Australian Government
Civil Aviation Safety Authority

DISCUSSION PAPER

Review of RPAS operations

DP number	DP 1708OS
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Audience

This discussion paper will be of interest to:

- commercial and recreational RPAS operators
- general aviation
- regular public transport operators
- charter operators
- airport and heliport operators
- helicopter operators
- local and State governments
- the general public.

About this discussion paper

The Civil Aviation Safety Authority (CASA) is responsible under the *Civil Aviation Act 1988* 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 discussion paper forms one part of the review of aviation safety regulation for remotely piloted aircraft (RPA). CASA is also engaging an external consultant to provide a risk assessment framework for RPA systems to assist in the development of a risk profile for the RPA sector, using CASA's safety risk profiling processes. Both the discussion paper and the outcomes of the risk assessment will inform a final report, which is expected to be completed by the end of 2017.

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 at https://consultation.casa.gov.au by **22 September 2017**.

Foreword

Australia was one of the first countries in the world to introduce legislation governing the operation of remotely piloted aircraft (RPA), commonly referred to as *drones*. Part 101 of the *Civil Aviation Safety Regulations 1998* (CASR) was introduced in 2002 in response to the need for an effective regulatory framework within which the development of this rapidly evolving technology could progress without compromising the safety of other airspace users and people and property on the ground.

Since that time the RPA sector in Australia, as elsewhere in the world, has experienced enormous growth, driven by advancements in technology that continue to fuel commercial and recreational consumer demand, while providing easier access to increasingly sophisticated devices at relatively low cost. As of 24 July 2017 there were 5,870 remotely piloted aircraft licence (RePL) holders and 1,106 remotely piloted aircraft operator's certificate (ReOC) holders in Australia. The vast majority of RPA owners and operators are recreational users who require neither a RePL nor a ReOC. It is estimated that there are at least 50,000 drones being operated in Australia today, mostly for sport and recreational purposes.

Globally, aviation safety regulators are facing the same kinds of challenges: to maintain high levels of safety without unnecessarily impeding progress or unduly constraining commercial opportunities to use a technology capable of a multitude of beneficial humanitarian, economic and recreational applications. Responding to these challenges, CASA introduced important amendments to the regulations that took effect in September 2016. While reducing the regulatory burden on some commercial uses of RPA, the regulations continue to require all drone operators to comply with the basic safety requirements set out in the *Civil Aviation Act 1988* and the regulations. In fact, the recent amendments to Part 101 of CASR included a set of generally applicable *standard operating conditions* designed to enhance the high level of safety already provided under the existing rules. The Notice of Final Rule Making for these amendments is expected to be released shortly.

We recognise, of course, that departures from these requirements—deliberate or unintentional—can heighten those risks, and that effective action to address, and where possible to prevent, such departures is essential. To that end, CASA has continued with a major education program about the safe and compliant operation of RPAs. CASA's drone safety awareness campaign is estimated to have reached more than a million people through our social media channels. It also includes targeted advertising through other media to explain the regulations for recreational and sub-2kg (very small) RPA users.

In May 2017, CASA released a free drone app called *Can I fly there?* Our app targets both recreational and very small commercial RPA users, providing useful and important information relevant to the user's intended drone operation. By 24 July 2017, this app had over 72,000 downloads of/unique visitors to its mobile device and web browser versions.

Effectively deterring those who would break the rules, and successfully apprehending those who do, is a formidable challenge. CASA is reaching out to state, territory and federal law enforcement agencies to enhance cooperation and coordination between these agencies. The evidence so far shows that CASA's compliance and enforcement outcomes compare well with those of our counterparts overseas.

I recognise the ongoing need for existing aviation safety requirements to be reviewed, critically assessed and updated in response to emerging risks, new technologies, international regulatory

developments, and the advice and views from other Government, industry and community stakeholders. Therefore, I look forward to your responses to this discussion paper.

I appreciate your commitment in time and effort in providing comments on these important issues, and I thank you in advance for your contributions.

Shane Carmody
Chief Executive Officer and
Director of Aviation Safety

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Discussion

Background

On 15 June 2017, CASA released the following terms of reference for this review:

> To review the approaches undertaken by the Civil Aviation Safety Authority (CASA) to the regulation of RPA operations which are consistent with the primacy of air safety, and with particular reference to:
>
> i) The relative safety benefits and their cost effectiveness:
>
> - introducing mandatory registration, education and training for all RPAS operators;
> - the deployment of geo-fencing capabilities for RPAS; and
> - any other mechanisms to enhance aviation safety associated with RPAS operations in Australian airspace and managing the relevant risks.
>
> ii) The effectiveness of CASA's operating model with respect to the regulation of RPA to ensure it takes into account:
>
> - technology growth of the RPAS community;
> - operational growth of the RPAS community; and
> - developments in ICAO and other international aviation safety agencies.
>
> This review will be informed by looking at the operation of CASR Part 101 amendments and take into account recommendations developed by the Unmanned Aircraft Systems Standards subcommittee. See https://www.casa.gov.au/aircraft/standard-page/drone-safety-review.

The purpose of this discussion paper

The purpose of this discussion paper is to obtain community and industry views on questions reflecting the terms of reference for this aviation safety review. The review itself is separate from the inquiry being conducted by the Senate Standing Committee on Rural and Regional Affairs and Transport (RRAT) into Regulatory Requirements that Impact on the Safe Use of Remotely Piloted Aircraft Systems, Unmanned Aerial Systems and Associated Systems.[1] It is expected that the outcomes of this review will serve to inform the RRAT inquiry process.

What this discussion paper doesn't cover

CASA's regulatory authority extends exclusively to matters of aviation safety. So, although they are certainly important, there are a number of issues involving the use of drones that are not matters CASA can regulate. These include security, privacy, importation, insurance and the broader social and economic implications of RPA technology. Except where they intersect with matters of aviation safety, these issues are not covered by the terms of reference for this review.

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1 http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Rural_and_Regional_Affairs_and_Transport/Drones

CASA's approach to RPA regulation

Under the *Civil Aviation Act 1988,* CASA has the function of conducting the safety regulation of civil air operations in Australian territory and the operation of Australian aircraft outside Australian territory. Consistent with CASA's obligations under the Act, in his *Statement of Expectations* for CASA the Minister highlighted the importance of:

- focusing on safety as the highest priority
- considering the economic and cost impacts of new or amended regulations
- taking a practical, proportionate and risk-based approach to regulation.

