Management of Remotely Piloted Aircraft Systems (RPAS) in ATM Operations

Operational Concept

Version 3

13 September 2019

Welcome to Airservices Operational Concept for RPAS.

Unmanned aerial systems are a key feature of the future of aviation. At Airservices we are committed to the safe integration of RPAS in the National Airspace System.

This presents challenges and opportunities as we adapt systems and processes to align with rapidly evolving technology, and an associated regulatory structure.

As an important step in taking an inclusive approach to the facilitation and integration of RPAS this inaugural operational concept details the approach being taken at Airservices to the management of unmanned operations. The concepts within this document form the basis of current and future developments, and make clear the manner by which Airservices intends to foster RPAS sector growth.

We look forward to working closely with industry partners as we continue to refine our approach to the ongoing management of RPAS operations.

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Introduction

As Australia's Air Navigation Service Provider (ANSP), Airservices has an obligation under the Airservices Act 1995 (Airservices Act) to promote and foster civil aviation, which includes RPAS.

Traditionally referred to as Unmanned Aerial vehicles (UAV's) or drones, the term Remotely Piloted Aircraft Systems (RPAS) was introduced by the International Civil Aviation organisation (ICAO) in 2011 (Circular 328-AN/190) to more accurately reflect the human and technical elements required for the overall operational control of an aircraft with no pilot on board.

RPAS is the fastest growing area of civil aviation. By the beginning of 2016, there were approximately 400 commercial RPAS operators registered with the Australian Civil Aviation Safety Authority (CASA) through receipt of an Unmanned Operator Certificate (UOC). In 2016 the Remote Operating Certificate (ReOC) replaced the UOC. As of June 2019 there were 1592 (ReOC) holders.

Australia was the first state to publish regulations under which all classes of RPAS can be operated in Australian airspace[1]. These regulations require RPAS operations under certain circumstances to be approved by the Air Traffic Services (ATS) provider. RPAS operations are however exempt from many traditional areas of aviation legislation.

The responsibility for aviation safety is shared between the Regulator, the ANSP and the RPAS Operator.

The task of facilitating and ultimately integrating RPAS operations into a pre-existent conventionally piloted aviation system is recognised as a significant global challenge. Not all key technologies required for RPAS to fly in civil airspace are mature or standardised. By necessity the integration of RPAS will be gradual, proportionate and evolutionary.

Airservices key strategic objectives are formulated taking into consideration a number of obligations. One such objective is for Airservices to foster civil aviation. Airservices recognises the need to take an inclusive approach to RPAS and to take a leading role in the development of an operational framework to accommodate RPAS operations in controlled airspace. In focusing on Airservices RPAS responsibilities the key priorities will provide the framework for improvement initiatives.

Those priorities are:

- Refining ATC Processes and Systems
- Contributing to Regulatory and Policy change
- Streamlining the application and approval process
- Enhancing RPAS and Aviation Community knowledge.

[1] Civil Aviation Safety Regulations Part 101

Purpose

The operational concept document will:

- Specify Airservices responsibilities and the principles that underpin both current processes and future developments for safe and compliant RPAS integration;
- Provide an overview of current processes in place to manage RPAS operations where required by Civil Aviation Safety Regulations (CASR) Part 101; and
- Provide an overview of the continuous evolution required in Air Traffic Services (ATS) to keep pace with RPAS growth, emerging technologies and regulatory developments.

Principles and Responsibilities

Principles

The management of RPAS in ATM Operations by Airservices will be guided by three principles;

1. In exercising its powers and performing its functions, Airservices must regard the safety of air navigation as the most important consideration.2 Airservices Safety Management System will be used to facilitate and where possible integrate RPAS operations to ensure that any identified risks will be managed to a level that is considered as low as reasonably practicable (ALARP)3.
2. Where achievable, RPAS should be equipped for or demonstrate an acceptable means of compliance with the communication, navigation and surveillance requirements of the airspace within which they operate.
3. A risk based approach to RPAS integration will be taken. This will include:
    a. The application of risk management tools and techniques[4] and consideration of Human Factors[5]; and
    b. The development of RPAS specific segregation methodologies where existing standards and procedures are not applicable or the RPAS is not capable of providing real time navigational information using approved navigation systems.

