Regulation Impact Statement

Civil Aviation Legislation Amendment (Remotely Piloted Aircraft and Model Aircraft – Registration and Accreditation) Regulations 2019

Executive Summary

The operation of Remotely Piloted Aircraft (RPA), also commonly known as drones, is a relatively new aviation sector that is experiencing rapid growth. Under current legislation in Australia, RPA, including model aircraft, are considered aircraft and are subject to certain operating limitations in the interests of safety. The number of RPA being operated in Australia is unknown as no registration scheme exists, there are no point of sale obligations on retailers or RPA manufacturers to report sales, and no data is readily discernible from overseas importation records. Some estimates suggest that over one million RPA are operating in Australia.

While legislation exists for the operation of RPA in Australia, the increase in reported sightings of RPA being operated near manned aircraft in flight, and the increasing volume of enforcement action presently undertaken by the Civil Aviation Safety Authority (CASA) against unlawful RPA operations, indicates a trend that some RPA operators are either unaware of legislation about the use of RPA, or are unwilling to operate lawfully. RPA operated without regard to safety and within existing legislation presents an unmitigated risk to aviation safety, including the risk of a catastrophic collision with a passenger aircraft. In addition to the number of RPA, these risks also increase with the rapid development of RPA technology that enables RPA to operate faster, higher and for longer periods before needing to recharge.

While ambiguity exists on the actual number of RPA in Australia, the analysis in this document is based on a figure of 150,000 RPA and model aircraft that weigh more than 250g and are operated recreationally; a figure derived from informal advice provided by RPA manufacturers.

The analysis is focused on the impact of the proposals upon individuals. Any upward adjustment to the number of RPA in Australia figure would increase the total community cost proportionately, particularly for the recreational sector, up to the speculated figure of over one million mentioned above. Similarly, the risks considered in this document increase as the numbers of RPA increases.

While there have been no deaths or significant injuries attributed to the use of RPA, CASA has taken enforcement action against individuals who have injured people through the unlawful and unsafe use of RPA near people.

With the growing use of RPA, the number of reported safety incidents has increased within Australia since 2012. In particular, there has been a notable increase in the reporting of incidents involving RPA being sighted by pilots in close proximity to their passenger aircraft.

Passive RPA surveillance technology is presently in use by several Australian Government agencies, including CASA. The technology provides the means to electronically identify an airborne RPA's serial number, its location, and the location of the RPA operator on the ground. While the technology is currently in use, without a means of linking an RPA serial number to a registered operator, identifying the RPA operator remains challenging.

The incident at Gatwick Airport in December 2018, where an RPA was reported operating near the runway environment, resulted in major disruptions over several days, with the airport being closed multiple times to manage the safety risk of RPA collision with passenger aircraft. Reports estimate around 1,000 flights were diverted or cancelled, affecting over 140,000 passengers during the busy Christmas period, and significant losses of revenue to airline and airport operators. In Australia, unlawful RPA use has caused the suspension of aerial firefighting by manned aircraft, placing people and property in the path of the fire at undue risk. Unlawful RPA use is also considered a concern from a national security perspective by the Australian Government, including for surveillance, transport of contraband, and domestic terrorism.

CASA's current research on RPA operators indicates many recreational RPA operators have a poor understanding of the legislation, safety risks and dangers associated with RPA operations. Baseline training to educate RPA operators through an online accreditation scheme, particularly recreational RPA operators, improves the understanding of RPA rules that are designed to protect the safety of other airspace users including passenger aircraft, as well as people and property on the ground. Awareness campaigns alone without a legislative requirement to complete a simple online course has not proved effective to mitigate against the growing risks posed by unsafe and unlawful RPA operation in Australia.

Despite the growth of RPA in Australia, one option is to continue only education campaigns and not to require mandatory training for recreational and simple commercial[1] operators or RPA registration requirements

Due to the recent, and continuing, rapid increase in the number of RPA in operation, and the capability of RPA to operate increasingly faster, higher and longer, the status quo option is not considered a reasonable or appropriate regulatory response to the growing safety risks, particularly risks to passenger aircraft operating to and from aerodromes.

Another option would be to expand the application of existing regulations for Remote Pilot Licensing and aircraft registration, which currently apply to larger RPA over 150 kg, to smaller RPA. However, this would require significant investment in time and resources by RPA operators, particularly recreational RPA operators and model aircraft operators, and is considered too onerous.

A preferred and reasonable regulatory response is to implement a registration and operator accreditation scheme (Option 2). This option would introduce proportionate requirements for operators to acquire knowledge to operate safely and lawfully and introduce a registration requirement that imposes a relatively low cost on operators but that provides the Government with an effective means of linking operators to RPA and model aircraft that are operated unsafely or unlawfully. Such measures substantially mitigate risks to other airspace users and people and property on the ground.

A requirement to re-accredit RPA and model aircraft operators every 3 years, unless they hold a Remote Pilot Licence, takes into account the rapidly evolving RPA and model aircraft technology and regulatory changes that CASA will likely be required to make on a regular basis. Re-accreditation

[1] Simple commercial RPA operations may be conducted without the need to obtain an RPA Operator's Certificate and Remote Pilot Licence, and is known as *Excluded RPA under* subregulation 101.237 of the *Civil Aviation Safety Regulations 1998*, however the rules for these operations, known as *standard operating conditions* restricts the sorts of RPA operations allowed and requires a notification to be made to CASA. Currently, no training requirements are required for *excluded RPA* operations.

every 3 years will ensure RPA and model aircraft operators have contemporary knowledge of the rules, and serves as a method for recurrent training that is an internationally recognised foundation to continued aviation safety.

This option also provides for CASA and law enforcement agencies to more easily identify RPA and model aircraft operators, and take appropriate actions where unlawful RPA model aircraft operations are detected, which in turn, reduces potential harm to the public.

While the responses to CASA's consultation for a registration and accreditation scheme indicated concerns around costs of registration, such views are not surprising given that the majority of respondents were existing operators not currently required to undertake any training or pay for registration. CASA subsequently amended parts of the scheme requirements based on the consultation feedback, including allowing exclusions to the requirements to register and complete accreditation for members of a model aircraft club operating at a CASA-approved model aircraft field, recognising that club requirements are considered adequate to mitigate relevant risks.

The final cost for registration is yet to be resolved by CASA, and will be subject to further public consultation in conjunction with a Cost Recovery Implementation Statement.

