Australian Government
Civil Aviation Safety Authority

DISCUSSION PAPER

UAS airworthiness framework

Issued for public consultation by
CASA's Standards Division

DP 1529US – June 2016
Project Number: US 14/18

Audience

This Discussion Paper (DP) will be of interest to:

- holders of Unmanned Operator's Certificates[1]
- unmanned aircraft system (UAS) owners and operators
- UAS designers and manufacturers
- UAS maintainers.

Response date

The Civil Aviation Safety Authority (CASA) is responsible under the *Civil Aviation Act 1988 (the Act)* for, amongst other functions, developing and promulgating appropriate, clear and concise aviation safety standards. CASA must, where appropriate, consult with government, commercial, industrial, consumer and other relevant bodies and organisations in the performance of this function and the exercise of its powers.

Civil Aviation Act 1988 Subsection 9(1)(c) and Section 16

This DP contains options that may be pursued in a future regulatory change proposal e.g. Notice of Proposed Rule Making (NPRM). These documents all form part of the consultation process.

No action will be taken until all responses and submissions have been considered. To ensure clear and relevant safety standards, CASA needs the benefit of your knowledge as an aviator, aviation consumer and/or provider of related products and services.

You can help by completing the online response form by 10 August 2016.

[1] As of 29 September 2016, a UOC will be known as a Remotely Piloted Aircraft Operator's Certificate, or ReOC.

Foreword

The unmanned aerial sector has been steadily growing in the background for over 15 years. Initially seen in the military, UAS are now increasingly used in a civil capacity to carry out various operations, often more cost effectively and with less safety risk to humans than conventionally piloted aircraft (CPA).

It is expected that over the next 15 years, the commercial use of unmanned systems will increase over one hundred fold (in the United States, by 2030, it is predicted that over 100,000 UAS will be operating commercially). This global growth trend is expected to be replicated in Australia.

The current Australian UAS regulatory framework was designed in the early 2000s and relied heavily on model aircraft policies. The framework is now out of date and in many cases is comparatively restrictive in relation to corresponding international standards. The original framework relies heavily on CASA overseeing all approvals of UAS use on a case-by-case basis, which is becoming time and cost prohibitive. The rapid rate of increase in the number and complexity of unmanned systems further necessitates a new regulatory framework.

This DP sets out CASA's proposed high-level airworthiness policies and framework that would form the basis of future UAS operations from an airworthiness perspective. It explains the considerations for selection of appropriate standards and describes a number of potential options for future regulatory change.

CASA recognises the valuable contribution that industry consultation makes to the regulatory development process, and issues this DP as the first stage of moving towards a more efficient airworthiness certification process for UAS.

I would like to thank you in advance for taking time to consider and respond to this DP.

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A/g Executive Manager
Standards Division

June 2016

Contents

1 Reference material

1.1 Acronyms and abbreviations

The acronyms and abbreviations used in this DP are listed in the table below.

Acronym / abbreviation	Description
AD	Airworthiness Directive
ARC	Aviation Rulemaking Committee
ASAO	Approved Self-Administering Aviation Organisation
ATC	Air Traffic Control
ATSO	Australian Technical Standard Order
BVLOS	Beyond Visual Line Of Sight
CAR	*Civil Aviation Regulations 1988*
CASA	Civil Aviation Safety Authority
CASR	*Civil Aviation Safety Regulations 1998*
CofA	Certificate of Airworthiness
CNPC	Control and Non-Payload Communication
CPA	Conventionally Piloted Aircraft
DAA	Detect and Avoid
DP	Discussion Paper
EASA	European Aviation Safety Agency
FAA	Federal Aviation Administration
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
ICA	Instructions for Continuing Airworthiness
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
LAME	Licensed Aircraft Maintenance Engineer
CS-LUAS	Certification Specification for Light Unmanned Aeroplane Systems
CS-LURS	Certification Specification for Light Unmanned Rotorcraft Systems
MA	Maintenance Authority
MOPS	Minimum Operational Performance Specifications
MOS	Manual of Standards
MTOW	Maximum Take-off Weight
NAA	National Aviation Authority

Acronym / abbreviation	Description
NPRM	Notice of Proposed Rule Making
ReOC	Remotely Piloted Aircraft Operator's Certificate
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft System
RPS	Remote Pilot Station
RTCA	Radio Technical Commission for Aeronautics
SRA	Safety Risk Assessment
TC	Type Certificate
UAS	Unmanned Aircraft System
UAV	Unmanned Aerial Vehicle
UOC	UAS Operator Certificate
VFR	Visual Flight Rules
VLOS	Visual Line of Sight

1.2 Definitions

Terms that have specific meaning within this DP are defined in the table below.

Term	Definition
Control and Non-Payload Communication (CNPC)	The data-link between the remote pilot station and the unmanned aircraft, allowing communication for control inputs to (the telecommand link) and system/operational information from (the telemetry link) the unmanned aircraft, as well as communications between the remote pilot and air traffic control.
Detect and Avoid (DAA)	The capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action.
Large UAS	A UAS that has a maximum take-off weight (MTOW) greater than 150 kg.
Medium UAS	A UAS that has an MTOW greater than 25 kg but not greater than 150 kg (i.e. 25 kg < MTOW ≤ 150 kg).
Remotely piloted aircraft system (RPAS)	A remotely piloted aircraft, its associated remote pilot station(s) (RPS), the required command and control links and any other components as specified in the RPAS design.
Small UAS	A UAS that has an MTOW greater than 2 kg but not greater than 25 kg (i.e. 2 kg < MTOW ≤ 25 kg).
State	A country that has signed the Convention on International Civil Aviation (the Chicago Convention)
UAS	An aircraft and its associated elements that are operated with no pilot on board. An unmanned aircraft system encapsulates all types of unmanned aircraft. This includes both aircraft piloted remotely, as well as autonomous unmanned aircraft, which may not have a remote pilot.
Very small UAS	A UAS that has an MTOW not greater than 2 kg (i.e. MTOW ≤ 2kg).