[2] Airservices Act 1995
[3] Safety Management System Objectives and Requirements (AA-NOS-SAF-0002)
[4] Safety Risk Management Tools and Techniques (AA-GUIDE-SAF-0105C)
[5] See reference at footnote 3

Responsibilities

Airservices responsibilities for the management of RPAS in ATM Operations are derived from a number of sources. Airservices responsibilities under aviation legislation administered by CASA, such as the Civil Aviation Act, CASR Parts 101 and 172 and the associated Manual of Standards (MOS) for each part need to be considered alongside other responsibilities, such as the Airservices Act.

Airservices is responsible under certain conditions for assessing RPAS applications received from CASA. Airservices provide a response to CASA on whether access is approved and under what conditions. This is then relayed to the RPAS operator by CASA. Airservices meets its regulatory requirements as detailed in CASR Part 101 through this process.

One of the challenges that Airservices face is that RPAS is a broad term. It can be applied to many types of remotely piloted aircraft or systems, with varying equipment levels and capabilities.

RPAS with advanced equipment levels

In general terms, where the equipment levels and capability of the RPAS are highly reflective of conventionally piloted aircraft, ATC is responsible for providing separation services to the RPAS. An RPAS is considered to have equipment levels and capability that are highly reflective of conventionally piloted aircraft if it is capable of presenting real time information from an approved navigation system and maintaining continuous two way communications with ATC[6].

RPAS with basic equipment levels

Where the equipment levels and capability of RPAS are not reflective of conventionally piloted aircraft, ATC responsibilities are dependent on the location and height of the RPAS operation. RPAS operations in controlled airspace do not automatically trigger responsibilities for ATC. If the RPAS operation is below 400 feet AGL and away from the movement area, runway or approach/departure path of a controlled aerodrome, ATC do not have any responsibilities.

The movement area, runway or approach/departure path of a controlled aerodrome is generally considered to be within 3NM and below 400 feet AGL although there are some variations depending on the extent to which an aerodrome has been analysed.

If an RPAS operation is above 400 feet AGL in controlled airspace or over the movement area, runway or approach/departure path of a controlled aerodrome, ATC is responsible for the provision of services to prevent collisions.

ATC traditionally exercise safety responsibilities and prevent collisions through the use of separation standards. As there are currently no published separation standards applicable between RPAS and manned aircraft, the respective operations are segregated so that their operations do not overlap.

[6] CASR Part 172 Manual of Standards

The development of the principles of segregation, safety buffers and the interaction with RPAS operators is detailed in subsequent parts of this document.

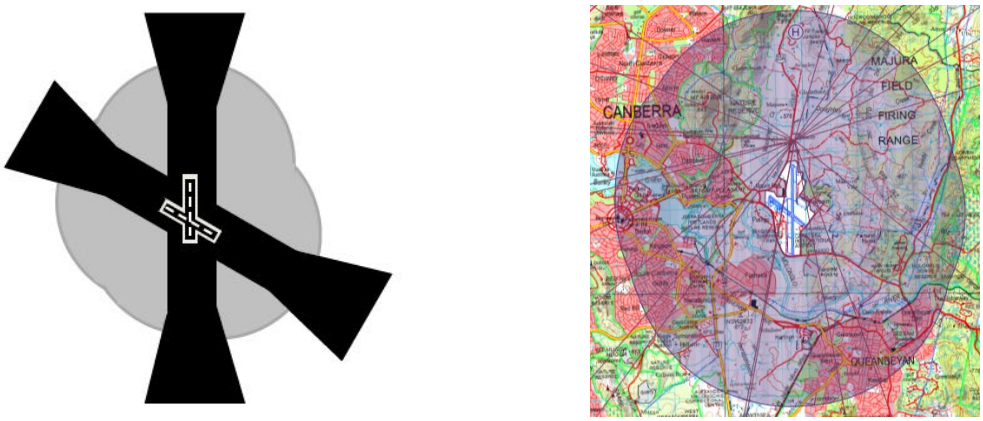
RPAS are exempt from many requirements for manned aircraft including IFR and VFR flight rules and associated airworthiness provisions. However, RPAS operators are accountable for the safe operation of the RPAS. This is often achieved by placing conditions on RPAS operators through the certification and licensing processes or through the application process for specific operations which affect ATC. The regulatory exemptions and specific conditions issued to individual operators add to the complexity of managing RPAS in ATM Operations.