In keeping with these principles, the amendments to Part 101, which commenced on 29 September 2016, significantly enhanced the existing safety framework by:

- strengthening and clarifying the requirements and limitations governing the safe operation of RPA
- expanding the range of activities in which RPA may safely be operated without unnecessarily burdensome administrative constraints.

These amendments take into account existing and emerging safety risks, without imposing excessive costs and without unnecessarily hindering participation in aviation or the industry's capacity for expansion. The changes introduced are also consistent with the adoption of performance-based and risk-based regulation, having regard to the nature of the activities involved.

Key elements of the amended RPA regulations

The regulations governing the use of RPA and RPAS in Australia today are summarised in Appendix A to this discussion paper. They are set out in full in Part 101 of CASR, which can be found on the Federal Register of Legislation website.[2] As outlined in the boxes below (and as described more fully in Appendix A), key elements of the amended Part 101 regulations that came into effect in September 2016 include:

Categorising RPA by size and weight

- *micro RPA*—an RPA with a gross weight of *100 g or less*
- *very small RPA*—an RPA with a gross weight *of more than 100 g but less than 2 kg*
- *small RPA*—an RPA with a gross weight of *at least 2 kg but less than 25 kg*
- *medium RPA*—an RPA with a gross weight of *at least 25 kg, but not more than 150 kg*
- *large RPA*—an RPA with a gross weight of *more than 150 kg*

[2] https://www.legislation.gov.au/Current/F2017C00164

Introduction of the *excluded RPA* category

RPA in the excluded category are considered to pose lower risk, having regard to their size and weight, the kind of operations in which they are engaged and the location of those operations. The operation of *excluded RPA* is subject to correspondingly liberalised regulatory requirements, eliminating the need for an operator to hold a RePL or a ReOC; however, those operations must be conducted in accordance with the *standard operating conditions.*

Introduction of the *standard operating conditions* for RPA

The standard operating conditions require that:

- the RPA is operated within the *visual line of sight* of the person operating it; and
- the RPA is operated at or below *400 feet above ground* level (AGL) by day; and
- the RPA is not operated:
  - *within 30 metres of a person* who is not directly associated with its operation;
  - in a *prohibited area* or in *specified restricted areas*;
  - over a *populous area*;
  - within *3 nautical miles of the movement area of a controlled aerodrome*;
  - over an area where a *fire, police or other public safety or emergency operation* is being conducted, without the approval of the person in charge of the operation; and
- the person operating the RPA is *only operating that RPA*.

What are the risks?

In general terms, the safety risks posed by the operation of any RPA involve the potential of such activities to:

- cause harm or injury to people on the ground or in other aircraft
- cause damage to property on the ground or to other aircraft in flight
- interfere with the safe and lawful operation of other aircraft.

Safety risks are assessed in terms of the *probability* or *likelihood* that an adverse event will occur, and the severity of the *consequences* if it does. The greater the probability and the more serious the consequences, the more important it is to ensure that the regulatory regime effectively mitigates or reduces the probability that an adverse event will occur and/or the severity of the consequences of that event it if does occur.

All aviation-related activities involve some measure of risk; the only way to eliminate the risks associated with the use of RPA would be to prohibit their use entirely. Nobody is advocating that approach. Our challenge is to find ways to mitigate the risks associated with different RPA activities to the lowest acceptable level.

The existing regulatory regime was developed having regard to the risks inherent in different kinds of RPA activities conducted today—from the purely recreational use of smaller RPA at relatively low speeds and altitudes, away from people, property and other aircraft, to the commercial operation of larger RPA at higher speeds, closer to people and property and at

altitudes where they are more likely to encounter other aircraft. It is timely, however, to review how effective the existing safety regulations are in mitigating the risks they are meant to address today and in the future.

As the number and sophistication of RPA grows, and the kinds of activities in which they can be used expands, there is no question that existing requirements will need to be refined and adjusted to suit these rapidly changing circumstances. The effectiveness of even the 'best' set of regulations, of course, depends on the ability and willingness of the regulated community to abide by those rules. More importantly, the capacity of any safety regime to deliver real outcomes largely depends on the attitude, understanding and behaviour of everyone involved, factors that extend beyond mere compliance with the law.

This discussion paper seeks your views on the effective and appropriate management of the safety risks associated with RPA activities today and in the future, having regard to both the kind of regulations that should be in place and other ways in which those risks might be mitigated.

Should all RPA be registered?

Subject to certain exceptions, all aircraft in Australia are required to be registered and to display the registration number issued on the aircraft itself. Formal registration of an aircraft under the CASR provides CASA with current and accurate contact details for the owner and the operator of the aircraft. It is an offence under the regulations if a person fails to notify CASA of any changes to these details or does not display the registration number on the aircraft, and a more serious offence under the *Civil Aviation Act 1988* if a person unlawfully operates an unregistered aircraft.

These formal registration requirements do not apply to:

- **model aircraft**—that is, aircraft that are used for sport or recreation and cannot carry a person
- **all RPA other than large RPA**—that is, RPA with a gross weight of less than 150 kg. RPA with a gross weight of more than 150 kg (which must be registered under the regulations, irrespective of the kind of operations in which they are engaged).

The arguments in support of requiring all RPA to be registered are based on the proposition that registration and marking would serve as a deterrent to those who might otherwise operate their drone unsafely and unlawfully, and as an effective means by which to identify and apprehend offenders.

In addition to these enforcement-related considerations, if eligibility for registration required the applicant to demonstrate a certain level of knowledge about the rules governing the safe operation of drones, then this would help to ensure that registered operators used their drones safely and lawfully. CASA could also use these contact details as a means by which to convey important and useful safety information and advisory material directly to individual owners and operators. Depending on the nature of the risks involved in particular kinds of RPA operations, relatively simple registration and marking requirements could be introduced that would allow for compliance with such a program without imposing the same kind of administrative requirements in all cases.