1.3 References

Regulations

Regulations are available on the Federal Register of Legislation https://www.legislation.gov.au/

Document	Title
the Act	*Civil Aviation Act 1988*
Part 4 of the *Civil Aviation Regulations 1988* (CAR)	Airworthiness Requirements
Part 4A of CAR	Maintenance
Part 21 of the *Civil Aviation Safety Regulations 1998* (CASR)	Certification and airworthiness requirements for aircraft and parts
Subpart 21.N of CASR	Approval of engines, propellers, materials, part and appliances: imported
Part 42 of CASR	Continuing airworthiness requirements for aircraft and aeronautical products
Part 66 of CASR	Continuing airworthiness – aircraft engineer licences and ratings

Document	Title
Part 101 of CASR	Unmanned aircraft and rockets
	Civil Aviation Legislation Amendment (Part 101) Regulation 2016
Part 145 of CASR	Continuing airworthiness – Part 145 approved maintenance organisations

Other documents

NPRMs are available at https://www.casa.gov.au/NPRM

European Aviation Safety Agency (EASA) documents are available at www.easa.europa.eu

Federal Aviation Administration (FAA) documents are available at www.faa.gov

International Civil Aviation Organization (ICAO) documents are available at www.icao.int

Document	Title
DAS-PN025-2010	International Aviation Safety Developments and Obligations Policy
DAS DIRECTIVE – 01/2015	Development and Application of Risk-Based and Cost-Effective Aviation Safety Regulations
NPRM 1309OS	Remotely Piloted Aircraft Systems
EASA A-NPA 2015-10	Introduction of a regulatory framework for the operation of drones
FAA NPRM FAA-2015-0150	Operation and Certification of Small Unmanned Aircraft Systems
ICAO Doc 10019	Manual on Remotely Piloted Aircraft Systems
FAA Webpage	Registration and Marking Requirements for Small Unmanned Aircraft
FAA Report	UAS Registration Task Force (RTF) Aviation Rule Making Committee (ARC) Task Force Recommendations Final Report
EASA Technical Opinion	Introduction of a regulation framework for the operation of unmanned aircraft
Micro-UAS-ARC-FINAL-Report	ARC Recommendations Final Report

2 Industry consultation

2.1 Consultation process

CASA is committed to working cooperatively with the aviation community to maintain and enhance aviation safety. This DP was developed in consultation with the Unmanned Aircraft Systems (UAS) Standards Sub-Committee's Airworthiness Working Group.

Publication of this discussion paper (DP) constitutes the first stage of public/industry consultation on issues and proposals related to the airworthiness of UAS. CASA will consider comments made in response to this DP prior to any specific change proposals in a subsequent Notice of Proposed Rule Making (NPRM).

2.2 What CASA does with your comments

At the end of the response period for public comment, CASA will consolidate and consider all submissions received in response to this DP. CASA is required to register and review each comment and submission received, but will not individually acknowledge a response unless specifically requested to do so.

CASA will produce a Summary of Responses (either individually or as part of a subsequent NPRM) to summarise each submission to this DP and provide CASA's disposition to those comments. If consent is provided, the respondent's name will be published in a List of Respondents and/or attributed to particular comments.

The outcomes from consultation on this DP may lead CASA to propose a rule change, which would typically be issued for subsequent consultation as an NPRM or Consultation Draft.

3 Discussion

3.1 Objectives

This DP is being released in relation to possible changes to the airworthiness requirements for UAS, in particular, changes to Parts 21 and 101 of the *Civil Aviation Safety Regulations 1998* (CASR). The objectives of this DP are to:

- explain CASA's proposed policies for a new UAS airworthiness framework
- seek feedback from the aviation community in relation to these proposals.

3.2 Background

CASA is updating the regulations to provide a comprehensive regulatory framework for UAS airworthiness to support safe and reliable operations into the future.

UAS are currently covered by Part 101 of CASR, which was promulgated in 2002 in anticipation of civil operations of UAS. At the time, there was little civil operational experience to draw on from other States and consequently the regulations relied heavily on the rules governing model aircraft and conventionally piloted aircraft (CPA).

In relation to airworthiness for smaller UAS, the current regulations generally provide insufficient detail, and for large UAS they apply the general airworthiness regulations, which are often unsuitable for UAS.

The international aviation community and National Aviation Authorities (NAAs) have made significant progress since 2002. The major aviation nations have been collaborating to develop an internationally harmonised regulatory framework for airworthiness of UAS.

This document sets out the high-level details of the airworthiness regulatory framework that CASA proposes to integrate into the regulations. It is closely harmonised with recent proposals by the European Aviation Safety Agency (EASA) and the Federal Aviation Administration (FAA), and provides a comprehensive airworthiness system that would support the ongoing growth of the UAS industry into the future.

3.3 Matters for discussion

This DP presents for comment:

- CASA’s proposed UAS airworthiness policies
- a summary of CASA’s proposed UAS airworthiness framework
- specific issues associated with the airworthiness of UAS.

A summary of proposed policy intent is provided in the following section. A more detailed explanation of these policies is discussed in section 4 of this DP.

3.4 Summary of proposed UAS airworthiness policies

In alignment with DAS-PN025-2010 and DAS DIRECTIVE – 01/2015, CASA's proposed UAS policy is designed to create a cost effective and risk based framework that scales with both size and operational capabilities, to create a holistic system encapsulating UAS from devices that can fit in your hand, to large scale, fully certified systems.

3.4.1 Harmonisation with international standards

Consistent with International Civil Aviation Organization (ICAO) policies, CASA envisions that, where practicable, UAS should be integrated into the existing regulatory framework. Therefore, existing high-level airworthiness arrangements and certification practices would be applied to UAS, commensurate with the level of risk involved with the operation, but the high-level requirements would necessarily refer to new standards that are specifically tailored for UAS. These new standards would take into consideration factors such as UAS requirements for occupants being vastly different to that of a CPA, but not compromise the requirements to ensure safety of other airspace users and persons on the ground, which remains similar to that of CPA.