RPAS No-Fly Zones

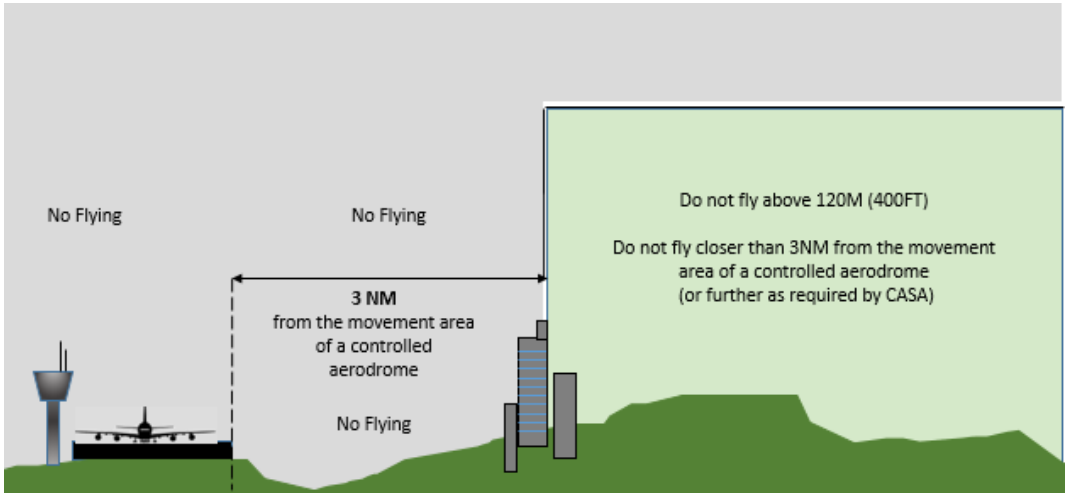
The Manual of Standards (MOS) Part 101 depicts no fly zones and approach and departure paths around controlled (and uncontrolled) aerodromes. These zones typically relate to RPAS operations within 3NM of a controlled aerodrome below 400FT AGL that potentially affect operations over the movement area, runway or approach/departure path of a controlled aerodrome as these are the significant parameters and assessment triggers contained in current Civil Aviation Safety Regulations.

The MOS 101 Chapter 4 (4.02) states ***no-fly zone of a controlled aerodrome*** means any areas and airspace that are below 400 ft and:

a) within 3 NM of the movement area of a controlled aerodrome; or
b) within the approach and departure paths referred to in section 4.05, whether or not they extend beyond 3 NM of the movement area of the controlled aerodrome.
c)