The arguments against universal registration and marking requirements point to the absence of evidence that such requirements actually do deter people from operating their drones safely or unlawfully. In so far as smaller RPA are concerned, and particularly those used for recreational purposes, the ease with which these aircraft can be obtained and flown makes it too easy for those who are not inclined to comply with the safety requirements not to comply with the registration requirements as well. Conversely, those responsible enough to register an RPA in accordance with a requirement to do so would most likely comply with the relevant safety requirements in any case.

What are others doing?

Different kinds of registration regimes are presently used in other countries.

For example, the **United States** introduced a mandatory drone registration scheme in December 2015, requiring all RPA weighing more than 0.55 lb (250 g) to be registered with the Federal Aviation Administration (FAA). The registration, which would have been valid for 3 years, was US$5.00. The registration number issued by the FAA was required to be displayed on all RPA

used by the registered operator, who was required to have proof of their registration available while operating a device. Failure to register could attract potentially significant civil penalties—depending on whether the operator was an individual, a small or a large business entity—and, in some cases, imprisonment.

> **Note:** On 19 May 2017, for reasons that would not apply in Australia, the United States Court of Appeals for the District of Columbia ruled that the FAA's drone registration requirements were unlawful and unenforceable in respect of model aircraft (i.e., drones used for purely recreational purposes). It is expected that the relevant US legislation will be amended, reinstating a registration requirement.

In **Canada**, while anticipated regulatory changes may include mandatory registration arrangements, an interim order was issued by the Minister of Transport in March 2017 requiring, among other things, that drones not weighing more than 35 kg that are being used for recreational purposes must have the name, address and telephone number of the owner clearly marked on the aircraft. Infringement penalties for breaching this requirement may be as high as C$3,000 for individuals and C$15,000 for a corporate entity.

The Civil Aviation Authority of the **United Kingdom** currently requires registration of RPA weighing more than 20 kg (subject to some exemptions); however, the UK government recently announced that it will be considering registration for drones weighing more than 250 g.

The **New Zealand** Civil Aviation Rules exempt all RPA from registration requirements, although an operator may apply for and obtain registration if they choose to do so.

Costs of registration

The introduction of any kind of registration and/or marking scheme would involve costs for owners and operators of covered RPA. These would include any charges CASA would need to impose to cover its costs in establishing and administering such a scheme.

Questions to consider

The question in response to which your views are sought is:

Should there be some form of mandatory registration of all RPA, RPA owners and/or RPA operators?

In thinking about your response, you may want to consider the questions suggested below:

- Which, if any, RPA should be required to be registered?
- Should individual RPA be registered or should individual RPA owners/operators of multiple RPA be registered?
- Who should bear the costs involved in establishing and maintaining a registration scheme, if such a scheme were adopted?
- Should registration requirements be based on the size/weight of the RPA, the kind of operations in which it is used, and/or some other criteria?
- When should a person be required to register? At the time of purchase and at the point of sale? Within a specified period after purchase or receipt?
- What kind of information should registrants be required to provide?

- Should some or all RPA be required to be marked for identification purposes, even if there is no specific requirement for registration?
- If a registration scheme were to be introduced, should it apply only in relation to RPA purchased from that time forward, or should it apply retrospectively to existing RPA owners and operators?
- If introduced, should registration requirements be imposed at point of sale? If so, how should registration requirements apply in relation to purchases made over the internet? What about an RPA received as a gift?
- Should a person's registration details be publicly available (in the same manner as conventional aircraft registration details are in Australia)?
- Should a registration scheme distinguish the owner from the operator in the same way that is done for manned aircraft?
- Should eligibility for registration include mandatory training and/or testing requirements?
- Should there be a minimum age below which a person is not permitted to register and/or lawfully operate an RPA?

Should all RPA users be required to meet specified training, experience, knowledge and/or assessment requirements?

With certain exceptions introduced under the most recent amendments to Part 101 of CASR, commercial RPA operators and operators of large RPA (> 150 kg) are required to hold a RePL and/or a ReOC when operating RPA in Australia. To obtain a RePL or a ReOC, a person must have successfully completed a specified training course and passed an examination. CASA has no plans to change the training, experience, knowledge and/or assessment requirements for these operators at this time. *This discussion paper is not concerned with these pilots and operators, or the training and examination requirements with which they must comply.*

The focus here is on those RPA users who are not currently required to undertake any training or study, or to successfully pass any examinations demonstrating proficiency in, or theoretical knowledge about, the safe operation of RPA before they may lawfully fly them. This group of RPA users includes owners and operators of:

- model aircraft
- very small RPA used for hire and reward (subject only to the new notification requirements in Division 101.F.5 of CASR)
- excluded RPA.

Anyone flying an RPA is required to comply with the basic safety requirements set out in the regulations and, where applicable, the more stringent requirements reflected in the *standard operating conditions*. These requirements ensure that at no time and in no circumstances may anyone operate an RPA in such a way as to create a hazard to another person, another aircraft or property.

Recognising that every RPA user is expected to abide by the law, particular concerns have been expressed, primarily about recreational users, as they are not required to have any experience or training, or to have demonstrated any level of practical proficiency in (or general understanding of) the safe operation of an RPA before they may lawfully take to the sky with their drone.

What are others doing?

There are currently no mandatory training or education requirements, or requirements to demonstrate knowledge about, or technical proficiency in, the operation of smaller RPA used *exclusively for recreational purposes* in the United States, Canada, the United Kingdom or New Zealand.

In the **United States**, a person using an RPA weighing less than 55 lbs (25 kg) for certain commercial purposes must pass an aeronautical knowledge test at an approved testing centre.

In **Canada**, a person using an RPA weighing up to 1 kg for certain commercial purposes does not require specified training, experience or demonstration of technical proficiency. There is, however, an expectation that the person will be familiar with, and abide by, the existing safety and operational requirements. The limited commercial use of RPA weighing more than 1 kg and up to 25 kg requires a special flight operations certificate, one of the conditions of which is that

the pilot must have the knowledge and training for the operations involved (as set out in the relevant advisory circular).