CASA proposes to use a similar UAS framework to those being developed in Europe[2] and the United States of America[3] in order to align Australian UAS regulations with the international community. International harmonisation would provide significant benefits to the UAS industry, specifically in relation to the acceptance of foreign-manufactured UAS into Australian airspace, as well as increasing the opportunities for Australian UAS designers, manufacturers and operators to export their systems and capabilities overseas. This would also allow CASA and the Australian industry to align with the risk-based methodologies of the international community.

3.4.2 Outcome-based framework

In order to improve the efficiency of the UAS approval process, the framework would be outcome based, which would allow applicants the flexibility to use approved equipment or systems, as well as show system compliance with the performance based standards through innovative and novel design.

3.4.3 Scaled risk-based categorisation

The following scaled categorisation is proposed for Australian UAS:

- open category, comprising of:
  - very small RPAS
  - small RPAS
- specific category
- certified category, comprising of:
  - restricted category UAS
  - fully type certificated UAS.

These categories are structured in such a way that the airworthiness requirements are scaled according to the risk associated with the aircraft and the permitted operations. As the risk of the

[2] For more information, refer to EASA A-NPA 2015-10.
[3] For more information, refer to FAA NPRM on small UAS FAA-2015-0150.

operation and the aircraft increases, the requirements would become more rigorous. At the highest end of the scale, a large UAS carrying out a high risk operation would be required to comply with airworthiness standards that provide an equivalent level of safety as that of a similar kind of CPA carrying out the same kind of operation (i.e. be type certificated and use certificated equipment).

3.4.4 Experimental UAS

UAS would continue to be eligible for experimental certificates; however, experimental certificates are not intended to be a permanent operating category. No changes to the experimental certificate regulations would be required.

3.4.5 Model aircraft

Model aircraft used for personal or recreational purposes would continue to be exempt from the airworthiness regulations, as is currently the case under Subpart 101.G of CASR.

CASA does not consider it necessary to require compliance with formalised airworthiness requirements for model aircraft. The model aircraft operating rules, which include Approved Self-Administering Aviation Organisation (ASAO) oversight for higher risk model aircraft are considered sufficient to maintain an appropriate level of safety.

However, model aircraft operations are not intended to be used for formal development to show compliance with airworthiness certification requirements for commercial UAS – these activities are to be carried out under an experimental certificate in accordance with documented test plans.

4 Detail of CASA UAS framework

4.1 Proposed framework

The following scaled categorisation is proposed for Australian UAS:

- open category
- specific category
- certified category.

This type of categorisation would align with other NAAs around the world. The open and certified categories are well established, whilst the specific category is still not well defined. CASA is considering several options for the specific category based on either:

- an operational permission system (*Option 1*)
- a Certificate of Airworthiness (CofA) system (*Option 2*)
- an optional CofA system (*Option 3*).

Table 1: Proposed UAS airworthiness categories

	Certified		Specific				Open	
			Option 1	Option 2		Option 3		
Category	Standard	Restricted	Specific Category	Specific Category 1	Specific Category 2	Specific Category	Small RPAS	Very small RPAS
type certificate (TC)	Yes	Yes (but with exemptions)	No	No	No	No	No	No
design approval	NAA	NAA	Industry	Industry	Industry	Industry	No	No
formalised design standards	Yes	Yes	No	Yes	No	No (optional)	No	No
production approval	NAA	NAA or Military type	No	Industry	No	No (optional)	No	No
CofA	Yes	Yes	No	Yes	Yes	No (optional)	No	No
operational restrictions	dependent on TC + installed equipment	operating conditions set according to TC and exempted standards + installed equipment	UOC + legislated operating conditions	UOC + legislated operating conditions	UOC + legislated operating conditions	UOC + legislated operating conditions	standard operating conditions for small RPAS	standard operating conditions for very small RPAS

4.2 Airworthiness categories

4.2.1 Open category

Due to the exponential increase in commercial off-the-shelf UAS with greater operational capabilities, it is necessary to address these UAS in a manner that is proportional to the risk they present to the public. Small UAS operated under standard operating conditions present a low risk to other air users and the public, which would be reflected in the regulations. Conversely, a 5 tonne UAS operated over populous areas would present a high risk to other air users and the public, requiring much more in depth and detailed analysis of the design and safety.

CASA proposes to harmonise with the policies set out in EASA A-NPA 2015-10 and FAA NPRM 2015-0150, and create an open category for RPAS below 25 kg maximum take-off weight (MTOW). RPAS in the open category would not require any airworthiness approval in order to operate, but would be subject to certain operational limitations based on the risk posed to other airspace users and persons or critical infrastructure on the ground.

Amendments to Part 101 of CASR to change the operating requirements for small UAS (≤ 2 kg) flown commercially have been made (see *Civil Aviation Legislation Amendment (Part 101) Regulation 2016*). This change removes the requirement for an Operators Certificate for commercial operation of very small RPAS (less than 2kg MTOW). The proposals outlined in this DP would retain and expand on those changes.

The open category would be separated into two sub-categories:

- very small RPAS: RPAS with an MTOW less than 2 kg
- small RPAS: RPAS with an MTOW less than 25 kg.

In alignment with EASA and the FAA, the open category would be restricted to standard operating conditions. These standard operating conditions would include, but not be limited to:

- visual line of sight (VLOS) operations only
- small RPAS - not to fly over any unsheltered person who isn't involved in the operation
- very small RPAS - operations over people permitted
- night visual flight rules (VFR) permitted
- no operations within 3 NM of a registered aerodrome
- minimum weather visibility of 3 NM from control station
- operating speed limitations depending on weight
- below 400 ft for all operations
- fully autonomous operations prohibited (automatic manoeuvres acceptable).