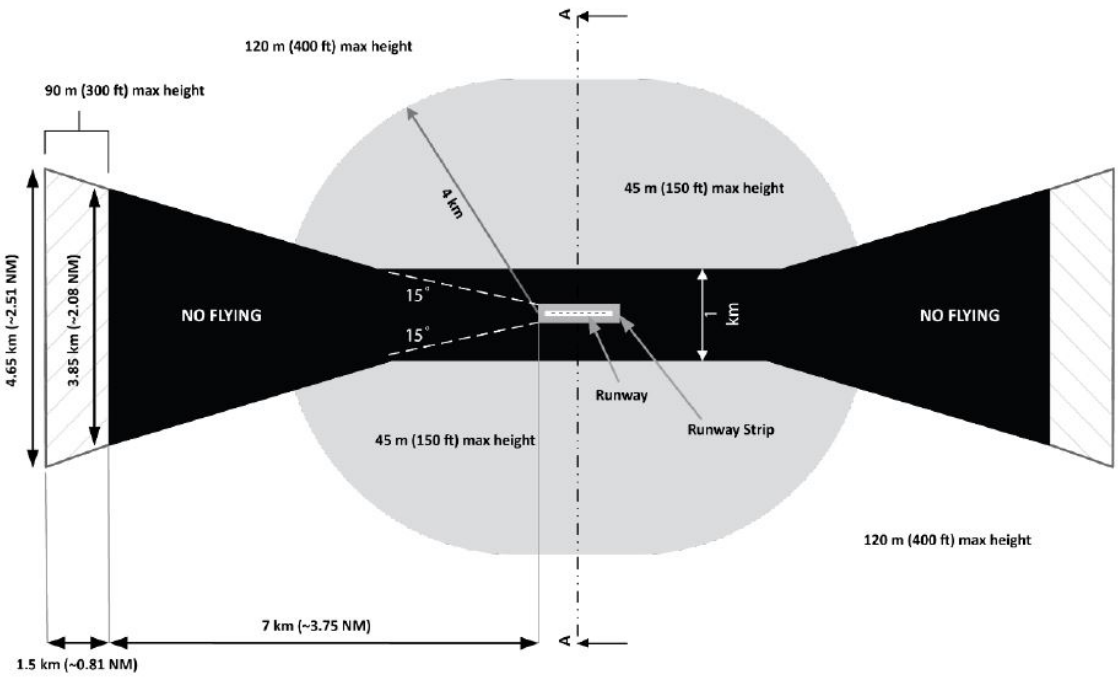


Left: Concept (MOS101) vs Right: actual depiction 3NM from Canberra (www.airservicesaustralia.com



Side view of the no-fly zone around controlled aerodromes

Additional information on no-fly zones are contained within the MOS101. The areas depicted below are elements of the approach and departure paths as described in 4.05 of the MOS.



The RPAS No-Fly Zones provide information to RPAS operators when planning to operate in areas where an approval is required.

A key enabler for planning in respect to the no-fly zones is a suite of three dimensional maps that specify the location of the zones for each aerodrome where an ATS service is provided by Airservices.

Concept of Facilitation

The Airservices facilitation models do not require changes to existing regulatory requirements or airspace classifications. The Airservices operational concept is formed within the current Regulatory and International framework and takes into account the characteristics of remotely piloted systems. The operational concept is underpinned by three models of facilitation; Segregated, Coordinated and Integrated operations. Each of these models describes the level of interaction required between the RPAS operator and ATC, and is dependent on the location of the operation and the equipment levels and capability of the RPAS.

The model of facilitation also provides a proxy indication of likelihood of Airservices approval. These models will evolve as knowledge and understanding grows, regulations evolve and experience drives efficiencies in processes. RPAS will move between the models as capability and technology develops.

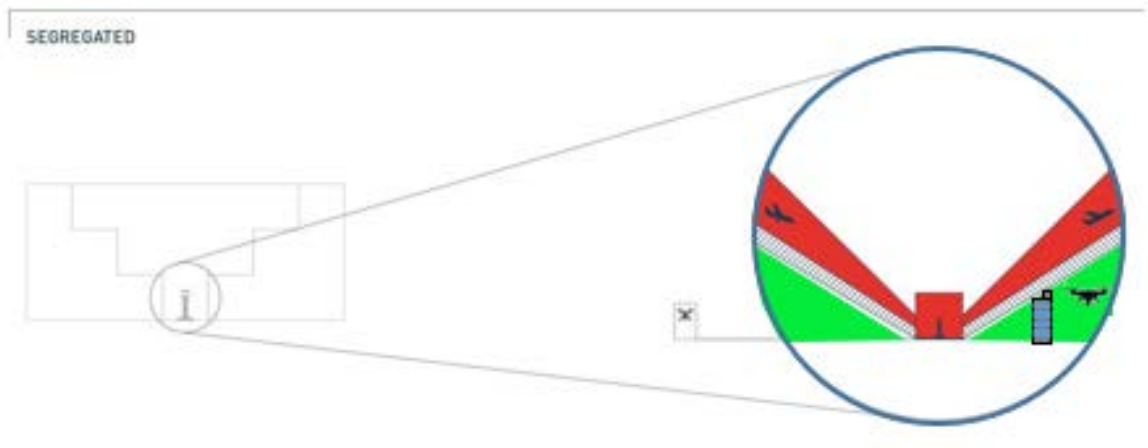
Segregated Operations

Segregated Operations refer to RPAS operations at a location which would normally impact on ATC but the characteristics of the requested location mean that direct interaction with ATC is not required and ATC can work independently around the RPAS operation.

Prohibited/Restricted/Danger (PRD) Areas are the most easily identifiable locations for segregated operations and existing military PRD Areas will be increasingly used for RPAS operations. For civil operations, CASA is responsible for assessing the level of risk and determining if a Temporary PRD Area is required. For RPAS operations within PRD Areas, existing procedures are used by ATC to segregate other airspace users from the PRD Area.

