FACTSHEET – AIRSPACE CONSIDERATIONS FOR UAS OPERATIONS: ENTRY REQUIREMENTS

AIM

The aim of this Factsheet is to define the conditions under which Defence Unmanned Aircraft Systems (UAS) could defensibly operate outside of Restricted Areas in Domestic (Australian) and International military and civil airspace.

INTRODUCTION

All classes of airspace, whether military or civil, have entry criteria that must be met before operations within that airspace may be conducted. Operators who meet the entry criteria are entitled to the protections afforded by the class of airspace they are operating in.

Where entry criteria cannot be met, operators wishing to utilise a class of airspace must seek formal approvals from Airspace Controlling / Administration Authorities or Airspace Regulator, as appropriate, prior to the commencement of operations. However, the fundamental principle is that such arrangements continue to afford an equivalent level of protection to other aircraft that comply with the airspace entry requirements.

While there are three categories of UAS under the Defence Aviation Safety Regulation (DASR), this Factsheet is primarily useful to operators of Specific Type A Category UAS looking to operate outside of Defence-controlled or - administered airspace under a UAS Operating Permit (UASOP). This Factsheet may also benefit operators of Certified Category UAS where the aircraft exhibits minor airspace equipage deficiencies. The requirements and limitations of Specific Type B Category UAS Standard Scenarios, and the Standard Operating Conditions of Open Category UAS already provide for the safety of civil aircraft, mostly through segregation.

OPERATING IN CIVIL AIRSPACE

The Civil Aviation Safety Authority defines two major types of airspace in Australia: controlled, and uncontrolled. Within controlled airspace, Air Traffic Control (ATC) provides positive separation between aircraft by applying ATC separation standards. ATC separation standards rely on a combination of aircraft equipage, pilot competence, and adherence to the Rules of the Air. Within uncontrolled airspace, pilots are responsible for preventing collisions between aircraft by adhering to the Rules of the Air, particularly on overtaking, right of way, and the see and avoid requirement. Consequently, for a Defence manned or unmanned aircraft to operate in controlled or uncontrolled airspace, it requires:

- Aircraft equipage: It must either:
 - o meet all aircraft equipage requirements for that class of airspace, or
 - for flight in controlled airspace, obtain agreement with the Airspace Controlling / Administration Authority that the equipage deficiencies can be safely accommodated in that airspace, or
 - for flight in uncontrolled airspace, obtain agreement with the Airspace Regulator that the equipage deficiencies can be safely accommodated in that airspace.
- **Pilot competence:** It must be operated by a pilot, whether on-board or remote, with the requisite qualifications, training and experience for that class of airspace.
- Adherence to the Rules of the Air: The operation must adhere to the Rules of the Air.

The remainder of this Factsheet examines the requirements for meeting aircraft equipage, obtaining Airspace Controlling / Administration Authority and Airspace Regulator agreements, obtaining requisite pilot competence, and adhering to the Rules of the Air.

MEETING AIRSPACE AIRCRAFT EQUIPAGE REQUIREMENTS

Depending on the class of airspace, equipage required may include altimetry, positional information, radio communications, transponder, Automatic Dependent Surveillance – Broadcast (ADS-B), lighting, Traffic Alert and Collision Avoidance System (TCAS), and so on.

For a Defence UAS to avoid any elevation of risk to other aircraft operating in that airspace, this equipage should meet the same requirements as levied on the other users of the airspace, namely:



- equipment must be designed and integrated per relevant design standards (and certified accordingly)
- maintenance must be performed per approved Instructions for Continuing Airworthiness and maintenance data.

Most current generation UAS fail to meet these requirements. For example, GPS-sourced positional information is normally provided on UAS, and the specified 'accuracy' figures are often impressive, but the 'integrity' of this information normally falls well short of manned aircraft requirements. Even systems as simple as altimetry can often fail to meet accepted aviation design standards and integration requirements. In both cases, the information they provide can be hazardously misleading.

Summarised, for Defence to declare that its UAS is suitably equipped to operate in a particular class of airspace, then that equipage must meet the same design and maintenance requirements as applied to all other operators in that airspace.

OBTAINING AIRSPACE CONTROLLING / ADMINISTRATION AUTHORITY AND AIRSPACE REGULATOR AGREEMENTS

Most current generation UAS fail to meet the above mentioned design requirements for equipage. However, alternate risk controls may be available that eliminate the elevated risk, thereby continuing to afford an equivalent level of protection to other airspace users.

In such circumstances, the risk controls and the circumstances in which they may be employed must be agreed to by the relevant Airspace Controlling / Administration Authority for controlled airspace, or the Airspace Regulator for uncontrolled airspace. Such formal agreements may be one-off, or may be enduring. Note that the Airspace Controlling / Administration Authority and Airspace Regulator consider the impact to all aircraft in such scenarios and may decline a proposal submitted by Defence.

In achieving the above agreements, there is a clear obligation on Defence to disclose all relevant deficiencies in the UAS design. For example, it would be misleading for Defence to claim an accurate height keeping ability for a UAS when the design of the altimetry system has not been verified as meeting aircraft design standards and maintenance requirements equivalent to those applied to other users of that airspace.