Aircraft that are below the 2 kg or 25 kg MTOW thresholds, but are not intended to be operated within the standard operating conditions for the relevant sub-category, would be required to move up categories accordingly. For example, an RPAS with 10 kg MTOW that is intended to be operated over unsheltered people would no longer be eligible for the open category and would be required to move into either the specific or certified category.

4.2.2 Certified category

UAS carrying out high risk operations (such as low-level operations of a large UAS over populated areas) would be type certified in order to ensure an appropriate level of safety.

Under Part 21 of CASR, a UAS could be issued with a TC in the same manner as a CPA. However, the current Part 101 regulations effectively limits type certification of UAS to the restricted category. This was appropriate when those regulations were made because there were no dedicated airworthiness standards for UAS, but there are now an increasing number of dedicated type certification standards for UAS. CASA therefore proposes to expand the type certification options for UAS to increase the flexibility of the regulations for the UAS industry.

Type certification of a UAS would be under an approved airworthiness standard, such as Certification Specification Light Unmanned Rotorcraft Systems (CS-LURS) or Light Unmanned Aeroplane Systems (CS-LUAS). These arrangements would require a CofA in a similar manner to CPA to demonstrate that the UAS complies with its type design. Due to the distributed nature of UAS subsystems, a UAS TC would include the remote piloting station and the command and control link.

Type certification of a UAS would provide for operations covered by the TC and ensuing CofA to be included in an operator's UOC without further airworthiness assessment of the UAS by CASA.

In a similar manner to CPA, certified UAS may need to be supplemented with certificated equipment required under the operational regulations in order to carry out operations that are not covered by the TC, e.g. if the TC did not include operations under Instrument Flight Rules (IFR).

4.2.3 Specific category

The specific category exists between the open and certified categories. This category is intended for UAS that fall outside the open category—either in mass or in kind of operation; for instance, operating within 3 NM of an aerodrome—or are not required to be issued with a full TC for the operation to be undertaken. This category is proposed in order to provide flexibility for operators.

This category allows larger UAS and/or more operational capability than what is possible in the open category, although a lesser range of operations (i.e. reduced risk) than that what would be available in the certified category. On the other end of the scale, this category also allows UAS with an MTOW ≤ 25 kg to apply for a greater scope of operations, by increasing airworthiness standards and/or operational procedures to mitigate the risks associated with this higher operational freedom.

This additional operational capability and/or increase in UAS size compared to the open category would require a 'safety risk assessment' (SRA) that would take into account both the unmanned system and the operation to be performed in order to determine the safety risks involved and appropriate safeguards for the proposed operations. An authorisation to operate (a UOC) would be granted if the SRA is appropriate and adequately addresses all the safety risks.

The use of recognised standards (e.g. software, system safety, structures) and certificated equipment is one method that can be used to mitigate risks and expand the range of permitted operations of a UAS.

There are various methods currently being used around the world to provide airworthiness certification of UAS that would fall into the specific category. Under the current Australian regulations, all large unmanned aerial vehicles (UAVs) must have a CofA but airworthiness certification standards have not been prescribed for other classes of UAV. Other methods in use in other countries include CofA, permits to fly and exemptions.

There are several possible approaches to the specific category, all detailed in Table 1, such as:

- operational permission system (*Option 1*):
  - An operational permission system would be similar to the current arrangements under Part 101 of CASR.
  - The airworthiness approval of a UAS would be done on a case-by-case basis by CASA as part of the issue of the UOC.
  - It would be the operator's responsibility to satisfy CASA that they have adequately addressed all the relevant safety requirements via a formally documented SRA to ensure that the UAS and the installed equipment are appropriate for the proposed operations and that the operator has made appropriate airworthiness arrangements.
  - This kind of system maintains the current high-level of involvement of CASA in the airworthiness approval of a UAS, which can significantly increase the time and cost associated with the issue of a UOC.
- a CofA system (*Option 2*):
  - A CofA system would be based on the issue of a CofA against either prescribed airworthiness standards or a demonstrated history of safe operation.
  - CofAs would be issued by appropriately authorised industry individuals using accepted standards and procedures.
  - The SRA would be able to rely entirely on the CofA for the aircraft's capability to carry out operations covered by the CofA.
  - This would significantly reduce the involvement of CASA and therefore would reduce the time and cost associated with the issue of an operational approval by CASA.
  - Table 1 shows a possible two-level specific category CofA system (Option 2):
    - specific category 1: this would be an industry self-certification arrangement whereby industry certifies the design and airworthiness of the aircraft against formalised airworthiness standards acceptable to CASA (this would be similar to the light sport aircraft system used for CPA)
    - specific category 2: this category would be based on a satisfactory history of operation (including military operations); it would not require the UAS to comply with any formalised airworthiness certification standard.
- an operational permission system that formally incorporates industry certification of airworthiness (*Option 3*):
  - This option would effectively combine Option 1 and Option 2. It would provide for CASA to use an operational permission system that includes the ability to rely on industry certification against accepted standards.
  - This process would be managed by formalised CASA procedures for assessment of a UOC rather than binding legislation requiring compliance with prescribed airworthiness standards and a CofA.
  - A CofA would not be required, but the legislation would provide for a CofA to be issued for a specific category UAS as an option.
  - If a UAS had a CofA then the SRA would be able to rely on a CofA (similar to Option 2), but if the UAS did not have a CofA then the SRA would be similar to Option 1.

CASA is seeking industry comments on the options described in this section.

4.2.3.1 Safety risk assessment

Approval to operate a UAS in the specific category would be based on an SRA compiled by the operator. The SRA would be the primary means by which an operator would satisfy CASA that all the safety risks associated with their proposed operations have been adequately addressed. CASA will publish acceptable standards and extensive guidance on compiling an SRA. It is envisaged that this will include acceptable means of compliance for some common elements and scenarios.

