) call upon ICAO to lead the development of ATM measures to enable unsegregated operation of high-altitude UAS with other high-level and suborbital operations at levels above FL600 but below the Karman line.