OBTAINING REQUISITE PILOT COMPETENCE

UAS operator training may not meet the requirements for operation outside of Defence airspace. While completion of a Defence-specific UAS operator course may be suitable for Defence operations in Defence-administered or Defence-controlled airspace where the UAS is segregated from non-participating aircraft, it may be insufficient for operations outside of such airspace. Consideration of the safety of other airspace users must remain at the forefront of planning considerations.

Defence UAS operations outside of Restricted Areas necessitate the Remote Pilot (RP) having the requisite qualifications, training and experience for the class of airspace in which they are flying. This is perhaps best understood by exploring one of the 'golden rules of aviation' – the aviate-navigate-communicate principle.

To 'aviate' requires the pilot to have the necessary training and skills to operate their aircraft, both in normal and emergency situations, while complying with ATC instructions as required. To 'aviate' also requires a pilot to have professional aeronautical knowledge on topics such as the fundamentals of aircraft design, aircraft aerodynamics, and weather to name a few. From an airspace safety perspective, these issues are equally relevant to UAS.

To 'navigate' refers to a pilot's ability to determine an aircraft's location and plan a course of action while complying with ATC instructions as required. This includes the ability to mission plan but also means pilots must be able to read and use items such as standard navigation charts and Notice to Airmen (NOTAM). ATC traffic management plans may necessitate the use of instrument approaches, standard instrument departures (SIDs), and standard instrument arrivals (STARs), which a pilot must be prepared to use if directed. Furthermore, emergencies may necessitate the UAS RP to respond to, and implement, ATC instructions immediately to maintain aircraft safety.

To 'communicate' means to have the ability to pass and receive information between ATC and other airspace users. Pilots are required to have met a level of general and aviation English language proficiency, have the ability to communicate using defined terms and phrases all while adhering to aeronautical radio procedures. 'Communicate' can also include multi-crew cooperation scenarios that consider how human factors can affect communication between people.

ADHERING TO THE RULES OF THE AIR

There are two major types of airspace in Australia: controlled, and uncontrolled. Controlled airspace is further defined by categories with specific aircraft performance, equipage, and pilot qualification requirements, and is actively monitored and managed by ATC. Uncontrolled airspace, also referred to as Class G airspace, has very limited monitoring by ATC with no positive separation or deconfliction services provided.

In controlled airspace, collisions between aircraft are mostly prevented by ATC providing aircraft separation. Controlled airspace may be considered better-suited to the safe conduct of UAS operations since ATC actively communicates with, directs, and provides a service to separate aircraft. However, this still requires a pilot to adhere to the Rules of the Air and presumes the UAS is equipped with the suite of communication, navigation, surveillance, and other equipment required for that airspace. As discussed previously in this Factsheet, the equipment must be designed, integrated, calibrated and maintained to the same standards as other airspace users - otherwise the pilot and ATC may be presented with misleading information, which could affect their ability to maintain aircraft separation standards.

In uncontrolled airspace, collisions between aircraft are prevented by adherence to the Rules of the Air (including, for example, set altitudes which require certified altimetry), radio communication procedures, and the pilot 'seeingand-avoiding' other traffic. Other measures such as collision avoidance systems can also contribute to aircraft separation.

For uncontrolled airspace, an additional complicating issue is that a certified replacement system for pilot 'see-andavoid' (often called 'detect-and-avoid' for UAS) is not yet available internationally. Consequently, most current generation UAS are inherently incompatible with flight beyond line of sight in uncontrolled airspace above 400ft AGL. Should flight in uncontrolled airspace be required for non-discretionary military operations, then the two options available are to:

- · request the creation of a Restricted Area / Temporary Restricted Area, or
- gain formal approval for the proposed risk controls to be implemented and the circumstances in which they must be employed from the relevant Airspace Regulator for the uncontrolled airspace.

OBLIGATIONS OF THE STATE FOR THE SAFETY OF CIVIL AVIATION

Australia is a State Party to the Convention on International Civil Aviation (commonly known as the Chicago Convention). By Article 3.d. of the Convention, "the contracting States undertake, when issuing regulations for their state aircraft, that they will have due regard for the safety of navigation of civil aircraft."

A common misconception may be that Defence operators can make a declaration of 'due regard' as an easy alternative in situations where platforms do not meet mandated aircraft equipage, requisite pilot competence, and Rules of the Air based entry requirements for a particular airspace. This is almost certainly incorrect. Article 3 of the Convention places specific requirements on States for the safety of civil air navigation. DASA has commenced a formal legal study¹ into this complex issue. In the meantime, operators considering operation of UAS within airspace where the entry criteria cannot be met **must** consult with DASA.

A second misconception, often conflated with 'due regard', is that Command can authorise operations of a deficient UAS in civilian airspace, without agreement from the Airspace Controlling / Administration Authority or Airspace Regulator, provided risks are minimised SFARP. This inherently relies on Command retaining risk to civilians sharing that airspace, which may be problematic for Defence. DASA has commenced a formal legal study² into this complex issue. In the meantime, the DASA is unable to issue UAS flight instruments that support such an approach.

USEFUL INFORMATION

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¹ Initiated in May 2020

² Initiated in May 2020