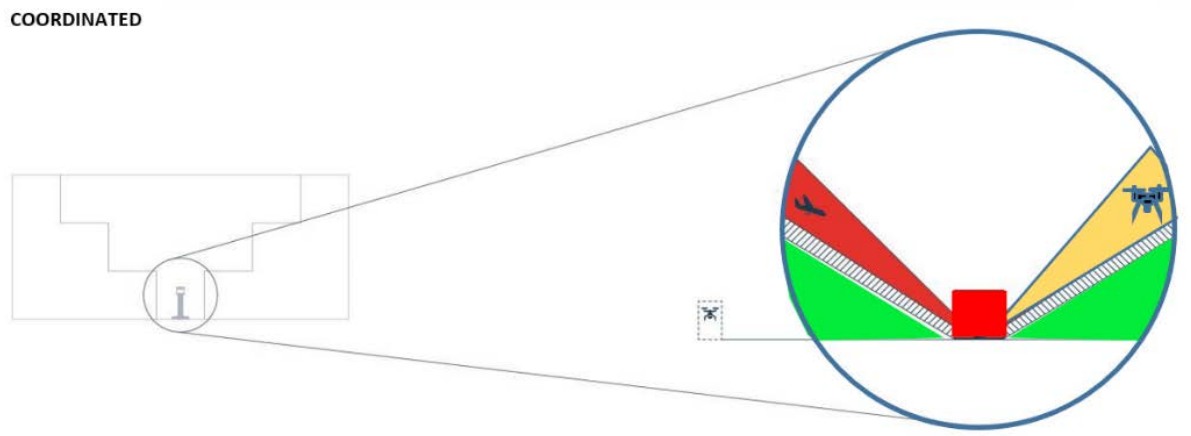
RPAS operations that are in close proximity to and beneath the height of a nearby terrain feature or man-made obstacle may be can be considered as a segregated operation if they are 'shielded' from other airspace users by virtue of the terrain or obstacle.

Additionally RPAS operations that are constrained below the approach and departure path may be considered as a segregated operation.



Coordinated Operations

Coordinated Operations refer to RPAS operations where interaction with ATC is required as determined through assessment of the characteristics of the location and equipment levels and capability of the RPAS.



Coordinated Operations form the majority of requests received by Airservices and require the greatest consideration and development of procedures. [7]

Coordinated Operations require the application of RPAS Buffers or the management of airspace such that the RPAS and the manned aircraft are not in conflict. An example of a coordinated operation is one where the RPAS may only be airborne when a particular runway (or runway mode) is being used ensuring that the RPAS remains segregated from operations to and from the aerodrome.

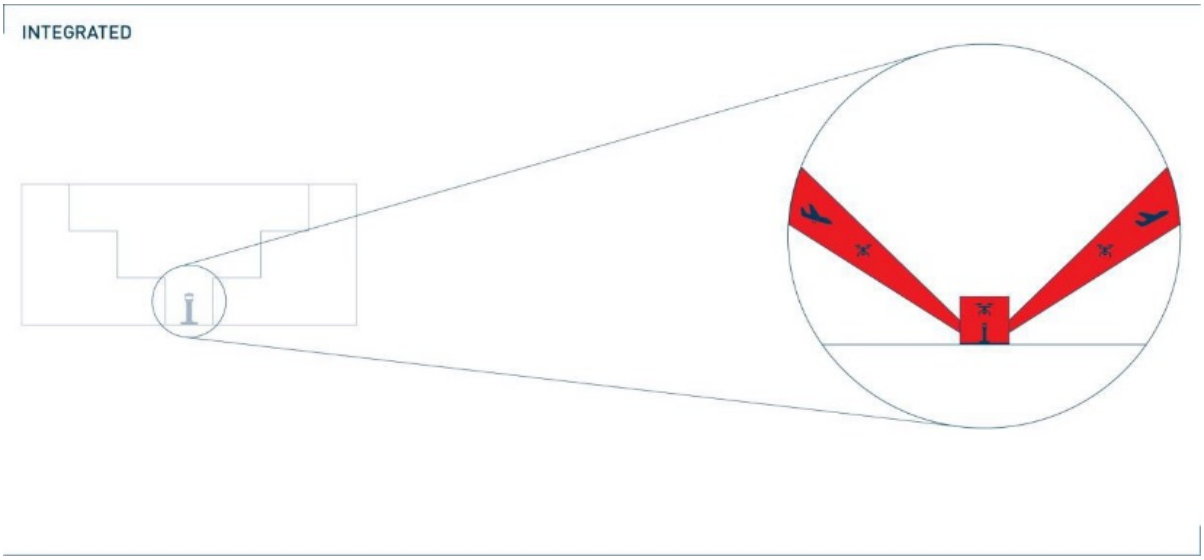
If coordinated operations are not able to be managed due to conflict with manned traffic, the RPAS may be offered segregated operations in order to fulfil operational requirements.