The SRA must take into account all the elements that contribute to the risk of the particular operation. For this purpose, the operator shall:

- provide CASA with all the information required for a preliminary applicability check of the category of operation
- provide CASA with an SRA covering both the UAS and the operation, identifying all the risks related to the specific operation, and proposing adequate risk-mitigation measures
- compile an appropriate Operations Manual containing all the required information, descriptions, conditions and limitations for the operation, including training and qualification for personnel, maintenance of the unmanned aircraft and its systems, as well as occurrence reporting and oversight of suppliers.

4.2.3.2 Unmanned operational certificate

The operation would be performed according to the limitations and conditions defined in the UOC. The following are parameters of the UOC:

- The UOC would be granted by CASA.
- The operator may only carry out the operations permitted under the UOC.
- The operator shall ensure that all involved personnel are sufficiently qualified and familiar with the relevant operation procedures and conditions.
- Before the initiation of any operation, the operator is responsible to collect the required information on permanent and temporary limitations and conditions and to comply with any requirement or limitation applicable to the UOC.

4.3 UAS approved self-administering aviation organisations

4.3.1 Part 149 of CASR ASAOs

Part 149 of CASR, which is currently under development, would provide a regulatory framework within which specified functions that would otherwise be performed by CASA may be delegated to qualified and approved industry organisations.

CASA recognises that the self-administration (co-regulation) model is an efficient and effective alternative to more conventional regulatory approaches. Under these arrangements, CASA's direct regulatory relationship would be with the approved organisation. The organisation would be primarily responsible for overseeing and administering the approvals it has granted. This arrangement significantly reduces the burden on CASA, and would be expected to provide reduced costs and improved approval timeframes for industry.

In order to improve the efficiency of the oversight of UAS, particularly in relation to the specific category, CASA proposes to allow organisations to apply for a Part 149 approval to oversight

certain UAS operations. This would operate similar to aviation organisations like the Model Aeronautical Association of Australia, Recreational Aviation Australia or the Gliding Federation of Australia.

The ASAO would operate as the oversighting body for the UAS under its jurisdiction, approving operations, personnel and organisations to carry out functions relating to UAS. In relation to airworthiness, this would include functions such as:

- airworthiness certification
- maintenance
- maintenance programs
- design approvals.

Any person may apply to be an ASAO. If the person complies with the requirements specified in the legislation then CASA must approve them as an ASAO.

The general requirements that apply to all ASAOs, such as requirements to have and comply with documented procedures, would reside in Part 149. The specific requirements, such as the qualification and experience requirements for an organisation's key personnel, would reside in the associated Part, which for UAS would be Part 101.

ASAOs must produce a documented set of policies and procedures that detail how the ASAO and the individuals under the ASAO would comply with the requirements of the regulations for all the activities and functions that the ASAO may carry out. The organisation must also appoint competent individuals to run the organisation and carry out the functions of the organisation.

CASA approves the organisation on the basis of its documented policies, procedures and personnel. CASA would then oversight the organisation to ensure ongoing compliance of the organisation with the regulations and its approved procedures.

4.3.2 ASAO privileges and functions

For UAS, ASAO airworthiness privileges would include:

- issuing certificates of airworthiness
- continuing airworthiness management approvals
- maintenance personnel approvals
- maintenance programs approvals
- design change approvals
- approval of parts, materials and processes for UAS
- operational approvals associated with required operational equipment.

An ASAO may be granted any or all of the above privileges, depending on their demonstrated capabilities and documented procedures. In the absence of an appropriate ASAO, CASA would be able to provide the relevant approvals.

4.4 Registration of UAS

The primary Australian civil aircraft registration regulations are in Part 47 of CASR, and are designed to meet ICAO standards for international air navigation. Currently, under subregulation 47.015(1), only large UAVs (as defined under regulation 101.240) are required to be registered.

In the latter half of 2015, the FAA determined that any UAS above 250 g MTOW would be required to be registered. EASA has also issued a Technical Opinion that stipulated registration requirements for aircraft over 250 g MTOW.[4] These registration requirements are different from the aircraft registration requirements that currently apply to large UAVs under Part 47 of CASR.

The limits specified by the FAA and EASA were determined via different analyses of the kinetic energy of UAS. The FAA UAS Registration Task Force report determined that 250 g was the mass of a UAS that would impart 80 joules of energy from an altitude of 400 ft.

The EASA Technical Opinion document determined that UAS with an MTOW below 210-250 g had a likelihood of 5×10^{-8} per flight hour to cause a fatality if a catastrophic failure occurred during operation of the UAS. The document states that the impact energy of such a collision would be 25 joules. Any UAS below this weight is considered to be in a 'harmless' category.

CASA is continuing to monitor international developments on the requirements for UAS registration and is looking towards an international consensus position via ICAO standards. If any changes to the current requirements of Part 47 of CASR are considered necessary then they will be published for consultation in an NPRM.

4.5 Initial airworthiness policies

It is intended that, as much as practicable, airworthiness provisions for UAS are to be integrated into the existing Part 21 of CASR regulations (as opposed to creating new provisions to deal with UAS separately). However, there would be several new provisions to cover new UAS matters. The following is a basic summary of the Part 21 policies and amendments that would be necessary to provide for UAS in Part 21.

4.5.1 Type certification

A standard TC may cover, in relation to UAS:

- UAS – no regulation amendments are necessary to provide for the type certification of a UAS. Specific standards would need to be included for UAS, including the unmanned aircraft, RPS and command and control links.
- RPS – numerous amendments are necessary to provide for the issue of a TC for an RPS as a stand-alone item.
- UAS engine – no regulation amendments are necessary to provide the type certification of an engine for a UAS. Specific standards would need to be included for UAS engines.
- UAS propeller – no regulation amendments are necessary to provide the type certification of a propeller for a UAS. Specific standards would need to be included for UAS propellers.