Currently in the **United Kingdom**, permissions and exemptions from the specific training and examination requirements are available for the conduct of certain commercial operations when using an RPA weighing less than 7kg. To use an RPA weighing more than 7 kg for such purposes, the person must have the competencies of a remote pilot licence holder, including the demonstration of adequate theoretical knowledge, successful completion of a practical flight assessment and completion of a minimum amount of recent flight experience.

The UK government recently announced that it is considering the introduction of basic knowledge and safety testing for anyone operating a drone that weighs more than 250 g.

In **New Zealand**, RPA weighing less than 15 kg may be used in certain commercial operations without requiring the completion of specified training or testing, so long as the operations are conducted in accordance with the applicable requirements. For commercial operations using RPA weighing 15 kg (but not more than 25 kg), the approval of the Civil Aviation Authority of New Zealand is required. In assessing applications for such an approval, consideration is given to the applicant's general aviation knowledge and their specific knowledge of how to remotely pilot the aircraft. Commercial operators using RPA weighing more than 25 kg require an operating certificate, with specified knowledge and experience requirements.

Costs of training and proficiency

The costs for undertaking training will vary, depending on the kind of training required (e.g. class room and text v online study, hands-on training) and the applicable assessment requirements. Costs would also be incurred by training organisations if the approval of certain training courses were required. Costs may also be incurred if demonstrations of proficiency are required, depending on how, where and by whom those tests would be conducted.

Questions to consider

The question in response to which your views are sought is:

Should there be some form of mandatory training and/or demonstration of proficiency in, and knowledge about, the safe and lawful operation of RPA before a person is permitted to operate any kind of RPA?

In thinking about your response, you may want to consider the questions suggested below:

- Should some form of training and/or education be mandatory for all or some categories of RPA?
- What form should this training and/or education take (e.g. online, enrolment in a face-to-face course, self-led)?
- What should such a training regime cover?
- Should all or some RPA owners and/or operators be required to pass an examination that assesses their knowledge and understanding of RPA rules and other related aviation rules?

- Should all or some RPA owners and/or operators be required to demonstrate their proficiency in the actual operation of the RPA they intend to use?
- How should mandatory training requirements be enforced and what penalties should apply if the training is not completed?
- How should the establishment, administration and management of mandatory training, education and assessment programs be paid for?
- If mandated, should training, education and/or passing an examination on a person's knowledge and practical proficiency be linked to a registration scheme (that is, should the mandatory registration of an RPA depend upon the applicant's successful completion of specified training and/or testing requirements)?

Should the introduction of geo-fencing be mandated?

Geo-fencing is a form of electronic containment/exclusion that uses GPS or other radio frequencies to create a virtual boundary in two or three dimensions around and between certain areas. Geo-fencing could be used to contain RPA within a fixed or dynamic area, to exclude them from designated areas and/or to prevent them from exceeding certain altitudes.

Research and testing of geo-fencing systems is producing promising results, and geo-fencing options are included in planning for the integration of RPA operations in airspace in North America and Europe. At this time, the kinds of systems that might be made available for use in the civil RPA sector have not been shown to meet the levels of technical reliability necessary to mitigate the safety risks they are meant to address. In some cases, the technology itself may generate additional safety risks. Programming one's own RPA not to fly in certain areas in the interests of safety is one thing, setting up a geo-fence that affects the RPA operations of others may be quite another, depending on who is doing this, how and why.

Other considerations include the effects on an RPA should it encounter a geo-fencing boundary:

Does the device return (safely) to the operator?
Does it fall to the ground?
Is it diverted or directed to some other location?

These are among the many questions that need to be considered, acknowledging that various geo-fencing solutions are recognised as likely to make critical contributions to the management of the risks posed by the presence of a growing number of RPA. Part 101 of CASR currently makes no provision for geo-fencing, but CASA is encouraging the development of effective geo-fencing systems, and has supported those efforts through the work of the former Unmanned Aircraft Systems Standards Sub-committee (UASSC).

What are others doing?

Research and development on the use and deployment of geo-fencing systems for RPA is proceeding around the world, within the industry and at universities and in conjunction with national governments and regional aviation authorities.

Currently, there are no geo-fencing requirements in place in the United States, Canada, the United Kingdom or New Zealand, although the introduction of geo-fencing arrangements is being seriously considered. In anticipation of political developments in the European Union, the United Kingdom recently announced that they too will be considering plans for the introduction of mandatory geo-fencing for drones.

Costs of geo-fencing

As the technology advances, the availability of effective geo-fencing systems is expected to increase and the costs to support such systems decrease. Some RPA manufacturers are already including geo-fencing software in their new products, some offer retro-fitments for products that have already been sold.

Depending on the size, weight of the RPA and the functionality of the system, costs could range from less than one hundred dollars to several thousand dollars. To the extent that certain geo-

fencing options depend on ground-based elements, such elements would involve additional costs.

Questions to consider

The question in response to which your views are sought is:

Should CASA mandate the introduction of certain kinds of geo-fencing options to limit the operation of RPA in certain areas?

In thinking about your response, you may want to consider the questions suggested below:

- If the incorporation or fitment of geo-fencing software is mandated, should it be required for all or only certain RPA used in Australia?
- If geo-fencing requirements were introduced, should the fitment of geo-fencing software apply only to RPA manufactured or sold after a certain date, or should fitment requirements also be applied retrospectively to existing RPA as well?
- If retrospective fitment to existing RPA were required, who should bear the cost?
- Should RPA owners and operators be able to control the geo-fencing options on their own devices, or should the determination of those boundaries be made by someone else (and if by someone else, then whom)?

What should be done about ‘counter-drone’ technology?

Along with the many benefits the increasing use of RPA can bring—and beyond the risks that irresponsible use of RPA can pose to the safety of other aircraft and to people and property on the ground—RPA can be used in ways that interfere with other people’s legitimate interests and expectations.

The right to the quiet enjoyment of one’s property or to conduct lawful commercial, agricultural and scientific activities on private premises, free from trespassers, unlawful surveillance or other kinds of disruptive intrusions, including the simple right to be left alone, are important freedoms that are already being challenged by insensitive and irresponsible RPA operators.

RPA have been linked to:

- the delivery of contraband to prisons and other controlled premises
- serious criminal activities
- interfering with fire-fighting operations
- encroaching unsafely (and unlawfully) on aerodrome take-off and departure paths and into controlled airspace.