Background

Within Australia, CASA has the function of conducting the safety regulation of civil air operations which includes Remotely Piloted Aircraft (RPA) and model aircraft. The RPA is one part of the Remotely Piloted Aircraft System (RPAS). The *Civil Aviation Safety Regulations 1998* (CASR) currently defines RPAS as a set of configurable elements consisting of a remotely piloted aircraft, its associated remote pilot station (or stations), the required command and control links and any other system elements as may be required at any point during the operation of the aircraft. Many interchangeable terms are used to also describe RPA, including drone, unmanned aerial vehicle (UAV), and unmanned aircraft system (UAS). They range in size from miniaturised platforms no bigger than a match box, to complex, very high-altitude platforms that remain airborne for multiple days and cover vast distances. RPA platforms include aeroplanes, sailplanes, helicopters and multi-rotors including those used for racing and first-person-view (FPV) racing.

The RPAS industry is a relatively new aviation sector that is experiencing rapid growth. There is uncertainty over the numbers of RPA and model aircraft being operated in Australia, with some estimates, derived through basic internet surveys, indicating over one million RPA and model aircraft. Presently, there is no data from overseas imports, as RPA and model aircraft are not always separately classified in data. The analysis in this document is based on a figure of 150,000 RPA and model aircraft that weigh more than 250g and are operated recreationally, which figure has been derived from informal advice provided by RPA and model aircraft manufacturers. CASA's best estimate is that the number of RPA and model aircraft is growing at approximately 15,000 annually.

Current regulations

The current regulations governing the use of RPA in Australia are contained in Part 101 of the *Civil Aviation Safety Regulations 1998.* The Part 101 regulations differentiate requirements on whether

the RPA is operated commercially or recreationally and the weight of the RPA, with the following weight categorisation (Table 1).

Table 1: 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*

The primary regulatory requirements are based around operator (pilot) training and organisational approval of the operator, with this approval based on the documented procedures of the operator to ensure the safe operation of the RPA. With certain exceptions all commercial RPA operators and private operators of medium and large RPA (above 25 kg) and certain small RPA must hold a Remote Pilot Licence (RePL) and an RPA Operator's Certificate (ReOC). In addition, RPA weighing more than 150kg must be registered.

For small, very small and micro RPA these aircraft may be operated in simple commercial operations as e*xcluded RPA* under division 101.5.F of CASR, and do not require a RePL or ReOC. However, the excluded RPA operations are restricted and must be conducted in accordance with the *standard operating conditions (Table 2).*

There is no requirement for an RPA weighing 150kg or less, operated either commercially or recreationally, to be registered.

Table 2: S*tandard 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;
- the person operating the RPA is *only operating that RPA*.

The remainder of this Regulation Impact Statement is structured as follows:

- a statement of the problem
- a statement of the objectives
- a statement of three options, including the status quo

- a statement of the cost and other regulatory impacts of the two options that deviate from the present regulatory response to the problem, including how the options pursue the stated objectives
- a statement of the outcome of consultation processes undertaken in relation to addressing the problem
- a statement of implementation and transition issues in relation to the preferred option
- a conclusion.

Problem

The primary problem is there is an increasing risk posed by the unlawful and unsafe operations of RPA and model aircraft to other airspace users, including passenger carrying aircraft, and people and property on the ground. The risk principally stems from certain RPA and model aircraft operators not knowing, or having insufficient knowledge of, safety regulations when operating RPA and model aircraft.

While CASA has extensive safety education and awareness campaigns, a free to download and use mobile application 'Can I Fly There?' that helps RPA and model aircraft operators know the rules and where they may operate lawfully, and plain language print and online material, it is not sufficiently effective to ensure that all RPA and model aircraft operators, particularly recreational RPA and model aircraft operators, understand the safety risks and rules for safe operation. Despite CASA's best efforts, these measures are no longer considered an appropriate response to the increasing risk.

In addition, a small number of RPA and model aircraft operators appear willing to deliberately contravene legal requirements for the operation of RPA and model aircraft, with some confidence that such operation cannot be attributed to them. Accordingly, a second but related problem is that, without registration of RPA or model aircraft, including a basic identification check and the provision of the RPA or model aircraft serial number, CASA and police agencies are unable to clearly and cost effectively identify the responsible operator. This is particularly concerning when the RPA or model aircraft is being operated unlawfully, or is involved in an accident, serious incident or offence.

As demonstrated through the incident at Gatwick Airport over several days in December 2018, unlawful use not only poses a safety risk, but can severely interrupt operations at a major airport, resulting in knock-on effects for aircraft diversions, cancellations, and disruption to industries that rely on air transport, including postal services. Apart from passenger disruptions, the unlawful use of an RPA as demonstrated at Gatwick results in significant financial impacts to the airline and airport operators, and ancillary suppliers.

Safety

Along with the many benefits the increasing use of RPA and model aircraft can bring, there are safety risks with the potential for RPA and model aircraft to:

- cause serious injury to people on the ground
- cause damage to property on the ground and/or to national infrastructure

- interfere with the safe and lawful operation of manned aircraft, such as at an airport
- compromise the safety of passengers and crew on aircraft through impact with a manned aircraft, resulting in catastrophic engine damage, penetration of the windscreen, penetration of wing and/or fuel tanks, and damage that disables aircraft control systems.

Collision between an RPA and manned aircraft has occurred overseas. In September 2017, an RPA collided with a Black Hawk military helicopter in the United States of America. The accident report found the RPA operator at fault. In Canada in October 2017, an RPA collided with the wing of a Beech King Air passenger aircraft on approach to the airport.

Limited data exists on likely damage to manned aircraft. Research by the University of Daytona Research Institute in 2018 showed that an RPA weighing less than 1 kg simulating an impact with the wing of a 4-seat light aircraft at 206.8 knots resulted in the RPA penetrating the leading edge of the wing (Image 1).

Image 1. Damage to the leading edge of a Mooney aircraft by a simulated 1kg RPA impact. Source: University of Daytona Research Institute

The safety risk to persons on the ground is related to the size of the RPA or model aircraft. An RPA and model aircraft weighing less than 2kg is unlikely to cause serious injury or death by directly contacting a person on the ground. However, this is not to say that the risk of injury or death is zero and it is possible to devise scenarios in which injury or death could result from the operation of these small RPA and model aircraft. For example, an RPA or model aircraft could seriously damage a person's eyesight.

The consequences of an RPA colliding with a person on the ground are highlighted by the ATSB, with one reported collision in 2014:

> *a race participant received minor injuries while competing in a triathlon in Geraldton, WA, from collision with an RPAS that was filming the race. The collision occurred after the remote pilot lost control of the aircraft*[2].