At present, the majority of applications for these operations are within 3NM of a controlled aerodrome but the number of requests for operations above 400 feet AGL is increasing and is expected to expand into more frequent Beyond Visual Line of Sight (BVLOS) operations over time.

[7] Note: no segregation is provided between multiple RPAS operations unless compliant with CASR Part 172 Manual of Standards 10.11.5

Integrated Operations

Integrated Operations refer to RPAS operations where the equipment levels and capability of the RPAS are highly reflective of conventionally piloted aircraft. They can be largely managed through pre-existent systems and processes.



Integrated Operations typically meet the requirements of CASR Part 172, and are capable of presenting real time navigational information using approved navigation systems and maintain continuous two way communications with ATC. Separation standards as per the Manual of Air Traffic Services are applied and the RPAS is effectively managed as an IFR aircraft.

Where elements of RPAS performance characteristics are subtly different to conventional aircraft, standards may have to be reviewed and amended as necessary. For example; in planning for the Global Hawk operation in Australian administered airspace in 2015, it was identified that the aircraft has a limited angle of bank when changing track. This resulted in increased separation standards being applied to its operation.
Integrated Operations are not typically associated with the low level airspace surrounding controlled aerodromes.

RPAS Controlled Airspace Access Request Processes

Specific RPAS operations within controlled airspace above 400 feet AGL or within 3NM of a controlled aerodrome (and potentially further as required by CASA) are required to submit an application to CASA in the first instance. Airservices is currently responsible for assessing these applications in order to facilitate access into the controlled airspace.

The function of assessing applications is managed by individual ATS units. The application is examined and categorised according to:

- RPAS equipment levels and capability;
- the location and height of the requested operation;
- the availability of terrain, obstacles or RPAS Safety Buffers which may be relevant to the operation;.
- the compatibility of the RPAS operation with other planned operations
- the risk to manned aircraft associated with the RPAS operation; and
- any other relevant information.

The assessment process will determine under what conditions the RPAS operation can be approved. The result of the assessment is provided directly to CASA by the affected ATS unit.

As technology develops it is anticipated that this process will be managed electronically in near real time.

Airservices RPAS Buffers

This refers to the development of a number of standard buffers for the segregation of aircraft. The buffers are similar in nature to separation standards applied between manned aircraft and promulgated in the National ATS Procedures Manual (NAPM)

The development of standard buffers is being progressed to provide ATC with a series of tactical options to *segregate* RPAS operations from other airspace users. This work is ongoing and additional buffers will be published once assessed through the Airservices safety management system. As experience with RPAS operations in controlled airspace expands it is expected that the buffers determined in the initial stages will be reviewed and refined.

Where required by the regulation, each RPAS operation is assessed in a similar manner to a manned aircraft request for the same operating area . As with manned aircraft the ‘buffers’ applied by ATC fall into a number of categories.

Buffers in respect to RPAS are:

- **Visual:** Where the ATC can visually monitor the progress of all aircraft to verify that the aircraft are not in conflict.
- **Lateral**: Where lateral limits are placed on the operation of the RPAS and other airspace users are managed around these lateral limits.
- **Vertical**: Where the RPAS is either restricted to a height of a known object; or the on-board altimetry is used (with corrections where required) to ensure that there is adequate vertical displacement between the RPAS and other airspace users.

RPAS Operations under 'Standard Operating Conditions' (SOC)

'Standard Operating Conditions' is a set of conditions under which very small RPAS weighing less than 2kg may be operated with minimal risk to manned aircraft and do not require direct ATC consideration or CASA authorisation. RPAS operated under the Standard Operating Conditions are not permitted within 3NM of a controlled aerodrome (or larger distances as required by CASA, e.g. on extended runway centrelines) or above 400FT in controlled airspace.