In response to the concerns that have been expressed about these kinds of activities, new and sophisticated technologies are being developed, and some basic, conventional methods are being used, to thwart the use of RPA in circumstances involving unlawful, offensive, potentially dangerous and simply undesirable operations alike.

To whatever extent a person may feel aggrieved by the perceived or actual intrusive operation of RPA, an action taken to disable or destroy a drone in flight, or to otherwise interfere with its operation, can itself be dangerous and unlawful. Under the civil aviation legislation an RPA is an aircraft and it is a serious offence under the Civil Aviation Act to do anything that threatens the safety of an aircraft, or to tamper with an aircraft in a way that may endanger the safety of the aircraft or any person or property. Where counter-drone technology operates in such a way as to allow a person to override the operator’s control and assume control of an ‘offending’ RPA, the person intervening in this way may effectively be operating the drone under circumstances in which their obligation to comply with the applicable regulations would be doubtful.

Understandable though the frustration and indignation of people may be when they believe that their rights have been intruded upon by an irresponsible or malevolent RPA operator, it is important not to encourage potentially dangerous and unlawful vigilantism. The uncontrolled use of counter-drone technology could create more problems than it is intended to solve.

At the same time, however, CASA has no interest in discouraging the responsible development and controlled deployment of effective counter-drone technologies. Such technologies can serve a range of important and beneficial purposes without unacceptably compromising safety. To this end, CASA is working with federal, state and territory law enforcement authorities, in whose capable hands such devices can be responsibly employed when it is necessary to do so. We are also enhancing our engagement with other government agencies and authorities to ensure that, among other things, our aviation safety regulatory framework continues to provide optimal support to these rationally managed efforts.

What are others doing?

Similar concerns about, and similar approaches to, the responsible development of various forms of counter-drone technology are guiding collaborative approaches being taken by aviation safety regulatory authorities in North America, Europe and elsewhere in the world. CASA is closely monitoring these developments, and liaising with our counterparts overseas to ensure our approach is informed by recognised and emerging 'best practice'. In this field, too, technology tends to outpace the development of responsive and anticipatory regulatory solutions, and everyone is striving to find the right balance between supporting technological progress and introducing necessary limits in the interests of public safety.

Questions to consider

CASA seeks your general views on the way in which counter-drone technologies should be managed, and whether there are particular aspects of this technology and its potential uses to which you think CASA should be devoting particular attention.

In thinking about your response, you may want to consider the questions suggested below:

- Other than use by law enforcement authorities in connection with law enforcement activities, are there any other situations in which you think the use of counter-drone technology might be necessary or appropriate?
- Except to the extent adjustments to the civil aviation legislation might be necessary to allow for the legitimate use of various kinds of counter-drone technology, do you think CASA has a greater or different role to play in relation to the issues that the use of this technology is generating?
- Are there particular government agencies (federal, state and territory) or private entities with which you think CASA should be working more closely to support the development and responsible deployment of counter-drone technology?

Are we doing enough of the right things?

As outlined in the foreword, the challenge we face is to have a regulatory approach that maintains high levels of safety without unnecessarily impeding progress or unduly constraining opportunities to use a technology capable of a multitude of beneficial applications. At the same time, we recognise that any workable regulatory approach to the rational management of RPA in the aviation system must be flexible, responsive and, in so far as possible, predictive of constantly evolving safety-related considerations. The rules themselves must continue to take into account the need for performance- and risk-based regulation.

CASA embraces an approach to regulation that fosters education and promotes the accountability of all participants in the aviation system. Helping to ensure accountability and responding fairly, firmly and proportionately when enforcement action is required, we strive to balance our efforts to provide existing and prospective RPA users of all kinds with a better understanding of the safe and responsible operation of these aircraft, while maintaining community confidence in the safety of the system within which those operations are taking place, today and in the future.

No aviation safety regulatory authority in the world has, or claims to have, all of the answers to the many questions raised by the unprecedented expansion of RPA activities. There is, however, growing agreement about the kinds of questions that should be addressed in a common effort to manage regulatory priorities.

The CASA Board has approved a high-level framework for CASA's strategic approach to the integration of remotely piloted aircraft, providing the broad platform from which CASA will continue to identify, prioritise and address the risks and issues related to the operation of RPA into Australian airspace. Essentially, this framework consists of active and planned initiatives to help ensure that:

- the existing regulations are effectively and fairly administered
- applications for approval of activities are efficiently managed with primary consideration always given to the interests of safety
- approved operations are subject to appropriate surveillance and oversight
- real and perceived safety risks are addressed in the most appropriate way
- enforcement practices and methodologies are developed and implemented in the most effective and efficient manner, including engaging with federal, state and territory law enforcement agencies (and other government agencies with relevant public safety functions)
- opportunities are recognised and taken to provide advice, guidance and assistance directly to users and indirectly through intermediaries
- current and emerging technological and regulatory developments elsewhere in the world are closely monitored and assessed
- community groups, agencies and organisations with other than purely safety-related interests in RPA-related developments are engaged and their contributions are leveraged in the interests of safety.

Within this framework, and as discussed above, CASA is focusing on issues related to:

- the proliferation of 'very small' and 'small' RPA, model aircraft used recreationally and the ease with which these can be acquired

- the utility of registration and identification options, notification requirements and other approaches to acquiring a reliable understanding of the 'size' of the sector and its various sub-sectors, as well as enhancing the ability to control errant operators
- prospects for the expanded use of RPA for commercial, commercial-like other non-recreational purposes, including:
  - agricultural and pastoral uses
  - land-based and off-shore surveying and exploration
  - customs and border protection
  - policing, search and rescue and other public safety activities
  - innovative approaches to service and product delivery and personal transport.

The full range of CASA's current and planned activities for RPA can be found on our dedicated RPA website page.[3] CASA's submission to the Senate Standing Committee on Rural and Regional Affairs and Transport inquiry into regulatory requirements that impact on the safe use of remotely piloted aircraft systems, unmanned aerial systems and associated systems can be found, along with others' submissions, on the Committee's website.[4]

What are others doing?