In the range of 2kg to 25kg the risk of injury increases with the weight of the aircraft and these RPA and model aircraft have proportionately increasing risks of causing death or serious injury to persons on the ground. Increasingly large RPA also creates increasing potential to damage manned aircraft in a way that may compromise safety, particularly at certain altitudes.[3]

The potential risk of RPA and model aircraft to manned aircraft is highlighted by manned aircraft accident and incident data reported by the ATSB[4]. Whilst CASA could not break down the occurrence data by size of RPA, the data does indicate that there is a risk to manned aircraft, as well as to unrelated people on the ground.

The number of RPA related occurrences reported to ATSB has increased considerably since 2012 (p.8 ATSB 2017)[5]. There were 632 occurrences reported to ATSB for the period 2012-2018. The occurrences were comprised of 140 accidents, 27 serious incidents (occurrences that whilst not accidents had a high probability of being an accident) and 465 incidents (occurrences which resulted in an unsafe operation with potential to result in an accident). 56 percent of the occurrences were classified as near encounter with RPAs and reported by manned aircraft operations.

Terrain collisions, aircraft control issues and technical failures (systems and powerplant/engine issues) were the other major categories contributing to 38 percent of the reported events. Figure 1 on the following page shows the distribution of the primary events by occurrence type.

The ATSB analysed the reasons for the RPA related occurrences and found that the major proportion were *individual action* findings (occurrences caused by an individual RPA operator) related to *aircraft operation action* (operation of the RPA), particularly in relation to inadequate monitoring and checking, aircraft (RPA) handling and pre-flight preparation (Figure 2 on the following page). Other factors included wind gusts and the lack of appropriate knowledge/skills to conduct the tasks.

Privacy and Security

Beyond the risks that irresponsible use of RPA and model aircraft can pose to the safety of other aircraft and to people and property on the ground—RPA and model aircraft can be used in ways that interfere with other people's legitimate interests and expectations.

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[2] https://www.atsb.gov.au/publications/2017/ar-2017-016/

[3] https://www.easa.europa.eu/sites/default/files/dfu/TF%20Drone%20Collision_Report%20for%20Publication%20(005).pdf

[4] https://www.atsb.gov.au/publications/2017/ar-2017-016/

[5] https://www.atsb.gov.au/publications/2017/ar-2017-016/

Figure 1. RPA related occurrence by type (2012-2018) Source: ATSB

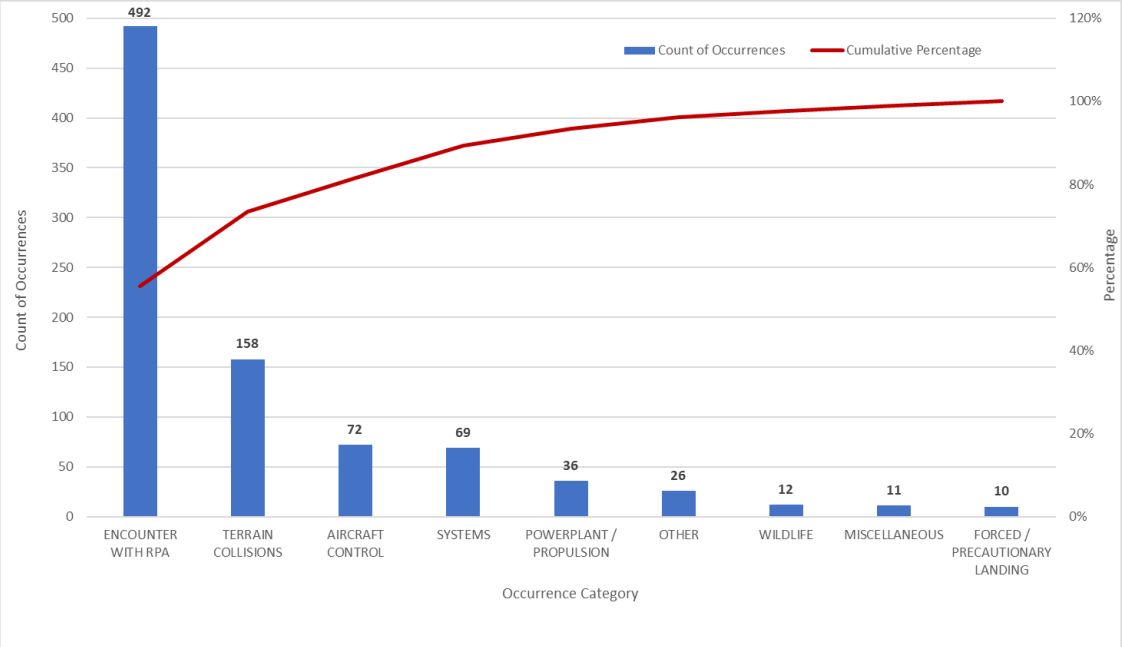
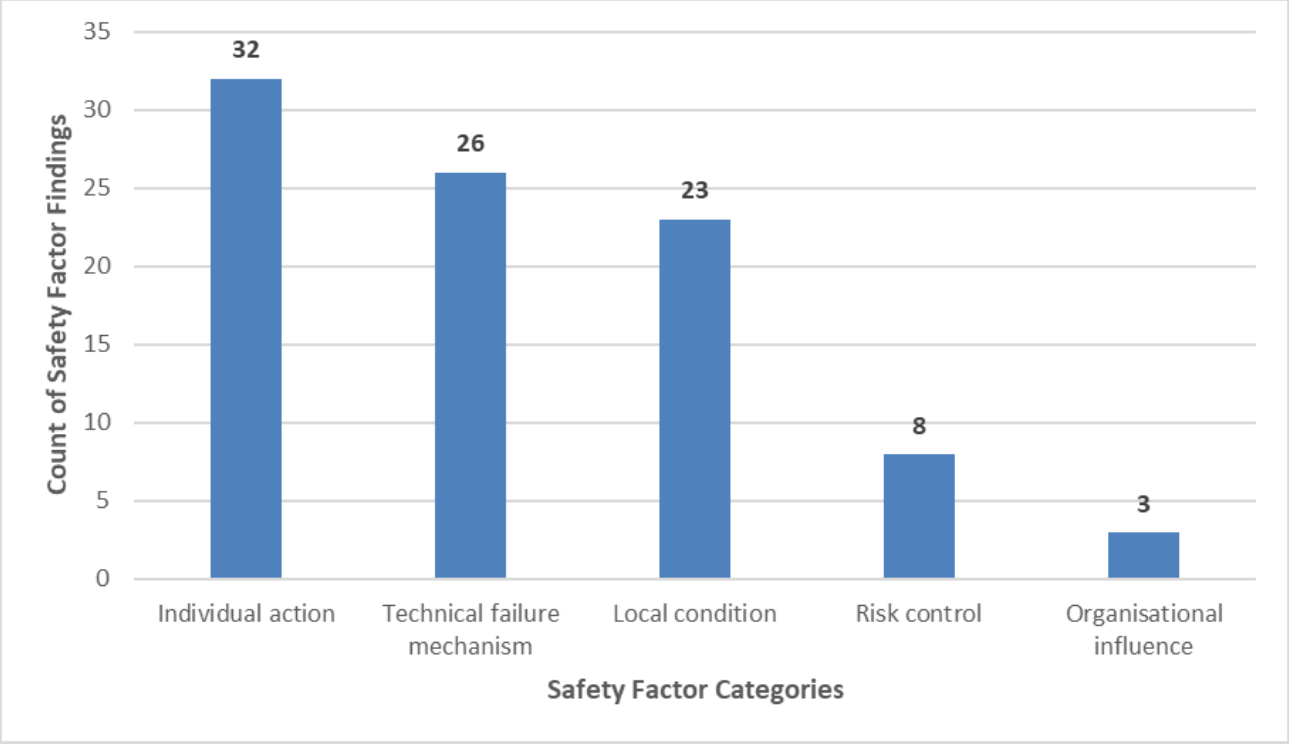