A restricted TC may only cover a UAS, i.e. the whole system, not an RPS, engine or propeller separately (similar to the existing regulations, a restricted type certificate can only be issued for an aircraft).

A remotely piloted aircraft (RPA) cannot be type certificated without an RPS, i.e. the TC for an RPAS must mention the RPS (the RPS may be separately type certificated, or be covered by the RPAS TC).

[4] Refer to the other documents table in section 1.3 for document links.

4.5.2 Type acceptance for UAS

Type acceptance would to apply to UAS and RPS, as it does for other aircraft and products.

4.5.3 Supplemental type certificates

Supplemental type certificates would apply to UAS and RPS, as they do for other aircraft and products.

4.5.4 Certificates of airworthiness

A standard CofA may be granted to a UAS if the aircraft has a standard TC. A special CofA in the restricted category may be granted to either:

- a UAS that has a restricted TC
- a UAS with a standard TC that has been modified and no longer complies with all the airworthiness requirements that applied for the standard TC.

A special CofA in the specific category would be a new kind of special CofA and would require a new regulation (if such provisions were to be adopted). The policies for duration of a CofA would be the same as for CPA.

Note: A CofA is only for an aircraft and therefore would not be issued for an RPS as a standalone item. The serviceability of a type certificated RPS as a standalone item is to be covered by an authorised release certificate (similar to current arrangements for an engine or propeller).

4.5.5 Optionally piloted aircraft – dual certification

An aircraft may have dual certification as both a CPA and a UAS. An inspection by a qualified individual is necessary to convert the aircraft between categories. This would function similar to the existing dual certification arrangements for CPA in the restricted and standard category.

4.6 Required instruments and equipment

Airworthiness certification standards for aircraft do not necessarily cover all kinds of operations. Certification against a particular standard only provides for an aircraft to carry out the operations covered by that standard.

The proposed framework for UAS would function similar to the arrangements in place for CPA, whereby the permitted operations for an aircraft can be expanded by the installation of additional instruments and equipment that provide the necessary level of safety.

Additionally, some kinds of operations would require certain kinds of equipment in order to carry out the operation safely. For example, a particular airworthiness standard for UAS may not cover operation in instrument meteorological conditions (IMC). A UAS certificated against that standard would only be permitted to operate in visual meteorological conditions. However, if the UAS was modified to include instruments and equipment that provide an acceptable level of safety for operation in IMC, then the permitted operations for the UAS would be expanded to include operation in IMC.

4.6.1 Required instrument and equipment policies

The operations that would require additional instruments and equipment would include:

- operations in IMC
- operations beyond visual line of sight (BVLOS)
- operations in controlled airspace.

Other kinds of operations (i.e. operations at night, or operations in particular areas or airspace) could also be included.

4.6.2 Airworthiness requirements for required instruments and equipment

Required instruments and equipment would be required to be approved against the applicable airworthiness standards. This ensures the equipment meets the necessary performance and reliability standards for safe operation.

Required instruments and equipment would be required to be maintained in accordance with the relevant instructions for continuing airworthiness (ICA) in order to ensure that the performance and reliability standards, and therefore the required level of safety, are maintained.

4.6.3 Legislative framework

The legislative framework would function such that the Part 101 Manual of Standards (MOS) would specify certain kinds of instruments and equipment as required for certain kinds of operation. The required instruments and equipment would have to be approved under Part 21 of CASR.

Part 21 already contains provisions that adequately provide for approval of instruments and equipment for all aircraft, including UAS. In particular, regulations 21.305 and 21.305A provide all the necessary means of approval, including:

- under an Australian Parts Manufacturer Approval (APMA)
- under an Australian Technical Standard Order (ATSO) authorisation or letter of ATSO design approval
- in conjunction with type certification procedures
- under Subpart 21.N of CASR
- in any other manner approved by CASA.

CASA may also approve an ASAO to approve required instruments and equipment.

4.7 Continuing airworthiness management

Continuing airworthiness management is the processes and procedures that ensure the continuing airworthiness of an aircraft. In general terms, an aircraft is airworthy when it complies with its approved design and is in a condition for safe operation.

Part 101 currently exempts unmanned aircraft generally from the normal continuing airworthiness regulations. However, it then reapplies the CAR airworthiness regulations for large UAVs and relies on operational certificate management to ensure the airworthiness of other UAVs. These arrangements do not provide a practical regulatory framework, nor do they provide

an appropriate level of safety for the volume and kinds of UAS operations anticipated for the near future.

CASA seeks to introduce a continuing airworthiness framework for UAS that is appropriate for UAS and is based primarily on the risk associated with the operation that the UAS is carrying out.

4.7.1 Continuing airworthiness management requirements

Continuing airworthiness management includes the following:

- airworthiness directives (AD): ensuring compliance with applicable ADs
- life limited parts: ensuring replacement of life limited parts
- design changes: ensuring modifications and repairs are approved and compatible with the aircraft
- ICA: dealing with applicable new ICA issued from time to time
- maintenance program: establishment and ongoing upkeep of the maintenance program
- defects: reporting and dealing with defects
- parts and materials: requirements for installation of parts and materials
- continuing airworthiness records: establishment and upkeep of a continuing airworthiness records system
- flight technical log: establishment and upkeep of a flight technical log
- operational equipment: ensuring operational equipment required for a flight is fitted to the aircraft
- airworthiness review: a periodic review to verify the airworthiness of the aircraft.

4.7.2 Continuing airworthiness management legislation

UAS would continue to be exempt from the normal CPA continuing airworthiness regulations. Continuing airworthiness for all UAS (including large UAS) would be covered by dedicated provisions in Part 101 (primarily Subpart 101.M). The detailed requirements would be provided in the Part 101 MOS.