A review of the RPA-related activities being conducted by other like-minded aviation safety regulatory authorities and international organisations, and their forward-looking plans to identify and manage the complex issues we are all facing, reveals how similar our approaches are to these challenges:

- United States (Federal Aviation Administration): https://www.faa.gov/uas/
- Canada (Transport Canada): https://www.tc.gc.ca/eng/civilaviation/drone-safety.html
- United Kingdom:
  - (Civil Aviation Authority): https://www.caa.co.uk/Consumers/Unmanned-aircraft-and-drones/
  - (Ministry for Transport): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/631638/unlocking-the-uks-high-tech-economy-consultation-on-the-safe-use-of-drones-in-the-uk-government-response.pdf
- New Zealand (Civil Aviation Authority): http://www.caa.govt.nz/rpas/
- European Aviation Safety Agency: http://www.easa.europa.eu/easa-and-you/civil-drones-rpas
- International Civil Aviation Organization: https://www4.icao.int/uastoolkit/home/about.

[3] https://www.casa.gov.au/aircraft/landing-page/flying-drones-australia

[4] http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Rural_and_Regional_Affairs_and_Transport/Drones/Submissions.

Questions to consider

CASA seeks your general views on the way in which we are approaching the regulation of RPA in Australia today.

Are we doing enough of the right kinds of things, with a view to current circumstances and what you think we will need to deal with in the future?

If not, what should we be doing or doing more of?

Are there any other issues or factors you believe CASA should take into account when considering its approach to the regulation of RPA?

In thinking about your response, you may want to consider the questions suggested below.

- In its approach to RPA regulation, does CASA have the right balance between the primacy of aviation safety and the various commercial and recreational interests in RPA operations?
- Should CASA devote more time, energy and resources to the development and publication of safety-related educational and guidance material for recreational RPA users?
- Have you used CASA's *Can I fly there?* app? If so, did you find it helpful?
- From 1 July 2017, the penalties for breaching the RPA safety regulations include court-imposed fines of up to $10,500.00, or infringement notice penalties of up to $1,050.00. A person convicted of recklessly operating an RPA so as to endanger another person's life may be fined and imprisoned for a period of up to five years. Are these penalties appropriate?
- Should the sale, possession, ownership and/or use of recreational RPA be prohibited completely until the actual and perceived safety risks they pose have been effectively mitigated? What would you consider to be 'effectively mitigated'?
- Are the distances RPA operators are currently required to keep from aerodromes, other aircraft and people and property on the ground, and the altitudes at which they may lawfully fly (without special approval) sufficiently and appropriately safe? Should they be made more restrictive, or should they be made less restrictive?
- Should a person be required to be a certain age before he or she is permitted to operate an RPA recreationally (without the need to hold a RePL)?
- Should a person be required to be a certain age before he or she can hold an RePL?

Appendix A Summary of Australian remotely piloted aircraft (RPA) regulations

Note: The official and authoritative statement of the rules governing RPA operations in Australia can be found in Part 101 of the *Civil Aviation Safety Regulations 1998*, on the Australian Government's Federal Register of Legislation website at: https://www.legislation.gov.au/Details/F2017C00470/Download.

A.1 Summary of current Australian RPA regulations

All RPA and RPA operations in Australia are governed covered by the regulations set out in:

- Subpart 101.A of CASR:[5]
  - containing *preliminary* provisions describing the applicability of Part 101;
  - dis-applying in some cases the regulations governing the marking and registration of certain unmanned aircraft;
  - exempting certain unmanned aircraft from various provisions of the *Civil Aviation Regulations 1988;*
  - defining the term *populous area* as it applies to operations covered by Part 101 of CASR;
  - providing for the issue of a Part 101 Manual of Standards (MOS);[6]
  - providing for CASA's approval of geographic areas within which unmanned aircraft may be operated (under circumstances different to those generally governing their operation);
  - explaining how information a person is required to provide to CASA is to be provided.
- Subpart 101.B of CASR—specifying general *prohibitions* on the unsafe operation of all unmanned aircraft.[7]
- Subpart 101.C of CASR—specifying operational *limitations* applicable to unmanned aircraft generally.[8]

[5] Regulations 101.005 to 101.035 of CASR.
[6] Manuals of Standards are documents which support the Regulations by providing detailed technical materials, such as technical specifications or standards. As legislative instruments, MOSs are subject to registration and disallowance under the *Legislation Act 2003*. See the note to regulation 11.265 of CASR.
[7] Regulations 101.050 to 101.101.055 of CASR.
[8] Regulations 101.060 to 101.097 of CASR. Subpart 101.C does not apply to: (a) control-line model aircraft; (b) model aircraft operated indoors; (c) unmanned airships operated indoors; (d) small balloons within 100 metres of a structure and not higher than the top of the structure; (e) unmanned tethered balloons that remain below 400 feet above ground level; and (f) firework rockets not capable of rising more than 400 feet above ground level. Subregulation 101.005(3) of CASR.

A.2 Generally applicable safety-related limitations on the operation of RPA

Safety is CASA's primary consideration in the performance of its regulatory functions.[9] Consistent with this overarching obligation, the regulations contain explicit requirements, restrictions and limitations governing the operations of unmanned aircraft. These include provisions expressly prohibiting:

a. the operation of an unmanned aircraft in a way that creates a hazard to another aircraft, another person, or property;[10]
b. the unauthorised operation of an unmanned aircraft in or over a prohibited or restricted area;[11]
c. the unauthorised operation of an unmanned aircraft above 400 feet above ground level (AGL) in controlled airspace;[12]
d. the unauthorised operation of an unmanned aircraft in controlled airspace otherwise than in accordance with such requirements as may be prescribed in the Part 101 MOS;[13]
e. the unauthorised operation of an unmanned aircraft beyond the visual line of sight of the person operating the aircraft;[14]
f. the unauthorised operation of an unmanned aircraft within 3 nautical miles (5.5 kilometres) of an aerodrome;[15]
g. the unauthorised operation of an unmanned aircraft above 400 feet AGL;[16]
h. the dropping or discharge of a thing from an unmanned aircraft in a way that creates a hazard to another aircraft, person or property;[17]
i. the unauthorised operation of an unmanned aircraft in or into cloud, at night or in other than visual meteorological conditions;[18]
j. the unauthorised launch or release of an autonomous unmanned aircraft.[19]

A.3 Modernising the regulatory framework for unmanned aircraft operations

Under the current regulations, RPA are categorised, and the operations in which RPA may be engaged are classified, in ways that better reflect the contemporary environment. These changes have been designed to facilitate the development and use of new technologies and applications, while ensuring appropriate safety requirements are maintained.