Figure 2: Safety Factor Findings



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.

Objective

In considering options to address the rapid uptake of RPAs and model aircraft, and the associated problems, CASA's objective is to implement an effective aviation safety regulatory framework to enable the safe and efficient integration of RPA and model aircraft into the Australian aviation system, and by cooperating with relevant police forces to minimise privacy and security issues. CASA's objectives sit within broader Australian Government policy objectives, including national security issues.

Options

Option 1: status quo

Option 1 would maintain the existing regulations that would impose no regulatory requirements for operator training in the excluded RPA category or for recreational operators. The safe operation of RPA within this excluded category would continue to depend on the operators of these aircraft choosing to inform themselves of the safe operation requirements for RPA and operate within the standard operating conditions. This would be assisted by CASA publishing relevant safety information on the CASA website, including an instructional video and supplying a one-page flyer within the box of RPAs sold within Australia. CASA would also undertake surveillance activity to enforce to the current requirements, including the standard operating conditions set out in Table 2.

The status quo would impose no training or knowledge testing for excluded RPA operators or for recreational operators, nor would it require RPA weighing less than 150kg to be registered.

Option 2: Accreditation and Registration

Under Option 2 operators of RPAs and some model aircraft who are not already Remote Pilot Licence (RePL) holders (with some exceptions) would need to be accredited by CASA which would require them to:

- verify their identity;
- undertake mandatory online education;
- successfully complete a safety quiz; and
- be issued with and continue to hold an accreditation.

There would be separate accreditations for recreational model aircraft operators and excluded RPA (simple) commercial operators. CASA already issues the RePL professional licence, however, the term 'accreditation' has been chosen for this different form of authorisation to differentiate between the privileges of an accreditation and licence.

Accreditation and 3 yearly re-accreditation

A significant reason for requiring re-accreditation is that the RPA and model aircraft sector is an area experiencing rapid technological change requiring periodic regulation changes, which CASA has estimated occurs at least once every 3 years. Re-accreditation every 3 years would enable operators to be informed of the updated regulatory requirements and any changes to the operating environment.

Re-accreditation is also based on the assumption that knowledge of safety requirements for individuals will decline after initial accreditation. Whilst RPA and model aircraft safety requirements could be compared to a drivers licence scheme that does not require reaccreditation, there is in general higher exposure of safety regulations to drivers that do not exist for RPA and model aircraft, such as speed limit signs, ongoing police monitoring, other safety signs, comprehensive government information campaigns including television and print commercials which all reinforce and remind drivers of relevant safety regulations.

RPA registration

Option 2 would also require the mandatory registration of all RPAs and model aircraft weighing more than 250 g through a unique RPA registration scheme administered by CASA, in one of two categories:

- Commercial operation of RPA as excluded RPA or under an RPA Operator's Certificate; or
- Recreational operation of a model aircraft.

Registration by reference to an RPA or model aircraft's manufacturer serial number enables CASA and law enforcement agencies to trace RPA and model aircraft to owners. The serial number is able to be interrogated electronically from the ground so that, for example, the suspicious operation of an unregistered RPA or model aircraft near a security facility could be immediately identified for response. The benefits of registration substantially redefine the ability of CASA and law enforcement agencies to monitor unsafe and unlawful RPA and model aircraft operations.

In summary, the registration and accreditation requirements apply (with certain exceptions) to the following RPA and model aircraft:

- RPA and model aircraft weighing more than 250 g that are operated recreationally; and
- all RPA operated commercially, including excluded RPA operations, regardless of weight.

The scheme contains certain exclusions and does not apply to every RPA or model aircraft or every operator. Commensurate with the risk profile, and recognising that model aircraft associations already have in place procedures for safe operation, the scheme does not apply to:

- RPA and model aircraft that weigh 250 g or less operated recreationally;
- model aircraft operated at a CASA-approved model aircraft field;
- RPA and model aircraft operated recreationally indoors.

A person must be 16 or over to register an RPA or model aircraft, and to complete accreditation. People under 16 must have a person 16 or over register the RPA or model aircraft and supervise its operation. The person supervising must hold an accreditation or RePL.

Option 3: Licensing for small RPA

Under Option 3 operators of RPAs and some model aircraft who are not already licence holders would need to obtain a Remote Pilot Licence (RePL) which would require them to:

- undertake a course of study (typically 5 days in duration);

- demonstrate a sufficient understanding of the safety regulations;
- demonstrate aircraft operational proficiency; and
- be issued with a Remote Pilot Licence by CASA.

Currently Remotely Piloted Aircraft weighing 150kg or more are required to be registered on the Civil Aviation Registry. Under Option 3 the weight limit for RPA would be lowered requiring all RPA weighing more than 250g to be registered on the Civil Aircraft Registry and be issued with a VH registration mark that must be attached to the aircraft.

Impact

Option 2: Accreditation and Registration

Option 2 would require a recreational or excluded RPA commercial user to be accredited by CASA. The option would also require the user to be reaccredited every three years.

This option would require a recreational or commercial RPA user who seeks to operate the RPA or model aircraft to register it with CASA annually, which would impact on the following types of operators:

- Recreational;
- Excluded RPA Commercial; and
- Commercial.