Urban Air Mobility

Urban air mobility has the potential to fundamentally transform the way people and goods move around our cities and reduce congestion on our roads. It has the potential to change our cities and the way we live, for the better.

Airservices has a clear role to ensure Australia's skies are managed safely, efficiently and reliably for all airspace users, which includes low-level airspace users such as aerial taxis and drones.

Airservices has been working closely with a range of potential future airspace users, as well as key government agencies to understand their views on future airspace use and management.

Regulatory Development

National policy and regulatory position for surveillance, navigation or communication equipage for RPAS is in its infancy. At present, there is no standardised approach or framework which supports:

- the equipment level and capability required for RPAS integration;
- the minimum specifications for RPAS equipment in any airspace category; or
- Certification standards.

This issue is compounded by the emerging development of low cost, often uncertified technology solutions. As one example there are several low power units in design based upon ADS-B technology. In many cases the traditional pathway for equipment certification is financially prohibitive to a point of creating an unviable environment for RPAS operators. This challenge is recognised globally and there are initiatives under way in various forums to address the issue.

Concept of Cost Recovery

Airservices is authorised under the Airservices Act to recover costs through the provision of charges for services and facilities. The conventional model for recovery is by way of air navigation charges described in the Contract for the Provision of Aviation Facilities and Services[8]. The nature of RPAS and their operations do not suit this method nor would the extant process accurately represent the costs incurred by Airservices in accommodating RPAS operations.

The current authorisation processes involves the RPAS operator submitting the application to CASA, who in turn refer the application to Airservices with the final determination relayed back to the operator through CASA. Airservices interface with the RPAS operator is through CASA and it is proposed that Airservices cost recovery will leverage from the existing process by having CASA recover Airservices costs from an RPAS operator with a periodic reconciliation to occur between CASA and Airservices finance teams.

Future changes to the access process may result in a direct fee to operators or may result in an aviation charge through current pricing mechanisms for RPAS operations where the equipment levels and capability of the RPAS are highly reflective of conventionally piloted aircraft.

RPAS Safety Performance Management

A number of initiatives have been implemented to enhance Airservices Safety Performance Management capability for RPAS. This has included upgrades to the CIRRIS system reporting module, changes to internal safety event review processes and the development of RPAS specific content for Executive and Board Safety Reporting purposes.

It is envisaged that there will be further enhancements to RPAS safety reporting and performance management systems in line with the operational enhancements discussed within this document. Discussions with the Australian Transport Safety Bureau (ATSB) and CASA have commenced to progress this initiative.

RPAS Surveillance

Increasingly, aerodrome operators are taking steps to monitor RPAS traffic in the vicinity of their aerodromes. There is a capability for this data to be shared between the aerodrome operator, the ANSP (Currently Airservices and the Department of Defence) and the Regulator (CASA).

[8] http://www.airservicesaustralia.com/services/charges-and-costing/customer-pricing-information/

Future Low Level Airspace Management

Future low level airspace is likely to look very different to what it does today. While there remains the possibility that low level airspace may be dedicated to unmanned or remotely piloted traffic, the greater likelihood is that there will be an integration of airspace and airspace users as technology develops. These technologies will be required to detect and track all aircraft within the low level airspace, and integrate that traffic into the existing air traffic management system.

Eventually information on all airspace users will be shared to ensure safety of all traffic within the shared airspace. Dedicated route structures may be required in support of unmanned or autonomous aircraft.

Conclusion

This RPAS concept document is designed to articulate, where Airservices have responsibility, the facilitation and integration of RPAS operations utilising existing regulations and technology. The document also articulates the strategic direction and work in progress at Airservices to further enhance the integration of RPAS operations. As research, collaborations, regulatory and technology changes develop the concept will be revised to keep pace with those changes.