4.7.3 Operation-based requirements

The continuing airworthiness requirements would be primarily based on the operations the UAS is carrying out, supplemented in some cases by the UAS classification. The operator of a UAS would be responsible for ensuring that the UAS complies with the continuing airworthiness requirements that apply for the operation the UAS is carrying out.

For example, a sub 25 kg RPAS being used for commercial purposes under standard operating conditions would not be subject to continuing airworthiness requirements other than for the owner, operator, hirer or pilot to ensure that the RPAS is in a condition for safe operation prior to commencing a flight. However, if that same RPAS was to be used for operations outside the standard operating conditions, then the continuing airworthiness requirements that apply for the UAS category and the particular kind of operation would apply whenever the RPAS was carrying out those operations. The operator carrying out the operations would be responsible for ensuring that the RPAS complies with the applicable continuing airworthiness requirements whilst the RPAS is carrying out operations outside the standard operating conditions.

4.7.4 Separation of continuing airworthiness and maintenance functions

UAS continuing airworthiness management requirements would be based on Part 42 continuing airworthiness management policy fundamentals (as opposed to the outdated CAR maintenance release policies). In summary, this means establishing continuing airworthiness management and maintenance as two separate functions and responsibilities.

The person responsible for the continuing airworthiness management of a UAS (generally the operator or UOC holder) must monitor the ICA for the UAS and order the necessary maintenance to be carried out as and when required. The maintainer carries out the maintenance that was ordered and takes responsibility for the maintenance that they carried out. If the maintainer did not complete all the maintenance that was ordered, or they discovered a defect in the course of their duties, then they must record that in the continuing airworthiness records for the UAS accordingly. It is then the responsibility of the person responsible for the continuing airworthiness management of the UAS to ensure that all the required maintenance is carried out and any defects are dealt with prior to the UAS being operated.

Although the responsibilities are separate, this does not preclude a single person handling both responsibilities. For example, in a small one-person operation, that one person may be the registered operator, the UOC holder, the person responsible for continuing airworthiness management and the person responsible for maintenance.

4.8 Maintenance of UAS

Under regulation 101.020 of CASR, UAS are generally exempt from Parts 4 and 4A of CAR. However, under regulations 101.260 and 101.265, large UAV must be maintained as class B aircraft under Part 4A of CAR , usually by the holders of a maintenance authority issued under regulation 33B of CAR. Maintenance of other than large UAVs is managed via the UOC.

These arrangements need to be updated to ensure consistency with the requirements of the *Civil Aviation Act 1988 (the Act)* and to better reflect the risk associated with the operations the UAS is permitted to carry out, and formally provide minimum competency standards with appropriate flexibility.

CASA does not intend to continue the use of maintenance authorities for the provision of UAS maintenance – the UAS maintenance legislation would adequately provide for UAS maintenance without the use of maintenance authorities.

4.8.1 Maintenance of open category RPAS

Open category RPAS would not be required to comply with the same maintenance regulations as certified aircraft. The reduction of regulatory burden for this lower risk category is in line with CASA's policy to have risk-based regulations. Any person acceptable to the owner or operator may carry out maintenance on an open category RPAS.

4.8.2 Specific category UAS maintenance

In the specific category, CASA intends that the maintenance requirements would be scalable depending on the risk associated with the operation and the kind of UAS. The higher the risk, the more regulatory requirements would be in place.

CASA intends that current B1 and B2 Licensed Aircraft Maintenance Engineers (LAMEs) certified under Part 66 of CASR would be able to maintain UAS in the specific category.

ASAOs would also be able to approve individuals to carry out maintenance on UAS in order to reduce regulatory burden for the lower risk operations of the specific category.

CASA intends that manufacturers would also be approved to perform maintenance on UAS. This is different from CPA, where a manufacturer cannot perform maintenance on their product unless they also have a maintenance permission (e.g. an approval under Part 145 of CASR or regulation 30 of CAR (CAR 30)).

For lower risk operations, it is proposed that the UAS operator would also be able to approve an individual who meets minimum competency standards to perform maintenance on the UAS used by the operator, including, for example, satisfactorily completing the maintenance training course provided by the UAS manufacturer.

In summary, those permitted to carry out maintenance on specific category UAS would be as follows:

- a Part 66 licence holder
- a CAR 30 approved maintenance organisation
- a Part 145 approved maintenance organisation
- the manufacturer of the UAS or associated aeronautical product
- a competent individual authorised by an ASAO (the person must meet the competency standards specified in the Part 101 MOS)
- a competent individual authorised by the UAS operator (the person must meet the competency standards specified in the Part 101 MOS).

4.8.3 Certified category UAS maintenance

UAS in the certified category would require the highest standards of maintenance. UAS in the certified category would therefore have similar maintenance requirements as a CPA. Persons that would be permitted to carry out maintenance on certified category UAS would be:

- a Part 66 licence holder
- a CAR 30 approved maintenance organisation
- a Part 145 approved maintenance organisation
- the manufacturer of the UAS or associated aeronautical product.

It would be the operator's responsibility to authorise a person to carry out maintenance on their UAS and to ensure that the person is competent.

4.9 Specific issues to the airworthiness of UAS

4.9.1 Separation and collision avoidance

One of the biggest issues for UAS flying BVLOS operations involves the ability to see and avoid aircraft. It is possible under VLOS operations for the remote pilot to see and avoid other aircraft and to separate the unmanned vehicle, however, when under BVLOS conditions this is not possible. To allow proper separation of the aircraft in lieu of the ability of the remote pilot to physically see and avoid the aircraft, sensors on board the aircraft can be used. Sensors

designed to perform these functions are part of what is known as the detect and avoid (DAA) system.

The minimum operational performance specifications (MOPS) for DAA for a range of operations are currently being developed by the Radio Technical Commission for Aeronautics (RTCA) and the Joint Authorities for Rulemaking on Unmanned Systems (JARUS). These safety performance levels, once solidified, would form the basis for the international aviation communities' regulations for DAA.