Initially the operator would need to provide information about the RPA or model aircraft, including the manufacturer, model and serial number in order to have it registered. The serial number would then be recognised as the registration number. Where a serial number is not provided, for example, a home built model aircraft, CASA will supply a serial number that is to be written indelibly onto the RPA or model aircraft.

In total the requirement for accreditation and registration would take the typical recreational user approximately 23 minutes (Table B1) to complete and require the payment of a $20 or less (subject to public consultation) levy for an annual registration. The recreational registration levy is proposed to apply only to the operator once per year, irrespective of the number of aircraft registered in that year (taken from the date of the first registration). Re-registration every year will take approximately 3 minutes.

For commercial operators the initial time commitment is likely to be 56 minutes (Table B2), with re-registration taking approximately 5 minutes every year.

Whilst the primary impacts are time and financial related, these are low relative to the time that the typical RPA user would be operating their RPA annually and the purchase cost of the RPA. An RPA purchase cost is typically in the range of $100 to $2,200 for recreational RPA, and commercial RPA typically $4,500 and above[6]. Given the low relative time and cost commitment it would be unlikely for the accreditation to be a deterrent for potential recreational users and would not impact on the number of RPA users.

[6] Review of consumer / recreational RPA and professional RPA available for purchase on the internet

Total costs for Option 2

The total cost over 10 years for Option 2 is estimated at $12.63m that consists of an estimated cost of $5.95m for recreational operators and $6.68m for commercial operators. This results in a 10-year annualised cost of $1.26m (Appendix B).

Safety Benefit

The primary safety benefit of the accreditation scheme is the increased probability of the RPA and model aircraft operator having a greater understanding of how to operate the RPA or model aircraft safely through education and thereby reducing likelihood of an incident or accident. With information provided in the safety video, it is likely that operators will more likely avoid operating near manned aircraft, including controlled aerodromes, and will operate a safe distance from people. This behavioural response is more likely when the operators are informed of potential infringement notices for such actions that are typically $1,050 per offence.

The primary safety benefit of requiring RPA and model aircraft (with certain exceptions) to be registered is that registration and marking would serve as a deterrent to those who might otherwise operate their RPA or model aircraft unsafely and unlawfully, and as an effective means by which to identify offenders.

Traceability of the operator through registration will increase the likelihood that it is operated safely and within the regulations, particularly to avoid infringement notices $1,050, or higher if a court imposes a higher penalty amount following a prosecution.

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. The contact details available through the registration scheme would also enable CASA to undertake information campaigns to address specific safety risks.

The significance of the safety benefit

The potential safety benefits are significant and in CASA's view justify the cost of the accreditation and registration scheme, on the basis that the scheme results in safer operation of RPA and model aircraft and reduced risk of collisions with people on the ground or manned aircraft.

Whilst there have been no reported collisions in Australia between an RPA and a manned aircraft resulting in fatalities, in Germany in 1997 an RPA collided with a motor glider breaking a wing of the glider and resulting in fatal injury to the two people on board (p.3, ATSB 2017).

In addition, the ATSB reports that an RPA striking a manned aircraft could cause loss of control due to damaged flight surfaces of the manned aircraft, such as the wings or tailplane, in a similar way to a bird strike. The ATSB reports on a US accident to highlight the possible outcome:

> *In 2008, a Cessna Citation collided with terrain in the United States following a birdstrike. The subsequent investigation found the accident was due to damage to the wing structure caused by one or more of the birds. The strike altered the aerofoil's aerodynamic profile enough to cause a loss of control, even though no penetration of the airframe was observed. This is one such example of a catastrophic outcome from a strike on the airframe without penetration. An RPAS*

collision is more likely to damage flight surfaces due to the higher potential mass and comparatively rigid components (p.36, ATSB 2017)

The evidence of the German glider collision resulting in 2 fatalities and the US Cessna Citation bird-strike accident that resulted in 5 fatalities show the possible safety consequences of collisions between RPA and manned aircraft. Excluding the value of the aircraft and focusing on the loss of human life, if Option 2 was to reduce the risk of a collision between RPA and manned aircraft to the extent that it avoided accidents resulting in 3 fatalities over a 10 year period this safety benefit would be valued at $13.5m using a value of statistical life of $4.5m[7] and would outweigh the costs of Option 2.

Evidence from other schemes

Whilst there is no specific evidence on the extent to which accreditation would reduce the likelihood of an accident, it is noted that educating individuals of the relevant safety regulations and requiring the individual to demonstrate an understanding of the safety regulations are employed in other regulatory areas to generate compliant responses. Some examples in all Australian jurisdictions for transport include (p. 9 CASA 2019)[8]:

- Obtaining a driver's licence requires successfully passing an exam on road rules
- Obtaining a boat licence requires successfully passing an exam on safety rules
- Obtaining a motorcycle licence includes a requirement to pass an exam on safety rules

However, it is difficult to determine the effectiveness of these programs because they are universally implemented, which does not permit the examination of safety outcomes for a subset of participants who do not go through the program. Internationally there is some survey evidence that providing education about safety regulations and the consequences of failing to comply with safety regulations can improve safety outcomes for young drivers (Paz-Cruz A, and Copeland D., 2014)[9].

Option 3: Licensing and VH registration

Option 3 would require recreational and excluded commercial operators to obtain a Remote Pilot Licence. This requires undertaking a course of study with an approved training provider, with a typical course duration of five days and a cost of approximately $3,000.

The commitment of time would also require a minimum face to face period of two days, which will require additional travel time for applicants.

Total costs for Option 3

The total cost over 10 years for Option 3 is estimated at $1,167m that consists of an estimated cost of $895m for recreational users and $272m for excluded commercial operators. This results in a 10-year annualised cost of $116.7m (Appendix B).

Given the relative high cost of obtaining a licence and the time commitment of five days, this is likely to deter a number of potential RPA users.

[7]Based on the 2014 VSL published by OBPR (PM&C 2014) and indexed by CPI.
[8] https://consultation.casa.gov.au/regulatory-program/pp1816us/supporting_documents/Policy%20Proposal%20%20PP%201816US.PDF
[9] https://www.nevadadot.com/home/showdocument?id=9089

Safety Benefit

Similar to Option 2, by providing operators with the information about the regulatory requirements applying to RPA use and the potential penalties for non-compliance it is likely that the behavioural response will be improved compliance with safety requirements and a lower likelihood of an accident.

The licence option by requiring a course duration that is approximately five days is more likely to lead to greater compliance with safety requirements. The licence option would provide a safety benefit with more proficient RPA users as the course will be able to teach and test for operator proficiency.