Appendix A Regulatory and International Framework (RPAS)

A.1 ICAO

The purpose of ICAO RPAS documentation is to:

4. Apprise States of the emerging ICAO perspective on the integration of RPAS into non-segregated airspace and at aerodromes;

- Consider the fundamental differences from conventionally piloted aviation that such integration will involve; and
- Encourage States to help with the development of ICAO policy on RPAS by providing information on their own experiences associated with these aircraft.[9]

ICAO has made several UAS-related amendments to the Annexes since 2010. These include:

- Amendment 13 to Annex 13: Defining accident to include reference to unmanned aircraft (March 2010)
- Amendment 6 to Annex 7: Registration and identification requirements for remotely piloted aircraft (April 2012)
- Amendment 43 to Annex 2: High level requirements relating to remotely piloted aircraft systems (April 2012).
- Amendment 175 to the International Standards and Recommended Practices, Personnel Licensing (Annex 1 to the Convention on International Civil Aviation) was adopted by the Council on 7 March 2018. The amendment relates to the introduction of a regulatory structure for the issuance of remote pilot licences and the provision of a global framework for the regulation of RPAS licensing to support international flights operating under international instrument flight rules (IFR).

In 2015 ICAO also published Doc 10019 – Manual on Remotely Piloted Aircraft Systems (RPAS)

A.2 CASA

Regulation of RPAS within Australian administered airspace is contained in Part 101 of the *Civil Aviation Safety Regulations* 1988 (CASR). CASR Part 101 was enacted in July 2002 and considers all modes of unmanned aerial operation such as aircraft, rockets and balloons.

Part 101 includes the following Subparts:

- Subpart 101.B that imposes a general prohibition on the hazardous operation of unmanned aircraft
- Subpart 101.C that imposes a range of obligations in relation to the operation of unmanned aircraft generally

[9] Advisory Circular 328 AN/190 – Unmanned Aircraft Systems (UAS)

- Subpart 101.D that comprises specific provisions for the regulation of tethered balloons and kites
- Subpart 101.E that comprises specific provisions for the regulation of unmanned free balloons
- Subpart 101.F that comprises specific provisions for the regulation of remotely piloted aircraft (RPA)
- Subpart 101.G that comprises specific provisions for the regulation of model aircraft

RPAS[10] are addressed specifically under Sub-part F.

A significant element of Part 101 is the exemption extended to aircraft regulated under the part from other major components of Civil Aviation Regulations.

101.020 Exemption from certain other provisions of CAR 1988

Parts 4, 4A, 4B, 4C, 5, 7, 9, 10, 11, 12, 13 and 14 of CAR 1988 do not apply to an aircraft to which this Part applies, nor to a micro UAV.[11]

Of particular relevance to Airservices are the consequences which arise from the exemption of RPAS operations from the provisions of the following CAR's:

- Part 4, Airworthiness Requirements,
- Part 10, Air Traffic Services and other Services
- Part 11, Conditions of Flight
- Part 12, Rules of the Air.

A significant amendment to CASR Part 101 and corresponding AC 101-10 took effect on the 29th Sep 2016 facilitating operation of excluded RPA. Excluded RPA operating in accordance with 'Standard operating Conditions' (SOC) do not require specific authorisation from CASA.

AC 101-10 Remotely piloted aircraft systems - operation of excluded RPA https://www.casa.gov.au/files/ac10110pdf

Following a public consultation process CASA issued Instrument 96/17 on the 17th Oct 2017 clarifying the application of Part 101 and strengthening content where it was deemed deficient.

Direction – Operation of certain unmanned aircraft (CASA ruling on changes to CASR 101) https://www.legislation.gov.au/Details/F2017L01370/Download

Part 101 (Unmanned Aircraft and Rockets) Manual of Standards was issued on the 5th April 2019.

CASA will ultimately modernise CASR Part 101 into CASR Part 102.

[10] Referred to in the Regulations as *Unmanned Aerial Vehicles* (UAV)

[11] *Civil Aviation Safety Regulations 1988*, s101.020

Appendix B Referenced Documents

Title	Identification
Airservices Act 1995	Airservices Act 1995
Civil Aviation Safety Regulations 1998	CASR 1998
Civil Aviation Regulations 1998	CAR 1998
ICAO Manual on Remotely Piloted Aircraft Systems (RPAS)	Doc 10019
ICAO Cir 328 Unmanned Aircraft Systems (UAS)	Cir 328
Manual of Air Traffic Services (MATS)	MATS
Manual of Standards Part 172 - Air Traffic Services	MOS Part 172
National ATS Procedures Manual	NAPM
Part 101 (Unmanned Aircraft and Rockets) Manual of Standards 2019	MOS Part 101
Safety Management System Objectives and Requirements	AA-NOS-SAF-0002
Safety Risk Management Tools and Techniques	AA-GUIDE-SAF-0105C