The proposed framework would provide for these standards to be formally adopted into the Australian legislation. Manufacturers and operators could then determine means of meeting the MOPS for the operation or system under consideration, and once demonstrated satisfactorily to CASA that the system meets the MOPS, the system would be approved for that purpose. It is expected that an ATSO (or a recognised foreign equivalent) to meet the MOPS would be developed, which would further facilitate production and expand the availability of approved systems for the UAS community. These approved systems can then be used to expand the range of operations carried out by a UAS.

The short term goals for DAA would be to have in place MOPS for aircraft transitioning through other airspace to fly in class A airspace, because in this class of airspace, IFR aircraft would have the required electrical visibility for the prototype DAA system sensors to determine other aircraft positions.

After this operational goal is verified and validated suitably, the next stage would be work on MOPS for aircraft that operate VFR (such as would be encountered in class G airspace). This would be necessary for the UAS to maintain safe separation and avoidance of aircraft flying under VFR.

In lieu of these MOPS, the determination of risk mitigation via DAA or other means (such as segregation of airspace) for UAS to fly above 400 ft would be determined by a case-by-case risk assessment. In some of these cases, further mitigation techniques would be required to allow the UAS to operate safely with other aircraft in Australian airspace.

4.9.2 Control and non-payload communications link

Due to the pilot being located remotely from the unmanned aircraft, the control and non-payload communications link (CNPC) is an additional complex system that could possibly fail and cause a hazard to the operation, other airspace users or people on the ground. MOPS for the CNPC provide a mechanism that can be used to ensure the likelihood of the loss of link (partial loss or full loss) meets the necessary safety standards and assure robust communication between the remote pilot, the unmanned aircraft and air traffic control (ATC).

In a similar manner to the DAA MOPS, the RTCA and JARUS are working on the MOPS for CNPC. The proposed framework would provide for these international standards to be formally adopted into Australian legislation when they are published. The legislation would provide for manufacturers and operators to determine the means by which they comply with the MOPS. Alongside this it is expected that ATSO standards would be published, thereby providing additional flexibility for industry.

Case-by-case assessment of each CNPC for specific operations would remain available, but it is envisaged that the increased level of confidence provided by the use of formal standards would increase the operational scope and flexibility in comparison to the operational restrictions and

conditions required to maintain an adequate level of safety for case-by-case, non-standards based assessments. Assessment using formal standards would also significantly decrease the amount of time required for each assessment of a UAS in its operational capability.

4.9.3 Software design assurance

Software would become a dominant design focus for unmanned aircraft systems. Due to the highly automated nature of UAS, this may even become the dominant design consideration. Software design assurance standards similar to those for CPA (e.g. RTCA DO-178) would become increasingly necessary for UAS.

Currently, the American Society for Testing and Materials F38 committee is developing software assurance standards for UAS that will fall into the specific category. Currently, the design assurance level would be between level C and D.

The use of formal software design assurance standards would provide increased confidence in the design of the UAS and therefore provide for a greater scope of operations and faster approvals.

4.9.4 Operations over people

After the release of the EASA A-NPA and the FAA's UAS NPRM, a significant number of comments were received relating, in particular, to the FAA proposal for micro UAS (sub 2 kg class) to be permitted to fly over people without being subject to defined performance standards. The FAA micro UAS Aviation Rulemaking Committee (ARC) released their final report, which recommended that only UAS with an MTOW less than 250 g be permitted to fly over people without showing compliance with appropriate performance standards; for UAS with an MTOW greater than 250 g, some form of performance standards should be applied. The FAA is reviewing these recommendations.

CASA has issued this DP with proposals for operation of very small UAS over people that are similar to those set out in the original FAA UAS NPRM and EASA A-NPA. CASA will consider the comments made in response to these proposals and continue to monitor the ongoing international developments in this area in order to develop appropriate safety standards for these kinds of operations.

5 Benefits and impacts of the proposed policy/framework

The policies and framework proposed in this DP would modernise the Australian UAS regulations and provide a scalable airworthiness framework that is based on the safety risk associated with the operation that the UAS is permitted to conduct.

These proposals would increase the flexibility for the Australian UAS community, by streamlining the airworthiness approval process for UOC applicants (especially for UAS with an MTOW less than 25 kg), as well as set the Australian UAS community for the safe and efficient integration of UAS into Australian airspace in a considered manner.

These proposed changes would also align the Australian legislation with the current international systems and standards. This would facilitate exports for Australian designers and manufacturers of UAS, and imports to Australia of UAS from international manufacturers. These proposed changes would also offer a significant reduction in regulatory burden for unmanned operations in the open category and streamline the approval process for the aviation community and CASA.

The specific category would maintain flexibility in UAS platforms for a variety of operations, while still upholding the high safety record Australia enjoys. Finally, the certified category would provide additional flexibility for type certification of UAS. It would provide for large scale, higher risk operations to be conducted by UAS that have an analogous design methodology to CPA, thereby ensuring that appropriate levels of safety are maintained.

6 Options for discussion

CASA recognises the need to establish a categorisation system and proposes to base this on open, specific and certified categories. Within these categories, CASA seeks feedback on the following:

a. **Open category** – CASA proposes to set the MTOW at 25 kg, but is interested in industry feedback on sub-categories with this category:
   i. sub-2kg
   ii. 2-25kg
b. **Specific category** – CASA welcomes all comments on this category. In particular, CASA seeks comments on an appropriate authorisation system for UAS in the specific category:
   i. Option 1 – operational permission system
   ii. Option 2 – mandatory Certificate of Airworthiness system
   iii. Option 3 – an optional Certificate of Airworthiness system
c. **Certified category** – CASA proposes that UAS certification process would be similar to the process that applies to type certificated manned aircraft, to ensure an equivalent level of safety.
d. **UAS approved self-administering aviation organisations** – CASA proposes to introduce UAS ASAOs in certain circumstances.

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