[9] See subsection 9A(1) of the *Civil Aviation Act 1988*.
[10] Subregulation 101.055(1) of CASR.
[11] Subregulation 101.065(1) of CASR.
[12] Subregulation 101.070(1) of CASR.
[13] Regulation 101.072 of CASR.
[14] Regulation 101.073 of CASR .
[15] Regulation 101.075 of CASR.
[16] Regulation 101.085 of CASR.
[17] Regulation 101.090 of CASR.
[18] Regulation 101.095 of CASR.
[19] Regulation 101.097 of CASR. An autonomous aircraft is an aircraft that does not allow pilot intervention during all stages of the flight of the aircraft.

A.3.1 Categorising unmanned aircraft by size and weight

The regulations now identify five types of RPA based on the size and weight of the aircraft. These include:[20]

- *micro RPA*—an RPA with a gross weight of *100 g or less*
- *very small RPA*—an RPA with a gross weight of *more than 100 g but less than 2 kg*
- *small RPA*—an RPA with a gross weight of *at least 2 kg but less than 25 kg*
- *medium RPA:*
  - an RPA with a gross weight of *at least 25 kg, but not more than 150 kg*

    or
  - a remotely piloted airship with an envelope capacity of *100 m^3 or less*
- *large RPA*, being any of the following*:*
  - a remotely piloted aeroplane with a gross weight of *more than 150 kg*
  - a remotely piloted powered parachute with a gross weight of *more than 150 kg*
  - a remotely piloted rotorcraft with a gross weight of *more than 150 kg*
  - a remotely piloted powered-lift aircraft with a gross weight of *more than 150 kg*

    or
  - a remotely piloted airship with an envelope capacity of *more than 100 m^3*.

A.3.2 Operating model aircraft

Model aircraft are defined in the regulations as aircraft used for sport or recreation and that cannot carry a person.[21] Beyond the requirements generally applicable to the operation of all unmanned aircraft, the operation of model aircraft weighing less than 100 grams is not subject to any other regulatory limitations.

The operation of model aircraft weighing 100 grams or more, however, is also governed by the provisions set out in Subpart 101.G, which specify additional limitations to help ensure the safe operation of these model aircraft. In summary, these requirements provide that:[22]

a. a person may only operate a model aircraft if the visibility at the time is good enough for the person operating it to be able to see it continuously;
b. a person may operate a model aircraft at night only in accordance with the written procedures of an approved administration organisation;
c. a person must not operate a model aircraft over a populous area at a height less than the height from which, if any of its components fails, it would be able to clear the area;
d. subject to certain exceptions, the person operating a powered model aircraft must ensure that, while the aircraft is in flight, landing or taking off, it remains at least 30 metres from anyone not directly associated with its operation; and
e. a model aircraft may only be operated outside an approved area at an altitude above 400 feet AGL if the person operating it keeps it in sight and clear of any populous areas.

Specific regulations govern the operation of giant model aircraft (defined as model aircraft having a take-off mass (excluding fuel) of more than 25 kilograms, but not more than

[20] CASR Dictionary, Part 1.
[21] CASR Dictionary, Part 1.
[22] Regulations 101.385 to 101.400 of CASR.

150 kilograms)[23] as well as the conduct of model aircraft flying displays.[24]

A.3.3 Operating RPA for other than sport or recreational purposes

As a general rule, the operation of very small, small and medium RPA for other than sport or recreational purposes—and the operation of large RPA for any purpose—is governed by Subpart 101.F.[25] In particular, Division 101.F.2 within that Subpart provides that:

a. subject to certain exceptions, a person must not operate an RPA within 30 metres of a person who is not directly associated with the operation of the RPA;[26]
b. the Part 101 MOS may prescribe areas within which certain RPA may be operated and requirements governing the operation of RPA in those prescribed areas with which a person must comply;[27]
c. very small, small and medium RPA may only be operated outside an approved area at a height of above 400 feet AGL with CASA's approval, and only if the RPA remains clear of any populous areas.[28]

A.3.4 Requirement to hold an RPA pilot licence (RePL)

In addition to the operational limitations and generally applicable requirements, and subject to certain exclusions discussed below, a person operating a very small, small, medium or large RPA *for purposes other than sport or recreation* must hold a RePL authorising those operations.[29] Requirements governing eligibility and application for a RePL, the imposition of conditions and any subsequent cancellation are set out in Division 101.F.3 of the regulations.[30]

A.3.5 Requirement to hold an RPA operator's certificate (ReOC)

In addition to the licensing requirements and subject, in some cases, to the exclusions discussed below, the conduct of operations *for purposes other than sport or recreation* using a very small, small, medium or large RPA requires that the person conducting those operations hold a ReOC.[31] Requirements governing eligibility and application for a ReOC, the imposition of conditions and compliance requirements, and any subsequent cancellation are set out in Division 101.F.4 of the regulations.[32]

A.3.6 Certification and maintenance requirements for large RPA

A person may operate a large RPA only if an airworthiness certificate in the restricted or experimental category has been issued for that RPA.[33] Continuing airworthiness responsibilities for large RPA involve the application of provisions in the *Civil Aviation Regulations 1988* that set out certain maintenance-related requirements for Class B aircraft.[34] CASA may authorise

[23] Regulation 101.380 of CASR.
[24] Regulation 101.410 of CASR.
[25] Regulation 101.235 of CASR.
[26] Regulation 101.245 of CASR.
[27] Regulation 101.247 of CASR.
[28] Regulation 101.250 of CASR.
[29] Regulation 101.252 of CASR.
[30] Regulations 101.290 to 101.320 of CASR.
[31] Regulation 101.270 of CASR.
[32] Regulations 101.330 to 101.370 of CASR.
[33] Regulation 101.255 of CASR.
[34] Regulation 101.260 of CASR. As defined in the *Civil Aviation Regulations 1988* (CAR), a Class B aircraft is an Australian aircraft that is not certificated as a transport category aircraft and/or is not being

persons to carry out maintenance on large RPA in accordance with the terms of their authorisation.[35] Airworthiness and maintenance related provisions for other RPA operated under a ReOC are included in CASA's template operations manual.[36]

A.4 Liberalising the regulation of certain RPA operations

In recent years, demand has grown for a liberalised regime under which certain operations involving RPA being used *for other than sport and recreational purposes* might be undertaken safely, but without necessarily requiring the full complement of licensing and certification requirements.