It is likely that Option 3 would provide the same safety benefit as the registration scheme in Option 2, that is the registration and marking would serve as a deterrent to those who might otherwise operate their RPA unsafely and unlawfully, and as an effective means by which to identify and apprehend offenders.

Additional analysis of the preferred Option

The estimated cost of moving to Option 2 relative to Option 1 is likely to be conservative because CASA has chosen conservative assumptions to estimate the cost of implementing Option 2. The impact of Option 1 has assumed (in the absence of data) that individuals seeking to operate an RPA or model aircraft currently invest zero time in informing themselves of the safety regulations and how to operate safely. It is likely that a number of individuals would spend at least some time informing themselves of the safety regulations and operational safety issues and therefore compliance with all the mandatory requirements of Option 2 would not represent additional time devoted to acquiring safety information.

In addition, the assumption that all excluded operators under Option 2 would become accredited is a conservative assumption. Informal feedback to CASA is that a proportion of excluded RPA operators are not operating their business and 'hold' the notification as an option value. When faced with the annual levy of $100 for accreditation and registration under Option 2 a proportion of the non-active operators may not register as they are not operating, which would reduce the estimated cost of Option 2 relative to Option 1.

Relevant to the decision on whether to implement Option 2 as opposed to maintaining Option 1 is the consideration of the cost of Option 2 on individuals, rather than just considering the aggregate cost. Whilst the aggregate cost of Option 2 is $12.63m[10] over 10 years, this primarily consists of a cost to individual users that is relatively low, for example the initial time commitment is less than 30 minutes for recreational users and less than 60 minutes for commercial operators.

The overall the cost of Option 2 relative to Option 1 is therefore estimated conservatively and, in addition, some of the benefits in relation to enforcement have been withheld as it may reduce their

[10] Consistent with the Best Practice Regulation requirement this excludes the registration and accreditation levy

effectiveness. Despite these constraints, the case for option 2 relative to option 1 is strong for these reasons:

- Internationally, comparable countries are moving to a form of mandatory registration and accreditation. In general, this movement is in response to the rapidly growing number of RPAs and the potential safety and security issues.
- There are significant efficiency benefits in the enforcement of RPA and model aircraft regulations, for example, security agencies being able to identify registered operators. In conjunction with electronic surveillance it will enable security agencies to make assessments more quickly as to whether an RPA or model aircraft is a security threat by analysing whether it is registered and who it is registered to.
- The consequences of the safety risks associated with unlawful and unsafe RPA and model aircraft operation are potentially catastrophic, with an attendant cost to society.
- Despite the potential benefits of Option 2 CASA does not want to overstate the significance of benefits, given the irregular and uncertain nature of the accidents that are likely to occur in Australia, which in part will depend on other regulatory responses taken by CASA and law enforcement agencies. Whilst the accreditation and registration scheme of Option 2 in isolation will not address all safety and security issues with the operation of RPA and model aircraft, they are considered the reasonable and appropriate next step to address those safety and security issues.
- CASA considers that Option 2 will achieve the objectives, while only imposing a relatively low cost on RPA operators. Whilst Option 3 would achieve the safety and security objectives the cost is significantly higher and is likely to deter RPA operators.

Consultation

The options considered in this RIS were developed following a number of public and industry consultations. In August 2017 CASA published a discussion paper *Review of RPAS operations*[11], among other questions, the discussion paper invited comment on the following:

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

The responses to the discussion paper supported mandatory registration and training and demonstrated proficiency.

Some form of registration is supported, with greater support by non-users

Proportionally more non-users advocated mandatory registration of all RPA, with 36% recommending registration of all RPA operators. By contrast, recreational and commercial users showed a clear preference for a more targeted approach to registration, with weight of the RPA the most popular method of determining whether registration is required.

[11] https://consultation.casa.gov.au/regulatory-program/dp1708os/

Training and demonstrated proficiency are broadly supported, particularly for users of large RPA

Recreational users, commercial users and non-users all indicated a preference for both mandatory training and demonstrated proficiency requirements to be determined by the weight of the RPA. Notably, there was some divergence in views, with recreational users more likely to advocate no mandatory training or proficiency requirements than commercial and non-users.

Respondents indicated support for free or inexpensive online training to be made available and the need for development of an awareness campaign to help new users learn about the safe and responsible use of RPA. Whilst there is broad support for large and small RPA to be treated differently (for registration, training and demonstrated proficiency) there were divergent views on defining a "small" RPA.

Senate Inquiry

On 31 July 2018, the report of the Senate Standing Committee on Regional and Rural Affairs and Transport inquiry, *Regulatory requirements that impact on the safe use of Remotely Piloted Aircraft Systems, Unmanned Aerial Systems and associated systems* was tabled in Parliament[12].

Recommendation 2 states:

> *The committee recommends that the Australian Government introduce a mandatory registration regime for all remotely piloted aircraft systems (RPAS) weighing more than 250 grams. As part of registration requirements, RPAS operators should be required to successfully complete a basic competence test regarding the safe use of RPAS, and demonstrate an understanding of the penalties for non-compliance with the rules.*

Aviation Safety Advisory Panel – Technical Working Group

A meeting of a Technical Working Group (TWG) established by the Aviation Safety Advisory Panel consisting of CASA and industry representatives was held in November 2018 to consider the policy proposals. The TWG meeting recommended that CASA proceed with public consultation on a new RPA registration scheme as well as an RPA operator education and accreditation scheme.

Policy Proposal

In January 2019 CASA published a proposal[13] for the Accreditation and Registration scheme options that are outlined in this RIS for public consultation. In contrast to previous consultations the majority of respondents (in the range of 80%) did not support the proposed Accreditation and Registration scheme options. There were also strong objections to the proposed fees for registration, including the $20 levy for recreational RPA.

In response to the negative feedback CASA will consider an appropriate fee levy structure before finalising the scheme requirements.

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[12] https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Rural_and_Regional_Affairs_and_Transport/Drones/Report

[13] https://consultation.casa.gov.au/regulatory-program/pp1816us/supporting_documents/Policy%20Proposal%20%20PP%201816US.PDF

Implementation and transition

CASA is working towards a regulation make date of 25 July 2019 with a graduated commencement. To minimise risks associated with the supporting information technology systems, a staged implementation is planned, whereby registration and accreditation are progressively introduced:

- November 2019 – RPA Operator's Certificate (ReOC) holders (registration only)
- November 2019 – Excluded RPA operators (accreditation and registration)
- March 2020 – Recreational model aircraft operators (accreditation and registration)

CASA has existing RPA operator educational material including a quiz on its *www.dronefyer.gov.au* website. CASA is developing an expanded question set that will enable a randomised exam that covers the syllabus to be provided.

Enforcing compliance with the accreditation and registration scheme
Incentives, positive and/or negative, imposed by CASA to 'drive' the desired RPA and model aircraft operator behaviour must be sufficient to produce the desired compliance outcome. CASA would, in relevant publications, emphasise the positive attributes of the accreditation-registration policy such as: airspace access, legitimacy of operation and wider social benefits.

A penalty would be introduced to provide a disincentive to those who illegally operate a non-registered RPA or model aircraft, or to operate without accreditation. The level of CASA enforcement action will depend not only on its own resourcing, but also on its continuing efforts to streamline existing frameworks with support from various Federal, State and Territory law enforcement agencies.

CASA, and other law enforcement agencies, will have an improved capability to enforce the registration requirements through electronic surveillance equipment. The equipment can identify RPA and model aircraft operating in a geographical area, as well as the electronic serial numbers of the RPA or model aircraft where present. The serial numbers may be cross-referenced against the CASA registration database and will identify whether the RPA or model aircraft is registered or not. As the equipment also pin-points the location of the airborne RPA or model aircraft and the location of the operator, CASA and/or law enforcement officers are enabled to take appropriate action against the operator where unlawful operation is detected.

Review
CASA will monitor and review the new regulations on an ongoing basis during the transition phase, with careful consideration given to the feedback from the regulated individuals and organisations and CASA will make any necessary changes to internal processes or the regulatory requirements.

The key information that CASA will be collecting during the transition is ease at which individuals and organisations can access the online systems and feedback on the content of the safety video and associated quiz.

The regulatory changes may be subject to a post-implementation review to assess the level of compliance with the accreditation and registration scheme and whether the safety objectives are being achieved.

Conclusion

CASA considers that Option 2 will achieve the desired safety and other regulatory objectives, while imposing only a low cost on individual RPA and model aircraft operators. Whilst Option 3 would also achieve those objectives, the cost is significantly higher and is likely to deter participation in RPA and model aircraft activities.

The Senate Standing Committee on Rural and Regional Affairs and Transport inquiry report: *Regulatory requirements that impact on the safe use of Remotely Piloted Aircraft Systems, Unmanned Aerial Systems and associated systems* recommended an accreditation and registration system for RPA in Australia. This is consistent with regulatory approaches either in place or planned in countries including the USA, UK, Canada and member states of the European Union[14].

Accreditation will encourage better educated RPA operators to constructively participate in the aviation-safety system and be better equipped to operate responsibly and competently. An interactive short online course that imparts the required knowledge, followed by an accreditation scheme indicating the attained proficiency is achievable and its implementation would have a safety benefit.

While CASA's most important consideration is safety, and having regard to the Australian Government's decision for CASA to implement a national registration scheme, the scheme is also expected to be of benefit for government agencies responsible for privacy, noise, security and undesirable social behaviour concerns associated with RPA and model aircraft operations. A registration system will also provide the foundational elements of a future RPA traffic management system that will ultimately further improve safety performance.

Subject to appropriate protocols and handling of personal information, data associated with the registration system will additionally provide a valuable data resource for CASA and, where appropriate and permitted by law, for other government agencies.

A challenge of the national accreditation and registration system will be to promote compliance by recreational operators, many of whom have no aviation background or previous engagement with CASA. It will also be a challenge to encourage commercial RPA operators' continual involvement with the safety regulatory system.

CASA therefore proposes to undertake a comprehensive national education campaign, and to ensure that the online accreditation and registration system is simple and easy to use without compromising integrity of the information received. CASA has already commissioned work into behavioural economics, user acceptance testing and market testing to ensure its desired

[14] https://www.easa.europa.eu/easa-and-you/civil-drones-rpas

implementation strategies are as effective as possible to attain high levels of compliance. Further, CASA has commenced discussions with manufacturers and retailers to best understand how to provide information to new RPA and model aircraft users at time of purchase.

CASA is committed to the successful implementation of a registration and accreditation scheme to pursue the objectives stated earlier in this statement, while reasonably minimising the costs to the community of the scheme.

Appendix A: Number of Remotely Piloted Aircraft and Model Aircraft

There is uncertainty over the numbers of RPA and model aircraft being operated in Australia. Basic internet surveys accessed by CASA indicate over one million RPA and model aircraft currently being operated in Australia. As importation data does not separately list RPA and model aircraft, import data is unable to be used to determine numbers. As sales data is confidential to manufacturers, only informal advice has been provided by the main manufacturers.

For the purposes of this analysis, CASA has used the estimate of 150,000 RPA and model aircraft currently operating in Australia and increasing at approximately 15,000 per year. The options under consideration impact on the following types of operators:

- Recreational;
- Excluded Commercial; and
- Commercial.

CASA estimates that there are approximately 108,000 recreational users, increasing at approximately 10,800 annually.

CASA has received 15,000 notifications for commercial operators in the excluded RPA category and based on this information CASA has assumed that in the first year there will be 15,000 initial excluded commercial accreditations. Based on the growth in the commercial operators over the last two years CASA has estimated that the number of commercial accreditations will be 4,000 per year after the initial year (Table A1).

For commercial operations CASA has issued 1,300 Remote Operating Certificates. Based on this information CASA has assumed that in the first year there will be 1,300 initial commercial registrations. Based on the growth in the commercial operators over the last two years CASA has estimated that the number of commercial registrations will be 100 per year after the initial year (Table A1). It is also assumed that 100% of the RPA will be registered each year.

Table A1: Number of RPA and model aircraft users

	Initial	Annual Growth Rate
Recreational	108,000	10,800
Excluded Commercial	15,000	4,000
Commercial	1,300	100

Appendix B: compliance costs

Option 2: Accreditation and RPA Registration

Option 2 would require a recreational or excluded commercial RPA user to be accredited by CASA and to register their RPA. The requirement for accreditation would not impact on Commercial RPA users who are currently required to hold a licence.

The starting point for accreditation is to create an account with CASA, which takes approximately 3 minutes. The individual will need to obtain an Aviation Reference Number (ARN), which is essentially a method for CASA to verify the identity of the individual using the Attorney General's online document verification services. This step takes individuals approximately 3 minutes to complete online.