In response, the amendments made to Part 101 in 2016 introduced new provisions in Subpart 101.F to allow selected operations of this kind to proceed without the need to comply with those requirements, *subject to appropriate safety enhancements*. These conditions are explained in the following sections.

A.4.1 Operation of very small RPA for hire or reward

Now, under Division 101.F.5 of CASR, very small RPA may be operated for hire or reward *without requiring the operator to hold a RePL or a ReOC*, subject only to certain notification requirements.[37]

At least *5 business days* before the first operation of a very small RPA for hire or reward occurs, the person must notify CASA, in writing, of their intention to conduct such an operation.[38] The information that must be provided includes details about the identity of the operator, the kind of very small RPA involved, the nature of the operations involved and the area in which the operations will be conducted.[39]

A person conducting such operations must do so in accordance with the applicable safety requirements, including the *standard operating conditions* described in Section A.4.3, and any other instructions or directions CASA may give.

A.4.2 Operation of 'excluded RPA'

The regulations now also include a category of *excluded RPA*, specifying the type of RPA eligible for measured relief from otherwise applicable operational requirements. As explained below, excluded RPA may be operated without the operator being required to hold certain licences and other permissions.[40]

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used, or to be used, by the holder of an Air Operator's Certificate authorising the use of the aircraft for regular public transport operations. See subregulation 2(1) of CAR.

[35] Regulation 101.265 of CASR.

[36] https://www.casa.gov.au/files/sampleoperationsmanualdocx

[37] Regulation 101.371 of CASR.

[38] Regulation 101.372 of CASR. Persons conducting operations in very small or another type of RPA in accordance with the terms of an existing ReOC need not provide this kind of notification to CASA. Information about the nature and circumstances of those operations will already have been provided to CASA in connection with their application for their ReOC.

[39] The information required to be provided is specified in the approved notification form, which is available on CASA's public website at https://www.casa.gov.au/standard-page/commercial-unmanned-flight-remotely-piloted-aircraft-under-2kg.

[40] Regulation 101.237 of CASR.

The following RPA are identified as *excluded RPA* on the basis of their size and weight and, in most cases, the operations in which they may be engaged:

- A micro RPA.
- A very small RPA if it is being operated:
  - for sport or recreational purposes; or
  - in the standard RPA operating conditions.
- A small RPA if it is being operated in accordance with all of the following:
  - by or on behalf of the owner of the RPA; and
  - over land owned or occupied by the owner of the RPA; and
  - in the standard RPA operating conditions; and
  - for the purpose of one or more of the following:
    - aerial spotting;
    - aerial photography;
    - agricultural operations;
    - aerial communications retransmission;
    - the carriage of cargo;
    - any other activity that is similar to an activity mentioned above;

  for which no remuneration is receive by the operator or the owner of the RPA, the owner or occupier of the land or any person on whose behalf the activity is being conducted.
- A small or medium RPA if it is being operated for sport or recreational purposes.
- A small or medium RPA if it is being operated in the standard RPA operating conditions by:
  - a person for the sole purpose of meeting certain experience requirements for the grant of remote pilot licence; or
  - the holder of a remote pilot licence for the sole purpose of gaining competency in the operation of an RPA.
- A medium RPA if it is being operated:
  - by or on behalf of the owner of the RPA; and
  - by a person who holds a remote pilot licence that authorises the person to operate the RPA; and
  - over land owned or occupied by the owner of the RPA; and
  - in the standard RPA operating conditions; and
  - for the sole purpose of one or more of the following:
    - aerial spotting;
    - aerial photography;
    - agricultural operations;
    - aerial communications retransmission;
    - the carriage of cargo;
    - any other activity that is similar to an activity mentioned above;

  for which no remuneration is received by the operator or the owner of the RPA, the owner or occupier of the land or any person on whose behalf the activity is being conducted.
- An RPA is an excluded RPA if it is being operated:

  - by a person solely for the purpose of the person receiving training from a RPA operator who holds an operator certificate authorising the conduct of operations using the RPA; and
  - in accordance with the operator's documented training procedures.
- The designation of an RPA as an excluded RPA operates to dis-apply the provisions of the regulations requiring a person to hold a RePL[41] or a ReOC.[42]

A.4.3 Standard RPA operating conditions

Part 101 now specifies a set of standard RPA operating conditions under which:

a. the RPA is operated within the visual line of sight of the person operating it; and
b. the RPA is operated at or below 400 feet above ground level (AGL) by day; and
c. the RPA is not operated within 30 metres of a person who is not directly associated with its operation; and
d. the RPA is not operated:
   i. in a prohibited area or in specified restricted areas; or
   ii. over a populous area; or
   iii. within 3 nautical miles of the movement area of a controlled aerodrome;
e. over an area where a fire, police or other public safety or emergency operation is being conducted, without the approval of the person in charge of the operation; and
f. the person operating the RPA is only operating that RPA.[43]

Guidance and advice on requirements governing the operation of excluded RPA (other than model aircraft), including very small RPA and small or medium RPA, is available in CASA *Advisory Circular 101-10*[44] and on the CASA website.[45]

[41] Subregulation 202.252(1) of CASR.
[42] Subregulation 101.270(1) of CASR.
[43] Regulation 101.238 of CASR.
[44] Remotely Piloted Aircraft Systems – Operation of Excluded RPA (other than Model Aircraft), v.1.2 (September 2016). See https://www.casa.gov.au/files/ac10110pdf.
[45] See https://www.casa.gov.au/aircraft/landing-page/flying-drones-australia.