After acquiring an ARN the potential user must then watch an online instructional video that provides information on how to safely operate a RPA and provide information on the regulatory requirements that apply to the use of RPA. It will include information for parents who are completing the RPA registration with the intention of children operating the RPA. Whilst the final content of the safety video is to be resolved it is expected to be approximately 3 minutes in length. This content is seen by CASA as a minimum level of safety information that would be needed by potential users in order to operate within the regulatory requirements. The potential user is then required to complete an online quiz with approximately 15 questions based on information provided in the video. This would take approximately 8 minutes to complete. After successfully completing the quiz the user would be required to enter details for each RPA and assuming one RPA per individual this will take approximately 4 minutes and the final step of making the payment will take 2 minutes. In total the requirement for accreditation and registration would take the typical recreational user approximately 23 minutes (Table B1).

Table B1: Time to comply with accreditation (Recreational)

Activity	**Time in Minutes**
Account Creation	3
ARN	3
Video	3
Quiz	8
RPA Details	4

Payment	2
Total	23

Excluded Commercial category

The excluded commercial operator will be required to watch a more extensive instructional video approximately 12 minutes in length that contains both safety and operational limitations content; and undertake a longer questionnaire of approximately 24 minutes in length, and assuming they register 3 RPA would lead to an overall compliance time of approximately 56 minutes (Table B2).

Table B2: Time to comply with accreditation (Excluded Commercial)

Activity	**Time in Minutes**
Account Creation	3
ARN	3
Video	12
Quiz	24
RPA Details	12
Payment	2
Total	56

Re-accreditation

Every third year the Recreational and Excluded Commercial user would be required to be reaccredited which involves watching the instructional video and undertaking the quiz.

Costs for recreational accreditation and registration

Based on the initial recreational accreditation and registration requiring 23 minutes of an individual's time this would be valued at $11.88 using a wage rate of $31 per hour. Reaccreditation every 3 years requiring 11 minutes of time would be valued at $5.68 per individual every 3 years or $1.89 when annualised. Re-registration will take approximately 3 minutes every year to renew the registration of their RPA. When valued at $31 per hour the re-registration is valued at $1.55. Based on the number of annual re-registrations from Table A1 this will result in a total cost of over ten years of $2.11m (Table B3). Based on the number of accreditations and reaccreditations per year from Table A1 this will result in a total cost over 10 years of $5.95m (Table B3).

Table B3: Costs for recreational accreditation

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
	$000	$000	$000	$000	$000	$000	$000	$000	$000	$000	$m
Initial	1,283	128	128	128	128	128	128	128	128	128	2.44
Re-accreditation	0	112	123	134	145	156	167	179	190	201	1.41
Reregistration	0	167	184	201	218	234	251	268	285	301	2.11
Total											5.95

Costs for Excluded Commercial accreditation

Based on the initial accreditation and registration requiring 56 minutes of an operator's time this would be valued at $63.47 using a wage rate of $68 per hour. Reaccreditation every 3 years requiring 36 minutes of time would be valued at $40.80 per operator every 3 years or $13.60 when annualised. Based on the number of accreditations and reaccreditations per year from Table A1 this will result in a total cost over 10 years of $6.68m (Table B4 on the following page).

Table B4: Costs for excluded commercial accreditation

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
	$000	$000	$000	$000	$000	$000	$000	$000	$000	$000	$m
Initial	571	254	254	254	254	254	254	254	254	254	2.86
reaccreditation	0	122	177	231	286	340	394	449	503	558	3.06
reregistration	0	31	44	58	71	85	99	112	126	139	0.77
											6.68

Total costs for Option 2

The total cost over 10 years for Option 2 is estimated at $12.63m that consists of an estimated cost of $5.95m for recreational users and $6.68m for excluded commercial operators. This results in a 10-year annualised cost of $1.26m.

Option 3: Licensing and VH Registration

Costs for recreational Remote Pilot Licensing

The Remote Pilot Licence (RePL) requires the applicant to complete an approved study course of approximately 40 hours of study time and is usually completed over five days and costs in the range of $3000. CASA estimates that an individual's time over the 40 hours would be valued at $1240 when using a wage rate of $31 per hour. The total cost is therefore estimated at $4240 when the value of time and course fees are considered. Based on 108 000 recreational pilots requiring a licence initially and 10 800 annually (Table A1) this will result in a total cost of $870m over 10 years (Table B5).

Costs for Recreational VH Registration

In order to register an RPA on the current Civil Aviation Registry the operator would need to complete an eleven-page paper-based form, which takes approximately 1 hour and return this form to CASA including the payment of a $130 one off fee. The operator would be required to wait approximately one week for the registration to be processed and be issued with a VH registration mark that must be attached to the aircraft.

The value of the one-week delay in obtaining the registration is estimated based on the average user operating the RPA for 4 hours per week. When the 4 hours is valued at $31 per hour this results in an estimated delay cost of $124. The total cost per registration is estimated $155 when the delay cost and time to complete the form is considered. The total cost over 10 years would be $25.44m based on the number of initial registrations from Table A1 (Table B5).

Table B5: Costs for recreational licensing

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
	$m	$m	$m	$m	$m	$m	$m	$m	$m	$m	$m
Initial Remote Pilot licence	$458	$46	$46	$46	$46	$46	$46	$46	$46	$46	$870m
VH Registration	13.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	$25.4m
											$895m

Costs for Excluded Commercial Remote Pilot Licensing

The cost for excluded commercial operators to obtain a Remote Pilot Licence is based on using a wage rate of $68 per hour. CASA estimates that an individual's time over the 40 hours would be valued at $2720 when using a wage rate of $68 per hour. The total cost is therefore estimated at $5720 when the value of time and course fees are considered. Based on 9000 excluded commercial pilots requiring a licence initially and 4000 annually (Table A1) this will result in a total cost of $257m over 10 years (Table B6).

Costs for Excluded Commercial VH Registration

For Excluded Commercial operators the value of the one-week delay in obtaining the registration is estimated based on the average user operating the RPA for 4 hours per week. When the 4 hours is valued at $68 per hour this results in an estimated delay cost of $272 per operator. The total cost per registration for an operator is estimated at $340 when the delay cost and time to complete the form is considered. The total cost over 10 years would be $14.47m based on the number of initial registrations for Excluded Commercial operators from Table A1 (Table B6).

Table B6: Costs for excluded commercial licensing

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
	$m	$m	$m	$m	$m	$m	$m	$m	$m	$m	$m
Initial Remote Pilot Licence	$51	$23	$23	$23	$23	$23	$23	$23	$23	$23	$257m
VH Registration	4.4	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	$14.5m
											$272m

Total costs for Option 3

The total cost over 10 years for Option 3 is estimated at $1167m that consists of an estimated cost of $895m for recreational users and $272m for excluded commercial operators. This results in a 10-year annualised cost of $116.7m.